Water Resources Center
Annual Technical Report
FY 2002

Introduction

Research Program

Research priorities for the Illinois Water Resources Center (IWRC) include: Watershed and stream protection; integrated water management for multiple users; wetland processes; and emerging issues, including other innovative research topics that are not included in the priorities above.

Two IWRC funded projects, which began in March 2001 were completed in February 2003. The projects are detailed below. A new Request for Proposals was issued in May of 2002. The Center takes a special interest in helping your scientists establish a track record in water resources research. The Water Resources Center encourages new scientists to submit proposals and gives their proposals extra consideration. The proposals must be of significant scientific merit (as determined by the reviewers and the Executive Committee) and have relevance to the water research priorities of Illinois to be judged worthy of funding. Virtually all projects supported by the IWRC contribute significantly to the education of students, both graduate and undergraduate, who participate in the research projects. The Student Support table lists students supported in both the internship program with the Illinois District Office of USGS, and the individual grants to faculty researchers.

In addition, IWRC continues to receive EPA funding for a regional center that provides research and other forms of technical assistance to drinking water systems in small communities. The Midwest Technology Assistance Center (MTAC) started in November 1998 and is a collaborative effort of the IWRC and nine other water resources research institutes in the Midwest and the Illinois State Water Survey. MTAC began funding four new projects in 2003. These projects include: evaluation of water treatment technology, source water protection planning, mitigation of nitrate contamination and cost-effective arsenic removal.

The Illinois Water Resources Center also assists in administering the research component of the Illinois-Indiana Sea Grant College Program in partnership with the University of Illinois, Purdue University and the National Oceanic and Atmospheric Administration (NOAA). IWRC's involvement in this program has increased the Center's opportunities for coordinating research activities with other water-related programs in the Midwest. Research topics include: water quality tracking, aquatic nuisance species mitigation, oyster disease, and aquaculture. Outreach topics include: aquatic nuisance species education and prevention.

Multi-Objective Decision Support Tools for Protection of Streams in Urbanizing Watersheds

Basic Information

Title:	Multi-Objective Decision Support Tools for Protection of Streams in Urbanizing Watersheds
Project Number:	2002IL1B
Start Date:	6/1/2001
End Date:	5/31/2003
Funding Source:	104B
Congressional District:	12
Research Category:	Not Applicable
Focus Category:	Management and Planning, Non Point Pollution, Water Quality
Descriptors:	
Principal Investigators:	John W. Nicklow, Leslie Aileen Duram

Publication

1. Allred, K.O., J.W. Nicklow, M.K. Muleta, L.A. Duram, 2003, A multiobjective SDSS for management of urbanizing watersheds: The case of the Lower kaskaskia Basin, Illinois, in Proceedings of the 2003 EWRI Congress, ASCE, Reston, VA.
2. Nicklow, J.W., M.K. Muleta, 2002, Integrative decision making for watershed management using evolutionary algorithms, in Porceedings of the 2002 EWRI Congress, ASCE, Reston, VA.

Illinois Water Resources Center
Annual Report

1. **Project Number:** 2002IL1B
2. **Project Title and PIs:** Multi-Objective Decision Support Tools for Protection of Streams in Urbanizing Watersheds; Dr. John W. Nicklow, Asst. Professor of Civil Engineering, and Dr. Leslie A. Duram, Assoc. Professor of Geography, Southern Illinois University at Carbondale
3. **Research Category:** Land Management, Urbanization, Decision Support System
4. **Problem and Research Objectives:** The 20th century has witnessed the conversion of many natural and agriculturally dominated watersheds to urban developments. The Lower Kaskaskia watershed, located in southwestern Illinois, is an example of a basin that is undergoing extensive land use changes through urbanization. It is clear that such drastic landscape changes in this and other watersheds stimulate a corresponding cascade of downstream adjustments in water quantity and quality. Sophisticated simulation models and Geographic Information Systems (GIS) have become the standard means for assessing the impacts of urban sprawl on water resources systems. Simulation and GIS models alone, however, are incapable of directly revealing optimal land development patterns that meet specified objectives. More comprehensive watershed-scale modeling techniques are needed to overcome this limitation and assist decision makers in planning new developments. Therefore, the objectives of this study were (i) to develop a basin-wide decision support model that could be used as a guide by land use managers and watershed management institutions to identify optimal land use changes in the Lower Kaskaskia and other similar watersheds; and (ii) investigate stakeholder concerns and reactions regarding formulation and application of the model in order to ensure local support and utility. Outcomes of this two-year project include the decision support model; a historical survey and conceptual model of the relationship between urbanization and the hydrologic and water quality variability in the Lower Kaskaskia basin; results of the decision support model when applied to the basin; and a summary and set of conclusions concerning the social science investigation.
5. **Methodology:** The decision support model has been created by integrating the U.S. Department of Agriculture's Soil and Water Assessment Tool (SWAT) for comprehensive hydrologic simulation, a GIS for generating input and visualizing output, and an evolutionary optimization algorithm for identifying weighted, optimal land use patterns. The combination of these modules results in a single, multi-objective decision framework capable of yielding land use changes that solve the following problem: Minimize the adverse effects on water quality and quantity caused by urbanization, while maximizing economic growth and profit to be earned through development; subject to laws governing watershed hydrology and realistic bound constraints on feasible land development. Within this problem formulation, scaled weighting factors are assigned to each of the two individual objectives so that the user can convey his or her personal hierarchy of specified objectives to the decision model. The independent decision matrix is comprised of alternative landscapes, while dependent variables are those that describe water quantity and quality variability and economic growth. By using SWAT to solve constraints related to watershed hydrology, the complex interactions between land use changes and water quality and quantity are fully captured. The remaining constraint that allows only feasible land use changes is handled directly by the optimization algorithm. Two types of evolutionary algorithms, a genetic algorithm (GA) and

