# MCES Water Monitoring Programs
# In Support of the
# Interagency Water Monitoring Initiative,
# 2002 – 2003 Biennial Progress Report

## Interagency Water Monitoring Initiative (IWMI)

## Background

In May 1997, the Minnesota Legislature provided $575,000 to the Metropolitan Council, via the Interagency Water Monitoring Initiative (IWMI), for an expansion of Metropolitan Council Environmental Services (MCES) water quality monitoring efforts. The funding was provided to the Metropolitan Council via the Minnesota Pollution Control Agency (MPCA) budget. Monitoring efforts began in 1998 and focused on two programs: the "Metropolitan Area Watershed Outlet Monitoring Program" and "Mercury and PCB Inputs to the Minnesota River Monitoring Program." Both programs are being conducted in cooperation with local, state, and federal partners with a mutual interest in the monitoring information.

In May 1999, the Minnesota Legislature provided an additional $600,000 to the Metropolitan Council for the 2000-2001 biennium, via the MPCA's budget. This funding allowed for continuation of the "Metropolitan Area Watershed Outlet Monitoring Program" and the "Mercury and PCB Inputs to the Minnesota River Monitoring Program" through June 2001. A 2000-2001 work plan for both programs was prepared by MCES Water Quality staff and submitted to the MPCA in September 1999. In September 2000, a business item was approved by the Environment Committee of the Metropolitan Council authorizing the Metropolitan Council to enter into the joint powers agreement with the MPCA, and to accept and expend the state funding. In November 2000, the MPCA and Metropolitan Council executed the joint powers agreement for the 2000-2001 monitoring work and funding. In August 2001, MCES submitted the "2000-2001 Biennial Progress Report" to the MPCA.

In June 2001, the Minnesota Legislature again appropriated $600,000 to the Metropolitan Council (via the MPCA), for continuation of the "Metropolitan Area Watershed Outlet Monitoring Program" and the "Mercury and PCB Inputs to the Minnesota River Monitoring Program" during the 2002-2003 biennium. A 2002-2003 work plan for both programs was prepared by MCES Water Quality staff and submitted to the MPCA in July 2001. In August 2001, a business item was approved by the Environment Committee of the Metropolitan Council authorizing the Metropolitan Council to enter into a grant contract with the MPCA, and to accept and expend the state funding. In February 2002, the MPCA and Metropolitan Council executed the grant contract for the 2002-2003 monitoring work and funding. In May 2003, MPCA extended the term of the grant contract for an additional year (to June 30, 2004), thereby allowing MCES to spend the remainder of the 2002-2003 funding (Table 9) on Minnesota River-related monitoring work.

In May 2003, the Minnesota Legislature appropriated $500,000 to the Metropolitan Council (via the MPCA), for continuation of the "Metropolitan Area Watershed Outlet Monitoring Program" and the

"Mercury and PCB Inputs to the Minnesota River Monitoring Program" during the 2004-2005 biennium. A 2004-2005 work plan for both programs was prepared by MCES Water Quality staff and submitted to the MPCA in July 2003. In August 2003, a business item was approved by the Environment Committee of the Metropolitan Council authorizing the Metropolitan Council to enter into a grant contract with the MPCA, and to accept and expend the state funding. MCES and MPCA staff have initiated the process for establishing a grant contract for the 2004-2005 funding. During the current biennium, MCES, MPCA, and Minnesota State University-Mankato (MSU-Mankato) will be discussing an opportunity to transfer responsibility and implementation of the "Mercury and PCB Inputs to the Minnesota River Monitoring Program" to the Water Resources Center at MSU-Mankato. The program transfer from MCES to MSU-Mankato will likely occur early in 2005, if logistics permit. The MSU-Mankato Water Resources Center has become a leader and advocate for Minnesota River Basin education and outreach, research, data management and assessment, technical support, and planning and coordination; so transfer of the MCES Minnesota River monitoring program to MSU-Mankato will further enhance the Water Resources Center mission and emphasize the importance of water quality monitoring in the Minnesota River Basin.

## IWMI Progress During the 2002-2003 Biennium

A number of regional, state, and federal agencies participate in the Interagency Water Monitoring Initiative (IWMI), including MCES, MPCA, MDNR, MDH, MDA, BWSR, the Minnesota Office of Planning, USGS, USACE, USDA, and NOAA[1]. As a long-term goal, the IWMI is working to achieve increased interagency coordination and cooperation for statewide water monitoring programs, as well as increased capability for sharing water monitoring data and environmental information. The IWMI surface water and ground water committees, with active MCES participation, continue to meet regularly to achieve this goal.

Several highlights during the 2002-2003 biennium include:

- In October 2001, the IWMI surface water committee met to discuss and provide feedback to the State Office of Planning on the state "Water Unification Initiative" and the state water plan ("Minnesota Watermarks").

- In June 2003, IWMI participants (including MCES) prepared a summary of Monitoring Action Steps taken in 2002, related to the Goals and Milestones from Chapter 5 of the Minnesota Nonpoint Source Management Plan (NSMPP). Submittal to the US Environmental Protection Agency of Monitoring Action Step updates is a condition for continuing receipt of federal Section 319 funds by the MPCA.

**Table 1. Acronyms of Agency Names**

[1] See Table 1 for complete agency names.

| | |
|---|---|
| BWSR | Minnesota Board of Water and Soil Resources |
| MCES | Metropolitan Council Environmental Services |
| MDA | Minnesota Department of Agriculture |
| MDH | Minnesota Department of Health |
| MDNR | Minnesota Department of Natural Resources |
| MPCA | Minnesota Pollution Control Agency |
| NOAA | National Oceanographic and Atmospheric Administration |
| USACE | United States Army Corps of Engineers |
| USDA | United States Department of Agriculture |
| USGS | United States Geological Survey |

## MCES Water Monitoring Programs

The two water monitoring programs that comprise the MCES contribution to the Interagency Water Monitoring Initiative include the "Metropolitan Area Watershed Outlet Monitoring Program" and the

"Mercury and PCB Inputs to the Minnesota River Monitoring Program." Both programs use the same monitoring technology and the same data format for reporting the monitoring results. However, each program has a slightly different objective.

## Metropolitan Area Watershed Outlet Monitoring Program

The "Metropolitan Area Watershed Outlet Monitoring Program," implemented in early 1998, significantly expanded the existing stream monitoring network in the Twin Cities Metropolitan Area (TCMA). Eight new monitoring sites (Bassett Creek, Cannon River, Crow River, Eagle Creek, Minnehaha Creek, Riley Creek, Valley Creek, and Willow Creek) were established in eight TCMA watersheds. The physical and chemical data from these eight monitoring sites are being used by MCES to develop target pollutant loads for these watersheds, and to measure water quality improvements as best management practices are implemented.

Local partners conduct the monitoring at these locations with guidance and oversight from the MCES project coordinator, Leigh Harrod. Local partners include the Science Museum of Minnesota (St. Croix Watershed Research Station), the Bassett Creek Watershed Management Organization, the Minneapolis Park and Recreation Board, the Wright County Soil and Water Conservation District, the Dakota/Goodhue County Soil and Water Conservation Districts, the Black Dog Watershed Management Organization, the Riley-Purgatory-Bluff Creek Watershed District, and the Lower Minnesota River Watershed District. To support and encourage the participation of local partners, MCES covers 75% of the monitoring cost for each site with the state funding, while the local partner contributes 25% of the monitoring cost.

## Mercury and PCB Inputs to the Minnesota River Monitoring Program

The "Mercury and PCB Inputs to the Minnesota River Monitoring Program," implemented in the fall of 1998, expanded the existing MCES river and stream monitoring network in the Minnesota River Basin. The objective of this program is to investigate sources and measure loads of mercury, PCB, and other non-point source pollutants in the Minnesota River Basin. Sources of mercury and PCB are contributing to fish consumption advisories in the Minnesota River, and sources of sediment, nutrients, and bacteria are contributing to a general degradation of Minnesota River water quality. Six monitoring sites are operating in the Mankato, MN area. Monitoring sites are located on the Minnesota River at Judson and St. Peter, and within the Blue Earth and Le Sueur River Watersheds. The monitoring work for this program is being conducted in cooperation with the Minnesota Department of Agriculture (MDA), the U.S. Geological Survey (USGS), and the Minnesota Pollution Control Agency (MPCA).

# Metropolitan Area Watershed Outlet Monitoring Program

## Introduction

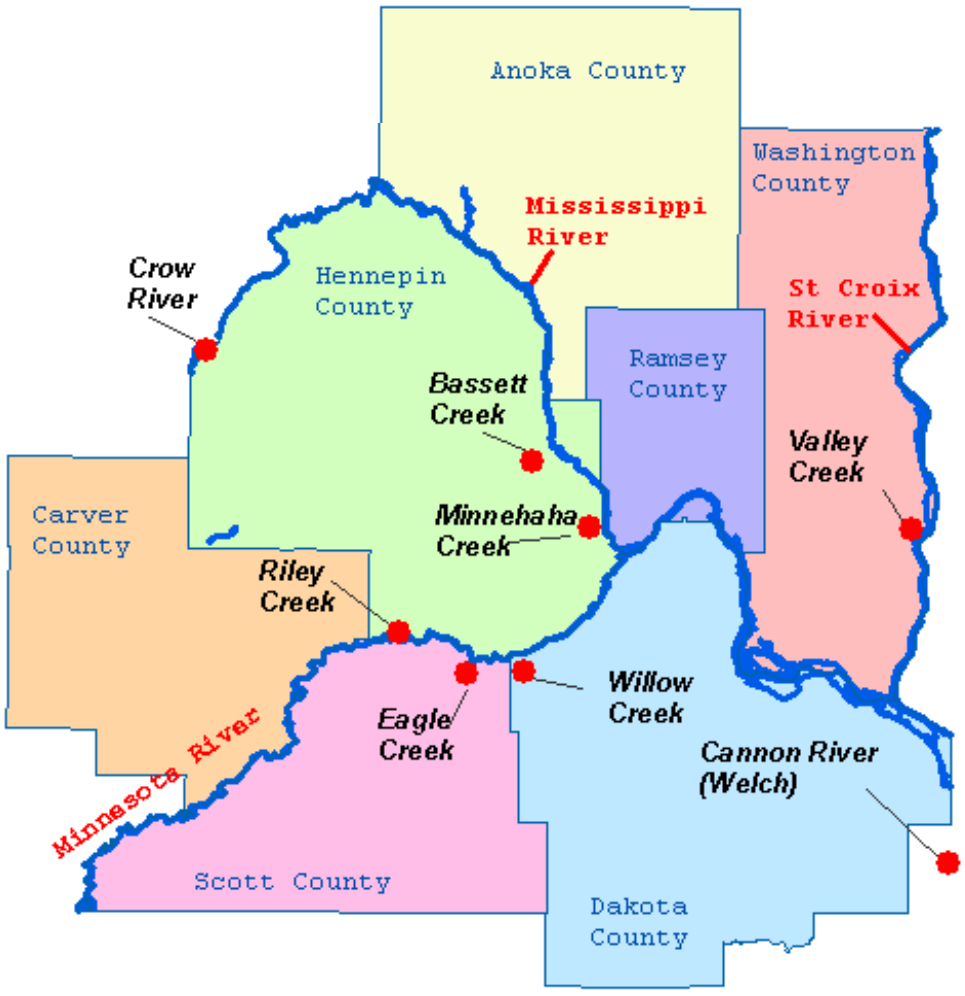
The "Metropolitan Area Watershed Outlet Monitoring Program (WOMP)", implemented in early 1998, has significantly expanded the existing MCES stream monitoring network in the Metropolitan Area. In February 1998, MCES hired Leigh Harrod as a Senior Environmental Scientist to coordinate the program, including establishment of up to ten new stream monitoring stations in Metropolitan Area watersheds. The objective of this program is to collect the water quality data needed to assess current watershed conditions and develop target pollutant loads. As the target loads are developed, the monitoring stations can measure progress toward achievement of the target loading goals as non-point source best management practices (BMPs) are implemented in these watersheds.

