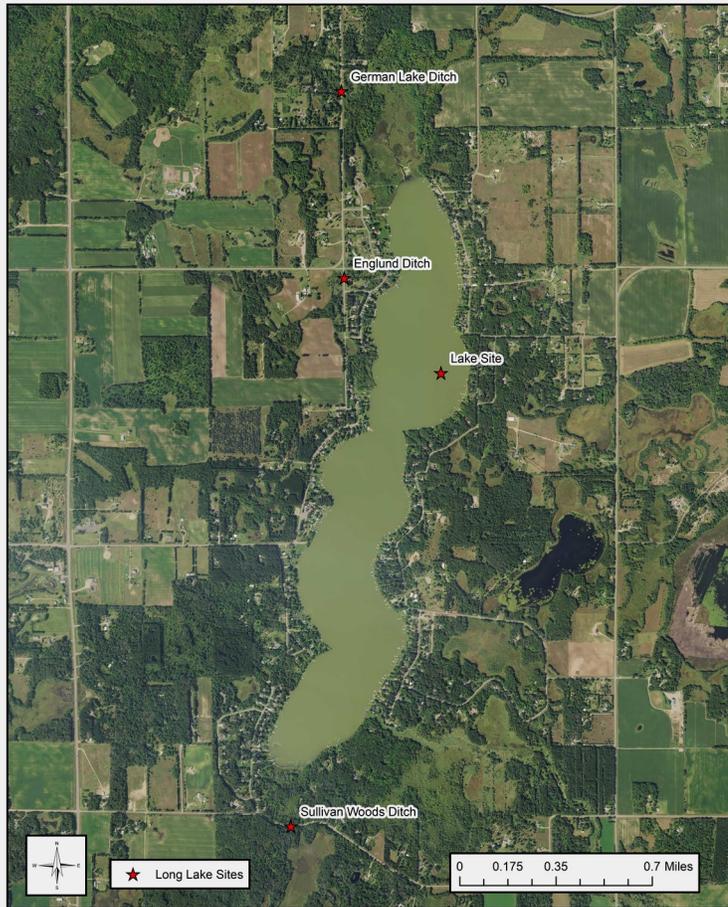


Long Lake—Bradford Township Monitoring Report 2018

Water Quality Monitoring - Long Lake



What: Long Lake Association volunteers collected Total Phosphorus (TP), chlorophyll-a, and transparency information every month 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 total TP reduction of 61% (36% from tributaries and 44% from lakeshed plus a few other sources) is required in order to improve recreational suitability and reduce algae blooms.

The monitoring data collected in 2018, the third 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 for trend analysis, assist with targeting and 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).

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 does not meet Clean Water Goals	Total Phosphorus: No
	Chlorophyll-a: No
	Secchi Transparency: No