an artificial life algorithm (ALA), have been investigated for solution to this problem. The GA is found to be particularly capable, while minor issues related to the ALA are still being resolved. The optimal landscape is defined as that which minimizes sediment yield, phosphorus and nitrogen loads, and other water quality indicators in subsequent streams, while simultaneously maximizing anticipated profit from urban development. Profit due to urbanization has been defined through distance relationships; lands closer to the Metro East region or in the vicinity of major interstates are more likely to incur larger profits from urbanization. In addition, following an extensive review of watershed planning activities in the Lower Kaskaskia basin, key stakeholders were identified. Meetings with stakeholders were used to promote technology transfer and to illuminate concerns and recommendations regarding this multi-objective planning effort and the value of model parameters.

6. **Principal Findings and Significance:** Detailed findings and conclusions will be presented in a forthcoming Master's thesis, which will represent the final report for this project, and in a manuscript to be submitted to a peer-reviewed journal. Briefly, findings thus far can be categorized into the quantitative modeling component and social science aspect of the research. The historical evaluation of existing data does reveal a relationship between increasing urbanization and negative impacts to hydrology and water quality. That relationship, however, is quite variable and difficult to quantify. Results of the decision support model for the Lower Kaskaskia basin indicate that the integrative approach can effectively identify areas in which development should occur from water quality and economic perspectives. The method thus serves as a guide for planning activities in urbanizing basins, with the understanding that modeling results cannot entirely replace the qualitative decision making aspect of watershed management. The latter refers to varying political and social dynamics and one's own personal hierarchy of management objectives that may not be quantifiable or that may not be integrated into the model.

   The social science objectives were realized through several important stages. First, an extensive investigation of stakeholder involvement identified two primary environmental planning and management activities in the Lower Kaskaskia basin: The Kaskaskia River Corridor Stewardship Plan, which brought stakeholders together to form the Kaskaskia River Private Lands Initiative Committee; and the Metro East Sustainable Growth Resource Group, which is comprised of a broad range of stakeholders and has been recently active as part of the Illinois Growth Task Force. The investigation also revealed the pivotal role played by the Southwest Resource Conservation and Development (SWRC&D) office in coordination of land management efforts in the area. Second, on July 22, 2002, the research team met with the Director of the SWRC&D. This was a valuable meeting in which early findings from the model were presented and relevant stakeholder groups were discussed. Third, on November 15, 2002, the team convened a broadly represented focus group meeting of fifteen stakeholders in Mascoutah, Illinois. Participants represented the Cities of Belleville, Swansea, and Shiloh, Madison County, SIMAPC, IDNR-C2000, USACE, Trust for Public Lands, American Bottom Conservancy, Sierra Club, and SWRC&D. The format of the meeting included a brief presentation of the model, followed by questions and discussion.

   Generally, stakeholders found the model interesting and potentially useful as a guide in planning activities. The meeting led to a great deal of feedback, including comments about application limitations, model cost and convenience, and data requirements. The group identified a number of parameters that should be integrated into the model. It was clear, however, that while some suggestions were realistic, many would be nearly impossible to

