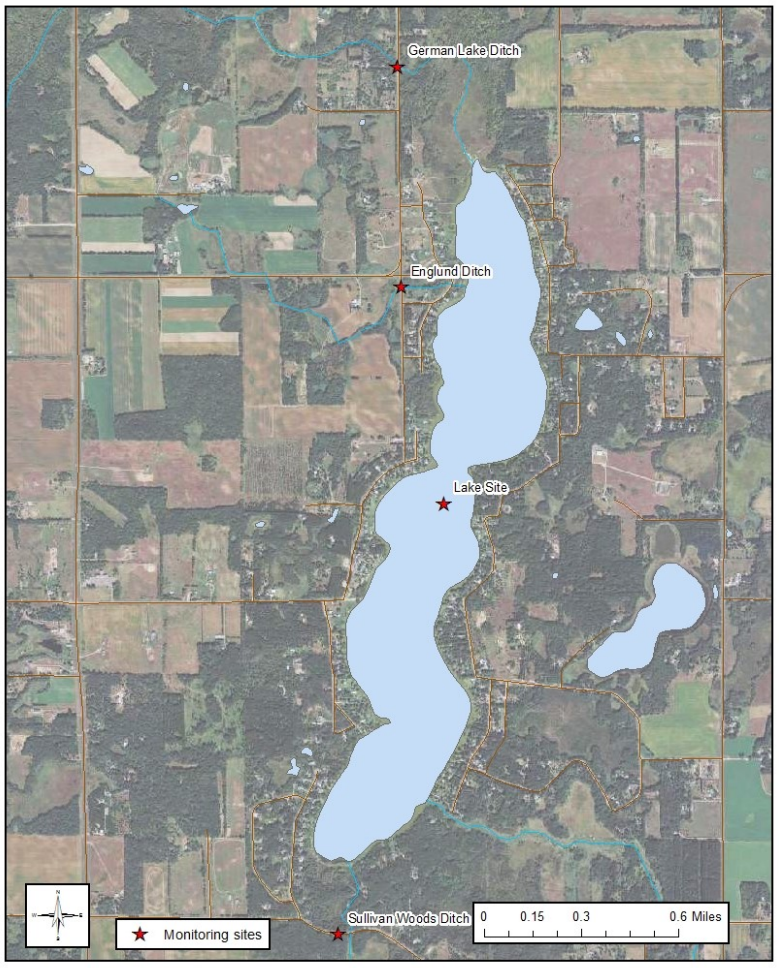
Long Lake—Bradford Township Monitoring Report 2017

What: Long Lake Association volunteers collected Total Phosphorus (TP), Chlorophyll-a, and transparency information every weeks from May through September in at the deepest part of the lake (see map). SWCD staff provided training, equipment and coordinated lab testing.

Why: Long Lake was added to the MN impaired waters list in 2015 for having high nutrients. The listing triggered the completion of a Total Maximum Daily Load (TMDL) study. TMDL's are studies that quantify the TP reduction necessary in order to make the lake healthy again. The study identified that a 61% TP reduction is required in order to improve recreational suitability and reduce algae blooms.

The monitoring data collected in 2017, the first year of monitoring partnership between the SWCD and LLID, will be paired with over 10 years of historical data to help us get a better understanding of the factors driving high nutrient levels. Additionally, we can use the data to track trends over time, assist with targeting/placement of projects that will improve lake health (to be identified in the two-Phased Subwatershed Assessments) and to track the effectiveness of those projects (i.e. raingardens & lakeshore restorations).

Water Quality Monitoring - Long Lake



Completed By: Todd Kulaf, Isanti SWCD

Lake Data for Long Lake—Bradford Township	
Township	Bradford
MN Lake ID	30-0072-00
# of Public Boat Access	2
Aquatic Invasive Species	Curly Leaf Pondweed Eurasian Water Milfoil
Surface Area	362 acres
Maximum Depth	11ft
Lake Meets Clean Water Goals	Total Phosphorus: No
(When compared to shallow lake goals)	Chlorophyll-a: No
	Secchi Transparency: No

