

Sturgeon River Watershed: Analysis of Water Quality Data

Project

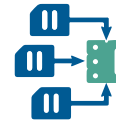
Associated Environmental was hired by the North Saskatchewan Watershed Alliance (NSWA), on behalf of the Sturgeon River Watershed Alliance (SRWA) to collect and analyze available water quality data in the Sturgeon River Watershed (SRW) in an effort to better understand certain water quality parameters in the river and lake systems.

Background

- Following the Sturgeon River Water Quality monitoring (2021-2022), SRWA became aware of various parameters that exceeded the Environmental Quality Guidelines for Alberta Surface Waters (pH, chloride, sulphate, nitrogen, *E.coli*, and MCPA (herbicide)).



Approach



- Collected, collated, and organized multiple sources of historic and currently available water quality data for the Sturgeon River Watershed. Resulting in over 100,000 data points and 149 sites were identified.



- Conducted high-level water quality analysis of four parameters of interest: dissolved oxygen, phosphorus, nitrogen, and *Escherichia coli* (*E. coli*).



- Evaluated potential spatial (i.e., hot spots) and temporal patterns of the parameters of interest



- Provided recommendations for future analysis and monitoring efforts.

Parameters of Interest Selected For Analysis

Dissolved Oxygen (DO)



- The most critical parameter for aquatic life. The amount of oxygen available to aquatic life is dependent on its solubility, with high saturation typically occurring near the air-water interface.
- Commonly evaluated parameter due to its importance but also because it can easily be measured in the field.

Phosphorus (total)



- An essential plant nutrient that contributes to a water bodies productivity.
- Many lakes contain naturally high concentrations of phosphorus from nutrient-rich soils and However, phosphorus may also come from human sources. Excess causes algal and plant growth .

Nitrogen (total)



- Similar to phosphorus, an essential nutrient for plant growth.
- Serves as a proxy for other nitrogen-based compounds, such as ammonia, nitrate, and nitrite, which can be toxic to aquatic life in higher concentrations.
- Nitrates and nitrites are harmful to cattle and can contaminate groundwater use for drinking.

Escherichia coli (*E. coli*)



- A form of bacteria typically found in the digestive tract of animals (domestic or wildlife) and humans.
- A common pollutant in freshwater systems.
- Can persist and become 'naturalized' in soil, manure, and water which can cause human health problems in high enough concentrations.

Chloride



- An essential ion that plants and animals require in small amounts for normal cell function, but also highly soluble & can be toxic.
- Originates from various sources, both natural (e.g. mineral deposits) and human (e.g. deicing salts, wastewater treatment, agricultural inputs).
- Contamination in freshwater ecosystems is called salinization.

Main Outcomes of the Water Quality Parameters

Dissolved Oxygen (DO)

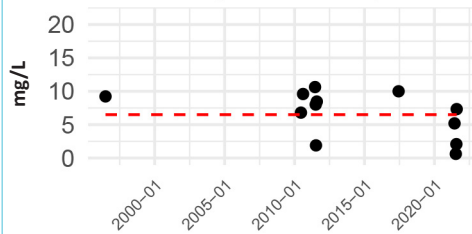


- Alberta Surface Water Quality Guidelines suggest DO concentrations must not decline below 5 mg/L and should not average less than 6.5 mg/L over a seven-day period.
- DO concentrations for most sites were above the guideline, suggesting it is not a watershed wide issue (seasonality—an important factor—was not evaluated).
- A number of the sites in the St. Albert area, had lower dissolved oxygen concentrations than other areas of the Sturgeon River.
- DO appears to be decreasing over time at some sites, while at others it is improving.

