SAND CREEK POLLUTANT TREND UPDATE

Introduction

The Twin Cities metropolitan area of Minnesota has a wealth of streams that traverse its landscape and ultimately flow into one of three major rivers – the Mississippi, the Minnesota, and the St. Croix. These streams provide a rich habitat for aquatic life and wildlife and enhance the recreational and aesthetic value of the metro area.

The Metropolitan Council is committed to the conscientious stewardship of the region's streams and tributary rivers and works with its partners to maintain and improve their health and function. The foundation for these efforts is the collection and interpretation of high-quality, long-term data to produce insightful, actionable information. The Council could not do this work at Sand Creek without the long-term partnership with Scott County Watershed Management Organization (WMO), Rice County and Le Sueur County.

Pollutant trends are a valuable tool to understand how a stream's water quality is changing over time. The Met Council first calculated statistical trends on Twin Cities streams and tributary rivers that are part of its monitoring programs in the 2014 *Comprehensive Water Quality Assessment of Select Metropolitan Area Streams* (subsequently referred to as the 2014 Stream Report). This report is available online at https://metrocouncil.org/Wastewater-Water/Services/Water-Quality-Management/Stream-Monitoring-Assessment.aspx. At that time, water quality trends were calculated for total suspended solids, total phosphorus, and nitrate through the year 2012. In addition, in 2021 the Met Council calculated chloride trends analysis for their monitored streams. The chloride trend results are reported in a series of memos which are available on the Met Council's Environmental Information Management System (EIMS) website: https://eims.metc.state.mn.us/Documents.

This memo provides updated total suspended solids, total phosphorus, and nitrate trends originally published in the 2014 Stream Report for Sand Creek using data through the end of 2021.

Site Description

Water quality and flow is monitored in Sand Creek at mile 8.2, near 2nd Street in the city of Jordan. Monitoring at this location started at the end of 1989.

Trend Overview

Trend analysis was performed using the USGS R-QWTREND package. R-QWTREND is a statistical model specifically designed to investigate pollutant trends, which tests potential trends (increase or decrease in concentration) against a no-trend model. The model is designed to investigate trends in flow-adjusted concentrations by removing the variability of annual flow and seasonality from the statistical analysis. The resulting trend line shows how pollutant concentrations have changed over time due to factors in the stream or watershed other than flow, such as land use modification, point discharge changes, best management plan (BMP) implementation, or stream restoration. The trend results do not show causation: why a trend might be moving up or down. However, they provide information about the effects of complex interactions occurring in the stream and watershed, which might help reassure managers that actions taken on the landscape are having an impact or motivate additional engagement in improving stream health.

Trends were assessed at a statistical significance level of 0.1. Overall and individual trends are shown whether they are statistically significant or not, but non-significant trends (trends with p-values greater than 0.1) are indicated in tables with a “NS” notation and are shown in graphs with a dotted line. A non-significant trend means that there is not enough evidence to state the trend is caused by real environmental change rather than natural variability. Often trends are identified but not significant when there are very small changes in concentration over time or when environmental data is scattered. While the underlying trend fit of the data is still valid and potentially useful, non-significant trends should be used with caution and qualified as such when describing environmental change.

For more detailed information on Met Council’s technical approach to trend analysis for this assessment using R-QWTREND, please see the Met Council’s methodology document specific to this study.

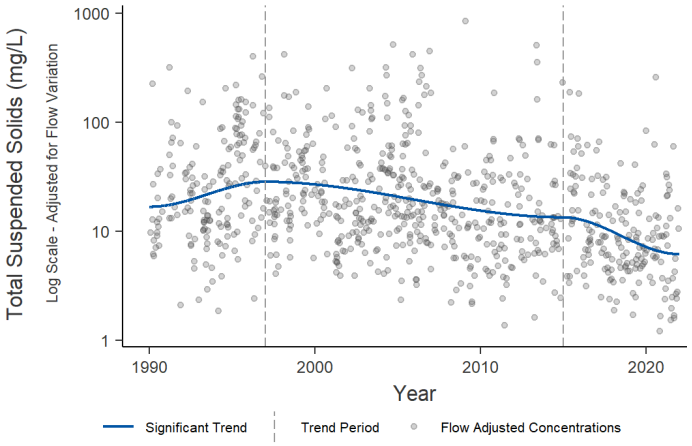
Total Suspended Solids Trend

A total suspended solids trend was calculated using data from 1990-2021. R-QWTREND analysis shows that changes in total suspended solids flow-adjusted concentration in Sand Creek can be best represented by a statistically significant two-trend model ($p < 0.001$). Total suspended solids concentration increased initially from during 1990 to 1996, and then decreased gradually from 1997 to 2014 followed by another faster decrease from 1995 to 2021. The results indicate a continuous improvement in water quality during the recent 25 years. The change in concentration percentages and p-values for each trend period are shown in Table 1 below, and a plot of the trend line with concentrations is shown in Figure 1.