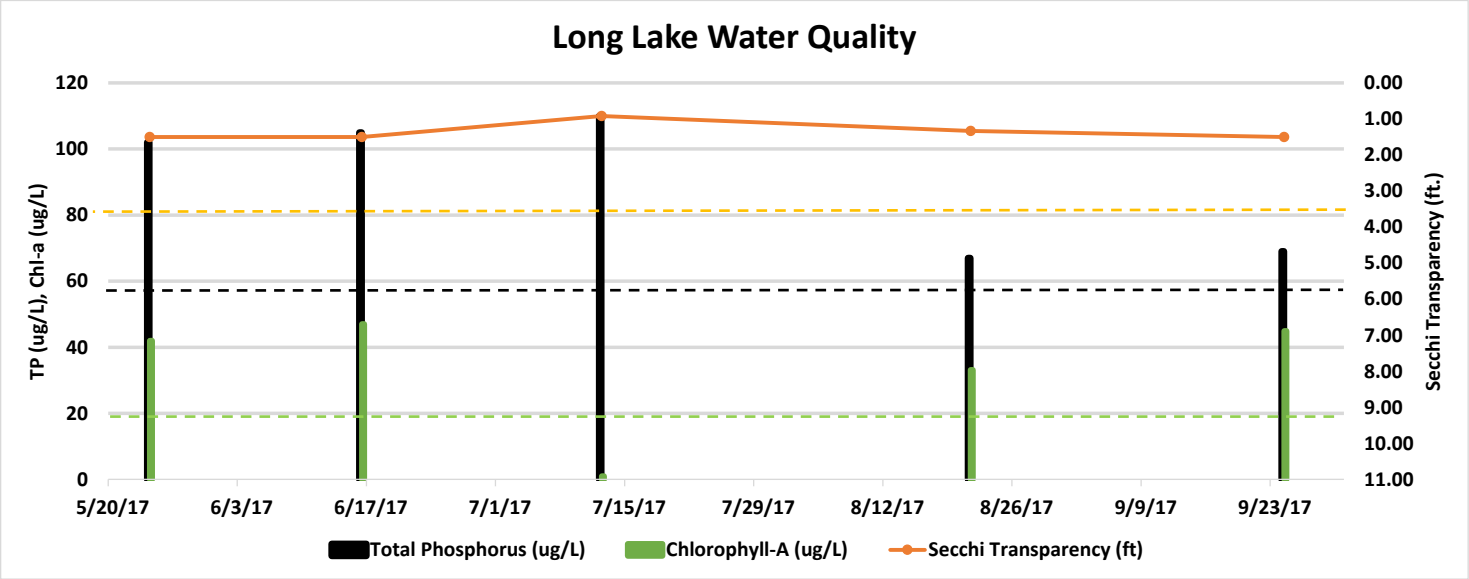
Long Lake Monitoring Results 2017

Total Phosphorus (TP), Chlorophyll-a (Chl-a) and Secchi Transparency

MN Clean Water Goals for Shallow Lakes

Total Phosphorus (TP): ≤ 60 ug/L Chlorophyll-a: ≤ 20 mg/m3 Secchi Depth: ≥ 3.28 feet

Growing season average (June-September)	90.60 (TP)	33.60 (Chl-a)	1.26 (Secchi)



Long Lake has a maximum depth of approximately 11ft which means the lake has characteristics of a shallow lake. Shallow lakes tend to occur in one of two conditions: one is a clear water condition with abundant rooted aquatic vegetation (high fish and wildlife habitat value) and the other is a turbid condition with few aquatic plants (low fish and wildlife habitat value). Shallow lakes are also more concentrated (less volume of water) and the water within them mixes easily; as such, shallow lakes naturally have higher levels of nutrients. The monitoring results for Long Lake are compared to the state's goals for shallow lakes in this area.

When compared to shallow lake water quality goals, Long Lake exceeded thresholds for all three parameters (TP, Chl-a, and transparency). This information was used by the Minnesota Pollution Control Agency (MPCA) to classify the lake as "impaired".

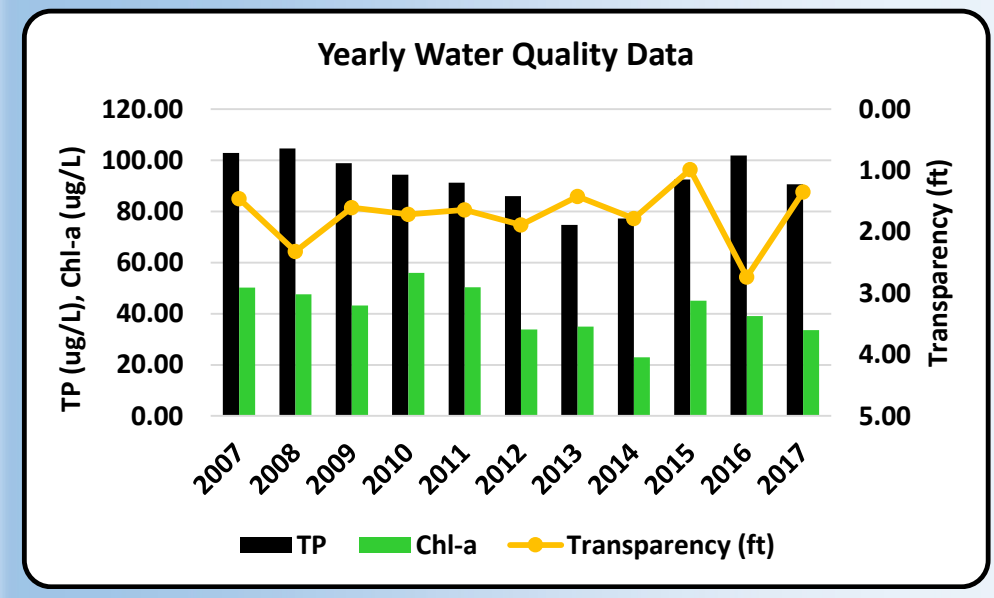
In 2017 early season (May-July) samples highest concentrations of nutrients. Interestingly, these water samples were all taken following rainfall events ranging from 1.5 to 3 inches. This suggests, nutrients from nearby land was carried in by stormwater runoff into the lake. It is important to note that the storm events could have also caused the lake water column and nutrients sitting at the bottom of the lake to mix and release nutrients from the bottom of the lake. The aforementioned scenarios combine with hot temperatures and algae blooms resulted in high concentrations of Chl-a and low transparency readings. Chl-a was low during the July sample event, we are unsure why.

