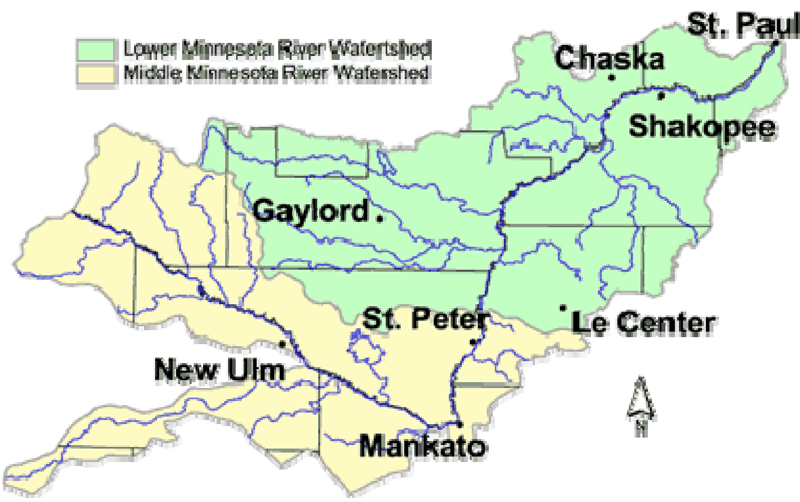
Minnesota Pollution Control Agency

Minnesota River Basin

Middle and Lower Minnesota River Watersheds.

Physiography And Description

The Middle Minnesota-Little Cottonwood and Lower Minnesota River watersheds define a large, irregular-shaped area that drains into the main stem through a large number of relatively small streams, as well as by seeps and springs draining into the valley itself. These watersheds differ from most of the other major watersheds of the basin in that they are defined more by the main stem than by any particular tributary.



The **Middle Minnesota-Little Cottonwood watershed** includes 230 square miles draining a thin strip of land along the Little Cottonwood River and an additional 1090 square miles draining into the main stem of the Minnesota for a total drainage area of 1370 square miles. Originating near the town of Jeffers, the Little Cottonwood River, the largest tributary of the Middle Minnesota, flows for over fifty miles in a northeasterly direction before confluencing with the Minnesota seven miles south of New Ulm. The section of the Minnesota's mainstem located within the watershed runs for approximately 79 miles, 60 of which run in a southeasterly direction from the city of Morton to the city of Mankato where the river turns to the northeast and flows for another 19 miles to the town of Ottawa. Basin outflow is approximately 91 miles upstream from the mouth of the Minnesota River. The Little Cottonwood drains the northeast section of Cottonwood County and the south-central section of Brown County. Contained within the Middle Minnesota watershed are portions of Redwood, Renville, Sibley, Nicollet, Le Sueur, Blue Earth, Watonwan and Brown counties. The Middle Minnesota-Little Cottonwood watershed ranks sixth in area of the twelve watersheds supplying the Minnesota River.

predominantly till plains. According to the University of Minnesota's Department of Soil Water and Climate, the southern half of this watershed (including the Little-Cottonwood River watershed) is mainly comprised of Wetter Blue Earth till deposits. These deposits are a complex mixture of relatively flat (2-6%) well drained soils and very flat (0-2%) poorly drained soils. Soils within these deposits are generally loamy in texture. Artificial drainage to remove ponded water from flat and depressional areas is extensive. Water erosion potentials are moderate on 46% of the land within this geomorphic setting. Surficial deposits within the northern half of the watershed fall primarily within the Olivia Till Plain although some clay/silt and morainal deposits exist in the eastern corner of the watershed. The Olivia Till Plain is characterized by landscapes with moderate slopes. Slightly over half of these lands have a moderate water erosion potential. Soils are mostly loams and silt loams, with roughly two thirds being well drained and the remainder being tile drained. Roughly one fourth of the land in the Olivia Till is adjacent to streams or drainage ditches.

The 1760 square mile **Lower Minnesota River Watershed** is situated northeast of the Middle Minnesota River Watershed and ranks second, behind the Chippewa River watershed in total area of the thirteen watersheds supplying the Minnesota River. Counties within the watershed include most of Sibley and Scott, the northern half of Le Sueur, southern half of Carver and smaller pieces of Hennepin, Dakota, Rice, Nicollet, Renville and McLeod. A relatively flat section of river, the 50-mile stretch of the Minnesota contained within this watershed drops approximately 90 feet in elevation from the small town of Ottawa, in Le Sueur County, to its confluence with the Mississippi River in St. Paul. Although the Minnesota is generally not used for navigational purposes, the lower fifteen miles from Savage downstream to the mouth have been dredged to provide a nine-foot-deep channel for commercial barge navigation. The Rush River and High Island Creek, two moderate tributaries, empty into the Lower Minnesota River watershed in addition to several smaller first and second order streams.