In 1998, continuous monitoring stations in seven different Metropolitan Area watersheds were constructed near the outlets of five streams and two rivers, which are tributaries to the Mississippi, Minnesota, and St. Croix Rivers. Continuous, year-round monitoring began in 1999 and all stations are fully functional to date. These seven stations are located near the outlets of the Cannon River, Crow River, Eagle Creek, Minnehaha Creek, Riley Creek, Valley Creek, and Willow Creek. In 2000, an eighth station was established on Bassett Creek. Locations of all eight WOMP stations are indicated in Figure 1. A ninth WOMP station (Cottage Grove Ravine) was scheduled for construction in the fall of 2001. However, the South Washington County Watershed District decided to implement its own monitoring program, without MCES support.

The fieldwork for this program is provided through cooperative, cost-share grant agreements with a number of local units of government in the Metropolitan Area. Local partners conduct the monitoring at these locations with guidance and oversight from the MCES project coordinator, Leigh Harrod. Local partners include the Science Museum of Minnesota (St. Croix Watershed Research Station), the Bassett Creek Watershed Management Organization, the Minneapolis Park and Recreation Board, the Wright County Soil and Water Conservation District, the Dakota/Goodhue County Soil and Water Conservation Districts, the Black Dog Watershed Management Organization, the Riley-Purgatory-Bluff Creek Watershed District, and the Lower Minnesota River Watershed District. To support and encourage the participation of local partners, MCES covers 75% of the monitoring cost for each site with the state funding, while the local partner contributes 25% of the monitoring cost.

This portion of the biennial report will describe the status of the "Metropolitan Area Watershed Outlet Monitoring Program (WOMP)" during the 2002-2003 biennium. Measures of monitoring success are described in terms of monitoring activity, number of samples obtained, number of analyses conducted, monitoring lessons learned, the continuation and enhancement of cooperative partnerships, data management and reporting, and uses and requests for WOMP data. The budget and financial accounting of funds used to date for this program are included in the **Budget** section of this report, which provides budget and financial information for both MCES monitoring programs.

**Figure 1**
**MCES Watershed Outlet Monitoring Station Locations**




## Monitoring Program Design

The streams enrolled in the "Metropolitan Area Watershed Outlet Monitoring Program" (WOMP) are characterized by a multitude of land uses within their watersheds. Twin Cities Metropolitan Area (TCMA) watersheds have been altered into a heterogeneous mix, ranging from the high-density urban corridors of Bassett Creek, to the suburban environs of Willow Creek, to the agricultural landscape of the Crow River basin, to the predominantly native vegetation that provides habitat for trout in Valley and Eagle Creeks. The variation in water quality among watersheds is dramatic. The monitoring results from each WOMP watershed, as distinguished by its land use characteristics, can therefore serve as a baseline for other watersheds that are not actively monitored but share similar characteristics.

## Monitoring Site Locations and Descriptions

### 1. Bassett Creek in Minneapolis, MN

BS 1.9 The Bassett Creek monitoring station is located in Minneapolis, MN, 1.9 miles upstream from the creek confluence with the Mississippi River and 0.25 mile upstream of a storm sewer flowing under downtown Minneapolis, in T118N R24W Sec.13. The station was activated in March 2000. Watershed area is approximately 43 square miles. Land use is urban, with 60% residential, 18% commercial-industrial, 14% open space, and 5% open water.

A digital sonic ranging sensor measured continuous stage during the 2000-2002 period. Electrical interference from nearby power lines prompted the installation of a gas-purge bubbler system in 2003 to measure stage, although the sonic sensor still remains active to serve as a check on the bubbler stage. A Campbell datalogger records precipitation from a tipping bucket rain gage, as well as 15-minute stage, temperature, and conductivity measurements. An automatic sampler captures event-generated, flow-weighted composite samples to supplement monthly grab samples. The local cooperator is the Minneapolis Park and Recreation Board, which is assisted by the Bassett Creek Watershed Management Organization through its technical consultant, Barr Engineering. Barr Engineering maintains the rating curve at this location.

### 2. Cannon River in Welch, MN

CN 11.9 The Cannon River monitoring station is located in Welch, MN, 11.9 miles upstream from the river confluence with the Mississippi River, in T113N, R16W, Sec.27. The station was activated in 1999, and is shared with the USGS Station No. 05355200. Watershed area is approximately 1,340 square miles. Land use is predominantly agricultural with some forest and scattered urbanized areas.

Instruments coupled to a Campbell datalogger include a digital shaft encoder installed in a stilling well to continuously measure stage, a tipping bucket rain gauge, in-stream temperature and conductivity probes, and an automatic sampler that captures event-generated flow-weighted composite samples to supplement monthly grab samples. A mechanical wire-weight gauge serves as an independent reference point to assure that the shaft encoder is accurately measuring stage. The local cooperator is the Dakota

County Soil and Water Conservation District (SWCD), with assistance from the Goodhue County SWCD. The site rating curve is maintained by the USGS.

**3. Crow River in Rockford, MN**

CW 23.1 The Crow River monitoring station is located in Rockford, MN, 23.1 miles upstream from the river confluence with the Mississippi River and 1 mile below the confluence of the North and South Branches of the Crow River, in T119N, R24W, Sec.29, on the northwest bank of the MN Highway 55 Bridge. The station was activated in 1999. Watershed area is approximately 2,620 square miles. Land use is 87% agricultural with 8% open water and wetland areas. Urbanization is increasing in Wright and Hennepin Counties along the riparian corridor.

A digital dry-gas pressure system continuously measures stage, which is recorded by a Campbell datalogger. Other monitoring equipment includes a staff gauge mounted to the MN Highway 55 Bridge footing, a wire weight gage, a tipping bucket rain gauge, in-stream temperature and conductivity probes, and a refrigerated automatic sampler that captures event-generated flow-weighted composite samples to supplement monthly grab samples. The local cooperator is the Wright County SWCD. The site rating curve is derived from the USGS rating curve table for Station No. 05280000 at Rockford.

**4. Eagle Creek in Savage, MN**

EA 0.8 The Eagle Creek monitoring station is located in Savage, MN, 0.8 mile upstream from the creek confluence with the Minnesota River, in T118N, R21W, Sec.7, under the 126$^{th}$ Street Bridge. The station was activated in 1999. Eagle Creek is an MDNR-designated trout stream, with base flow supplied by artesian groundwater discharging at Boiling Springs, and with native habitat largely intact. Watershed area is approximately 3.4 square miles. Despite the small watershed area, monitoring at this location provides an ideal control site because land use is largely native vegetation, despite increasing development pressure in this area of Scott County. The City of Savage has implemented a 100-foot buffer strip along the stream corridor as a best management practice (BMP).

A Campbell datalogger continuously captures stage readings from a digital dry-gas pressure system. Other monitoring instruments include a staff gauge, a tipping bucket rain gauge, in-stream temperature and conductivity probes, and an automatic sampler that captures event-generated flow-weighted composite samples to supplement monthly grab samples. The local cooperator is the Lower Minnesota River Watershed District, but the City of Savage and HDR Engineering have been conducting the monitoring work on behalf of the watershed district. The site rating curve was initially developed by the MDNR, but maintenance of the rating curve is achieved by in-stream wading rod measurements conducted by HDR and MCES staff.

**5. Minnehaha Creek in Minneapolis, MN**

MH 1.7 The Minnehaha Creek monitoring station is located in Minneapolis, MN, 1.7 miles upstream from the creek confluence with the Mississippi River, in T117N, R24W,

Sec.14, on City of Minneapolis park property at 32nd Avenue South, west of MN Highway 55. The station was activated in 1999. Land use in the watershed is predominantly riparian urban with a network of upland lake and wetland storage. Watershed area is 181 square miles, including Lake Minnetonka. The urbanized, lower watershed area, without Lake Minnetonka, is 55 square miles, or 31% of the total watershed area. The lower watershed area contributes most of the creek's annual pollutant loading into the Mississippi River at the confluence near Ft. Snelling.

Stage and flow are measured by a digital dry-gas pressure system and recorded by a Campbell datalogger. There is no rain gauge at this station. Other monitoring instruments include in-stream temperature and conductivity probes and an automatic sampler that captures event-generated flow-weighted composite samples to supplement monthly grab samples. The local cooperator is the Minneapolis Park and Recreation Board. Site rating curve measurements have been regularly obtained by Wenck Engineering on behalf of the Minnehaha Creek Watershed District, but MCES will be assuming this responsibility during the 2004-2005 biennium.

**6. Riley Creek in Eden Prairie, MN**

RI 1.3 The Riley Creek monitoring station is located in Eden Prairie, MN, 1.3 miles upstream from the creek confluence with the Minnesota River, in T116N, R22W, Sec.33. The monitoring station is situated at the base of a steep bluff river terrace, and a box culvert situated underneath Flying Cloud Drive (MN Highway 212) serves as the site control structure. The station was activated in 1999. Land use in the watershed is transitioning from a former agricultural base to a suburban residential and commercial community. In 2000, about 31% of the watershed area was categorized as undeveloped or open space. Watershed area is approximately 13 square miles.

A Campbell datalogger continuously captures stage measurements from a digital sonic ranging sensor mounted under the box culvert. A staff gauge mounted on a wing of the box culvert serves as a reference stage. Other monitoring instruments include a tipping bucket rain gauge, in-stream temperature and conductivity probes, and an automatic sampler that captures event-generated flow-weighted composite samples to supplement monthly grab samples. Barr Engineering operates the station and maintains the rating curve on behalf of the Riley-Purgatory-Bluff Creek Watershed District.

**7. Valley Creek in Afton, MN**

VA 1.0 The Valley Creek monitoring station is located in Afton, MN, 1.0 mile upstream from the creek confluence with the St. Croix River, in T28N, R20W, Sec.15, at the Putnam Boulevard Bridge. The station was activated in 1999. Valley Creek is an MDNR-

designated trout stream located in a groundwater discharge zone. Land use in the watershed is largely a mix of agriculture and rural residential development, although large tracts have been set aside in land trusts and restored to prairie. In addition, much of the riparian corridor is re-developing into floodplain forest following cessation of agriculture in the stream valley 30-40 years ago. Watershed area is approximately 16.8 square miles.

A Campbell datalogger continuously captures stage readings from a digital dry-gas pressure system. Other monitoring instruments include a staff gauge, in-stream temperature and conductivity probes, and an automatic sampler that captures event-generated flow-weighted composite samples to supplement monthly grab samples. Precipitation data is collected by a tipping bucket rain gauge on the Belwin property west of the station. The St. Croix Watershed Research Station (part of the Science Museum of Minnesota) operates the station and maintains the rating curve on behalf of the Valley Branch Watershed District.

**8. Willow Creek in Burnsville, MN**

WI 1.0 The Willow Creek monitoring station is located in Burnsville, MN, 1.0 mile upstream from the creek confluence with the Minnesota River, in T115N, R21W, Sec.14, behind the Cub Foods store on MN Highway 13. The station was activated in 1999. Land use in the watershed is predominantly residential, with 20% open space and agriculture remaining. Watershed area is approximately 10 square miles.

A Campbell datalogger continuously captures stage readings from a digital sonic ranging sensor. Other monitoring instruments include a tipping bucket rain gauge, in-stream temperature and conductivity probes, and an automatic sampler that captures event-generated flow-weighted composite samples to supplement monthly grab samples. The automatic sampler and Campbell datalogger are housed in an above-ground shelter, while the other monitoring instruments are mounted in an underground box culvert. The rating curve at this site is based upon a Manning equation, because it is too hazardous to enter the culvert with a wading rod during high flows, and the confined space creates a safety issue. This site is particularly flashy due to the predominance of impervious cover in the watershed. Barr Engineering operates the station and maintains the rating curve on behalf of the Black Dog Watershed Management Organization.

Additional information on the eight MCES WOMP sites is presented in **Appendix A**.

## Monitoring Activity and Analyses

Since July 1999, seven WOMP stations have continuously logged stream flow, temperature and conductivity, with 15-minute average values reported. Bassett Creek was activated in March 2000. All stations captured both water quality samples and continuous discharge data for snowmelt and

storm-generated runoff during the 2002-2003 biennium. In addition, monthly base flow samples were collected at all sites. Six of the eight stations are equipped with rain gauges.