quantitatively define within the modeling effort. Some participants also conveyed the notion that issues of regional planning are always secondary to other local concerns, which is indicative of the complexity revolving around the numerous perspectives that should be represented in broad planning activities. In addition to these findings, several general points became clear: (i) Stakeholders have a difficult time conceptualizing a model at the watershed level; rather they demand a sub-watershed scale for management. This finding makes it difficult to implement broad planning activities that promote watershed-scale ecosystem health. (ii) Although attempts were made to focus group discussion on model improvements and recommendations, it was difficult to move 'entrenched' opinions beyond their narrow views of the topics. Specifically, two environmentalists firmly felt their topic (e.g., aesthetic values of habitats) should be included in the model, yet no one could identify data to represent these variables. Consequently, much of the discussion revolved around tangential comments. (iii) Stakeholders are concerned about whether the model will be available to them from the perspective of cost, time, and computing capabilities. Emphasis was placed on the need for a user-friendly, low-cost model that runs on a simple personal computer. (iv) Stakeholders believe that it would be helpful to focus on specific types of development in the model's findings. For example, the model could help determine whether some areas are better for residential versus industrial development. Finally, it became clear that many delicate preceding relationships existed among various stakeholders in the watershed. Research had to move carefully through that existing framework, so as not to inflame past conflicts, and future planning efforts in the region must be sensitive to these somewhat concealed relationships and historical issues.

7. **Graduate Students Supported with Funding:** Mr. Kyle Allred, M.S., Dept. of Civil Engineering, College of Engineering, SIUC, August 2, 2003 (expected); Dr. Misgana Muleta, Ph.D., Dept. of Civil Engineering, College of Engineering, SIUC, May 10, 2003.

8. **Publications and Presentations**

Allred, K.O., J.W. Nicklow, M.K. Muleta, L.A. Duram, 2003, A multiobjective SDSS for management of urbanizing watersheds: The case of the Lower Kaskaskia Basin, Illinois, in Proceedings of the 2003 EWRI Congress, ASCE, Reston, VA.

Nicklow, J.W., M.K. Muleta, 2002, Integrative decision making for watershed management using evolutionary algorithms, in Proceedings of the 2002 EWRI Congress, ASCE, Reston, VA.

9. **Notable Achievements:** The strategic interface between an optimization algorithm and a comprehensive watershed simulation model represents a new methodology and visualization tool to guide cost effective and environmentally sound watershed planning decisions. In addition, new insight regarding the social dynamics of the Lower Kaskaskia have been revealed, which will likely serve as key information in future planning activities.

10. **Related and Seed Projects**

Beaulieu J., J. Nicklow, S. Kraft, C. Lant, 2001, Decision support for water quality planning in multiple ownership watersheds: The case of the Cache River and applications in other Illinois watersheds, Illinois Council for Food and Agricultural Research: Water Quality Strategic Research Initiative. 7/01-6/03, $113,000.

Nicklow, J.W., 2001, A management model for controlling hydrologic alteration in the Illinois River, The Nature Conservancy, Freshwater Initiative. 1/02-6/03, $15,000.

Integrated Engineering and Geomorphological Analysis for Assessing the Performance of Bendway Weirs in Illinois Streams

Basic Information

Title:	Integrated Engineering and Geomorphological Analysis for Assessing the Performance of Bendway Weirs in Illinois Streams
Project Number:	2002IL2B
Start Date:	6/1/2001
End Date:	5/31/2003
Funding Source:	104B
Congressional District:	15
Research Category:	None
Focus Category:	Management and Planning, Surface Water, None
Descriptors:	None
Principal Investigators:	Bruce L. Rhoads, Marcelo Garcia

Publication

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1. Project Number: 2002IL2B

2. Project Title and PIs: Integrated Engineering and Geomorphological Analysis for Assessing the Performance of Bendway Weirs in Illinois Streams; Bruce Rhoads, Department of Geography, Marcelo Garcia, Department of Civil and Environmental Engineering, University of Illinois at Urbana-Champaign.

3. Research Category:

Geomorphological and engineering analysis of bendway weirs

4. Problem and Research Objectives:

The purpose of this study is to conduct an integrated geomorphological and engineering evaluation of the performance of bendway weirs in streams in Illinois. The research will integrate a geomorphological analysis of bendway weirs supported by the Illinois Department of Natural Resources with an engineering-based assessment that uses numerical modeling of flow through bends with weirs to evaluate the impact of these structures on fluvial processes. The goal is to provide a wide-ranging, theoretically based evaluation of bendway weir performance for a variety of meander configurations. Specific objectives are: 1) to develop a general computational fluid-dynamics (CFD) model to accurately predict patterns of two-dimensional and three-dimensional flow through meander bends with bendway weirs and 2) use field data collected as part of the IDNR-funded geomorphological assessment to test the predictive capabilities of the model developed in phase 1 for real-world cases.