The University of Minnesota's Department of Soil, Water and Climate delineates the western half of the Lower Minnesota watershed as fairly flat with surface deposits composed mainly of wetter clays and silts. Landscapes here are primarily flat (0-2% slopes), extensively ditched and poorly drained or tile drained. A geomorophological shift occurs in the eastern half of the watershed as landscapes are composed mainly of morainal complexes. The western half of this section of the watershed is classified as being composed of Less Steep Moraine. Agricultural lands within this area are dominated by moderately steep (2-12%) well drained soils, although one fourth of the land is flat sloped (0-2%) and tile drained. Fifty percent of the cropped lands have a high potential for water erosion. The eastern quarter of the watershed is found within Steep Wetter Moraine. This region includes the rapidly expanding suburban areas of the Twin Cities. Much of the land next to streams is very steep, with a large potential for sediment delivery to streams. Soil textures in this region range from sandy loam to loam, and landscapes are primarily well drained with a high water erosion potential.

Main Stem Characteristics

The Middle Minnesota-Little Cottonwood and Lower Minnesota River watersheds differ from most of the other major watersheds of the basin in that they are defined more by the main stem than by any particular tributary. As such, the descriptions of these watersheds will include a description of the roughly 288-mile stretch of the main stem that extends from the town of Milan to its confluence in St. Paul.

The Minnesota River changes dramatically over both time and space. Over time, its flow as measured at any one point can vary from a mere trickle to a raging flood. At Montevideo, for example, the river literally dried up on several occasions in 1933, 1934 and 1936. Photos from 1933 show automobile tracks running up and down the dry bed. On April 6, 1997, by contrast, the river reached a maximum daily peak flow of 47,500 cfs at the same site -- 56 times the mean annual flow.

Over space, the river's mean annual flow increases rather dramatically from west to east (see Table 4.38), which is not surprising given the pattern of increasing precipitation and runoff along the same west to east gradient through the basin.

Table 4.38: Mean Annual Discharge of the Minnesota River by Location

Mean Annual Discharge Source: U.S. Geological Survey, 1909-1996			
Station Site	**Number of miles upstream from the mouth of the MN River**	**Mean Annual Discharge (cfs)**	**Percent increase in flow from previous station**
Montevideo	271	854	NA
Morton (estimated)	203	1,500 - 2,500*	100 -200%
Mankato	107	3398	38-126%
Jordan	39.4	4266	26%

*Lower range derived by summing mean annual flow at Montevideo with those of the major between site tributaries. Upper range is the average of six flow measurements taken by the USGS from 1989-1992 for the Minnesota River Assessment Project.

In its upper reaches, from Browns Valley to Montevideo, the Minnesota River is somewhat smaller than the Blue Earth River, the largest tributary to the main stem. In this reach, the Minnesota River channel alternates from rock outcrop to sand and gravel, with banks of sand and silt. Rock outcrops appear where the river cuts down to bedrock along sudden gradient changes.

Long term data collected by the Minnesota Pollution Control Agency have shown that mean annual concentrations of total phosphorus and sediment are relatively lower at the monitoring site located by Milan (288 miles upstream of the confluence) compared to those collected in the lower reaches of the Minnesota River (see Figures 4.13 and 4.14).

Figure 4.13: Mean Annual and Mean Summer Total Phosphorus Concentrations at Monitoring Sites along the Minnesota River

