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Annis Water Resources Institute

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In This Issue...

Results Of White Lake Project Will Help Evaluate Clean-Up Options

Researchers from the Robert B. Annis Water Resources Institute, the Great Lakes Environmental Research Laboratory of the National Oceanic and Atmospheric Administration (NOAA), the University of Florida, and the University of Michigan recently completed an investigation of sediment contamination in White Lake (Muskegon County). The project was funded by the U.S. EPA's Great Lakes National program Office and NOAA.

The International Joint Commission designated White Lake an Area of Concern (AOC) in 1985 because of historical discharges of heavy metals and organic chemicals. A tannery located on the southeastern shore discharged waste materials containing chromium, mercury, arsenic, and animal hides into the lake. By using a combination of chemistry, stratigraphy, toxicological evaluation, benthic macroinvertebrate analysis, and radiodating, the project defined the ecological effects and the nature and extent of sediment contamination in the Tannery Bay area of eastern White Lake.

The concentration of chromium in uncontaminated areas of White Lake ranged from 10-30 mg/kg. In con-

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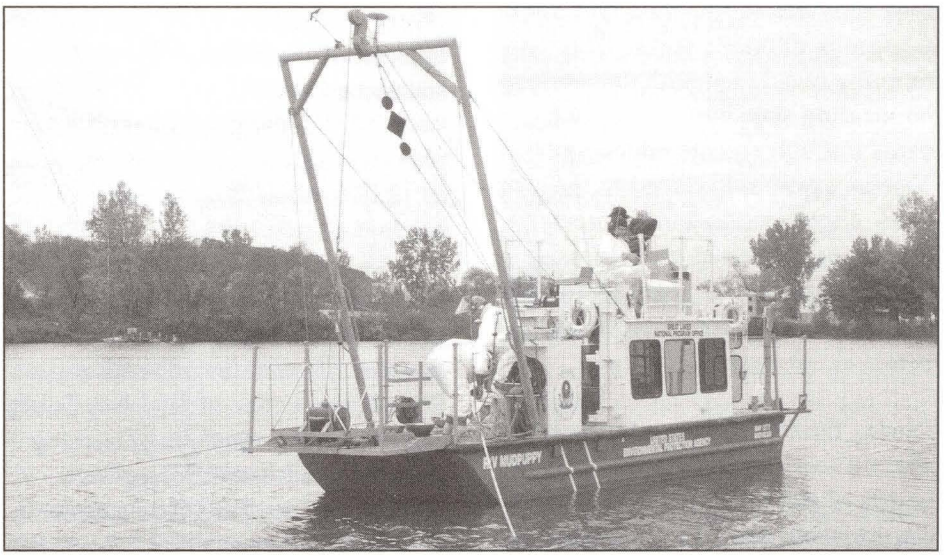


***U.S. EPA and GVSU researchers collect sediment samples using the EPA's* R/V MUDPUPPY.**

Teachers Gather In Muskegon For A Day Of Aquatic Education

Cool!," "neat" were some of the comments when teachers performed a series of hands-on lake stratification experiments at a WRI teacher workshop in February. The workshop was part of the *Building a Learning Community through Aquatic Education* professional development series —a year-long effort funded by the Michigan Department of Education Dwight D. Eisenhower Higher Education Professional Development Grant Program.

Over 70 teachers and GSVU teacher candidates convened at the Muskegon County Museum for a full day of activities. It was the first time that the users of the *D.J. ANGUS* and *W.G. JACKSON* vessels were able to meet as a group to network and share ideas.

As keynote speaker, Dr. Ronald Ward provided a holistic framework for integrating Great Lakes information into the curriculum. A lively hands-on science break-out session included water experiments during which vessel instructor Gus Unseld assembled activities to illustrate lake stratification in dramatic ways. The morning concluded with discussions on meeting state educational standards through aquatic education. Teachers were introduced to the standards alignment document prepared especially for vessel trips. Vessel instructor Bonnie Cowles shared her special expertise for curriculum issues at the elementary level.

During the lunch-time information sharing session, Dr. Martin Hetherington of the Michigan State University Museum provided an update on the GLOBE project. Schools in the GLOBE project all over the world collect environmental data and share it on the Internet.

