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WATER RESOURCES REVIEW

Water Resources Institute
Grand Valley State University

Volume 3, Number 1

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ACTION-ORIENTED GRAND RIVER PROGRAM INTO START-UP PHASE

Activities are already underway to organize the first of three special committees pivotal to WRI's Grand River Watershed Program.

As early as this coming June, a Technical Task Force of faculty from several universities, representatives from the state Department of Natural Resources and other experts will begin to review existing knowledge and slate early program research. Their initial focus will be on watershed wetlands, which are critical to the health of the river as well as wildlife in the region.

This will be the first stage of progress in what is planned as a five-year commitment to the most comprehensive research effort ever conducted on the Grand River. Funding for this initiative has been provided by The Grand Rapids Foundation.

The watershed program is not one long-term survey but a coordinated series of research studies, outreach activities and educational efforts designed to facilitate local action. WRI will be collaborating with many organizations and individuals during the program. In addition to the Technical Task Force, there will be a Government Task Force of representatives from local, state and federal organizations involved in environmental activities and a Citizen Advisory Committee reflecting community, business and civic interests along the Grand.

A First Agenda

While it will not make up a major portion of program work, first on the agenda is a gathering and review of all available information and the

development of baseline data on the Grand River and its watershed.

At 260 miles from headwaters to mouth, the river is the longest in Michigan, and its watershed comprises 5,572 square miles stretching across more than 15 counties. The river also creates a "zone of influence" in Lake Michigan that extends miles into the lake and up and down the coastline.

A review of baseline and background data will suggest specific, immediately needed research studies. Other projects will be undertaken as their need becomes apparent through general program progress.

Beyond Research

Essential components of the watershed program's design are strong commitments to outreach and

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FROM THE DIRECTOR

The past few months have been some of the most exciting since the establishment of the Water Resources Institute. In this newsletter you will read that major WRI projects have achieved significant progress, important new projects have been launched and our work is proceeding at a faster pace, in many cases, than we thought possible.

In the history of WRI, the initiation of the Advancement Program for new capital support and the inauguration of the Grand River Watershed Program will certainly stand as milestones. These two events alone enhance the Institute to new levels of service and are programs that will be central to the life of WRI in coming years.

WRI is science and technology set to work on behalf of our environment. But the Institute is also con-

cerned, dedicated people. I want to salute here all of the WRI Research Associates who have built the Institute into the productive organization it is today. I also want to thank the many, many others who have become part of a growing corps of supporters of our work.

Together--as we all focus our attention on the critical environmental issues that face west Michigan, this country and the entire world today--we will achieve exactly what we want: a better, safer world tomorrow.

~ ~ ~ ~ ~

Ronald W. Ward, Ph.D.
Director
Water Resources Institute

education. The three special committees will assist in planning, effecting plans, developing recommendations and communicating the results of program activities. There will be opportunities for WRI to coordinate its efforts with those of other institutions and organizations.

The public will be informed of all progress and research results. Frequent program reports will be issued, and a possible "report card" on the Grand River may be developed. Issues to be covered may include public health, the presence of toxic substances, recreation and more. There will be direct participation in some program activities by school groups and other public constituencies.

This summer, for example, a requested Michigan Youth Corps grant will support a special Grand River Improvement Project. It will involve local youths in several capacities: taking samples from the river, working with WRI computers and removing debris from the banks and bed of the Grand.

The initial five-year Grand River Watershed Program will end with publication of a major summary of concerns and recommendations for action to insure the well-being of the river.