General Definitions

Phosphorus (TP): an essential plant nutrient in which an excess can cause severe algal blooms, measures all usable forms.
Chlorophyll-a (Chl-a): a pigment found in green plants, used to estimate amounts of algae in a lake.
Secchi Transparency: a measure of light penetration in water, an indication to the amount of algae in the water.

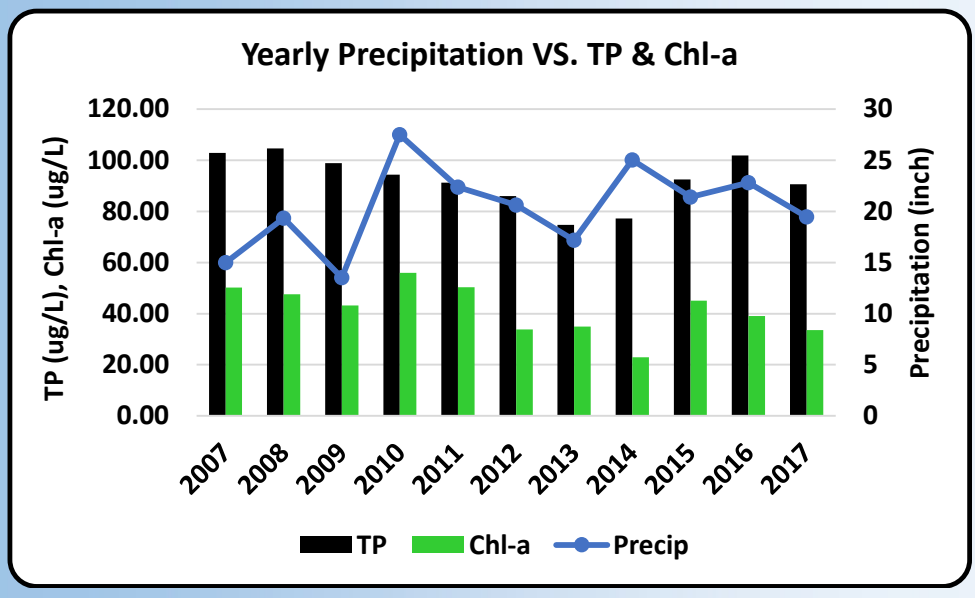
Historic Monitoring Data Comparison

Total Phosphorus (TP), Chlorophyll-a (Chl-a) and Secchi Transparency



Source: MPCA and Isanti SWCD

Sporadic water quality data is available for the lake dating back to 1985 and a robust data set is available dating back to 2007. Recent years data indicates a slight improving pattern.



Source: MPCA and Isanti SWCD

Precipitation clearly plays a role in Long Lake's water quality. For the majority of the 10 monitoring years, precipitation corresponds with annual nutrient concentrations. At this point, we believe that it is important to address upland sources of nutrients that are making their way into the lake via the inlets and adjacent shoreline property.

General Definitions

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2017 Monitoring Recommendations

Long Lake has consistent TP, Chl-a and transparency data dating back to 2007. Yearly average nutrient concentrations have exceeded clean water goals during each of those years. For the majority of the years, precipitation corresponds with nutrient concentrations—this is an indicator that stormwater runoff has a negative effect on lake health. As such, it will be important to continue the shoreline restoration program and to implement projects that will reduce runoff within the watershed. The two-phased watershed assessment under development by the SWCD will help pinpoint locations for said projects.

Internal recycling of nutrients is also a likely factor contributing to poor water quality. Driving factors of internal recycling could be: rough fish such as black bullhead and/or carp, curlyleaf pondweed senesce, or water column/sediment mixing. These sources can and should be addressed after upland sources of nutrients are addresses or as the LLID deems appropriate.

<u>Below are key points and recommendations for lake monitoring in 2018:</u>

- Continue monitoring as planned.
- Make note periods of heavy boat traffic on the lake.
- Start thinking about addressing internal loading aspects.