Afternoon break-out sessions with WRI staff included dissolved oxygen with Dr. Ron Ward and Ron Dykstra, advanced instrumentation with Dr. Rick Rediske, and plankton with Roger Tharp. The presentation of Karen Lagerberg of Michigan Sea Grant answered many of the teacher's questions about exotic species and peaked their interest in teaching that topic.

The group assembled for a final session on using data from the vessels in the classroom. Each teacher received a notebook of materials and a computer disk with 1997 water quality data from the *D.J. ANGUS* and the *W.G. JACKSON*. A vessel home page where teachers can access the vessel guide on-line and link to a multitude of water-related Internet sites will be available soon.

The project will next focus on interest areas such as stream monitoring, curriculum development, and "practice cruises." Also, GVSU instructors will be going to classrooms for pre-trip orientations.

In the fall, the teachers will be invited for a post-season gathering to share activities and projects their students were able to do related to water themes. WRI plans to continue this series of development opportunities next year. For more information on the aquatic education project, contact Janet Vail, 616/895-3048 or vailj@gvsu.edu.

Geographic Information System To Be Used In Deer-Auto Collision Study

In 1996, the state of Michigan had the dubious distinction of being the nation's leader in deer-automobile collisions with 68,233 reported statewide. Kent County led the state with 2,223 deer-car accidents for this period — part of an alarming upswing of 12,000 accidents throughout Michigan since 1994.

White Water Associates, Inc., an ecological consulting firm, has been awarded $50,000 from the Michigan State Police Office of Highway Safety and Planning to fund the pilot study. In collaboration with White Water Associates, Inc., WRI Research Associate Kurt Thompson will develop the necessary GIS data layers for the subject area.

Accident information from the Michigan Accident Location Index (MALI) for the years 1992-96 will be assembled into a GIS data layer so that it is compatible with county information of land use and cover, hydrology, and surface transportation routes. The project researchers will use this data to locate areas with high concentrations of deer-car accidents and then test various methods designed to alleviate the frequency of their occurrence.

For more information, contact Kurt Thompson at 616/895-3091 or at thompsok@gvsu.edu.

The Blueprint Gets A Roadmap

On April 7, 1994 west Michigan received the Metropolitan Development Blueprint prepared by the Grand Valley Metro Council. This report, which took 18 months to prepare, reflects a community-based desire to protect our strong economy, enhance our social diversity, and maintain our high quality natural environment through managing future urban growth.

With input from more than a hundred citizens, planners, and consultants, the Blueprint defines the need for tools and techniques that curb wasteful use of land and thus limit the impacts of urban sprawl.

Several things have happened since the Blueprint was first unveiled. Metro Council has organized a committee to provide guidance in implementing the Blueprint. Organizations, such as the City/Township Cooperation Committee, the North Kent Townships Association, and the Greenways Council, have formed to encourage input from the community and from local officials. WRI and Metro Council have hosted four consecutive Growing Community Conferences with plans for a fifth at the Amway Grand Plaza on June 11th, 1998. And, the Environment and Development Committee of the Greater Grand Rapids Home Builders Association has created a "Roadmap," which details the steps necessary to implement the Blueprint.

WRI and other community-based organizations have joined Metro Council in finding support for the Roadmap. The first major contribution toward this cause came from the Frey Foundation in a $102,000 grant to Metro Council and WRI. The Frey Foundation grant makes it possible to hire Myron Orfield, Minnesota state representative and author of the book titled, *Metro Politics, A Regional Agenda for Community and Stability*. Orfield will conduct a Regional Disparities Study for the Grand Rapids area. WRI will incorporate the geographic analysis prepared by Orfield in its already extensive information system prepared on behalf of Metro Council and its members.

For more information on the Blueprint or the Roadmap, contact John Koches at 616/895-3792 or at kochesj@gvsu.edu.

White Lake Project *continued from front*

trast, chromium concentrations in the Lake's Tannery Bay ranged from 2,000-4,000 mg/kg. In White Lake proper, researchers detected levels exceeding 500 mg/kg with a level 837 mg/kg found over 1.5 miles from the discharge area. The laboratory toxicity evaluation of the Tannery Bay surface sediments found six of eight locations to be toxic to amphipods and two of eight locations to be toxic to midges. Populations of midges that feed on detritus were less abundant in Tannery Bay than in White Lake proper.