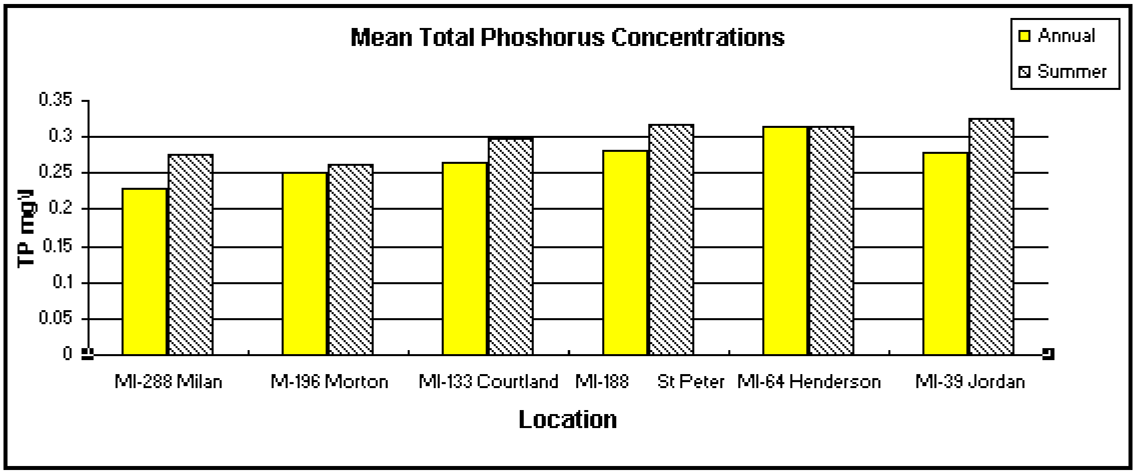
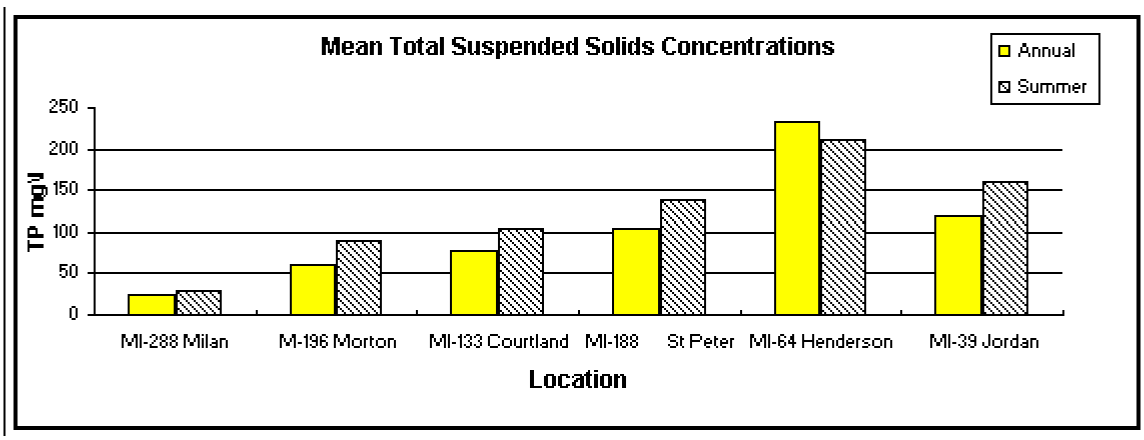


Figure 4.14: Mean Annual and Mean Summer total Suspended Solids Concentrtions at Monitoring Sites along the Minnesota River



Between Montevideo and Morton, the river's flow more than doubles as it takes on discharges from a string of tributaries: the Yellow Medicine and Redwood rivers and Hawk Creek. Below Granite Falls the gradient of the river levels out. Composition of the river bed varies from sand and gravel within the faster flowing reaches to finer silts within and along the banks of the slower reaches. Mean annual total phosphorus concentrations rise along this reach and approach the basin's ecoregion mean of .251 mg/L near Morton. Suspended solid concentrations at this site rise almost three-fold from levels measured at the Milan site.

Between Morton and Mankato, the river's mean annual flow doubles once again, largely because of the discharge of the Blue Earth River into the main stem at Mankato and to a lesser degree from the inputs of the Cottonwood and Little Cottonwood Rivers. Certain reaches of the river, such as the one upstream of the confluence with the Cottonwood River at New Ulm, are relatively slow-moving. Concentrations of both total suspended solids and phosphorus continue rising.

Between Mankato and Jordan, the Minnesota's mean annual discharge climbs from 2298 to 4266 cubic feet per second, or four and five times the river's average flow at Montevideo, respectively. Average annual total phosphorus and total suspended solid concentrations climb rather sharply throughout the 123-mile reach from Courtland to Henderson, then drop off in the 25-mile reach between Henderson and Jordan. A possible explanation for this apparent anomaly is that concentrations are being diluted along this 25-mile reach by groundwater springs and seeps while fluvial inputs are at a minimum. Summer time total phosphorus levels do rise between Henderson and Jordan however. This may be due to the load consistency of point source inputs coupled with decreased river flows which generally occur during this time period.

In the final 25-mile reach of the Minnesota River, dredging ensures that a 9-foot-deep channel is maintained for barge traffic. The river spreads out into a braid of backwater areas. During low flow, the lock-and-dammed Mississippi River can create lake-like conditions in the lower reach, favoring the production of algae from excess phosphorus loadings and increased residence time (the time it takes a volume of water to flow through a given system). The algae die, decompose and consume large quantities of dissolved oxygen.

More Information

For questions about the Minnesota River Basin management framework, contact Norm Senjem at (507)280-3592.