METROPOLITAN COUNCIL

Environmental Services

2013

River Water Quality Summary for the Twin Cities Metropolitan Area

This document is a summary of the 2013 water quality of major rivers in the Twin Cities metropolitan area (metro area) based on monitoring results from the Metropolitan Council Environmental Services (MCES) River Monitoring program. The river monitoring program began in 1927 after the Mississippi River was declared a public health hazard. Today the river monitoring program serves a wide array of needs, including determining whether metro area waters meet state water quality standards and criteria, assessing the performance and effectiveness of MCES treatment plants, and documenting long-term trends and changes in water quality. In 2013, river monitoring was conducted at 5 automated and 15 conventional sampling sites along the Mississippi, Minnesota, and St. Croix Rivers in the metro area. Samples were collected four to five times per month during the open-water season (March through October) when more recreational activities are expected and the river environment changes more quickly, and up to two times per month during the remainder of the year.

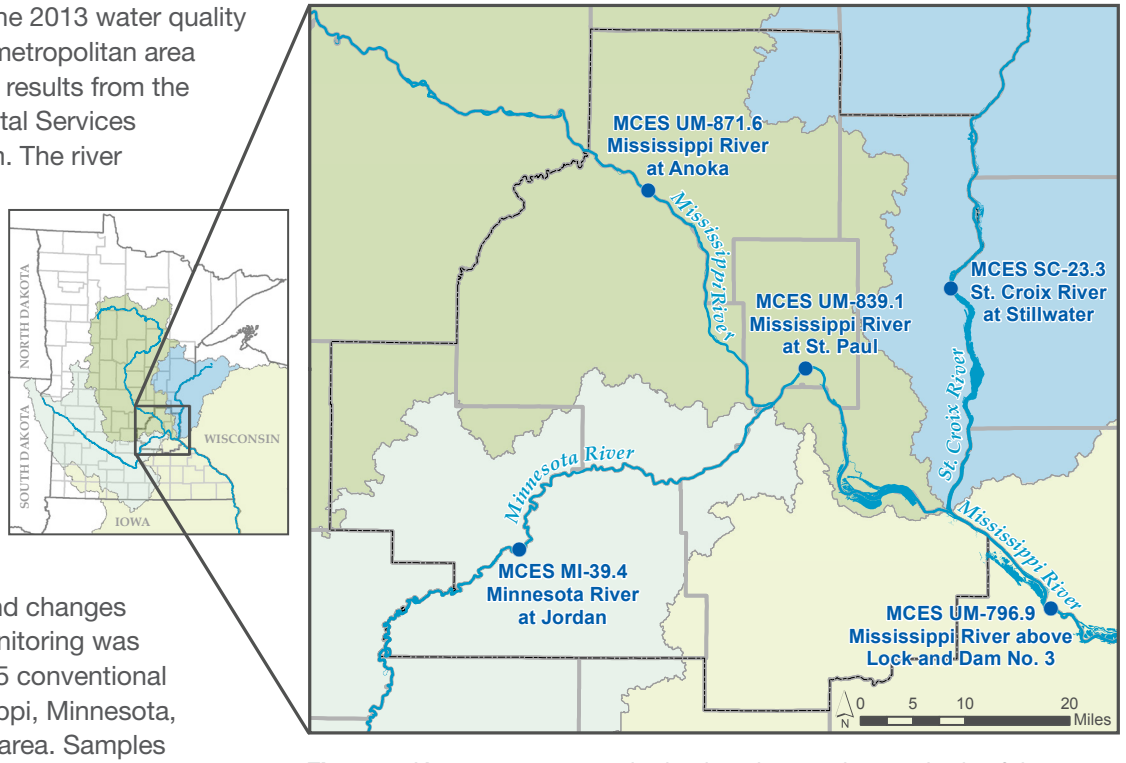


Figure 1: Key metro area monitoring locations and watersheds of the Mississippi, Minnesota, and St. Croix Rivers upstream of the metro area.