Long Lake Monitoring Results 2018

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

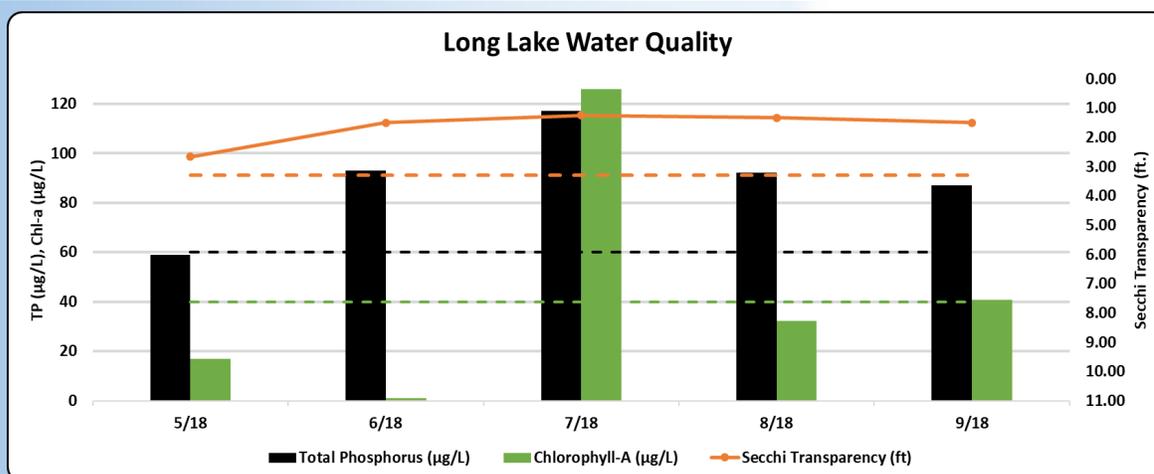
MN Clean Water Goals for Shallow Lakes

Total Phosphorus (TP): $\leq 60 \mu\text{g/L}$

Chlorophyll-a: $\leq 20 \mu\text{g/L}$

Secchi Depth: ≥ 3.28 feet

Growing season average (June-September)	97.25 $\mu\text{g/L}$	49.95 $\mu\text{g/L}$	1.40 ft
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2018 Data Summary:

- The lake has a maximum depth of 11 feet and is categorized as a shallow water lake.
- Monitoring results are compared to State water quality goals for shallow lakes. Shallow lakes naturally have high nutrient levels.
- Overall 2018 water health was similar to previous years and TP, Chl-a and Transparency did not meet goals for shallow lakes.
- June Chl-a results were identified as “under detection limits”. We believe this was an erroneous result.
- July Chl-a results were extremely high—because TP was also very high we suspect that this may have been due to curlyleaf pondweed die-off or an algae bloom following a lake mixing event.
- 2018 was largely devoid of heavy rainfalls that would have contributed to pollutants in rainwater runoff. This undoubtedly influenced conditions form the year.
- Increasing nutrient concentrations over the summer period usually indicate some level of recycling of nutrients form within the lake (Internal loading). This was different than previous years— likely due to rainfall, temperature and snowmelt timing.

General Definitions

Phosphorus (TP): an essential plant nutrient which can cause algal blooms in excess, measures all usable forms.

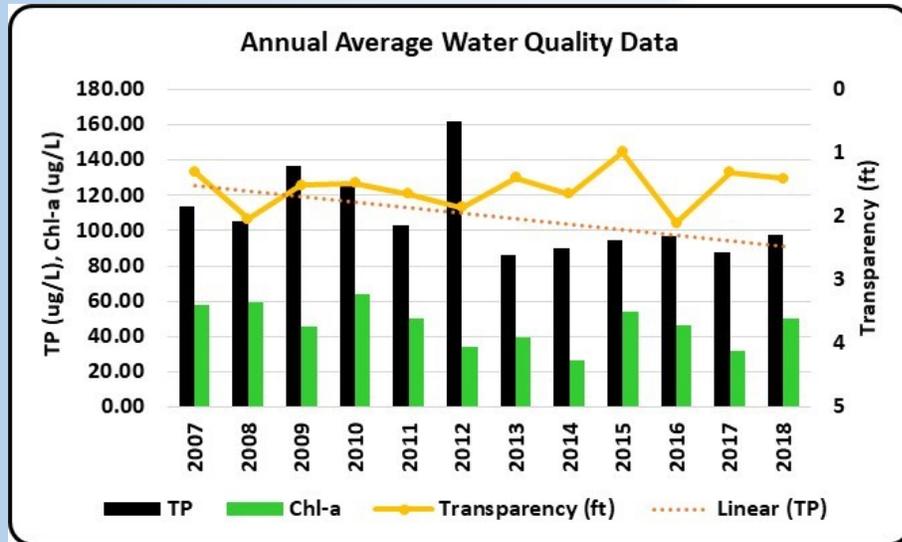
Chlorophyll-a (Chl-a): a pigment found in green plants, used to estimate amounts of algae in a lake.

Secchi Transparency: a measure of light penetration in water, which helps estimate algae concentration.

