

REPORT TO THE LEGISLATURE

**WISCONSIN GROUNDWATER
COORDINATING COUNCIL
AUGUST 1994**

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EXECUTIVE SUMMARY

This is the Report to the Legislature by the Groundwater Coordinating Council (GCC) as required by s. 15.347, Wisconsin Statutes. The report describes the condition of the groundwater resource, its management and summarizes the Coordinating Council's activities for fiscal year (FY) 1994.

In 1984, the Legislature enacted Wisconsin Act 410 with the intention of improving 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 nonregulatory 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); Industry, Labor and Human Relations (DILHR); Agriculture, Trade and Consumer Protection (DATCP); Health and Social Services (DHSS); Transportation (DOT); the President of the University of Wisconsin System (UWS); the State Geologist; and a representative of the Governor. Members are listed on the inside of the front cover.

Since its last report, the Groundwater Coordinating Council has accomplished the following:

1. The GCC and the UWS Groundwater Research Advisory Council continued coordination of the annual solicitation for groundwater research and monitoring proposals among state agencies. Thirty-two projects were funded in FY 94 by one or more of the following agencies: UWS, DATCP, DNR and DILHR. The projects funded are listed in Table 1. The locations of the field sites for the projects are shown in Figure 2. A joint solicitation for groundwater-related monitoring and research project proposals for funding in FY 95 was distributed in November, 1993. A copy of the joint solicitation is contained in the appendix to this report. A total of 36 project proposals were received. Eighteen new projects were selected by the UWS, DNR and/or DATCP for funding in FY 95 in addition to 15 projects which will carry over into the new fiscal year. The FY 95 groundwater monitoring and research projects and their funding agency are listed in Table 2. The GCC endorsed the UWS groundwater research plan for FY 95 as required by s. 160.50(1m), Wis. Stats.
2. The GCC reviewed and approved the final Comprehensive State Groundwater Program Plan (CSGWPP) Profile, the CSGWPP Self-Assessment, and the CSGWPP Vision Statement which were prepared by the DNR and reviewed by DATCP, DILHR, DOT and representatives from the UWS. The three final documents were submitted to the U.S. EPA on February 25, 1994 for endorsement as core and fully-implementing program plans. Wisconsin is the first state to do this.

3. The Monitoring & Data Management Subcommittee of the GCC published the Directory of Groundwater Databases in March, 1994. The Directory provides information on databases, computerized and non-computerized, which include information on groundwater quality, quantity and susceptibility. The Directory makes information on the location, accessibility and content of numerous groundwater databases much more accessible. The Directory was widely distributed to university, state and local government personnel.
4. The DNR hired a Water Resources Management Specialist in April 1994, to work with the GCC and its subcommittees. So far that employee has arranged and attended GCC and subcommittee meetings, organized a database of projects funded through the joint solicitation process, written research project summaries and coordinated the writing of this report.
5. The GCC endorsed a recommendation of the Research Subcommittee that a temporary, part-time editor be hired for one year by the UW Water Resources Center to help publish summaries of completed joint solicitation projects. There are about 100 projects which have been completed for which summaries have not been published. The new DNR Water Resources Management Specialist will prepare summaries of the projects funded by the DNR.
6. The GCC has continued to work with representatives of federal agencies to promote communication and coordination of federal and state groundwater activities. Representatives from the U. S. Soil Conservation Service (SCS), U. S. Agricultural Stabilization and Conservation Service (ASCS) and the U. S. Geological Survey (USGS) attend GCC meetings and serve as ex officio subcommittee members.

INTRODUCTION

PURPOSE

The Groundwater Coordinating Council 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 1994.

The following section, "Summary of Agency Activities" describes groundwater management programs and implementation of ch. 160, Wis. Stats., by the individual state agencies. "Groundwater Monitoring and Research" provides information on monitoring and research activities to address groundwater issues in Wisconsin and describes the condition of the groundwater resource. The activities of the Groundwater Coordinating Council and its subcommittees are described under "Coordination Activities" and in the minutes which are contained in the appendix to this report. The recommendations of the Council are contained in "Directions for Future Groundwater Protection."

SUMMARY OF WISCONSIN'S GROUNDWATER LEGISLATION

Wisconsin has a long history of groundwater protection. The culmination of this effort has been the adoption and implementation of 1983 Wisconsin Act 410, Wisconsin's comprehensive Groundwater Protection Act which was signed into law on May 4, 1984. This law greatly expanded Wisconsin's legal, organizational, and financial capacity for controlling groundwater pollution. The Groundwater Protection Act created chapter 160, Wisconsin Statutes, which serves as the backbone of Wisconsin's program. Chapter 160, Wis. Stats., provides a multi-agency comprehensive regulatory approach, using two-tiered numerical standards, based on the premise that all groundwater aquifers in Wisconsin are entitled to equal protection. There are a number of major components to Wisconsin's groundwater protection program:

- 1) Standards. Under chapter 160, Wis. Stats., the Department of Natural Resources (DNR) is required to establish state groundwater quality standards based on advice from the Department of Health and Social Services (DHSS). Standard setting is a continuing process based upon a priority list established by the DNR in conjunction with other state agencies. The state groundwater standards are contained in chapter NR 140, Wisconsin Administrative Code.
- 2) Regulatory Programs. Once standards are established, all state agencies must manage their regulatory programs to comply. Each state regulatory agency must have rules to assure that the groundwater standards are met and to require appropriate responses when the standards are not met. The state regulatory agencies are the DNR (solid and hazardous waste, industrial and municipal wastewater, spills); the Department of Industry, Labor and Human Relations (DILHR) (private sewage systems, petroleum

product storage tanks); the Department of Agriculture, Trade and Consumer Protection (DATCP) (pesticide use and storage and fertilizer storage); and the Department of Transportation (DOT) (salt storage). The implementation of the groundwater standards by the state agencies is described under "Summary of Agency Activities".

3)Aquifer Classification. One of the most important features of Wisconsin's groundwater law is something that was left out. When Wisconsin was debating the groundwater protection legislation, the U. S. Environmental Protection Agency (EPA) tried to develop a nationwide groundwater approach. A keystone of EPA's proposal was aquifer classification -- a scheme whereby each aquifer would be classified according to its use, value or vulnerability and then would be protected to that classification. This entailed the "writing off" of certain aquifers as industrial aquifers not entitled to protection and never again usable for human water supply. Wisconsin said "no" to aquifer classification. The philosophical underpinning of Wisconsin's groundwater law is the belief that all groundwater in Wisconsin is capable of being used for people to drink and must be protected to assure that it can be.

4)Monitoring and Data Management. At the time the groundwater legislation was created, there was concern that Wisconsin needed a groundwater monitoring program to determine whether the groundwater standards were being met. Therefore, a groundwater monitoring program was created under s. 160.27, Wis. Stats. Money from the Groundwater Account of the Environmental Fund has been used for problem assessment monitoring, regulatory monitoring, at-risk monitoring and management practice monitoring, as well as establishment of a data management system for collection and management of the groundwater data. See the "Groundwater Monitoring and Research" discussion in this report for further information.

5)Research. Although all state agencies must comply with the groundwater standards, the processes by which groundwater becomes contaminated, the technology for clean-up, the mechanisms to prevent contamination and the environmental and health effects of the contamination are often not well understood. In addition, the basic data on geology, soils, and groundwater hydrology is often not available. The University of Wisconsin System (UWS) and the state agencies have recognized that additional efforts in these research areas are badly needed. The Governor and the Legislature included a new groundwater research appropriation for the UWS beginning with the 1989-1991 biennial budget. During the past year, the UWS and the Departments of Agriculture, Trade and Consumer Protection, Industry Labor and Human Relations, and Natural Resources participated in a joint solicitation for groundwater-related research and monitoring proposals for funding during fiscal year 1994. See the "Groundwater Monitoring and Research" discussion for more details.

6)Coordination. In establishing the groundwater law, the Legislature recognized that management of the state's groundwater resources was a responsibility divided among a number of state agencies. Therefore, the Groundwater Coordinating Council was created to advise and assist state agencies in the coordination of non-regulatory programs and the exchange of information related to groundwater. The Coordinating

Council has been meeting since 1984. See the "Coordination Activities" discussion in this report.

7) Local Groundwater Management. The Groundwater Protection Act clarified the powers and responsibilities of local governments to protect groundwater in partnership and consistent with state law.

a. Zoning authority for cities, villages, towns and counties was expanded to "encourage the protection of groundwater."

b. Counties can adopt ordinances regulating disposal of septage on land (consistent with DNR requirements); cities, villages or towns may do so if the county does not.

c. Counties can regulate (under DNR supervision) well construction and pump installation for certain private wells.

d. Property assessors must consider the time and expense of repairing or replacing a contaminated well or water supply when assessing the market value of real property; they must consider the "environmental impairment" of the property value due to presence of a solid or hazardous waste disposal facility.

The following report is intended to update the Legislature and Governor on the status of the state's groundwater program and the activities of the Groundwater Coordinating Council.

SUMMARY OF AGENCY ACTIVITIES

The following summary describes the groundwater management efforts undertaken by the member agencies of the Groundwater Coordinating Council during the past year. As these summaries show, Wisconsin continues to have a strong commitment to protection of the groundwater resource.

DEPARTMENT OF NATURAL RESOURCES

The Department of Natural Resources (DNR) has statutory authority as the central unit of state government to protect, maintain and improve groundwater within the state (s. 144.025(1), Wis. Stats.). The DNR establishes the groundwater quality standards for the state under authority of s. 144.025(2)(b) and ch. 160, Wis. Stats. In addition to the establishment of groundwater quality standards, DNR has specific regulatory programs.

DNR regulatory programs to protect groundwater fall into one of three categories: water supply, wastewater, and solid and hazardous waste management. In addition, the Groundwater Management Section (GMS) assists in coordinating groundwater activities within the DNR, as well as with other state agencies. The GMS is responsible for adoption of groundwater standards contained in ch. NR 140, Wis. Adm. Code, development of an annual groundwater monitoring plan, coordination of the joint solicitation, review and management of groundwater monitoring projects, and maintenance of a data management system for groundwater data.

In August 1993, the Natural Resources Board approved amendments to ch. NR 140, Wis. Adm. Code, which add groundwater standards for 13 new substances, revise the standards for 22 substances, revise the preventive action limits for six substances and clarify rule language. The amendments were sent to the Legislature in September for review. The Assembly Natural Resources Committee voted to ask the Natural Resources Board to consider not revising the proposed standards for toluene and xylene because of a concern that the proposed revised standards would be above the taste and odor thresholds for these substances. At its January meeting, the Natural Resources Board approved keeping the standards for toluene and xylene unchanged while a study is performed to determine the taste and odor threshold for these substances. The remaining amendments were sent to the Revisor of Statutes in January and became effective April 1, 1994. Chapter NR 140 now includes groundwater standards for 96 substances of public health or welfare concern.

GMS staff will request hearing authorization from the Natural Resources Board in August on additional amendments to ch. NR 140, including Department of Health and Social Services (DHSS) recommended groundwater standards. Proposed amendments to ch. NR 140 would add groundwater standards for 13 new substances, revise 10 substances, clarify rule language, and add temporary exemption language for recirculation, infiltration, or injection as part of a remedial response.

GMS staff have received suggestions from state agency staff for substances for groundwater standards development. A draft list of suggested substances was sent to the DHSS in

August 1994 for groundwater standards development.

The NR 141 Ad Hoc Advisory Committee met four times during FY 94 to discuss groundwater monitoring well requirements. Early meetings focused on minimum borehole diameters and standards for flush mount manholes. The committee decided that the borehole diameter should remain six inches and that flush mount manholes shall have a wall thickness of 1/4 inch.

Other recommendations by the advisory committee include the inclusion in the code of tables for determining the amount of water to be purged during well development, educational efforts to enhance compliance, refined language, modified depths for the use of bentonite chips, and a strategy for labeling wells with a unique well number to allow tracking. Work has begun on methods for automating report submittals and developing a data base for tracking monitoring wells. A recommendations package is near completion. The committee will continue to meet and discuss improvements to the code and ways to incorporate new technologies.

A total of eight inspections of drilling operations were performed in FY 94. These inspections are designed to educate drillers and consultants about NR 141 and to enhance compliance with the code. Training sessions relating to NR 141 and drilling have been planned so that more DNR, DATCP, and DOT personnel are trained to make inspections.

The Bureau of Solid and Hazardous Waste Management continued to meet with two external technical advisory committees (TAC). The Hazardous Waste Management Section TAC continued to work with the DNR on modifications to the ch. NR 600, Wis. Adm. Code, rule series (NR 600-685). Public Hearings were held in May 1994. The TAC will request authorization to promulgate the rule at the September 1994 Natural Resources Board meeting. Included in the rule will be changes to ch. NR 635, Wis. Adm. Code, which covers groundwater and leachate monitoring standards.

The Emergency and Remedial Response (ERR) section, with the help of an external advisory committee and a focus group continued to develop a series of administrative codes (NR 700-736) covering remedial responses to environmental contamination including soil contamination. Seventeen chapters of the rule covering site notification through case closeout went into effect May 1, 1994. Two key elements of the rule are: (1) soil standards based upon protection of groundwater, per ch. NR 140, Wis. Adm. Code, and direct contact to substances in soil and (2) a standard remedy selection process. The latter is key to clearly defining how NR 140 groundwater standards will be used in remediating contaminated groundwater. The chapters on soils standards and remedy selection received final approval from the Natural Resources Board in July 1994.

The ERR section, with assistance from the Groundwater Management section and Legal Services has nearly completed the NR 140 guidance as it applies to groundwater clean-ups. It is expected that this guidance will be distributed by fall 1994.

The ERR section, as part of its responsibility to administer the State's Environmental Fund to cleanup severe contamination problems, initiated, or continued action at locations where groundwater contamination is known or suspected. \$3,760,000 was spent during the FY 92-93 biennium to address groundwater contamination at existing project sites. Approximately

\$2,100,000 was spent during FY 94 to address groundwater contamination at existing project sites.

The DNR continued its groundwater monitoring program which includes problem assessment monitoring, at-risk well monitoring, management practice monitoring and regulatory monitoring.

During fiscal year 1994, \$294,831 were awarded to 15 projects for the management practice monitoring program (see Table 1). The 15 projects were selected during the joint solicitation process described under "Groundwater Monitoring and Research" in this report.

During fiscal year 1995, approximately \$291,240 will be awarded to 14 projects for the management practice monitoring program (see Table 2). Five projects will be new studies selected during the joint solicitation process.

During FY 94, private wells in seven new priority watersheds were sampled for nitrate as part of the joint DNR-DATCP nonpoint source program. The new priority watersheds are: South Fork Hay River, Branch River, Soft Maple/Hay Creek, Tomorrow/Waupaca River, Camp/Center Lakes, Lake Mendota Priority Lake and Hillsboro Lake. Sampling was offered to well owners free of charge and on a voluntary basis. Watershed project managers had the option of applying for additional funding for triazine pesticide sampling and other parameters depending on their needs. All wells sampled were assigned a unique well number and inventoried. The primary sampling objective was to provide private well owners with information and education on well testing and groundwater. A secondary objective of sampling was to look at the quality of drinking water in the selected priority watersheds. A total of 5,101 nitrate and 2,491 triazine analyses have been performed since 1990. Results show that nitrate + nitrite exceeded the preventive action limit (PAL) in 53% and the enforcement standard (ES) in 13% of the wells sampled. Using the triazine screen, which tests for the triazine family of compounds, the atrazine PAL was exceeded in 11% and the ES exceeded in less than 1% of the wells sampled.

Additional funds were granted to the Red River/Little Sturgeon Bay and Whittlesey Creek Watersheds by the Bureau of Water Supply to sample private wells for bacteria and other parameters considered necessary to complete groundwater quality appraisals for basin plans.

During FY 94, the Bureau of Water Supply initiated several groundwater monitoring projects aimed at determining the impact of surface activities on groundwater and determining the extent of naturally occurring contaminants in drinking water wells. These included sampling for naturally occurring arsenic in the Lake Michigan, North Central and Southern Districts, radon sampling in private wells in the Lake Michigan District, radon sampling of public community wells statewide, sampling for VOCs at identified contamination sites in the Southeast District to determine the extent of groundwater contamination, and continued VOC and pesticide sampling statewide at identified high risk sites. More details on the Department's monitoring activities are contained in the Fiscal Year 1994 Groundwater Quality Monitoring Plan.

In September of 1993, the Region 5 office of the U.S. Environmental Protection Agency (EPA) approved the Wisconsin Wellhead Protection (WHP) Program Plan. In Wisconsin the DNR is the lead state agency for developing and implementing the Wisconsin WHP Protection Plan. The specific goal of Wisconsin's plan is to achieve localized groundwater pollution prevention

measures within public water supply wellhead areas consistent with the state's overall goal for groundwater protection.

The DNR, working with other state and federal agencies, and with extensive citizen input, has developed a two-part state WHP Program. The first part is mandatory. Wisconsin Administrative Code ch. NR 811 requires that a WHP protection plan be developed for any municipal water supply well that has been developed since May 1, 1992. This plan must be written and submitted to the DNR Public Water Supply Section for approval. If approval is not granted, the plan must be resubmitted until it is an acceptable plan.

The second part of the WHP Protection Plan covers any public water supply well that was approved prior to May 1, 1992. For those wells the DNR has determined that a voluntary wellhead protection program will be most effective. The voluntary program will not only provide increased protection for the public water supplies, but complement and enhance the overall groundwater protection programs that already exist in Wisconsin.

The WDNR has initiated a statewide public information campaign aimed at encouraging water purveyors to proactively protect their water supplies from potential sources of contamination. The WDNR is also committed to providing technical assistance to water suppliers who want to develop WHP protection plans for the water wells in their charge.

The WDNR is actively promoting wellhead protection efforts in the state. It has entered into a contract with the Wisconsin Rural Water Association to develop WHP protection plans for communities with less than 10,000 people. Through this contract, WHP plans are provided for small water systems at no cost. The WDNR is also providing funding for the development of a combined WHP plan for a portion of Chippewa County. A pilot project is planned where a WHP plan will be completed for the entire county.

The Municipal Wastewater Section (MWWS) of the Bureau of Wastewater Management, continues to work with communities utilizing land application for disposal of treated domestic wastewater. New municipal wastewater WPDES permits reflect the more stringent effluent limits for total nitrogen and chloride contained in ch. NR 206, Wis. Adm. Code. Management plans are required of permitted facilities and are used to assist communities to optimize the operation of their wastewater facilities. Groundwater monitoring is required at municipal land application facilities to confirm compliance with NR 140 Groundwater Quality Standards. A concerted effort is also being made to evaluate and require upgrading of groundwater monitoring systems in place at existing permitted facilities. Research by the Section to develop new methods of improving the effectiveness of community rapid infiltration land application systems has been completed.

The Industrial Wastewater Section (IWWS) continues to issue WPDES permits to facilities which land apply industrial waste waters, sludges, and/or food processing by-products, which may ultimately impact the groundwater. These facilities are required to submit management plans to ensure that the wastes are applied in a safe manner. Groundwater monitoring is also required at all large land application and wastewater storage sites. Analytical results of groundwater samples are reviewed for compliance with ch. NR 140, Wis. Adm. Code, on a continual basis as submitted. The IWWS has also been continuing its evaluation of all

industrial wastewater storage lagoons and large vegetable by-product storage structures. Per ch. NR 213, Wis. Adm. Code, approximately 200 facilities were required to conduct such evaluations, most of which were initiated in 1991 - 92. Several studies are now reaching completion, resulting in the upgrading or abandonment of many lagoons. Facilities with lagoons found to be adversely impacting the environment, including waters of the state, are required to meet the standards of ch. NR 213, Wis. Adm. Code, no later than July 1, 1995, or as specified by a WPDES permit. The Animal Waste Advisory Committee was formed to develop a comprehensive and effective proposal to resolve animal waste-related water quality problems. The Committee's proposal is due to be completed by December 31, 1994.

For more information, contact Mr. Mike Lemcke, DNR, P.O. Box 7921, Madison, WI 53707-7921; phone 608-266-2104.

DEPARTMENT OF AGRICULTURE, TRADE AND CONSUMER PROTECTION

Protecting Wisconsin's groundwater is of the highest priority for the Department of Agriculture, Trade and Consumer Protection (DATCP). DATCP's major activities in this area include management of pesticides, research, and funding local soil and water resource management projects.

Under the Wisconsin Groundwater Law, DATCP is responsible for managing pesticides and pesticide practices to assure that established groundwater standards for contaminants are not exceeded. This can include prohibition of certain activities including pesticide use. The agency has a further objective to manage practices to "minimize" groundwater contamination to the extent "technically and economically feasible". Pesticide practices regulated by DATCP include storage, handling, use, and disposal. DATCP also regulates the storage of bulk quantities of fertilizer.

Enforcement standards have been established in Wisconsin for many known and potential groundwater contaminants, including 30 pesticides. Standards for additional pesticides have been proposed. In response to concerns about atrazine contamination, DATCP amended administrative rule ch. ATCP 30 in 1992 to manage the use of atrazine in an effort to reduce or eliminate the potential for further groundwater impacts. Annual rule revisions are anticipated to respond to additional groundwater detects. Rule revisions for the 1994 growing season increased the number of prohibition areas. These amendments were enacted to address groundwater findings available as of April 1993. The rule amendments for 1994 took into account additional atrazine findings. Information suggests that atrazine use has declined as a result of the atrazine management rule and concern about groundwater contamination.

According to the EPA pesticides strategy document, when EPA determines that a pesticide presents a significant risk of leaching to groundwater in a state, it may either cancel the registration of that compound or allow the state to prepare a "State Management Plan" (SMP) describing how the state will manage the pesticide to protect groundwater.

DATCP and DNR staff cooperatively drafted Wisconsin's SMP for protection of groundwater from pesticides. The draft SMP was submitted to the EPA to facilitate finalization of their SMP

final submittal criteria. Our state plan was reviewed by the EPA's Headquarters Regional Review Team and will be used as a model for other state SMPs.

In the fall of 1989, DATCP and DNR funded a project to conduct groundwater and surface soil contamination investigations at 28 randomly selected commercial pesticide mixing and loading sites. The results from the DATCP/DNR study indicate that most sites throughout the state have some contamination; two thirds of the sites had soils contaminated with pesticides at concentrations above normal field use levels and over half had groundwater contamination. Of the sites with groundwater contamination, one third had pesticide levels exceeding the current state groundwater enforcement standards.

Based on previous Department conducted investigations, this reservoir of contaminants in all likelihood has and will continue to result in significant groundwater contamination thereby putting nearby well owners, including municipal wells in some cases, at risk. Surface water run-off from contaminated areas can also result in direct human and livestock exposure, property damage and/or surface water contamination.

Section 94.73 of the Wisconsin Statutes was created in August of 1993 and established the Agricultural Chemical Cleanup Program. The legislation authorizes funding for reimbursement of the high clean up costs related to cleaning up pesticide and fertilizer contamination at pesticide and fertilizer handling facilities.

The cleanup program funds will also allow program staff to identify and investigate pesticide contaminated sites throughout the state and then clean-up these contaminated sites. Sites that are suspected of being the most contaminated will be the first to be investigated by the Department. Investigation will include discussions with facility staff to determine the likely locations of contamination at the facility.

DATCP and DNR are surveying alachlor and its principal metabolites in Wisconsin groundwater. About 1000 immunoassay test kits were mailed to well owners selected from the DATCP groundwater database. Those well owners with a positive response to the immunoassay are offered a comprehensive pesticide water analysis at no cost. The project is nearing completion.

DATCP is evaluating the Atrazine Rule. One component of the evaluation is a statistically designed survey of atrazine in groundwater. About 280 private water supply wells will be selected at random for sampling. During FY 94, DATCP contracted with a consultant for survey design and hired an LTE to collect samples. Sample collection is about 25% completed.

DATCP also contributed to the development of DNR rules (NR 700 series) that establish soil cleanup standards.