5. Methodology:

The methodology involves the development of a CFD model of flow through bends with weirs. Both 2-D and 3-D numerical models (STREMR and FLOW-3D) are being adapted for this purpose. Once the models are developed and calibrated, the influence of bendway weirs of different types on flow through hypothetical meander bends of different configurations will be explored through a series of numerical simulations. Finally the model will be used to simulate flow through two real-world bends that contain bendway weirs: one site where weirs have effectively mitigated erosion and one site where the weirs have failed to mitigate erosion. Field data collected as part of the IDNR-supported study will provide the basis for developing these simulations and for evaluating predicted patterns of 3-D velocities relative to measured patterns of 3-D velocities

6. Principal Findings and Significance:

This research attempts to clarify some concepts, especially those related to fluid dynamics around weirs and sediment transport redistribution (mainly as bedload). A comparison between conditions with and without submerged weirs is necessary. This comparison can be achieved by numerical modeling of these two conditions. The numerical modeling can be done using a 2D depth-averaged model named “STREMR HySeD”, which calculates flow characteristics (hydrodynamics) as well as sediment transport (both suspended and bed-load

transport). However, flow patterns around submerged weirs are basically three-dimensional, therefore a 3D modeling would be done using a commercial program named "FLOW3D".

2-D Modeling

As preliminary result, the 2D modeling of one of the three sites has been done. A discharge of 1.0 m^3/s was assumed (this value is derived from field measurements). Two conditions are modeled. In the first condition, the weirs are not included (Figure 1), and in the second condition, the weirs are included (Figure 2). A mesh of 507 x 42 cells was used in both cases. In the second case the weirs were considered to be obstacles without porous characteristics, because according to field evaluation, for low flows, these weirs are not submerged. Further work during the summer 2003 will refine the 2-d modeling and complete 3-D modeling. Predictions will be compared with field data to evaluate model performance.