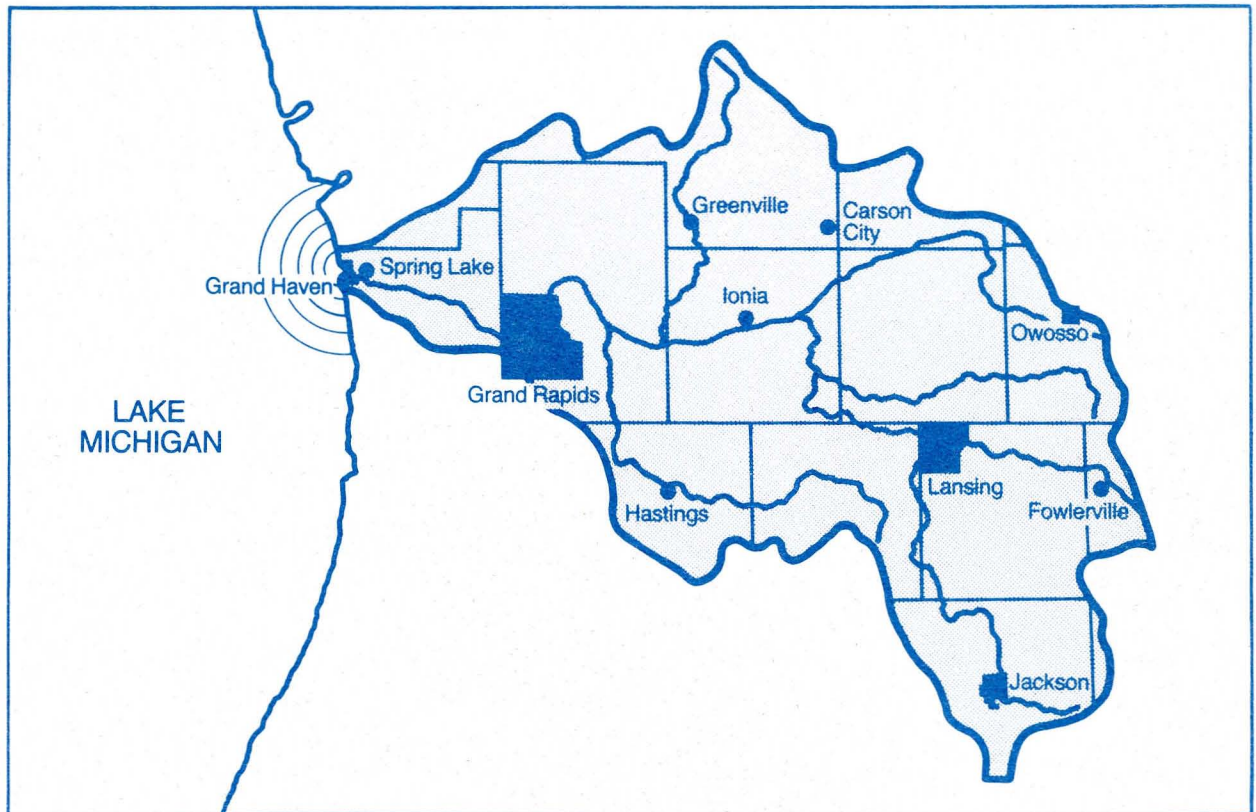
Program Goals

In announcing the program, GVSU President Arend D. Lubbers stated: "It will provide detailed scien-

tific data covering both the current status of the Grand River and the effect on river quality of community, industrial and agricultural activities throughout the watershed. It will also provide the direction for activities designed to help insure a quality environment for future generations in Michigan."

The program will produce a new body of knowledge about the Grand River watershed that will assist in establishing realistic environmental goals for it in the year 2000, and the program will recommend actions needed to achieve these goals.

GRAND RIVER WATERSHED PROGRAM



Grand River Watershed

Zone of Influence in Lake Michigan

A PROJECT OF THE
GVSU WATER RESOURCES INSTITUTE
AND THE GRAND RAPIDS FOUNDATION

FIRST WRI YEAR AS GEM CENTER EXCEEDS GOALS AND EXPECTATIONS

In January WRI submitted to the W.K. Kellogg Foundation a first Annual Progress Report on its activities as a Regional Center in the Groundwater Education in Michigan (GEM) Program. The Foundation underwrites the program, and WRI was the first regional hub designated in it.

The report covers the inaugural year of WRI's participation, from November 1988 through October 1989. During this period all first-year goals were either met or exceeded, and specific projects were accomplished well ahead of original schedules.

Four main areas of emphasis have evolved in WRI/GEM activities: 1) groundwater research, 2) information networking, 3) community outreach and 4) K-12 education. Successful work was accomplished last year in all four areas.

Accelerated Research

As part of its commitment to GEM, WRI has created a well-log database of information on more than 12,000 wells located in Ottawa, Muskegon and Kent counties. The database not only catalogues the location of wells but enables the identification of aquifer systems and other water resource characteristics. It was anticipated that this work might take as long as three years, but the use of computer technology enabled completion of the database last year.

The well-log database will allow WRI researchers to conduct aquifer recharge/discharge analyses and other studies. Its information has already been utilized in a groundwater analysis of 10 townships associated with the Grand Rapids South Beltline Project. Well-log information is also being made available to other agencies, organizations and individuals that may benefit from it.

In its second GEM year, WRI will expand its well-log database and continue to compile data necessary to perform detailed research into regional groundwater chemistry.