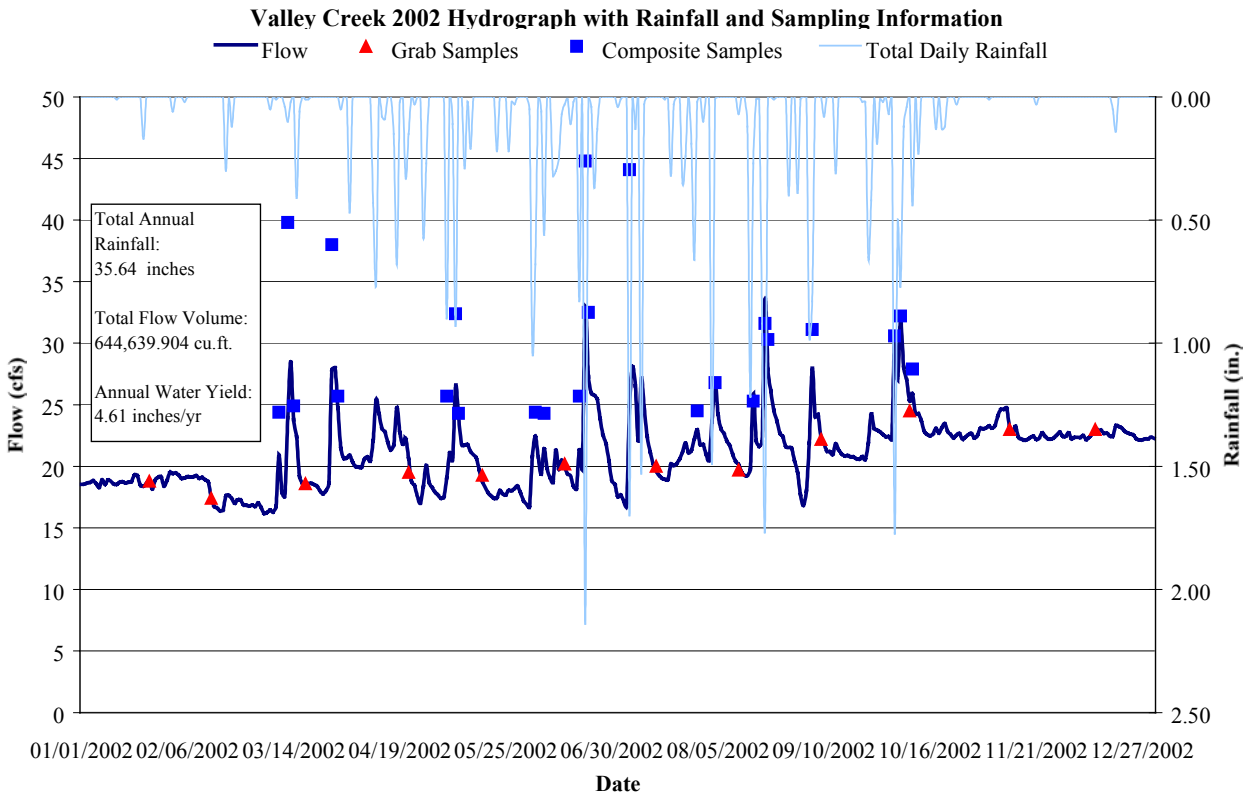
Table 2 summarizes the numbers of grab and composite samples obtained at each WOMP site during the 2002-2003 biennium.

**Table 2. Numbers of Grab and Composite Samples Obtained at MCES WOMP Monitoring Sites during the 2002-2003 Biennium**

| Station | No. of samples: COMPOSITES | No. of samples: GRABS |
|---|---|---|
| BASSETT CREEK | 26 | 31 |
| CANNON RIVER | 19 | 30 |
| CROW RIVER | 28 | 35 |
| EAGLE CREEK | 22 | 24 |
| MINNEHAHA CREEK | 39 | 27 |
| RILEY CREEK | 26 | 25 |
| VALLEY CREEK | 35 | 24 |
| WILLOW CREEK | 37 | 16 |
| TOTALS | 232 | 212 |

Figure 2 illustrates the 2002 hydrograph for Valley Creek. This hydrograph depicts the sampling strategy used for the collection of grab and composite samples. Composite samples are collected during periods of storm-generated runoff and higher flows. Grab samples are obtained during baseflow conditions, and are also used as needed to supplement composite samples during high-flow periods.

**Figure 2. 2002 Hydrograph, with Sampling Information, for Valley Creek**




All grab and composite samples are transported by the WOMP cooperators to the MCES Laboratory Services Section in St. Paul, MN. Each sample can be analyzed for water transparency, total and volatile suspended solids, turbidity, alkalinity, hardness, metals, chlorides and sulfides, nitrogen, phosphorus, chlorophyll-a, total organic carbon (TOC), chemical oxygen demand (COD), biochemical oxygen demand (BOD), and fecal coliform bacteria. Table 3 shows the types and numbers of chemical analyses that were conducted on water samples from the eight WOMP sites during the 2002-2003 biennium.

**Table 3. Types and Numbers of Chemical Analyses Conducted for MCES WOMP Monitoring Sites during the 2002 – 2003 Biennium**

| | Bassett Creek | Cannon River | Crow River | Eagle Creek | Minnehaha Creek | Riley Creek | Valley Creek | Willow Creek | Total Analyses |
|---|---|---|---|---|---|---|---|---|---|
| Total Submissions | 71 | 50 | 79 | 55 | 77 | 56 | 70 | 64 | |
| ***Analytes*** | | | | | | | | | |
| Alkalinity | 70 | 50 | 62 | 55 | 77 | 56 | 64 | 64 | **498** |
| 5-day BOD | 59 | 25 | 38 | 38 | 64 | 35 | 30 | 30 | **319** |
| 5-day CBOD | 25 | 12 | 15 | 17 | 25 | 15 | 14 | 8 | **131** |
| Total Organic Carbon | 38 | 28 | 45 | 29 | 48 | 34 | 41 | 38 | **301** |
| Chemical Oxygen Demand | 70 | 50 | 62 | 55 | 77 | 56 | 70 | 64 | **504** |
| Fecal Coliform Bacteria | 33 | 32 | 21 | 22 | 29 | 21 | 18 | 13 | **189** |
| Hardness | 70 | 50 | 62 | 55 | 77 | 56 | 69 | 64 | **503** |
| Copper | 53 | 28 | 25 | 37 | 58 | 31 | 32 | 34 | **298** |
| Nickel | 53 | 28 | 25 | 37 | 58 | 31 | 32 | 34 | **298** |
| Lead | 53 | 28 | 25 | 37 | 58 | 31 | 32 | 34 | **298** |
| Zinc | 53 | 28 | 25 | 37 | 58 | 31 | 32 | 34 | **298** |
| Cadmium | 53 | 28 | 25 | 37 | 58 | 31 | 32 | 34 | **298** |
| Total Chlorophyll a | 2 | 0 | 1 | 8 | 2 | 4 | 2 | 4 | **23** |
| Total Chlorides | 71 | 50 | 61 | 55 | 77 | 56 | 70 | 64 | **504** |
| Total Sulphates | 37 | 28 | 45 | 29 | 48 | 34 | 44 | 38 | **303** |
| Nitrate N | 71 | 50 | 62 | 55 | 77 | 56 | 69 | 64 | **504** |
| Nitrite N | 71 | 50 | 62 | 55 | 77 | 56 | 69 | 64 | **504** |
| Ammonia NH3 | 69 | 50 | 62 | 55 | 77 | 56 | 70 | 64 | **503** |
| TKN | 71 | 50 | 62 | 55 | 77 | 56 | 70 | 64 | **505** |
| Total Phosphorus | 71 | 50 | 62 | 55 | 77 | 56 | 70 | 64 | **505** |
| Orthophosphorus | 63 | 31 | 39 | 44 | 70 | 29 | 31 | 26 | **333** |
| Dissolved Phosphorus | 71 | 50 | 62 | 54 | 77 | 56 | 70 | 64 | **504** |
| Total Suspended Solids | 69 | 50 | 61 | 54 | 77 | 56 | 59 | 64 | **490** |
| Total Volatile Solids | 69 | 50 | 61 | 54 | 77 | 56 | 59 | 64 | **490** |
| Turbidity | 67 | 43 | 58 | 42 | 77 | 40 | 49 | 38 | **414** |
| **Total Analyses** | **1432** | **939** | **1128** | **1071** | **1577** | **1039** | **1198** | **1133** | **9517** |

## Monitoring Lessons Learned

In addition to the same lessons learned in the "Mercury and PCB Inputs to the Minnesota River Monitoring Program" (page 29), the added experience gained since establishment of the WOMP

stations in 1998 has been equally valuable to both programs. Lessons learned in hindsight frequently lead to changes in procedures and station design. Had the lessons learned by this hindsight initially been discernable when the program started, they would have been incorporated from the outset. Below are several important lessons that have been learned, which in the end have strengthened the program.

- **Power Supply Can be Fickle:** Even though the WOMP stations are all served by commercial AC power supply, this source of energy can become unstable, particularly during electrical storms. The dataloggers and samplers all have battery backup, but these deplete fairly rapidly without restoration of AC power to recharge them. Sometimes something as simple as a ground fault interrupter being tripped by a power surge can cause the trickling recharge system to fail. Field staff, being surprised to see no display in the LCD of the sampler, may initially conclude that the sampler itself has failed when actually the culprit is the AC power supply. The lesson learned is as follows: One should always suspect power supply problems first before examining or replacing the equipment.

- **Daily Downloading:** The Campbell datalogger software has the capability to automatically download on a schedule independent of whether or not the station operator is present at the computer. A daily download can always be conducted manually, but experience has found that the use of the automatic download feature is more efficient. Statistics displayed after each download can quickly alert the data owner if a potential problem exists at the station.

- **WOMP Coordination:** Regular on-going coordination and oversight of the consortium of WOMP cooperators from local governments is essential to a successful program. A program this large must have oversight to assure that the standardized monitoring protocols are being followed. Otherwise each cooperator can quickly diverge into their own way of doing things. If this tendency to diverge were allowed to occur unchecked or unnoticed, then the integrity of the monitoring data would ultimately become compromised. Additionally, since rainfall often occurs late at night, on weekends, or on holidays, the availability of a WOMP Coordinator assures that the stations are still being managed remotely even during off-duty hours. Opportunities to check the status of the stations, activate the automatic samplers, and capture event-generated composite samples are not missed simply because they occur when no one is at the office. WOMP coordination also figures prominently when local cooperators are unable to address equipment failure or a need for station maintenance.

## Cooperative Monitoring Partnerships

### Local Monitoring Partners

With direction and oversight provided by MCES staff, local cooperators are conducting WOMP monitoring. Watershed districts, soil and water conservation districts, cities, and non-profit

organizations participate as WOMP cooperators through cost-share grant agreements with MCES. To achieve greater benefit from the legislative funding, the local cooperators provide 25% of the lab, labor, mileage, and new equipment costs for the WOMP stations, while MCES provides the remaining 75%. MCES pays 100% of maintenance costs for both stations and equipment, and pays all the utility bills.

Cooperators have been participating in a WOMP "user group" forum, which serves as a network for coordinating stream monitoring efforts and for facilitating training when new sampling protocols are introduced. MCES staff facilitate the meetings, which inform cooperators about any changes in data management, monitoring equipment, and technology. MCES will continue to conduct these meetings in response to cooperators' requests for training.

**Appendix A** provides a list of all WOMP cooperators and their contact information.

**New Partnerships with Watershed Districts**

The presence of MCES WOMP stations in watersheds throughout the Metropolitan Area has stimulated an increasing interest in stream monitoring by local governments. In 2002, the Nine Mile Creek and Riley-Purgatory-Bluff Creek Watershed Districts approached MCES with a request to build six new water monitoring stations in the Nine Mile and Purgatory Creek Watersheds, and further offered to pay for all construction and operating costs. These two watershed districts expressly asked that the new stations be modeled after current MCES WOMP stations such as those on Nine Mile, Riley, and Bluff Creeks. Both districts will be following all WOMP monitoring protocols and using the MCES laboratory for chemical analysis of all water samples.