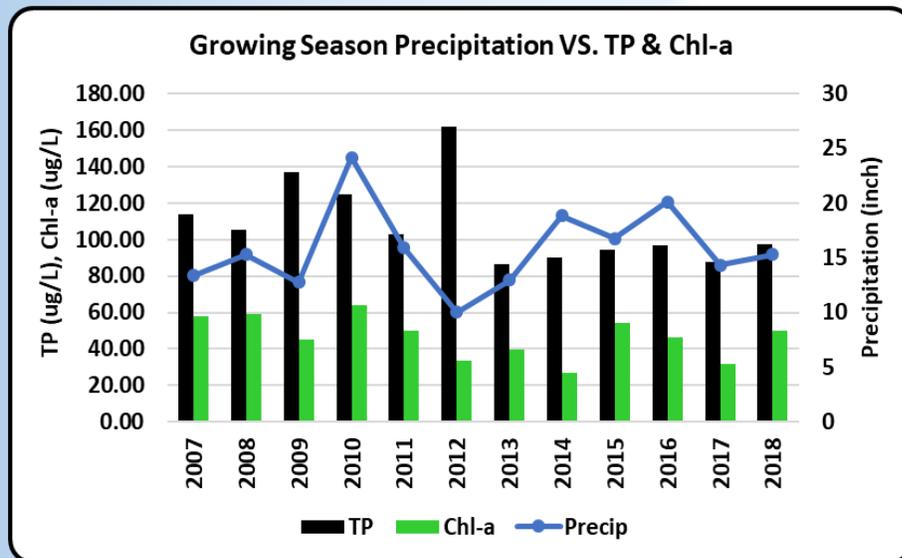
Historic Monitoring Data Comparison

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 1988 and a robust data set is available dating back to 2007. Recent years indicate a slight improving pattern for TP, Chl-a and Secchi transparency.



While the relationship may be weak, there does appear to be a slight connection between the amount of precipitation and the health of Long Lake (though not enough to draw any certain conclusions). Years with low precipitation (2009, 2012) resulted in higher in-lake TP. This would indicate that the sediments within the lake have high nutrients and their effect is more evident when inflow is lower. The timing of precipitation is also influential. In 2018 the majority of rainfall occurred during the growing season, this resulted in better lake health for many monitored lakes in the county (less inflow= better lake health); however, this did not appear to occur for Long Lake (less inflow=similar or worse lake health).

2018 Monitoring Recommendations

Since the onset of regular lake monitoring in 2007, Long Lake water has not met state water health goals.

Why? Nutrients appear stem from a combination of upland and internal pollution sources. Upland sources include nutrients in rainfall runoff from properties close the lake and it's inlets (includes residential and cropland areas) and degraded wetlands. Internal sources (nutrients being recycled form within the lake itself) include sources such as rough fish (black bullhead and/or carp), curly-leaf pondweed and water column/sediment mixing (the nutrients in the soils within and surrounding the lake are likely naturally high).

The LLID/LLIA Lakeshore restoration program plays a critical role in reducing the amount of nutrients entering the lake from the land. The program should be paired with the implementation of projects identified in the Subwatershed Assessment (SWA) the SWCD is currently working on (completion targeted spring 2019).

Internal sources of TP should be addressed only after upland sources of nutrients are eliminated to the extent possible or as the LLID deems appropriate.

Below are key points and recommendations for lake monitoring in 2019:

- Continue monitoring as planned.
- Consider collecting dissolved oxygen and temperature profiles in the future.



For more information contact: Isanti SWCD 763-689-3271
Thomas Zimmermann, Conservation Tech, tzimmermann@isantiswcd.org
Tiffany Determan, District Manager, Tiffany.Determan@mn.nacdnet.net

Thanks to the LLID members who have assisted with lake and stream monitoring, especially Don Hansen!

Long Lake Tributary Monitoring 2018



Englund Ditch

2018 was the second year the Long Lake Improvement District (LLID) 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

This report describes the results of monitoring that occurred in 2018 as well as comparisons to previous years.

General Definitions:

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



Long Lake Tributary Monitoring 2018

German Lake Ditch



2018 Rainfall

The area was largely missed by heavy rains throughout the year. The majority of rain events occurred during the growing season (vegetation was growing and available to take up water) and nearly all events were under two inches. As a result, less sediment and phosphorus made its way into surface waters and water levels and flow were lower than usual across the county. Consistent (though still small) rain events and cooler than average temperatures in the fall led to a slight rebound in stream levels late in the season.