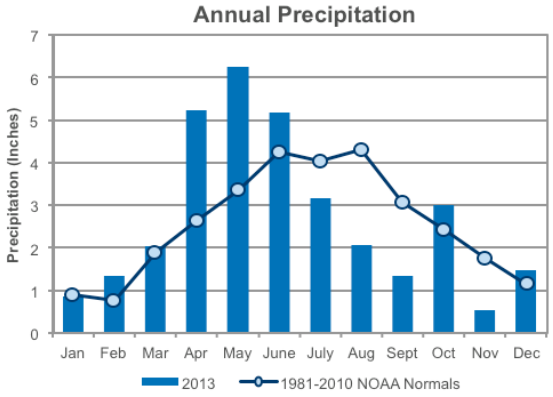
As a summary of the water quality of rivers in the metro area, 2013 concentrations of key water quality variables at five critical locations throughout the metro area are compared. These locations are shown in Figure 1 and can be described as the waters entering the metro area at the Mississippi River at Anoka, Minnesota River at Jordan, and St. Croix River at Stillwater, after the Minnesota River enters the Mississippi River at downtown St. Paul, and leaving the metro area on the Mississippi River above Lock and Dam 3 near Red Wing. The water quality of each river is influenced by a number of factors including watershed size, predominant land use, level of urbanization, geology, and soil type. Figure 1 also shows the entire watersheds of the Mississippi, Minnesota and St. Croix Rivers upstream of the metro area. The metro area is a relatively small percentage of this total area. Changes in point or non-point source discharge to the rivers within the metro area may not have a significant impact on river water quality because of the large upstream watershed of each river.

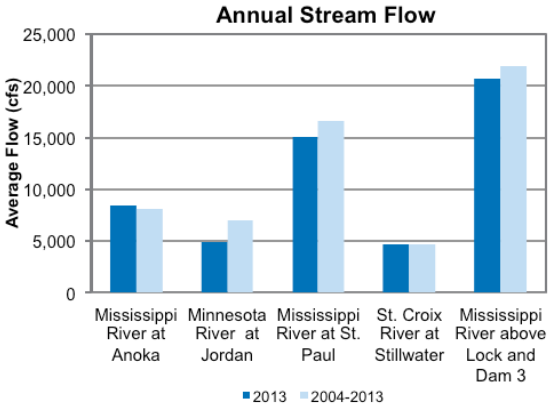
To provide a historical perspective, 2013 average values at the five monitoring points are compared to 10-year average values for the 2004-2013 time period. Whether the 2013 average concentration is higher or lower than the 10-year average should not be taken as an indication of increasing or decreasing water quality, but rather as a comparison to normal river conditions. Concentration in any given year is highly affected by the timing and quantity of river flow. Concentrations are also compared to state water quality standards where applicable. Table 1 contains a summary of results.

Precipitation and River Flow

Description: Regional precipitation is measured at the Minneapolis-St. Paul International Airport which is a good indicator of significant rainfall events because of its central location, even though actual precipitation varies throughout the metro area. During wet periods, nonpoint source pollutants are carried through storm sewer systems and smaller streams to the rivers, and higher flows can also cause stream bank erosion, habitat destruction and flooding. During dry periods, flows may be too low to sufficiently dilute pollution, sediment deposition increases, and habitat quality may be adversely affected.

2013 Results: Precipitation in the metropolitan area during 2013 was almost 2 inches above the NOAA 1981-2010 normal precipitation for the area (a data set updated once every 10 years), though departures from normal differed greatly between the beginning and end of 2013. Precipitation in the metropolitan area from January through June was 7.0 inches above normal. In May alone, the Twin Cities experienced over 6.2 inches of precipitation, an anomaly of approximately 3 inches. The second half of the year was a stark contrast with a drought beginning in July that lasted into the fall, resulting in a July-December rainfall deficit of 5.2 inches. 2013 river flows were slightly below their 10-year averages for the Minnesota River at Jordan, Mississippi River at St. Paul and above Lock and Dam 3, while the Mississippi River at Anoka and the St. Croix River at Stillwater flows were not noticeably different from the 10-year averages.