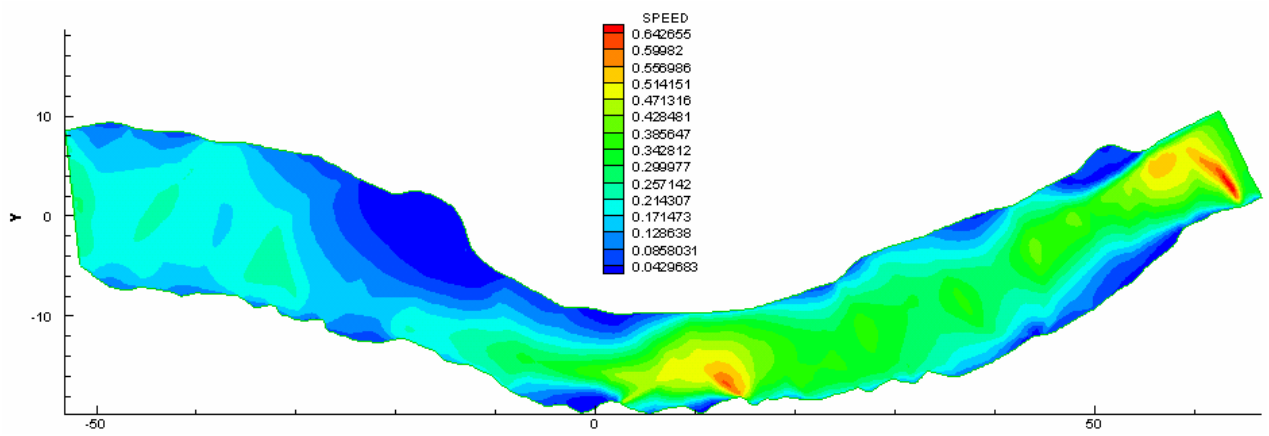

Figure 1: Hanlin site modeling without weirs

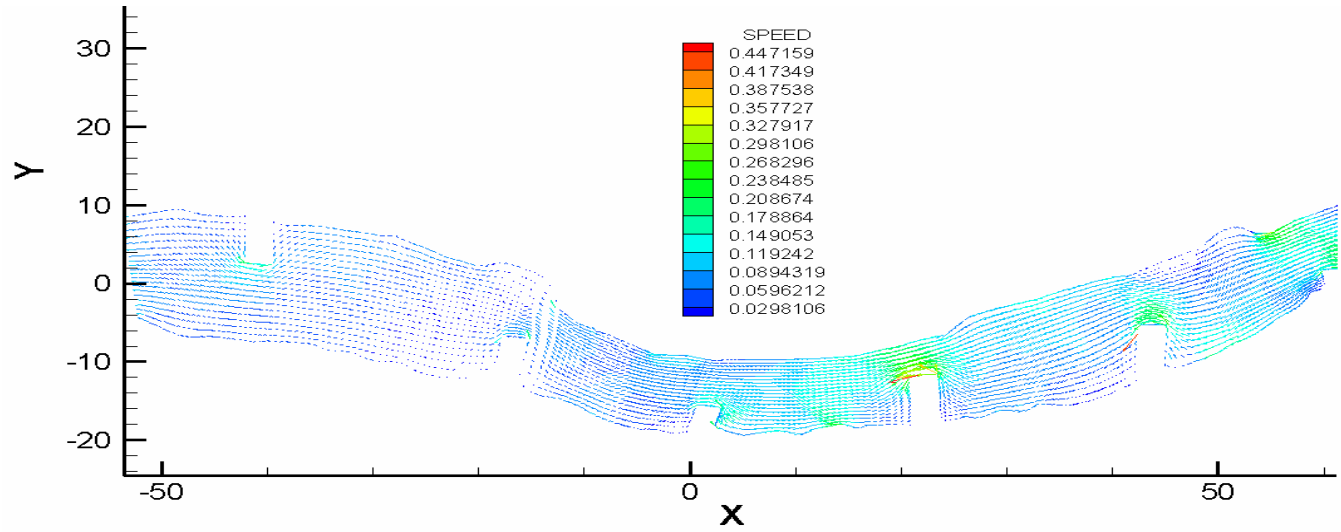

Figure 2: Hanlin site modeling with weirs

Field work has produced data sets on three-dimensional flow through weir fields at three sites in Illinois – one along Big Creek in Clark County, one along Sugar Creek in McLean County and one along Kickapoo Creek in McLean County. All sets of measurements were

obtained when flow was at or near the crests of the weirs at each site. Analysis of field data is complete for two of the three sites and nearly complete for the third site. The analyzed data provide the basis for field testing the predictive capabilities of the 2-d and 3-D models.

7. Graduate Students Supported with Funding:

Name	Department	College	Institution	Degree Sought	Date Degree was or will be awarded
Jorge D. Abad	Civil and Env. Engineering	Engineering	Univ. of Illinois	M.S.	Anticipated May 2003

8. Publications and Presentations:

9. Notable Achievements:

The research is developing a state-of-the-art predictive tools that can be used to enhance the success of stream restoration.

10. Related Seed Projects:

The research is a companion project to a grant to PI Rhoads from the Illinois Department of Natural Resources to develop a manual for geomorphological assessments of bendway weirs.

Development and Validation of a 3D Coupled Hydrologic-Biogeochemical Model for Evaluation of the Impact of Water-Table Management on Nitrate Loads from Tile-Drained Agricultural Fields

Basic Information

Title:	Development and Validation of a 3D Coupled Hydrologic-Biogeochemical Model for Evaluation of the Impact of Water-Table Management on Nitrate Loads from Tile-Drained Agricultural Fields
Project Number:	2002IL7G
Start Date:	9/1/2001
End Date:	8/31/2003
Funding Source:	104G
Congressional District:	15th
Research Category:	Water Quality
Focus Category:	, Non Point Pollution, Solute Transport
Descriptors:	
Principal Investigators:	Robert J. Hudson, Albert Joseph Valocchi

Publication

1. Yue, Feng, August 2003, "Physically-based three dimensional hydrological conjunctive modeling of water movement in tile-drained fields," MS Thesis, Department of Civil and Environmental Engineering, College of Engineering, University of Illinois, Urbana, IL.
2. Hudson, Robert J.M., Albert J. Valocchi, David Hill, Feng Yue, Stephen P. Wente, Jaswinder P. Singh, 2002, "Modeling Denitrification in Agroecosystems of Central Illinois: Investigations at the Field and Watershed Scale" in EOS Transactions of American Geophysical Union, 84(47), Fall Meeting Supplement, p. F270-271.

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1. Project Number: 2002IL7G

2. Project Title and PIs:

Development and Validation of a 3D, Coupled Hydrologic-Biogeochemical Model for Evaluation of the Impact of Water Table Management on Nitrate Loads from Tile-Drained Agricultural Fields, Robert J.M. Hudson and Albert Valocchi.

3. Research Category:

Water quality

4. Problem and Research Objectives:

One of the most promising approaches to minimizing nitrate export to rivers draining agricultural watersheds is the use of water table management, or controlled drainage. The Illinois District of the USGS is conducting a field pilot study of the benefits of controlled drainage at an active farm in east-central Illinois. Two adjacent 40-acre plots, one with tile management and the other without, have been instrumented for collecting a variety of data. Modeling is required to fully interpret the field data and to extend the results to other farm conditions. A portion of the project involves modeling studies with Drainmod-N, a widely-applied quasi 2-dimensional model. However, because raising the water table of a farm field may increase the amount of runoff and change its subsurface interactions with the larger-scale groundwater flow field, we hypothesize that a fully 3-dimensional model is required to properly quantify the hydrologic and nitrogen budgets of the study site. Our model will simulate both surface runoff/runon and subsurface flow between the adjacent managed/conventional plots (and adjacent fields), processes which can only be represented very approximately in DRAINMOD. The improved hydrology of the model will also allow us to improve our analysis of the N budgets of the two plots, since it accounts more accurately for nitrate exchange between adjacent plots by the above hydrologic paths and will better simulate differences in denitrification in surface ponds/puddles and in the subsurface due to increases in water and solute residence times.

