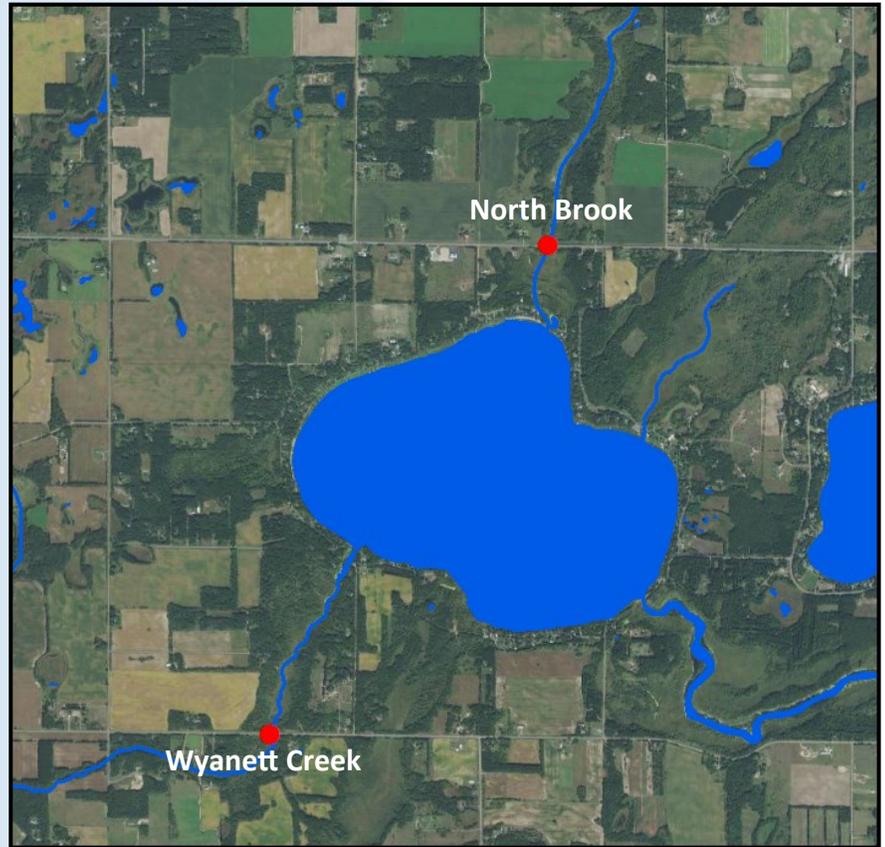
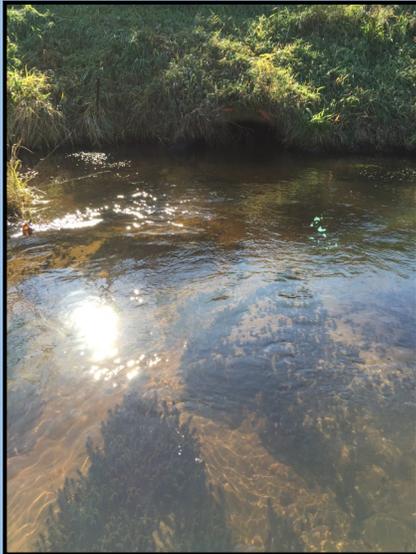


Green Lake Tributary Monitoring 2016

Introduction

2016 was the first year the Green Lake Improvement District (GLID) partnered with the Isanti Soil and Water Conservation District (SWCD) to monitor the health of two tributaries that empty into Green Lake:

- North Brook at highway 95
- Wyanett Creek at 325th Ave.



Tributary Monitoring

Tributary ID's were developed by the Isanti SWCD

What: In 2016 eight sample events were conducted at both major tributaries targeting four samples during rain events and four during base flow. The samples were tested for total phosphorus (TP), total suspended solids (TSS) and transparency. Dissolved oxygen, temperature, conductivity, pH and water flow were also measured in the field. TP concentrations were paired with flow to help us get a better understanding of how much water and nutrients are being carried from the tributaries and into the lake (i.e. pounds of phosphorus per day).

Why: The information collected is being used in the development of the Subwatershed Assessment for North Brook and Wyanett Creek (underway). The data will help us determine which tributary should be a higher priority for water quality projects. In theory, the stream that delivers the most nutrients to the lake would be the highest priority. Additionally, this information will be used to track trends, determine how well water quality improvement projects are working, and track progress towards the goals set for the streams in the Green Lake Total Maximum Daily Load Study (TMDL).

Total Phosphorus: an essential plant nutrient in which an excess can cause severe algal blooms.

Orthophosphate: the amount of phosphorus that is immediately available for algae and plant growth.

Total Suspended Solids: tiny particles of soil and other matter that remain suspended in water making it cloudy. Particles include sediment and organic matter.