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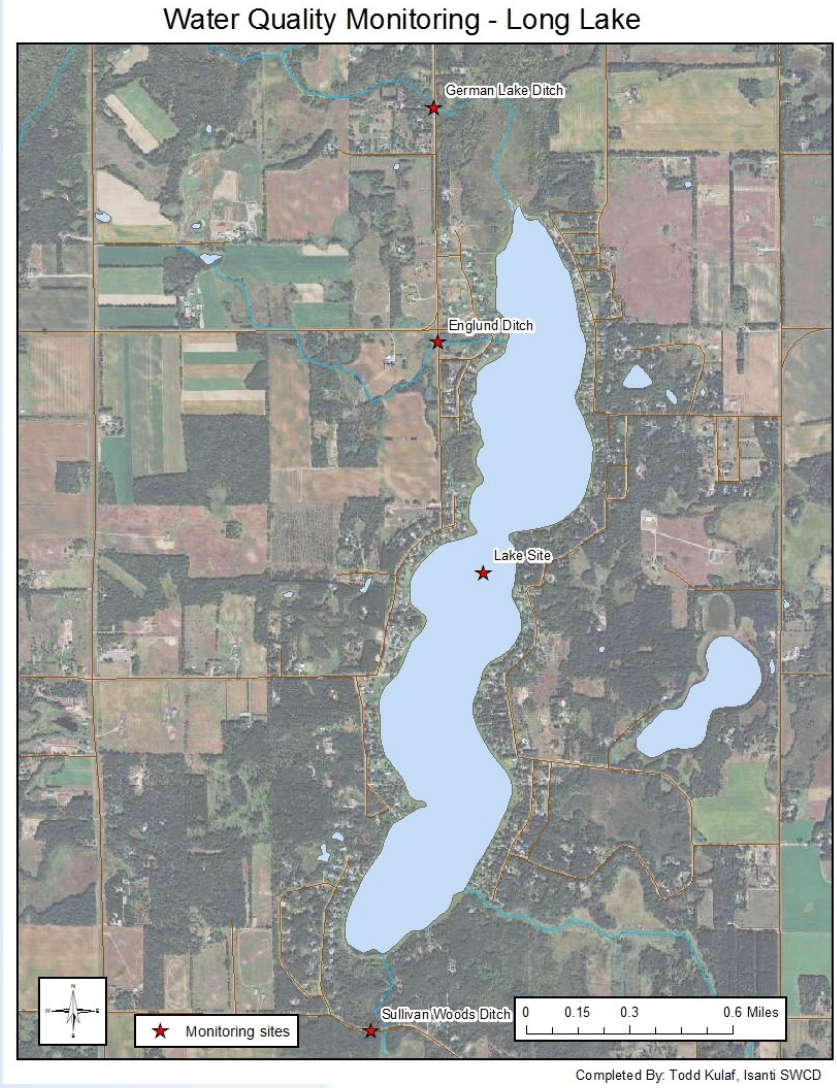
Long Lake
Tributary Monitoring 2017

Introduction

2017 was the first year the Long Lake Improvement Association partnered with the Isanti Soil and Water Conservation District (SWCD) to monitor the health of three inlets that empty into Long Lake:

- German Lake Ditch
- Englund Ditch
- Sullivan Woods Ditch



Tributary Monitoring

What: In 2017 four sampling events were conducted at all three inlets targeting two samples during rain events and two during base flow. Samples were lab-tested for total phosphorus (TP) and total suspended solids (TSS). Water temperature, stream condition and stream depth were recorded in the field.

Why: The information collected, in combination with the future sub-watershed assessment , will help us focus future lake water quality improvement projects at the best places on the landscape. Additionally, this information can be used to track health trends and to determine how well water quality improvement projects are working.

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

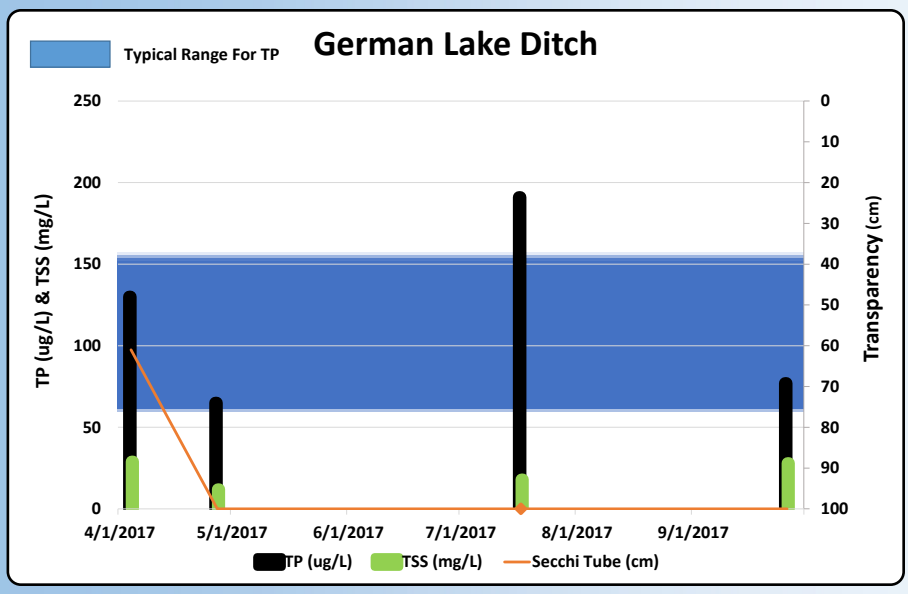
Total Suspended Solids: tiny particles of soil and other matter that remain suspended in water making it cloudy. Particles include sediment and organic matter.