Under a contract for services agreement, MCES built six new WOMP-style stations, including three new stations in the Nine Mile Creek watershed, and another three in the Purgatory Creek watershed. MCES trades staff built the stations, with guidance and oversight from Leigh Harrod. Construction of these stations has just been completed and monitoring has been implemented according to WOMP protocols. The watershed districts reimbursed all MCES costs, thereby paying 100% of construction and equipment costs, representing a significant financial commitment to long-term continuous monitoring of their watersheds.

The fact that these local governments chose to model their monitoring program after the MCES WOMP program is a testament to the high regard they hold for this program, and to the value they place upon the need for reliable stream monitoring data.

## Data Management and Reporting

Every six months, the continuous monitoring data from the WOMP stations are compiled by the cooperators in a specified format and reported to MCES WOMP Coordinator. The WOMP Coordinator works closely with the cooperators to check the monitoring data.

Excel is currently the easiest tool for the WOMP cooperators to use for reporting the data obtained from their respective monitoring stations. All the cooperators have been trained to download data in

an identical manner, and a pre-formatted Excel template has been developed for storage of their data. Data from the individual cooperators is imported into an MCES Oracle database.

From the MCES Oracle database, the WOMP data can be exported to the MPCA in a variety of formats, or provided directly in the original Excel templates submitted by the cooperators. Each year two data sets are delivered to the MPCA: one data set consists of daily averages for stage, flow, rainfall, conductivity and temperature; and the second data set consists of the laboratory results from sampling. Both data sets currently are provided to the MPCA in an Excel spreadsheet.

Two monitoring reports, including the results of all MCES monitoring conducted during the July - December 2001 and January – December 2002 periods, have already been provided to the MPCA. A third monitoring report, which will include the results of all MCES monitoring conducted during the January – June 2003 period, will be provided to the MPCA by September 30, 2003.

It is recognized that the current format for data submittal is an interim solution that will be modified in the future to reflect the needs of both MCES and the MPCA. MCES is in the process of implementing an Environmental Information Management System (EIMS) for data management. As this tool evolves, decisions regarding data format, data retrieval, and data delivery to MPCA can be incorporated into the final output.

A further analysis of 2001 monitoring information from all MCES WOMP and Minnesota River sites can be found in the report: "Metropolitan Council Environmental Services 2001 Stream Monitoring Report". This report was prepared by MCES staff and distributed to the MPCA, other state and federal agencies, and the local government partners at the end of 2002. For each monitoring station, the report provides a watershed land use map, an annual hydrograph with rainfall and sampling information, a summary of water chemistry information, annual loading information for suspended solids and nutrients, and macroinvertebrate monitoring results and metrics. The "Metropolitan Council Environmental Services 2002 Stream Monitoring Report" is currently being prepared for distribution at the end of 2003.

## Use of WOMP Monitoring Data

WOMP monitoring data continue to be requested and used by a number of agencies, as well as individuals conducting research. Consultants and agencies often report that they now focus the design of their hydrologic studies upon watersheds that have WOMP stations, because the WOMP datasets are purportedly the best available.

During the 2002-2003 biennium, WOMP data were requested by the USGS for a major groundwater recharge study. MDNR requested Eagle Creek data, MPCA asked for chloride data, and the Cannon River Watershed Joint Powers Organization (JPO) used WOMP data to assess loads for a TMDL study. Both the Minnesota Department of Transportation and consultants for the Minnehaha Creek Watershed District continue to request stream flow data for use in assessing possible impacts of the MN Highway 55 construction project, the impact of construction at the International Airport upon Camp Coldwater Springs, and the effect of dewatering activities upon Lake Nokomis.

In addition to external agency use, the local cooperators are using WOMP data for their own watershed projects. Barr Engineering is cataloging Riley Creek, Willow Creek, and Bassett Creek WOMP data in anticipation of MCES development of target pollutant loads, TMDL studies, and implementation of MPCA Phase II stormwater rules in Hennepin County municipalities. Baseline data are frequently supplied to developers and municipalities for planning projects.

The Minneapolis Park and Recreation Board (MPRB) publishes the Minnehaha Creek monitoring results in their annual "Water Resources Report". This report can be found in the Minneapolis public libraries. The MPRB reports that they receive many requests for data from consultants working on various projects. The MPRB uses the WOMP data for their own internal planning projects, including streambank restoration projects throughout the city. In 2003, the Minnehaha Creek Watershed District used WOMP data to calibrate an XP-SWMMS hydrology model of the entire watershed.

The Crow River Organization of Water (a 10-county JPO) used the data from the Rockford WOMP station in their initial Crow River Diagnostic Study. Results and findings of that study have now identified several "management areas" in the Crow River that will be the initial focus of a Phase 2 implementation plan under a Clean Water Partnership grant.

Flow data from the Riley Creek, Eagle Creek, and Willow Creek WOMP stations will be used for the development of a Lower Minnesota River water quality model during the 2004-2006 period. Partners in this modeling effort include MCES, MPCA, USACE, USGS, and the Lower Minnesota River Watershed District.

Valley Creek WOMP data have been used during the 2002-2003 biennium to support a University of Minnesota master's thesis on nutrient dynamics, a study that was also partially funded by the Minnesota Board of Water and Soil Resources. WOMP data also supported a successful Legislative Committee on Minnesota Resources (LCMR) study that modeled both the surface and ground water of trout streams facing urbanization. The St. Croix Watershed Research Station reports many requests for data from various universities, including the University of Minnesota Department of Fisheries and Wildlife. The use of Valley Creek WOMP data provides an excellent example of how data from WOMP stations continue to support many spin-off studies and research efforts.

## Contact Information for the Metropolitan Area Watershed Outlet Monitoring Program

Questions or comments about this report or the Metropolitan Area Watershed Outlet Monitoring Program may be directed to:

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# Mercury and PCB Inputs to the Minnesota River Monitoring Program

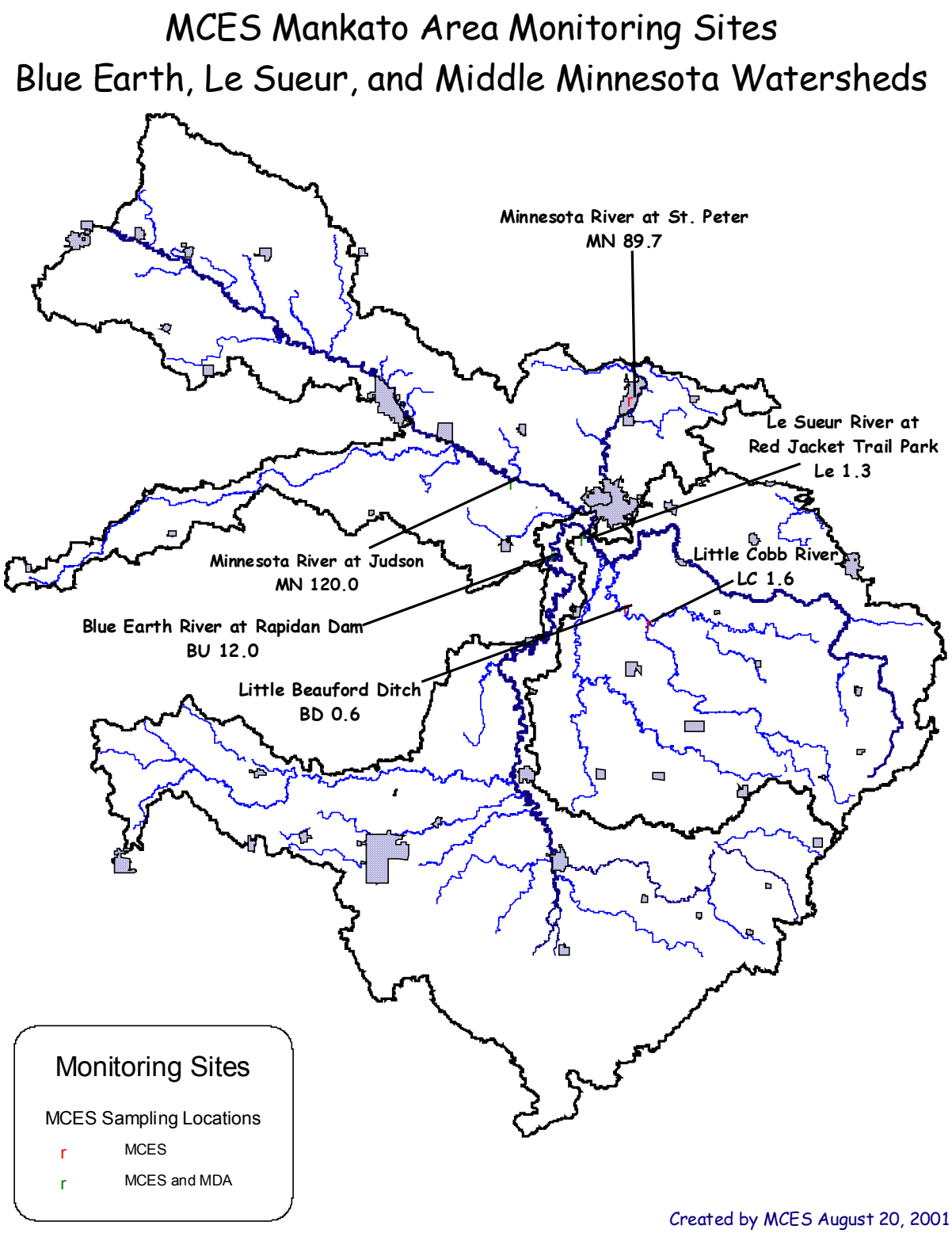
## Introduction

The "Mercury and PCB Inputs to the Minnesota River Monitoring Program" began in the fall of 1998, with the establishment of six monitoring stations in the vicinity of Mankato, MN. The program's objective is to investigate sources and measure loads of mercury, PCB, and other nonpoint source pollutants in the Middle Minnesota River, Blue Earth River, and Le Sueur River Watersheds of the Minnesota River Basin. Two monitoring stations are located on the Minnesota River at Judson and St. Peter in the Middle Minnesota River Watershed. One monitoring station is located near the mouth of the Blue Earth River in the Blue Earth River Watershed. The three remaining monitoring stations are all located in the Le Sueur River Watershed. One station is located near the mouth of the Le Sueur River, and two stations are located on smaller tributaries (Little Cobb River and Little Beauford Ditch) in the Le Sueur River Watershed. Locations of the six Mankato area monitoring stations are presented in Figure 3.

MCES Research and Development Section staff members (Steve Balogh and Tom Franz) in St. Paul are providing support for the mercury and PCB monitoring components of the program. An MCES Environmental Monitoring and Assessment Section staff member (Heather Offerman) in the Mankato Field Office is providing support for the conventional pollutant monitoring component of the program.

This portion of the biennial report will describe the status of the "Mercury and PCB Inputs to the Minnesota River Monitoring Program" during the 2002-2003 biennium. Initial results are reported for the Hg and PCB monitoring components of the program during the second half of 2001. No other Hg or PCB samples were obtained during the remainder of the 2002-2003 biennium. For the conventional pollutant monitoring component, information is provided about the monitoring site locations, monitoring equipment, rating curve development, initial results, monitoring lessons learned, cooperative monitoring partnerships, and data management, analysis, and reporting. The budget and financial accounting of funds used to date for this program are included in the **Budget** section of this report, which provides budget and financial information for both MCES monitoring programs**.**

**Figure 3**




## Monitoring Site Locations and Descriptions

Land use in the Middle Minnesota River, Blue Earth River, and Le Sueur River Watersheds where the six monitoring stations are located is dominated by row crop agriculture, primarily corn and soybeans. A brief description of each monitoring station is provided below.