DATCP solely funded three pesticide research projects during FY 94 and cooperatively funded one project each with the University of Wisconsin system and the DNR. \$135,000 is available each year through fees from pesticide manufacturers as a result of the pesticide law.

DATCP, through its soil and water resource management program, provides funding primarily to counties to assist in the protection of these resources. An increasing portion of this funding is dedicated to the development and implementation of better nutrient and pesticide management practices. \$176,000 has been provided to develop and demonstrate better management practices for nutrients and pesticides. This funding level is expected to increase.

Funding has been provided for the following projects: development of a county-wide geographic information system (GIS) to evaluate hydrogeologic factors and land-use practices with potential for groundwater contamination in Dane County; development of a groundwater management plan in Burnett County; implementation of nutrient management practices on selected farms in Buffalo, Chippewa, Manitowoc, and Marathon counties; and, an economic analysis of nutrient and pesticide management practices conducted by the University of Wisconsin Extension - Nutrient and Pest Management (UWEX-NPM) Program.

DATCP provided \$401,000 to fund projects in 13 counties for collection and disposal of waste pesticides and containers. More than 82,000 pounds of these wastes were collected from farm sites, thereby reducing the potential for inadvertent environmental damage. DATCP is requesting additional proposals from counties for the 1995 fiscal year. Approximately \$500,000 will be available during FY 95 for these projects.

For further information, contact Mr. Nicholas Neher, DATCP, 801 W. Badger Road, Madison, Wisconsin, 53708-8911; phone: 608-266-7130.

DEPARTMENT OF INDUSTRY, LABOR AND HUMAN RELATIONS

Private Sewage Systems

The Department of Industry, Labor & Human Relations (DILHR) continues to develop private sewage system regulations that will be embodied in chapter (ch.) ILHR 83, Wis. Adm. Code. Staff plan to present a draft revised code to the ILHR 83 Advisory Code Committee and the Secretary's office by September 1, 1994. The revised code is performance based; that is, the private sewage system code focuses on the quality of the end products and allows designers and owners options to meet these quality standards. There is a trade-off, however; in return for this flexibility, owners will be required to enter into contracts with management entities to ensure the long-term maintenance of their private sewage systems as specified by DILHR.

DILHR is completing its research at the Black River Falls Correctional Institute. In conjunction with a private consultant and the University of Wisconsin-Small Scale Waste Management Project, DILHR is testing three alternative designs. Preliminary results indicate that the designs achieve nitrogen removal. The study will be completed in Fiscal Year 1995, and a final study report will be issued by July 1, 1995.

DILHR is also completing efforts with the Department of Natural Resources to study the feasibility of a decentralized wastewater management system for Washington Island. The pilot project, which uses nitrogen-removal private sewage systems that are under municipal management, may be a model other communities can consider if the project is successful. These systems show promise; they come close to meeting the groundwater protection standard

for total nitrogen. The Department is now assessing what additional treatment credit, if any, can be recognized as the effluent moves through the native soils. The Department believes that a combination of treatment and soil dispersal may be sufficient at most sites to meet groundwater protection standards.

Petroleum Storage Tanks

Through the Bureau of Petroleum Inspection and Fire Protection, DILHR continues the implementation of the Flammable and Combustible Liquids code, ch. ILHR 10, Wis. Adm. Code. In FY 94, the main program objectives continue to be verifying that tank owners are meeting their leak detection responsibilities, increasing the number of annual inspections conducted at facilities having tank systems, and completing the implementation of the network of local program inspectors.

Owners meeting their leak detection responsibilities are identified through a use permit system and annual on-site inspections. The number of individuals who are in compliance with the leak detection requirements of the state and federal code has increased significantly because of this effort. The closure of substandard and older tanks have also been impacted by this effort. Since 1988, over 27,000 federally regulated tanks systems have been closed.

The focus on annual inspections has involved establishing a network of local inspectors and inspection of retail service stations by the Bureau's petroleum inspectors. The petroleum inspectors inspect retail sites for both product quality and compliance with the groundwater protection provisions of ch. ILHR 10. The number of retail sites inspected by this network comprise approximately 45 percent of the federally regulated underground storage tanks (USTs) found in Wisconsin.

The inspection of non-retail sites is conducted by local program operators who contract with DILHR to perform inspections. This network continues to grow and provide service throughout the state. In fiscal year 1994, the Bureau completed a bid process to obtain coverage for the remaining areas of the state that had not been covered by voluntary agreements.

The Petroleum Environmental Clean-up Fund Act (PECFA) program, which has been in operation since 1988 continued to implement cost control strategies that are detailed in administrative rule, ch. ILHR 47, Wis. Adm. Code. The main elements of the administrative rule include:

1. Requiring owners to compare proposals before hiring a consultant.
2. Limiting consultants only to providing consulting services when they have been hired to remediate a site.
3. Requiring that non-consulting services be contracted through a competitive bid process.
4. Establishing the maximum award that will be paid for a site investigation unless Departmental approval is obtained for additional costs.

5. Requiring consultants and consulting firms to register with the Department and meet certain standards to perform work under the PECFA program.
6. Financial audits to verify program costs claimed by owners.

The PECFA program was also expanded in 1994 to include limited coverages for small farm tanks and heating oil tank systems for schools. In addition, coverages were increased for above ground tank systems.

For more information, contact Mr. Bennette Burks, DILHR, P. O. Box 7969, Madison, Wisconsin 53707-7969; phone: 608-266-0056, FAX 608-267-0592

DEPARTMENT OF HEALTH AND SOCIAL SERVICES

Chapter 160, Wis. Stats., directs the Department of Health and Social Services (DHSS) to recommend health-based enforcement standards for substances found in groundwater and specifies the protocol for developing the recommended standards. DHSS prepares recommended standards for the substances at the top of a prioritized list identified by the DNR.

DHSS sends the recommendations to the DNR which then proceeds through the rule-making process to amend ch. NR 140, Wis. Adm. Code. In October 1993, DHSS sent draft recommendations for 13 new groundwater standards. In addition, recommendations were made to revise existing standards for 11 substances. Authorization to subject these recommendations to public hearings will be considered by the DNR board in August 1994. Hearings are expected to be held during October 1994.

The DHSS distributed research funds to The University of Wisconsin - Green Bay for a study of the health effects of consuming arsenic-contaminated water in Outagamie and Winnebago Counties. DHSS funded a graduate student to organize water sampling in the area, distribute a health survey and analyze the results.

DHSS staff review copies of advisory letters sent to well owners by DNR representatives. The agency often provides additional advice and information to owners of wells which are seriously contaminated with toxic substances such as benzene. Followup letters sent by DHSS explain the health effects of the specific contaminant and advise the homeowner regarding continued use of the water for bathing, laundry, etc.

The DHSS is responsible for investigating suspected cases of water-related illness. During the past year investigations have been conducted to examine the health effects of exposure to copper- and arsenic-contaminated water.

DHSS staff are listed on literature distributed by other agencies as resources for health risk information and handle several telephone calls each week answering questions about the health risks associated with consumption and household use of contaminated water. Toxicologists, public health educators, and epidemiologists employed by DHSS frequently present health-risk information at public meetings. They also prepare and distribute a wide variety of informational materials.

For more information, contact Dr. Henry Anderson, 1414 E. Washington Ave., Rm.96, Madison, Wisconsin, 53703-3044; phone: 608-266-1253.

GEOLOGICAL AND NATURAL HISTORY SURVEY

The Wisconsin Geological and Natural History Survey (WGNHS) performs basic and applied groundwater research and provides technical assistance, maps, and other information and education to aid in the management of groundwater resources. The WGNHS groundwater program is complemented by geology, soils, and climate programs that provide maps and research-based information essential to the understanding of groundwater occurrence, quality, and movement. Survey personnel are presently preparing groundwater-related maps (such as water-table or aquifer maps) at a scale of 1:100,000 for the following counties: Racine, Kenosha, Waukesha, Dane, Ozaukee, Price, Washington, Fond du Lac, La Crosse, Buffalo, Trempealeau, Eau Claire, Walworth, Polk, Burnett, Oconto, and Lincoln.

In FY 1994, the WGNHS responded to an increased number of requests for information and assistance from other local, state, and federal agencies, consultants, students, and the public. These requests ranged from the simple, "What will I find underground if I dig or drill here?", to the more complex, such as questions about groundwater flow and contaminant transport in areas of agricultural chemical use.

The public information, records, and research results that the WGNHS stores and disseminates save the considerable expense of gathering the same geologic or groundwater information several times for different purposes, or "re-discovering" the same information over time. To help this service, the WGNHS continues to review, sort and catalog about 12,000 well construction reports per year (in cooperation with the DNR), measure monthly groundwater levels in a monitoring network of 210 wells (in cooperation with the U. S. Geological Survey), collect, and describe geologic samples from 300 wells per year, and collect and analyze approximately 600 groundwater samples per year for nitrate, chloride, and several other basic parameters.

Research projects that have been completed this year or are in progress, include the following:

1. Groundwater flow and quality in fractured dolomite in Door County.
2. Hydrogeologic and engineering properties of glacial materials.
3. Age, origin, and movement of groundwater in low-permeability materials.
4. Pesticides in groundwater in Western Dane County.
5. Hydrogeology of Dane County.
6. Hydrogeology of Southeast Wisconsin.
7. Delineation of hydrogeologic units throughout Wisconsin.
8. Extent of atrazine contamination in the Lower Wisconsin River valley.
9. Soils, geologic, and hydrogeologic setting for atrazine movement in Dane County.
10. Evaluation of NURE hydrogeochemical data for use in Wisconsin groundwater studies.
11. Distribution of radionuclides in Wisconsin groundwater.

12. Delineation of potentiometric divide in the sandstone aquifer between the Wolf River and the Lower Fox River basins.
13. Hydrogeology and groundwater use, and quality of the Fox Cities area.
14. Preliminary comparison of a discrete fracture model with a continuum model for groundwater movement for fractured dolomite.
15. Evaluation of several groundwater susceptibility models and methods.

For more information, contact Mr. Ron Hennings, WGNHS, 3817 Mineral Point Road, Madison, Wisconsin, 53705-5100; phone: 608-263-7395.

DEPARTMENT OF TRANSPORTATION

The Department of Transportation (DOT) regulates the storage of highway salt under ss. 85.17 and 85.18, Wis. Stats., for the purpose of protecting the waters of the state from harm due to contamination by dissolved chloride. Additional groundwater management and protection related activities are performed by DOT as part of the design, construction, and maintenance process of state and federal highways. These activities include road salt research, hazardous materials (petroleum) and hazardous waste investigation and remediation, and wetland evaluation and compensation. The responsibility for the management of these activities is divided among several groups within DOT:

- *Salt Storage - Central Office and District Maintenance Sections (Division of Highways)
- *Salt Research - Central Office Materials Section (Div. of Highways)
- *Hazardous Materials (petroleum) - Office of Environmental Analysis (Div. of Highways) and District Environmental Coordinators (Div. of Highways)
- *Hazardous Waste - Risk & Safety Management Section (Div. of Business Management)
- *Wetlands - Office of Environmental Analysis (Div. of Highways) and District Environmental Coordinators (Div. of Highways)

Salt Storage and Road Application

Highway salt is stored statewide at various sites by suppliers, counties, cities, villages, and private companies. Annual inspections and reports are made of salt storage sites to insure that storage practices are in accordance with ch. Trans 277, Wis. Adm. Code (Highway Salt Storage Requirements). The intent of the Code is to help prevent the entry of highway salts into the waters of the state from storage facilities. All salt is required to be stored on a base which is constructed and maintained to be impermeable. The base is required to function as a holding basin and to prevent runoff. All salt piles are also required to be covered by impermeable materials or structures to prevent contact with precipitation.

Current policy in the State Highway Maintenance Manual restricts the spreading of deicer salts to a maximum of 300 pounds per lane mile per application. Electronic controls for salt spreader trucks are continually being tested to record and verify application rates and coverage effectiveness. Additional efforts to minimize and conserve salt applications are being pursued by the use of an in situ weather monitoring system consisting of temperature sensors and

remote processing units which determine and record temperatures of road pavement at approximately 30 separate statewide locations along major highway routes. The pavement temperature information is used to help determine the optimal sand/salt ratio applications. Also, annual training for proper snowplowing and salt spreading techniques is provided for county snow-plow operators, and the counties provide weekly reports of salt usage.

Salt Research

Since 1970, DOT has been investigating potential road salt impacts to the environment adjacent to highways. Early investigations (1970s to early 80s) were focused on evaluating road salt impacts to surface water runoff, vegetation, and soils. In the last several years DOT has conducted limited investigations evaluating road salt impacts to groundwater (1 or 2 shallow monitoring wells per site). To date approximately 18 sites throughout the state have been studied. In general, each site is monitored quarterly for a period of 5 years. The monitoring consists of analyzing soil, water, or vegetation samples for calcium, sodium, chloride, and electrical conductivity. Approximately 5 sites are currently being monitored, and future groundwater monitoring plans are being evaluated (i.e., longer monitoring periods and multiple well arrangements per site). Results from earlier studies are discussed in four separate DOT progress reports prepared by the Central Office Materials Soils entitled: Investigation of Road Salt Content of Soil, Water and Vegetation Adjacent to Highways in Wisconsin (1972, 1975, 1979, and 1989). The completion date of an updated progress report (Report 5) is unknown at this time.

Hazardous Materials (Petroleum) and Hazardous Waste

As part of the road construction program, DOT performs an estimated 500 environmental assessments annually along right-of-way where potential sources of petroleum or hazardous waste contamination may occur. The assessments consist of standard environmental audits of properties adjacent to highways, and environmental drilling and sampling to identify or delineate the extent of soil or groundwater contamination. This information is necessary for purposes of road design and construction. Numerous contaminated sites are identified as part of the environmental assessment process. This information is shared with the DNR so that appropriate enforcement and remedial action is taken to protect groundwater resources. In addition, DOT works with DNR and DILHR on 40 to 60 sites per year where underground storage tank removal or other remedial actions are necessary to accomplish highway improvement (i.e., managing the treatment, removal, or disposal of contaminated soils or groundwater).

Wetlands

During the past three years, DOT has engaged in a cooperative study with the U. S. Geological Survey to investigate groundwater relationships with respect to wetland creation and restoration projects. These projects are required as compensatory mitigation under section 404 of the Clean Water Act. The groundwater studies are intended to increase the certainty of establishing wetland hydrology. In addition, DOT has several ongoing wetland monitoring projects which will evaluate wetland hydrology and water quality.

For more information, contact Ms. Carol Cutshall, DOT, Room 3B, P. O. Box 7916, Madison, Wisconsin 53707-7916; phone: 608-266-9626.

UNIVERSITY OF WISCONSIN SYSTEM

The University of Wisconsin System (UWS) has research, teaching and information/education responsibilities. These three missions are well integrated through the cooperation and joint appointments of teaching, research, and extension personnel who work on groundwater issues.

Research - During FY 1994, the UWS has directed a wide-ranging program of priority groundwater research consisting of 13 projects. These projects are usually of 2-year duration.

Some are fundamental, others are applied in nature. The projects provide a balanced program of laboratory, field, and computer-simulation work aimed at determining whether laboratory experiments can be used to reliably predict conditions in the natural environment.

Among the categories of groundwater problems which have been investigated are:

1. Chemical and biological degradation of pollutants in surface soils, subsoils, and groundwater, including identification of degradation products.
2. Transport of pollutants in soil and groundwater, including elucidation of soil and hydrologic factors controlling movement.
3. Development of predictive models for the transport of pollutants in soil and groundwater.
4. Impact of waste management practices on groundwater quality.
5. Impact of agricultural management practices on groundwater quality.
6. Characterization of geologic factors affecting groundwater movement.
7. Examination of the social and economic impacts of groundwater contamination.
8. Evaluation of policy alternatives for controlling groundwater contamination.
9. Biological, chemical, and physio-chemical technologies for remediation of contaminated soils and groundwater.
10. Biological effects of groundwater contaminants.
11. Initiation of a reporting mechanism to disseminate groundwater research results.

The 13 projects funded in these categories provided training in several disciplines for many students, including postdoctoral research associates, graduate student research assistants, and undergraduate students. A complete list of the research projects funded during FY 94, their respective principal investigators, and associated costs may be found in Table 1. Table 2 provides a similar list of information for the 15 projects scheduled to be funded during FY 95.

Solicitations for these projects are coordinated with research and monitoring projects on groundwater in the DNR, DATCP, and DILHR. The projects are jointly reviewed and ranked and then funded by the appropriate agency. The UWS program is reviewed by the University's Groundwater Research Advisory Council (GRAC) and the Wisconsin Groundwater Coordinating Council (GCC).

Teaching - The UWS institutions continue to offer courses and/or programs at the undergraduate and/or graduate level focusing on groundwater resources. In addition, several

campuses offer credit, field-oriented water curriculum courses for middle school and high school teachers during the summer sessions.

Information/Education - The UW System institutions and county-based staff continue involvement in groundwater education activities. In cooperation with other state and federal agencies, groups and individuals, innovative problem-solving educational programs on groundwater resources are provided to the State's citizens through publications, meetings, teleconferences, satellite programs, water testing, and other forms of assistance. Activities of several specific programs follow.

The UWS farmstead assessment system (Farm*A*Syst) helps farmers and rural non-farm residents assess the relationship of their structures, management practices and site characteristics to groundwater pollution potential. The system has been applied in depth in seven Wisconsin counties, integrated into at least 3 Wisconsin Priority Watershed projects and is under consideration as a major part of the educational plan for other projects. A pollution prevention delivery system based on Farm*A*Syst is being developed in cooperation with farm supply groups and other businesses. Project evaluation shows Farm*A*Syst to be an effective, voluntary program which increases knowledge and, most importantly, leads to changes in practices. The expanded, national project is already working with several Canadian provinces and all 50 states in adopting this system. The National Comprehensive Groundwater Protection Guidance document encourages states to develop a cooperative FAS program. This is a cooperative project funded by the USDA Extension Service, Soil Conservation Service and EPA.

The U.S. Department of Agriculture (USDA) Water Quality Demonstration Project in the East River Watershed (Green Bay) is adopting research-based practices for cost-effective water quality protection. This year's educational emphasis has been on manure handling, private well protection, milkhouse waste reduction, integrated crop management, and fuel and pesticide storage. Use of specific crediting of nutrients from applied manure has resulted in the reduction in use of phosphorus and nitrogen on corn fields. Resulting economic savings of \$10 to \$20 per corn acre has impressed farmers.

The USDA Hydrologic Unit (Stevens Point, Whiting, and Plover Wellhead Protection) project in Portage county applies innovative, research-based practices to maintain or improve the communities' well-water supply. Agricultural practices, such as irrigation water management and reducing fertilizer and pesticide use complement an urban groundwater protection component in the project's educational and technical assistance efforts. This is the second year of a three-year program that comprehensively manages crop nutrients and pests, resulting in reduction of fertilizer and pesticide applications. Farmers in the project reduced inputs of nitrogen fertilizers, a source of nitrate contamination.

The UW Nutrient and Pest Management (NPM) program is engaged in thirty-one on-farm demonstration and field day activities to disseminate information on best management practices (BMPs) around the state. The program works to help landowners understand how their farm practices may influence the quality of groundwater. Another incentive is farm profitability. Over the past four growing seasons, NPM regional specialists established 138 demonstrations

on 72 farms statewide. Overall, 83% of the improved management practice demonstrations were more profitable than the standard practices to which they were compared.

The UWS cooperates with other state agencies involved in the Non-point Source Water Pollution Abatement program (Priority Watershed Program). This program works to improve water quality by providing education and/or technical assistance, and financial assistance through cost-sharing for BMPs to improve water quality in over sixty-five watersheds. Several projects incorporate groundwater education strategies into their overall information and education programs. Six Area Water Quality Education Specialists and 3 publication/editorial staff work with County Extension Agents and Land Conservation staff in educating both rural and urban residents. A common element to the program strategies used in these projects is well water testing and groundwater education. Additionally, this educational programming includes drinking water fact sheets, newsletter articles about groundwater and, in some instances, specific watershed studies that address unique water quality problems (e.g., elevated levels of arsenic in drinking water samples from Door County).

During the 1993 floods, some rural landowners experienced contamination of their wells. Wells are susceptible to contamination by flooding as well as high groundwater. UWEX used special USDA Flood Assistance funding to show people how to properly close unused wells and to explain how bacteria and parasites are transported in flooded areas. About 300 people attended the half-day well closing demonstrations.

To address issues related to water resources, Cooperative Extension formed the Extension Water Resources Coordinating Council (EWRCC). The EWRCC has conducted several projects aimed at:

- 1) maintaining an inventory of water-related programs and research,
- 2) enhancing internal communication,
- 3) assisting in priority-setting,
- 4) facilitating external coordination; and
- 5) fostering water resources education which integrates county and state staff expertise.

In the past year, the EWRCC has sponsored informational resources for those providing groundwater programming. These inventories have included:

- 1) a listing of committees, councils, and advisory groups which have work tasks related to water resources,
- 2) a national directory of electronic bulletin boards and databases that provide information about water resources topics; and
- 3) a directory of newsletter and periodic bulletins which contain water-related information.

The EWRCC publishes a monthly newsletter called Keeping Current which brings information about water-related issues to more than 1000 agency personnel in Wisconsin.

The Central Wisconsin Groundwater Center's (CWGC) mission is to provide groundwater education and technical assistance to the citizens and governments of Wisconsin. Center programs range in breadth from answering citizen questions (i.e. is my water safe? how deep

should I drill my well? where is this nitrate coming from?) to helping communities with wellhead protection planning to describing the extent and causes of groundwater nonpoint pollution in Wisconsin. The Center frequently works through county Extension faculty in program delivery.

Last year, the Center assisted 3780 households in having their water tested in conjunction with county Extension offices and the UWSP Environmental Task Force Lab. Of these, 7% exceeded the drinking water standard for nitrate nitrogen. Ten percent were unsafe for coliform bacteria. Twenty-two percent had moderate to severe corrosivity indexes. Education programs helped many of these families understand potential remedies for these problems and the relationship of land use practices to groundwater quality.

The Center worked with DATCP and DNR last year to "paint a picture" of groundwater nonpoint pollution in Wisconsin, and showed that in many agricultural counties in the state, 1 of 7 wells exceed the Enforcement Standard for nitrate. In addition, perhaps as many as 1 of 3 wells in some counties contain at least one pesticide. The Center sponsored a highly successful conference this spring (Nitrate in Wisconsin's Groundwater: Strategies and Challenges) which concluded that current efforts to slow the rate of nitrate pollution are ineffective.

Other projects include studying agricultural leaching in the Port Edwards Groundwater Priority Watershed; basin-scale modeling of contaminant loading and migration to the Stevens Point, Whiting, and Plover wells; grant-funded workshops which provided sand-tank groundwater flow models to four Central Wisconsin schools; and development of Home Water Safety educational materials.

For more information, contact Dr. G. Earl Peace, UW System, 1220 Linden Drive, Madison, WI 53706; phone (608) 262-5851.

LISTING OF GROUNDWATER-RELATED PUBLICATIONS FOR FISCAL YEAR 1994

Published by the Wisconsin Geological and Natural History Survey and available from WGNHS Map and Publications Office, 3817 Mineral Point Road, Madison, WI 53795. Contact WGNHS for a complete list of publications.

Variability of hydraulic conductivity in sandy till: The effects of the scale and method: 283 p. report.

Preliminary comparison of a discrete fracture model with a continuum model for groundwater movement in fractured dolomite: 44 p. report plus diskette.

Evaluation of groundwater susceptibility assessment systems in Dane County, Wisconsin: 52 p. report.

Distribution of radionuclides in Wisconsin groundwater: 20 p. report.

Hydrogeologic and land-use controls on atrazine detections in Dane County, Wisconsin: 64 p. report.

Bibliography of Wisconsin weather and climate: 14 p. report.

Depth to bedrock map of Eau Claire County, Wisconsin: two-color map (scale 1:100,000).

Precipitation summary for 1993: 4 p. brochure.