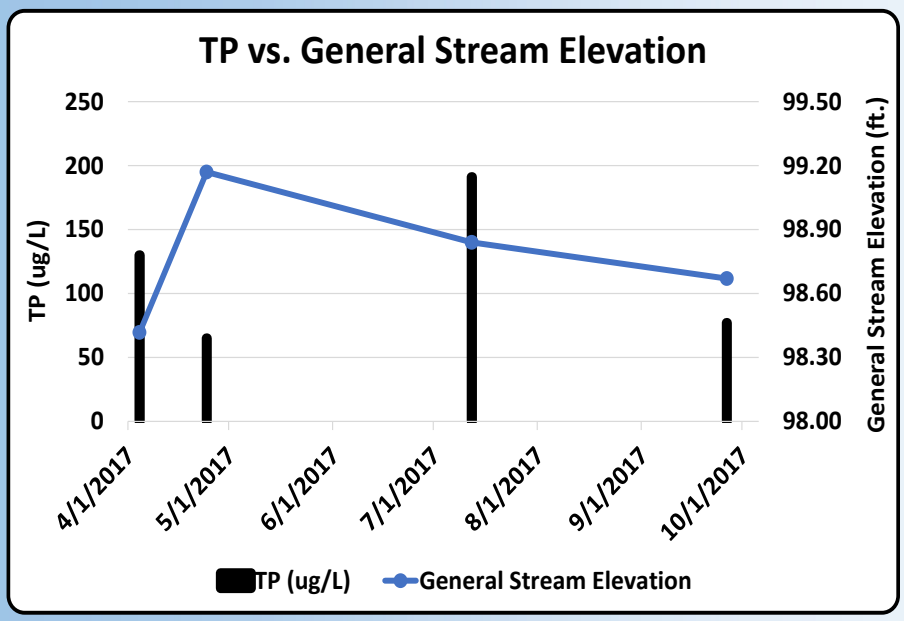
Transparency: an indirect measure of suspended and dissolved materials (soil particles and tea color caused by organic materials) in the water.

2017 Tributary Monitoring Results

Total Suspended Solids, Total Phosphorus and Transparency Tube

Eco-region Concentrations		
	TP (µg/L)	TSS (mg/L)
Typical Range	60 to 150	4.8 to 16
2017 Average	115.75	21.75
Goal	100	NA





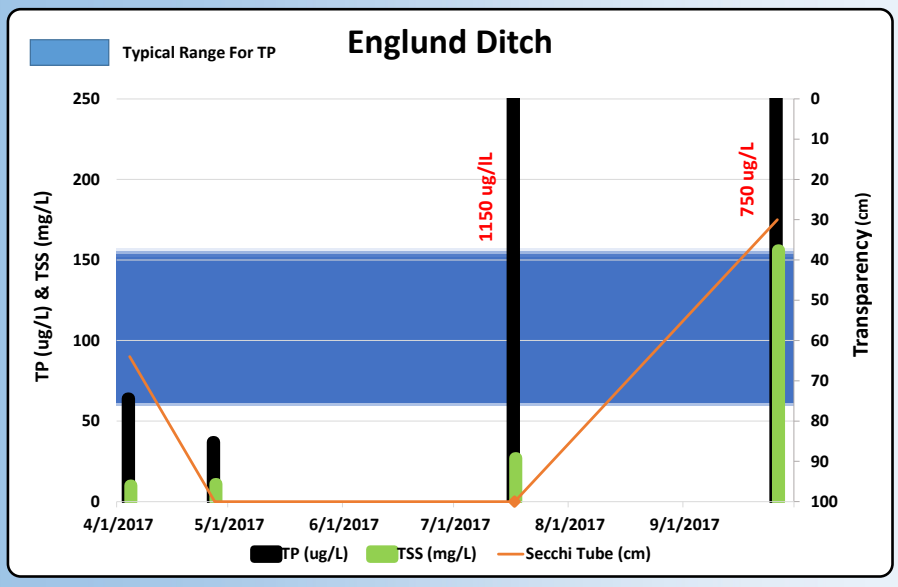
Data Analysis German Lake Ditch:

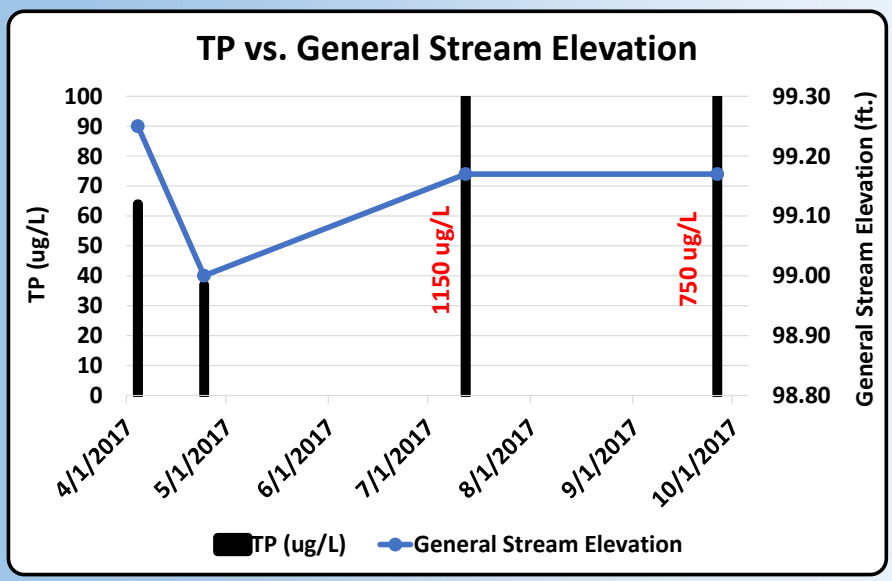
- Land use in this drainage area is dominated by ditched wetlands surrounded by agriculture.
- TP measurements for this area typically range between 60 and 150 µg/L (indicated in the graph as shaded blue zone). 2017 average was 115.75.
- The TMDL study set a TP goal of 100 µg/L as a concentration. With the exception of April and July, all samples were below this goal.
- TSS measurements for this area typically range between 4.8 and 16 mg/L. The average concentration of TSS detected at this location was 21.75 mg/L.
- Transparency readings averaged 90.25 cm (Transparency tubes only measure to 100 cm) this means the water is very clear. Samples taken April were cloudy. TSS was also elevated indicating that organic particles were present in the water column.
- When comparing TP and water level, its difficult to find any correlations between the two because of the minimal sampling events. It appears water elevation fluctuates only slightly throughout the year but with only 4 data sets it is difficult to understand if water level is effecting nutrient concentrations.

