CENTRAL REGION INTEGRATED SCIENCE PARTNERSHIP FUNDS

Project Title: Development of a fate and transport model for nitrate and bacteria in the Cedar River Watershed of the Eastern Iowa Basins NAWQA Unit

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Partners/Collaborators and Affiliations: USEPA, Iowa Dept. Natural Resources

Total USGS Funding Requested: $49,273

Proposal Submission Date: Feb. 11, 2002

Problem: *Why is the project/activity being proposed?* Excessive nutrients (nitrogen and phosphorus), pesticides, and other emerging contaminants (human and animal drugs), are of concern across the Midwest. The concentrations of nitrate and total phosphorus in streams of Eastern Iowa rank among the highest in the nation (Kalkhoff and others, 2000) and may be contributing to hypoxia in the Gulf of Mexico (Goolsby and others, 1997).

The Cedar River is a major stream draining much of Eastern Iowa NAWQA Unit (EIWA) that extends from southern Minnesota to the Mississippi River in southeastern Iowa. The Cedar River has shown increasing trends in nitrate concentrations in the last 30 years (Schnoebelen and others, 1999). The Iowa 303(d) list specifies a 57-mile segment of the Cedar River above Cedar Rapids, Iowa as impaired by fecal coliform and nitrate-nitrogen (NO_3-N) (Iowa Department of Natural Resources, 1999, p. 172). In addition, increasing trends of nitrate concentrations in the Cedar River have raised concerns from the City of Cedar Rapids Iowa for protecting their water supply. Cedar Rapids obtains its water supply from a series of wells completed in the alluvial aquifer along the Cedar River. Approximately seventy percent of the recharge for the alluvial aquifer used by the City of Cedar Rapids comes from the Cedar River (Schulmeyer, 1995; Schulmeyer and Schnoebelen, 1998).

Several agencies, including the Iowa Department of Natural Resources, the U.S. Environmental Protection Agency, the City of Cedar Rapids, and the U.S. Geological Survey are examining ways of assessing fundamental questions of flow and transport of chemical constituents in the Cedar River watershed. All agencies recognize the need for a basin wide approach and the need to establish fundamental water-quality, flow, and chemical transport information for improving water-quality conditions in the Cedar River. The coordinated effort of local, state, and federal agencies will provide an integrated cost-share approach for assessing water-quality in the Cedar River basin in addressing water-quality problems and in establishing a "framework" for future studies.

Objective: *What are the goals of this project/activity?* The objective of this project is to determine the sources and transport times of nutrients and bacteria in the Cedar River Watershed.

Scope: *What tasks are to be accomplished and what geographic area does the project/activity encompass?* The proposed study of the Cedar River basin will integrate time of travel and water-chemistry to address several objectives: (1) to accurately determine time of travel on the Cedar River for different flow regimes that can be used for water-quality and transport models, (2) to predict the arrival and passage of time of contaminants released or spilled upstream, (3) to determine primary tributary sources of nitrogen and bacteria within the system, and (4) to

evaluate in-stream processing and or degradation of nitrate and other chemical constituents. The scope of the study would be from the reach between Waterloo and Cedar Rapids, Iowa.

Approach: *How will the project/activity results be accomplished*? The NMD and WRD will spatially map the watershed to determine landform, soils, land-cover, and land-use of the Cedar River Watershed. The Elevation Derivatives for National Applications (EDNA) and other models will be applied to develop hypotheses regarding the relationships between characteristics of the landscape and the hydrologic behavior of nitrates and bacteria. A dye study will be conducted using a Lagrangian approach to determine transport times of nutrients and bacteria within the main stem of the Cedar River. Separate point estimates of tributary sources of nutrients and bacteria will be determined. Data will be compiled into a basic conceptual model of sources and transport times of nutrients and bacteria for the river.

Benefits: *What are the benefits to Federal science interests, partners, stakeholders, and the public? How will the awarded funding support the Director's goals of integrated science?* These funds will be used to integrate science within USGS by combining expertise within 3 divisions in a multidisciplinary project to develop and demonstrate approaches for assessing sources, fates, and impacts of nutrients and bacteria in aquatic systems. Data will be used by the USGS in collaborative efforts with local water districts, the State of Iowa, and the USEPA in providing basic information needed for protection of protect public water supplies. This data will be used in future efforts to develop a Total Maximum Daily Load allocation for the Cedar River Watershed. The process will also be useful for exploring and developing basic approaches applicable to other watershed in the EIWA and to the entire Mississippi River Basin. This basic research approach is essential for studies of the Gulf hypoxia problem in addition to other national water quality concerns.

Outcome/Products: *What products/outcomes will be developed from the project/activity?* Products will include a final report and basic assessment methodologies for use in the EIWA and other sites with the nation.

Budget: $ 49,273

Timeline:

Activity	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Mapping/Modeling											
Field Study											
Analysis											
Final Report											

Table 1. Calculation of costs per sample.

Analysis	**Cost ($)**	**Source**
Nutrient profile	125	WRD/NWQL (schedule 2702)
Bacteria	50	BRD/CERC
Chloride	20	BRD/CERC
Chlorophyll/POC	25	BRD/CERC
Hydrolab/YSI	0	BRD/CERC
ICP/MS	200	BRD/CERC
Sediment particle size	25	BRD/CERC
Sediment TOC	10	BRD/CERC
Total per sample	455	
Total for 30 samples	13,650	

Table 2. Budget costs by USGS Division and Category.

Division	**Activity**	**Total**
WRD	Salary	6,711
	Travel	1,000
	Contract (NWQL)	3,750
	Indirect costs (30%)	4,912
WRD total		16,373
NMD	Salary	3,521
	Travel	1,000
	Contract (NWQL)	0
	Indirect costs (31.5%)	2,079
NMD total		6,600
BRD	Salary	9,920
	Travel	1,000
	Sample analysis	10,650
	Field per diem 3 people @ 7d	2,100
	Indirect costs (10%)	2,630
BRD total		26,300
Total		49,273