Groundwater levels in Wisconsin, summary, 1991-93: 4 p. brochure.

Pleistocene geology of Taylor County, Wisconsin: 25 p. report plus four-color map and cross sections (scale 1:100,000).

Soil-attenuation-potential map of Trempealeau County, Wisconsin: two-color map (scale 1:100,000).

Published by the UW System: A- series bulletins are available from UW-Extension Publications, 30 N. Murray St., Madison, WI 53706.

Nowak, P. J., et alia "The Effectiveness and Impacts of the Wisconsin Atrazine Rule" DATCP Tech. Rept., Madison, WI, 101 pp

Keeping Current A newsletter publisher by UWEX to provide a monthly update on WI water resource programs and issues.

Using Legumes as a Nitrogen Source (revised) A3517

Credit What You Spread - and Reap the Profits A3580

Credit Nitrogen on Corn - and Reap the Profits A3589

How Much Fertilizer Do Your Animals Produce? A3601

Avoiding Herbicide Resistance in Weeds A3615

Field Notes A newsletter published by NPM, six times per year.

Publications and Reports by the Central Wisconsin Groundwater Center:

Feind, C.L., J.A. Gearing, G.J. Kraft, and W. Stites. 1993. Agricultural contaminant loading and effects on groundwater quality in the Port Edwards Groundwater Priority Watershed. In Proceedings of the American Water Resources Association 17th annual meeting.

- Kraft, G.J. 1994 Nitrate in Wisconsin's Groundwater: Is it a problem and should we care? Proceedings of the conference Nitrate in Wisconsin's Groundwater - Strategies and Challenges. Central Wisconsin Groundwater Center, University of Wisconsin - Stevens Point.
- Kraft, G.J. 1994 Groundwater nonpoint pollution in Wisconsin: The consequences of a de facto policy. Proceedings of the 18th annual meeting of the American Water Resources Association - Wisconsin Section.
- Kraft, G.J., and W. Stites. 1994 Groundwater Impacts of potato and vegetable production. In Dave Curwen et al., eds. Proceedings of Wisconsin's annual potato meeting 1994. University of Wisconsin Extension, Hancock Agricultural Research Station, Hancock, Wisconsin.
- Kraft, G.J., B.H. Shaw, and J.O. Peterson. 1993 Public groundwater education leading to active groundwater management. In Proceedings of Symposium on Water Resources Education: A Lifetime of Learning. American Water Resources Association. Seattle, WA.
- Kraft, G.J., W. Stites, J.A. Gearing, and C.L. Feind. 1993. Impacts of agricultural leaching in a Wisconsin central sand plain groundwater basin. In Proceedings of Agricultural Research to Protect Water Quality. Soil and Water Conservation Society. Minneapolis, MN.
- Mechenich, C., and B. H. Shaw. 1994 Chemical Use Practices and Opinions about Groundwater Contamination in Two Unsewered Subdivisions. Journal of Environmental Health 56(6): 17-22.
- Mechenich, C., D. Mechenich, R. Hennings, J. Hovland and G. Blomberg. 1993 Evaluation of the Effectiveness of Drinking Water Education Programs in Wisconsin - Reaching Audiences and Empowering Change. American Water Resources Association. Proceedings of the Symposium, "Water Resources Education - A Lifetime of Learning". Bellevue, WA. pp 313-322.
- Mechenich, C. 1993 Groundwater Protection TV Campaign. Journal of Extension. Summer, 1993 p. 37.
- Publications and Reports by the UW Water Resources Center (Some of these UW publications were published in FY 1993 but were not included in the 1993 GCC Report to the Legislature and so are include here).
- Aiken, J. S. 1993. A three-dimensional characterization of coarse glacial outwash used for modeling contaminant movement. M.S. Thesis. Department of Geology and Geophysics, University of Wisconsin-Madison. 110 pp. + appendices.

- Anderson, J. L., R. H. Dowdy, J. A. Lamb, G. N. Delin, R. Knighton, D. Clay, and B. Lowery. 1993. Northern cornbelt sand plains management system evaluation area. pp. 39-47. *In: Agricultural Research to Protect Water Quality.* Soil and Water Conservation Society, Ankeny, Iowa.
- Anderson, P., and J. Strasma. 1993. Owning and operating a materials recovery facility (MRF): The inherent economic advantages of public and private ownership and operation. *Municipal Solid Waste Management*, May/June 1993.
- Anderson, P., J. Reindl, and J. Strasma. 1993. Sorting through the garbage: A new way to measure the effectiveness of recycling. *Resource Recycling*, April 1993.
- Bundy, L. G., and P. C. Widen. 1993. Land application of sweet corn waste - part II (Wisconsin). *Proc. of the 1993 Midwest Food Processors Assoc. Processing Crops Conf.* 5:95-106.
- Chambers, L., and J. M. Bahr. 1993. Tracer test evaluation of groundwater-surface water interactions. pp. 235-240. *In: N. E. Peters, E. Hoehn, Ch. Leibundgut, N. Tase, and D. E. Walling (eds.). Tracers in Hydrology.* IAHS Publ. No. 215. *Proceedings of the Yokohama Symposium*, July 1993. International Association of Hydrological Sciences, Velp, The Netherlands.
- Chesters, G., J. Levy, H. W. Read, and D. P. Gustafson. 1993. Distribution, transport and fate of major herbicides and their metabolites. *Final Report to Wisconsin Department of Agriculture, Trade and Consumer Protection*, Madison, Wisconsin. 185 pp.
- Chesters, G., and H. W. Read. 1993. Renovation of pesticide contaminated rinse waters. *Tech. Completion Rept.* University of Wisconsin System Groundwater Research Program, Water Resources Center, University of Wisconsin-Madison.
- Chesters, G., H. W. Read, J. M. Harkin, and C.-P. Chen. 1993. Safe on-farm disposal of dilute pesticide wastes. *Final Report to the U.S. Department of Agriculture*, Washington, D.C. Water Resources Center, University of Wisconsin-Madison. 67 pp.
- Dean, L. R. 1993. Colloids from intact soil columns: production and organic chemical sorption. M.S. Thesis. Water Chemistry Program, University of Wisconsin-Madison. 177 pp.
- Dolan, P. W., B. Lowery, and K. Fermanich. 1993. Nitrogen placement and leaching in a ridge-tillage system. pp. 176-183. *In: Agricultural Research to Protect Water Quality.* Soil and Water Conservation Society, Ankeny, Iowa.
- Dolan, P. W., B. Lowery, K. J. Fermanich, N. C. Wollenhaupt, and K. McSweeney. 1993. Placement and fate of nitrogen with ridge tillage in a sandy soil. pp. 201-208. *In: Proceedings of the Wisconsin Fertilizer, Agrilime and Pest Management Conference*, Madison, Wisconsin.

- Fermanich, K. J., B. Lowery, W. L. Bland, and K. McSweeney. 1993. Water, atrazine, and nitrate flux below the root zone of a sandy soil. pp. 92-99. *In: Agricultural Research to Protect Water Quality.* Soil and Water Conservation Society, Ankeny, Iowa.
- Grundl, T., and G. Small. 1993. Mineral contributions to atrazine and alachlor sorption in soil mixtures of variable organic carbon and clay content. *J. Contam. Hydrol.* 14:117-128.
- Grundl, T., and G. Small. 1993. The sorption of atrazine and alachlor to organic-poor mineral surfaces. Abstract. American Water Resources Association, Wisconsin Section, 17th Annual Meeting, Wausau, WI. p. 7.
- Keating, E. H., J. M. Bahr, D. Krabbenhoft, and J. Walker. 1993. Dissolved iron and redox changes in groundwater discharging to a stream. Abstract. 1993 Spring Meeting, American Geophysical Union. EOS p. 147.
- Levy, J. 1994. A field and monitoring study of atrazine transport and fate in groundwater. Ph.D. Dissertation. Land Resources Program, University of Wisconsin-Madison. 353 pp. + appendices.
- Lowery, B., K. J. Fermanich, and K. McSweeney. 1993. Herbicide and nitrate movement in a sandy soil under three tillage systems. pp. 448-454. *In: Agricultural Research to Protect Water Quality.* Soil and Water Conservation Society, Ankeny, Iowa.
- Lowery, B., K. J. Fermanich, K. McSweeney, and D. E. Stoltenberg. 1993. Parent and atrazine metabolite movement in a sandy soil. p. 321. *In: Agronomy Abstracts.* American Society of Agronomy, Madison, Wisconsin.
- Meigs, L. C., and J. M. Bahr. 1993. Tracer test evaluation of groundwater/surface water interactions. pp. 235-240. *In: N. E. Peters, E. Hoehn, C. Leibundgut, N. Tase, and D. E. Walling (eds.). Tracers in Hydrology.* International Association of Hydrological Sciences.
- Page, G. W., and H. Rabinowitz. 1993. Groundwater contamination: Its effects on property values and cities. *J. Am. Planning Assoc.* 59(4):473-481.
- Page, G. W., and H. Rabinowitz. 1993. The impacts of environmental problems on redevelopment. *Economic Development Quarterly,* Sage Publications.
- Park, J. K., J. Y. Kim, and T. B. Edil. 1993. Sorption capacity of shredded waste tires. *Proceedings of a Symposium on Geotechnics Related to the European Environment,* Bolton, U.K.
- Park, J. K., Kim, J. Y., and T. B. Edil. 1993. Mitigation of Organic Compound Movement in Landfills by a Layer of Shredded Tires. *Hazardous Waste and Groundwater Symposium V: Hazardous Waste Evolving Technologies,* 66th Annual Water Environment Federation Conference, Anaheim, California, October 3-7, 1993.

- Porter, W. P., S. M. Green, N. L. Debbink, and I. Carlson. 1993. Groundwater pesticides: Interactive effects of low concentrations of carbamates, aldicarb and methomyl and the triazine metribuzin on thyroxine and somatotropin levels in white rats. *J. Toxicol. Environ. Health* 40:15-34.
- Rayne, T. W. 1993. Variability of hydraulic conductivity in sandy till--the effects of scale and method. Ph.D. Dissertation. Department of Geology and Geophysics, University of Wisconsin-Madison. 134 pp.
- Rayne, T. W., and K. R. Bradbury. 1993. The effect of measurement scale on hydraulic conductivity. Abstracts. *Geol. Soc. Am.* 25(6):256-257.
- Stoltenberg, D. E., B. Lowery, K. McSweeney, and N. C. Wollenhaupt. 1993. Effect of tillage and no-tillage, irrigation scheduling, and polymer on atrazine, alachlor and metabolite movement in coarse-textured soil. Annual Progress Report to North Central Region Pesticide Impact Assessment Program, The Ohio State University, Columbus, Ohio.
- Webb, E. K., and J. S. Aiken. 1993. Jack and Jill went up the hill to fetch a pail of water: current approaches to joint hydrogeological and sedimentological research. Abstracts. *Geol. Soc. Am.* 25(6):108.
- Zhang, X. X., E. R. Christensen, and L.-Y. Yan. 1993. Fluxes of photocycling aromatic hydrocarbons to Green Bay and Lake Michigan sediments. *J. Great Lakes Res.* 19(2):429-444.

GROUNDWATER MONITORING AND RESEARCH

CONDITION OF THE RESOURCE - GROUNDWATER QUALITY

As part of 1983 Wisconsin Act 410, the Groundwater Account of the Environmental Fund was created to support groundwater monitoring by state agencies to determine the extent of groundwater contamination in Wisconsin and identify the sources of contamination. Groundwater monitoring has found that the primary contaminants of concern are volatile organic chemicals (VOCs), pesticides and nitrates. Each is discussed below.

Volatile Organic Chemicals - VOCs volatilize under normal temperatures and pressures. Examples of VOCs include gasoline and industrial solvents, paints, paint thinners, drain cleaners, air fresheners and household products (such as spot and stain removers). Many VOCs are suspected carcinogens when exposure is long term. In the short term, high concentrations of VOCs can cause nausea, dizziness, tremors or other health problems.

To date, the DNR has sampled over 6,000 wells for VOCs. Fifty-nine different VOCs have been found in Wisconsin groundwater. Trichloroethylene is the VOC which has been found most often in Wisconsin's groundwater. Sources of VOCs include landfills, underground storage tanks, and hazardous substance spills.

Wisconsin has 106 active licensed solid waste landfills of which 104 are required to monitor groundwater. Two studies conducted over four years revealed that out of 51 total landfills, including industrial and municipal landfills (both engineered and unengineered), 27 (53%) had VOC contamination in groundwater. However, VOC contamination occurred in groundwater at 21 (81%) of the 26 unengineered municipal solid waste landfills included in the two studies. While 20 different VOCs were detected overall, 1,1-Dichloroethane was the most commonly occurring VOC at all solid waste landfills. The two DNR publications: "Volatile Organic Compounds in Groundwater and Leachate at Wisconsin Landfills," dated February 1988, and "VOC Contamination at Selected Landfills - Sampling Results and Policy Implications" dated June 1989 further describe the research results. In a follow-up VOC study conducted from July 1992 through June 1994 the Department reviewed historical data and sampled groundwater at 11 closed, unengineered landfills and at six older, engineered landfills. VOC levels have decreased at all but two of the unengineered landfills though at many of the sites VOC levels do not show continued decline, and the level of contamination remains high at several sites. There was no VOC contamination definitely attributable to leachate migration at any of the six older, engineered landfills.

Wisconsin requires underground storage tanks to be registered if their capacity is greater than or equal to 60 gallons. This registration program has identified 146,142 tanks as of November 1992 in the state, of which 67,842 are regulated by the federal underground storage tank program and 40,050 are currently in use. As of December 20, 1988 approximately 17,500 underground storage tanks have been removed, and approximately 3,200 have been removed since October 1, 1991. Currently there have been 1,115 underground storage tank clean-ups completed and 6,105 clean-ups are currently active. The contaminants most commonly associated with leaking underground petroleum storage tanks are benzene, xylene, toluene,

and ethyl benzene. Sampling data from the State Laboratory of Hygiene (SLOH) for the period of January 1987 through May 1994, shows that benzene has been detected in 221 wells. 172 wells have had benzene detects exceeding the enforcement standard (ES) of 5 micrograms/liter (ug/l).

Section 144.76, Wis. Stats, the Hazardous Substance Spill Law, became effective in 1978. This law requires those who spill hazardous substances to report spills and to take actions necessary to restore the environment. The number of reported spills has increased from 360 in 1978 to 1,063 in 1989, 1,100 in 1990, and 1,324 in 1991. Petroleum products comprise 65 percent of all reported spills in Wisconsin.

Another VOC source is hazardous waste storage and handling facilities. VOCs can disperse quickly in groundwater and often spread over large distances. When various VOC sources are present in an area, it is difficult to identify the specific source of contamination.

Pesticides - Pesticides can reach groundwater as a result of normal application practices (nonpoint sources) or as a result of spills, waste disposal and improper storage practices (point sources). Pesticides were first determined to be a problem in Wisconsin when aldicarb was detected in groundwater near Stevens Point in 1980. Aldicarb use was discontinued in 1990 due to the issue of food safety, the findings of aldicarb in groundwater and the implementation of a rule regulating the use of aldicarb by the DATCP. Though aldicarb persists in the groundwater of the Central Sands, the number of wells impacted is beginning to decline.

Since 1983 the pesticide sampling program has expanded to sample for numerous pesticides, in addition to aldicarb, used in Wisconsin. Groundwater quality standards have been adopted to include 32 pesticides to date.

A significant problem identified through pesticide sampling is groundwater contamination related to the handling and storage of pesticides. To date, over 30 sites in Wisconsin have been identified where the improper handling of pesticides may have contributed or caused groundwater contamination problems found near the facilities. Due to the number of handling facilities at which groundwater contamination has been detected, the DNR and DATCP initiated a project to determine how widespread the problem is by investigating 27 randomly selected pesticide mixing/loading sites across the state. Results indicate soil and groundwater contamination is common at agri-chemical facilities in Wisconsin. Soils at 25 of the 27 sites contained pesticides. Groundwater samples from 15 sites contained pesticides and 9 had pesticide levels in groundwater above the state's ES. Nitrates were found in groundwater at 15 of the sites and seven of these had nitrate levels above the ES of 10 milligrams/liter (mg/l).

DATCP has initiated several studies to investigate pesticides in groundwater. Beginning in 1985, using DNR management practice monitoring monies, DATCP installed monitoring wells at a number of farm fields in susceptible geologic environments to determine the impact of pesticide use on groundwater. To date, the herbicide atrazine has been found at 25 of 35 sites and the herbicide alachlor (trade name Lasso) has been found at 7 of 23 sites.

DATCP randomly sampled well water on 534 Grade A dairy farms between August 1988 and February 1989 to determine the extent of pesticide contamination. Grade A dairy farms were

sampled taking into account ease of access and regulatory authority considerations. Water samples were analyzed for 44 pesticides and nitrates. A total of 71 wells (13%) contained one or more pesticides. Atrazine was found alone or in combination in 66 wells (12%). In 39 of these 66 wells (59%), the concentration of atrazine was above its preventive action limit (PAL) of 0.35 micrograms per liter (ug/l), and in 3 of these it was over its ES of 3.5 ug/l. Alachlor exceeded its ES of 0.5 ug/l in all 5 wells where it was found.

Two studies were initiated as a follow-up to the Grade A dairy survey. In the first study, DNR staff resampled 69 of the 71 wells which showed detectable concentrations of one or more pesticides as well as nearby wells to determine the extent of pesticide occurrence associated with the original detects. Of the 69 resampled wells, 57 had detections of one or more pesticides. Atrazine was found in 50 wells by itself and in 6 wells with one or more other pesticides. Atrazine concentrations exceeded the ES in 2 wells. A total of 212 adjacent wells were sampled. One or more pesticides were detected in 63 of these wells. Atrazine was detected by itself in 57 wells and in combination with one or more other pesticides in 6 wells. One well had atrazine concentrations above the ES.

A second study initiated by DATCP was a rural well sampling program to get a better understanding of pesticides and nitrates in groundwater in rural portions of Wisconsin. Immunoassay testing was used to screen for atrazine and similar triazine herbicides. Approximately 2,200 rural wells were sampled at a cost of \$16 to each homeowner. Sixteen percent (351 of 2,187) of the well tests contained detectable concentrations of triazine-class compounds. Atrazine is the most widely used triazine herbicide in Wisconsin. Six percent (127) of the wells had triazine concentrations over the atrazine PAL and less than 1% (11) had triazine concentrations above the atrazine ES.

A groundwater standard for total chlorinated atrazine residues to include parent atrazine and metabolites of health concern was adopted in February of 1992. The new enforcement standard is 3.0 ug/l for the sum of atrazine and its three chlorinated metabolites (deethylatrazine, deisopropylatrazine and diaminoatrazine). The new PAL is 0.3 ug/l.

As part of the Rural Well Survey, CIBA-GEIGY Corporation received a split sample from each of the 236 follow-up wells that had a value at or above 0.35 ug/l from the triazine test. CIBA-GEIGY analyzed these samples for parent atrazine and all the chlorinated metabolites, deethylatrazine (DEA), deisopropylatrazine (DIA), and diaminoatrazine (DAA). Results from this phase of the Rural Well Survey were received by DATCP in March 1992. These are the first data on the presence of diaminoatrazine in Wisconsin groundwater. Eighty-five percent (200 of 236) of the wells contained atrazine, 88% (208 of 236) contained DEA, 61% (143 of 236) contained DIA, and, surprisingly, 83% (195 of 236) contained DAA. Average concentrations (including non-detects) were 0.90, 0.71, 0.27, and 0.86 ug/l for atrazine, DEA, DIA, and DAA, respectively.

The addition of the diaminoatrazine metabolite to the total chlorinated residues from the 236 samples analyzed by CIBA-GEIGY increased the number of samples at or above the PAL (0.30 ug/l) from 197 to 208. More importantly, the number at or above the ES (3.0 ug/l) increased from 45 to 71. Comparing these to the 2187 samples screened in the Rural Well Survey, 9.5% (208 of 2187) exceed the PAL and 3.2% exceed the ES. It is interesting to note that the Grade

A survey estimated that between 5 and 9% of wells on Grade A dairy farms contain parent atrazine at or above the PAL for parent atrazine (0.35 ug/l) which was in place in 1988.

Any well with a concentration of triazines above the PAL or nitrates above 10 milligrams/liter (mg/l) was resampled by the DNR and analyzed by the DATCP for a more complete list of pesticides. A total of 452 follow-up samples were collected. 220 of the 452 contained a detectable pesticide; in 215 cases, it was atrazine.

Triazine Screening - Triazines are a class of herbicide compounds which include atrazine and simazine. Beginning in January of 1991 the Wisconsin State Laboratory of Hygiene (SLOH) initiated a testing program for the public based on the immunoassay screening test for triazine based compounds. This program is available to the public via a toll-free telephone number. Since the start of this program, approximately 8,000 groundwater samples have been analyzed.

Triazine screen sampling data from the SLOH, since the program began in 1991 indicates that 17.9% of the samples have exceeded the PAL for atrazine of 0.3 ppb, and 2.24% have exceeded the ES of 3.0 ppb for atrazine. These numbers are used only for reference since the test screens for compounds other than atrazine specifically.

One drawback of the triazine immunoassay test kit, currently in use by the SLOH, is that it can detect only one of the three atrazine metabolites in the total atrazine standard, deethylatrazine. The other two metabolites, deisopropylatrazine and diaminoatrazine are not detected in this screen. In addition, atrazine and related triazine compounds are reactive to different degrees in the test. Combinations of triazine compounds can result in cross-reactivity between compounds causing the least detectable dose of each compound to increase.

Nitrate - Nitrate-nitrogen is the most commonly found groundwater contaminant, and frequently exceeds the state drinking water standard and ES of 10 milligrams/liter (mg/l) nitrate + nitrite. (Nitrate + nitrite nitrogen will henceforth be referred to as nitrate.) Consumption of water containing high concentrations of nitrate can induce methemoglobinemia or "blue baby syndrome," a condition in which hemoglobin is oxidized to a form which is unable to carry oxygen to the body's tissues in infants under six months. Serious poisonings in infants has occurred following ingestion of water containing nitrate concentrations as low as 50 mg/l, just 5 times the current standard. Fatal poisonings usually involve ingestion of water containing 100-150 mg/l nitrate. The effects of ingesting lower concentrations are not known, but some experts believe this could cause a chronic oxygen shortage, which could injure an infant's nervous system. Nitrate is not usually harmful to adults or older children.

Nitrate can enter groundwater from many sources, including nitrogen based fertilizers, animal waste storage and feedlots, municipal and industrial wastewater and sludge disposal, refuse disposal areas, and private sewage systems. Approximately 10% of the private wells in the state are estimated to contain nitrate above the ES.

This number was confirmed by the nitrate sampling that was done in conjunction with the DATCP Grade A farm well survey. The sampling found nitrate concentrations above the PAL of 2 mg/l in 255 wells (48%) and over the ES of 10 mg/l in 55 (10%) of these wells. The April, 1989 DATCP report "Grade A Dairy Farm Water Well Survey" provides a summary of this

pesticide and nitrate sampling effort. Of the 2,187 wells in the Rural Well Survey, 355 (16%) exceeded 10 mg/l nitrate.

This study and other statewide studies have shown nitrate contamination above the drinking water standard in 10% of the state's domestic wells overall. At that rate 75,000 of Wisconsin's 750,000 wells exceed the standard of 10 mg/1 of nitrate. Groundwater sample data from the SLOH for the past three years has indicated that approximately 55% of the samples have exceeded the PAL of 2.0 mg/l and approximately 18% have exceeded the ES of 10.0 mg/l for nitrate.

Concentrations of nitrate are not uniform across the state. Some undeveloped areas have low levels of nitrate in groundwater, whereas up to 50% of rural wells in some agricultural areas of southern Wisconsin exceed the enforcement standard for nitrates. County groundwater assessments conducted by the Wisconsin Geological and Natural History Survey have found counties ranging from 2% in Burnett county to 16% in Pepin, of the samples tested for private water supply wells had nitrate above the groundwater enforcement standard. Most of the differences across the state can be related to variations in nitrogen loading and to differences in soil, geology, and groundwater conditions across the state.

