Progress Report

April 2003 – May 2004

Lower Fox River Watershed Monitoring Program

University of Wisconsin-Green Bay

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June 2004

Granting Agency:

Arjo Wiggins Appleton, Ltd

Grant Period: April 14, 2003 – June 30, 2007

This report highlights major milestones and activities that were accomplished during year one of the *Lower Fox River Watershed Monitoring Program* grant. Summaries of these accomplishments were recently reported at the First Annual Watershed Symposium held at UW-Green Bay, May 19, 2004. Included with this report are copies of PowerPoint and poster presentations given at the symposium. These oral (MS PowerPoint) are also available at the project website (*www.uwgb.edu/watershed*).

The following sections of this report provide a list of project goals, milestones, and presentations; a brief summary of the student-teacher monitoring program activities; and a list of program personnel.

Program Goals

The overall project goal is to establish a long-term monitoring program that improves our ability to address watershed quality issues (water quality, habitat, land management and use, etc.) in the Fox River Basin.

Goals of the Student-Teacher Monitoring Program:

1. Enhance student knowledge and understanding of land use impacts on water quality and stream ecosystems.
2. Develop a stream integrity database targeting sub-watersheds of the Fox River that helps understand changes over time and contributes towards the design of future land management strategies.
3. Enhance teacher capacity to teach watershed science by providing hands-on training in water quality sampling techniques.
4. Foster a relationship between high-school students, teachers, university faculty, and agency professionals.
5. Establish a program that has the potential to grow and attract additional funding to sustain and enhance activities.

Goals of Continuous and Rainfall-Event Monitoring Activities:

(Primary contributors: UW-Green Bay, UW-Milwaukee, USGS, and GBMSD)

1. Compare relative contributions of phosphorus and suspended sediment between watersheds and source areas within the Lower Fox River subbasin.
2. Better understand cause and effect relationships through event and continuous monitoring.
3. Analyze long-term trends for each continuous monitoring site, and compare relative changes in ecological integrity and water quality between sites with time.
4. Assess the validity and ability of models to reliably estimate stream flow and loads from different watersheds on an event, monthly, and annual basis.

Program Partners

University of Wisconsin - Green Bay

Department of Natural and Applied Sciences

Cofrin Center for Biodiversity

University of Wisconsin – Milwaukee

Department of Biological Sciences, Stream Ecology Lab

United States Geological Survey, Water Resources Division, Middleton, WI

Green Bay Metropolitan Sewerage District

Oneida Nation

Appleton East High School

Green Bay Preble High School

Green Bay Southwest High School

Luxemburg-Casco High School

Markesan Public Schools

Program Monitoring Network Initiation

A number of tasks to be accomplished during the first year of the Program were identified in the project proposal. The following list of project milestones details activities completed to address the first year objectives.

Program Milestones April 2003-May 2004

Contracts and cooperative funding agreements were established with UW-Milwaukee and USGS.

A Watershed Education and Outreach Coordinator/Program Assistant, a Watershed Graduate Research Assistant, and a Watershed Analyst/Assistant Researcher were recruited and hired at UWGB.

Four teacher teams were established and working agreements were signed by teachers and school administrators. Teachers recruited student participants.

UW-Milwaukee appointed a Senior Environmental Technician to the project to assist with implementation of the automated sonde and biotic monitoring programs.

School-based monitoring protocols were established. Many of the protocols were adapted from the Student Watershed Research Project (*www.swrp.org*) in Oregon. Requisite supporting equipment was purchased and tested.

Four continuous and rainfall-event monitoring stations were installed by USGS and UW-Milwaukee cooperators from July to September 2003. The sites are outfitted with modems and provide near real-time access to flow and YSI sonde data. Flow data is available via the USGS National Water Information System (USGS NWIS). Rainfall-event monitoring has been ongoing at the four sites since October 2003.

Base-line fish, aquatic invertebrate and stream habitat monitoring was completed in the five sub-watersheds July 2003 by UW-Milwaukee stream ecology scientists.