Transparency: an indirect measure of suspended and dissolved materials (soil particles and tea color caused by organic materials) in the water.

2016 Tributary Monitoring Results

Total Suspended Solids (TSS), Total Phosphorus (TP) and Transparency Tube

Eco-region Concentrations

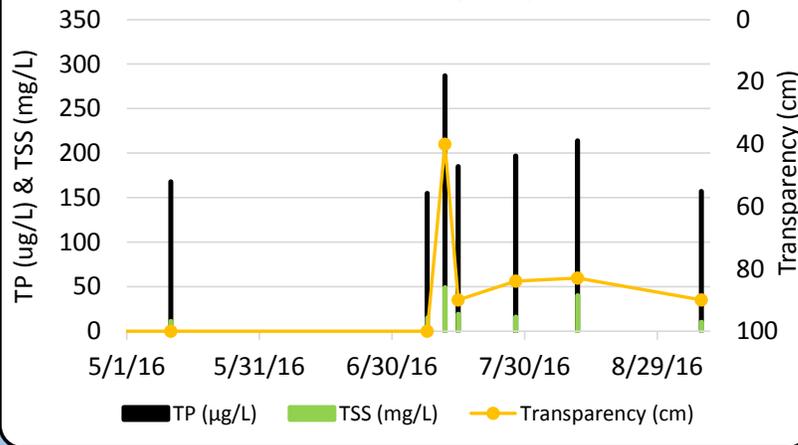
	TP ($\mu\text{g/L}$)	TSS (mg/L)
Typical Range	60 to 150	4.8 to 16
2016 Average	181.25	20.65
Goal	100 $\mu\text{g/L}$	NA

Site:

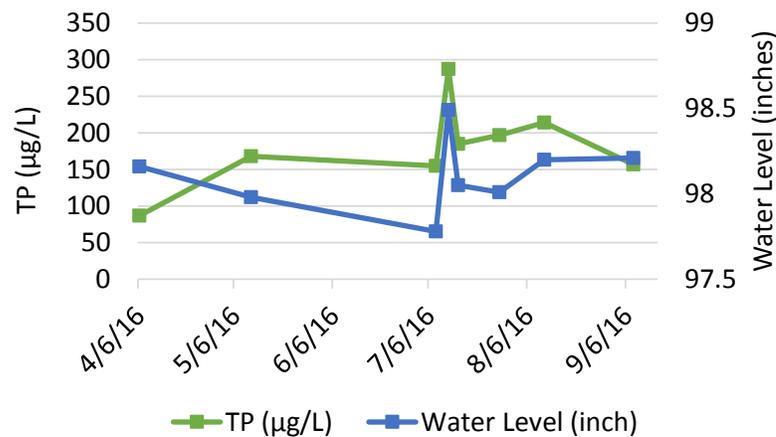
North Brook at Highway 95

- The average concentration of TP at this location was 181.25. This concentration is above the expected range of concentrations for this region.
- The TMDL Study set a TP goal of 100 $\mu\text{g/L}$ as a concentration for North Brook.
- The average concentration of TSS detected at this location was 20.65 mg/L. This concentration is above the expected range of concentration for this region.
- Based on one year of paired flow and sample information, we believe North Brook may contribute less nutrients to the lake than Wyanett Creek. More information is needed.
- Transparency readings averaged 85.87 cm (Transparency tubes only measure to 100 cm) this means the water is typically quite clear.
- The high concentration of TP found in the July 12th sample correspond with a high rain event that proceeded a moderate drought period.
- Water quality does fluctuate in relation to rainfall at this location; the most likely causes are a combination of flushing of nutrients from the wetland-dominated watershed following dry spells and rain water runoff from land.

North Brook at Highway 95



Total Phosphorus vs. Water Level



2016 Tributary Monitoring Results

Total Suspended Solids (TSS), Total Phosphorus (TP) and Transparency Tube

Eco-region Concentrations

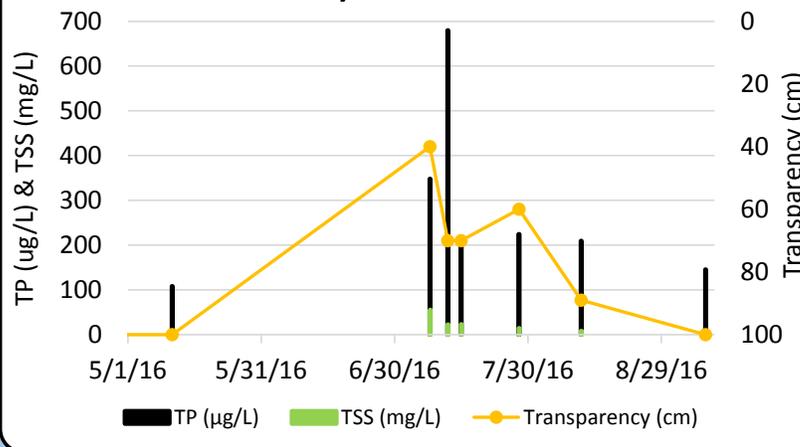
	TP ($\mu\text{g/L}$)	TSS (mg/L)
Typical Range	60 to 150	4.8 to 16
2016 Average	247	17.5
Goal	100 $\mu\text{g/L}$	NA