Due to the concern over nitrate, the Groundwater Coordinating Council (GCC) endorsed a resolution in 1989 recommending that newly constructed water supply wells be tested for nitrate in addition to coliform bacteria.

Natural Groundwater Quality - Natural groundwater quality varies greatly throughout Wisconsin. Undesirable constituents commonly found in Wisconsin groundwater include arsenic, and radioactive compounds, iron, manganese, chloride, and sulfate. High levels of iron have been detected throughout the state. High levels of manganese, arsenic and sulfates are less commonly found and are more localized in extent.

Naturally occurring radioactivity in groundwater, including uranium, radium and radon, have become a concern in Wisconsin in recent years. The state has initiated programs to test groundwater for radioactivity. Recent sampling has identified radionuclides in groundwater in north-central Wisconsin. High levels of radium have also been found in water supplies in eastern Wisconsin.

Biological Hazards - The DNR is aware of several areas in Wisconsin where biological contamination of the aquifer is common place. Biological agents include bacteria, virus, and parasites. These agents can cause acute illness which could result in serious illness for some groups of people.

Approximately 10 - 13% of water samples test positive for coliform bacteria, an indicator species of other biological agents. The Department recommends that well owners test for biological quality annually or when there is a change in taste, color, or odor of the water.

CONDITION OF THE RESOURCE - GROUNDWATER QUANTITY

Wisconsin is favored with thick sequences of permeable deposits across most of the state forming four major aquifers that yield water to wells:

- 1) sand and gravel aquifer,
- 2) eastern dolomite aquifer,
- 3) sandstone aquifer, and
- 4) crystalline bedrock aquifer.

Groundwater is plentiful and of good quality in most of the state except in a part of north-central Wisconsin underlain by poorly productive, fractured crystalline rocks (see figure 1). In this area, yields of groundwater during dry seasons are too low in some places to sustain large water supplies. However, yields adequate for domestic wells can usually be found.

Groundwater supplies more than 70 percent of Wisconsin's population, and is a primary source of water for agriculture and the sole source of private water supplies. The overall supply of groundwater is more than adequate to meet the growing demand in the foreseeable future. More than one million billion (1,000,000,000,000,000) gallons of water is estimated to be stored underground in Wisconsin. At current pumping rates for private, municipal, industrial and agricultural uses, groundwater in storage would last more than 5,000 years without replenishment. However, replenishment of groundwater occurs constantly.

For all practical purposes, the total amount of water available in Wisconsin remains essentially the same as it was more than one hundred years ago. Groundwater is being constantly replenished by precipitation, which brings annually about 31 inches of water to the surface area of the state. Of this amount, almost 10 inches enters streams and eventually flows out of the state. The rest returns to the atmosphere by evaporation or transpiration. Of the 10 inches per year, or 30 billion gallons of water per day, that flows out of Wisconsin, between 15 and 20 billion gallons is contributed by groundwater.

The occurrence and availability of groundwater differs considerably from area to area, depending on the character and thickness of water-bearing rocks and their connection with underlying and overlying rocks, soil, and surface water. The rate of groundwater recharge varies correspondingly from close to zero in parts of eastern Wisconsin where there are mainly impermeable soils, to perhaps as much as 50 percent of annual precipitation in the central portions of the state where sandy glacial deposits cover the surface and allow good access of rain water to groundwater.

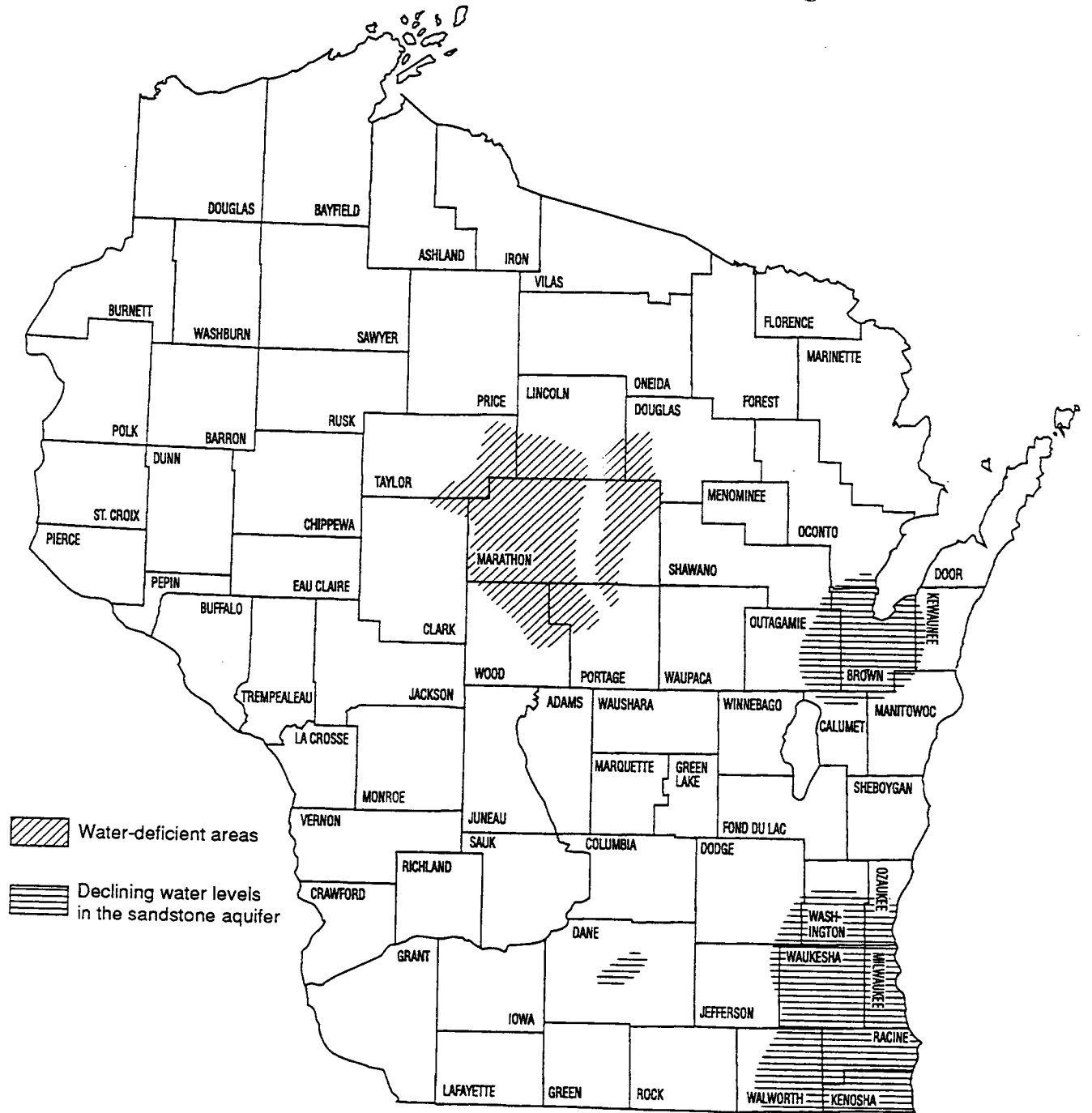


Figure 1. Map showing generalized areas of water-deficiency and declining water levels (Source: WGNHS files)

If we assume that, on average, about 15 percent of annual precipitation reaches the water table, approximately 14 billion gallons of water is recharged to groundwater every day. This is enough to fill Lake Winnebago 600 times each year. Estimated daily use of groundwater in Wisconsin is about 600 million gallons, which represents only 4 percent of daily groundwater recharge.

Despite this general abundance of groundwater, water levels are declining slowly in local areas of concentrated pumping, primarily in southeastern Wisconsin, the Lower Fox River Valley and Dane County (see Figure 1). Fortunately, the declines thus far have been primarily in artesian pressure, resulting in increased costs of pumping but not in dewatering of aquifers. Management options to maintain an adequate groundwater supply are being considered in most of these areas.

Effective management of groundwater in Wisconsin requires up-to-date information on groundwater levels and their fluctuations and trends. The WGNHS and U.S. Geological Survey (USGS) initiated a statewide water-level observation network in 1946. Water-level measurements are checked and entered into a computer data base. Statewide summaries of groundwater level trends are published annually or biennially. During 1992, systematic observations of water levels were made on 193 wells. Currently, the observation network is being evaluated for efficiency. Geophysical logging and well testing are being planned for 1994-95 to obtain adequate data on geologic units and their hydraulic parameters on observation wells with insufficient basic documentation.

A computer program for retrieval of water-level data was developed and a Groundwater Data County Series was initiated in 1990. Groundwater data are summarized on a single information sheet. The first side of the information sheet contains station history, which includes well number and location, well construction and observation information, and length of record. The second side of the information sheet contains the water-level record, including average monthly and annual levels and maximum and minimum levels for each year on record. Groundwater data sheets are available on request from the WGNHS or USGS.

In 1994 water levels in Wisconsin wells were again at normal levels after extreme climatic conditions in 1988-89 (drought) and in 1993 (flooding), which had significant impacts on groundwater levels in the state: first, record low levels during 1989-91, and then, record high levels in 1993.

More attention is being paid to the connection between groundwater and surface water. In 1992 the WGNHS, USGS, and Dane County Planning Commission began a cooperative study of the hydrogeology of Dane County with emphasis on groundwater/surface water relationships, and in particular, the effects of groundwater withdrawals on streams, lakes, and wetlands. One of the primary products of this study will be a new countywide numerical groundwater flow model, which should be completed in early 1995. Once this model and the associated hydrogeologic data bases are in place, the WGNHS will be better able to assess such issues as production well siting, wellhead protection, effects of land-use changes, and groundwater recharge in Dane County. Results of the study will be applicable to similar areas in Wisconsin.

COORDINATION OF GROUNDWATER MONITORING AND RESEARCH

Four state agencies have approximately \$825,000 available each year for groundwater-related monitoring or research. The purposes and sources of money include:

1. DNR Management Practice Monitoring - The DNR has approximately \$350,000 available each year to support groundwater monitoring studies evaluating existing design and/or management practices associated with potential sources of groundwater contamination. The intent of these studies is to reduce the impacts of potential sources of contamination by changing the way land activities which may impact groundwater are conducted.
2. DATCP Pesticide Research - Since 1989, DATCP has had approximately \$125,000 available annually through fees from pesticide manufacturers as a result of the pesticide law to fund research on pesticide issues of regulatory importance.
3. UWS Groundwater Research - \$300,000 is available annually for groundwater research administered by the University of Wisconsin System (UWS).
4. DILHR Private Sewage System Research - DILHR received an appropriation of \$50,000 for four years, beginning in 1990, to fund research on alternatives to current private sewage system technology. The research, which will include groundwater monitoring, focuses on designs, products, and management practices that minimize nitrate contributions from private sewage systems.

In order to provide consistency and coordination among the four state agencies (DATCP, DNR, DILHR and UWS) in funding groundwater monitoring and research to meet state agency needs, there have been discussions among the involved agencies through the GCC for some time. At the request of the GCC, the UWS in 1988 created a Groundwater Research Advisory Council (GRAC) to establish a long-range groundwater research plan and develop a groundwater research decision item narrative (DIN) for inclusion in the University's biennial budget. The GRAC consists of university, state agency, and public representatives.

Based on discussions with the GCC, the GRAC prepared a groundwater research DIN for inclusion in the University's 1989-1991 biennial budget request. The GCC endorsed the DIN at its October 14, 1988 meeting. The DIN was included in the governor's budget and was approved by the Legislature at a level of \$500,000 for the 1989-1991 biennium for groundwater research. This amount was increased to \$600,000 for the 1991-1993 biennial budget. Statutory language requires that there be agreement between the UWS and the GCC on the use of the UWS research funds before the funds can be released by the Department of Administration.

To expedite this agreement, a Memorandum of Understanding (MOU) was signed in 1989 by representatives of the GCC, the GRAC and the UWS on use of the UWS groundwater research funds. The MOU spells out the procedures for establishing priorities and selection of projects for funding of UW groundwater research. The MOU recognizes that the GCC has a

substantive role in establishing research priorities and an advisory role in project selection to minimize overlap and duplication.

The UWS funded 19 groundwater research proposals during FY 90 & 91 with concurrence from the GCC. The results of the first studies that were funded by the UWS were published in October 1991 by the UW Water Resources Center in a report titled, "UWS Groundwater Research Program, Summary of 21 Projects".

During the summer of 1990, the GRAC and GCC developed and endorsed a plan to coordinate the solicitation of projects for funding in FY 92 and future years. The mechanism provides for only one submittal of project proposals, rather than four as has been the case. The intent of the plan is to determine the most appropriate funding source for funding a particular project.

Summarization of agencies efforts promoted through the joint solicitation is as follows:

Additional Funding Information

1. DNR - The DNR has been funding groundwater management practice monitoring projects since FY 86. The money has come from the Groundwater Account of the Environmental Fund (which is funded by various fees). Through FY 94, the DNR has spent approximately \$2.8 million on 112 monitoring projects. One project has been co-funded with DATCP.
2. UWS - The UWS has received funding as part of the base UWS budget since FY 90 for groundwater research. They received \$200,000 in FY 90 and \$300,000 annually since then. Through FY 94, the UWS has spent \$1.4 million on 38 groundwater research projects. Three of the 46 projects have been co-funded with DATCP.
3. DATCP - DATCP has received approximately \$125,000 per year since FY 90 for pesticide research. The money comes from fees paid by pesticide manufacturers to sell their products in Wisconsin. Through FY 94, DATCP has spent about \$6250,000 on 12 pesticide projects. Three were co-funded with the UWS and 1 was co-funded with the DNR.
4. DILHR - DILHR received a special GPR appropriation of \$50,000 for 4 years s. 145.20(5), Stats., beginning with FY 90 to fund research on alternatives to current private sewage system technology. That appropriation ended at the end of FY 93; DILHR is seeking an appropriation to continue this research. Through FY 93, DILHR spent \$263,100 on three projects.

Approximately \$5.1 million has been spent through FY 94 on 163 different projects dealing with groundwater or related topics.

FY 94 Monitoring Projects - Joint Solicitation

The joint solicitation for FY 94 was sent out November 30, 1992. A total of 43 project proposals were submitted in response to the joint solicitation. To assist in the review process, a joint meeting of the Monitoring & Data Management and Research Subcommittees of the Groundwater Coordinating Council was held in early March 1993 to review and rank the projects submitted for funding. As a result of that meeting and review of the proposals by DNR staff, 7 new projects were selected for funding in FY 94; one of those is being co-funded with the DATCP. Eight on-going projects were carried over into FY 1994.

In addition to the projects funded by the DNR, the UW System fully funded 12 projects and co-funded one project with DATCP. DILHR fully funded one project in FY 94. A total of 28 projects were funded through the joint solicitation at a cost of approximately \$862,000 (see Table 1 and Figure 2).

FY 95 Monitoring Projects - Joint Solicitation

A joint solicitation for project proposals by the UW System, DNR, DATCP and DILHR was sent out on November 30, 1993 for funding in FY 95. The deadline for proposals was January 15, 1994. The joint solicitation contains a listing of the priorities for each of the agencies (see appendix). The priority needs for the DNR's management practice monitoring program for FY 1995 were identified by the Monitoring & Data Management and Research Subcommittees of the Groundwater Coordinating Council. The two subcommittees met in early March to rank the 36 proposals submitted. A summary of the projects funded in FY 95 is listed in Table 2.

Table 1 - Groundwater Projects Funded Through
the Joint Solicitation for FY 1994

Projects funded by the DNR in FY 94

1. * Tracer Study for Characterization of Groundwater Movement and Contaminant Transport in Fractured Dolomite by Ken Bradbury, \$10,050.
2. * Long-term Transformations and Fate of Nitrogen with Mound Type Soil Absorption Systems for Septic Tank Effluent by John Harkin, \$34,057.
3. * A Further Study of Organics at Wisconsin Municipal Solid Waste Landfills by Jack Connelly, \$24,040.
4. * Evaluation of Five Groundwater Susceptibility Assessment Systems in Dane County, Wisconsin by Mike Bohn, \$16,224.
- * Urban Stormwater Infiltration: Assessment and Enhancement of Pollutant Removal by David Armstrong, \$31,500.
5. * A Study of the Response of Nitrate and Pesticide Concentrations to Agricultural BMPs in Sandy Corn Fields, Fred Madison, \$2,896.80.
6. * DATCP Pesticide Field Study by Jeff Postle, \$11,259.00.
7. * Investigation of Potential Groundwater Impacts at Yard Waste Compost Sites. Connelly. \$5,970
8. Optimization of Two Recirculating Sand Filters for Nitrogen and Organic Chemical Removal from Domestic Wastewater, by Byron Shaw, \$30,179.
9. The Further Incidence of Native Arsenic in Eastern Wisconsin Water Supply Wells; Marinette, Oconto, Shawano and Brown Counties, by Richard Stoll, \$20,532.
10. Integrated Computerized Mapping of Point Source Contaminants and Physical Environmental Characteristics to Protect and Manage Groundwater Quality by Richard Stoll, \$29,940.
11. An Investigation of Field-Filtering and Low-Flow Pumping When Sampling for Metals by Jack Connelly, \$24,896.
- Factors Effecting the Determination of Radon in Groundwater by William Sonzogni, \$9,600.
12. Groundwater Survey of Alachlor and its Polar Metabolite by James Vanden Brook, \$13,509.

Including the co-funded project listed below the total cost for DNR projects in FY 94 was \$294,831.80.

Projects funded by the UWS in FY 94

13. * Trace Metal Transport Affected by Groundwater/Stream Interactions by Jean Bahr, \$17,730.

14. * Management of Sweet Corn Processing Wastes to Protect Groundwater Quality by Larry Bundy, \$17,320.

15. * Variability of Hydraulic Conductivity in Supraglacial Sediments by David Mickelson, \$28,900.

16. * Field Evaluation of Near Source Transport of Contaminants in Heterogeneous Media by John Hoopes, \$38,300.

* Ultrasonic Verification Technique for Evaluating Well Seals by Tuncer Edil, \$21,590.

17. * Impact of Tunnel Dewatering on Surface Water Bodies in Milwaukee County by Doug Cherkauer, \$27,900.

Mineral Phase Sorption of Selected Agrichemicals to Wisconsin Soils by Tim Grundl, \$20,000.

18. Stratigraphy, Sedimentology, and Porosity Distribution of the Silurian Rocks of the Door Peninsula, Wisconsin by Mark Harris, \$16,810.

19. Using 'PREDICT' to Reduce Herbicide Usage and Improve Groundwater Quality by Robert Gordon Harvey, \$15,000.

Photocatalytic Degradation of Volatile Organic Carbon by Marc Anderson, \$32,000.

Comparative Evaluation of Biostimulation Approaches for Enhancing in Situ TCE Degradation in Contaminated Aquifers by William Hickey, \$24,570.

Improved Design of Pump and Treat Systems for Heterogeneous Aquifers by Jean Bahr, \$21,840.

The total cost for projects funded by UWS in FY 94 was \$284,000.

Projects funded by DATCP in FY 94

20. Leaching Potential of Imazethapyr and Nicosulfuron Herbicides in Sparta Sand by Birl Lowery, \$18,680.

21. Cover Crops to Limit Herbicide Use on Sweet Corn by Astrid Newenhouse, \$24,000.

22. The Use of Peat as a Adsorptive Medium for Remediation of Pesticide Contaminated Groundwater by James Wiersma, \$14,300.

The cost for projects funded by DATCP was \$114,980, including co-funded projects listed below.

Project co-funded by DATCP and UWS in FY 94

23. Herbicide Contamination of Soil and Groundwater at a Mixing and Loading Site by Gordon Chesters, \$55,040 (\$10,040 UWS, \$45,000 DATCP).

Project co-funded by DATCP and DNR in FY 94

24. Ground-Water Hydrology of an Agricultural Watershed by Kenneth Potter, \$50,179 (DATCP \$20,000, DNR \$30,179).

Project funded by DILHR in FY 94

25. * Nitrogen Removal from Domestic Wastewater in Unsewered Areas by Richard Otis, James Converse, et. al. \$63,100.

Projects preceded by an asterisk are projects which were also funded in FY 1993.

Numbered projects are located on the State map in Figure 2.

Table 2 - Groundwater Projects Funded Through
the Joint Solicitation for FY 1995

Continuing projects to be funded by the DNR in FY 95

Optimization of Two Recirculating Sand Filters for Nitrogen and Organic Chemical Removal from Domestic Wastewater, by Byron Shaw, \$30,390.

Integrated Computerized Mapping of Point Source Contaminants and Physical Environmental Characteristics to Protect and Manage Groundwater Quality by Richard Stoll, \$27,940.

Pesticides and Groundwater Impacts by Jeffrey Postle, \$11,731.

Long-term Transformation and Fate of Nitrogen with Mound type Soil Absorption Systems for Septic Tank Effluent, John Harkin, \$10,000.

Nitrate Sampling in Priority Watersheds, \$10,000.

The total for continuing projects including the co-funded project below is \$109,604.

New projects to be funded by the DNR in FY 95

Application of a Discrete Fracture Flow Model for Wellhead Protection at Sturgeon Bay, Wisconsin by Kenneth Bradbury and Maureen Muldoon, \$43,155.

A Comparison of Low Flow Pumping and Bailing for VOC Sampling by Jack Connelly and Hank Kuehling, \$24,996.

An Evaluation of Long-term Trends and a Mineralogical Interpretation of Naturally Occurring Metals Contamination and Acidification of the St. Peter Sandstone Aquifer, Annette Weissbach, \$17,210.

Agrichemical Impacts to Groundwater Under Irrigated Vegetables in the Central Sand Plain by George Kraft and Larry Binning, \$27,500.

Characterization of E. Coli and Total Coliform Organisms Isolated from Wisconsin Groundwater and Reassessment of their Public Health Significance, by Bill Sonzogni and Jon Standridge, \$7,600.

Collection of Hydraulic and Geologic Data to Improve the Quality of the Wisconsin Groundwater Monitoring Network by Alex Zaporozec, \$14,180.

Vertical and Horizontal Variability of Hydrogeologic Properties in Glaciated Landscapes, Dave Mickelson, \$26,250.

Direct and Residual Effects of Land-applied Sweet Corn Processing Wastes on Nitrate Loss to Groundwater by Larry Bundy, \$20,745.

The cost for new projects funded by the DNR in FY 95 is \$181,636.
The total cost for all projects funded by the DNR in FY 95 is \$291,240.

Continuing projects to be funded by the UWS in FY 95

Photocatalytic Degradation of Volatile Organic Carbon by Marc Anderson, \$14,275.

Improved Design of Pump and Treat Systems for Heterogeneous Aquifers by Jean Bahr, \$22,935.

Mineral Phase Sorption of Selected Agrichemicals to Wisconsin Soils by Tim Grundl, \$21,115.

Stratigraphy, Sedimentology, and Porosity Distribution of the Silurian Rocks of the Door Peninsula, Wisconsin by Mark Harris, \$20,755.

Using 'PREDICT' to Reduce Herbicide Usage and Improve Groundwater Quality by Robert Gordon Harvey, \$1,500 (co-funded by USGS, \$15,800).

Comparative Evaluation of Biostimulation Approaches for Enhancing in Situ TCE Degradation in Contaminated Aquifers by William Hickey, \$23,835.

The cost for continuing projects funded by UWS in FY 95 including the project co-funded with DATCP listed below is \$137,415.

New projects to be funded by the UWS in FY 95

Tracer Study for Characterization of Groundwater Movement and Contaminant Transport in Fractured Dolomite by Ken Bradbury, \$19,000.

Evaluating the Effectiveness of Landfill Liners by Craig Benson, \$24,255.

Geologic Constraints on Arsenic in Groundwater with Applications to Groundwater Modeling by Juan Simo, \$27,870.

