

Lower Minnesota River Project

Determination of ground-water inflow into the Minnesota River between Jordan, Minnesota, and the mouth of the 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

Revision Date: July 18, 2003

A. OBJECTIVE AND SCOPE

Objective of this task is to (1) determine the areas of ground-water discharge to the Minnesota River from Jordan, MN, to its mouth and to determine if the river loses any water to ground-water, (2) determine the areas of greatest ground-water discharge, and (3) determine if ground-water discharge to the river is a significant portion of the river's flow during lower discharges in the Minnesota River.

B. METHODS

The flow of ground water into and out of the Minnesota River will be determined by measuring the discharge of the Minnesota River at several locations and the discharge of its tributaries during a period of low, steady discharges. For each reach of the Minnesota River the flow of ground water into or out of the river will be determined by the following equation:

$$GW = D_d - D_u - \sum D_t$$

Where GW is the ground water flow

D_d is the discharge in the Minnesota River at the downstream end of the reach

D_u is the discharge in the Minnesota River at the upstream end of the reach, and

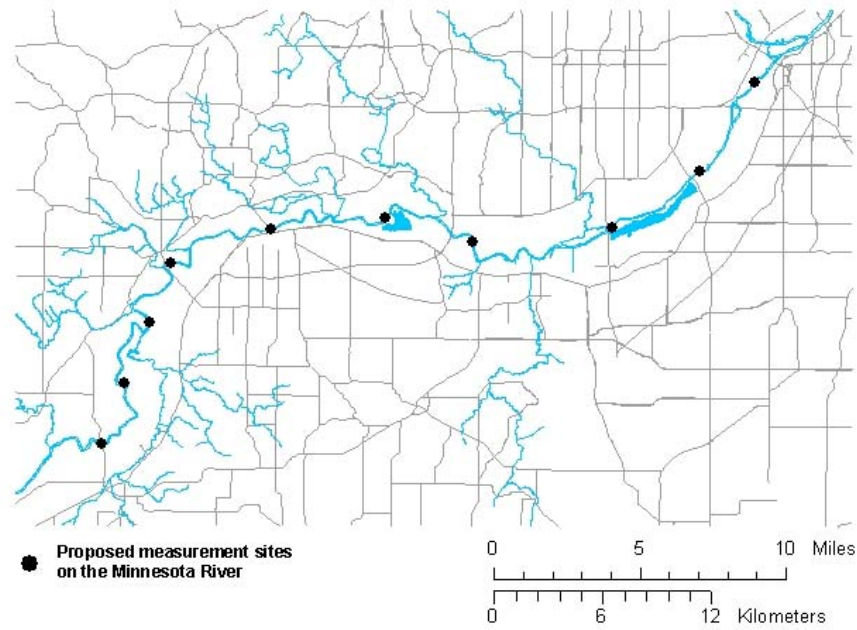
D_t is the discharge of tributaries to the Minnesota River within the reach.

If GW is positive, ground water flows into the river within the reach (gaining reach); if it is negative, ground water receives river water within the reach (loosing reach).

1. Location of measurements

The ground-water flux will be determined for about 40 miles of the river, from Jordan, Minnesota, to its confluence with the Mississippi River. Nine reaches will be measured, each about 4.5 miles long. The locations of the measurements are shown

in the figure. Discharge in tributaries to the Minnesota River will be measured either near the top of the bluffs bordering the Minnesota River Valley or near the base of the bluffs.



2. When to make the measurements

The measurements will be made during an extended period of lower discharge in the Minnesota River, under $1,000 \text{ ft}^3/\text{s}$, and when its tributaries are in base flow, which may be as long as 10 rain-free days. Rain should not be forecast for the 2 days required for the measurements.

3. Methods of making measurements

Discharge in the Minnesota River will be measured from a boat using an acoustic-doppler meter. The tributaries will be measured using Price current meters. When measuring the tributaries the field crews will have the option of either boating to the mouth of the tributaries to make the measurements or making the measurements from an upstream bridge or culvert, whichever will provide the most efficient, cost-effective means of determining the water being discharged to the Minnesota River.

Two field crews of two persons each will be required. One will make the discharge measurements in the Minnesota River from a boat. The second will make discharge measurements of the tributaries.

Two days will be required to make the measurements.

C. PUBLICATION OF DATA

The data will be (1) published in the Annual Report of the Minnesota District, U.S. Geological Survey, (2) posted on the internet as part of the USGS water-information system, NWIS web, and (3) sent to MCES in a letter. The letter will specify which segments of the river were gaining or losing reaches.