Chromium stratigraphy in the Tannery Bay region indicated that the top 15-20 cm of sediment were less contaminated (2,000-4,000 mg/kg) than sediment located below 30 cm (>5,000 mg/kg). Radionuclide results suggested that this surface sediment layer was well mixed, however, distinct from the deeper more highly contaminated sediments.

The surface layer was followed by a region (30-80 cm) that contained chromium levels in excess of 20,000 mg/kg. The lack of a decreasing gradient of chromium concentration in the near surface zone sediments (0-20 cm) suggested that the processes of mixing and resuspension continue to be active in Tannery Bay.

The Michigan Department of Environmental Quality (MDEQ) and the U.S. EPA will use the results of the project to evaluate remediation options for the contaminated sediment.

Copies of the report entitled *Preliminary Investigation Of The Extent And Effects Of Sediment Contamination In White Lake Near The Whitehall Leather Tannery* are currently available and work is underway to make it available on the world wide web via NOAA's web site.

For more information on the White Lake Project, contact Rick Rediske at 616/895-3047 or at redisker@gvsu.edu.

Outreach Program Connects With Business And Industry

The WRI outreach program impacts not only students through the vessel program, but also environmental professionals through presentations, partnerships, and grant-supported research.

WRI helped to plan a community forum to discuss environmental priorities in Muskegon County. This event was co-sponsored by the Community Foundation for Muskegon County, WRI, Muskegon Economic Growth Alliance (MEGA), Muskegon Conservation District, and the Lake Michigan Federation. As a forum panelist, Janet Vail, Outreach Program Manager, spoke about air quality issues. Numerous environmental organizations had displays at the forum.

For the 4th Annual Hazardous Waste Conference, WRI partnered with the West Michigan Chapter of the Air & Waste Management Association (WM A&WMA) and the Grand Rapids District Office of the Michigan Department of Environmental Quality. This conference drew over 120 participants to a half day event at GVSU Eberhard Center. Dale DeKraker, a GVSU alumnus, was the keynote speaker. This popular series helps to educate business and industry in proper management of hazardous waste. The Environmental Assistance Division of the Department of Environmental Quality provided pollution prevention information for the conference.

WRI was involved in the planning of the annual Spring Conference for WM A&WMA. John Byl of Warner, Norcross & Judd served as chair for the conference which was held at GVSU Eberhard Center. Timely topics of computers and environmental management were well received by the participants.

WRI's connection with A&WMA goes beyond the local Chapter. WRI Research Associate Janet Vail serves as an A&WMA education committee chair and works with A&WMA on the teacher guides for air quality and for nonpoint pollution. As part of her duties, she hosted John Thorner, Executive Director of the International Air and Waste Management Association, on a visit to WRI and the GVSU campuses in January.

Progress continues on the Office of Great Lakes Michigan Great Lakes Protection Fund pollution prevention grant. The project, Organizational Factors Associated with Successful Pollution Prevention Programs, will result in a report complete with case studies based on on-site interviews with a broad array of companies. Keith Fry of the Retired Engineers Technical Assistance Foundation managed the on-site interview portion of the project. Preliminary results have been shared at the 4th Annual Hazardous Waste Update in Grand Rapids, the Great Lakes Regional Pollution Prevention Roundtable in Chicago, and the Pollution Prevention Technical Assistance Group (TAG) organizational meeting in Lansing. A future issue of the *Review* will highlight the outcomes of this project.

For more information on WRI's outreach program contact Janet Vail at 616/895-3048 or at vailj@gvsu.edu.

WRI Assists Ottawa County With Solid Waste Management Plan

The Robert B. Annis Water Resources Institute (WRI) recently entered into an agreement to assist Westshore Engineering & Surveying, Inc. of Muskegon to update Ottawa County's Solid Waste Management Plan.

The updated solid waste management system will consist of a comprehensive approach to managing Ottawa County's solid wastes and recoverable materials. The plan will describe solid waste generators, transfer systems, and disposal areas and will contain a program for resource conservation and recovery. Each major step in updating the plan will require input from Ottawa County and local officials and the general public.