Integration of Hydraulics and Geology into a Hydrostratigraphic Model for the Paleozoic Aquifer of Eastern Dane County, Wisconsin by Douglas Cherkauer, \$21,725.

Use of Heavy Nitrogen to Study Nitrate Flux from Septic Systems by John Harkin, \$21,725.

Development and Demonstration of an Accurate Manure Spreading System to Protect Water Quality, Improve Waste Management and Farm Profitability by Kevin Shinnars, \$22,320.

Evaluation of Enzyme-linked Immunosorbent Assay for Herbicide Analysis of Wisconsin Soil in Comparison to Gas Chromatography by William Sonzogni, \$8,890.

Synergistic Effects of Endocrine Disrupters in Drinking Water by Warren Porter, \$24,265.

The cost of new projects funded by UWS in FY 95 is \$170,050. The total cost for all projects funded by UWS in FY 95 will be \$291,000.

Projects to be funded by DATCP in FY 95

Leaching Potential of Imazethapyr and Nicosulfuron Herbicides in Sparta Sand by Birl Lowery, \$18,680.

Cover Crops to Limit Herbicide Use on Sweet Corn by Astrid Newenhouse, \$24,000.

The Use of Peat as a Adsorptive Medium for Remediation of Pesticide Contaminated Groundwater by James Wiersma, \$14,300.

A Low-Input Crop Management Plan for Wisconsin Fresh-Market Vegetable Growers by Karen Delahaut, \$3,000.

The cost for projects funded by DATCP was \$114,983, including the co-funded project listed below.

Project to be co-funded by DATCP and DNR in FY 95

Groundwater Hydrology of an Agricultural Watershed by Kenneth Potter, Carl Bowser and Kenneth Bradbury. \$49,543 (\$29,543 DNR, \$20,000 DATCP).

Project to be co-funded by DATCP and UWS in FY 95

Herbicide Contamination of Soil and Groundwater at a Mixing/Loading Site by Gordon Chesters, \$12,000 UWS, \$45,000 DATCP.

Project to be funded by DILHR in FY 95

Nitrogen Removal from Domestic Wastewater in Unsewered Areas by Richard Otis, James Converse, et. al. \$74,500.

BENEFITS FROM MONITORING AND RESEARCH PROJECTS

Table 3 is a list of all groundwater-related monitoring or research projects funded by state agencies since enactment of Wisconsin's comprehensive groundwater protection legislation (1983 Wisconsin Act 410) in 1984. Those agencies which have funded projects are the DNR, DATCP, DILHR and the UWS. There are 155 projects listed. Sixty-six of these projects have been funded through the joint solicitation process, which began in FY 1992. The remaining projects were funded by the above agencies through separate solicitation processes prior to 1992. The table includes the project title, principal investigator or investigators, the years the project was funded and the funding agency or agencies.

Nitrate is the most commonly found contaminant of groundwater and remains a primary focus of groundwater research funded by all four agencies. Eighteen projects have directly focused on nitrate contamination of Wisconsin's groundwater. Projects funded by the DNR have monitored the effects of agricultural, waste disposal, and wastewater disposal management practices and have resulted in improved guidance or regulations for these practices. DILHR, DNR and UWS have funded projects related to alternative septic system designs to comply with the nitrate groundwater standard. The impact of septic systems on groundwater has been the subject of eight projects. The studies funded to date regarding nitrate are providing valuable information on the presence of nitrate in groundwater, best management practices for reducing nitrate migration to groundwater and possible alternative septic systems.

Pesticide research has been a major focus of research funded by DATCP, DNR and UWS. Pesticide impacts on groundwater and hydrogeological factors affecting these impacts have been the topics of approximately 20 studies. Nine of these projects have specifically looked at the pesticide atrazine and its metabolites. Research on atrazine and its metabolites by DATCP and other state agencies has resulted in regulatory changes in the use of atrazine. Research on aldicarb, alachlor, metolachlor and other pesticides has increased understanding of groundwater impacts as a result of their use and best management practices. Pesticide management practices and their impact on groundwater quality have been the topic of approximately 10 projects.

Groundwater monitoring and research projects have benefited the DNR's Solid Waste Management program in many ways. VOC sampling in groundwater around landfills from 1986 through 1994 provided valuable data which was used to convince EPA to reduce the number of VOCs required to be sampled for at municipal solid waste landfills in Wisconsin. This reduction in monitoring allows landfill owners considerable savings while providing equivalent environmental protection. The VOC data has also been used to establish requirements for VOC sampling at new and existing landfills. Additionally, the VOC data was used to require responsible parties to define the degree and extent of contamination and remediate groundwater contamination at their landfills.

Research on statistical methods of assessing groundwater quality has been helpful to Department staff and consultants in interpreting groundwater quality data from landfills and other facilities.

An assessment of Wisconsin's Groundwater Monitoring Plan program for active non-approved landfills provided the documentation that there is a set procedure for selecting monitoring sites.

This information has been useful in recent meetings with municipalities held to convince municipalities that they have not been singled out for further evaluation of groundwater contamination and to demonstrate that the process used for selecting landfills for monitoring is objective.

Interest in construction and demolition landfills and yard waste sites has increased tremendously over the last year. Many states and the EPA have contacted the DNR Solid Waste Management Program about the information collected while investigating the potential groundwater impacts at demolition landfills, deer pits and yard waste sites. Research has provided the information necessary to establish policy regarding monitoring and siting of demolition landfills, deer pits, and yard waste sites in Wisconsin.

Wisconsin is one of two leading states in revising the methodology for groundwater sampling for metals. The results of an investigation of field-filtering and low-flow pumping when sampling for metals was presented at the EPA sponsored groundwater sampling workshop held in Dallas, Texas in December 1993. The DNR will use this information to revise required groundwater sampling procedures.

Wisconsin is also a leader in groundwater monitoring for naturally occurring compounds. The results from arsenic and radon monitoring projects will be useful in the federal standard setting process and may influence the standard selected.

The DNR and the UWS have funded projects involving mathematical modeling of groundwater contaminant transport in varying hydrogeologic and soil conditions, and remediation of contaminated soils and water. Other research has focused on developing tools to measure hydrogeologic properties and track contaminants. The Wisconsin Geological and Natural History Survey has greatly benefited by the findings of the funded research. Hydrogeological and modeling projects have not only increased our understanding of hydrogeologic conditions in Wisconsin, but have also increased our understanding of the behavior of contaminants in the subsurface. Immediate benefits from hydrogeological and modeling research in Door County are being realized from the application of a discrete fracture model for wellhead protection in Sturgeon Bay.

Applications of a wide variety of tools for gathering and working with hydrogeologic and groundwater quality data have been funded. Projects involving one of the most promising tools in environmental management, Geographic Information Systems (GIS) have been funded in the Lake Michigan District and in Dane County. The funding agencies hope to continue to develop improved methodologies to make groundwater quality and contaminant source data more readily available.

TABLE 3
STATE OF WISCONSIN
GROUNDWATER MONITORING/RESEARCH PROJECTS 1986-1994

1. A Simple Stochastic Model Predicting Conservative Mass Transport Through the Unsaturated Zone into Groundwater. J. Hoopes. 1986. DNR.
2. Groundwater Monitoring for Pesticides. J. Postle. 1986-1994. DNR.
3. Fate of Aldicarb Residues in A Groundwater Basin near Plover, Wisconsin. G. Kraft. 1986-87. DNR.
4. Volatile Organic Compounds in Groundwater and Leachate at Wisconsin Landfills. M. Friedman. 1985-87. DNR.
5. VOC Contamination at Selected Wisconsin Landfills - Sampling Results and Policy Implications. J. Battista. 1988-89. DNR.
6. Volatile Organic Compounds in Small Community Wastewater Disposal Systems Using Soil Absorption. W. Boyle, W. Sonzogni. 1986. DNR.
7. The Use of Groundwater Models to Predict Groundwater Mounding Beneath Proposed Groundwater Gradient Control Systems for Sanitary Landfill Designs. J. Hoopes. 1986. DNR.
8. Evaluation Techniques for Groundwater Transport Models. J. Hoopes. 1986. DNR.
9. West Bend Road Salt Use and Storage Study. M. Sucht. 1986-91. DNR.
10. Barnyard Management Practices: Effect on Movement of Nitrogen Through Soils and Impact on Groundwater Quality. B. Shaw. 1991-92. DNR.
11. The Prediction of Nitrate Contamination Potential Using Known Hydrogeologic Properties. D. Cherkauer. 1986-87. DNR.
12. Nitrate Contamination in West-Central Wisconsin with Emphasis on Mill Run First Edition Subdivision. J. Tinker. 1987-90. DNR.
13. Investigation of Hydrogeology and Groundwater Geochemistry in the Shallow Fractured Dolomite Aquifer in Door County, Wisconsin. K. Bradbury. 1986-1990. DNR.
14. Lead Migration from Contaminated Sites - Door County, Wisconsin. J. Wiersma, R. Stieglitz. 1987-88. DNR.
15. Graphical and Statistical Methods to Assess the Effect of Landfills on Groundwater Quality. K. Potter. 1986-87. DNR.

16. Methods for Determining Compliance with Groundwater Quality Regulations at Waste Disposal Facilities. K. Potter. 1988-89. DNR.
17. Groundwater Quality Monitoring - Long Term Effects of Intensive Farming and Sprinkler Irrigation on Groundwater Quality. P. Kammerer. 1986. DNR.
18. The Effect of Construction, Installation and Development Techniques on the performance of Monitoring Wells in Fine-Grained Glacial Till. D. Cherkauer, C. Palmer. 1986. DNR.
19. Field Investigation of Groundwater Impacts from Absorption Pond Systems Used for Wastewater Disposal. J. Hoopes. 1985-86. DNR.
20. A Case Study of Nitrogen Transformations at a Rapid Infiltration System Used for the Disposal of Food Processing Wastewater. W. Boyle, J. Hoopes. 1986. DNR.
21. The Occurrence of Volatile Organic Compounds in Wastewater, Sludges and Groundwater at Selected Wastewater Treatment Plants in Wisconsin. C. Hunger. 1985-90. DNR.
22. Fate and Mobility of Radium-226 in Municipal Wastewater Sludge Following Agricultural Landspreading. T. Portle. 1986. DNR.
23. Filtration Preservation Study of Groundwater Samples. D. Sauer. 1984. DNR.
24. Groundwater Survey of Bacterial Contamination Near Rapid Infiltration Wastewater Treatment System. C. Norenberg, J. Standridge. 1987. DNR.
25. Hydrogeology of the Wisconsin River Valley in Marathon County, Wisconsin. K. Bradbury. 1986. DNR.
26. Treatment of Cheese Processing Wastewater by Ridge and Furrow Disposal - Nitrogen Transformations. W. Boyle. 1986. DNR.
27. Environmental Investigation of the City of Two Rivers Landfills, Manitowoc County, Wisconsin. T. Van Biersel. 1986-87. DNR.
28. Hydrogeologic Investigation and Groundwater Quality Assessment. P. Singh. 1987. DNR.
29. Groundwater Quality and Laundromat Wastewater: Summit Lake, Wisconsin. J. Saltes. 1986-1988. DNR.
30. Flambeau Paper Sulfite Lagoon Site Contamination Study. W. Lantz. 1987. DNR.
31. Monitoring of Volatile Organic Compounds in Tomah, Wisconsin. C. Krohn. 1986, 1989. DNR.

32. Hydrogeological Investigation of VOC Contaminated Private Wells Near Hudson, Wisconsin. J. Anklam. 1986. DNR.
33. Sealing Characteristics of Sodium Bentonite Slurries for Water Wells. T. Edil. 1988. DNR.
34. Barron County Nitrate Study. D. Hanson. 1986-87. DNR.
35. Mutagenic Effects of Selected Toxicants Found in Wisconsin's Groundwater. L. Meisner, D. Belluck. 1988-89. DNR.
36. Downward Movement of Water Below Barnyard Grass Filter Strips - Case Studies. G. Bubenzer, J. Converse. 1987-1989. DNR.
37. 1987 Volatile Organic Compound Testing Project in Rock County, Wisconsin. D. Holman. 1987. DNR.
38. Volatile Organic Compound Contamination of Private Water Supplies Adjacent to Abandoned Landfills in Marathon County. T. Wittkopf. 1986-1989. DNR.
39. Investigation of Large Scale Subsurface Soil Absorption Systems. D. Peerenboom. 1987. DNR.
40. Characterization of Groundwater Impacts at an Above Ground Petroleum Storage Terminal. G. Becker, R. Ham. 1987. DNR.
41. Lead Contamination Study of Door County. R. Stoll. 1988. DNR.
42. Freedman Creek Hydrogeologic Baseline Report. A. Wilson. 1988-89. DNR.
43. Analytical Determination of Atrazine, Alachlor and Their Selected Degradation Products in Contaminated Groundwater: Implication for Wisconsin Groundwater Standards. W. Sonzogni. 1988-89. DNR.
44. Plover Area Nitrate Study. F. Bailey. 1987-88. DNR.
45. Assessment of Geologic Controls on Groundwater Flow and Distribution in Precambrian Bedrock, Central Wisconsin, Using Remote Sensing and Geophysical Analysis. B. Brown, D. Davidson Jr. 1988. DNR.
46. A Ground Penetrating Radar Study of Water Table Elevation in a Portion of Wisconsin's Central Sand Plain. M. Anderson, C. Bentley. 1988. DNR.
47. Mineralogical and Geophysical Monitoring Naturally Occurring Radioactive Elements in Selected Wisconsin Aquifers. G. Morsky, R. Taylor. 1988. DNR.

48. Degradation of Atrazine, Alachlor, Metolachlor in Soils and Aquifer Materials. G. Chesters. 1988-1990. DNR.
49. Evaluation of the Effect of Stormwater Disposal on Groundwater. G. Nienke, B. Shaw. 1988-89. DNR.
50. Radionuclides in Drinking Water of Northcentral Wisconsin. B. Dobbins, C. Fitzgerald. 1988-89. DNR.
51. Pesticide Migration Study. Shaw. 1989-90. DNR.
52. Research and Data Analysis of Groundwater Contamination from Municipal Rapid Infiltration Land Disposal Systems. W. Boyle, J. Hoopes, K. Potter. 1987-88. DNR.
53. Digital Simulation of Solute Transport to Green Bay and Lake Michigan by Groundwater from Door County, Wisconsin. D. Cherkauer. 1988-91. DNR.
54. Grade A Dairy Farm Water Well Quality Survey. G. LeMasters, D. Doyle. 1989. DNR.
55. Demo of Low Input Strategies for Potato/Vegetable Production in Irrigated Sands. Shaw, Curwen, Kraft, Osborne. 1989-90. DNR.
56. Groundwater Quality Investigation of Selected Townships in Jefferson County, Wisconsin. F. Madison. 1989. DNR.
57. Effects of Volatile Organic Compounds on Clay Landfill Liner Performance. Edil, Berthouex, Park, Sandstrom. 1989. DNR.
58. Effect of Soil Type on Atrazine and Alachlor Movement Through Unsaturated Zone. T. Daniel. 1989. DATCP, DNR.
59. Designs for Wellhead Protection in Central Wisconsin. Osborne, Sorenson, Knaak, Mechenich, Travis. 1989. DNR.
60. Atrazine Contamination of Groundwater in Dane County, Wisconsin. Bradbury, McGrath. 1990-91. DNR, DATCP.
61. Sources and Extent of Atrazine Contamination of Groundwater at a Grade A Dairy Farm in Dane County, Wisconsin. Chesters, Levy. 1990-91. DATCP, UWS, DNR.
62. Effect of Soil Type, Selected BMPs, and Tillage on Atrazine and Alachlor Movement Through the Unsaturated Zone. Lowery, McSweeney. 1991. DATCP, DNR.
63. Subdivision Impacts on Groundwater Quality. Shaw, Ameson, VanRyswyk. 1989. DNR.
64. Incorporation of County Groundwater Inventory Data into the DNR Groundwater Information Network (GIN). M. Bohn. 1990. DNR.

- 65.DNR and DATCP Rural Well Survey. LeMasters. 1990. DNR, DATCP.
- 66.Follow Up to the Grade A Dairy Farm Well Water Quality Survey. Cowell, LeMasters. 1990. DATCP, DNR.
- 67.Optimum Manure Application Rate - Corn Fertility Management and Nitrate Leaching to Groundwater in Sandy Soils. Shaw. 1989-90. DNR.
68. Report on Bacteriological Water Quality Monitoring of Door County Variance and Special Casing Approval Wells. Hutchinson. 1990-91. DNR.
- 69.Volatile Organic Chemical Attenuation in Unsaturated Soil Above and Below an Onsite Wastewater Infiltration System. Tyler, Peterson, Sauer. 1990-91. DNR, UWS.
- 70.Variation in Hydraulic Conductivity in Sandy Glacial Till: Site Variation Versus Methodology. Mickelson, Bradbury, Rayne. 1990-92. DNR, UWS.
- 71.A Field Evaluation of Drainage Ditches as Barriers to Contaminant Migration. Bahr, Chambers. 1990-91 DNR.
- 72.Nitrogen Isotope Monitoring at Unsewered Subdivisions. Tinker. 1990. DNR.
- 73.Analytical Determination of Pesticide Metabolites and Carrier Chemicals in Wisconsin Wells. Sonzogni, Eldan, Lawrence. 1990. DNR.
- 74.Integrated Decision Support for Wellhead Protection. Adams, Bensen. 1991. UWS.
- 75.Nitrate Movement Through the Unsaturated Zone of a Sandy Soil in the Lower Wisconsin River Valley. Lowery, Kussow. 1991-93. UWS.
- 76.In-situ Removal of Fe, Mn, and Ra from Groundwater. Christensen, Cherkauer. 1991. UWS.
- 77.Effect of Complex Mixtures of Leachate on the Transport of Pollutants in Groundwater. Grundl, Cherkauer. 1991-92. UWS.
- 78.Adsorptive Behavior of Atrazine and Alachlor in Organic-Poor Sediments. Grundl. 1991. UWS.
- 79.The Economic Effects of Groundwater Contamination on Real Estate. Page. 1991. UWS.
- 80.Near-Source Transport of Contaminants in Heterogeneous Media. Hoopes. 1991-92. UWS.
- 81.Chemical Transport Across a Sediment-Water Interface. Green. 1991-92. UWS.

82. Role of Mobile Colloids in the Transport of Chemical Contaminants in Groundwaters. Armstrong, Shafer. 1991-93. UWS.
83. Prediction of Organic Chemical Leachate Concentrations from Soil Samples. Park. 1991. UWS.
84. Using Ground Penetrating Radar to Predict Preferential Solute Movement and Improve Contaminant Monitoring in Sandy Soils. Kung, Madison. 1991. UWS.
85. A Tracer Technique for Measuring Regional Groundwater Velocities from a Single Borehole. Monkmeyer. 1991. UWS.
86. Tracking Contaminant Pathways in Groundwater Using a Geologically Based Computer Code for Outwash. Mickelson, Anderson. 1991-92. UWS.
87. Bioremediation of Herbicide-Contaminated Soil and Water. Harris, Armstrong. 1991. UWS.
88. Renovation of Pesticide Contaminated Rinse Waters. Chesters, Harkin. 1991. UWS.
89. Contamination Attenuation Indices for Sandy Soils: Tools for Information Transfer. McSweeney, Madison. 1991. UWS.
90. Reactions of Chlorohydrocarbons on Clay Surfaces. Fripiat. 1991. UWS.
91. Design of a Small Scale Transportable Mixing/Loading System. Kammel. 1991. DATCP.
92. Evaluation of Potential Phytotoxicity and Crop Residues when Using Sprayer Rinsate as a Portion of the Diluent in Pesticide Spray Mixtures. Binning. 1991. DATCP.
93. Barnyard Management Practices: Effect on Movement of Nitrogen Through Soils and Impact on Groundwater Quality. Shaw. 1991-92. DNR.
94. To Expand Groundwater Sampling in the Lower Wisconsin River Valley. Cates, Madison, Postle. 1991. DNR.
95. Waupaca County Groundwater Project: Towns of St. Lawrence and Little Wolf. Wilson, Blonde. 1991. DNR.
96. Waupaca County: Towns of Lebanon and Scandinavia. Wilson, Blonde. 1992. DNR.
97. Crop Rotations Effects on Leaching Potential and Groundwater Quality. Posner, Bubenzer, Madison. 1991-92. DNR.
98. A Study of the Response of Nitrate and Pesticide Concentrations to Agricultural BMPs in Sandy Corn Fields. Madison, Cates. 1991-94. DNR.

99. A Comparative Study of Nitrate-N Loading to Groundwater from Mound, In Ground Pressure and at Grade Septic Systems. Shaw, Turyk. 1991-92. DNR.
100. The Biological Impact of Landfill Leachate on Nearby Surface Waters. Geis, Sonzogni, Standridge. 1991. DNR.
101. Dependence of Aldicarb Residue Degradation Rates on Groundwater Chemistry in the Wisconsin Central Sands. Kraft, Helmke. 1991-92. DNR.
102. Municipal Wastewater Project. Kopecky. 1991. DNR.
103. Arsenic as a Naturally Elevated Parameter in Water Supply Wells in Eastern Winnebago and Outagamie Counties. Stoll. 1992. DNR.
104. Spatial Attributes of the Soil-Landscape-Groundwater System of the Lower Wisconsin River Valley. McSweeney, Madison, Attig, Bohn, Falk. 1992-93. DNR.
105. Herbicide and Nitrate Movement in a Sandy Soil in the Lower Wisconsin River Valley. Lowery, McSweeney. 1992-93. UWS, DATCP.
106. Preliminary Comparison of a Discrete Fracture Model with a Continuum Model for Groundwater Movement in Fractured Dolomite. Bradbury, Muldoon. 1992. DNR.
107. Evaluation of NURE Hydrogeochemical Groundwater Data for Use in Wisconsin Groundwater Studies. Bradbury, Mudrey, Shrawder. 1992. DNR.
108. Distribution of Radionuclides in Wisconsin Groundwater. Bradbury, Mudrey. 1992. DNR.
109. Assessment of Wisconsin's Groundwater Monitoring Plan Program for Active Non-Approved Landfills (1985-1990). Pugh, Gear. 1992. DNR.
110. GIS Mapping of Groundwater Contaminant Sources, Quality and Contamination Susceptibility for Door County. Carlson, Stoll, Hronek. 1992-93. DNR.
111. Effects of Transient Cross-Stratification Flow on Contaminant Dispersion. Bahr. 1992-93. UWS.
112. Geographical Information System for Subsurface Characterization. Bosscher, Adams. 1992-93. UWS.
113. Distribution, Transport and Fate of Major Herbicides and Their Metabolites. Chesters. 1992-93. UWS, DATCP.
114. Use of Tire Chips to Attenuate VOCs. Edil, Park. 1992-93. UWS.

115. Living Mulch Systems for Nitrate Trapping in Vegetable Production. Harrison. 1992-93. UWS.
116. New Approaches to Measuring Biologic Effects of Groundwater Contaminants. Porter. 1992. UWS.
117. Estimating the Spatial Distribution of Groundwater Recharge Rates Using Hydrologic, Hydrogeologic and Geochemical Methods. Potter. 1992-93. UWS, DATCP.
118. Evaluation of Denitrification Systems for Improving Groundwater from On-Site Waste Disposal Systems. Shaw 1992-93. DNR.
119. Optimization of Two Recirculating Sand Filters for Nitrogen and Organic Chemical Removal from Domestic Wastewater. Shaw. 1994. DNR.
120. Remediation of Soils Contaminated by Leaking Underground Storage Tanks by Vapor Extraction and *In-situ* Biostimulation. Hickey, Jacobsen, Bubenzer. 1992-93. DNR.
121. Municipal Wastewater Absorption Pond Renovation for Enhanced Nitrogen Removal. Gilbert. 1992-93. DNR.
122. Investigation of Potential Groundwater Impacts at Demolition Landfills and Deer Pits (Preliminary Report). Pugh, Connelly. 1992-93. DNR.
123. Investigation of Potential Groundwater Impacts at Yard Waste Sites. Pugh, Connelly. 1994. DNR.
124. Dane County Atrazine/Land Management Project. Conners, Bohn, Madison, Muldoon, Richardson. 1992. DNR, DATCP.
125. Facility Plan Amendment for Wastewater Collection for Green Lake Sanitary District, Green Lake, WI. McMahon & Assoc. 1991. DILHR.
126. On-site Nitrogen Removal Systems Research Demonstration Project: Phase I. Ayers & Assoc. 1991. DILHR.
127. Nitrogen Removal from Domestic Wastewater in Unsewered Areas. Otis, Converse. 1992-95. DILHR.
128. Trace Metal Transport Affected by Groundwater Stream Interactions. Bahr. 1993-94. UWS.
129. Management of Sweet Corn Processing Wastes to Protect Groundwater Quality. Bundy. 1993-94. UWS.
130. Impact of Tunnel Dewatering on Surface Water Bodies in Milwaukee County. Cherkauer. 1993-94. UWS.