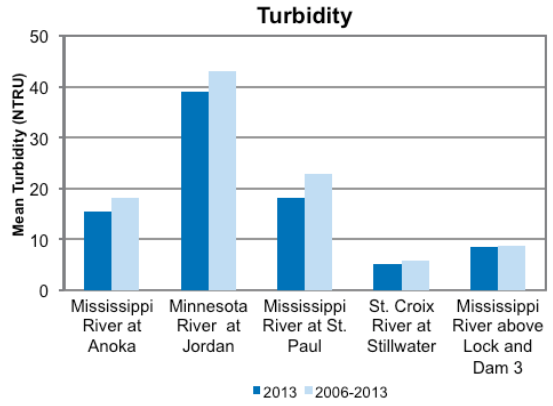


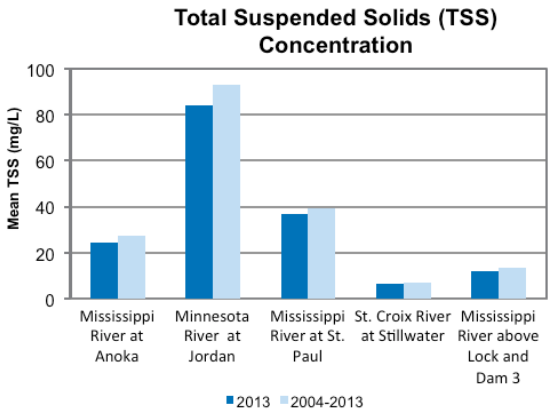
Turbidity and Total Suspended Solids (TSS)

Description: Particulate matter in the water may harm aquatic life by decreasing the light available for plant growth, increasing water temperature, clogging gills of aquatic inhabitants and covering habitat. Suspended solids can also negatively affect user perception of water quality and decrease swimmability. Particulate matter in the water has a variety of sources including sediment eroded from stream banks or carried into a river with urban or agricultural runoff or organic particulate such as decaying matter or algae. The amount of particulate matter in a river can be measured as turbidity or total suspended solids. Turbidity is an easier measurement that can be done in the field, but is harder to compare between sites because readings can be influenced by the presence of dissolved matter, temperature, and the shape of the particles.

Standards: The turbidity standard is a daily maximum of 25 Nephelometric Turbidity Units (NTU). The MCES lab has measured turbidity in Nephelometric Turbidity Ratio Units (NTRUs) since 2006, and the standard of 25 NTU has been approximated as 39 NTRU by the Minnesota Pollution Control Agency. A TSS river standard is currently going through the review and approval process by the MPCA.

2013 Results: 2013 average turbidity values in the Mississippi River at all three sites were below their 10-year averages, with the Mississippi River at St. Paul experiencing the greatest departure from average. In the St. Croix, 2013 average turbidity was also below its 10-year average. The Minnesota River at Jordan had a lower than average turbidity and the 2013 average turbidity was at the 39 NTRU threshold. Of the 210 turbidity samples in 2013, 26 were above the daily maximum of 39 NRTU, 19 of which were in the Minnesota River, 5 in the Mississippi River at St. Paul, and 1 each in the Mississippi River at Anoka and above Lock and Dam 3. Turbidity and TSS track well together: all five stations had slightly lower than average TSS concentrations as well as lower than average turbidity. Overall, the Minnesota River is the primary TSS contributor within the metro area.

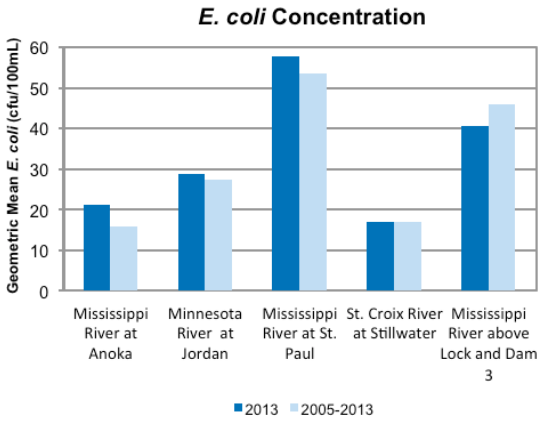




E. coli Bacteria

Description: Suitability for recreation is determined by the level of *Escherichia coli* (*E. coli*) bacteria. High *E. coli* levels can indicate the presence of potentially dangerous pathogens such as typhoid fever, hepatitis and dysentery. Sources can include failing septic tanks, untreated wastewater, livestock, pets and wildlife.

