FREEDOM WATER QUALITY REPORT 2024

Jill Emerson, *Water Quality Coordinator*

Emma Revenaugh, *AmeriCorps Water Quality Resource Assistant*

RIVERS Field Sampling Parameters

Conductivity

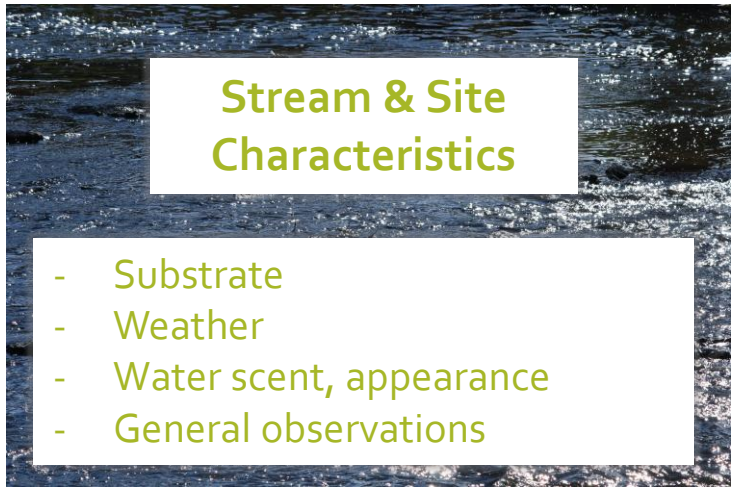
- Ability of water to pass an electrical charge
- Based on amount of charged elements [Mg+, Ca+, Cl-, NO_3-, etc.]
- Can be useful in interpreting salt loads in water bodies

Total Phosphorus

- Critical nutrient for photosynthesis and algae/plant growth
- High levels indicate elevated decomposition (including sewage inputs)

Dissolved Oxygen (DO)

- Measure of how much oxygen is available to aquatic organisms – different species require different amounts

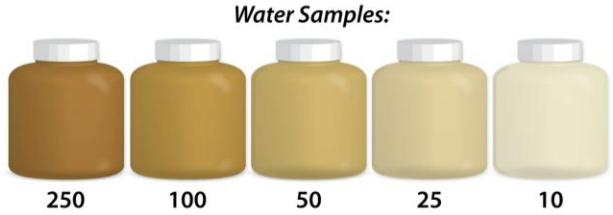


Stream & Site Characteristics

- Substrate
- Weather
- Water scent, appearance
- General observations

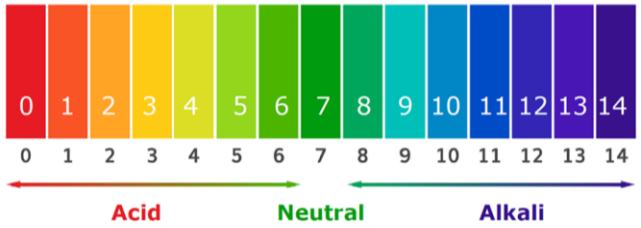
Turbidity

- Water clarity
- Determined by the amount of suspended particles and sediment



pH

- Pure water has a pH of 7, although most water in NH is closer to 6.5 (more acidic)
- The optimal range for aquatic organisms is 6.5 to 8.2



Temperature

- Influences…
  - Amount of dissolved oxygen
  - Rate of chemical reactions in water
  - Plant and algal growth
  - Activity and life cycles of aquatic organisms

Water Quality Standards & Allowable Limits

Parameter	Limit/ Standard
Conductivity	< 100 µS/cm
Total Phosphorus (TP)	< 30 µg/L
Dissolved Oxygen (DO)	6-11 mg/L , 75%-120%
Turbidity	< 10 NTU
pH	6-8, preferably close to 6.5 in NH
Temperature	No standard, but monitored for major changes

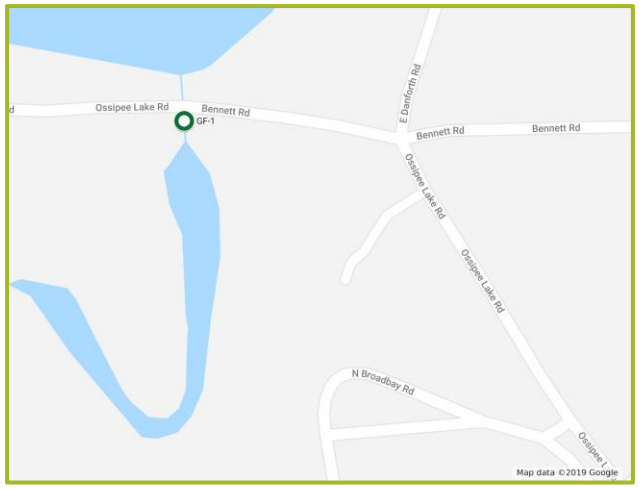
Based on NHDES and EPA Criteria

Anything above is considered "nuisance levels"