131. Ultrasonic Verification Technique for Evaluating Well Seals. Edil 1993-94. UWS.
132. Field Evaluation of Near Source Transport of Contaminants in Heterogeneous Media. Hoopes. 1993-94. UWS.
133. Variability of Hydraulic Conductivity in Supraglacial Sediments. Mickelson. 1993-94. UWS.
134. The Impact of Atrazine Management Areas Designation on Weed Control Strategies in Wisconsin Corn Production. Nowak. 1993. DATCP.
135. Evaluation of Five Groundwater Susceptibility Assessments in Dane County, Wisconsin. Bridson, Bohn. 1993-94. DNR.
136. Tracer Study for Characterization of Groundwater Movement and Contaminant Transport in Fractured Dolomite. Bradbury, Muldoon. 1993-94. DNR.
137. Urban Stormwater Infiltration: Assessment and Enhancement of Pollutant Removal. Armstrong. 1993-94. DNR.
138. Long-Term Transformation and Fate of Nitrogen with Mound Type Soil Absorption Systems for Septic Tank Effluent. Harkin. 1993-94. DNR.
139. A Further Study of Organics at Wisconsin Municipal Solid Waste Landfills. Connelly. 1993-94. DNR.
140. Comparative Evaluation of Biostimulation Approaches for Enhancing in Situ TCE Degradation in Contaminated Aquifers. Hickey. 1994. UWS.
141. Stratigraphy, Sedimentology and Porosity Distribution of the Silurian Rocks of the Door Peninsula, WI. Harris. 1994. UWS.
142. Improved Design of Pump and Treat Systems for Heterogeneous Aquifers. Bahr, Anderson. 1994. UWS.
143. Herbicide Contamination of Soil and Groundwater at a Mixing-Loading site. Chesters. 1994. UWS, DATCP.
144. Photocatalytic Degradation of Volatile Organic Carbon. Anderson, Marc, Hill. 1994. UWS.
145. Mineral Phase Sorption of Selected Agrochemicals to Wisconsin Soils. Grundl. 1994. UWS.
146. Using "Predict" to Reduce Herbicide Usage and Improve Groundwater Quality. Harvey. 1994. UWS.

147. Leaching Potential of Imazethapyr and Nicosulfuron in Sparta Sand. Lowery. 1994. DATCP.
148. Integrated Computerized Mapping of Point Source Contaminants and Physical Environmental Characteristics to Protect and Manage Groundwater Quality. Stoll. 1994. DNR.
149. An Investigation of Field-Filtering and Low-Flow Pumping When Sampling for Metals. Connelly. 1994. DNR.
150. Groundwater Hydrogeology of an Agricultural Watershed. Potter 1994. DATCP, DNR.
151. The Further Incidence of Native Arsenic in Eastern Wisconsin Water Supply Wells; Marinette, Oconto, Shawano and Brown Counties. Stoll. 1994. DNR.
152. Factors Affecting the Determination of Radon in Groundwater. Sonzogni. 1994. DNR.
153. Groundwater Survey of Alachlor and ESA its Polar Metabolite in Southern Wisconsin. Vanden Brook, Postle. 1994. DNR, DATCP.
154. Cover Crops to Limit Herbicide Use on Sweet Corn. Newenhouse. 1994. DATCP.
155. The Use of Peat as an Absorptive Medium. Wiersma, Stieglitz. 1994. DATCP.

GROUNDWATER DATA MANAGEMENT

WISCONSIN DEPARTMENT OF NATURAL RESOURCES

The collection and coordination of groundwater data exchange within the DNR and with outside agencies continues to be an important issue. The DNR is currently in the middle of a renewed effort to coordinate the collection and retrieval of all groundwater data, as a result of DNR funding, inter-agency responsibilities, and cooperative agreements.

The initial programming of the new DNR groundwater data retrieval system, the Groundwater Retrieval Network (GRN), was completed in October 1993. A list of enhancements to the system, suggested by District and Central office staff, is in the final stages of programming. The current GRN system has links to the Public and Private Water Supply and Water Resources program data systems for retrieval. The Solid and Hazardous Waste and Wastewater program data systems will be made accessible to the retrieval network when the redesign of those program systems are completed. The Solid and Hazardous Waste Groundwater and Environmental Monitoring system (GEMs) is in the programming stage. Work on the Bureau of Wastewater Management's data system will follow shortly after the GEM system is completed.

The new GRN system will include a mechanism for creating and updating a statewide coverage of well locations in a GIS format. An ARC/INFO (industry standard GIS software) layer will provide graphical depiction of well locations and associated database information. The initial portion of this project is being finalized and tested. This GIS layer or coverage will not be accessible through the GRN menu system, but will be accessible through ARC/INFO software at the DNR.

In order to provide access to the system for other state agencies, computer hardware and software was provided to DATCP, DILHR, and DHSS, WGNHS and the Central Wisconsin Groundwater Center. In FY 95 documentation and training will be provided for using the new GRN system. The sharing and exchange of information between agencies dealing with groundwater should be greatly enhanced by the completion of the GRN system.

DEPARTMENT OF AGRICULTURE, TRADE AND CONSUMER PROTECTION

DATCP needs up-to-date, reliable data on pesticide contamination of groundwater. These data are used to develop substance specific rules on pesticide use, such as DATCP's "Atrazine Rule" (Chapter ATCP 30, Wis. Adm. Code), to respond to citizen requests on groundwater quality data for specific locations, and to initiate timely investigations of pesticide contamination of groundwater. DATCP ensures the quality of its database by carefully checking and cross-referencing manual (e.g., paper lab slips) and computerized data received from DNR and other sources. DATCP feels that this is necessary because the data are used for regulatory purposes.

The DATCP groundwater database currently contains locational information for over 13,000 wells and over 22,000 sample analysis results. These data represent samples analyzed by DATCP, the State Laboratory of Hygiene, and other public and private laboratories. The groundwater database operates in a multiuser environment under Paradox 3.5. All members of the groundwater unit access the database via Pathworks operating on the Department's VAX computer. DATCP is converting the database application to Paradox 4.0 during FY94. Links between the groundwater database and the Department's pesticide case tracking system are also being developed.

DATCP uses GIS tools to analyze groundwater data and prepare maps for public hearings and other uses. For example, a pcARC/INFO data layer containing well locations and associated database information is being used to generate maps of atrazine and other pesticide detections statewide for the Atrazine Rule.

WISCONSIN GEOLOGICAL AND NATURAL HISTORY SURVEY

The University of Wisconsin-Extension Geological and Natural History Survey has responsibility for geologic mapping, collection and analysis of basic data, and survey and research on Wisconsin's groundwater resources. Products from the Survey geologic mapping program support land-use planning and groundwater quality management and protection. County-wide inventories of groundwater resources are supported through cooperative agreements with county governments. Through analysis and integration of data from subsurface records and water quality sampling programs, these studies develop water table elevation maps and other products, providing planners and educators with a good foundation of information for groundwater quality management and protection. Detailed research and monitoring of groundwater movement and quality are undertaken on a project basis. Maps, publications, and presentations are developed for groundwater education and outreach.

Computerized groundwater databases have generally been developed on a project basis to support on-going research and inventory efforts. Many of these data have been incorporated into the ARC/INFO geographic information system. The Survey is continuing initiatives to better integrate our data holdings, which are currently on a variety of personal computers, media and software systems. This effort will improve access and use of our existing and future groundwater and geologic data.

DEPARTMENT OF INDUSTRY, LABOR AND HUMAN RELATIONS

DILHR has embarked on an information technology (IT) initiative, the purpose of which is to integrate data the division has. With regard to groundwater protection, the Department will, at the completion of this project, be able to identify sites that have underground petroleum storage tanks and private sewage systems. Sanitary permits, groundwater monitoring data, and underground storage tank information will be located in combined databases, the result will be groundwater quality data and information on activities that may affect groundwater quality.

DEPARTMENT OF HEALTH AND SOCIAL SERVICES

DHSS does not maintain a centralized database on groundwater data. The Department relies on other state agencies for computerized groundwater information. DHSS maintains lab slip samples data in project specific files.

UNIVERSITY OF WISCONSIN SYSTEM

The Central Wisconsin Groundwater Center maintains a database of private well testing data from the Environmental Task Force Regional Lab, UW-Stevens Point, and Drinking Water Education Programs conducted through the Center. There are currently over 159,000, individual test results for approximately 26,200 samples covering the entire state. Chemistry data includes Ph, conductivity, alkalinity, total hardness, nitrate-nitrite, chloride, saturation index and coliform bacteria. The database primarily covers the period 1985 to the present. The database is PC based and can be easily queried to be a significant source of information for local communities and groundwater managers. Thirty-one counties are represented by 100 or more samples in the databases, and 14 counties are represented by 500 or more samples.

DEPARTMENT OF TRANSPORTATION

The DOT maintains records of hazardous materials investigations associated with highway projects. Records of hazardous materials encountered during these investigations, including any groundwater contamination, are kept on file in the Hazardous Materials section of the Office of Environmental Analysis.

Groundwater monitoring is conducted in association with several DOT wetland mitigation projects. The records of this monitoring effort contain information on groundwater elevation and horizontal and vertical groundwater gradients as it relates to a wetland restoration or creation project.

The DOT is currently evaluating databases to incorporate data from wetland delineations, hazmat sites and groundwater monitoring sites. Future plans involve using a GIS system to access data for use in planning design construction.

COORDINATION ACTIVITIES

GROUNDWATER COORDINATING COUNCIL

The Groundwater Law, 1983 Wisconsin Act 410, established the Wisconsin Groundwater Coordinating Council (GCC) to advise and assist state agencies in coordinating nonregulatory programs and exchanging groundwater information. The GCC consists of the heads of all state agencies with some responsibility for groundwater management plus a Governor's representative. The state agencies include the DNR, DILHR, DHSS, DATCP, DOT, WGNHS, and the UWS. The GCC had four meetings during the past year and met once via teleconference. The meeting minutes are included in the appendix.

The focus of the GCC's activities during the past year changed as past goals were attained and future goals were refined. Accomplishments came as a response to new opportunities for groundwater management.

- *The GCC approved the 1995 fiscal year joint solicitation package for groundwater research and monitoring to meet state needs described in the previous section. The package was sent out on November 30, 1993 and is contained in the appendix. On April 26, 1993 the GCC met by teleconference and unanimously approved the proposed UWS groundwater research plan. The UWS will fund 8 continuing and 8 new projects in fiscal year 1995.
- *As a result of floods in 1993, the DHSS and the DNR answered many questions relating to safety of submerged private wells and contamination in overbank deposits. The GCC determined that in the future, the DNR and DHSS will contact each other earlier to more effectively coordinate flood control efforts.
- *The GCC reviewed and approved three documents for the U.S. EPA Comprehensive State Groundwater Protection Program (CSGWPP). The DNR prepared a CSGWPP State Profile, a CSGWPP Self-assessment and a CSGWPP Vision Statement for EPA Region V endorsement of Wisconsin's groundwater program as a core and fully-implementing program. The Vision Statement is included in the appendix.
- *The GCC selected Susan L. Sylvester of the DNR to be the permanent Council Chair.
- *The GCC recommended that the UW Water Resources Center hire a temporary, part-time employee for one year to assist in the preparation and publication of summaries of funded research. A format for the summaries was also agreed upon. Principal investigators will be required to provide a summary of their projects in the agreed upon format.
- *The DNR hired a Water Resources Management Specialist in April 1994, to work with the GCC and its subcommittees. To date, this employee has arranged, attended and documented GCC and subcommittee meetings, organized a database of groundwater research and monitoring projects including all those projects funded through the joint

solicitation process, written research project summaries and coordinated the writing of this report.

*The GCC continued to promote communication, coordination, and cooperation between the state agencies through its quarterly meetings. The GCC received briefings on:

- Subcommittee activities (see below);
- Evaluation of two recirculating sand filters for nitrogen removal in Portage County;
- Remediation of soils contaminated by leaking underground storage tanks by vapor extraction and biostimulation;
- Demonstration of alternative on-site sewage systems on Washington Island;
- ATCP 30 Wis. Adm. Code (the atrazine use rule for the 1994 growing season);
- Wisland;
- Nonpoint source groundwater pollution;
- Nitrogen removal from domestic wastewater in unsewered areas;
- The Comprehensive State Groundwater Protection Program;
- The Dane County regional hydrologic study;
- Fate of nitrogen in mound-type soil absorption systems
- The "Nitrate in Wisconsin's Groundwater: Strategies and Challenges" conference in Stevens Point on May 10, 1994;
- The pesticide acetochlor registration;
- DATCP board meeting nitrate presentation;
- Groundwater movement in fractured dolomite in Door County; and
- Management of sweet corn processing wastes to protect groundwater quality;

*The GCC continued to maintain a dialogue on groundwater issues with federal agencies. Representatives from the Soil Conservation Service (SCS), Agricultural Stabilization and Conservation Service (ASCS) and the U. S. Geological Survey (USGS) have attended Council meetings and are ex officio subcommittee members.

The subcommittee reports which follow summarize the actions taken by each subcommittee.

SUBCOMMITTEE ACTIVITIES

Research and Monitoring & Data Management Subcommittees - The two subcommittees reviewed the priorities for the DNR's groundwater management practice monitoring program for fiscal year 1995. The revised priorities were then included in the joint solicitation distributed by the UWS, DNR, DILHR and DATCP in November, 1993.

The two subcommittees met again in early March to review the 36 proposals which had been received as a result of the joint solicitation. Subcommittee members made recommendations which were used by the three agencies and the UW system in deciding which groundwater-related proposals to fund for fiscal year 1995.

At the request of the GCC, the Research Subcommittee met to develop a recommendation for distributing the results of monitoring and research projects funded through the joint solicitation

process. The Subcommittee prepared a plan for publishing summaries of projects which have been completed. This plan was approved by the GCC at its' May meeting.

The Monitoring & Data Management Subcommittee published the Directory of Groundwater Databases in February 1994.

Planning and Mapping Subcommittee - Members of the Subcommittee have continued to work on a review and evaluation of groundwater vulnerability mapping practices in the United States. A field verification study of several different mapping techniques is in progress in Dane County. The Subcommittee hopes that the results of this study and the nation-wide data will provide sufficient information to hold several educational meetings to provide training in how to interpret and use groundwater vulnerability maps.

Education Subcommittee - The Education Subcommittee met twice during the past year. The focus of its activities was encouraging agencies to coordinate production of written education materials and to reach consensus on recommendations made in these materials. Materials and education needs about radon and nitrate were also reviewed.

The Education Subcommittee initiated the revision and reprinting of two nitrate publications: "Nitrate in Drinking Water" (DNR and DHSS), and "Nitrate in Wisconsin's Groundwater" (UW-Extension). Work has also progressed on preparation of a brochure on radon in groundwater and updating the Groundwater Education Resource Directory. The Subcommittee has also discussed ways to increase the effective use of the Groundwater Study Guide.

For FY 95, the Subcommittee will continue its dissemination of information and education materials for distribution by state agencies. Work will also continue on the nitrate and radon issues, and revision of the Groundwater Resource Directory.

Local Government Subcommittee - The Local Government Subcommittee was formed to represent local units of government and organizations representing local units of government. The Local Government Subcommittee will continue to discuss issues of concern to the local units of government and develop recommendations to be presented to the GCC for future action. Additionally the subcommittee will focus on promoting wellhead protection within the state and will continue to open new lines of communication between state and local governments.

DIRECTIONS FOR FUTURE GROUNDWATER PROTECTION

PRIORITY ISSUES THAT NEED TO BE ADDRESSED

- *Improved communication between local and state government: The GCC took the first step in addressing this issue by forming the Local Government Subcommittee to the GCC which began meeting in February 1993. The Subcommittee is unique among the GCC committees in that it has not produced a tangible "product". In part, this is due to the regulatory nature of many of the concerns of local governments. As created in ch. 160, Stats., the GCC is a non-regulatory body that can only make recommendations to appropriate regulatory agencies regarding groundwater issues. The Subcommittee's role is to provide a line of communication from local government to the GCC. An effort must continue to ensure that the subcommittee and GCC work in concert so that there will continue to be interest from local governments in participating in the process.
- *Distribution of findings from groundwater research or monitoring projects: There has been considerable interest in providing summaries of the results of groundwater related monitoring and research to interested audiences. Target audiences have been identified and plans have been made to prepare summaries of the completed studies which have been funded through the joint solicitation process. Both the DNR and the UW Water Resources Center have begun summarizing projects that have been completed. Both intend to complete the backlog of unfinished summaries in FY 95. It is important that the summaries and final reports are distributed widely.
- *Communication between agencies on data management issues: Important progress has been made in this area through publication of the Directory of Groundwater Databases and redesign of the DNR's groundwater computer system. These efforts will allow more convenient access to groundwater data by state and local government agencies. The GCC will continue to promote consistency between the agencies on data management issues by providing leadership and communication from its Monitoring and Data Management Subcommittee. Consistency will be promoted by use of translatable geolocational coordinate systems and consistent data elements for later use in a GIS environment. Efforts will be made to further quantify hydrographic relationships of surface and groundwater. This continued effort displays the GCC's commitment to management of the resource through sound scientific methods.
- *Reaffirmation of the GCC's intent to act as a coordinating and facilitating mechanism for the publication and distribution of information and educational materials on groundwater related issues: The public has benefitted from the consistent educational messages which have been endorsed by the Education Subcommittee over the past year. The Education Subcommittee will continue to provide its leadership and assistance to state agencies providing educational materials to the public.
- *Evaluation of goals for the Planning and Mapping Subcommittee: The Subcommittee will assess its established charge and determine if it should be changed. If change is needed, the Subcommittee will establish new goals, bring them to the Council for endorsement, and act upon those goals.

- *Research on land use management and its impact on the groundwater resource: This includes evaluation of impacts on both groundwater quality and quantity. This issue crosses agency lines and promises to be an important issue for years to come.
- *Continued evaluation of alternatives to on-site septic systems: As described under "Summary of Agency Responsibilities," there are currently no designs or installations of septic systems that have been proven to consistently meet the state groundwater standards. Although both the DNR and DILHR have recently funded monitoring projects in this area, additional work is needed to find state-of-the-art solutions to this national problem.
- *Investigation of the presence of nitrate in groundwater: The GCC will support the agencies and the UW-system in attaining information pertinent to the health implications of consuming nitrate contaminated groundwater. In addition, it will facilitate consistent education to provide a clear message on the many causes and effects of nitrate in groundwater for both urban and rural citizens.
- *Investigation of groundwater quantity in Wisconsin: Although Wisconsin is blessed with abundant groundwater supplies, there is increasing evidence of adverse impact from groundwater withdrawals in some parts of the state. There is a need to study groundwater quantity issues, especially groundwater/surface water relationships and the effects of groundwater withdrawals on surface waters and long-term groundwater availability.

WISCONSIN GROUNDWATER COORDINATING COUNCIL

REPORT TO THE LEGISLATURE

APPENDIX

**Wisconsin Groundwater Coordinating Council
Meeting Minutes - August 13, 1993**

Members Present: Lyman Wible (DNR), Jamie Robertson (WGNHS), Marvin Roshell (DILHR), James Vanden Brook for Nick Neher (DATCP), Henry Anderson (DHSS), Al Beaver (UW System), Jack Metcalf (Governor's Representative) and John Lewis for Carol Cutshall (DOT).

Others Present: Bennette Burks (DILHR); Tom Gilbert, Mike Lemcke, Jay Payton and Kevin Kessler (DNR); Steven Osesek (UW-SP); William Hickey and James Peterson (UW-Madison); Michael Bohn (WGNHS); Jim Kaap (SCS); and Gary Lueck (WRWA).

The meeting was held in the conference room of WGNHS in Madison, beginning at 12 noon.

I. Introductions

Introductions were made.

II. Agenda Review and Changes

Henry Anderson suggested adding an agenda item on flood management. James Vanden Brook suggested adding an agenda item on DATCP's ATCP 30, Wis. Adm. Code. Both of these items were added to the agenda.

III. Approval of Minutes

The minutes of the May 14, 1993 GCC meeting were approved as written.

IV. Subcommittee Reports

A. Information and Education Subcommittee - Mike Lemcke reported that the Subcommittee had met and had finalized their work for the Report to the Legislature. Mike noted that the committee will be focusing on facilitating the publication of brochures on Radon, Nitrate, and Nitrate and Agriculture.

B. Monitoring and Data Management Subcommittee - Mike Lemcke reported that the Subcommittee is continuing to work on a directory of groundwater data bases. The directory is being compiled by an LTE working for DNR and should be completed by Christmas.

C. Local Government Subcommittee - Jay Payton reported that the Subcommittee has had two meetings and one conference call. The Subcommittee has discussed a number of topics and asked the GCC to provide them with additional direction as to what type of "product" the GCC would like to see from the Subcommittee. The GCC suggested that the consensus from the Wisconsin Groundwater Conference in 1991 was that local government agencies' needed a mechanism whereby they could have a voice at the state level. The GCC recommended that since the subcommittee was formed to address the desire of local governments, they should be responsible for providing themselves with direction.

The Subcommittee has addressed the issue of the septage hauling and spreading program. It has been determined that inadequate records are being maintained and that this is an issue of genuine concern to local governments. The subcommittee asked the GCC to recommend to the DNR and DILHR that this issue needs to be addressed when code changes are being made. These agencies agreed to work on the issue together.

V. Approval of the FY 93 Report to the Legislature

Michael Lemcke reported that Randell Clark (DNR) took the lead in producing this year's Report to the Legislature. He followed the process that had been established by Dave Lindorff in the past. He sent last year's report to each of the agencies for their review and comment. Comments from all of the agencies were then incorporated into the final draft.

After a brief discussion on the contents of the report the GCC members approved the report as written with the inclusion of minor comments.

Jim Kaap suggested that the report would be easier to read if it were presented in 2 column newspaper format. The Council agreed that this would be an option for next year's report.

VI. Comprehensive State Groundwater Protection Program (CSGWPP)

Kevin Kessler reported on CSGWPP activities since the last meeting. The draft state profile of Wisconsin's groundwater protection program was mailed to the GCC and its subcommittee members for their comments, their comments were incorporated and a new draft was produced. The GCC was then asked to endorse the draft state profile.

The GCC members commented that they had not been personally contacted for their comments and wished to check with their staff members to determine what their agencies input had been. Kevin Kessler said that he would mail out to each of the members a listing of the various department staff which had been contacted. The Council members said that they would contact Laura Chern, the DNR's primary author, by August 20, with their comments.

The Council decided to give its conditional approval to the state profile document providing all of the agencies comments are incorporated. The committee will be polled by telephone to get its final approval on the profile document.

VII. Evaluation of Two Recirculating Sand Filters for Nitrogen Removal in Portage County

Steve Osesek reported on the recirculating sand filter project which has been funded through the GCC joint solicitation process by the DNR for the past two years. The project has shown a reduction of Nitrate-Nitrogen from 50-70 mg/l to 10-15 mg/l in the water exiting the recirculating system. Steve pointed out that the system has only been running for a little over a year and that there have been several minor electrical and float problems. These problems have virtually been eliminated and he hopes that over the next year the efficiency of the system will be improved.