Our primary objective is to develop a physically-based, 3-dimensional model that couples surface and subsurface flow with a biogeochemical model for nitrogen fate. The model will be calibrated and validated using the field data collected by the USGS and other existing data from fields in central Illinois.

Our secondary objective is to apply our newly developed automatic calibration tools to DRAINMOD in order to understand the hydrology and nitrogen budgets of the controlled-drainage field study. We will attempt to quantify differences in denitrification using the model and calibrate field-specific parameters for use in the 3-dimensional model.

5. Methodology:

The project involves using two different modeling approaches to analyze data being collected by USGS researchers from a paired set of agricultural fields with and without controlled subsurface drainage. The first approach involves continuing development and

application of a 3-dimensional model of hydrologic and solute transport. The second approach employs automatic calibration of an existing pseudo 2-dimensional groundwater/nutrient transport model (DRAINMOD) to investigate causes for the differences in nutrient export between the two fields.

6. Principal Findings and Significance:

3-Dimensional Modeling

The objective of this task is to develop a new model of surface/subsurface flow suitable for fields with subsurface drainage systems. Progress this past year includes:

1) An improved algorithm for coupling overland and subsurface flow, which allows the model to execute more quickly and accurately.
2) A fast, efficient solution to variably-saturated subsurface flow with detailed water balance analysis, which llows a unified model to simulate flow through unsaturated and saturated soils more quickly and accurately.
3) 3-dimensional simulations of water table depths in fields with irregular subsurface drainage systems.
4) A simplified ET algorithm, which allows simulation of the annual hydrologic cycle in the field.

Automatic calibration

1) Developed an improved objective function that eliminates artifacts due to autocorrelation of residuals (e.g., simulated minus observed flow). The new approach will permit accurate calibration of both daily flows and long-term trends using a single objective function.
2) Discovered a nitrogen balance error in DRAINMOD-N. This prevented a large waste of time using the error-impacted model. The model requires correction prior to further use for analyzing nitrogen export data.

7. Graduate Students Supported with Funding

Name	Department	College	Institution	Degree Sought	Date Degree was or will be awarded
Feng Yue	Civil and Environ. Engr.	Engineering	Univ. of Illinois	M.S.	Aug. 2003
Ho-young Kwon	Nat. Res. and Env. Sci.	ACES	Univ. of Illinois	Ph.D.	Dec. 2004

8. Publications and Presentations:

DISSERTATIONS

Yue, Feng; Aug. 2003, "Physically-based three-dimensional hydrological conjunctive modeling of water movement in tile-drained fields", M.S. Thesis, Dept. of Civil and Environmental Engineering, College of Engineering, University of Illinois, Urbana, IL.

CONFERENCE PROCEEDINGS

Hudson, Robert J. M., Albert J. Valocchi, David Hill, Feng Yue, Stephen P. Wente, Jaswinder P. Singh, 2002, "Modeling Denitrification in Agroecosystems of Central Illinois: Investigations at the Field and Watershed Scale" in *Eos Transactions of American Geophysical Union*, 83(47), Fall Meet. Suppl., p. F270-271 .

9. Notable Achievements:

We made significant progress in modeling the 3-dimensional flow of water over and within agricultural fields with subsurface drainage for periods of a year or longer. The model is now capable of simulating the evolution of water table depths and moisture availability in fields over the growing season, not just during storm events. The CPU time required to run the model makes it feasible for use on fast desktop computers.

We completed development of novel techniques for automatically calibrating water quality models. These techniques will allow these models to be objectively calibrated, rather than subjectively and selectively adjusted by model users. It will open new avenues to analyzing water quality data at field and watershed scales by allowing physically-based simulation models to be "fitted" to data just as empirical regression equations are. This will allow more accurate application of models to the study of hydrology and water quality issues in general and to the field study under consideration here in particular.

10. Related Seed Projects:

No seed projects funded.

Information Transfer Program

The major functions of the Illinois Water Resources Center are to oversee a research program and convey the results of research and development within the water resources field to specialists and the interested public. Information transfer is accomplished through workshops, conferences, published proceedings, a website, and maintenance of a library of Illinois Water Resources Center reports and videotapes. In addition, the Center Director and staff serve on state advisory committees and consult with government agencies.

Governor’s Illinois River Conference 2003

Basic Information

Title:	Governor’s Illinois River Conference 2003
Project Number:	2002IL37B
Start Date:	9/30/2002
End Date:	10/1/2003
Funding Source:	104B
Congressional District:	IL-15
Research Category:	Not Applicable
Focus Category:	None, None, None
Descriptors:	Outreach, conference, river, management, restoration, basin
Principal Investigators:	Robert Frazee, Stephen P. Havera

Publication

GOVERNOR'S ILLINOIS RIVER CONFERENCE: Both the IWRC Director and the Program Specialist are serving on the planning committee for the 2003 *Governor's Conference on the Management of the Illinois River System*, which will be held on October 7-9, 2003 in Peoria, Illinois. IWRC staff will produce the Conference program, abstracts, and proceedings.