Water Health Comparisons:

- TP measurements for this ecoregion typically range between 60 and 150 $\mu\text{g/L}$.
- TSS measurements for this area typically range between 4.8 and 16 mg/L .
- The State goal or standard for TP in streams is 100 $\mu\text{g/L}$ (i.e. we would like to see TP stay below this number).

Tributary Monitoring

What: In 2018 eight sampling events were targeted at all three inlets. We targeted four samples during rain events and four during base flow. Six samples were collected at Sullivan Woods ditch due to low/no flow conditions. Samples were lab-tested for total phosphorus (TP) and total suspended solids (TSS). Water temperature, pH, transparency, stream condition and stream depth were recorded in the field.

In addition to water quality, water levels were continually tracked using in-stream data loggers at German Lake and Englund Ditch inlets. The water levels were recorded every four hours from early June through early November.

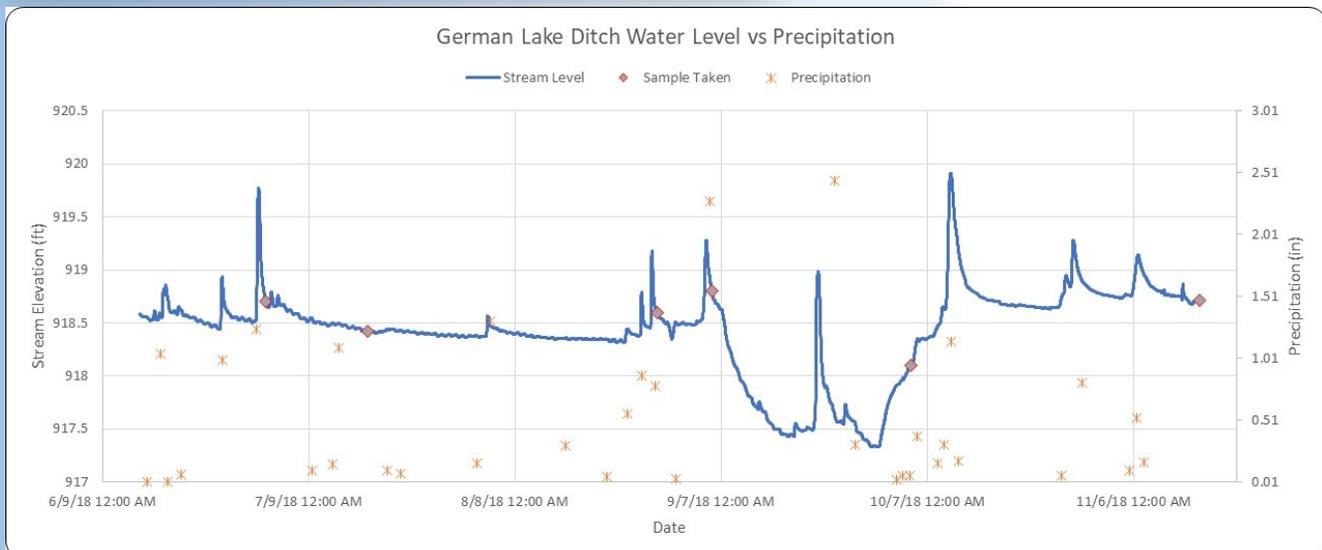
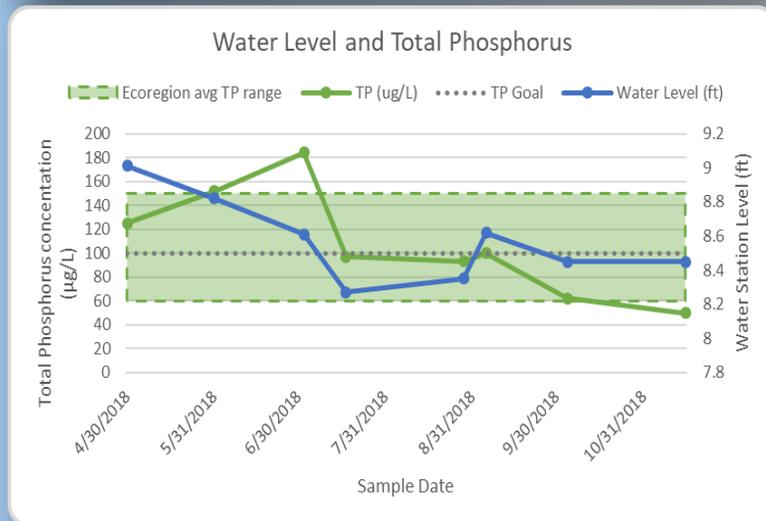
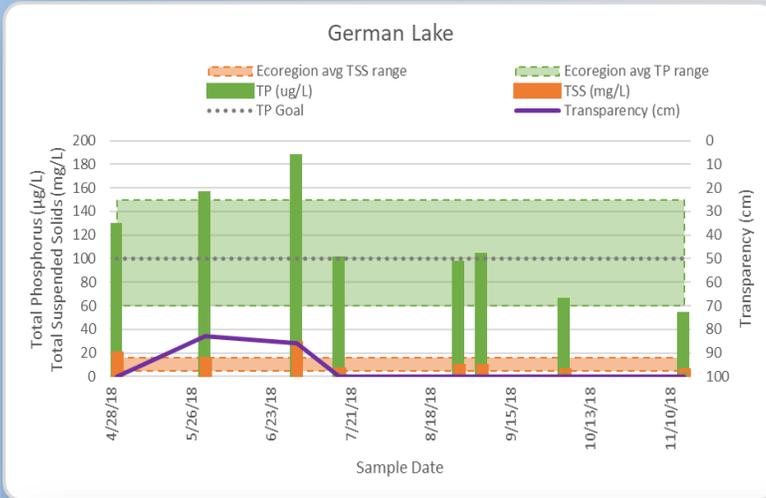
Why: The information collected helps us focus future lake water quality improvement projects at the best places on the landscape. In other words, near the streams that deliver the most nutrients to the lake. Additionally, this information will be used to track trends and to determine how well water quality improvement projects are working.