Networking and Outreach

Two of WRI's important service functions through GEM are its roles as a regional hub in a growing statewide groundwater communications network and as a cooperating body with other GEM and related environmental initiatives.

made presentations at more than 100 meetings during the first GEM program year. Phone contact or correspondence was conducted with over 500 agencies, institutions and individuals.

As another of its first-year GEM accomplishments, WRI established HUNRIS, a regional Human and Natural Resources Information System. Its purpose is to make an increasing amount of environmental information available to state and local government, planners, consultants and other decision-makers.

Public Education

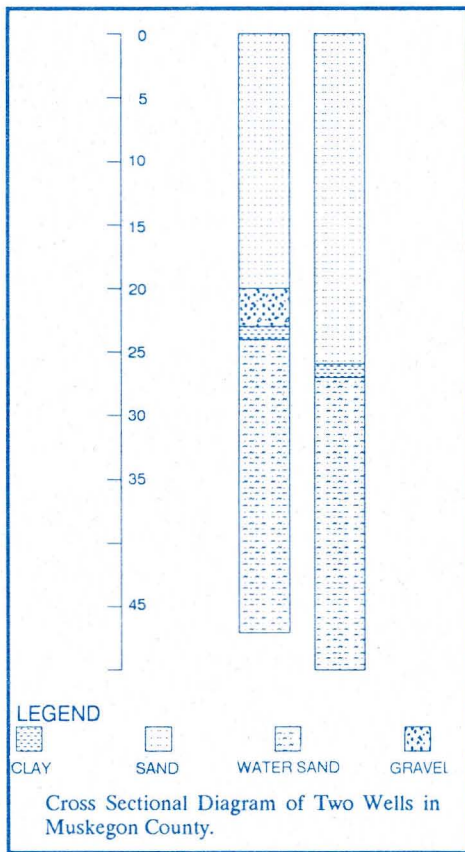
A central commitment of the GEM program overall is the enhancement of public knowledge about major issues in groundwater conservation. Last year, WRI staff contributed to the development of numerous newspaper and journal articles on groundwater that were aimed at many levels of public awareness. Several groundwater information reports were also published by the Institute.

As a special educational project, GVSU Professor Melvin L. Northup has been working on the preparation of interactive computer programs for public groundwater education, with particular application in K-12 classrooms. Three such programs have entered testing stages during WRI's second GEM year, a full year ahead of schedule.

GEM Future

All of the above-mentioned work is the result of a three-year \$580,680 grant to WRI from the W.K. Kellogg Foundation. The GEM program is funded statewide by the foundation and is headquartered at Michigan State University.

According to WRI Director Ronald W. Ward, "We are proud of our first-year accomplishments as the Regional Center for GEM in west Michigan. Building on this work, we expect highly productive years during the remainder of this initial grant period." ~ ~ ~ ~ ~



In June 1989, for example, WRI sponsored its first Regional Groundwater Conference, which was held at the L.V. Eberhard Center in Grand Rapids. About 100 local officials from Ottawa, Muskegon and Kent counties attended the conference, organized a year earlier than originally expected. WRI also hosted its first WELOG/WELLKEY Users Conference last October. It helped disseminate groundwater information and materials useful to researchers, health officials and planners throughout the state.

WRI staff members were active in communicating with a variety of constituencies involved with groundwater. Staff attended or

GROUNDWATER REPORT COMPLETED ON SOUTH BELTLINE PROJECT

A major research assignment was completed by WRI last November, when it submitted a master Summary Report on groundwater associated with the Grand Rapids South Beltline Project. The project is the result of a recommendation by the Grand Rapids and Environs Transportation Study for construction of a new linkage south of Grand Rapids between highways I-96 and I-196.

The Michigan Department of Transportation, working with the engineering/consulting firm of Deleuw Cather, is preparing a Draft Environmental Impact Statement on the project. In turn, the firm of Johnson Johnson & Roy (JJR) is responsible for data collection efforts. JJR assigned to WRI the development of a groundwater assessment of the project corridor and its surrounding area.

The Summary Report required an intensive eight-month period of preparation, involving up to 16 staff members at work on the compilation and analysis of data and the generation of interpretive maps. The study

site was defined by JJR to include an area at least 28 miles long and three miles wide on either side of the 60th to 68th streets corridor in southern Kent and Ottawa counties that is under consideration for the new transportation system.

To complete the assignment, WRI staff compiled existing residential well logs for the study site, created a groundwater database from these records, created map series based on compiled data and organized the results and findings of this work into the submitted Summary Report. The map series included graphic displays of well locations, depth to groundwater, groundwater flow-paths, aquifer locations and boundaries and potential recharge sites.