Watershed Academy

Basic Information

Title:	Watershed Academy
Project Number:	2002IL38B
Start Date:	1/1/2002
End Date:	6/30/2002
Funding Source:	104B
Congressional District:	
Research Category:	Water Quality
Focus Category:	Water Use, None, None
Descriptors:	Watershed, Planning, Management, Water Quality
Principal Investigators:	John B Braden, L. Chris Johns

Publication

1. Illinois Water Resources Center, University of Illinois Department of Natural Resources, and Illinois Environmental Protection Agency. 2002. Watersheds in Transitin; Workbook. 200p.

WATERSHED ACADEMY: A top-down regulatory approach has worked to control pollution from point sources (industrial and municipal sources). The same cannot be said of problems originating from nonpoint sources (excessive nutrients, pesticides, excessive sediment, water flow extremes), partly because of the diffuse nature of the sources and complexity of the problems and partly because of socio-political concerns about retaining local control and protecting private property rights. Watershed management addresses the complexity issue and watershed partnerships provide a bottom-up, collaborative alternative to top-down control. However, the partnerships will not succeed and water quality will not improve unless some degree of technical competence and organizational skill can be transferred to the local partnerships. Connections must be made between the partnerships, delivery systems (e.g., extension), and the expanding knowledge base in both nonpoint pollution control and local governance. A Watershed Academy developed by the Illinois Water Resources Center provides those connections.

Following the first curriculum about basic watershed science (2000) and the second curriculum (2001) on effective leadership, a third curriculum was developed in 2002 about watershed planning in the context of a changing landscape. A team of Academy members from the University of Illinois, Illinois Department of Natural Resources, American Farmland Trust, USACE Construction Engineering and Research Laboratory, Northeastern Illinois Planning Commission, Conservation Design Forum, Integrated Lakes Management and Purdue University Extension presented the workshop *Watersheds in Transition,* March 13-15, 2002, to twenty-four Illinois watershed leaders. A 200-page loose-leaf resource manual was prepared and tested during the workshop.

Publication: Illinois Water Resources Center, University of Illinois, Illinois Department of Natural Resources, and Illinois Environmental Protection Agency. 2002. *Watersheds in Transition*; Workbook. 200p.

Water 2002

Basic Information

Title:	Water 2002
Project Number:	2002IL39B
Start Date:	3/1/2002
End Date:	2/28/2003
Funding Source:	104B
Congressional District:	
Research Category:	Water Quality
Focus Category:	Education, None, None
Descriptors:	Science, Policy, Regulation
Principal Investigators:	John B Braden

Publication

1. Water 2002 Connections. Conference proceedings of the 3rd biellian conference. November 6 and 7, 2002. The Chancellor Hotel and Convention Center, Champaign, IL. Edited by Nancy Koeneman. 71 p.

WATER 2002: The Center hosted the third statewide biennial conference on water issues (Water 2002) on November 6-7, 2002. The conference addressed science, technology, and policy developments in water resources and engaged citizens, researchers, and groups interested in water issues. Specific issues to be addressed are integrated ecosystem management, the role of science in policy and regulation, and water supply and treatment.

IWRC Website

Basic Information

Title:	IWRC Website
Project Number:	2002IL40B
Start Date:	3/1/2002
End Date:	2/28/2003
Funding Source:	104B
Congressional District:	
Research Category:	Not Applicable
Focus Category:	None, None, None
Descriptors:	Website, education, water, information
Principal Investigators:	L. Chris Johns, Nancy Koeneman

Publication

IWRC WEB SITE: The Illinois Water Resource Center web site (www.environ.uiuc.edu/iwrc) provides direct links to IWRC publications, news, funding sources, and a calendar of events. Links to current topical resources include TMDL's, Gulf hypoxia, and aquatic invasive species. The IWRC homepage links to the National Institutes for Water Resources (wrri.nmsu.edu/niwr/) where all 54 State Water Research Institute's home pages are listed, to the Universities Council on Water Resources (www.uwin.siu.edu/ucowr/index.html), and the Illinois-Indiana Sea Grant home page (www.iisgcp.org/). Links to government and non-government websites, IWRC publications and upcoming events about water resource topics can be accessed from the IWRC main page.

the Link

Basic Information

Title:	the Link
Project Number:	2002IL41B
Start Date:	3/1/2002
End Date:	2/28/2003
Funding Source:	104B
Congressional District:	
Research Category:	Not Applicable
Focus Category:	Education, None, None
Descriptors:	Newsletter
Principal Investigators:	Nancy Koeneman