Standard: The geometric mean of at least five samples cannot exceed 126 organisms/100ml in any given month, and no more than 10% of samples taken during a given month can exceed 1,260 organisms/100ml. The standard applies only between April 1 and October 31.

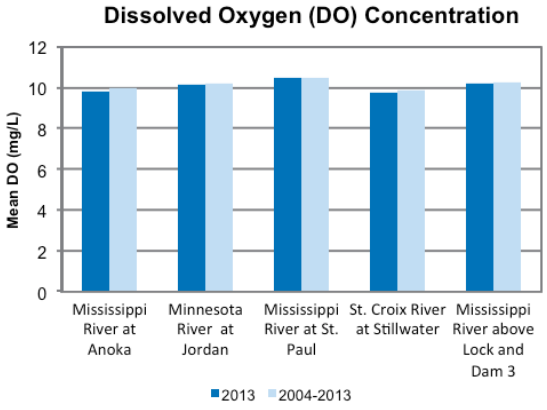


2013 Results: 2013 average E. Coli concentrations were well below the average monthly water quality standard of 126 organisms/100ml at all points, indicating favorable conditions for recreational use. There were only three samples within the April 1 to October 31 window in 2013 that exceeded 1,260 organisms/100 ml: one each in the Minnesota River at Jordan, and in the Mississippi River at Anoka and above Lock and Dam 3. The 2013 average concentration exceeded the 10-year average at Minnesota River at Jordan, Mississippi River at Anoka, and Mississippi River at St. Paul. The 2013 average concentration was below the 10-year average at Mississippi River above Lock and Dam 3. The 2013 average concentration was not noticeably different from the 10-year average at St. Croix River at Stillwater.

Dissolved Oxygen (DO)

Description: High oxygen levels provide healthy conditions for a diverse fish population, indicating fishable conditions. Living organisms need oxygen to survive so the amount of dissolved oxygen in a river determines whether it can support aquatic life. Dissolved oxygen can enter an aquatic system from the atmosphere but is also produced in aquatic systems through photosynthesis. DO concentrations can be reduced through high temperatures, low flow, increased pollution, and the decomposition of organic material in the water.

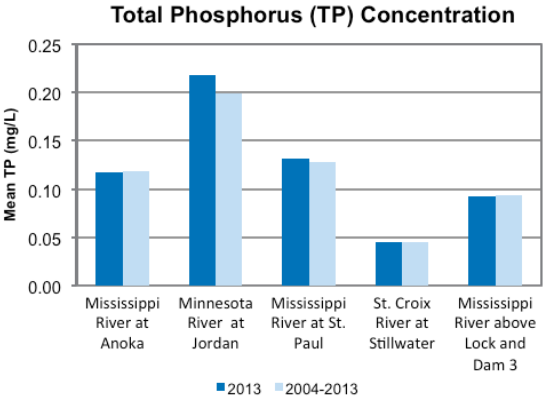
Standard: Dissolved oxygen must not be below 5 mg/L for a daily minimum.



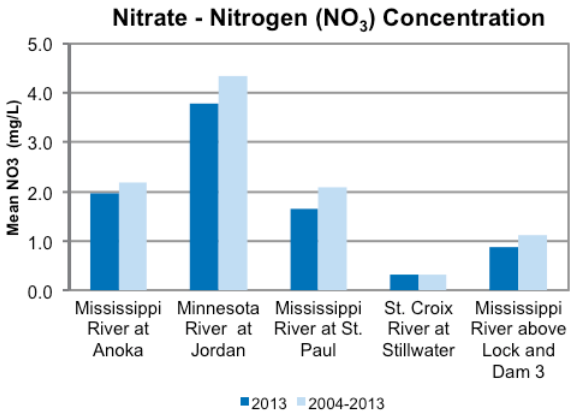
2013 Results: No individual sample measurements in 2013 at any of the five sites were below 5 mg/L, including the Minnesota River, where traditionally concentrations have been below the standard. The 2013 average DO concentration was slightly below the 10-year average at Mississippi River at Anoka and at St. Croix River at Stillwater. The 2013 average DO concentration was not noticeably different from the 10-year average at Minnesota River at Jordan, Mississippi River at St. Paul, or Mississippi River above Lock and Dam 3.