Four transportation alternatives have been identified for the beltline corridor, ranging from construction of a limited-access freeway or a boulevard with a median to making no changes in the current road system. The Draft Environmental Impact Statement, which is scheduled for completion in fall 1990, will analyze wetlands, farmland, wildlife

habitat, endangered species, aquatic resources and groundwater in the corridor and assess the impact of project alternatives.

"Further analysis of our work," said WRI Director Ronald W. Ward, "will assist in determining the best location for any new construction. It will also help determine the impact of construction on existing water supplies and answer a variety of questions regarding groundwater vulnerability within the corridor and the surrounding area."

As awareness of the Institute's capabilities spreads, WRI hopes to provide similar research to assist in meeting the needs for environmentally sound planning and development in west Michigan.

Research Associate John K. Koches was responsible for overall management of the WRI effort, with principal assistance provided by Research Associate and Assistant Professor of Geology Kevin Cole, Project Coordinator Kurt J. Thompson and Research Assistant Mike Patterson.

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## PROGRESS IN SCIENCE PROGRAM FOR PROSPECTIVE ELEMENTARY TEACHERS

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Important initiatives have been achieved in PRISE, WRI's Project to Improve Science Education. The project is supported by a three-year \$361,319 grant from the National Science Foundation. Its goal is facilitate the preparation of prospective elementary teachers to teach more effective science content and process curricula in biology, chemistry, geology and physics.

According to Thomas P. Kelly, WRI Research Associate, "A major objective of PRISE is to expose students planning careers in elementary education to hands-on investigative experience which utilizes scientific instrumentation and analysis. Also, we want to increase their interest,

confidence and competence in science."

Each student involved in the project is educated in model classroom methodology and is encouraged to elect more science courses, possibly even choosing to minor or major in science. At GVSU the common project linkage between the four science disciplines is water resources. The project is being developed, however, as a model so that universities across the country can benefit from its results in broader application.

### Our Water Resources

This past fall, a course entitled Our Water Resources was intro-

duced on an interim basis by the GVSU Department of Biology. It has been approved since then as a general education course offered by the department.

Fall students were actively involved in four investigative field trips aboard the research vessel D.J. Angus. They had the opportunity to observe, collect and analyze data concerning the changing geophysical, chemical and biological characteristics of Lake Michigan, the Grand River and Spring Lake. Other activities included field trips to a wastewater treatment plant, to Hofmaster State Park north of Grand Haven for exploration of a dune system and to Hofma Park south of



Grand Haven for examination of a wetland.

Course students gained firsthand experience in working with a fifth-grade class from the Grandville Public Schools to conduct water quality tests on Buck Creek. This gave the prospective teachers an opportunity to try out their newly learned techniques on a group of elementary students.

#### New Geology Lab Course

Currently, Dr. Richard Lefebvre, Professor of Geology, is teaching a special PRISE laboratory as part of GVSU's Geology 111 course. This is an interim offering while department staff consider the best geology curriculum for the project's target constituency.

Highlights of the geology lab include a tour of a gypsum mine to observe its unique geological characteristics and a lab project utilizing a topographical map and a compass to identify geological features on the GVSU Allendale campus. Students will also work one on one and in small groups with elementary students at the Mathematics/Science Magnet School of the Grand Rapids Public Schools.

#### PRISE Advisory Committee

An Advisory Committee was established last fall to assist PRISE Project Director Ronald W. Ward in the design, implementation and modification of overall project activities. The committee is composed of elementary science educators, representative inservice elementary teachers and administrators and GVSU faculty members from the School of Education and the four participating science departments. Dr. Burt Voss, Professor of Science Education at the University of Michigan is also a member of the committee.

The Advisory Committee has conducted a needs assessment to determine its priorities. Also, a March 14 meeting was held by representatives of the committee, who met with elementary science teachers and GVSU science faculty to assess what science is currently being taught in elementary schools and how well the teachers were prepared in their college courses.

#### Summer Workshop

Planning is underway for a special summer workshop, which will provide GVSU science faculty an opportunity to develop syllabuses for new science courses for prospective elementary teachers and to format activities and laboratories enhancing their eventual science teaching.

After the workshop, participants will deliberate with their respective departments to obtain formal ap-

proval for each designated PRISE course. It is anticipated that approved special courses in biology, geology, chemistry and physics will be fully in place by fall 1991.

