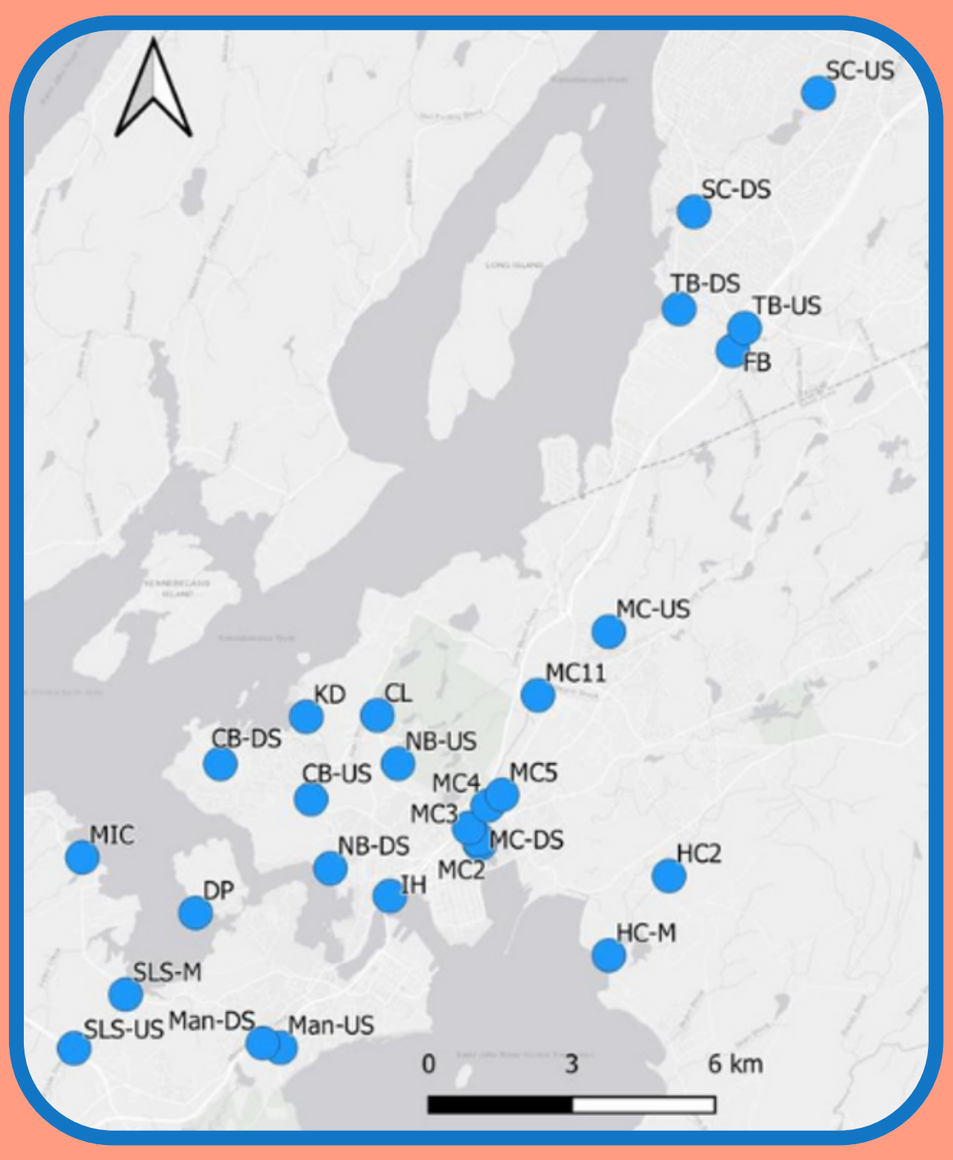
WATQC

GENERAL STATISTICS

WHAT DO ALL THESE NUMBERS MEAN?