A partnership was developed with the Green Bay Metropolitan Sewerage District and USGS to cost-share installation and operation of a fifth continuous water quality and flow monitoring station at the mouth of the East River. This station has been operational since December 2003.

A program website was created in Fall 2003 (*www.uwgb.edu/watershed*). The website serves to integrate overall project elements (school program, flows and loads, real-time water quality data, stream biotic integrity studies, etc.) The website includes an online database for student data, GIS-based landuse maps, reference materials and teacher access to all data forms and procedures. In addition, the website serves to communicate Program activities to the community.

The first annual teacher training workshop was held at UW-Green Bay in July 2003. Monitoring protocols and schedules were established. A more detailed summary of the student-teacher monitoring program is presented in a later section of this report.

Ongoing Program activities have been reported as oral and poster presentations at numerous meetings and conferences during this first year (see list that follows). In addition, Program updates have been given as agenda items for meetings of the Science and Technical Advisory Committee (STAC) of the Lower Fox River-Green Bay Remedial Action Plan. Jessie Fink and teacher Charlie Frisk from the Program serve on the Board of the Baird Creek Preservation Foundation and frequently report on project activities and conduct field trips to the monitoring sites.

Program resources have provided educational and research experiences for five graduate students and several undergraduate students.

Presentations by LFRWMP Team

(Copies of presentations can be found on the Program website under "activities and resources." Select presentations and posters are also found in Sections 3 and 4 of this document.)

First Annual Watershed Symposium, May 19, 2004 at UW-Green Bay:

1. Welcome, Introductions and Program Overview, Kevin Fermanich, UW-Green Bay.
2. Monitoring of Biological Integrity in Tributaries to the Lower Fox River, Wisconsin, Tim Ehlinger, UW-Milwaukee.
3. Water Quality Monitoring by the U.S. Geological Survey in Tributaries to the Fox River and Duck Creek, David Graczyk, Dale Robertson, Peter Hughes, and Troy Rutter, USGS.
4. Poster: The Lower Fox River Watershed Monitoring Program, UW-Green Bay.
5. Poster: Phosphorus Forms and Fate in the Lower Fox River Watershed, UW-Green Bay/USGS.
6. Poster: Preliminary Monitoring Results – Hydrographs, TSS & Phosphorus Concentrations, UW-Green Bay and USGS.
7. Poster: The Effects of Urban Development on Baird Creek, Green Bay, WI, UW-Green Bay.
8. Poster: Biotic Monitoring in Fox River Tributaries, UW-Milwaukee.
9. Poster: Lower Fox and Green Bay Water Quality Monitoring, Green Bay Metropolitan Sewerage District.
10. Poster: Flow and Water Quality Monitoring in Fox River Tributaries, USGS.

11. Overview and Progress: Lower Fox River Watershed Monitoring Program, Green Bay Metropolitan Sewerage District Employee Earth Week Event. Kevin Fermanich, April 23, 2004.
12. Education in Stormwater Session, Fox-Wolf Watershed Alliance (FWWA) Stormwater Conference, Neenah, WI. Bud Harris, March 31, 2004.
13. High Schools and Universities Team Up for Water Quality Monitoring, Wisconsin Society of Science Teachers Convention, Appleton, WI. Lynn Terrien, Bud Harris, Kevin Fermanich, and Tim Ehlinger, March 13, 2004.
14. From Watersheds to Lakes - Issues, Impacts, Needs, and Opportunities, FWWA Summit, Appleton, WI. Bud Harris, February 12, 2004.
15. Overview of Watershed Activities at UWGB, USDA Natural Resources Conservation Service Annual Statewide Soil Scientists' Workshop,

Treehaven Field Station, Tomahawk, WI. Kevin Fermanich, February 3-4, 2004.