Site:

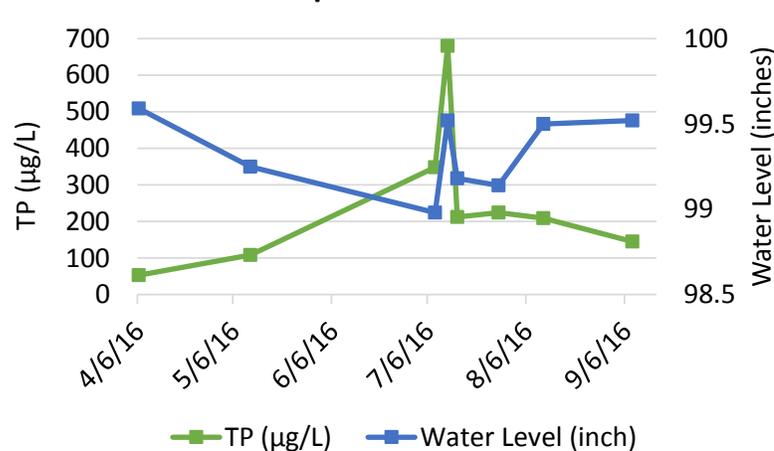
Wyanett Creek

- The average concentration of TP at this location was 247 $\mu\text{g/L}$; significantly higher than the range of expected concentrations for this ecoregion.
- The TMDL Study set a TP goal of 100 $\mu\text{g/L}$ as a concentration for Wyanett Creek.
- The average concentration of TSS detected at this location was 17.5 mg/L. This concentration is above the expected range of concentrations for this region.
- Based on one year of paired flow and sample information, we believe Wyanett Creek may contribute more nutrients to lake than North Brook. More information is needed.
- Transparency readings averaged 78.67 cm (Transparency tubes only measure to 100 cm) this means the water is typically quite clear.
- The high concentration of TP found in the July 12th sample correspond with a high rain event that proceeded a moderate drought period.
- Water quality does fluctuate in relation to rainfall at this location; the most likely causes are a combination of flushing of nutrients from the wetland-dominated watershed following dry spells and rain water runoff from land.

Wyanett Creek



Total Phosphorus vs. Water Level



2016 Results and Recommendations



Nutrient concentrations were consistently high throughout the sample season at both Wyanett Creek and North Brook. The highest observed concentrations occurred following a large rain event that was preceded by a dry spell. We suspect that the increase in TP was a result of one or a combination of the following: 1) flushing of nutrients and organic material from the large wetland-dominated watersheds and/or 2) runoff of nutrients from nearby agricultural land.

Interestingly, TP was also high during base-flow events. This characteristic is often observed downstream of wetlands that become anoxic (low –no oxygen) during periods of low flow. Anoxic conditions cause phosphorus to release from sediments. If the wetland is in fact a source of pollution a wetland restoration/treatment may be key to lake restoration.

The subwatershed assessment for North Brook and Wyanett, along with additional monitoring data, will help locate and determine appropriate projects to reduce nutrient contributions from both of the major tributaries.

Because weather conditions and other environmental factors can vary so drastically from year to year it is recommended to continue monitoring at each of the tributaries as planned. Continued monitoring will give us a better understanding of how the streams and lake respond to environmental conditions and therefore how we might best be able to work together to protect the quality of the lake.

Below are key points and recommendations for monitoring in 2017 at each of the two tributaries:

- Sample as planned (same as 2016): 8 grab samples at highest and lowest water levels (peak flow and low flow); water level measurements; flow; dissolved oxygen; temperature; pH.
- Continue monitoring stream flow: collect stream flow data during 4 peak flow and 4 low flow stream conditions.
- **NEW:** Implement surface water equipment to continuously record stream water level data at programmable intervals. This information will allow us to more accurately determine nutrient loading variables and conditions.

OTT Orpheus Mini Water Level Logger:



For more information contact: **Isanti SWCD 763-689-3271**
Tiffany Determan, District Mgr Tiffany.Determan@mn.nacdnet.net or
Todd Kulaf, Conservation Tech todd.kulaf@mn.nacdnet.net

Thanks to the GLID members who have assisted with lake and stream monitoring.