Table 1: Statistical Trend Summary for Total Suspended Solids

Trend Period	Change in Concentration (%)	Trend *p* value
1990 - 1996	69.6%	0.024
1997 - 2014	-52.8%	< 0.001
2015 - 2021	-54.0%	0.083

Figure 1: Statistical Trend Graph for Total Suspended Solids



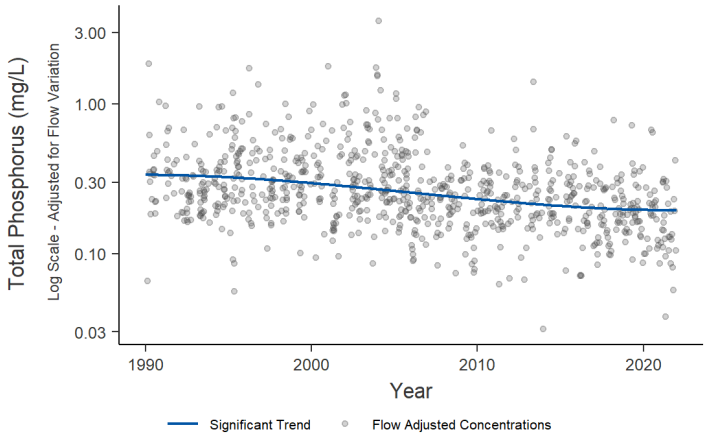
Total Phosphorus Trend

A total phosphorus trend was calculated using data from 1990-2021. R-QWTREND analysis shows that changes in total phosphorus flow-adjusted concentration in Sand Creek can be best represented by a statistically significant one-trend model ($p < 0.001$). Total phosphorus concentration decreased gradually over the entire assessment period from 1990 to 2021, indicating a continuous improvement in water quality during the assessment period. The change in concentration percentages and p-values for each trend period are shown in Table 2 below, and a plot of the trend line with concentrations is shown in Figure 2.

Table 2: Statistical Trend Summary for Total Phosphorus

Trend Period	Change in Concentration (%)	Trend *p* value
1990 - 2021	42.0%	< 0.001

Figure 2: Statistical Trend Graph for Total Phosphorus



Nitrate + Nitrite Trend

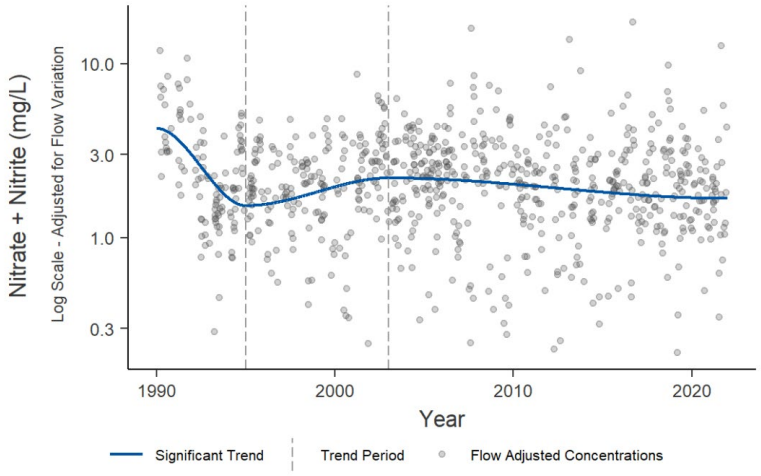
A nitrate+nitrite trend was calculated using data from 1990 - 2021. The trend was determined for nitrate+nitrite rather than just nitrate as in the 2014 Stream Report to be consistent with state agency partners.

R-QWTREND analysis shows that changes in nitrate+nitrite flow-adjusted concentration in Sand Creek can be best represented by a statistically significant three-trend model ($p = 0.022$). Nitrate+nitrite concentration decreased sharply from 1990 to 1994, increased from 1995 to 2002 and then decreased slowly over the remaining assessment period until 2021. The results indicate a continuous improvement in water quality during the recent 19 years. The change in concentration percentages and p-values for each trend period are shown in Table 3 below, and a plot of the trend line with concentrations is shown in Figure 3.

Table 3: Statistical Trend Summary for Nitrate + Nitrite

Trend Period	Change in Concentration (%)	Trend *p* value
1990 - 1994	-64.2%	< 0.001
1995 - 2002	44.3%	0.011
2003 - 2021	-23.7%	0.030

Figure 3: Statistical Trend Graph for Nitrate + Nitrite



For Additional Information

Met Council staff are available for additional discussions about these trend analysis results, including discussions about the potential impact of watershed activities on stream conditions, future data collection, data analysis, or other technical advice. Please contact Dan Henely, Assistant Manager, Water Resources, daniel.henely@metc.state.mn.us, to discuss options.

The raw data used to calculate trends is available on the Met Council's EIMS website: https://eims.metc.state.mn.us/.

Previous technical analysis, including the 2014 Stream Report and 2021 chloride fact sheets can be found on the EIMS document repository: https://eims.metc.state.mn.us/Documents.