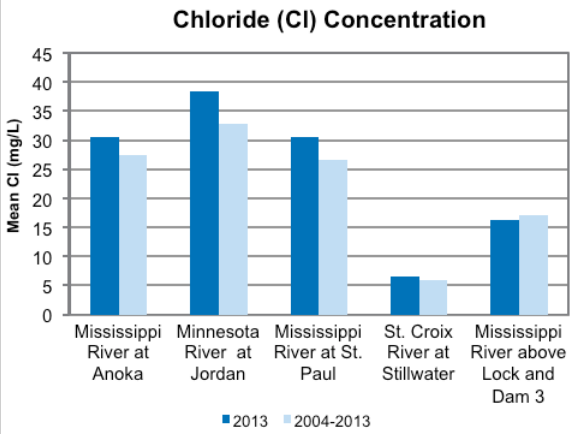
Nutrients: Total Phosphorus (TP) and Nitrate-Nitrogen (NO_3)

Description: Aquatic plants provide food, oxygen and habitat for river organisms. However, an excess of plant growth can lead to unsightly algae blooms, oxygen depletion, and odor upon decaying, making the water unpleasant for recreational activities and unsuitable for aquatic life. Nitrogen and phosphorus are essential nutrients for plant growth and individually or combined are often the limiting nutrient(s) in aquatic systems. Nitrogen and phosphorus are common components of wastewater treatment plant discharges and urban and agricultural runoff. They can stimulate excessive plant growth when levels in rivers are too high.



Standards: No river standard for total phosphorus currently exists. A eutrophication standard that would include phosphorus is currently going through the review and approval process by the MPCA. Class 2Bd drinking waters cannot exceed 10 mg/l nitrate-nitrogen. The Mississippi River above the Upper St. Anthony Falls and the St. Croix River are classified as drinking waters.





2013 Results: Almost all 2013 samples met the drinking water standard except for 7 samples at the Minnesota River at Jordan. The 2013 average phosphorus concentration was above the 10-year average and the average nitrate concentration was below the 10-year average at both the Minnesota River at Jordan and the Mississippi River at St. Paul. The 2013 average nitrate concentration was below the 10-year average and the average phosphorus concentration was not noticeably different from the 10-year average for the Mississippi River at Anoka and the Mississippi River above Lock and Dam 3. The 2013 average total phosphorus and nitrate concentrations were not noticeably different from the 10-year average at the St. Croix at Stillwater.

Chloride (Cl)

Description: Excess levels of chloride can be toxic to aquatic and terrestrial organisms. Although some chloride is derived from natural sources, the majority of chloride in the metro area rivers is from urban sources such as road deicing and water softening.
Standards: Chloride concentration must not exceed a 4 day average of 230 mg/l or a one hour average of 860 mg/l.
2013 Results: No samples at any site exceeded the 4 day average standard of 230 mg/l. The 2013 average chloride concentration was above the 10-year average at the Minnesota River at Jordan, the Mississippi River at Anoka, the Mississippi River at St. Paul, and the St. Croix River at Stillwater. The 2013 average chloride concentration was slightly below the 10-year average at the Mississippi River above Lock and Dam 3.

Table 1: 2013 average water quality as compared to the 10-year average (2004 – 2013)

	Flow	Turbidity[a]	TSS	*E.coli*[b]	DO	TP	NO_3	Cl
Mississippi River at Anoka	Higher	Lower	Lower	Higher	Lower	Same	Lower	Higher
Minnesota River at Jordan	Lower	Lower	Lower	Higher	Same	Higher	Lower	Higher
Mississippi River at St. Paul	Lower	Lower	Lower	Higher	Same	Higher	Lower	Higher
St. Croix River at Stillwater	Same	Lower	Lower	Lower	Lower	Same	Same	Higher
Mississippi River above Lock and Dam 3	Lower	Lower	Lower	Same	Same	Same	Lower	Lower

"Same" means that the average 2013 concentration was within 1% of the 10-year average concentration.
[a]Average is based on data from 2006 – 2013.
[b]Average is based on data from 2005 – 2013.

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