Sites under observation in selected area

PHYSICAL

Temperature, pH and Salinity are physical parameters that greatly influence plant and animal survival in a water body.

POLLUTANT

Ammonia, Phosphate and *E. coli* levels are natural parameters which, when greatly disturbed by human pollution influence, can change water body properties and ecology negatively.

FISH SPECIES

Bait, Forage and Sport Fish are fish types that interact to keep ecological balance of a water body. When physical and pollutant parameters change, fish species that could survive in the water body may no longer be able to do so.

Most **physical parameters** are difficult to control and are affected by large scale factors such as acid rain, global warming and coastal proximity. Every waterbody is different and has its own baseline physical parameters, though similar waterbodies can be compared! **Temperature** indicates if a waterbody is hot or cold. The **power of Hydrogen (pH)** indicates if a waterbody is acidic (lower) or alkaline (Higher), most organisms prefer close to neutral (pH 7). **Salinity** indicates if a waterbody is more or less salty.

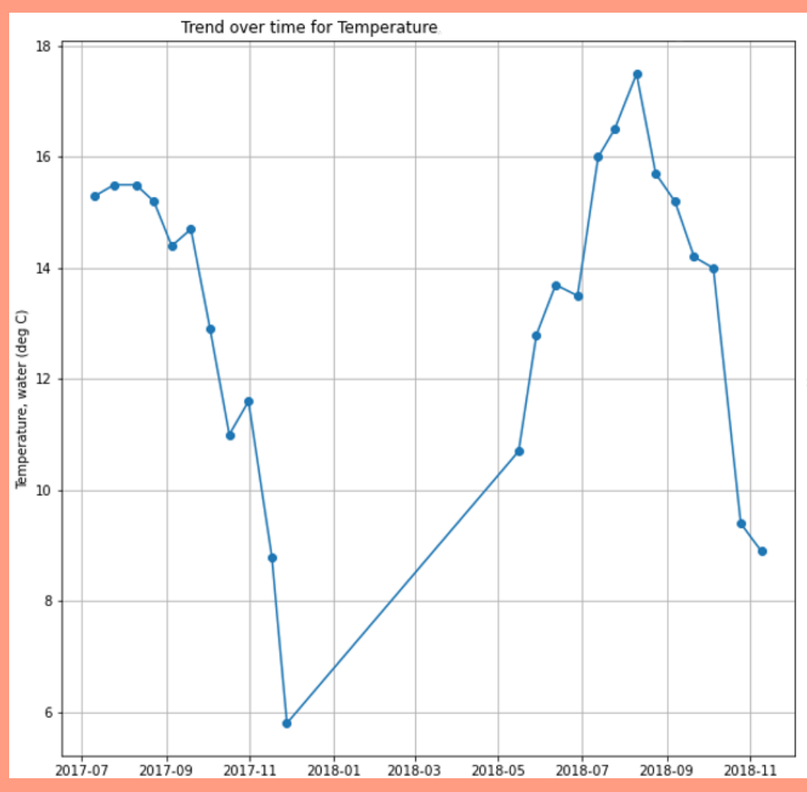
Pollutant parameters are more heavily influenced by local conditions, primarily of human origin such as intensive agricultural runoff, sewage processing, wastewater dumping, port activity along with proximate industrialization of the area. **Ammonia level** is a key part of the nitrogen cycle that sustains life. **Phosphate level** is a key part of the phosphorus cycle. Increased presence of ***E. coli***, a bacteria normally in waterbodies, may result in more contamination and make water unsafe to swim in!