****Each site we monitor will vary in these values- a normal occurrence- due to differences in surrounding plant life, land use, infrastructure, geology, etc.**

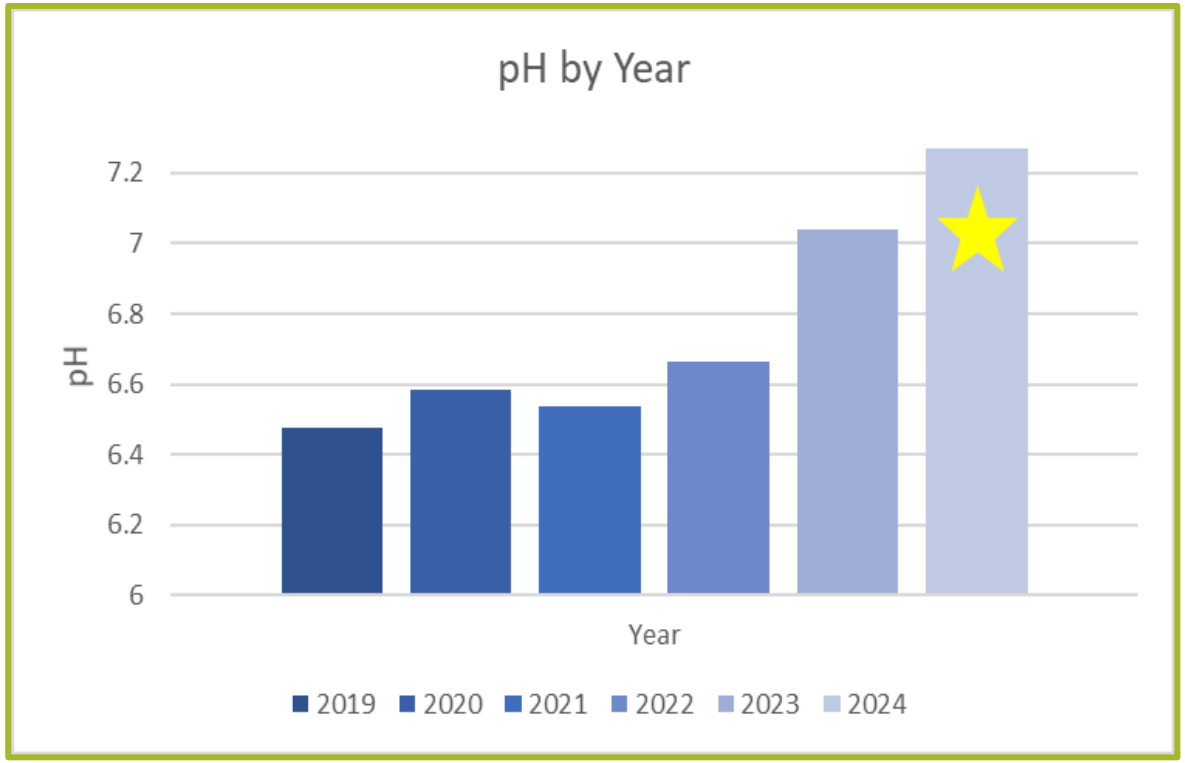
GF-1 Danforth Brook: May 2019-Oct 2024