Publication

1. the Link. Spring 2002 and Fall 2002 Newsletters. Environmental Council and Illinois Water Resources Center, University of Illinois at Urbana-Champaign.

the Link is a joint publication of the Environmental Council and the Illinois Water Resources Center at the University of Illinois at Urbana-Champaign. **the Link** is published bi-annually and distributed to faculty members, departments, and other persons interested in the efforts of the Environmental Council and the Illinois Water Resources Center. The publication highlights outstanding efforts and research of faculty members and students and brings together the efforts and achievements of environmentally-related programs, groups, and events on campus. **the Link** also promotes conferences and other outreach activities and provides program descriptions of environmentally-related undergraduate and graduate programs.

Midwest Technology Assistance Center (MTAC)

Basic Information

Title:	Midwest Technology Assistance Center (MTAC)
Project Number:	2002IL42B
Start Date:	3/1/2002
End Date:	6/30/2002
Funding Source:	104B
Congressional District:	
Research Category:	Water Quality
Focus Category:	Water Quality, None, None
Descriptors:	Water systems, assessment, evaluation
Principal Investigators:	John B Braden, Kent Smothers

Publication

The Midwest Technology Assistance Center for Small Public Water Systems (MTAC) assists small public water systems and Tribal systems in USEPA Regions 5 and 7. Over the last year, MTAC has developed interactive guides for source water protection planning and emergency planning for small water utilities. These guides are computer based, free to small water utilities, and provide the means for developing planning tools efficiently and cost-effectively.

MTAC also supports 3-5 competitively selected grants each year. Grants are limited to a maximum of $50,000 for eighteen months. During the past year, MTAC funded projects dealing with arsenic removal, nitrate mitigation, cost effective water treatment technology, and source water protection planning.

Student Support

Student Support					
Category	**Section 104 Base Grant**	**Section 104 RCGP Award**	**NIWR-USGS Internship**	**Supplemental Awards**	**Total**
Undergraduate	0	0	1	1	2
Masters	2	1	1	1	5
Ph.D.	1	1	0	1	3
Post-Doc.	0	0	0	1	1
Total	3	2	2	4	11

Notable Awards and Achievements

Drs. John W. Nicklow and Leslie A. Duram completed a project evaluating decision support for stream protection in urbanizing areas. The strategic interface they developed between an optimization algorithm and a comprehensive watershed simulation model represents a new methodology and visualization tool to guide cost effective and environmentally sound watershed planning decisions. In addition, new insights regarding the social dynamics of the Lower Kaskaskia River, an economically depressed part of Illinois, have been revealed. These insights will likely serve as key information in future planning activities.

Drs. Bruce Rhoads and Marcelo Garcia have assessed bendway weirs in Midwest streams. Bendway weirs are used to reduce erosion in meandering Midwestern streams, but their effects on stream dynamics are not well understood. Designing measures to optimize their use has been more art than sciences. In this research, Drs. Rhoads and Garcia of the University of Illinois at Urbana Champaign used engineering and geomorphologic methods to improve the scientific basis for predicting the performance of bendway weirs resulting in state-of-the-art predictive tools that can be used to enhance the success of stream restoration.

Drs. Robert Hudson and Al Valocchi made significant progress in modeling the 3-dimensional flow of water over and within agricultural fields with subsurface drainage for periods of a year or longer. The model is now capable of simulating the evolution of water table depths and moisture availability in fields over the growing season, not just during storm events. The CPU time required to run the model makes it feasible for use on fast desktop computers.

Hudson and Valocchi completed development of novel techniques for automatically calibrating water quality models. These techniques will allow these models to be objectively calibrated, rather than subjectively and selectively adjusted by model users. It will open new avenues to analyzing water quality data at field and watershed scales by allowing physically-based simulation models to be fitted to data just as empirical regression equations are. This will allow more accurate application of models to the study of hydrology and water quality issues in general and to the field study under consideration here in particular.

The Midwest Technology Assistance Center continues to serve small public water systems. In cooperation with the Illinois Section of the American Water Works Association, MTAC has developed an emergency planning guide for small public water systems. The guide, available on CD-Rom with an accompanying booklet, is free to all small systems. The CD outlines the process of developing an Emergency Response Plan and walks the small system representative through the process of developing his or her own plan.

In November 2003, the Illinois Water Resources Center hosted 250 people at the Illinois Water 2003 conference in Champaign, Illinois. Water professionals, local government officials, state agency representatives and private citizens attend the two day even. Focusing on connections between science and policy, national, regional and local speakers discussed what is needed to ensure that good science leads to good policy.

Publications from Prior Projects