**Middle Minnesota River Watershed:**

**Minnesota River near Judson, MN**

MN 120.0 This Minnesota River monitoring station is located near Judson, MN, 120.0 miles upstream from the mouth of the Minnesota River, in T109, R28, S33, at the Minnesota Department of Natural Resources boat landing near Nicollet County Road 23 in Nicollet Township, Nicollet County. Watershed area is approximately 11,400 square miles

**Minnesota River in St. Peter, MN**

MN 89.7 This Minnesota River monitoring station is located in St. Peter, MN, 89.7 miles upstream from the mouth of the Minnesota River, in T110, R26, S21, behind the Chamber of Commerce Building near the MN Highway 99 Bridge in Oshawa Township, Nicollet County. Watershed area is approximately 15,500 square miles, encompassing 11 of the 12 major watersheds in the Minnesota River Basin.

**Blue Earth River Watershed:**

**Blue Earth River near Rapidan, MN**

BU 12.0 The Blue Earth River monitoring station is located near Rapidan, MN, 12.0 miles upstream from the confluence with the Minnesota River, in T107, R 27, S6, on the left descending river bank, 0.2 mile downstream from the power plant, in Rapidan Township, Blue Earth County. Watershed area is approximately 2,430 square miles.

**Le Sueur River Watershed:**

**Little Beauford Ditch near Beauford, MN**

BD 0.6 The Little Beauford Ditch monitoring station is located about 0.5 mile north of Beauford, MN, 0.6 mile upstream from the ditch confluence with the Little Cobb River, in T106, R26, S4, on MN Highway 22, in Beauford Township, Blue Earth County. Watershed area is approximately 7 square miles.

**Little Cobb River near Beauford, MN**

LC 1.6 The Little Cobb River monitoring station is located near Beauford, MN, 1.6 miles upstream from the river confluence with the Le Sueur River, in T106, R26, between S11 and S12, adjacent to the bridge on County Road 16, in Beauford Township, Blue Earth County. Watershed area is approximately 130 square miles.

**Le Sueur River in Red Jacket Trail County Park**

LE 1.3 The Le Sueur River monitoring station is located in the Red Jacket Trail County Park, 1.3 miles upstream from the river confluence with the Blue Earth River, in T108, R27, S34, 20 feet downstream from the MN Highway 66 Bridge, in South Bend Township, Blue Earth County. Watershed area is approximately 1,100 square miles.

The Le Sueur River Monitoring Location, May 2003

## Monitoring Equipment

The following is a general description of the monitoring equipment at each site, with exceptions noted.

All six monitoring sites have AC power and phone line connections to the shelter. Power is converted to DC with a Campbell Scientific Inc. (CSI) CH12R regulator charger. The data collection platform consists of a CSI CR10X datalogger with extended memory. The system operates with a 60-second execution interval and data are averaged and saved as output on a 15-minute basis. Stage is measured using a Design Analysis (DA) H350 Pressure Transducer and H355 dry gas bubbler system. The orifice for the bubbler is typically located in the stream, except at the Blue Earth River site below the Rapidan Dam, where the bubbler orifice is located in a USGS stilling well below the USGS building. Adjustments are made to the bubbler when readings deviate from actual stage by more than 0.02 foot. At several sites, stage measurements are also recorded as a backup on a PCMCIA flash memory card in the H350 instrument. Continuous in-stream temperature and conductivity are also recorded at most sites. Rainfall data is collected at all sites using a TE525 tipping bucket rain gauge. Regular or Refrigerated Sigma 900 autosamplers are used to collect storm runoff samples on an Equal Flow Increment (EFI) basis.

At the Judson and St. Peter sites on the Minnesota River, and at the Blue Earth River site below the Rapidan Dam, in-stream pumps are used to transfer water from the river to the monitoring shelter because of the large lift between the river and the shelters. The water is pumped into a reservoir in the shelter and the autosamplers sample from the reservoir. The in-stream pump is activated by the datalogger several minutes ahead of the actual sample collection, allowing the system to effectively purge prior to sample collection. Sample tubing connecting the shelter to the stream consists of both polypropylene and Teflon-lined polypropylene. All sites are equipped with heat tape to keep sample lines from freezing during cold weather.

Blue Earth River Monitoring Site, August 2002. The PVC pipe contains the gas bubbler line, pump line, and temperature and conductivity probes, which run from the river up to the monitoring station.

## Mercury Monitoring

Sampling and analysis of total mercury (THg) continued at all six monitoring sites during the July-December 2001 period, thereby extending the THg sampling and analysis conducted during the July 1999-June 2001 period. No mercury samples were obtained in 2002 or 2003. This mercury monitoring work, conducted by the MCES Research and Development Section, is an extension of previous MCES mercury monitoring of the Minnesota, Mississippi, and St. Croix Rivers in the Twin Cities Metropolitan Area. Steve Balogh is directing the mercury monitoring component of the program, with support from Yabing Huang. Grab samples were collected weekly during 2001 when waterways were open and ice free. In addition to monitoring THg concentrations, a substantial effort was directed toward characterizing methyl mercury (MeHg) concentrations in the target streams in 2000 and 2001. The MeHg data constitute the most comprehensive MeHg dataset yet produced for streams in Minnesota. The total numbers of THg and MeHg samples obtained at six sites during the July-December 2001 period are indicated in Table 4.

**Table 4. Numbers of Mercury Samples Collected and Analyzed, July – December 2001**

| Monitoring Site | River Mile | Total Hg | Methyl Hg |
|---|---|---|---|
| Minnesota River at St. Peter | MI 89.7 | 24 | 24 |
| Minnesota River at Judson | MI 120.0 | 24 | 24 |
| Blue Earth River near Rapidan | BU 12.0 | 24 | 24 |
| Le Sueur River in Blue Earth County | LE 1.3 | 24 | 24 |
| Little Cobb River near Beauford (Hwy 16) | LC 1.6 | 24 | 24 |
| Little Beauford Ditch near Beauford (Hwy 22) | BD 0.6 | 24 | 24 |

From the data collected and analyzed through the mercury monitoring component of this program, two articles have recently been published in scientific journals:

Balogh, S.J., Huang, Y., Offerman, H.J., Meyer, M.L., and Johnson, D.K. 2002. Episodes of elevated methylmercury concentrations in prairie streams. Environmental Science and Technology 36: 1665-1670.

Balogh, S.J., Huang, Y., Offerman, H.J., Meyer, M.L., and Johnson, D.K. 2003. Methylmercury in rivers draining cultivated watersheds. Science of the Total Environment 304: 305-313.

## PCB Monitoring

Polychlorinated biphenyl (PCB) monitoring efforts have continued in the Middle and Lower Minnesota River, Blue Earth River and Le Sueur River Watersheds through 2001. No PCB samples were obtained in 2002 or 2003. This PCB monitoring work is being conducted by the MCES Research and Development Section. Tom Franz is directing the PCB monitoring component of the program, with support from Angella Craft-Reardon. The total numbers of PCB samples obtained and PCB concentrations at six sites in 2001 are indicated in Table 5.
A complete review of the PCB monitoring component of this project can be found in **Appendix B**.

**Table 5. Numbers of PCB Samples Collected and Total PCB (Dissolved + Particulate) Concentrations in 2001**

| Monitoring Site | River Mile | Number Samples | Mean (ng/L) | Median (ng/L) | Range (ng/L) |
|---|---|---|---|---|---|
| Minnesota River at St. Peter | MI 89.7 | 9 | 0.0081 | 0.011 | 0.0001 - 0.046 |
| Minnesota River at Judson | MI 120.0 | 7 | 0.14 | 0.26 | 0.008 - 1.8 |
| Blue Earth River near Rapidan | BU 12.0 | 10 | 0.72 | 0.83 | 0.005 – 68 |
| Le Sueur River in Blue Earth County | LE 1.3 | 8 | 1.0 | 2.9 | 0.012 – 29 |
| Little Cobb River near Beauford (Hwy 16) | LC 1.6 | 10 | 4.7 | 5.9 | 0.13 – 66 |
| Little Beauford Ditch near Beauford (Hwy 22) | BD 0.6 | 10 | 5.5 | 13 | 0.17 – 55 |

## Conventional Pollutant Monitoring

The conventional pollutant monitoring component of the program has been successfully operating since 1998. A unique aspect of this component is the joint partnership between MCES and the Minnesota Department of Agriculture (MDA). MCES and MDA share office space in Mankato and monitoring responsibilities at three of the six monitoring locations. MDA shares monitoring duties and collects samples at the Le Sueur River, Blue Earth River, and Minnesota River at Judson sites, to quantify the long-term trends and impacts of normal pesticide use on surface water quality. This partnership is a functional template that illustrates the effectiveness of different government agencies working together toward a common goal, and how resources can be used in the most beneficial manner, with minimal duplication.

All six Mankato Area monitoring sites are fully operational. Data are logged continuously for water stage and flow, temperature, conductivity, and precipitation. Flow-composited samples are generated automatically during runoff events, and a bi-weekly grab sampling routine has been established at all sites. Grab samples characterize water quality under base flow conditions and supplement the automated composite samples taken during runoff events. Grab sampling is conducted year round as conditions permit, while composite sampling is typically conducted during the open-water season (March – October).

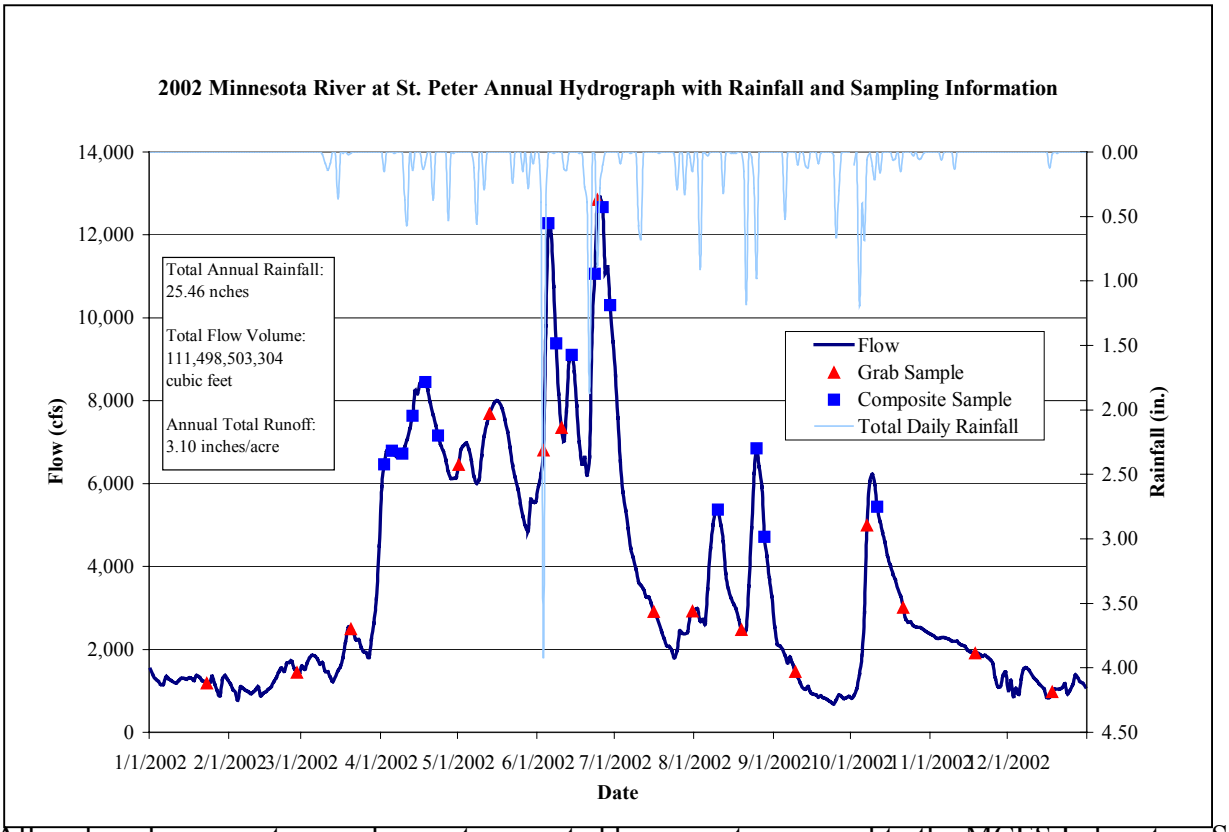
The monitoring record for the six Mankato Area sites has grown each year, beginning in 1999. In 1999, only a partial monitoring record is available for all sites, since the flow monitoring equipment was not installed until the summer months. Due to high water conditions at the two Minnesota River sites, monitoring equipment was not installed until October 1999. The 2000 monitoring season marked the first complete year of water quality monitoring at all six sites. Table 6 summarizes the numbers of grab and composite samples obtained at each site during the 2002-2003 biennium. As of June 30, 2003, approximately 774 grab and composite samples have been collected from the six monitoring locations since the program began in 1999.