WRI will use its Geographic Information Systems (GIS) to access up-to-date information on land use, demographics, and natural resource information. The GIS will also provide creative tools for data management such as map products. Contact Rod Denning at 616/895-3793 or at denningr@gvsu.edu for more information.

Making Lake Michigan Great Tour To Happen This Summer

Summer of 1998 will be a memorable time as the *W.G. JACKSON* makes its way around Lake Michigan to spread the word about the U.S. Environmental Protection Agency's (U.S. EPA) Lakewide Management Plan for Lake Michigan. Funded by a challenge grant by the SC Johnson Wax Fund, the tour will provide hands-on experience in water issues for the public aboard the *W.G. JACKSON*. Cruises for students and the public, open houses, and community forums will be available.

The *Making Lake Michigan Great* tour will include August visits to Racine, Milwaukee, and the southern shore of Lake Michigan with possible ports of call in Chicago, Indiana, and west Michigan. The *W.G. JACKSON* will leave Muskegon and head north to Traverse City and Petoskey for a week-long tour. The *Jackson* will be part of Bay Day in Traverse City. The Petoskey-Harbor Springs Area Community Foundation and the Community Foundation for Muskegon County are key supporters of this project.

Making Lake Michigan Great is a project in conjuction with the Lake Michigan Forum. The Forum was organized to provide input from broad interests around Lake Michigan into the development of the U.S. EPA Lakewide Management Plan. A diverse stakeholder group, the Forum is comprised of representatives from academia, government, business, industry, and others. Grand Valley State University Robert B. Annis Water Resources Institute (GVSU-WRI) is represented on the Forum by Janet Vail, GVSU-WRI Research Associate who serves as co-chair. The Forum's home page can be accessed at http://www.epa.gov/glnpo/lmf/

As part of the* Making Lake Michigan Great *tour, Chuck Vanderlaan (left in photo above) will provide information on water issues for participants. Tours onboard the research and education vessel W.G. JACKSON have become a very effective way to convey important water quality issues.

During the tour, researchers will unveil highlights from the Lake Michigan Mass Balance Study as well as the Lake Michigan Explorer interactive software, available for the general public. Release of scientific data from the Lake Michigan Mass Balance Study began in 1997. These data will provide a wealth of information on how contaminants enter, remain, or leave the Lake Michigan Basin. The information, if presented properly, could have a major effect on policymaking in the region with respect to water quality.

Increased awareness and understanding of Lake Michigan issues leading to positive actions are the paramount goals of the project. *Making Lake Michigan Great* will help involve more citizens in the protection and management of one of our national treasures, Lake Michigan.

For more information about the tour this summer, contact Janet Vail at 616/895-3048 or at vailj@gvsu.edu.

WRI To Analyze Sediment Samples From Grand River For Contamination

The Robert B. Annis Water Resources Institute (WRI) received a grant to investigate the nature and extent of sediment contamination in the lower Grand River.

Using the U.S. EPA's research vessel *R/V MUDPUPPY*, scientists collected 25 core samples in October 1997 from sediment deposition areas in the lower Grand River. WRI will analyze the samples for heavy metals, PCB congeners and semivolatile organics, selected pesticides, and physical parameters. Based on these results, WRI will select six locations for sediment toxicity evaluation.

The project team for the investigation includes the following WRI staff members:

- Dr. Richard R. Rediske, Principal Investigator
- Dr. Min Qi, PCB/Pesticide Residue Analysis
- Jeff Cooper, Sediment Toxicology

Four GVSU undergraduate students are also participating in the investigation as research assistants.

For more information on the Grand River sediment research project, contact Rick Rediske at 616/895-3047 or at redisker@gvsu.edu.

Farmland Preservation. What Policy?

For northern Kent County Townships, the question "What policy?" does not have a one-size-preserves-all-farmland answer. Northern Kent County is the focus of the R. B. Annis Water Resources Institute's (WRI) Farmland Preservation Project. The Project is centered on the interests of northern Kent County townships organized as the North Kent Townships Association (NKTA).