2017 Tributary Monitoring Results

Total Suspended Solids, Total Phosphorus and Transparency Tube

Eco-region Concentrations		
	TP (µg/L)	TSS (mg/L)
Typical Range	60 to 150	4.8 to 16
2017 Average	500.24	51
Goal	100	NA





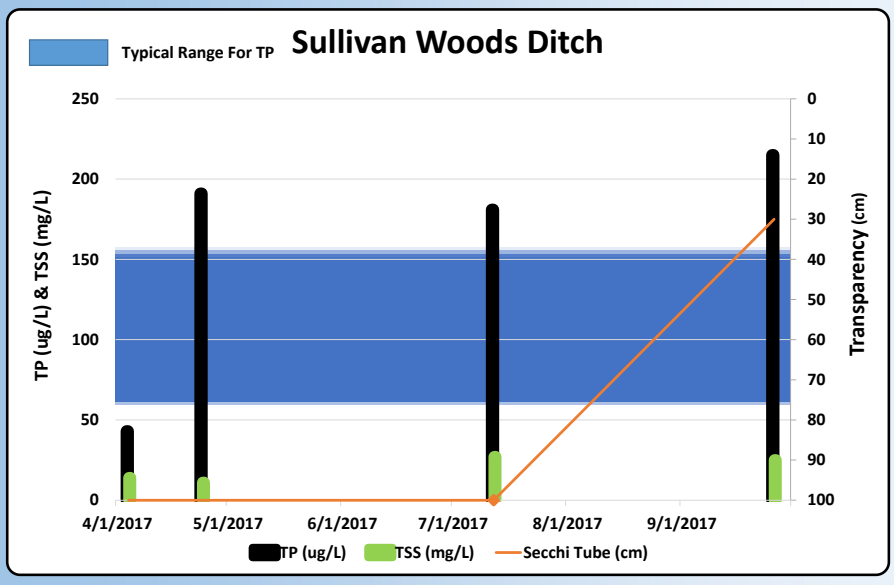
Data Analysis Englund Inlet:

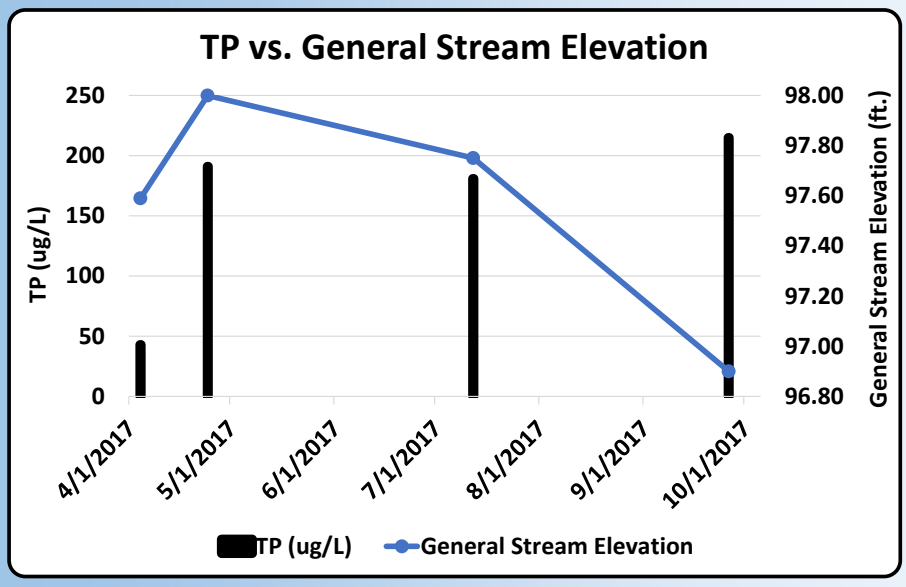
- Land use in this drainage area is dominated by agriculture.
- TP measurements for this area typically range between 60 and 150 µg/L (indicated in the graph as shaded blue zone).
- The TMDL study set a TP goal of 100 µg/L as a concentration.
- The average concentration of TP at this location in 2017 was 500.25 µg/L. Extremely high concentrations in July and September skewed the average. These samples contained large amounts of sediment; thus, the samples were flagged.
- TSS measurements for this area typically range between 4.8 and 16 mg/L. The average concentration of TSS detected at this location was 51.00 mg/L. Like the TP samples in July and September, the excess amounts of sediment in the sample skewed the results.
- Transparency readings averaged 73.5 cm (Transparency tubes only measure to 100 cm) this means the water is somewhat clear.
- When comparing TP and water level, the TP concentrations stay consistent with water level at the start of the sampling season. Later season data was flagged and assumptions can not be made.