Sites with concerning DO trend over time:

- Carrot Creek – Tributary to Big Lake
- East basin of Lac Ste. Anne Lake
- Sandy Lake
- Sturgeon River (Lac Ste. Anne outlet)

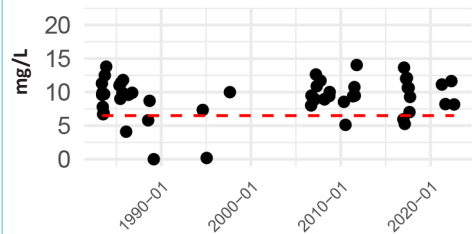
Sturgeon River - Lac Ste. Anne Outlet



Sites with improving DO trend over time:

- Sturgeon River (Near Namao)
- Hubbles Lake
- Matchayaw/Devils Lake
- Sturgeon River outlet to the NSR (Figure below)

Sturgeon River outlet to NSR



Total Phosphorus (TP)

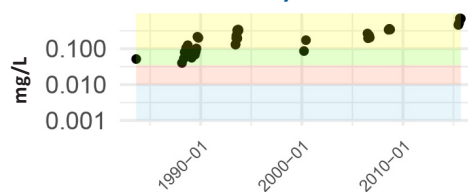


- No current guideline for this parameter
- Over 30% (11 of 34) of the sites appear to have increasing trends of TP over time. Only a few sites appear to have decreased temporal trends.
- Most sites had average concentrations of TP, suggesting these sites have high productivity. Overall, lotic (flowing) systems, such as the Sturgeon River had much higher phosphorus (total) concentrations than lentic (still) systems.
- Greatest increase in TP was recorded at Sandy Lake: ~0.05 mg/L (mesotrophic) in 1983 to ~0.7 mg/L (hypereutrophic) in 2015.
- Largest cause of TP in lakes is from naturally rich lake bottom sediments. Sandy Lake's recycling from bottom sediments contributes about 3000 kg/yr of phosphorus, 3x more than other sources!

Sites with increasing TP trend over time:

- Inlet, west + east basin of Lac Ste. Anne
- East area of Lake Isle
- Entire reach of Carrot Creek
- Sturgeon River inlet to Big Lake
- Sturgeon River outlet from Lac Ste. Anne
- Sandy Lake (Figure below)

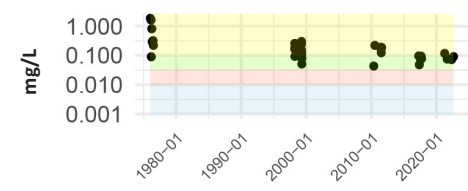
Sandy Lake



Sites with decreasing TP trend over time:

- Sturgeon River (near hwy 37 + 44)
- Matchayaw/Devils Lake
- Atim Creek (North of hwy 16 and west of hwy 44), a tributary to Big Lake (Figure below)

Atim Creek



Total Nitrogen (TN)

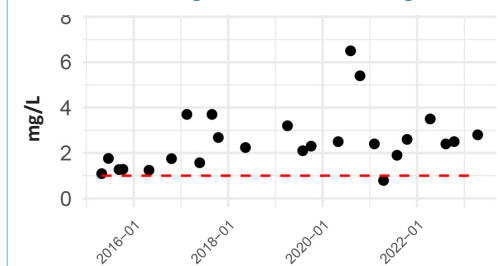


- Note: No current guideline for this parameter.
- For most of the sites a temporal trend was not evident.

Site with increasing TN trend over time:

- The highest average concentrations and increasing trend was observed at the outlet of Big Lake into St. Albert (note that this site had 2023 data available, unlike other parts of the system).

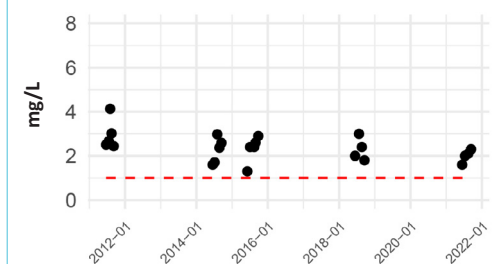
Sturgeon R - Outlet of Big Lake



Site with decreasing TN trend over time:

- Decreasing trend observed at Lake Isle (Figure below)

Isle Lake



Main Outcomes of the Water Quality Parameters

E. coli



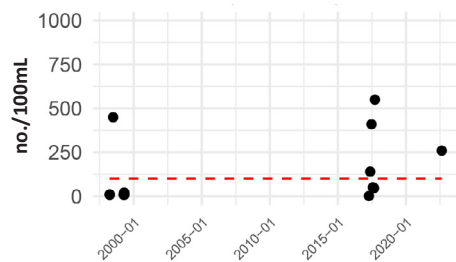
- Alberta recreational/agricultural surface water guideline (100 no./100 mL)
- The average concentration ranged from 20 to 179 no./100 mL; most being below the recreational/agricultural surface water guideline.