WRI's Farmland Preservation Project began with data collection, data development, and distribution of the data. WRI is investigating the use of this data/information in the development of township policies to protect farmland. Townships currently have varying land use regulations to protect farmland. Effective preservation policy development should reflect the overall goals of township citizens and decision makers.

Those involved in the NKTA will soon know more about the opinions of Kent County agricultural producers, those most affected by farmland policy. WRI has partnered with Kent County Michigan State University Extension to produce a survey addressing farmland preservation issues. Other partners involved in the development of the survey include Kent County farmers, township officials, and the Michigan Farm Bureau. The purpose of the survey is to discern the opinions of agricultural landowners/operators on farmland preservation to provide feedback to policymakers. The feedback from this survey will help to answer the question, "What policy?"

For more information about the Project, contact Christy Klinge at (616) 895-2527 or at klingec@gvsu.edu. More details about the Farmland Preservation Project can also be found on the internet at http://www.wri.gvsu.edu.

Groundwater Education In Michigan Program Continues

As previously reported, the R.B. Annis Water Resources Institute (WRI) has joined five other Regional Centers and Michigan State University in a year-long celebration of the many accomplishments resulting from the W.K. Kellogg Foundation's *Groundwater Education in Michigan Program* (GEM). The GEM Program, which began in 1988, has enjoyed tremendous success across the state and is often heralded as a model for information dissemination.

While support from the W.K. Kellogg Foundation for GEM-related activities will soon come to a close, the impact felt by this program will remain for years to come. Not only has the GEM Program been successful at educating local officials, policy makers, and the general public about groundwater concerns, it has also elevated those concerns to a new level of awareness, and the process employed has itself received a great deal of attention.

The complimentary strengths of each Regional Center has enable all of those involved to contribute more to the issue of groundwater protection than we ever could have on our own. WRI was able to substantially accelerate the growth and development of the Geographic Information Systems, given support from Michigan State University and other GEM Centers. We learned from each other, and learned as much from our mistakes as we did from our successes.

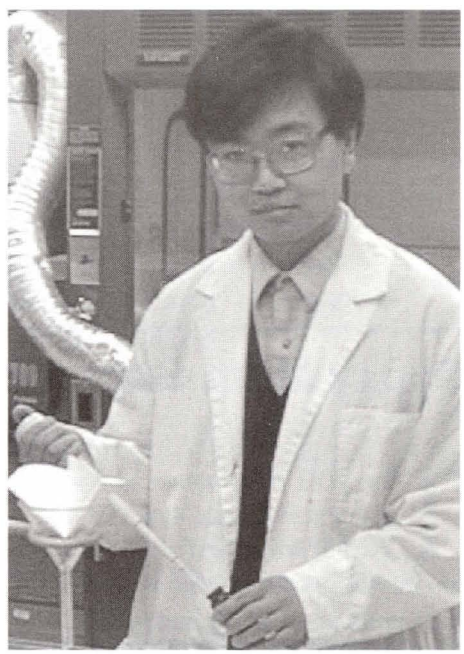
Many problems of statewide significance, such as the issue of land use, might benefit from the approach taken during the GEM Program. Whether GEM Regional Centers expand their focus to include land use and urban growth management remains to be seen. One thing is certain, the information compiled and the technological tools developed during the GEM Program will continue to support anyone interested in the effective management of our natural resources.

Contact Kurt Thompson at 616/895-3091 or at thompsok@gvsu.edu for more information.

Research Associate From China Works With WRI To Examine New Wastewater Treatment Process

An international collaborated research project is currently underway in the Robert B. Annis Water Resources Institute (WRI) analytical laboratory. This past January, research associate Tong Zhang from the Environmental Engineering Department in the East China University of Science and Technology (ECUST) arrived at GVSU to study the effectiveness of Horseradish peroxidase (HRP) enzyme in removing cholorophenals from wastewater. Tong is working with WRI research associate Dr. Min Qi on the project.

Experimental results indicate that the HRP technique is a very promising candidate in the replacement of old methods. HRP catalyses the oxidation of phenols in wastewater by hydrogen peroxide resulting in the formation of water insoluble polymers which can be separated by coagulation and sedimentation. Even though current methods (solvent extraction, microbial degradation, and adsorption) are effective, they suffer from high cost, incompleteness of purification, and formation of hazardous byproducts.