2017 Tributary Monitoring Results

Total Suspended Solids, Total Phosphorus and Transparency Tube

Eco-region Concentrations		
	TP (µg/L)	TSS (mg/L)
Typical Range	60 to 150	4.8 to 16
2017 Average	157	19.25
Goal	100	NA





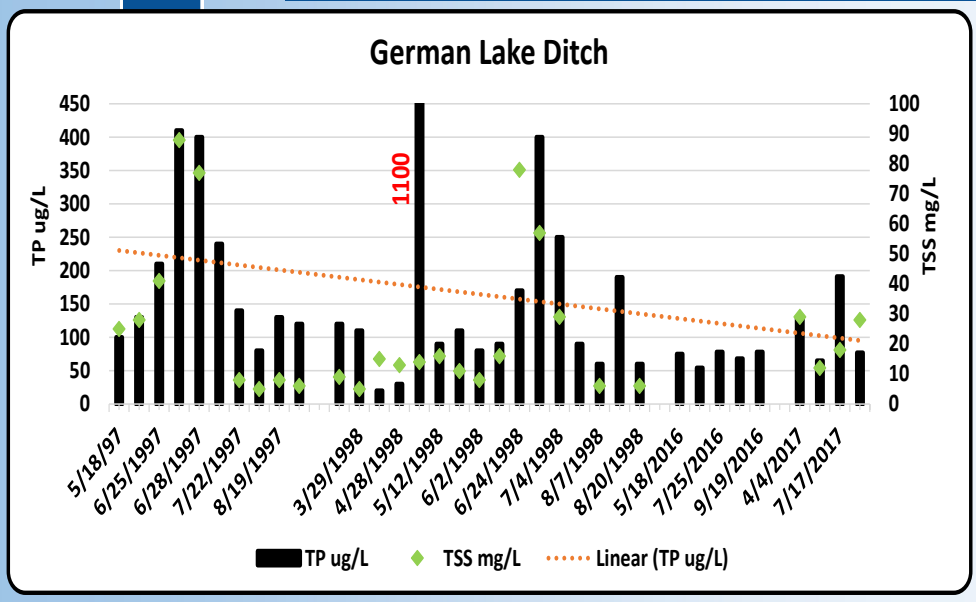
Data Analysis Sullivan Inlet:

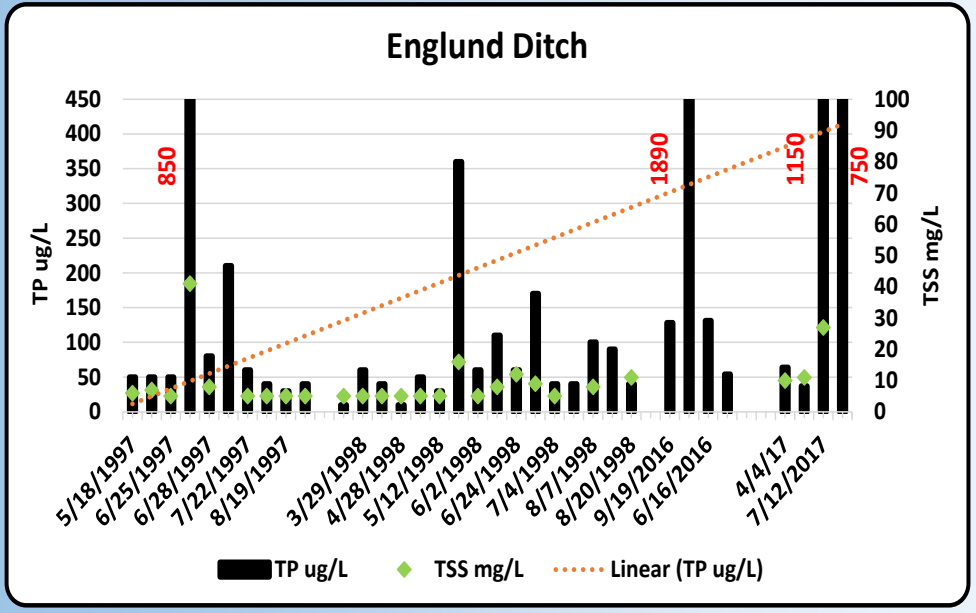
- Land use in this drainage area is dominated by wetlands.
- TP measurements for this area typically range between 60 and 150 µg/L (indicated in the graph as shaded blue zone).
- The TMDL study set a TP goal of 100 µg/L as a concentration.
- The average concentration of TP at this location in 2017 was 157 µg/L. Sediment was present in September's sample; thus, the sample was flagged.
- TSS measurements for this area typically range between 4.8 and 16 mg/L. The average concentration of TSS detected at this location was 19.25 mg/L.
- Transparency readings averaged 82.5 cm (Transparency tubes only measure to 100 cm) this means the water is typically clear.
- TP concentrations stay consistent with water level in the beginning of the year. When water level drops so does TP concentration. However, fall reading showed opposite. This could be a result from excess sediment in the water samples.