**Table 6. Numbers of Grab and Composite Samples Obtained at MCES Mankato Area Monitoring Sites during the 2002-2003 Biennium**

| Monitoring Site | River Mile | Grab | Composite |
|---|---|---|---|
| Minnesota River at St. Peter | MI 89.7 | 35 | 27 |
| Minnesota River at Judson | MI 120 | 43 | 11 |
| Blue Earth River near Rapidan | BU 12 | 37 | 18 |
| Le Sueur River in Blue Earth County | LE 1.3 | 48 | 23 |
| Little Cobb River near Beauford (Hwy 16) | LC 1.6 | 37 | 18 |
| Little Beauford Ditch near Beauford (Hwy 22) | BD 0.6 | 38 | 5 |

Figure 4 illustrates the 2002 hydrograph for the Minnesota River at St. Peter. This hydrograph depicts the sampling strategy used for the conventional pollutant monitoring component of the program. Composite samples are collected during periods of storm-generated runoff and higher flows. Grab samples are obtained during baseflow conditions, and are also used as needed to supplement composite samples during high-flow periods.

**Figure 4. 2002 Hydrograph, with Sampling Information, for the Minnesota River at St. Peter**




All grab and composite samples are transported by project personnel to the MCES Laboratory Services Section in St. Paul, MN. Each sample can be analyzed for water transparency, total and volatile suspended solids, turbidity, alkalinity, hardness, metals, chlorides, nitrogen, phosphorus, chlorophyll-a, total organic carbon (TOC), chemical oxygen demand (COD), and biochemical oxygen demand (BOD). Table 7 shows the types and numbers of chemical analyses that have been conducted on water samples from the six monitoring sites during the 2002 – 2003 biennium.

**Table 7. Types and Numbers of Chemical Analyses Conducted for MCES Mankato Area Monitoring Sites during the 2002 – 2003 Biennium**

| | Beauford Ditch | Blue Earth River | Le Sueur River | Little Cobb River | Minnesota River at Judson | Minnesota River at St. Peter | Total Analyses |
|---|---|---|---|---|---|---|---|
| **Total Submissions** | 43 | 58 | 71 | 55 | 54 | 62 | |
| Alkalinity | 42 | 58 | 69 | 55 | 54 | 62 | 340 |
| 5-day BOD | 38 | 35 | 44 | 35 | 39 | 37 | 228 |
| Total Chlorophyll a | 40 | 37 | 47 | 42 | 42 | 38 | 246 |
| Chloride | 41 | 53 | 67 | 52 | 53 | 58 | 324 |
| COD | 40 | 39 | 49 | 45 | 51 | 45 | 269 |
| Hardness | 33 | 28 | 36 | 31 | 36 | 33 | 197 |
| Copper | 26 | 23 | 30 | 24 | 32 | 28 | 163 |
| Nickel | 26 | 23 | 30 | 24 | 32 | 28 | 163 |
| Lead | 26 | 23 | 30 | 24 | 32 | 28 | 163 |
| Zinc | 26 | 23 | 30 | 24 | 32 | 28 | 163 |
| Cadmium | 26 | 23 | 30 | 24 | 32 | 28 | 163 |
| Chromium | 26 | 23 | 30 | 24 | 32 | 28 | 163 |
| Total Organic Carbon | 41 | 40 | 51 | 45 | 52 | 45 | 274 |
| Sulfide | 41 | 45 | 56 | 50 | 52 | 50 | 294 |
| Ammonia NH3 | 43 | 58 | 70 | 55 | 54 | 62 | 342 |
| Nitrite N | 43 | 58 | 70 | 55 | 54 | 62 | 342 |
| Nitrate N | 43 | 58 | 70 | 55 | 54 | 62 | 342 |
| TKN | 43 | 58 | 70 | 55 | 54 | 62 | 342 |
| Total Phosphorus | 43 | 58 | 70 | 55 | 54 | 62 | 342 |
| Dissolved Phosphorus | 43 | 58 | 71 | 54 | 54 | 62 | 342 |
| Dissolved OTP | 43 | 58 | 71 | 54 | 54 | 62 | 342 |
| Suspended Solids | 43 | 58 | 71 | 55 | 54 | 62 | 343 |
| Volatile Solids | 43 | 58 | 71 | 55 | 54 | 62 | 343 |
| Turbidity | 43 | 58 | 71 | 55 | 54 | 62 | 343 |
| Total Analyses | 902 | 1053 | 1304 | 1047 | 1111 | 1156 | 6573 |

## Rating Curve Development

To ensure the ongoing collection of good stream flow information, rating curves have been developed for all six Mankato Area sites and are continually being refined. Some of the rating curves are based upon historical USGS data or other historical data, such as measurements made by the National Weather Service. Rating curves have also been developed based upon field stage measurements and interpolated flow measurements.

Flow measurements are obtained by a variety of methods. Flows at the two Minnesota River sites (Judson and St. Peter) are measured with an Acoustic Doppler Current Profiler (ADCP), which gives a complete picture of the channel geometry and flow velocity across a river transect. When the streams are wadeable, a USGS Price Meter with Aqua Calc 5000 is used to calculate the discharge. Because important high flow measurements were being missed, a USGS bridge board with accompanying sounding reel was acquired in 2001. This allows MCES and MDA field personnel to take measurements during higher flow conditions.

Manual flow measurements will continue to be made as time and resources permit. Special emphasis will be placed upon collecting low-flow and high-flow measurements, which are needed at all sites to better refine rating curves.

## Initial Results: Conventional Pollutant Monitoring

Estimates of 2001 total suspended solids, nitrate-nitrite nitrogen, total phosphorus, and ortho-phosphorus loads at all MCES Mankato Area monitoring sites are presented in Table 8. Analysis of 2002 results is currently in progress. MCES uses FLUX software and a manual method to calculate these annual pollutant loads. FLUX is an interactive program that allows a user to estimate loads and flow-weighted mean concentrations (FWMCs) by combining grab sample concentration data and continuous flow measurements for the annual sampling period.

Because FLUX is designed to use mean daily flows coupled with grab sample chemistry data, flow-composited samples that were collected over a period of greater than one day required slight adjustments when the FLUX input files were prepared. This adjustment consisted of selecting a day to represent the sample (generally the last full day of the composite) and calculating an instantaneous flow. Instantaneous sample flows were derived by dividing the total flow volume (in cubic feet) for the composite sample by the total number of seconds elapsed during the composite sample collection period, thereby providing an average composite flow in cubic feet per second. A potential complication of this methodology is that the concentration range from low to high is theoretically smaller with composite samples than with grab samples. As such, automated composite samples, while better at characterizing total flow concentrations, do not represent either the maximum or minimum concentration at one point in time on an event hydrograph.

The manual method was used to calculate 2001 loads for Little Beauford Ditch and the Little Cobb River. The manual method determines loads and FWMCs by calculating discrete flow period (stormflow and baseflow) volumes and assigning concentrations to the discrete volumes based upon samples collected during that flow period. Equal flow increment stormflow sampling lends itself well to this sort of analysis, since stormflow sample concentrations represent flow-based averages over the respective hydrograph period. Concentrations are assumed static during flow periods (base flow and stormflow) until another sample is collected.

**Table 8. 2001 Pollutant Loads (in Tons) at Mankato Area Monitoring Sites**

| Monitoring Site | Total Suspended Solids | Nitrate-Nitrite Nitrogen | Total Phosphorus | Ortho-Phosphorus |
|---|---|---|---|---|
| Minnesota River at St. Peter | 1,872,270 | 52,263 | 3,649 | 1,494 |
| Minnesota River at Judson | 583,823 | 18,735 | 2,193 | 1,138 |

| | | | | |
|---|---|---|---|---|
| Blue Earth River near Rapidan | 448,920 | 20,290 | 1,007 | 423 |
| Le Sueur River in Blue Earth County | 397,145 | 11,356 | 681 | 224 |
| Little Cobb River near Beauford (Hwy 16) | 9,115 | 1,141 | 33 | 15 |
| Little Beauford Ditch near Beauford (Hwy 22) | 2,717 | 125 | 6 | 2 |

A much more in-depth analysis of the pollutant loading information for the Mankato Area monitoring sites can be found in the report: "State of the Minnesota River: Summary of Surface Water Quality Monitoring 2001", jointly prepared by MCES, MDA, MPCA, and the Minnesota State University-Mankato Water Resources Center.

## Monitoring Lessons Learned

Any time a program of this magnitude is undertaken, there will be some unforeseen problems that arise. Frequently these problems created opportunities to learn valuable lessons. Below are several important lessons that have been learned, which in the end have strengthened the program.

- **Expect the Unexpected:** Unknown problems can creep up quite unexpectedly, and one must be prepared for them. There have been several situations in the past two years that have caused monitoring problems and delays. One example can been seen in this picture of the Minnesota River at Judson (at right). During ice-out conditions in the spring of 2003, the pump and the 8-foot log to which it was attached were completely lifted out of the water and deposited on the shore. Because of this event, it has not been possible to collect composite samples, and a weekly grab sampling routine has been implemented at this site. This routine will continue until the river recedes enough so the pump can be recovered and repaired.

- **Data Discrepancies:** The biggest lesson learned throughout this project is the value of checking and rechecking monitoring data. It has become evident that it is imperative to check one's data and then allow others to look at the same data set. Data problems and inconsistencies with sampling techniques and loading estimates have been discovered, discussed, and resolved through the process of cooperation with team partners.

- **Pests:** Unfortunately, pests can cause sampling problems. Within the past year, almost every site has been the home to some type of pest, which, if persistent enough, can cause problems. At the Le Sueur River station, a huge infestation of army ants in the refrigerated sampler caused delays in sample collection and resulted in more time in

the field to rid the sampler of its inhabitants.

- **Bridges:** Bridges often provide good locations for monitoring stations, as they afford safe, convenient access above the high-water mark. When long-term monitoring sites are constructed, it is hoped that the bridges by which they are stationed will be stable and safe. However, all bridges have a life span, and the Nicollet County Road 23 Bridge near the Minnesota River at Judson station is slated for removal. The construction of a brand new bridge at the same location is set to begin in the spring of 2004. This has meant a year of talking with county officials, drawing up plans, thinking about possible new station locations, and starting over when plans don't fit the county engineer's ideas. When placing a monitoring station near a bridge, it is important to take into consideration the age and condition of the bridge, so the costly problem of moving a long-term station can be avoided.

## Cooperative Monitoring Partnerships

### Minnesota Department of Agriculture (MDA)

MCES has established an important monitoring partnership with the Minnesota Department of Agriculture (MDA). MCES and MDA cooperatively established a shared field office in Mankato, and the two agencies worked closely together to further develop the Le Sueur River, Blue Earth River, and the Minnesota River at Judson monitoring stations. The MDA shares these three stations for their pesticide monitoring program. Currently, MDA has a grab sampling routine similar to the MCES grab sampling routine.