Visiting Research Associate Tong Zhang

The research team is in the process of collecting more data. Chemistry undergraduate Sharon Wilson will present their preliminary results in the GVSU Student Scholarship Day.

For more information, contact Min Qi at 616/895-2731 or at qim@gvsu.edu.

And The Creek Goes On

Although federal grant money supporting the Bear Creek Watershed Project will end on June 30, 1998, the Robert B. Annis Water Resources Institute (WRI) and the Michigan Department of Environmental Quality (MDEQ) hope that the project will continue beyond that date through local efforts.

The watershed project began in late 1992 when local residents became increasingly concerned about the growing quantities of sediment and fecal coliform bacteria in the creek. Five years later these types of nonpoint source pollution still threaten the high water quality in Bear Creek.

Project efforts have focused on educational activities for watershed residents. The project has demonstrated some very innovative approaches to water quality education including the annual outdoor Waterfest at Townsend Park, the touring environmental theatrical troupe known as the Bear Creek Players, the video mini-documentary *Muddy Waters...Clear Choices*, the *Indicator* newsletter, and a 24-hour automated telephone line called the Hydrologic Education Line for Partners (HELP).

Watershed project staff have also conducted a sampling of Best Management Practices (BMPs) including livestock exclusion fencing, stream bank stabilization, and the construction of a sedimentation pond to help reduce the impact of nonpoint source pollution.

The protection and preservation of natural resources, open spaces, and rural character is a priority in Cannon Township. One of the benefits of the Bear Creek Watershed Project has been more public participation and attention focused on additional environmental issues within the township. Cannon Township's efforts to protect their environment have acted as a model for other townships looking for ways to safeguard their natural resources.

Building on the enthusiasm and success of the techniques used in Bear Creek, WRI staff hope to repeat these approaches in other watershed projects. For more information about the Bear Creek Watershed Project, contact Barbara Scott at 616/895-3789 or at scottb@gvsu.edu.

Gypsy Moth Suppression Program Enters Fourth Year

The WRI Information Services Center will once again be a part of Michigan's gypsy moth suppression program. Eight Michigan counties — Kent, Jackson, Lenawee, Livingston, Manistee, Newaygo, Osceola and Washtenaw —are currently contracting digitizing services with the WRI Information Services Center to enable aerial pesticide treatment of approximately 20,000 infested acres. Information Services Center technicians will receive base maps from the county's gypsy moth coordinators throughout February and March. These maps delineate the gypsy moth infestation areas in each of the eight counties. The areas will then be digitized and converted into geographically accurate spray blocks, using a geographic information system (GIS). The resultant digital spray block files will then be use by the aerial applicator's navigational equipment to guide the aircraft directly to the infested area for pesticide treatment.

The Michigan Department of Agriculture allows the counties to apply Bacillus thuringiensis, a natural occurring soil bacteria, as a pesticide to suppress the gypsy moth defoliation. Aerial spraying of the participating counties usually takes place toward the end of May, when the warm spring weather induces the gypsy moth egg masses to hatch.

For more information on the Gypsy Moth Suppression Program, contact Kurt Thompson at 616/895-3091 or at thompsok@gvsu.edu.