2018 Tributary Monitoring Results

Total Suspended Solids, Total Phosphorus and Transparency Tube

German Lake Ditch

- Land use in this drainage area is dominated by ditched wetlands surrounded by agriculture.
- 2018 average TP was 108 µg/L. The average TP range from 2016-2017 was 71-116 µg/L.
- 2018 average TSS was 9 mg/L. The average TSS in 2017 was 22 mg/L.
- TSS and TP tends to be high early in the season— the samples correlated with snowmelt and rainwater runoff.
- 2018 average transparency was 96 cm. The average transparency in 2017 was 90 cm.
- Transparency readings only measure to 100 cm, this means the water is typically quite clear.
- Flow here is the highest of all sites monitored; as such, the total phosphorus contribution to the lake is the highest at this location.
- The water level at this location responds quickly to rainfall early in the season and much slower late in the season.

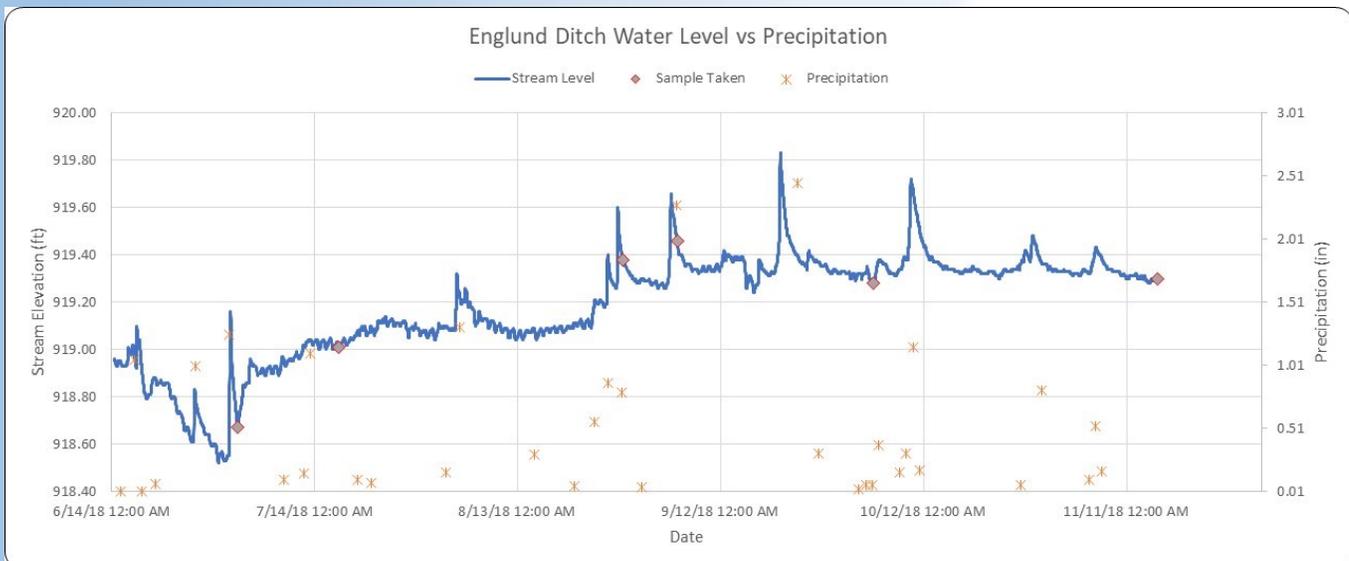
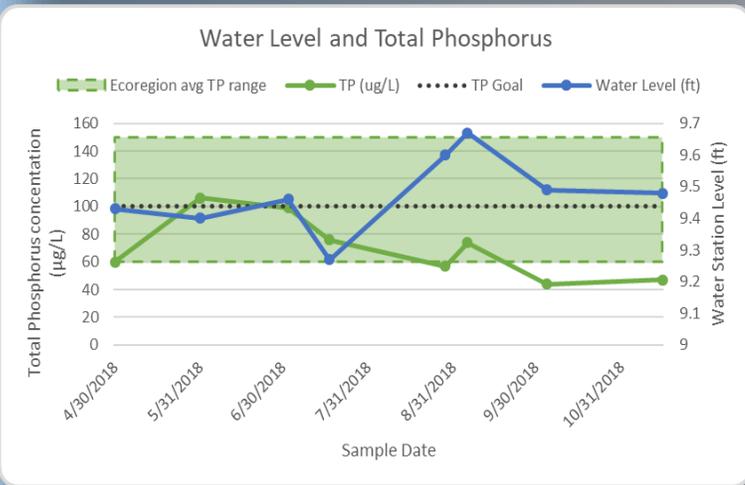
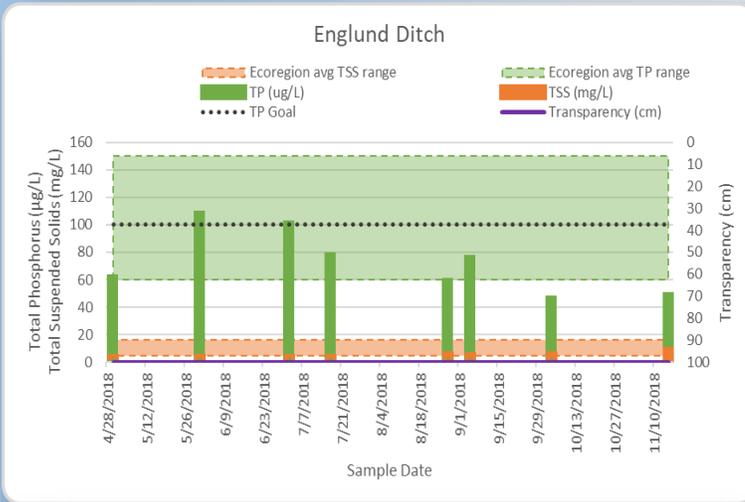