Momentum has been established for the design of curricula which will ultimately have an impact on elementary science teaching into the next century.

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## RESEARCH VESSEL LOGS SUCCESSFUL 1989 SEASON AND PLANS FOR 1990

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The D.J. Angus, WRI's floating classroom and laboratory, served a record 2,599 schoolchildren and adults during its 1989 season. Based in Grand Haven and cruising near-shore Lake Michigan and accessible inland waters, the 45-foot vessel remains the only boat of its kind with so active a schedule of teaching and research assignments.

Throughout its last season, the Angus offered demonstration cruises, dockside demonstrations, and open house events to a variety of constituencies, introducing them to water resource management and research. Many program participants had the opportunity to conduct water-related experiments while on board the boat.

A total of 312 teachers attended workshop cruises or accompanied K-12 classes during the 1989 season. Students in classes or other organized groups totaled 1,133 participants. In addition 1,154 adults other than teachers took part in the Angus's Aquatic Resources Education Program, which has been sponsored by the Charles Stewart Mott Foundation.

Some 500 GVSU students participated in class sessions and trips aboard the vessel as part of their academic course work.

Among highlights of the season were special cruises for representatives of state universities and colleges and cruise events in Escanaba and South Haven during their Celebrate the Great Lakes program. The Angus crew also hosted high-

ranking teams from the Michigan Science Olympiad, minority students from various area programs, and members of local, state and the federal government.



At the end of its eight-month 1989 season, the Angus recorded a 48-percent increase in program participation over its previous service season.

Planning is already underway for an active 1990 schedule. The boat will return to the water in mid-April, with a first date of operation set for April 30. During the first three days of the new season, the Angus will be based in Ludington, a visit which is becoming an anticipated annual event for local school groups.



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## DATA COMPILED FOR TESTING OF NONPOINT SOURCE POLLUTION MODEL

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Frederick B. Bevis, WRI Research Associate and Chairman of the GVSU Departments of Biology and Natural Resources Management, has completed the compilation of preliminary data needed for an evaluation of the Agricultural Nonpoint Source Pollution Model (AGNPS).

The AGNPS computer model was developed by the U.S. Soil Conservation Service and has been adopted for use in several Great Lakes states. Professor Bevis is working to evaluate and validate the accuracy of the model, which simulates loading to receiving waters from various land uses and geographic situations under varying storm events.

After about a year of initial work, Professor Bevis has developed a variety of baseline environmental and land-use data on three west Michigan watersheds. He has investigated areas associated with the Bass River

in Ottawa County, the Smith Drain in Muskegon County and the south branch of the Pentwater River in Oceana County. Each of these watersheds is characterized by intensive land use for agriculture. This land use generates nonpoint source pollution, which results in the reduction of water quality within the watershed.

The primary causes of water pollution in these areas are agricultural practices that disturb soils, fertilizer applications and feedlot applications on topographic situations which tend to concentrate overland flow during storm events into receiving waters. The Smith Drain watershed is 81 percent cropland, pasture and orchard, while the watersheds of the Bass River and the south branch of the Pentwater River are, respectively, 75 percent and 65 percent agricultural in use.

Now that baseline information has been accumulated, Professor Bevis will be able to compare specific data on environmental changes related to storm events with parallel simulations created with AGNPS. He says, "For four specific storm events I have monitored to date, there is a reasonable correlation between actual data and AGNPS simulation."

Full validation of the computer model will enable more confident observations on how changing land-use patterns in a watershed may affect nonpoint loading to receiving waters. It will also provide new information on environmentally and economically sound agricultural production techniques and on a variety of other environmental topics.

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WRI RECEIVES GRASS SOFTWARE FROM SOIL CONSERVATION SERVICE

WRI has joined the U.S. Soil Conservation Service in the development of applications for the Geographical Analysis Support System (GRASS) software. GRASS is a Geographic Information System (GIS) first developed by the U.S. Army Corps of Engineers and later extensively modified by the Soil Conservation Service. The computer program will assist the Institute in compiling, interpreting and communicating information about land and water resources.

GRASS is significant for WRI in part because it has greater mapping and interpretive power than the software already employed by the Institute's for research in such areas as groundwater studies, which have already proven useful to the community in efforts such as the South Beltline Project. Grand Valley is

currently one of only three sites in the state for this system.

Traditionally, researchers and planners have relied on paper maps, aerial photographs, field surveys and time-consuming manual calculations to access and analyze environmental data. GRASS enables the rapid input, extraction, overlay, display and evaluation of such data. Users can develop statistical tables and multi-level interpretive maps with GRASS to help their understanding of complex spatial resource relationships.