Rain, Rain, Go Away

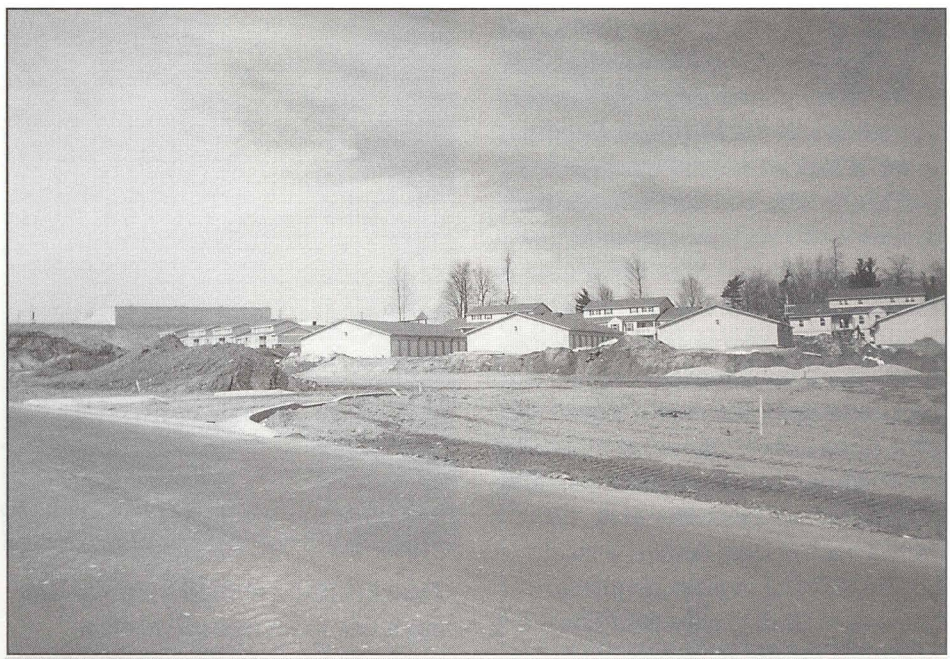
Stormwater — we seldom notice it. Only when it floods our street or basement do we give it much thought. However, stormwater has a huge impact on our area lakes and streams.

Because of the importance of stormwater management, the Robert B. Annis Water Resources Institute (WRI) and project partner Fishbeck, Thompson, Carr & Huber recently completed a report titled "Stormwater Management Planning and Policy Recommendations for Kent County, Michigan" and a companion brochure for the general public "rain, rain, go away... A Summary Report."

The documents were prepared for the Metropolitan Water and Sewer Planning Agency — an organization of the Grand Valley Metropolitan Council, Kent County Drain Commissioner and the City of Grand Rapids.

The need for flood prevention and control to protect existing buildings and infrastructure has historically determined stormwater management policy. While this policy is surely relevant, officials should consider a goal-oriented, natural resource management program that includes water quality, recreation potential, aesthetics, and wildlife habitat issues. Managing stormwater on a watershed basis will go a long way in helping to expand the current stormwater management focus.

The second part of the project began with the development of a Stormwater Management Decision Support System (DSS). WRI developed the system around the ArcView™ geographic information system to provide County officials and others with a tool specifically designed to enhance planning and decision-making processes. Included in the DSS are data layers that depict land use and cover conditions, watershed boundaries, impervious surfaces, and erodable soils.



"The social implications resulting from an increase in impervious surface area over the years are far-reaching. Impervious surface area devoted to car habitat — like parking lots and roads — has grown by 50% since World War II. Each person generates one-half acre of impervious area. For every car manufactured, ten parking spaces are created."

Tom Scheuler, Center for Watershed Protection

The Kent County and Grand Rapids Community Development Departments funded the project with an entitlement grant from the United States Department of Housing and Urban Development, Community Development Block Grant Program.

For more information about the report and brochure, contact John Koches at 616/895-3792 or at kochesj@gvsu.edu.

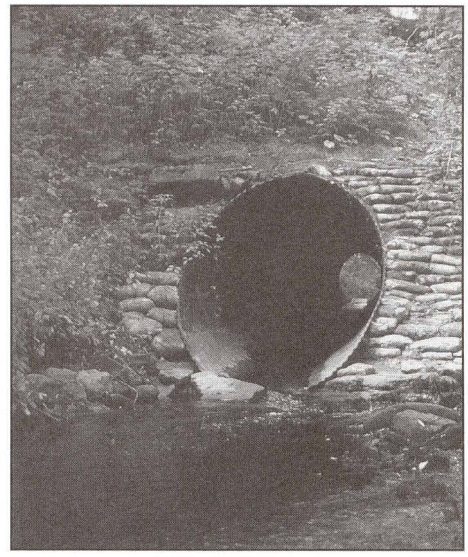
For more information about the Stormwater Management DSS contact Rod Denning at 616/895-3793 or at denningr@gvsu.edu.