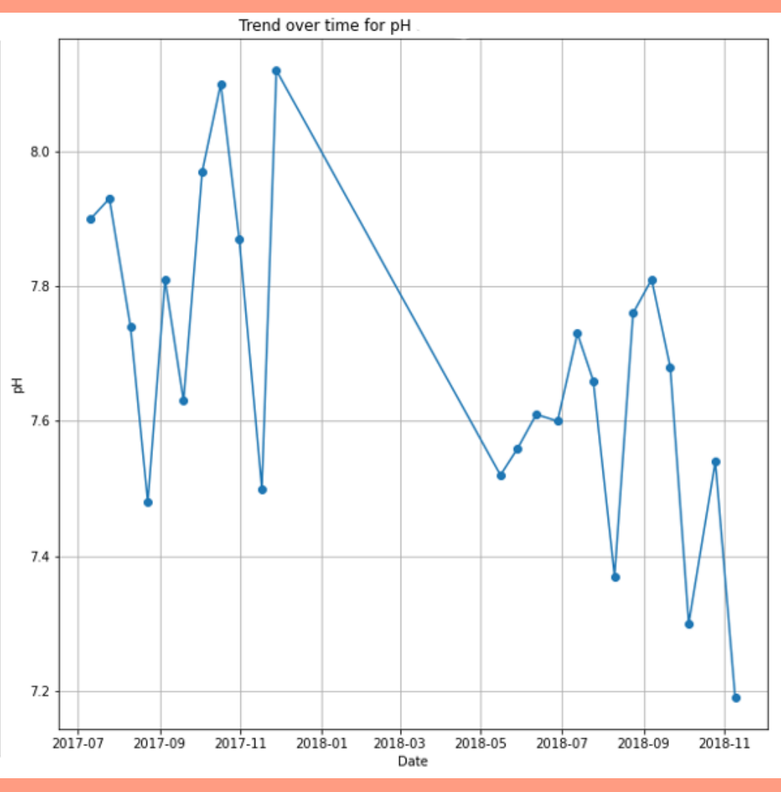
Fish Species are generally used as indicators of waterbody health. **Bait fish** are smaller fish (Ex: Fathead Minnows) that become food for **Forage fish** (Ex: Rainbow Smelts), medium sized fish which become food for larger **Sport fish** (Northern Pike). The predation of smaller fish supports larger fish, which are important for recreational anglers! Remember that all fish are important for ecological balance to be maintained.

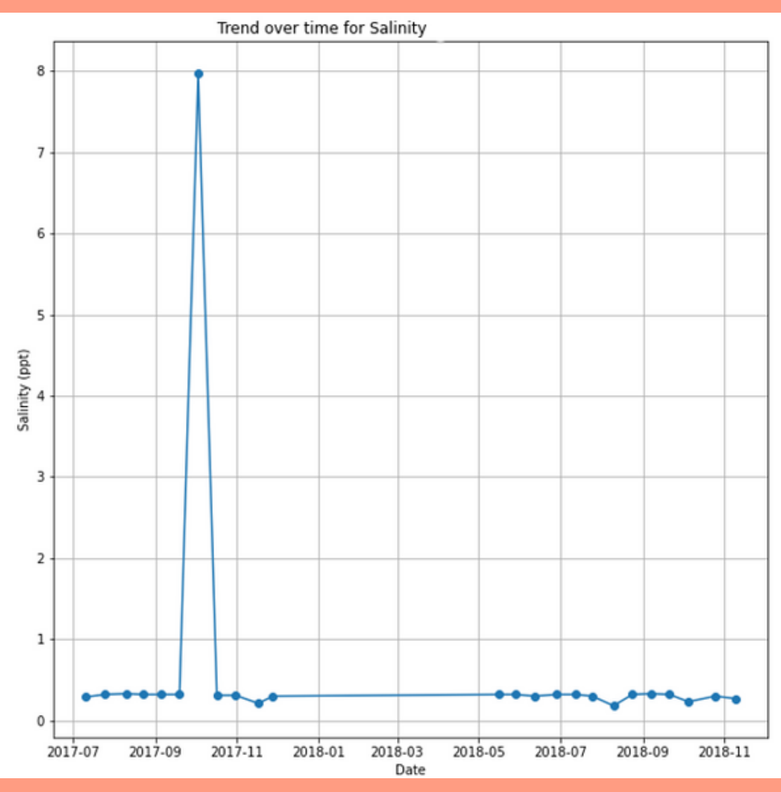
WATQC

SPECIFIC TRENDS IN DATA:

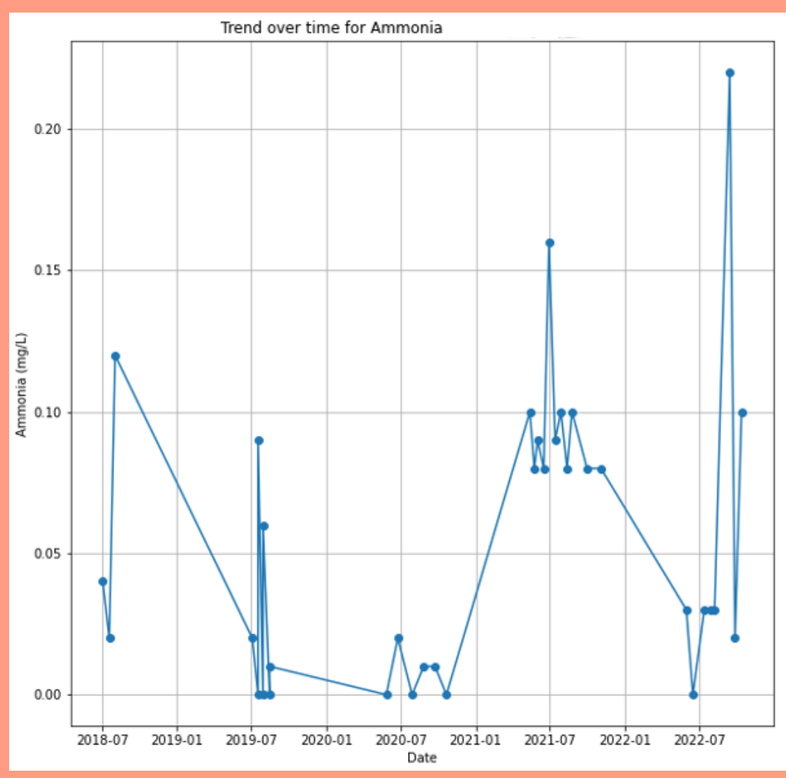
COLD BROOK

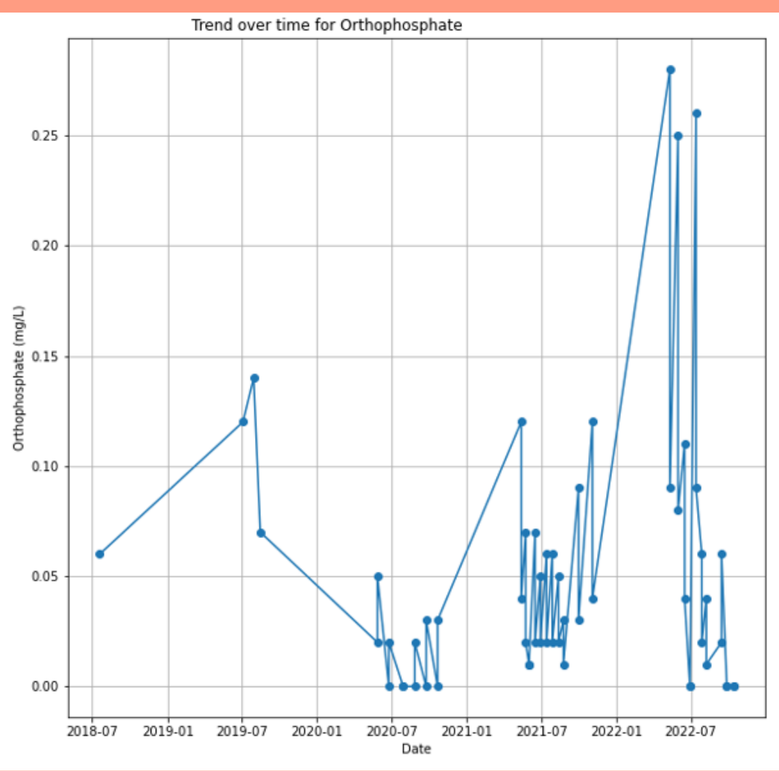


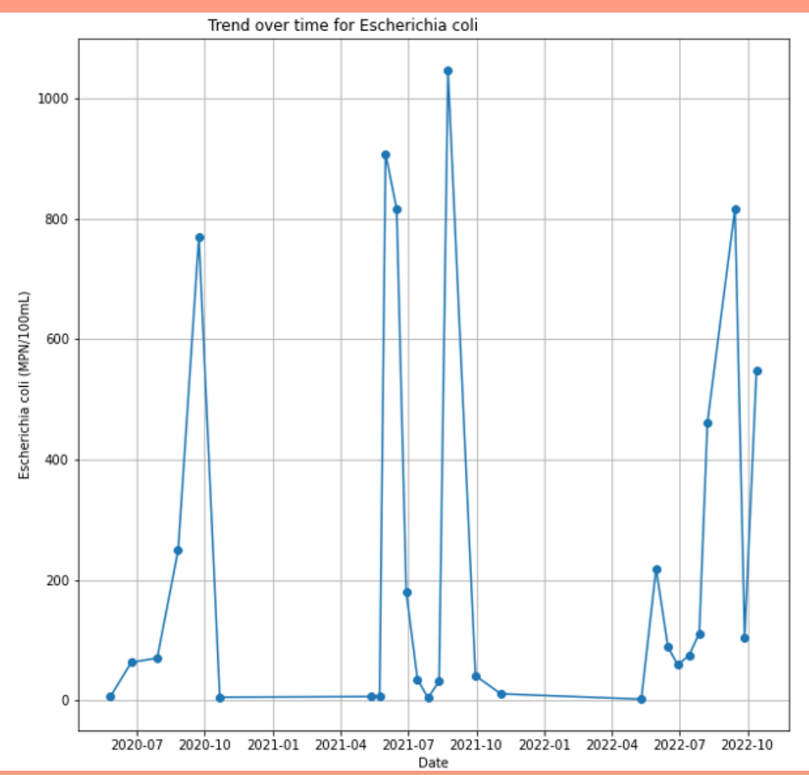




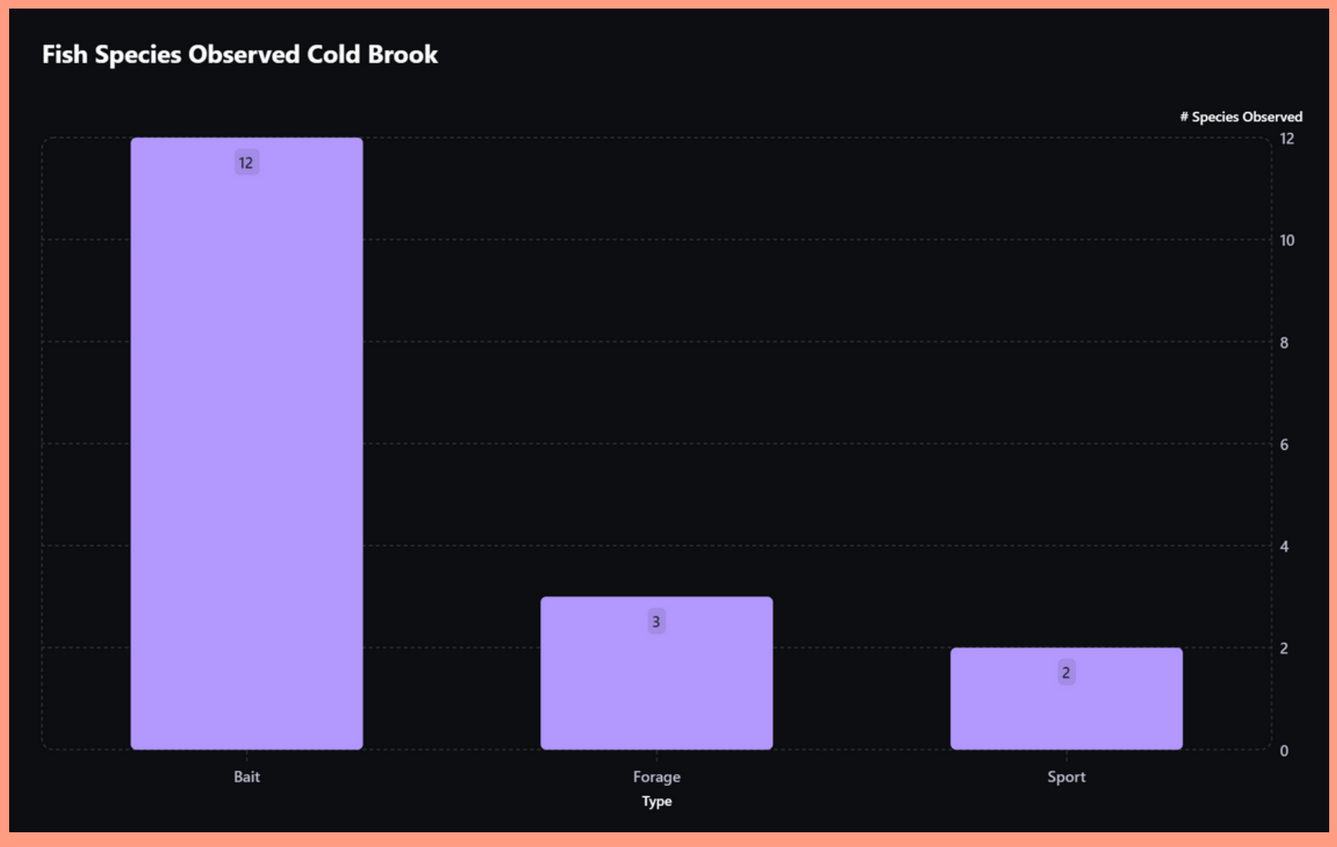
From 2017 - 2018, ***Cold Brook*** appears to be getting slightly **warmer** and slightly more **acidic**, though its **saltiness** stayed about the same!







From 2018 - 2022, ***Cold Brook*** seems to increase in seasonal **ammonia** and **phosphate** fluctuations, though its **E. coli** burden appears to be consistent.



In 2022 fish species observed in **Cold Brook** included 12 species of **bait**, 3 species of **forage**, and 2 species of **sport** fish. Some are included for reference:

(**Bait**) - Creek Chub, Northern Redbelly Dace, Fathead Minnow...

(**Forage**) - Rainbow Smelt, White Sucker...

(**Sport**) - Atlantic Salmon, Brook Trout...

More technical explanations about **Cold Brook** data can be found in the APPENDIX of this report!

WATQC

WATER QUALITY INDEX

Water Quality Index (WQI) is a generalized score (0 - 100) given to a waterbody based on a combination of three factors. These factors include several measured parameters compared against their recommended appropriate thresholds outlined in the water quality guidelines created by the Canadian Council of Ministers of the Environment (CCME).

- Scope: Number of parameters that fail to meet water quality objectives (In total over the year, so this could mean none of the parameters failed to all the parameters failed).

- Frequency: Number of times the tested parameters fail to meet water quality objectives (per year, so if water was sampled 4 times during the year the frequency could be 0 - 4 for each parameter).

- Amplitude: Scaled amount by which the water quality objectives are not met (this could be highly variable but mostly expressed by a percentage of the excess versus the total amount).