For example, graphic data layers defined by users can portray such features as soils, land cover, roads and streams and field boundaries, leading to accurate assessments of appropriate land use or potential environmental problems. GRASS has already been used by governmental agencies in projects ranging from the designation of road and railroad cor-

ridors to the management of archaeological sites.

According to WRI Research Associate John Koches, "We can now offer the availability of GRASS to local conservationists, planners and other potential users. We also hope to import into GRASS databases we have developed at WRI and new databases that will expand the usefulness of the system."

On March 27 and 28, Dr. David P. Lusch, Research Specialist in Remote Sensing and Geodata Processing from Michigan State University, conducted a workshop which highlighted GIS applications and allowed hands-on use of simple systems. The sessions were attended by local health officials, planning agency representatives and Soil Conservation Service personnel.

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## TWO LEADERSHIP GIFTS STIMULATE WRI ADVANCEMENT PROGRAM

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In the opening weeks of the new year, two leadership gifts totaling \$1.3 million provided early impetus to the GVSU's new \$5.1 million Advancement Program for WRI.

The Steelcase Foundation confirmed the first official commitment to the program in January: an unrestricted three-year grant of \$300,000. Kate Pew Wolters, Executive Director of the foundation, said, "We are concerned for the environment, and we see the Institute as an organization that has strong potential to help protect the natural resources which contribute to west Michigan's quality of life."

In February The Grand Rapids Foundation announced a \$1 million grant to WRI in support of its Grand River Watershed Program. This five-year initiative of research, outreach and educational activities will constitute the most comprehensive

study ever undertaken on the Grand River. The grant is one of the largest single commitments made in the history of The Grand Rapids Foundation.

### New Fund-Raising Program

Both of these grants are the result of early progress in the Advancement Program, a special private-sector effort to raise capital funding for WRI equipment, projects and endowment. The program is, in turn, part of an overall \$22.5 million planned enhancement of University resources in the sciences. Included in this sum are anticipated state funding to construct a new science building on GVSU's Allendale campus and funds to increase research faculty positions.

The new science building is now designed as a 144,000-square-foot facility providing expanded space for

research and instructional laboratories, classrooms and faculty offices. New offices and laboratories for WRI are a principal feature of the building.

### WRI Steering Committee

Backing the Advancement Program is a WRI Steering Committee led by Chairman Richard M. DeVos, President of Amway Corporation. He is joined currently by 28 other business and civic leaders from throughout west Michigan.

The committee was organized last fall, after an initial briefing luncheon in September. Its purpose is to provide continuing private-sector guidance and support to WRI operations and progress.

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INTERACTIVE TEACHING PROGRAM MOVES INTO TESTING PERIOD

Three interactive computer teaching programs on water resources, developed by Dr. Melvin L. Northup, have entered a period of early distribution and field testing. Dr. Northup is a WRI Research Associate and a GVSU Professor of Natural Resources Management.

The programs are named Groundwater Education WIZard (GEWIZ), Groundwater Education Encyclopedic WIZard (GEEWIZ) and Groundwater Primer (GWPRIMER). Each is appropriate for users at particular levels of educational advancement, ranging from fourth-grade students to high schoolers and adults.

Dr. Northup is now in the process of making copies of the programs available to a select number of individuals who can use them in teaching situations, assess their value and provide feedback for their enhancement. These individuals include science coordinators in public schools, contacts at the State Board

of Education and educators at other universities and organizations. A program coordinator for the Four H Clubs of Michigan, for example, has expressed interest in reviewing their applicability for club use.

Each of the developed programs requires the use of an IBM PC-compatible computer with a graphics monitor. GEWIZ and GEEWIZ can be supplied on one 3 1/2-inch diskette or two 5 1/4-inch diskettes for dual disk-drive machines. GWPRIMER utilizes one diskette in either format.

All of the programs are "user friendly" and contain such features as bright color graphics, instant user feedback and adjustment to individual performance, an online dictionary explaining terminology and program personalization to the specific user. They are fun to operate and yet provide important education on the basics of our water resources. In just one session, users can learn what groundwater is, how an artesian

well works and the flow of the hydrologic cycle.

The long-range goal of Dr. Northup's work is to make his programs available as stand-alone teaching tools on groundwater or as complements to other curricula on the subject. Much of the development of these interactive learning programs has been supported through WRI's funding as a Regional Center of the Groundwater Education in Michigan program.

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