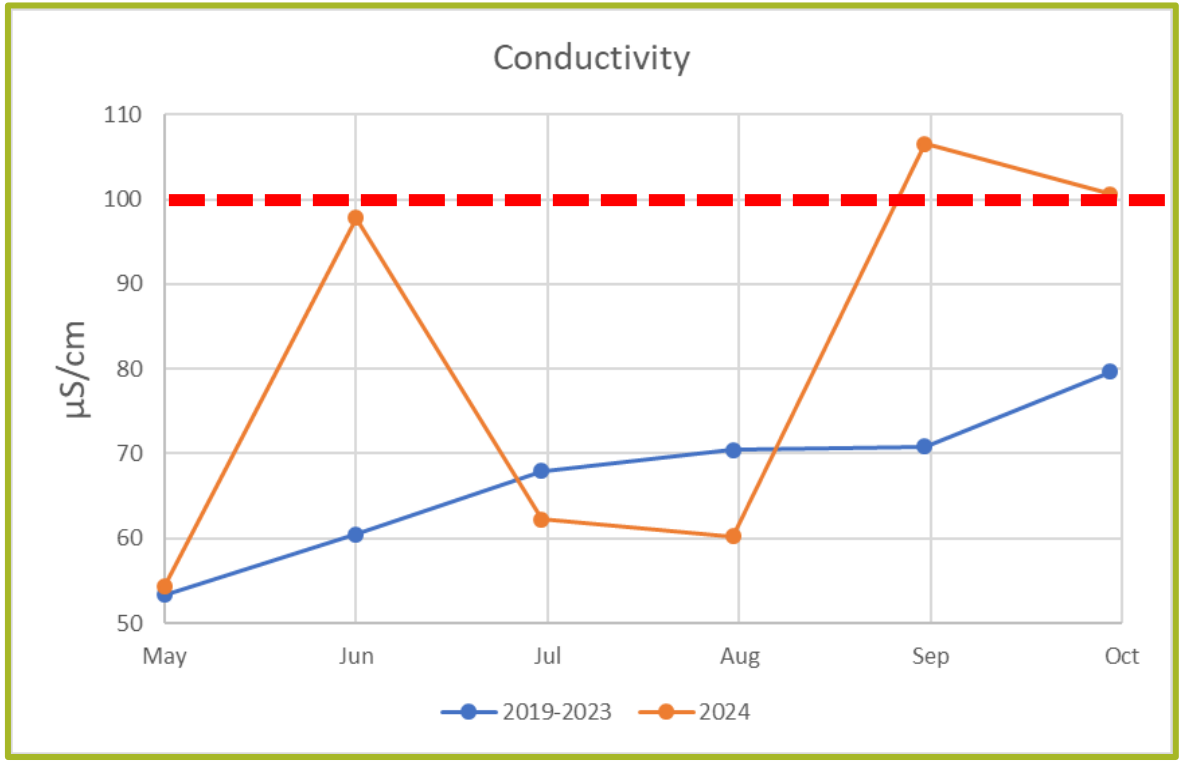
- Monitored since 2002
- Parameters measured: pH, turbidity, temperature, conductivity, DO, TP



Parameter	Status
Turbidity	Stable and in healthy range, lowest median value in the last 6 years.
Temp.	Stable.
TP	Stable and in healthy range.