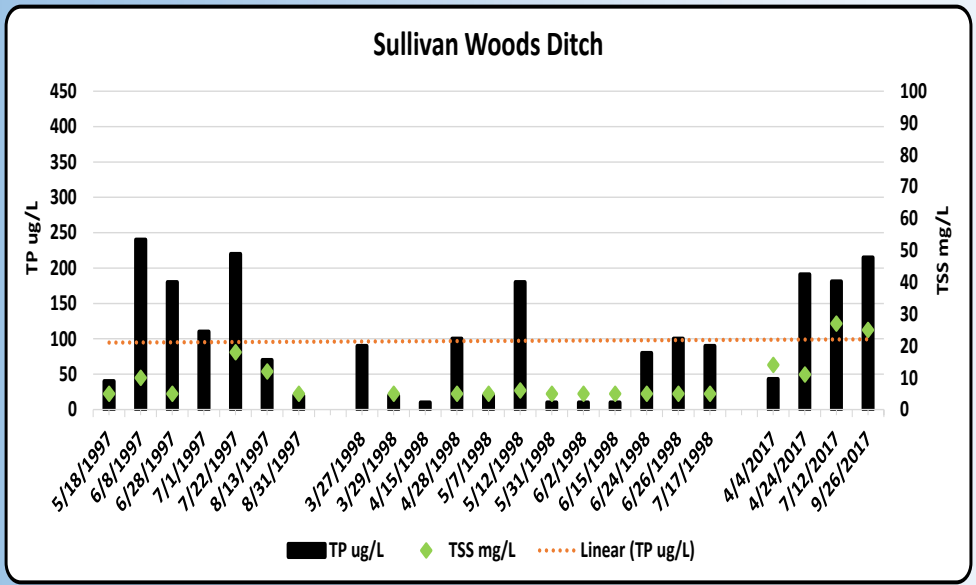
Historical Tributary Monitoring Results

Total Suspended Solids, Total Phosphorus and Transparency Tube

Data From MPCA—Concentrations exceeding 450 ug/L are labeled in red on the graphs







Eco-region Concentrations		
	TP (µg/L)	TSS (mg/L)
Typical Range	60 to 150	4.8 to 16
Goal	100	NA

The Minnesota Pollution Control Agency has monitoring data for at three tributaries for 1997, 1998, 2016 and 2017. Having data from 20 years ago gives insight to how the water quality has changed over time. However, with minimal data between 1998 and 2016 its difficult to understand water quality trends and potential contributing factors

German Lake Ditch:

Year	TP Average ug/L	TSS Average mg/L
1997	196	31.78
1998	186	20.21
2016	71	NA
2017	116	21.75

- Significant decline in nutrient concentrations from 1998 to 2016.
- Typically observed highest concentrations in June and July.

Englund Ditch:

Year	TP Average ug/L	TSS Average mg/L
1997	146	9.67
1998	79.375	7.43
2016	550.75	NA
2017	500.25	51

- Extreme TP concentration in 2016 and 2017.
- 2017 samples flagged for excess amounts of sediment in sample.

Sullivan Woods Ditch:

Year	TP Average ug/L	TSS Average mg/L
1997	125.71	9.17
1998	60	5.1
2016	NA	NA
2017	157.5	19.25

- Highest average nutrient concentrations observed in 2017

Results and 2018 Recommendations

Summary:

2017 data does give us some preliminary insight into the stream inlet impacts on Long Lake water health. Note: it is difficult to draw hard conclusions with minimal data. Furthermore, sediment present in some of the samples left the accuracy of the results questionable.

German Lake Ditch: Early and mid-season TP was above the TMDL goal. High TP in July (following a rain event) may have been due to wetland flushing and/or land use runoff. We are unable to draw conclusions for the results at this time. When looking at historical data, it appears that water quality from this inlet has improved over the years.

Englund Ditch: Early season TP was low at this location. Unfortunately, sediment present in late season samples rendered the results questionable. When looking at historical data, it appears that water quality at this inlet has not changed much over the years.

Sullivan Woods Ditch: TP concentrations were consistently high following rain events (April and July). Because the land use in the drainage area is dominated by wetlands, we can make the assumption that TP is being flushed from the wetlands during rain events. September results were not considered in this data analysis due to sediment present in the sample. When looking at historical data, it appears that water quality at this inlet has not changed much over the years.

Below are key points and recommendations for monitoring in 2018.

- **NEW:** Have the SWCD conduct sampling events 8 times during the year. Target four samples during storm events and four samples during base flow.
- **NEW**: Pressure monitoring equipment will be implemented at Englund Ditch and Sullivan Woods Ditch. The equipment will continuously record stream elevation which help to better understand nutrient concentration data.

For more information contact: IsantiSWCD 763-689-3271
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