WRI Addresses York Creek Watershed Degradation

WRI manages the York Creek Watershed Project through a partnership with Alpine Township and the Michigan Department of Environmental Quality (MDEQ). The York Creek watershed is situated around the intersection of Alpine Avenue and Four Mile Road in northwestern Kent County. Since the project's inception in 1993, WRI staff have identified stormwater runoff (i.e. rain or melted snow that is piped directly to a local stream) as the major contributing factor to the demise of York Creek and its tributaries. The York Creek system housed a viable coldwater trout population just ten years ago. Today, only pollution-tolerant fish inhabit its waters.

WRI staff and Project partners have initiated measures to address the degradation of York Creek. Of greatest importance is the institution of a regional stormwater management system within the watershed boundaries. This system includes the installation and/or improvement of stormwater detention basins, plus the development of stormwater management ordinances for Alpine Township. In addition, WRI staff have developed a Decision Support System to assist the township in managing its residential and commercial growth.

The York Creek Watershed Project's original goal was the restoration of the stream's historic coldwater trout fishery. WRI staff have since revised project goals to focus on controlling the degradation of stream conditions. Given the continuing pace of urbanization in the watershed, trout fishery restoration is a long-term goal.



The York Creek Watershed Project continues to drive home the point that proactive and informed land use planning at the local level is the best way to insure the protection of our natural resources.

The change from rural to urban land use tends to dramatically affect creeks and streams. Urban pollutants like gasoline, oil, antifreeze, lawn fertilizers, septic effluent, and soil eroded from construction sites all impact stream conditions. These pollutants are often directly washed into streams via stormwater sewers. Each time it rains, stormwater surges into natural waterways, scouring banks while sweeping hazardous materials off parking lots and into the water column. This scenario continues to plague York Creek and threatens the stream's future.

The headwaters of York Creek may hold promise for stream improvements and protection. Land use in the headwaters region has stayed relatively stable over the past five years, remaining mostly agricultural and large-lot residential. In addition, this stretch of York Creek is buffered by well-vegetated banks that serve to trap sediment and other pollutants from entering the stream.

Land development, however, is slated to occur on a large scale in this part of the watershed. WRI staff hope to work with Alpine Township officials and local landowners to implement administrative and scientific methods to protect this portion of York Creek. Protective measures might include special zoning practices, the installation of in-stream habitat improvement structures, and the enhancement of native vegetation along the streambanks.

The York Creek Watershed Project continues to drive home the point that proactive and informed land use planning at the local level is the best way to insure the protection of our natural resources. Attempting to retrofit damaged surface water systems is tremendously difficult and enormously expensive. Perhaps the challenges inherent to the York Creek Watershed Project will spur municipalities in other area watersheds to develop natural resource agendas before their situation becomes an emergency.

For more information on the York Creek Watershed, contact Frank Wash at 616/895-3277 or at washf@gvsu.edu.

Outreach Education Program 1997 Season Highlights

1997 marked the first full season for the *W.G. JACKSON*, which served more than 3,200 participants in 148 events. This popularity did not, however, detract from that of the *D.J. ANGUS*, which hosted more than 3,000 participants in 150 events during 1997.

High points during the season included the *W.G. JACKSON*'s trip to the Petoskey-Harbor Springs area, funded by the Petoskey-Harbor Springs Area Community Foundation. Events held during the four-day visit included cruises and dockside tours for Petoskey and Littlefield area schools as well as a workshop for teachers from Harbor Springs. The visit ended with an open house co-hosted by the Foundation.

1997 also marked the 30th annual visit to Grand Valley by the *D.J. ANGUS*-Scientech Educational Foundation, led by Foundation member Robert B. Annis. Eighteen Indianapolis Regional Science Fair awardees spent a weekend learning about science onboard the *D.J. ANGUS* and in WRI's facilities. University representatives presented Mr. Annis and the Foundation a Certificate of Recognition for their years of supporting science education and sponsoring WRI internships.

A new dimension for the Water Resources Outreach Education Program was the assigning of two science instructors to share duties on each cruise. The instructors — retired K-12 teachers — bring years of classroom experience to the vessels. Two other innovations added include a computerized database of water quality obtained from cruises and a new teacher's guide — both of which will soon be available on the World Wide Web.

Planning for the 1998 season began last fall. The preliminary schedules promise another busy season for both vessels, their crews, and instructors.

For more information, call WRI at 616/895-3749.

Participants In The Program