100-95 PRISTINE

94-80 USUALLY DESIRABLE

79-65 SOMETIMES DESIRABLE

64-45 OFTEN NOT DESIRABLE

44-0 USUALLY NOT DESIRABLE

Based on the WQI scores, in this dataset there are no sites that fall into **pristine** classification, 1 that is **usually desirable**, 2 that are **sometimes desirable**, 2 that are **often not desirable** and 2 that are **usually not desirable**.

WATQC

REFERENCES

PAGE 1: MAP OF WATER SAMPLING SITES EXTRACTED FROM ACAP WATER QUALITY REPORT CARD. GRAPHICAL IMAGES MADE ON CANVA.COM. PARAMETERS ADAPTED FROM ACAP WATER QUALITY REPORT CARD.

PAGE 2: DATA FROM ACAP SJ WAS EXTRACTED FROM GITHUB REPOSITORY MADE AVAILABLE FOR THE PURPOSE OF THIS HACKATHON.

PAGE 3: WATER QUALITY INDEX SCHEMATICS ADAPTED FROM CANADIAN WATER QUALITY GUIDELINES FOR THE PROTECTION OF AQUATIC LIFE (CANADIAN COUNCIL OF MINISTERS OF THE ENVIRONMENT WATER QUALITY INDEX 1.0 USER'S MANUAL). WQI SCORES EXTRACTED FROM ACAP WATER QUALITY REPORT CARD.

WATQC

APPENDIX - TDS:

COLD BROOK

Total Dissolved Solids–

1. Total Dissolved Solids (TDS) are the minerals, salts, metals, cations or anions dissolved in water. The concentrations illustrated in the chart describe the sum of the cations and anions ions in the water, providing a qualitative measure of the amount of dissolved ions but not the nature of the ion relationships. The primary ions being measured include inorganic salts such as: calcium, magnesium, potassium, sodium, bicarbonates, chlorides, and sulfates. These originate from anthropocentric sources such as sewage, urban run-off, industrial wastewater, salts used for road de-icing, anti-skid materials, stormwater, agricultural runoff, and chemicals used in water treatment processes; ions can also originate from natural sources such as mineral springs, carbonate deposits, salt deposits, and sea water intrusion.
2. The majority of testing indicates a high concentration of dissolved ions which may cause the water to be corrosive with a salty or a brackish taste as well as result in scale formation. It could also suggest that there are many ions that are above the drinking water standards such as an elevated level of nitrate, arsenic, aluminum, copper, lead, etc. Early on there is a spike of low TDS indicating a low ion concentration and samples consisting mostly of water molecules; this event could be caused by a number of phenomena that inputs a large volume of fresh water into the wetland system such as a heavy rainfall event or elevated air temperatures increasing the influx of meltwater.

WATQC

APPENDIX - TURBIDITY:

COLD BROOK

Turbidity–

1. Turbidity is the measure of relative clarity of a liquid. It is an optical characteristic of water and is a measurement of the amount of light that is scattered by material in the water when a light is shined through the water sample. The higher the intensity of scattered light, the higher the turbidity. Material that causes water to be turbid include clay, silt, inorganic and organic matter, algae, dissolved colored organic compounds, plankton, and other microscopic organisms.
2. Wetlands such as the Cold Brook Wetland act as spongy filters for water, as such the chart illustrates the cyclical nature of “dirty” water inputs (illustrated by the spikes in concentration) having their impurities removed by periodic drying that binds the soil, settles fine sediment in calm water and the healthy growth of aquatic plants. High turbidity can be caused by silt, mud, algae, plant pieces, melting ice, sawdust, wood ashes or chemicals in the water. Turbidity increases in wetlands mainly because of floating algae, soil washing from the banks into the water, fires, or from industrial activity such as mining, logging or dredging.