2018 Tributary Monitoring Results

Total Suspended Solids, Total Phosphorus and Transparency Tube

Englund Ditch

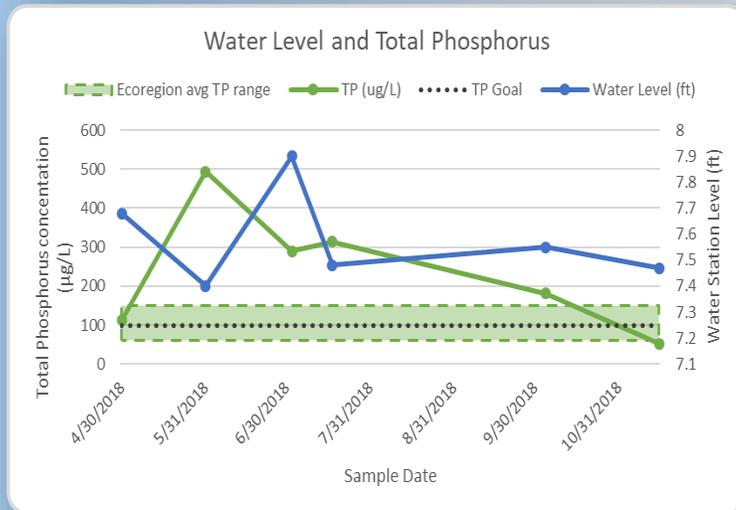
- Land use in this drainage area is dominated by agriculture.
- 2018 average TP was 70 µg/L. The average TP range from 2016-2017 was 550-500 µg/L.
- The majority of samples in 2018 had TP concentrations well below the standard; as such, this site had the lowest TP of all three sites in 2018.
- 2018 average TSS was 3.3 mg/L. The average TSS in 2017 was 204 mg/L.
- Extremely high TP and TSS concentrations in July and September of 2016/2017 skewed the averages. – until we know more we have flagged the data.
- 2018 average transparency was 100 cm. The average transparency in 2017 was 74 cm.
- Based on measured flow and TP concentrations, Englund ditch contributed the least amount of TP to Long Lake in 2018.



2018 Tributary Monitoring Results

Total Suspended Solids, Total Phosphorus and Transparency Tube

Sullivan Woods Ditch



- Land use in this drainage area is dominated by wetlands.
- 2018 average TP was 251 µg/L. The average TP in 2017 was 157 µg/L.
- A beaver dam limited flow the majority of the growing season and likely resulted in higher TP concentrations in 2018.
- TP concentrations were the highest at this location while flow was the lowest.
- 2018 average TSS was 11 mg/L. The average TSS in 2017 was 19 mg/L.
- 2018 average transparency was 65cm. The average transparency in 2017 was 83 cm.
- TP and water levels seem to have a negative relationship.
- Continuous water levels were not recorded at this location.



Beaver dam at Sullivan woods ditch.

2018 Results and Recommendations

2018 Summary:

2018 data gives some additional insight into the stream inlet impacts on Long Lake water health. Note: there is still limited data to draw conclusions or show meaningful trends.

German Lake Ditch: While TP levels are not “off the charts”, this site does have the highest flow and therefore contribute more nutrients than the other sites. There may be options for restoration projects here.

Englund Ditch: 2018 water monitoring results were very different than previous years. More information is needed to draw any conclusions.

Sullivan Woods Ditch: Low water flow at this location make is difficult to collect representative results. While the TP concentrations are very high, the flow is very low. At this point we suggest suspending monitoring at this location.

Recommendations for monitoring in 2019:

- Consider eliminating Sullivan woods ditch from sampling schedule.
- Monitor as planned— Englund ditch and German Lake inlet.
- No inlet monitoring is planned for 2020 (lake samples only).



German Lake Inlet



Englund Ditch



Sullivan Woods Ditch

For more information contact: Isanti SWCD 763-689-3271

Thomas Zimmermann, Conservation Technician, tzimmermann@isantiswcd.org

Tiffany Determan, District Manager, tdeterman@isantiswcd.org