

Lower Minnesota River Project

Study of mixing characteristics of the Lower Minnesota River

A cooperative project between the U.S. Geological Survey and
Metropolitan Council Environmental Services

Dates: October 1, 2002 – September 30, 2004

Cooperator: Metropolitan Council Environmental Services

Project Chief: Thomas Winterstein

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A. PROBLEM

An important consideration in building the water-quality model of the Minnesota River is how many dimensions to make the model: one, two, or three. This depends upon how well the river is mixed. In addition, how water is collected for water-quality analysis depends upon how well the cross-section is mixed. Currently, how well the river is mixed is not known.

B. OBJECTIVES AND SCOPE

The objective is to use easily measured physical parameters of the river during a range of flows to determine if the river is well mixed or not.

C. RELEVANCE AND BENEFITS

The completion of this task benefits the Lower Minnesota River Project by providing information needed to design the water-quality sampling portion of the project and to design the water-quality model.

D. WORKPLAN

1. Location of measurements.

The physical parameters will be measured at the five sampling locations of the Metropolitan Council Environmental Services (MCES) on the Minnesota River: river miles 3.5, 8.5, 14.3, 25.1, and 39.4. These measurement sites can be changed after consultation with the MCES.

If sufficient time is available, measurements will be made at additional locations determined through discussions with MCES.

2. Frequency of measurements.

The measurements will be made once a month. The measurements will be made in July, August, and September 2003 and April, May, and June 2004.

3. Method of measurement.

The physical parameters will be measured with a multiparameter meter from a boat. The parameters will be measured at five points in the cross-section: near left-edge-of-water, .25, .5, and .75 way across, and near right-edge-of-water. Dissolved oxygen, specific conductance, temperature, pH, and turbidity will be measured at each location. The parameters will be measured 1 m below the river surface and 1 m above the river bottom at each location. The measurements will be made at 1-m increments from top to bottom if these conditions exist:

- (a) top and bottom dissolved oxygen measurements differ by more than 0.5 mg/L,
- (b) top and bottom specific conductance measurements differ by more than 10 percent,
- (c) top and bottom temperature measurements differ by 2 degrees Celsius or more,
- (d) top and bottom pH measurements differ by more than 0.5 standard unit,
- (e) top and bottom turbidity measurements differ by more than 20 percent.

These conditions can be adjusted after consultation with the MCES.

One crew of four persons will be used. Two hydrologic technicians will drive the boat and trailer to the boat launch point, launch the boat, and make the measurements at the five cross-sections from the boat. Two students will drive a second van to the boat launch, move the first van and boat trailer boat landing where the boat will be loaded onto the trailer, and then drive back to the office.

The measurements will take one 10-hour day and one 5-hour day. Therefore, 2 technicians will work 13 hours plus 2 hours overtime per measurement. It will take the two students about 3 hours to drive to the first site, move the boat trailer, and drive back to the office. Therefore, two students will work for 6 hours per measurement.

One of the technicians in the boat crew will be a qualified boat operator.

E. QUALITY-ASSURANCE PLAN

The multiparameter meters will be calibrated in the field at the start of the day and at the end of the day following established U.S. Geological Survey (USGS) procedures for calibrating multiparameter meters.

F. PRODUCTS

The data will be entered into NWIS, where it will be available on the internet through NWIS Web. The data will be sent to MCES by e-mail as it is collected. The data will be compiled and sent to MCES in a letter at the end of the task and presented to them in a meeting. The letter will include recommendations on appropriate sampling protocols given the state of mixing in the river. Preliminary recommendations will be provided in the fall of 2003.