### United States Geological Survey (USGS)

The U.S. Geological Survey (USGS) is an invaluable source of historical stage and flow information. All of the MCES Mankato Area monitoring stations are located at or near sites which are currently being gauged by the USGS, or which have been gauged by the USGS in the past. This USGS information is the basis for the preliminary rating curves for all six monitoring stations. At the Little Cobb River and the Blue Earth River sites, the MCES stations are located next to the USGS stations, where stream stage and flow are being monitored. Because of the close proximity, USGS is be able to draw from the electrical power in the MCES stations to power their own equipment, eliminating the need for heavy, awkward marine batteries.
The USGS publishes its stage and flow information on the web. For the Little Cobb River site, information can be found at:
http://waterdata.usgs.gov/mn/nwis/uv/?site_no=05320270&PARAmeter_cd=00065,00060

For the Blue Earth River site, information can be found at:
http://waterdata.usgs.gov/mn/nwis/uv/?site_no=05320000&PARAmeter_cd=00065,00060

The MCES Le Sueur River monitoring station is located one mile downstream from USGS stream gauging station number 05320500. The data from the USGS station are used to help develop the rating

curve for the MCES Le Sueur River monitoring station. The preliminary stage and real-time flow data for this USGS station can be found at:
http://waterdata.usgs.gov/mn/nwis/uv/?site_no=05320500&PARAmeter_cd=00065,00060

**Minnesota Pollution Control Agency (MPCA)**

MCES is supporting a monitoring study currently being conducted by Laurie Sovell from the MPCA office in Mankato. The study is determining the effectiveness of a new piece of monitoring equipment, the transparency tube. Volunteer citizen monitoring groups are using the tube to assess water clarity in streams and rivers. The MPCA is trying to establish a relationship between transparency tube measurements of water clarity and laboratory measurements of turbidity and total suspended solids concentrations. MCES has incorporated transparency tube measurements into the sampling routine, and will contribute all relevant data to the MPCA study.

**Minnesota State University-Mankato**

MCES has been working cooperatively with the Water Resources Center (WRC), which is housed at Minnesota State University-Mankato. Starting July 1, 2003, the WRC is providing office space for MCES and MDA staff. The benefits of having three organizations housed in the same facility will enhance future collaboration on projects addressing Minnesota River Basin issues.

During the current biennium (2004-2005), MCES, MPCA, and Minnesota State University-Mankato will be discussing an opportunity to transfer responsibility and implementation of the "Mercury and PCB Inputs to the Minnesota River Monitoring Program" to the Water Resources Center at MSU-Mankato. The program transfer from MCES to MSU-Mankato will likely occur early in 2005, if logistics permit. The MSU-Mankato Water Resources Center has become a leader and advocate for Minnesota River Basin education and outreach, research, data management and assessment, technical support, and planning and coordination; so transfer of the MCES Minnesota River monitoring program to MSU-Mankato will further enhance the Water Resources Center mission and emphasize the importance of water quality monitoring in the Minnesota River Basin.

**Local Cooperators**

MCES has established important monitoring partnerships with many local cooperators in the Mankato Area. Among these are staff from the local MDNR, MPCA, and MNDOT offices, WRC staff at Minnesota State University-Mankato, staff from the Blue Earth County Roads and Parks Departments, Blue Earth and Nicollet County water planners, and several private citizens.

## Data Management, Analysis and Reporting

All of the flow and water quality data collected by the dataloggers have been summarized in an Excel database, and have been made accessible to the MPCA and other water resource professionals. The Excel database for each site is organized into monthly worksheets. Data are reported as 15-minute average values for stage, flow, temperature, and conductivity, and as 15-minute total values for precipitation. In addition, a special line of data is written each time the autosampler collects a water sample. This detailed information is summarized into daily, monthly, and annual averages.

All of the analytical chemistry results from the MCES laboratory are currently stored in an MCES Oracle database. This information is also summarized in an Excel spreadsheet and made accessible to the MPCA and other water resource professionals. Annual pollutant load estimates for all six Mankato Area monitoring sites have been calculated for the 2000-2002 period, using FLUX and the manual load estimation method.

Two monitoring reports, including the results of all MCES monitoring conducted during the July – December 2001 and January – December 2002 periods, have already been provided to the MPCA. A third monitoring report, including the results of all MCES monitoring conducted during the January – June 2003 period, will be provided to the MPCA by September 30, 2003.

A further analysis of MCES Mankato Area monitoring information, along with information from other agency monitoring sites in the Minnesota River Basin, can be found in the report: "State of the Minnesota River: Summary of Surface Water Quality Monitoring 2001." MCES, MDA, MPCA, and the Minnesota State University-Mankato Water Resources Center jointly prepared this report.

## Contact Information for the Mercury and PCB Inputs to the Minnesota River Monitoring Program

Questions or comments about this report or the Mercury and PCB Inputs to the Minnesota River Monitoring Program may be directed to: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Mces@mctcnet.net

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kent.johnson@metc.state.mn.us


# Budget

## Combined Programs: Costs for the 2002 – 2003 Biennium

Cost accounting for both the "Metropolitan Area Watershed Outlet Monitoring Program (WOMP)" and the "Mercury and PCB Inputs to the Minnesota River Monitoring Program" has been continuously tracked by MCES program staff and the Metropolitan Council's internal accounting department. The $600,000 grant from the MPCA for the 2002 – 2003 biennium is being disbursed to MCES in three installments, as specified by the grant contract. The first installment of $300,000 was received by

MCES in March 2002, and the second installment of $240,000 was received by MCES in January 2003. The remaining $60,000 is being withheld by the MPCA until MCES submits this 2002-2003 biennial progress report in August 2003. As indicated in the work plans accompanying the grant agreement, the estimated budget for the Metropolitan Area Watershed Outlet Monitoring Program during the 2002-2003 biennium was $370,000, while the estimated budget for the Mercury and PCB Inputs to the Minnesota River Monitoring Program was $230,000. The expenditures in Table 9 below reflect the actual costs for both programs during the period from July 1, 2001 through June 30, 2003.

**Table 9. Program Expenditures from July 1, 2001 through June 30, 2003**

| Program | WOMP $370,000 | Hg/PCB $230,000 | Total $600,000 |
|---|---|---|---|
| MCES Staff Labor | 141,279.24 | 136,634.22 | 277,913.46 |
| WOMP Grants and Contracted Services | 110,997.37.79 | 996.65 | 111,994.02 |
| Materials and Supplies and Office Expenses | 3,576.38 | 2,645.19 | 6,221.57 |
| Monitoring Equipment | 0.00 | 0.00 | 0.00 |
| Monitoring Utilities | 13,450.39 | 14,047.66 | 27,498.05 |
| Laboratory Expenses | 49,819.03 | 39,905.00 | 89,724.03 |
| Professional Development and Travel Expenses | 964.36 | 1,787.10 | 2,751.46 |
| Miscellaneous | 52.82 | 573.50 | 626.32 |
| TOTAL | 320,139.59 | 196,589.32 | 516,728.91 |
| Surplus | | | 83,271.09 |

The accounting figures in Table 9, although based upon information provided by the Metropolitan Council's accounting department, should be regarded as preliminary. For more detailed accounting information on these two programs, please contact Mary Elverum (651-602-1084) in the Metropolitan Council's accounting department.

Table 9 indicates that, as of June 30, 2003, a surplus existed in the approximate amount of $83,271.09. Of the surplus amount, an estimated $12,000 is allocated for final 10% payments to WOMP cooperators, for monitoring work conducted during the 2002-2003 biennium. After these payments are made, an estimated surplus of $71,000 is still available. In May 2003, MPCA extended the term of the 2002-2003 grant contract for an additional year (to June 30, 2004), thereby allowing MCES to spend the remainder of the 2002-2003 funding on Minnesota River-related monitoring work. A workplan

and budget for expenditure of the remaining funding is incorporated into the grant contract amendment. The majority of the surplus amount will be used in support of the "Mercury and PCB Inputs to the Minnesota River Monitoring Program".

## Public Education Efforts

During the 2002-2003 biennium, MCES staff participated in numerous public education efforts in support of both monitoring programs and the Interagency Water Monitoring Initiative, as indicated below:

- Heather Offerman worked collaboratively with the Water Resources Center at Minnesota State University-Mankato to sponsor two canoe trips along reaches of the Blue Earth and Le Sueur Rivers in June and July 2001. The canoe trips fostered awareness of the rivers and provided an opportunity for local partners to discuss issues and concerns about these rivers.
- In August 2001, Heather Offerman participated in the 6th Annual Minnesota River Summer Conference: "Clean Water in Our Lifetime". A draft of the report: "State of the Minnesota River: Summary of Surface Water Quality Monitoring 2000" was presented during the keynote speech.
- In October 2001, MCES staff (Leigh Harrod and Heather Offerman) made a presentation at the national annual meeting ("Hydrologic Science: Challenges for the 21st Century") of the American Institute of Hydrology in Minneapolis, MN. The presentation, *"Enlisting Local Governments: A Model for a Regional Stream and River Monitoring Network"*, described the partnerships that MCES has established for encouraging local government participation in stream and river monitoring efforts.
- In November 2001, Heather Offerman spoke at the Mankato Outdoor and Paddling Club meeting about the "River Gauging System, Stage, and Discharge".
- In March 2002, Heather Offerman met with the Director of the Legislative Commission on Minnesota Resources (LCMR) to discuss Minnesota River Basin surface water quality monitoring programs and current projects.
- In March 2002, Leigh Harrod and Heather Offerman helped develop and organize, and also presented at the "Samplers Forum" for MCES stream monitoring cooperators.
- Heather Offerman prepared an article on the MCES Minnesota River monitoring program for the September 2002 edition of the "Minnegram", published by the Water Resources Center at the University of Minnesota.
- In September 2002, Heather Offerman participated in the Minnesota River Research Forum and presented preliminary results from the report: "State of the Minnesota River: Summary of Surface Water Quality Monitoring 2001" to over 100 meeting attendees.
- In October 2002, Heather Offerman assisted the MPCA with FLUX training for Clean Water Partnership staff.
- Heather Offerman participated in a joint venture of MCES, MDA, MPCA, and the Water Resources Center at Minnesota State University-Mankato to create the report: "State of the Minnesota River: Summary of Surface Water Quality Monitoring 2001". The report contains information from MCES and MDA Mankato Area monitoring sites, from other MCES Minnesota

River sites in the Twin Cities Metropolitan Area, and from sites monitored by other local water organizations in the basin. The primary purpose of the report was to consolidate 2000 and 2001 surface water quality monitoring information collected in the Minnesota River Basin. The consolidation of data collected by multiple agencies and organizations enables water quality comparisons to be made between some of the major tributaries and mainstem sites in the Minnesota River Basin. The report also identifies strengths and weaknesses in the Minnesota River Basin surface water quality monitoring network and continues to build monitoring partnerships.

- In February 2003, Leigh Harrod made a presentation at the Air, Water, and Wastewater Conference in St. Paul, MN. The presentation was entitled: *"Metropolitan Council Stream and River Monitoring Network"*.
- In March 2003, Heather Offerman and fellow MDA and MPCA staff gave a lecture about water quality field methods for the University of Minnesota graduate level course: "Applied Field Methods".
- Heather Offerman continued to meet with local water planners to talk about the MCES monitoring program in Mankato, and to offer information to suit their specific county needs.

## Goals for the 2004 – 2005 Biennium

The first biennium (1998-1999) of the Interagency Water Monitoring Initiative focused on implementation of the two MCES water monitoring programs. Monitoring stations were built, personnel were hired, and contracts with cooperators were established. Both monitoring programs were in a start-up phase.

The second biennium (2000-2001) reflected the emphasis placed upon coordination and operation of what is now a sizeable monitoring network.

During the third biennium (2002-2003), as described throughout this report, program managers and participants had the benefit of being fully operational, as well as the advantage of experience. New tools and activities were initiated for both MCES monitoring programs, including an increased emphasis on data analysis and reporting. Three key reports were prepared to document stream and river conditions during the 2000-2001 period: "State of the Minnesota River: Summary of Surface Water Quality Monitoring 2000", "State of the Minnesota River: Summary of Surface Water Quality Monitoring 2001", and the "Metropolitan Council Environmental Services 2001 Stream Monitoring Report". These monitoring, data analysis, and reporting enhancements reach beyond the standard monitoring tasks outlined in the MCES program work plans. Implementation of these goals in the third biennium not only enhanced the monitoring programs, but also increased public awareness of the importance of these programs for characterizing the quality of Minnesota's water environment.