WATQC

APPENDIX - TEMPERATURE:

COLD BROOK

Water Temperature–

1. Water temperature is a measure of the kinetic energy of water, it varies according to season, depth, and, in some cases, time of day. Because most aquatic organisms are cold blooded, they require a certain temperature range to survive. Temperature also affects the water's ability to dissolve gasses, including oxygen.
2. The graph illustrates the cyclical changes in water temperature with the season, since the temporal sale is so large we cannot infer the variance of water temperatures on a smaller scale (daily, weekly, etc.) nor differences in temperatures at varying water column depths. The water temperature was the warmest in the summer months with peaks in August; water temperatures were lowest in the winter months with a peak in December.

WATQC

APPENDIX - SALINITY:

COLD BROOK

Salinity–

1. Salinity is the amount of dissolved salts present in water. In natural bodies of water, salinity is most commonly a measure of sodium chloride, magnesium, sulfate, and calcium. Fresh water has a salinity of 0.5 ppt or less while the salinity of ocean water generally ranges from 33 ppt to 38 ppt.
2. Salinity is relatively constant in this watercourse with the average concentration below 0.5 ppt making this a freshwater ecosystem. However, on August 2017 there was a large spike in concentration which increased to 8 ppt which is approximately 20% as saline as ocean water but 16 times higher than the threshold for freshwater. Since this event occurred in the summer months when road salts aren't present in runoff this indicates that a storm event caused an influx of seawater to enter the wetland ecosystem increasing overall salinity.

WATQC

APPENDIX - PH:

COLD BROOK

pH–

1. pH is a quantitative measure of the acidity or basicity of liquid solutions. The term translates the values of the concentration of the hydrogen ion—which ordinarily ranges between about 1 and 10−14 gram-equivalents per liter —into numbers between 0 and 14. In pure water, which is neutral (neither acidic nor alkaline), the concentration of the hydrogen ion is 10−7 gram-equivalents per liter, which corresponds to a pH of 7. A solution with a pH less than 7 is considered acidic; a solution with a pH greater than 7 is considered basic, or alkaline. If the pH of water is too high or too low, the aquatic organisms living within it will die. pH can also affect the solubility and toxicity of chemicals and heavy metals in the water. The majority of aquatic creatures prefer a pH range of 6.5-9.0, though some can live in water with pH levels outside of this range.
2. In 2017 the average pH for this watercourse is approximately 7.8 while in 2018 it decreases to an average of approximately 7.5 while seeing highs reaching a pH of 8.5 and lows reaching a pH of 7.19. The lowering of this watercourses average pH may be caused by a number of sources including acid rain, runoff from nearby rock formations, and plant decomposition however the decrease is small and well within the healthy range of variance for a wetland ecosystem.

WATQC

APPENDIX - DISSOLVED OXYGEN:

COLD BROOK

Dissolved Oxygen–

1. Dissolved oxygen refers to the level of free, non-compound oxygen present in water or other liquids. Non-compound oxygen, or free oxygen (O2), is oxygen that is not bonded to any other element; the bonded oxygen molecule in water (H2O) is in a compound and does not count toward dissolved oxygen levels. It is an important parameter in assessing water quality because of its influence on the organisms living within a body of water. A dissolved oxygen level that is too high or too low can harm aquatic life and affect water quality, a minimum of 5mg/L of dissolved oxygen is recommended for optimal fish health.
2. This watercourse has an average dissolved oxygen concentration of approximately 9.5 mg/L. The trend illustrated sees dissolved oxygen rising in the and decreasing in the summer months, this is because the concentration of dissolved oxygen in surface water is affected by temperature cold water can hold more dissolved oxygen than warm water. There was an abnormal spike at the end of June 2018 which saw dissolved oxygen hit it's peak of 12.7 mg/L which is most likely due to either a storm event which increased turbulence of surface waters, a bloom in aquatic and riparian vegetation releasing elevated levels of oxygen into the watercourse via photosynthesis, or a combination of the two.