VIII. Remediation of Soils Contaminated by Leaking Underground Storage Tanks by Vapor Extraction and Biostimulation

Professor William Hickey presented a summary of his project which was also funded through the GCC joint solicitation process by the DNR for the past two years. The primary goal of his work was to evaluate the effects of a Soils Vapor Extraction system operation on the subsurface microbial activity.

Initial data from the project have shown 2 results. The first is that the efficiency of the vapor extraction system decreases with time. This means that the systems efficiency for removing VOCs works well at high concentrations but as concentrations decrease over time the system reaches an equilibrium point, when keeping the volume of air removed a constant. The second result is that the toxicity the microbes exhibit is not due to lack of oxygen, which has often been thought of as the limiting factor in the microbial success in the breakdown process, but the toxic levels of VOCs found in the system. It appears that the high concentrations of VOCs are toxic to these creatures. Therefore, by using soil vapor extraction to lessen the VOC concentration at a site it enables the naturally occurring microbial processes to more effectively break down the chemical pollutant.

IX. Demonstration of Alternative On-site Sewage Systems on Washington Island

Tom Gilbert reported on the progress that has been made on providing Washington Island with an alternative to their sewage systems and holding tanks. The work has been funded by the state clean water fund and has been ongoing since the fall of 1991. A recirculating sand system similar to that used in the Portage County project was used. Although data is still being collected preliminary observations suggest that the recirculating sand system has caused a dramatic decrease in the level of total nitrogen in the water leaving the system. The water sampled entering the system is about 120 mg/l and after the system the total nitrogen level in the water dropped to 40 mg/l. Tom pointed out that on Washington Island people are very water conservative and this conservative nature actually increases the amount of nitrogen going into a sewage system because it is not as diluted and, therefore, is much harder to reduce its concentration to the state's groundwater quality standard.

X. Flood Management

Henry Anderson inquired as to what degree other agencies were being called on by the public in regards to Wisconsin's recent flooding incidents. In general, the current demand placed on the agencies caused by flooding is no greater than during the drought years. The two agencies responding most frequently to flood questions were the DNR and DHSS. DHSS has had many questions related to how soon local residents could begin drinking the water from a private water supply well after it had been submerged below the surface water level. In addition, other common questions are related to what extent the overbank deposits from streams and rivers have harmful contaminants. The DNR has also fielded many similar type questions and, as a result, has appointed Jay Hockmuth as the state flood coordinator for the Division for Environmental Quality. DNR and DHSS will contact each other in the near future to more effectively coordinate their flood control efforts.

XI. Atrazine Rule

James Vanden Brook handed out the proposed amendments to ATCP 30, Wis. Adm. Code, the atrazine use rule for the 1994 growing season. The proposed rule repeals one current prohibition area, repeals and recreates 3 current prohibition areas to expand those areas, and creates 23 new prohibition areas. The new prohibition areas encompass 72,000 acres. This results in a new total of 76 prohibition areas throughout the state. The proposed rule will be taken out to public hearing on September 20, 1973. The hearings will be in the cities of Darlington, Portage, Eau Claire and Stevens Point.

XII. Next Meeting

The meeting adjourned at 2:55 pm. The next meeting of the Groundwater Coordinating Council will be November 12 in the Board Conference Room of the Wisconsin Department of Agriculture, Trade and Consumer Protection, 801 W. Badger Road, Madison beginning at noon.

Respectfully submitted,

Michael D. Lemcke
Groundwater Management Section
Department of Natural Resources

Wisconsin Groundwater Coordinating Council
Meeting Minutes
November 12, 1993

Members Present: Jay Hochmuth (DNR), Jamie Robertson (WGNHS), Bennette Burks for Marvin Roshell (DILHR), Nick Neher (DATCP), Lynda Knobloch for Henry Anderson (DHSS), George Kraft for Al Beaver (UW System), Jack Metcalf (Governor's Representative) and Carol Cutshall (DOT).

Others Present. Mike Lemcke, Wendy Weisensel and David Lindorff (DNR); Ron Hennings (WGNHS); Jim Peterson (UW System); Jeff Postle (DATCP); Chuck Warzecha (DHSS) and Jill Jonas (Wis. Rural Water Association).

The meeting was held in the Board Conference Room of the DATCP offices, 801 W. Badger Road, Madison, beginning at 12 noon.

1. Introductions

Introductions were made. Since the August meeting, Lyman Wible, Chair of the Coordinating Council, resigned to take another position. Therefore, Jay Hochmuth, Acting Administrator for the Division for Environmental Quality of the DNR, served as Acting Chair for the meeting.

2. Agenda Review and Changes

Ron Hennings asked to talk briefly about Wisland. Chuck Warzecha asked to speak briefly about an upcoming workshop on groundwater and drinking water sampling related to the recent flooding. Nick Neher brought in a map showing the location of atrazine detects for the state.

3. Approval of Minutes

The minutes of the August 13, 1993 GCC meeting were approved as written.

4. Subcommittee Reports

a. Education Subcommittee - Mike Lemcke reported that, at its last meeting, the Education Subcommittee discussed preparing a popularized summary of the 1993 GCC Report to the Legislature. Although a popularized summary of the 1992 Report to the Legislature was prepared and distributed widely, there was little feedback on the summary. The Subcommittee asked the Coordinating Council whether it was appropriate to prepare a popularized summary for the 1993 Report. After some discussion, the Coordinating Council agreed that a summary wouldn't be prepared for the 1993 Report. The Coordinating Council will revisit the issue for next year's report. Mr. Lemcke also reported that the Subcommittee will work on facilitating a coordinated effort on the preparation of nitrate and radon brochures.

Mr. Lemcke indicated that the Subcommittee is interested in updating the Education Resource Directory that was prepared two years ago. The Subcommittee believes that there have been enough changes that the Directory should be revised. The Coordinating Council endorsed this

effort.

b. Research Subcommittee - David Lindorff reported that the Research Subcommittee met twice since the last Coordinating Council meeting to prepare a proposal for summarizing the results of the monitoring and research projects which have been funded through the joint solicitation process. Although several mechanisms were identified, the Research Subcommittee proposed to the G-CC that a half-time editor be hired to work at the UW Water Resources Center for a year to prepare summaries of as many projects as possible. At the end of that time, the Research Subcommittee would have a better idea of the amount of work that might be necessary to prepare reports to reach the varied audiences. The Coordinating Council expressed concerns about endorsing a work effort without knowing what the final product would be and the difficulty of working with principal investigators after their work was done in order to fairly and appropriately summarize the original research.

There were two issues identified - agreeing on contract language to take care of summaries of future work and taking care of the backlog of projects for which summaries have not been prepared. The Coordinating Council asked that the Research Subcommittee prepare a scope of work to bring to the Coordinating Council to allow the GCC to see exactly what would be done and under what time frame. The Council also asked that Dr. Gordon Chesters of the UW Water Resources Center be present to answer questions regarding the proposal. It was suggested that a list of research be included in the revised Education Resource Directory.

5. Nonpoint Source Groundwater Pollution

George Kraft presented information on nonpoint source groundwater pollution. He pointed out that nonpoint source groundwater pollution primarily from nitrates but also from pesticides was a problem that needed to be addressed. He asked the GCC for help in dealing with the nitrate problem. An option presented was to establish a task force to determine the extent of the problem and identify solutions. There was an extended discussion of this issue and how best to address it. Council members agreed that the issue should be investigated but there wasn't agreement on whether it is a problem. The Coordinating Council expressed concern that this might get into regulatory issues that are beyond the scope of the GCC. Jack Metcalf indicated that if limits are placed on the amount of nitrate farmers are allowed to put on fields, yields would go down and the price for food would go up. There was a consensus that looking into the nitrate issue would likely take some time and an incremental approach seemed most appropriate. Jay Hochmuth agreed that the DNR would work with Dr. Kraft and perhaps prepare a proposal for the next GCC meeting.

6. Midwest Flood Workshop with EPA

Chuck Warzecha handed out an announcement for a meeting regarding this summer's flooding to be held November 15 and 16 in Kansas City. The meeting with EPA and states affected by this summer's flooding will discuss groundwater and water supply sampling plans to identify the need for flood relief. The draft plan calls for sampling for nitrates and bacteria.

7. Joint Solicitation Package

David Lindorff asked for comments on the joint solicitation package for fiscal year 1995. The draft package had been mailed out to GCC members. There were only a few changes made in the package from last year. There will be about \$375,000 available for new projects next year as compared with over \$500,000 this year. With minor edits, the package was approved by the GCC.

8. Nitrogen Removal from Domestic Wastewater in Unsewered Areas

Professor William Boyle handed out a summary of research to date at the correctional center in Black River Falls. The UW in conjunction with Ayres Associates are studying three alternative septic systems - recirculating sand filters, anaerobic upflow and peat. The actual field study began last October and will continue for another year and a half. They are able to get nitrate concentrations down to 15-25 milligrams per liter in the treated effluent.

9. Long-range Groundwater Information and Education Strategy

Wendy Weisensel suggested that the GCC develop a broad education strategy that would include both short- and long-term approaches. In publishing the results of the projects funded through the joint solicitation, it's important not only to report the findings, but also indicate what the results mean. We may want to focus on the results of the joint solicitation, but there other things going on that need to be included as well. It was suggested that Wendy come to the next meeting of the Education Subcommittee and see what ideas come out of that meeting.

10. Comprehensive State Groundwater Protection Program (CSGWPP)

Mike Lemcke reported on the status of CSGWPP. The state profile of Wisconsin's groundwater protection program has already been endorsed by the GCC. Comments on the assessment by the state agencies have been incorporated into the copy sent to GCC members. The GCC members endorsed the assessment as written with changes that were made by its members. The next step would be to prepare a vision statement of where we want to go to continue to have a "fully-integrating" groundwater protection program. There was a consensus that our vision for the state is to continue our "fully integrated" program and strive to meet the challenges that are in front of us in the 1990's and beyond.

11. Wiscland

Ron Hennings talked about Wiscland which is an umbrella group of state agencies working on land cover and land use mapping for the state. The DNR has been a major player in this effort. It was agreed that a more detailed presentation would be appropriate for a future meeting. There has been discussion of the appropriate scale for the proposed mapping which should be of value to groundwater quality and land use assessments in the state.

12. 1994 Meeting Schedule

The 1994 meeting schedule was approved. The next meeting will be February 11 at the Geological and

Natural History Survey. Future meetings will be May 13 at Dodgeville, August 12. at the DNR, and November 11 at DATCP. All meetings will start at noon. The meeting adjourned at 3:30 pm.

Respectfully submitted,

David E. Lindorff, Hydrogeologist Supervisor
Groundwater Management Section
Department of Natural Resources

Wisconsin Groundwater Coordinating Council
Meeting Minutes
February 11, 1994

Members Present: Jay Hochmuth (DNR), Jamie Robertson (WGNHS), Bennette Burks for Marvin Roshell (DILHR), Henry Anderson (DHSS), Al Beaver (UW System), and Bob Pearson for Carol Cutshall (DOT).

Others Present: Mike Lemcke, David Johnson and David Lindorff (DNR); Ken Bradbury (WGNHS); Jim Peterson and John Harkin (UW System); Chuck Warzecha and Lynda Knobloch (DHSS); Gary Lueck (Wis. Rural Water Association); Jim Kaap (SCS) and John Robinson and Edwin Huntoon (Wisconsin Water Well Association).

The meeting was held in the Conference Room of the Wisconsin Geological and Natural History Survey, 3817 Mineral Point Road, beginning at 12:15. Jay Hochmuth, Assistant Administrator for the Division for Environmental Quality (DEQ) of the DNR, served as Acting Chair for the meeting. Jay indicated that Ms. Susan Sylvester, the new Administrator for the DEQ had planned to attend this meeting, but other conflicts came up.

1. Introductions

Introductions were made.

2. Agenda Review and Changes

There were no changes to the agenda.

3. Approval of Minutes

David Lindorff (DNR) indicated that the minutes of the November 12, 1993 meeting have been amended to indicate that Marvin Roshell had been at that meeting. No other corrections to the minutes were identified.

4. Subcommittee Reports

a. Education Subcommittee - Jim Peterson (UW) reported that, at its January 25th meeting, the Education Subcommittee had discussed several items. The Subcommittee is trying to identify funds to republish the groundwater study guide that Elaine Andrews (UW Extension) had worked on. Work is progressing on two nitrate in groundwater brochures. A radon brochure will also be published soon by the DNR. The Subcommittee will begin updating the Groundwater Education Resource Directory that was prepared two years ago. The Subcommittee discussed its goals and objectives and decided they don't need to be revised. The Subcommittee will meet again on April 20, 1994.

b. Monitoring and Data Management Subcommittee - Mike Lemcke handed out the draft Groundwater Database publication which a subgroup within the Subcommittee has been working on. The Subcommittee has reviewed it. Mike asked that people send comments to him by February

18th. The DNR intends to publish it by the end of the month. There was discussion of updating, follow up to and distribution of the report. It will be sent to state agencies and libraries in the state.

c. Research Subcommittee - David Lindorff reported that 36 proposals were received as part of the joint solicitation sent out in November. Approximately \$375,000 is available for funding new projects among the four agencies; the proposals ask for a total of about \$375,000 for the next fiscal year. Copies of the proposals have been sent to the state agencies and the Research and Monitoring and Data Management Subcommittees for their review. A meeting will be held March 2nd to discuss each of the proposals. A GCC teleconference will be set up in April to approve the U W System groundwater research plan.

David also discussed the proposal to publish summaries of projects funded through the joint solicitation that haven't been published yet. At its last meeting, The Coordinating Council asked that the Research Subcommittee prepare a scope of work to bring to the Coordinating Council to allow the GCC to see exactly what would be done and under what time frame. The Council also asked that Dr. Gordon Chesters of the UW Water Resources Center be present to answer questions regarding the proposal. Dr. Chesters wasn't able to make this meeting. In order to get input from the GCC on preparing a proposal for preparing summaries, David handed out a portion of the DNR Management Practice Monitoring Summaries publication prepared by the DNR in 1990. This publication summarized the first 55 projects summarized by the DNR. The GCC had no criticisms about the general format of the publication. Al Beaver suggested exploring putting the summaries on e mail as a way to get information out to the scientific audience. Jamie Robertson also urged the Subcommittee to work out the details so we can require summaries in the appropriate format for projects to be finished this year. Henry Anderson encouraged periodic updating of publications which come out of a particular project.

5. Comprehensive State Groundwater Protection Program (CSGWPP)

Mike Lemcke reported that, based on the discussion at the last GCC meeting, DNR staff prepared a vision statement, the last document in the CSGWPP program. The vision statement was sent out to GCC members. There seemed to be agreement on the statement. Mike asked for comments by February 25th. At that time, the DNR will send under Secretary Meyer's signature, the profile, assessment and vision state to EPA Region V asking for endorsement as a core and fully-implementing program.

6. DNR Groundwater Monitoring Plan

David Lindorff handed out the draft DNR Groundwater Monitoring Plan that has been prepared for fiscal year (FY) 1994. Because it has been prepared so far into the fiscal year, the report has just been updated with new information since last year's report. The focus of the plan is on the DNR's management practice monitoring program which is part of the joint solicitation and the DNR's at risk and assessment monitoring performed by the water supply program. The report also contains a listing of all management practice monitoring projects funded since its inception in 1985. Jim Kapp suggested that the report be done in two columns. Dave indicated that people could send comments

to him by the end of the month. Then the report will be finalized. David indicated that the FY 95 monitoring plan will be prepared at the start of the new fiscal year.

7. Dane County Regional Hydrogeologic Study

Ken Bradbury (WGNHS) presented an overview of the Dane County Regional Hydrologic Study currently ongoing. The purposes of the study are to improve the database, and understand of the surface water and groundwater resources of the County, establish a hydrogeologic framework for more detailed studies, develop water management tools (e. g. models), and use the tools to evaluate management options. The study was started because of concerns about the impact of development on the water resources of the County and the lack of study in nearly 30 years. A number of water table maps are being prepared.

Preliminary work indicates that the cone of depression in Madison has expanded since 1965, but that it is more spread out. The main focus this year will focus on development of a computer model. The study will run till the end of 1995. It is not clear what will happen after that time. No provisions have been made yet to maintain and update the model.

8. Fate of Nitrogen in Mound-type Soil Absorption Systems

John Harkin (UWS) discussed his research on septic systems and mound systems. He provided background information on how a septic system and mound system work. He indicated that nitrate is the contaminant most likely to migrate from these systems. He and other UW researchers studied a number of septic systems and mound systems in the 1970s. He started another study a year and a half ago to study the same systems to see what the long-term impacts of these systems is on groundwater. Based on data so far, it appears that the systems still are working. Nitrate concentrations are less than 10 milligrams/liter (the drinking water standard) within a few feet of the systems. John indicated that the data supported smaller lot sizes for subdivisions with individual septic systems.

9. New Chair for the Groundwater Coordinating Council

The GCC discussed a new chair for the Council. Lyman Wible of the DNR was Chair from the creation of the GCC in 1984 until he left the DNR in October of 1993. Susan Sylvester has been hired to replace him, but she has asked for some time to become familiar with the workings of the GCC before she would consider whether she would be willing to serve as Chair. There was a consensus among the GCC that it would make most sense to eventually have her as Chair since the GCC is assigned to the DNR administratively. But the GCC recognized Susan's request. After some discussion, Jay agreed to chair the next GCC meeting in May. At that meeting, a temporary chair would be chosen for the remaining meetings in 1994. Nominations for the temporary chair can be submitted to David Lindorff until April first. A permanent chair would be chosen to serve beginning in 1995.

10. Next meeting

The next meeting will be May 13 at the DNR Area Office in Dodgeville starting at noon. The meeting adjourned at 3:15 pm.

Respectfully submitted,

David E. Lindorff, Hydrogeologist Supervisor
Groundwater Management Section
Department of Natural Resources

Wisconsin Groundwater Coordinating Council
Teleconference Minutes
April 26, 1994

Members Present: Nick Neher (DATCP), Susan Sylvester (DNR), Ken Bradbury for James Robertson (WGNHS), Marvin Roshell (DILHR), Henry Anderson (DHSS), Al Beaver (UW System), Jack Metcalf (Governor's Representative), and Bob Pearson for Carol Cutshall (DOT).

Others Present: Gordon Chesters (UW); David Lindorff and Jeff Helmuth (DNR).

The only agenda item for the teleconference was to review the proposed University of Wisconsin System (UWS) groundwater research plan for FY 1995 which begins July 1, 1994. Gordon Chesters (UW) provided an overview of the process that was followed in selecting the projects for UWS funding. Dr. Chesters also briefed the Council on the Proposed UWS Groundwater Research Plan for FY 95.

Thirty-five proposals were received through the joint solicitation by the University of Wisconsin System (UWS) and the Departments of Natural Resources (DNR), Agriculture, Trade and Consumer Protection (DATCP) and Industry, Labor and Human Relations (DILHR) to select new projects for funding in FY 95. The UWS proposals were reviewed by the Research & Monitoring and Data Management Subcommittees of the Groundwater Coordinating Council (GCC), outside reviewers and the UWS Groundwater Research Advisory Council. The reviewers were from Wisconsin, other states and other countries.

Eight projects which are being funded in FY 94 will carry over to FY 95. The total cost for those 8 projects in FY 95 will be \$125,639 as shown on the attachment. The UWS will fund eight new projects at a cost of \$174,361 (see attachment).

With the exception of Ken Bradbury (WGNHS) who abstained due to a conflict of interest, the GCC unanimously endorsed the recommended UWS groundwater research plan for FY 95 and the transmittal of that endorsement to the Department of Administration for release of funds. Letters of endorsement will be sent to the UWS and the Department of Administration.

Respectfully submitted,

Jeff Helmuth, Water Resources Management Specialist
Groundwater Management Section
Wisconsin Department of Natural Resources

Wisconsin Groundwater Coordinating Council
Meeting Minutes
May 13, 1994

Members Present: Susan Sylvester (DNR), Ron Hennings for James Robertson (WGNHS), Bennette Burks for Marvin Roshell (DILHR), Nick Neher (DATCP), Henry Anderson (DHSS), Al Beaver (UW System), Jack Metcalf (Governor's Representative), Carol Cutshall (DOT).

Others Present: David Lindorff and Jeff Helmuth (DNR), Ken Bradbury and Maureen Muldoon (WGNHS), Bob Pearson (DOT), Larry Bundy (UW) and Jon Cleveland (Wis. Rural Water Association).

The meeting was held in the conference room of the DNR Dodgeville Area Office in Dodgeville, beginning at 12 noon.

1.Introductions

Introductions were made. Susan Sylvester was nominated as permanent chair by Nick Neher; Jack Metcalf seconded the motion. By unanimous approval Susan Sylvester was selected to be the Groundwater Coordinating Council's (GCC) permanent chair.

2.Agenda Review and Changes

One modification was made to the agenda. Nick Neher indicated he would talk about the recent EPA registration of acetochlor. A separate meeting will take place with WGNHS, DNR and Tom Dawson to address the issue of surface water/groundwater interactions.

3.Approval of Minutes

The minutes of the February 11, 1994 GCC meeting and April 26, 1994 teleconference were approved as written.

4.Subcommittee Reports

a.Joint Solicitation Process - Dave Lindorff provided an update on the status of the joint solicitation process and handed out a list of the projects to be funded by the DNR in FY 1995. Besides the projects to be funded by the UWS which were approved at the April 26 teleconference, a total of 6 continuing and 8 new projects will be funded by the DNR. Neither DATCP nor DILHR have money to fund new projects.

b.Research Subcommittee - Ken Bradbury reported on the results of an April 25 Research Subcommittee meeting to develop a plan for preparation of summaries of projects funded through the joint solicitation. The Subcommittee had agreed that the DNR format would be appropriate for 2-page technical summaries of each project. There also was consensus on the importance of distributing the results from projects funded through the joint solicitation process and the importance of the Water Resources Center in that process. Mr. Bradbury presented three options that the subcommittee put together to publish summaries of the

funded research (see attached).

Nick Neher suggested that option #2 might cost less than option #3 due to fewer fringe benefits made available to temporary employees. Ron Hennings stipulated that principal investigators should sign off on the summaries before publication. Funding of the position was also discussed. Gordon Chesters has \$9,000 available and intends for the position to start July 1, 1994. Nick Neher suggested that DNR and DATCP might be willing to provide the remaining funding. Mr. Neher stressed the need for an LTE or intern to be hired for one year to handle the backlog of work that has accumulated. Ron Hennings proposed that the editor or Gordon Chesters come to the next GCC meeting with a plan for the years work and that the editor or Gordon Chesters report to the council at each quarterly meeting. There was a consensus endorsement of option #2 with these two added provisions.

5. Agricultural Concerns

a. Nitrate Conference - Dave Lindorff and Ron Hennings talked about the presentations at the nitrate conference (Nitrate in Wisconsin's Groundwater: Strategies and Challenges) held May tenth in Stevens Point. The conference was well attended. Ron Hennings noted that there are some individuals that don't believe that nitrate is a problem. Both Mr. Lindorff and Mr. Hennings agreed that the conference was a good start.

b. DATCP Board meeting - Nick Neher distributed copies of a series of overheads from the DATCP Board meeting nitrate presentation on May tenth. He emphasized that more nitrate is being applied to fields than can be taken up by crops and that the safety factor for the nitrate drinking water standard is small. The potato crop is the highest contributor of nitrate to groundwater on a per acre basis. Corn is the highest contributor on a total basis. DATCP will prepare a budget initiative for two staff to look at this issue further.

c. Pesticides - Nick Neher discussed the recent EPA conditional registration of the pesticide acetochlor. DATCP was not consulted and prevented sale of the product until a monitoring agreement was signed with the manufacturers. The movement of acetochlor in groundwater is not well understood. DATCP is concerned about acetochlor metabolites. Recent alachlor research has shown a higher incidence of metabolite detects than parent compound detects.