16. Lower Fox River Watershed Monitoring Program, UW Consortium Planning Meeting, UW Green Bay. Kevin Fermanich, November 25, 2003.
17. Fox Basin Tributary Monitoring: Phosphorus Forms and Loading Update, Phosphorus Research Update Conference, UW-Green Bay. Paul Baumgart, Kevin Fermanich and Dale Robertson, November 18, 2003.
18. Poster: The Lower Fox River Watershed Monitoring Program, Phosphorus Research Update, UW-Green Bay. November 18, 2003.
19. Overview of the Lower Fox River Watershed Monitoring Program, FWWA Annual Research Meeting. Kevin Fermanich, September 12, 2003.
20. Northeast Wisconsin & Lake Michigan Watershed Planning Conference, Green Bay, WI. Bud Harris, August 14, 2003.
21. 2003 Annual Teacher Workshop Introduction, UW-Green Bay. Kevin Fermanich, July 21, 2003.

Student-Teacher Monitoring Program

The school-based portion of the Lower Fox River Watershed Monitoring Program (the Program) is a collaborative effort between area high school teachers and their students, UW-Green Bay, UW-Milwaukee, and agency researchers. The overall goals of the school-based program are: (1) to improve student, teacher and community stewardship and understanding of watershed and land use impacts on water quality and stream ecosystems; (2) to enhance teacher ability to teach watershed science; and (3) to contribute to the development of a long-term water quality database. A specific first-year goal was to establish a workable program that has the capacity to grow.

UW-Green Bay staff that contributed to the program during its first year included Dr. Kevin Fermanich, project director; Paul Baumgart, watershed analyst and monitoring coordinator; Jessie Fink, graduate research assistant; Jill Fermanich, outreach/education assistant; Dr. Robert Howe, Director of the Cofrin Center for Biodiversity; and Kathy Groves, graduate assistant in biodiversity. UW-Milwaukee contributors included Dr. Timothy Ehlinger, co-project director; Lori Schacht DeThorne, watershed technician; and Christina Buffington, watershed/environmental educator.

The four core teachers selected to participate in the program each recruited a teacher partner. Each pair of teachers worked in a specific sub-watershed within the Fox Basin. Eight teachers from five area high schools participated in the Program during its first year of operation. The teacher teams were: Lynn Hudock Terrien and Rick Berken (Green Bay Southwest High School); Kara Pezzi and Ryan Marx (Appleton East High School); David Burbach and Andy

Cassidy (Markesan High School); and Charlie Frisk (Luxemburg-Casco High School) and Wes Ebert (Green Bay West High School). Lynn Hudock Terrien also served as the teacher coordinator of the school-based monitoring activities and as a liaison between the project and the participating teachers. The major activities involving the teachers during this year included teacher training and establishment of the monitoring program; field monitoring activities; the first annual watershed symposium, and various organizational meetings.

1. Teacher Training and Establishment of Program

- Organizational Meeting, June 3, 2003. Teachers were given an overview of the monitoring program and were introduced to the list of monitoring parameters.
- Teacher Workshop, July 21-24, 2003. A three and a half day workshop for teachers was held from Monday, July 21 to Thursday, July 24, 2003 at UW-Green Bay. The purpose of the workshop was to provide teachers with an introduction to the science of watershed monitoring and to develop competency in a subset of monitoring techniques. Teachers were introduced to the parameters and methods that were to be monitored in their selected watersheds. The training was based on the Student Watershed Research Project (SWRP), a watershed monitoring program based out of Portland State University in Oregon. Monitoring equipment and manuals were also distributed during the training. Each teacher received a SWRP manual, and each teacher team received a set of monitoring equipment including an YSI 55 dissolved oxygen/temperature probe; an Oakton pH probe; an Oakton EC conductivity probe; a transparency/turbidity tube; a HACH DR/850 colorimeter; reference standards and miscellaneous supplies. Seven teachers attended the workshop. A copy of the teacher training workshop program is attached in Section 2 of this report.
- The program sent teacher/teacher coordinator Lynn Hudock Terrien to SWRP training in Oregon in August 2003.
- Project meeting and presentation at Wisconsin Society of Science Teachers (WSST) in Appleton, WI, March 13, 2004.
    - Teachers Kara Pezzi and Dave Burbach led a WSST field trip to Apple Creek to provide hands-on training in Program monitoring activities. The field trip was attended by approximately 15 teachers.
    - Lynn Hudock Terrien, Bud Harris, Kevin Fermanich, and Tim Ehlinger gave a presentation on project logistics that was attended by approximately 10 teachers.