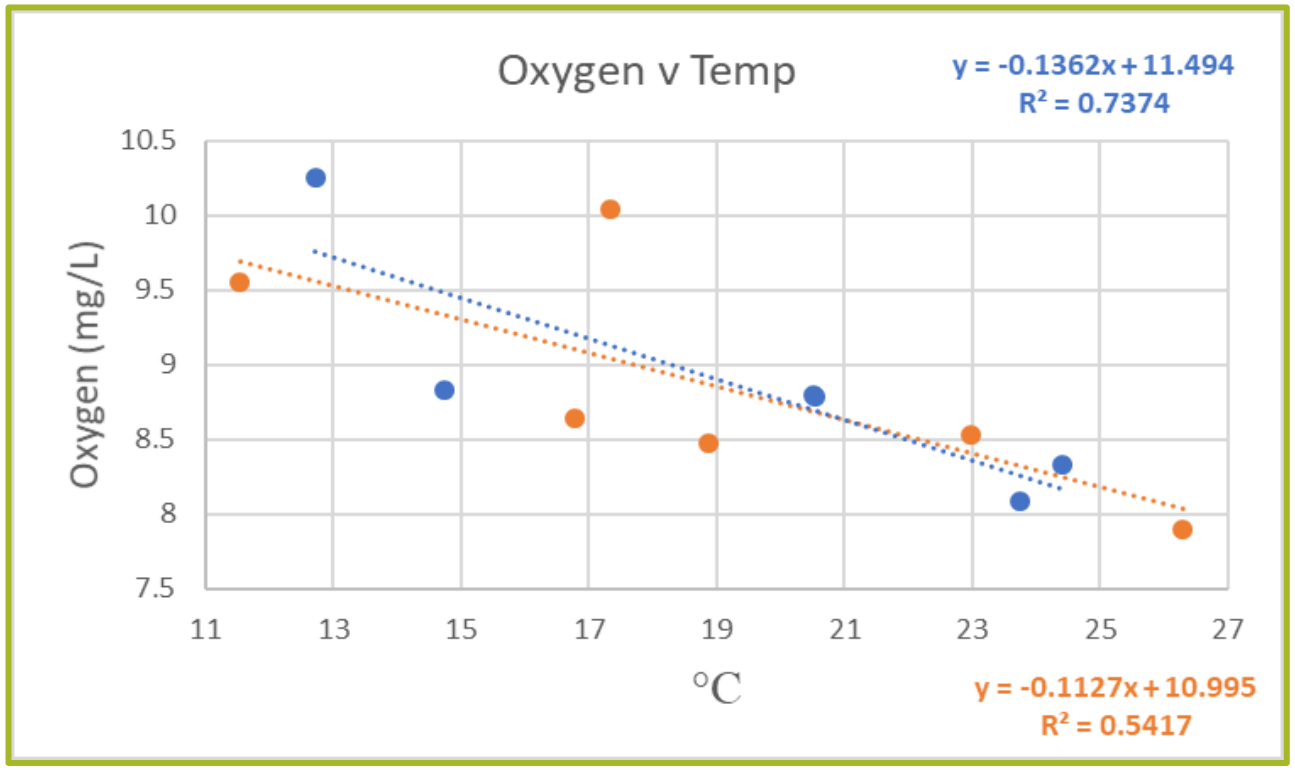
GF-1 Danforth Brook: May 2019-Oct 2024

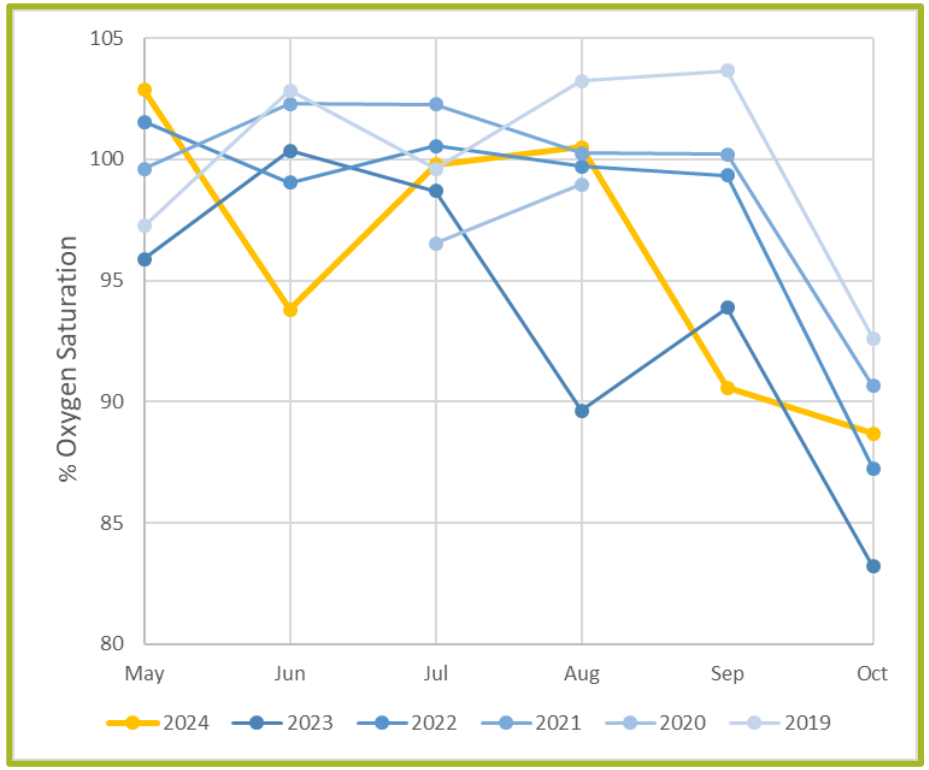




Parameter	Status
pH	pH values in 2024 were greater than in the past 4 years, although all values were within a healthy range.
Conductivity	Conductivity values in 2024 were higher in June, September, and October than in those same months from 2019-2023, and exceeded the standard in September.