Sites that exceeded the threshold, with high maximum values*:

- Atim Creek (a tributary to Big Lake, north of hwy 16 and west of hwy 44)
- Sturgeon River (Outlet of Big Lake)

*All of the above sites as well as Site 36 (Sturgeon River) had values over 1000 no./100 mL which were not shown on the graphs.

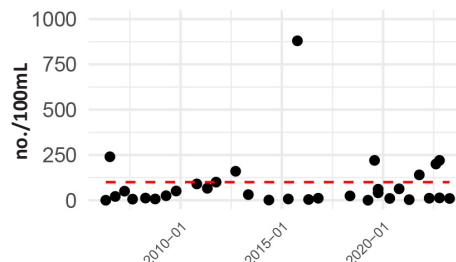
Atim Creek



Two sites had a high frequency of exceedance:

- Atim Creek - 29%
- Sturgeon River (Outlet of Big Lake) - 24%

Sturgeon River - Outlet of Big Lake



Chloride (Cl⁻)

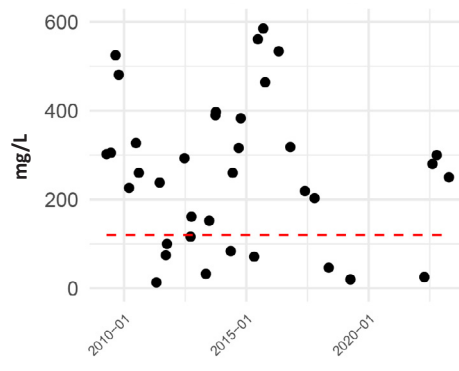


- CCME guideline: chronic (120 mg/L) and acute (640 mg/L) surface water guidelines for Cl⁻, above which there are elevated risks to aquatic life.

One primary site with an elevated risk of chloride to aquatic life:

- Carrot Creek

Carrot Creek



- Two other sites along Carrot Creek had many occurrences that fell in the zone between chronic and acute (120-640 mg/L)
- For more information about the impact of chlorides found in road salts on water, see our 2-page info sheet "[Road Salt Management in the Sturgeon River Watershed](#)"



Details to Consider

- This high-level analysis is preliminary in nature and provides a stepping stone to better understand current water quality issues in the Sturgeon River Watershed.
- There are recommendations for additional data organizing and analysis.
- Temporal analysis was only evaluated observationally.
- Data from lakes were often collected at varying depths on the same day (lake profiles), sampling depth is not within the data file.
- Lake retention time and flow have implications for water quality, particularly with respect to nutrient loading.
 - Lake Isle: Retention time of 9.5 years was estimated in the "Atlas of Alberta Lakes"
 - Lac Ste. Anne: Retention time was estimated at 12 years in the "Atlas of Alberta Lakes"
 - In comparison to Wabamun and Pigeon, which have residence times ~ 100 years

Learn more

For more about the SRWA, other research reports and 2-page summaries, go to: <https://www.nswa.ab.ca/partnerships-programs/the-sturgeon-river-watershed-alliance/>

Find more information on Lake Water Quality on ALMS' LakeWatch Reports: <https://alms.ca/reports/>

Sturgeon River Watershed Alliance



Sturgeon River Water Monitoring Project

Research Highlights of Water Quality Analysis

Completed: December 2023

KEY

- Concerning Dissolved Oxygen Trends
- Improving Dissolved Oxygen Trends
- Increasing Total Phosphorus
- Decreasing Total Phosphorus
- Increasing Total Nitrogen
- Decreasing Total Nitrogen
- High Frequency of e.Coli Exceedance
- Concerning Chloride Trends