2. **First Year Field Monitoring Activities** (September 2003 – May 2004)

Each pair of teachers and their students performed several rounds of monitoring within their selected sub-watershed during the first year of the

project. Student-teacher teams performed monitoring activities at two or more monitoring locations within their sub-watersheds. Teachers and their students monitored for water quality parameters (streamflow, temperature, dissolved oxygen, pH, turbidity, conductivity, soluble reactive phosphorus, ammonia, and nitrate) and performed a stream habitat assessment in September. The teams performed amphibian monitoring from April to June; and again monitored for water quality in May. During the month of June, student-teacher teams along with experienced bird monitoring experts from the UWGB Cofrin Center for Biodiveristy will conduct bird surveys in their watersheds. Water quality will be monitored again in June and July 2004, a macroinvertebrate survey will be performed in June, and a habitat assessment will be completed in July.

3. **Student Watershed Symposium** (May 2004)

   A one-day symposium was held May 19, 2004 at UW-Green Bay. The symposium brought together student-teacher teams from the participating schools, program partners, agency representatives, and community members to learn about overall Program activities and research projects, and to exchange ideas and compare data from the various watersheds. The school teams prepared posters about their watersheds and monitoring procedures; participated in field bird monitoring training by the UWGB Cofrin Center for Biodiversity and attended a plenary session presented by the Universities of Wisconsin at Green Bay and Milwaukee and the U.S. Geological Service. Students and teachers also attended break-out sessions on various monitoring techniques and then participated in "quiz sessions." Fifty-four students and teachers attended the symposium, along with approximately 40 community, university, and agency representatives. Copies of the symposium brochure and program are included in Section 2 of this report.

The student-teacher training and monitoring activities received significant coverage by print and television media. Links to some of the print articles can be found on the project website under the "About Us – News Archive" section.

Program Extensions

A number of initiatives that extended Program activities to other projects and groups took place during the first year of the Program. They included (1) a graduate student project on the effects of urban development on Baird Creek; (2) a graduate student project investigating phosphorus forms at different spatial scales; (3) a USDA-National Research Initiative Watershed Processes and Water Resources proposal in which Program activities would support a study of watershed sources of mercury; (4) utilization of school-based monitoring protocols in a service-learning travel course to Carara National Park in Costa Rica; and (5) interest by community conservation advocates in Door County to

establish a school-university-agency monitoring program modeled after the Lower Fox River Watershed Monitoring Program. Details of these initiatives follow.

1) *Effects of Urban Development on Baird Creek*. This is a thesis project of Jessie Fink, a graduate student in the Environmental Science and Policy Program at UW-Green Bay. Her project assesses how nonpoint source pollution from urban development is affecting the water quality and channel morphology of Baird Creek. The project is closely linked to the biotic, continuous, and rainfall-event monitoring activities of the larger monitoring program.

2) *Phosphorus Forms at Different Spatial Scales.* This project is part of a Master's thesis by Erika Sisel, a graduate student in the Environmental Science and Policy Program at UW-Green Bay. Dissolved and total phosphorus concentrations are being compared at different scales (multi-field < 2 km^2, 10-40 km^2, and watershed ~100 km^2) within the Apple Creek watershed. Targeted event sampling is being conducted upstream of the LFRWMP USGS-cooperative monitoring station.