In May 2003, the Minnesota Legislature appropriated an additional $500,000 to the Metropolitan Council (via the MPCA), for continuation of the "Metropolitan Area Watershed Outlet Monitoring Program" and the "Mercury and PCB Inputs to the Minnesota River Monitoring Program" during the 2004-2005 biennium. MCES staff have prepared program work plans and budgets for the 2004-2005

biennium. MCES and MPCA staff have initiated the process for establishing a grant agreement for the 2004-2005 funding.

During the fourth biennium (2004-2005), new tools and activities will continue to be implemented for both MCES monitoring programs as opportunities arise. Increasing emphasis will be placed on presentation and assessment of the monitoring data. With long-term datasets now available for both programs, water quality problems and issues can be identified, and the monitoring information can be translated to watershed activities and actions that foster water quality protection and improvement. A major goal for the 2004-2005 biennium will be to transfer responsibility and implementation of the "Mercury and PCB Inputs to the Minnesota River Monitoring Program" to the Water Resources Center at MSU-Mankato. The program transfer from MCES to MSU-Mankato will likely occur in early 2005, if logistics permit.

## Monitoring Enhancements

Some of the monitoring enhancements anticipated during the 2004-2005 biennium include:

- Surveying the elevation reference points at all monitoring stations, so that stages can be converted to mean sea level.
- Moving the Minnesota River at Judson monitoring station to a new location, involving coordination with Nicollet County and MCES Metro Plant trades staff to help move the station out of the way of the new bridge construction work.
- Continuing to enlist the Metropolitan Area Volunteer Stream Monitoring Partnership for collection of macroinvertebrate data in WOMP and Mankato Area watersheds, thereby providing valuable biological data to complement physical and chemical data.
- Implementing the use of hand-held PDAs[2] for collection and automation of field notes.
- Implementing continuous dissolved oxygen monitoring at two sites (Crow River and Bassett Creek).
- Increasing the use of transparency tubes and Hach kits in the field.
- Continuing to train the WOMP cooperators in the use of FLUX, and developing protocols for calculation of pollutant loads.
- Thoroughly reviewing, assessing, and interpreting the data from both programs to characterize water quality conditions and impacts.
- Providing recommendations, where appropriate, for watershed best management practices that will protect and improve water quality.
- Partnering with professors at Minnesota State University-Mankato to create opportunities for graduate students to work with MCES and MDA staff. Through educational partnerships, students

[2] PDA = Personal Digital Assistant, commonly known as a Palm Pilot. Because field notes currently are hand-written on paper, it is both labor intensive and difficult to transcribe field comments into a database so they can be viewed electronically when the data are displayed or manipulated. PDAs will automate the process of writing field notes in a digital format common to all monitoring stations in the MCES network.

can conduct further research on the physical, chemical, and biological dynamics of these river systems. This information can then be used by project staff for assessment purposes.

- Creating additional "State of the Minnesota River" and "MCES Stream Monitoring" reports and enhancing the visibility and accessibility of monitoring data to the public and policy makers.

## Public Education Efforts

Some of the public education efforts anticipated during the 2004-2005 biennium include:

- Updating and enhancing information about the two MCES monitoring programs on the Metropolitan Council web site.[3]
- Increasing the frequency of group meetings of the WOMP cooperators.
- Publishing a semi-annual newsletter and distributing it to local partners and other interested parties.
- Conducting field day education activities.
- Continuing and expanding partnerships with local groups and agencies.
- Participating in external hydrologic and watershed studies.
- Presenting program data and information at local and state conferences, promoting the use of program data by outside agencies, and ensuring easy access to the data through the MCES Environmental Information Management System (EIMS).
- Assisting the Water Resources Center at Minnesota State University-Mankato with future conferences addressing water quality issues in the Minnesota River Basin.

# Recommendations for Continued Monitoring

The funding provided to MCES since 1998 by the Minnesota Legislature, as a part of the Interagency Water Monitoring Initiative, has been valuable for filling stream monitoring gaps in the Metropolitan Area, and for establishing an important monitoring presence in the Minnesota River Basin. The expanded monitoring work has provided insightful information on the condition of Minnesota waters, as well as current land use impacts on water quality. Since these land use impacts are largely a reflection of non-point sources of pollution that are heavily influenced by precipitation and runoff, long-term monitoring is critical for characterizing water quality conditions that occur as a result of considerable climatological variation from year to year. Long-term monitoring also provides crucial information for determining if changes in land use with application of best management practices are indeed achieving protection and improvement of water quality conditions, as desired.

[3] See www.metrocouncil.org/environment/RiversLakes

A continuation of the "Metropolitan Area Watershed Outlet Monitoring Program" during the 2004-2005 biennium and beyond will help support the Metropolitan Council's legislative mandate to develop management objectives and target pollution loads for watersheds in the Metropolitan Area. Long-term water quality monitoring information is needed for assessing current watershed and water quality conditions, developing target pollutant loads, and measuring progress toward achievement of target loads, as best management practices (BMPs) are implemented in these watersheds.

A continuation of the "Mercury and PCB Inputs to the Minnesota River Monitoring Program" during the 2004-2005 biennium and beyond will help achieve "fishable and swimmable conditions" in the Minnesota River, as mandated by the Federal Clean Water Act and Minnesota State Rules. Fish consumption advisories based on mercury and PCB (polychlorinated biphenyl) currently exist for the Minnesota River throughout the Metropolitan Area, as well as in outstate areas. Violations of water quality standards for dissolved oxygen, turbidity, and bacteria are also evident in the Minnesota River, while high levels of phosphorus and nitrogen pose water quality problems as well. Long-term water quality monitoring information is needed for assessing current watershed and water quality conditions, and measuring progress toward achievement of "fishable and swimmable conditions" in the Minnesota River, as best management practices (BMPs) are implemented in watersheds throughout the Minnesota River Basin.

In 2003, MCES staff will complete an analysis and assessment of the mercury and PCB data obtained for the Minnesota River during the 1998-2001 period. When this assessment is complete, information will be available on the sources contributing to mercury and PCB contamination in the Minnesota River. Based on this information, recommendations can be made regarding best management practices that may help reduce mercury and PCB loads in the river. Given the monitoring work to date (1998-2001) on mercury and PCB sources in the Minnesota River Basin and the considerable cost and labor for analysis of these variables, very minimal monitoring of mercury and PCB is anticipated during the 2004-2005 biennium. Rather, monitoring will focus on conventional water quality pollutants contributing to exceedances of water quality standards/criteria and impairment of designated uses in the Minnesota River Basin. Conventional pollutant monitoring data is needed for establishing target loads (TMDLs) and measuring progress toward achievement of these target loads, as best management practices (BMPs) are implemented in Minnesota River watersheds.

MCES greatly appreciates the support of the Minnesota Legislature and the Minnesota Pollution Control Agency for implementation and on-going maintenance of these important monitoring programs. An additional significant benefit of these monitoring programs is the establishment of partnerships with local, state, and federal governmental agencies and the public, since a collaborative effort is needed to protect and improve Minnesota's waters.

For more information about the MCES water monitoring network in the Metropolitan Area, or the two MCES programs that comprise a portion of the Interagency Water Monitoring Initiative, contact:

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Environmental Monitoring and Assessment
Metropolitan Council Environmental Services
230 East Fifth Street
St. Paul, MN 55101

Phone: 651-602-8117
E-mail: kent.johnson@metc.state.mn.us

# Appendix A

## MCES Watershed Outlet Monitoring Program Sites and Cooperators (2002 – 2003 Biennium)

## MCES Watershed Outlet Monitoring Program Sites and Cooperators (2002 – 2003 Biennium)

Grant funding provided to MCES by the Minnesota Legislature, via the MPCA, as a part of the "Interagency Water Monitoring Initiative"

## Monitoring Cooperators and Contact Information

| | |
|---|---|
| Bassett Creek | Bassett Creek Watershed Management Organization and Minneapolis Park and Recreation Board |
| Cannon River | Dakota County and Goodhue County Soil and Water Conservation Districts |
| Crow River | Wright County Soil and Water Conservation District (SWCD) |
| Eagle Creek | Lower Minnesota River Watershed District and City of Savage |
| Minnehaha Creek | Minneapolis Park and Recreation Board |
| Riley Creek | Riley-Purgatory-Bluff Creek Watershed District |
| Valley Creek | Valley Branch Watershed District and Science Museum of Minnesota |
| Willow Creek | Black Dog Watershed Management Organization |

## Addresses and Contact Information

**Bassett Creek**

| | |
|---|---|
| Station Location: | 100 Irving Avenue South, Minneapolis, MN |
| Cooperator 1: | Bassett Creek Watershed Management Organization |
| Contact: | Jim Herbert, Barr Engineering<br>ph: 952-832-2784 |
| Cooperator 2: | Minneapolis Park and Recreation Board |
| Contact: | Mike Perniel<br>ph: 612-313-7762 fax: 612-370-4831 e-mail: *mperniel@minneapolisparks.org* |

**Cannon River**

| | |
|---|---|
| Station Location: | 14951 264th Street Path, Welch, MN |
| Cooperator: | Dakota County SWCD |
| Field Services: | Laura Jester, Dakota County SWCD<br>Matt Jacobson, Goodhue County SWCD |
| Contact: | Laura Jester, Dakota County SWCD<br>4100 220th Street West #102, Farmington, MN 55024-8087<br>ph: 651-480-7784 fax: 651-480-7775 e-mail: *lora.jester@co.dakota.mn.us* |

**Crow River**

| | |
|---|---|
| Station Location: | 8200 MN Highway 55, Rockford, MN |

| | |
|---|---|
| Cooperator: | Wright County SWCD |
| Field Services: | Brad Wozney, Wright County SWCD |
| | Greg Mitten, USGS, for rating curve |
| Contact: | Kerry Saxton, Wright County SWCD |
| | ph: 763-682-1933 fax: 763-682-1970 e-mail: *bjw@mnbuffalo.fsc.usda.gov* |

**Eagle Creek**

| | |
|---|---|
| Station Location: | 8451 West 126th Street, Savage, MN |
| Cooperator 1: | City of Savage |
| Cooperator 2: | Lower Minnesota River Watershed District |
| Field Services: | HDR, Inc., and MCES |
| | Tina Ludlow, HDR |
| Contact: | Leigh Harrod, MCES |
| | ph: 651-602-8085 e-mail: *leigh.harrod@metc.state.mn.us* |

**Minnehaha Creek**

| | |
|---|---|
| Station Location: | 4712 32nd Avenue South, Minneapolis, MN |
| Cooperator: | Minneapolis Park and Recreation Board |
| Field Services: | Minneapolis Park and Recreation Board |
| Contact: | Mike Perniel |
| | ph: 612-313-7762 fax: 612-370-4831 e-mail: *mperniel@minneapolisparks.org* |

**Riley Creek**

| | |
|---|---|
| Station Location: | 15995 Flying Cloud Drive, Eden Prairie, MN |
| Cooperator: | Riley-Purgatory-Bluff Creek Watershed District |
| Field Services | Chris Bonick, Barr Engineering |
| Contact: | Hal Runke, Barr Engineering |
| | ph: 952-832-2804 fax: 952-832-2601 e-mail: *hrunke@barr.com* |

**Valley Creek**

| | |
|---|---|
| Station Location: | 15800 Putnam Boulevard South, Afton, MN |
| Cooperator 1: | Valley Branch Watershed District |
| Cooperator 2: | Science Museum of Minnesota |
| Field Services: | St. Croix Watershed Research Station |
| Contact: | Jim Almendinger |
| | ph: 651-433-5953, ext.19 fax: 651-433-5924 e-mail: *dinger@sci.mus.mn.us* |

**Willow Creek**

| | |
|---|---|
| Station Location: | 2900 West MN Highway 13, Burnsville, MN |
| Cooperator: | Black Dog Watershed Management Organization |
| Field Services: | Barr Engineering |
| Contact: | Chris Bonick, Barr Engineering |
| | ph: 952-832-2760 fax: 952-832-2601 e-mail: *cbonick@barr.com* |

# Appendix B

## PCBs in the Minnesota River Basin: 2001