6. Outline for the FY 93 GCC Report to the Legislature

David Lindorff asked for comments on the draft outline for the 1994 GCC Report to the Legislature which is due in August. The draft outline remains similar to the 1993 Report with the only change being the addition of a table containing a list of all projects funded by the joint solicitation process.

7. Groundwater Movement in Fractured Dolomite

Ken Bradbury and Maureen Muldoon synthesized the results of three hydrogeological research projects that have enabled them to develop a framework for studying the complex groundwater flow regime in fractured rock found in many parts of the state. The first project started as a non-point source watershed project investigating the hydrogeology and groundwater geochemistry in the shallow fractured dolomite aquifer in Door County. Groundwater quality was found to vary widely over time with bacteriological contamination common. The second study showed that modeling results obtained from a discrete fracture model varied considerably from results produced by a continuum model for groundwater movement. The discrete fracture model estimated capture zones, groundwater flow paths and groundwater travel times by using mathematical representations of fractures digitized from aerial photos. The third study used a tracer for characterization of groundwater movement and contaminant transport. It revealed that hydraulic conductivity can vary widely in the same well depending on what depth interval is tested. A fourth study (to be funded in FY 95) will apply a discrete fracture flow model for wellhead protection at Sturgeon Bay.

8. Management of Sweet Corn Processing Wastes to Protect Groundwater Quality

Larry Bundy discussed his research on optimizing the land spreading of sweet corn waste. He has found that, applied in the fall, the waste releases nitrate to soil water for two seasons. Dr. Bundy also showed the results of a number of different application rates on corn production.

9. Next Meeting

The meeting adjourned at 2:55 pm. The next meeting of the Groundwater Coordinating Council will be at 12:00 noon on August 12 at Wisconsin Department Of Natural Resources GEF II building in Madison in conference room 511.

Respectfully submitted,

Jeff Helmuth
Groundwater Management Section
Department of Natural Resources

Joint Solicitation of Groundwater and
Related Research/Monitoring Proposals

November 1993

The University of Wisconsin System (UWS), Wisconsin Department of Natural Resources (@NR), Wisconsin Department of Agriculture, Trade and Consumer Protection (DATCP) and Wisconsin Department of Industry, Labor and Human Relations (DILHR) are participating in a joint solicitation of research/monitoring proposals dealing with groundwater and pesticides. Funding will be available for fiscal year (FY) 95 beginning July 1, 1994. The reasons for this solicitation to be made jointly are to:

- Facilitate proposal writing.
- Streamline the review process.
- Curtail duplication.
- Improve coordination among agencies and researchers.
- Enhance communication between the agencies and between principal investigators.

Joint-funding of some projects may be appropriate, but it is not the purpose of this solicitation to jointly fund all projects. Each agency has its own designated mission and priorities. Contributors to this solicitation and their roles are:

- University of Wisconsin System (UWS) through its Water Resources Center (WRC). The WRC, with oversight from the UWS Groundwater Research Advisory Committee, has approximately \$145,000 available in FY 95 to fund new projects. The remainder of the UWS groundwater research funds have been committed to ongoing projects for FY 1995. The funds are restricted for use by faculty within the UWS. Projects of fundamental and applied research will be supported on all matters relating to groundwater including natural science, engineering, social science and law. Projects will be considered for long- and short-term support, but each project will be approved for a MAXIMUM of 2 years during any solicitation cycle.
- The Wisconsin Department of Natural Resources has approximately \$190,000 available in FY 95 to fund new groundwater monitoring projects. About \$160,000 has been allocated for ongoing monitoring projects. Proposals must be for groundwater monitoring or related activities. WDNR is also helping WDILHR fund projects that focus on the performance of currently-approved onsite wastewater treatment (private sewage) systems. The research will establish and improve management practices which will allow the state to meet the groundwater quality standards enumerated in NR 140, Wisconsin Administrative Code. Although no restrictions are placed on who may apply for these funds, preference will be given to UWS and state agency contractors. Contracts will be approved on an annual basis, and no out-of-state submittals will be accepted.

The Wisconsin Department of Agriculture, Trade and Consumer Protection will administer \$135,000 of research funds for FY 95 as part of this joint solicitation. Although most of the money will be used to fund continuing projects, limited funds will be available for new projects. Investigators should note that the focus of the V-DATCP program is on pesticide research which includes but is not limited to groundwater issues. Proposals may be submitted by any college or university, research foundation or individual having a demonstrated capacity in pesticide or other applicable research.

The Wisconsin Department of Industry, Labor and Human Relations will administer \$75,000 for FY 95 to support research on alternatives to current onsite wastewater treatment systems. Some of the funds will be available for new projects.

Please read the solicitation carefully; it contains a description of the priorities for each agency program and other pertinent information. Capital items may not be purchased with these funds, and faculty salaries plus fringe benefits will be limited to a maximum of 10% of an individual grant (for a \$50,000 grant, a maximum of \$5,000 can be allotted to faculty salaries and fringe benefits).

A cover page and proposal format have been agreed upon and they are contained in this package. Although all proposals received will be distributed to each agency, each investigator is asked to identify the agency whose mission and priorities best match the project.

Attached is the description of each agency's guidelines, the outline for a cover page, and a detailed format for the proposal. Proposal narratives should be no longer than 10 double-spaced, single-sided pages.

The deadline for submittal of proposals is January 17, 1994. There will be a minimum of two reviews of each proposal, one of which will be from out-of-state. Funding decisions will be made in April 1994, if possible.

If you have any questions please call the following contacts at the individual agencies.

George Blondin	262-3470	University of Wisconsin-Madison
David Lindorff	266-9265	Wisconsin Department of Natural Resources
Jeffrey Postle	266-9959	Wisconsin Department of Agriculture, Trade and Consumer Protection
Bennette Burks	266-0056	Wisconsin Department of Industry, Labor and Human Relations

Please submit the original and three copies of each separate proposal to:
Mr. David Lindorff
Bureau of Water Resources Management
Wisconsin Department of Natural Resources
P.O. Box 7921
Madison, WI 53707

PROPOSAL FORMAT (Original and three copies)

Deadline for Submission: January 17, 1994

A. Cover Page--Sample copy is appended.

B. Project Summary (not to exceed 2 double-spaced pages)

1. Specific groundwater or related problem addressed by research/monitoring proposal.
2. What will findings contribute to problem solution?
3. Project objectives.
4. Project approach to achieve objectives.
5. Users of project findings.

C. Proposal Narrative (begin on new page, not to exceed 10 double-spaced pages)

1. Objectives.
2. Background information describing prior research/monitoring relevant to objectives; references to ongoing projects and how they relate to proposed investigation; information gaps which will be filled by the proposed project.
3. Project plan outlining experimental design and schedule.
4. Methods detailed enough to convince the reviewer that the investigators are up-to-date on modern techniques; a general statement alluding to techniques is not acceptable.
5. Relevance to groundwater and related problems.

D. Principal Investigators

Include 2-page resume (including recent publications) of each investigator and state the time each will spend on the project. A recent reprint or offprint of a key publication should be submitted when available. If any project personnel will receive training, state its nature.

E. Budget using order shown in sample form

1. Salaries and wages, including percentage of grant to be used for faculty salaries.
2. Fringe benefits, including percentage of grant to be used for faculty salaries.
3. Supplies--list office, laboratory, computer and field supplies separately. Fabrication of equipment should be listed as separate item.
4. Travel to support field operations only. Travel to meetings is excluded because of the limited funding.
5. Publication costs.
6. Total direct costs.

SAMPLE COVER PAGE

Project Title

PRINCIPAL INVESTIGATOR:

Name	Title and Affiliation	Address	Telephone	FAX
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CO-PRINCIPAL INVESTIGATOR(S):

Name	Title and Affiliation	Address	Telephone	FAX
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Location of Research

Desired Start-up Date and Duration of Project:

Amounts Requested	FIRST YEAR	SECOND YEAR	TOTAL
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Agency(ies) to which this proposal is targeted:
(If appropriate for more than one agency rank highest I to lowest 4)

UWSWDNRWDATCPWDILHR

Date of Submittal

SAMPLE BUDGET PAGE

Budget Period from July 1, 1994 to June 30, 1995

(Make a separate page for each year of support)

1. Salaries and Wages Time, % Cost, \$

Name and title if known

- a.
- b.
- c.
- d.

% of grant to be used for faculty salaries =
(including fringe benefits)

2. Fringe Benefits

% of which salaries

3. Supplies

- a. Office
- b. Laboratory
- c. Field
- d. Computer
- e. Fabrication of equipment

4. Travel only for support of field operations.

Detail transport, meals, hotels and number of persons involved.

5. Publication Costs.

6. Total Direct Costs

7. On a separate sheet, indicate the level of current or pending support.

See attached example.

UNIVERSITY OF WISCONSIN SYSTEM (UWS) PROJECTS FUNDED
THROUGH THE GROUNDWATER RESEARCH ADVISORY COUNCIL

As part of the joint solicitation for groundwater and related research monitoring proposals, the UWS seeks projects of a fundamental or applied nature on any aspect of groundwater research either in the natural sciences, engineering, social sciences or law.

Application Requirements: Most often the principal investigator will be a faculty member on any campus in the University of Wisconsin System. However, academic staff who have achieved nomination to PI status by endorsement of the relevant academic dean may serve in this capacity. Budgetary

Considerations: About \$145,000 will be available for new grants in FY 95. Projects will not be approved in any one budget cycle for a period of more than 2 years, although a continuation project will be considered for funding in a subsequent solicitation. No capital equipment (more than \$1,000/item) will be purchased. Travel for attendance at scientific meetings will not be accepted. Faculty salaries and fringe benefits to be paid from any project will not exceed 10% of the total individual grant.

Priorities: Presented in no particular order of importance.

- Chemical and biological degradation of pollutants in surface soils, subsoils and groundwater, including identification of degradation products.
- Transport of pollutants in soil and groundwater, including elucidation of soil and hydrologic factors controlling movement, and development of predictive models.
- Impact of waste management practices on groundwater contamination.
- Impact of agricultural management practices on groundwater contamination.
- Characterization of geologic factors affecting groundwater movement.
- Examination of the social and economic impacts of groundwater contamination.
- Evaluation of policy alternatives for controlling groundwater contamination.
- Biological, chemical and physio-chemical technologies for remediation of contaminated soils and groundwater.

Proposal Format: Is fully outlined in the joint solicitation.

Review: Each project will receive at least two reviews one of which will be from out-of-state.

PESTICIDE RESEARCH PROGRAM

RESEARCH GRANTS PROGRAM FOR SOLICITATION OF APPLICATIONS

Applications are invited for competitive grant awards focusing on the regulatory issues associated with pesticide use and control. This program is administered by the Agricultural Resource Management Division of the Department of Agriculture, Trade and Consumer Protection. Under this program, the Department may award grants not to exceed three years for the support of research projects to advance the program priorities outlined below. Proposals may be submitted by any college or university, research foundation or individual having a demonstrated capacity in pesticide or other applicable research. \$135,000 will be available for fiscal year 1995 for pesticide research. Most of the funds will be used for continuing projects, so limited funds will be available for new pesticide research projects.

DATCP RESEARCH PRIORITIES FOR 1993/1994

High Priorities

- 1) **Evaluation of the Environmental Fate and Remediation Alternatives for Contaminated Soil and Water at Pesticide Mixing/Loading Sites.**

Projects should investigate the degradation and movement of pesticides at spill sites, develop criteria on the need for and appropriate extent of remedial actions, and evaluate various methods for remediation of contaminated soil and water.

- 2) **Refinement of Application Methods for Metham Sodium Soil Fumigants to Reduce Environmental and Public Health Problems.**

Research should focus on how different application methods and environmental conditions affect the potential for volatilization or leaching of metham sodium or the breakdown product MITC.

- 3) **Evaluation of Factors Influencing the Patterns of Groundwater Contamination by Pesticides and Pesticide Metabolites in Wisconsin.**

This topic involves examining factors which influence pesticide leaching to determine areas of the state that are susceptible to groundwater contamination by specific pesticides.

- 4) **Use Related Monitoring of Pesticides and Pesticide Metabolites in Groundwater.**

Projects should assess groundwater contamination by field application of pesticides in key environmental settings such as fractured bedrock areas.

Additional Priorities

5) Identification of the Sources of Pesticide Contamination in Groundwater in Rural Wisconsin.

Methods should be developed and investigations conducted at a selected number of contaminated rural well sites to determine if contamination is due to field use (nonpoint source) or spills or mishandling (point source) of pesticides.

6) Evaluation of the Economic Feasibility of Various Chemical and Non-Chemical Weed Control Practices.

Projects should develop a methodology for evaluating the economic feasibility of modifying weed control practices and apply it to examples where practices are changed to reduce impacts on groundwater.

7) Pesticide Use Surveys.

Projects should provide detailed pesticide use surveys that compliment other data -gathering efforts, such as ground and surface water monitoring, to improve the understanding of pesticide related issues and problems.

8) Evaluation of the Effect of Irrigation Management on Pesticide Contamination in Groundwater.

Projects should evaluate current irrigation management practices and assess their effects on pesticide leaching.

9) Identify Pesticide Use Practices on Commercial Cranberry Marshes which will Minimize the Potential for Pesticide Discharges to Surface Water.

Projects on this topic may evaluate the environmental impacts of specific pesticide use practices at cranberry marshes and make recommendations on how practices can be modified to reduce adverse impacts.

DEPARTMENT OF INDUSTRY, LABOR AND HUMAN RELATIONS

RESEARCH OBJECTIVES

The Department of Industry, Labor and Human Relations (DILHR) is currently conducting research focused on alternate onsite sewage system designs, products, and management practices that can be incorporated into the administrative rules regulating onsite sewage systems. These designs, products, or management practices must be:

- Directed towards minimizing nitrate loadings to protect groundwater and surface water quality;
- Result in onsite sewage treatment that is consistent with the provisions of the Groundwater Protection Law, particularly as it relates to the nitrate standard;
- Be affordable by the average owner of an onsite sewage system; and
- Be practical for the climate and soils of Wisconsin.

Application Requirements: Anyone may apply for research funds. Applicants will be required to demonstrate education, training, and experience consistent with research objectives.

Budgetary Constraints: The Department is limited to a budget of \$50,000 per year, and existing projects may receive continued funding for another year. Applicants are encouraged to seek additional funding from the DNR, or other sources, where projects also meet funding priorities of other agencies.

Proposal Format: The proposal format is outlined in the joint solicitation.

Review: Each project will be reviewed individually.

WISCONSIN DEPARTMENT OF NATURAL RESOURCES

GROUNDWATER MANAGEMENT PRACTICE MONITORING PROGRAM

Management practice monitoring is defined as groundwater monitoring or support activities associated with groundwater monitoring, such as laboratory technique development or geologic resource description, for establishing or improving management practices necessary to meet the state groundwater quality standards of NR 140, Wis. Adm. Code.

Applicant Requirements

Any individual, government body or private concern can submit project proposals; however, preference will be given to University of Wisconsin System and state agency contractors. No submittals will be accepted from out of state.

Budget Considerations

Monitoring proposals will be considered for a maximum of two years. Projects costing less than \$25,000 annually will be given greater consideration. Management practice monitoring projects are funded solely by state funds; there are no federal funds involved. Budget items to be identified should include such things as personnel costs, supplies, equipment, necessary travel, and other appropriate items. The management practice monitoring funds cannot support capital equipment or indirect costs.

A number of projects which are being funded in fiscal year (FY) 1994 will continue into FY 1995. As a result, some money will be set aside to fund continuing projects. Approximately \$190,000 will be available to fund new monitoring projects in FY 95.

In preparing the budget be aware of the following contractual requirements.

Contractual Requirements

All monitoring wells installed shall meet Department regulations and approved procedures for installation, construction and documentation (Chap. NR 141, Wis. Adm. Code.)

For each new monitoring well, a well construction report shall be submitted on a form (Form 4400-113A) or in a computer format supplied by the Department.

For all groundwater sample points (monitoring wells, piezometers, and private water supplies), an inventory form supplied by the Department shall be completed and submitted.

For any water supply well that is sampled, the contractor shall determine if a well construction report was prepared. A copy of the well construction report, if available, shall be attached to the inventory form.

All groundwater quality monitoring data shall be collected on forms or in a computer format provided by the Department and shall be reported to the Department within two (2) weeks after the data has been received by the contractor. Computerized data shall be verified by the contractor.

All groundwater samples shall be analyzed by a laboratory certified in Wisconsin for that purpose under Chapter NR 149, Wis. Adm. Code.

The contractor shall request labels with Wisconsin Unique Well Numbers from the Department for wells constructed and/or sampled to allow identification of wells. Wells shall be labeled to allow identification.

Abandonment of monitoring wells shall be the responsibility of the contractor. Wells shall be abandoned in accordance with Department regulations (Chap. NR 141, Wis. Adm. Code) and approved procedures upon completion of the project, unless alternative prior arrangements have been made with the Department.

Review of Proposals

All proposals will be reviewed by DNR staff, the Monitoring and Data Management and the Research Subcommittees of the Groundwater Coordinating Council. Projects given high rankings will be those that address identified priority concerns and appear to have a high probability of successfully obtaining their stated goal.

The project must involve either groundwater monitoring or activities conducted to support groundwater monitoring. Support functions can include, among other things, laboratory analysis technique development, well drilling and construction methodology development and definition of geologic and hydrogeologic conditions for groundwater management purposes.

It is also important that the proposal address a priority monitoring topic as listed below. Other considerations include project cost, proposed timeline, whether the proposed project methodology will meet the objectives stated, whether the resources requested are adequate to carry out the project, and whether the project investigators have the abilities to complete the proposed project.

In making final funding decisions, the DNR's Groundwater Management Section will formulate its recommendations based on the input from all project reviewers. The Bureau Director of the DNR's Bureau of Water Resources Management will make the final funding decisions.

Priority Monitoring Topics

For state fiscal year 1995, the following priority topics for groundwater management practice monitoring have been selected based on input for a number of state agency staff and university researchers to identify priorities to meet state needs. This list of priority needs is not in any specific order.

1. Nutrient management. Examples: monitoring to determine the percentage of fertilizer (either chemical fertilizer or manure) applied to the land surface which reaches groundwater and the factors that affect the amount of leaching that occurs; monitoring to correlate groundwater quality with the extent of land owner implementation of best management practices in environmentally sensitive areas; monitoring to evaluate the impacts of animal waste management practices including barnyards, storage design and operation and manure application on groundwater quality; and monitoring to distinguish nitrate contamination caused by chemical fertilizer application from nitrate contamination from other waste sources.

2. Pesticide management. Examples: monitoring to determine if changes in pesticide application procedures and/or tillage practices have significant potential for reducing pesticide impacts on groundwater, especially projects focusing on atrazine, alachlor (lasso) and metolachlor (dual) and the potential reduced groundwater impact from pesticide use under low input agricultural practices; monitoring to identify the soil and geologic conditions under which pesticides contamination is likely to occur, particularly fractured bedrock conditions plus loam and clay soils; evaluation of the extent of groundwater contamination from agricultural and nonagricultural pesticide use and handling in various geologic settings; contamination potential and possible health impacts of pesticide metabolites and alternatives to atrazine; monitoring at pesticide loading facilities to evaluate the effectiveness of the facility to protect the surrounding soils and groundwater from contamination; development of laboratory procedures for analyzing metabolite concentrations in water and soil.
3. Landfill regulation. Evaluation of current or innovative landfill design, operation or monitoring criteria in relation to compliance with groundwater quality standards.
4. Groundwater remediation. Examples: monitoring of vapor extraction systems to determine their effectiveness in removing volatile organic compounds from various depths and soil types; monitoring various types of bio-remediation methods to determine how effective they are in Wisconsin.
5. On site wastewater disposal. Monitoring to evaluate the extent to which current and alternative on site wastewater (private sewage) systems comply with state groundwater quality standards. Examples: Identification and quantification of contaminants in groundwater resulting from wastewater disposal through private sewage systems; determination of the extent to which current septic system technology prevents wastewater contaminants from complying with groundwater quality standards in various hydrogeologic settings or varying operating conditions; determination of the performance of new or innovative alternatives to current technology, design criteria or management practices with respect to groundwater quality; field monitoring studies to separate the impacts of septic systems from those from other sources, such as current and previous agricultural practices, lawn fertilizer use, road salt use and nearby commercial operations.
6. Urban nonpoint pollution. Examples: evaluation of infiltration trenches, infiltration basins and grass swales; determination of the constituents of urban discharge runoff water; monitoring in areas of continuous use of fertilizer and pesticide, such as at golf courses or cemeteries.
7. Wastewater land disposal. Monitoring of different types of wastewater land disposal systems to evaluate and, if necessary, revise the design standards for these wastewater disposal systems.
8. Organic chemicals. Evaluation of the extent of groundwater contamination from organic chemicals in various geologic and land use settings.
9. Naturally occurring substances. Evaluation of the distribution and seasonal fluctuation of naturally occurring substances such as radionuclides, sulfates or saline waters.
10. New technology. Development of new laboratory or field technology (or new applications of

existing technologies) for determining the characteristics of groundwater and geologic formations for management purposes, including toxicity testing and downhole groundwater monitoring techniques.

11. Data management. Development of improved methods for managing groundwater monitoring data. Examples: interpretation techniques for comparing groundwater quality data to groundwater standards; methodologies to make groundwater quality or contaminant source data more readily available; and spatially relating various chemical and geologic conditions.
12. Resource definition. Resource definition studies to better describe the geologic and groundwater properties in the state for management purposes.
13. Wellhead protection. Evaluation of techniques used to delineate wellhead protection areas in various geologic settings.
14. Vulnerability information verification. Field studies to verify resource data used for vulnerability assessments.
15. Evaluation of health effects of groundwater contaminants. Investigate health effects of groundwater contaminants and interactive or synergistic effects of substances which are frequently found together in groundwater.
16. Groundwater - surface water connection. Monitoring of surface and groundwater flow to determine hydrologic connections and pathways between them to assess the potential movement and fate of contaminants from one hydrologic regime to another.
17. Microbial contamination of Groundwater. Investigate the incidence, analytical and monitoring techniques and infective dosages of microbial contaminants, including parasites, bacteria and viruses.
18. Land use management. Examination of the impact of land use (e. g. urbanization) on groundwater quality and quantity.

Wisconsin's Vision for a Comprehensive State Ground Water Program

In 1983, Wisconsin Act 410 was signed into law. Act 410 established a comprehensive program for management and protection of groundwater. The cornerstone of the 1983 Wisconsin Act 410 is chapter 160, Wisconsin Statutes, referred to as the Groundwater Law, which created the framework for the development and implementation of groundwater protection in Wisconsin. This framework has afforded the citizens of Wisconsin the opportunity to continuously improve state groundwater programs. The Groundwater Law also provides a framework for state agencies responsible for protecting groundwater to work together on improving both regulatory and nonregulatory programs. The following is Wisconsin's Vision for a Comprehensive State Ground Water Program.

1. The State of Wisconsin will continue to improve state groundwater programs within the framework of chapter 160, Wisconsin Statutes, to protect future groundwater uses for citizens and the environment.
2. The State of Wisconsin will work with federal agencies, other states and native american nations to improve and protect groundwater quality and quantity on a regional scale.
3. The State of Wisconsin will continue to improve communication, increase the efficiency and facilitate effective functioning of state agencies with groundwater related activities, be they regulatory or nonregulatory, through the Groundwater Coordinating Council.
4. The State of Wisconsin will continue to provide local governments a voice on improving state groundwater programs to best serve the citizen's of the state.
5. The State of Wisconsin is committed to providing and improving general awareness of the groundwater resource through information and education programs.
6. Groundwater protection will continue to be a high priority for Wisconsin's state agencies who are dedicated to identifying and solving future groundwater problems.

As Wisconsin's regulatory and nonregulatory programs continue to change in response to changing needs, the Groundwater Coordinating Council will insure that state agencies, local, tribal and federal governments and citizens work together in the most efficient manner possible to preserve and protect Wisconsin's buried treasure.