3) *Bioavailability of Mercury in Contrasting Watersheds of the Wolf-Fox Basin*. K. Fermanich and P. Baumgart were proposed to be co-investigators on a project led by Drs. James Hurley and Christopher Babiarz from the UW-Madison Environmental Chemistry and Technology Program. The proposal was submitted to the USDA-National Research Initiative Watershed Processes and Water Resources program 7 January 2004, with total requested funding of $436,544 over 2 years. The UWGB portion was $100,000. The project was not funded.

4) *Rainforest Science and Policy Interfaces*. A UW-Green Bay travel course to Carara National Park in Costa Rica, January 2004 (also scheduled for 2005), was led by Drs. Troy Abel and Kevin Fermanich from UW-Green Bay. A major focus of the course was initiation of a water and bird monitoring program that will assist park staff in meeting conservation and community education goals. Twelve UW-Green Bay students utilized similar equipment and procedures to those of the Lower Fox River Watershed Monitoring Program to perform monitoring in Costa Rica and to train Carara Park staff.

5) Roy Aiken, Executive Director of the Land Use Forum in Door County, attended the Student Watershed Symposium and expressed interest in establishing a monitoring program based on the LFRWMP. Program staff is assisting in this effort.

Program Staff

Program Director - Dr. Kevin Fermanich, Department of Natural and Applied Sciences, UW-Green Bay: Dr. Fermanich oversees portions of the school-based monitoring activities, develops procedures, supervises water quality research projects, coordinates activities between partners, reports project results, and interfaces with the community.

Co-Director/Principal Investigator - Dr. Timothy Ehlinger, Department of Biological Sciences, UW-Milwaukee: Dr. Ehlinger directs the stream ecosystem integrity activities, including operation of the continuous monitoring sondes, invertebrate and fish sampling, and development of student stream biological monitoring procedures. He also serves as an instructor for the summer workshops and assists in the publication of project results.

Watershed Analyst/Assistant Researcher - Paul Baumgart, UW-Green Bay: Paul provides GIS, data management, and watershed modeling expertise to the project. He coordinates and oversees cooperative monitoring activities with the USGS, GBMSD and Oneida Nation, assists with teacher-student methods development and workshop training sessions, and contributes to the design and implementation of supplemental stream monitoring activities.

Senior Environmental Technician – Lori Schacht Dethorne, UW-Milwaukee: Lori oversees deployment, calibration, maintenance, and data management activities associated with the automated, continuously-logging YSI sondes. She also assists with teacher training.

Program Assistant (Outreach/Education) - Jill Fermanich, UW-Green Bay: Jill serves as the primary contact for the teachers in the school-based monitoring program, and assists in the development of the monitoring manual and QA/QC procedures. She also plans and organizes the annual Summer Teacher Workshop and the Student Watershed Symposium.

Master Teacher - Lynn Terrien, Green Bay Southwest High School: As Master Teacher, Lynn acts as a liaison between the different schools participating in the monitoring program and the universities. Lynn reviews and develops curricula, assists with the procedures manual development, helps to plan the summer workshop, and coordinates activities between schools.

Graduate Research Assistant - Jessie Fink, UW-Green Bay: Jessie provides a variety of support services for the project, including assistance in school-based monitoring activities and training, QA/QC of school-based water data, maintenance of the website, and servicing of USGS automated samplers. She is also performing independent thesis research on the effects of urbanization on water quality in Baird Creek.

Riparian Fauna Monitoring Experts – Dr. Robert Howe and Graduate Student Kathy Groves, Cofrin Center for Biodiversity, UW-Green Bay: Dr. Howe and Kathy develop bird and frog monitoring protocols and training materials and provide hands-on training for student-teacher teams.

Student Technicians – UW-Green Bay (2) and UW-Milwaukee (3):
Students assist with servicing of the USGS automated samplers, low-flow manual sampling, processing of samples for delivery to GBMSD, and monitoring of stream habitat, fish, and benthic macroinvertebrates.