GF-1 Danforth Brook: May 2019-Oct 2024



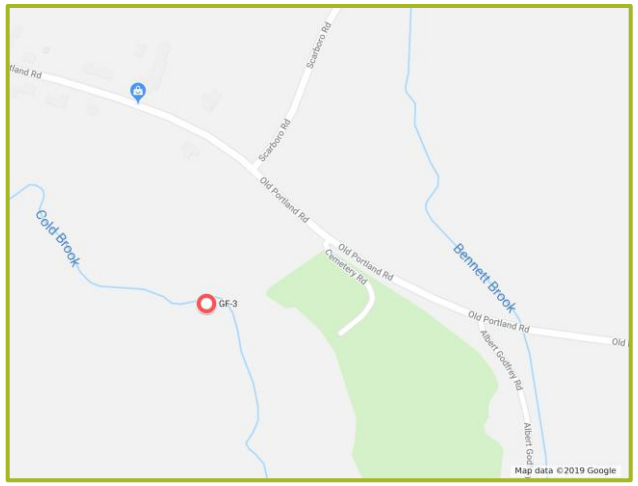


DO (mg/L) and temperature should have an inverse relationship- as it gets colder, water can dissolve more oxygen

Parameter	Status
DO (mg/L)	The R^2 value from 2024 (orange) is lower than the R^2 value from 2019-2023 (blue) which may indicate a weaker relationship between the parameters at this site. All values were within a healthy range.
DO (%)	In 2024, DO % values were similar to 2019-2023 values and were within a healthy range.

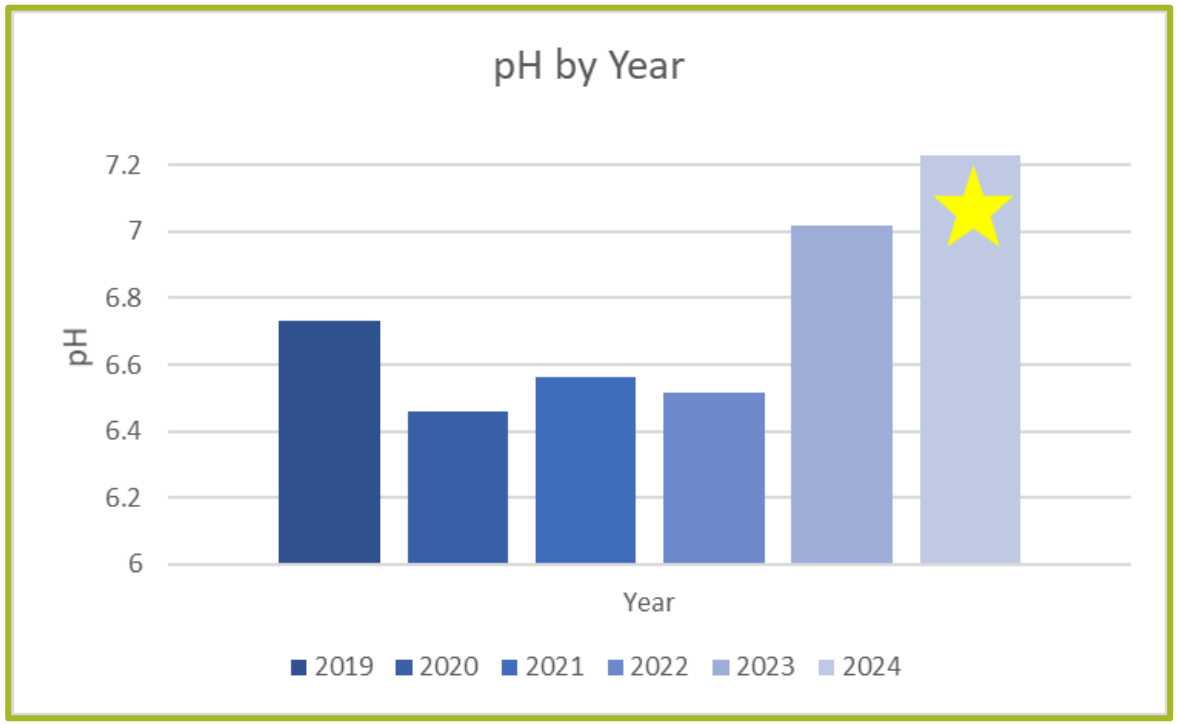
GF-3 Cold Brook: Jan 2019-Dec 2024

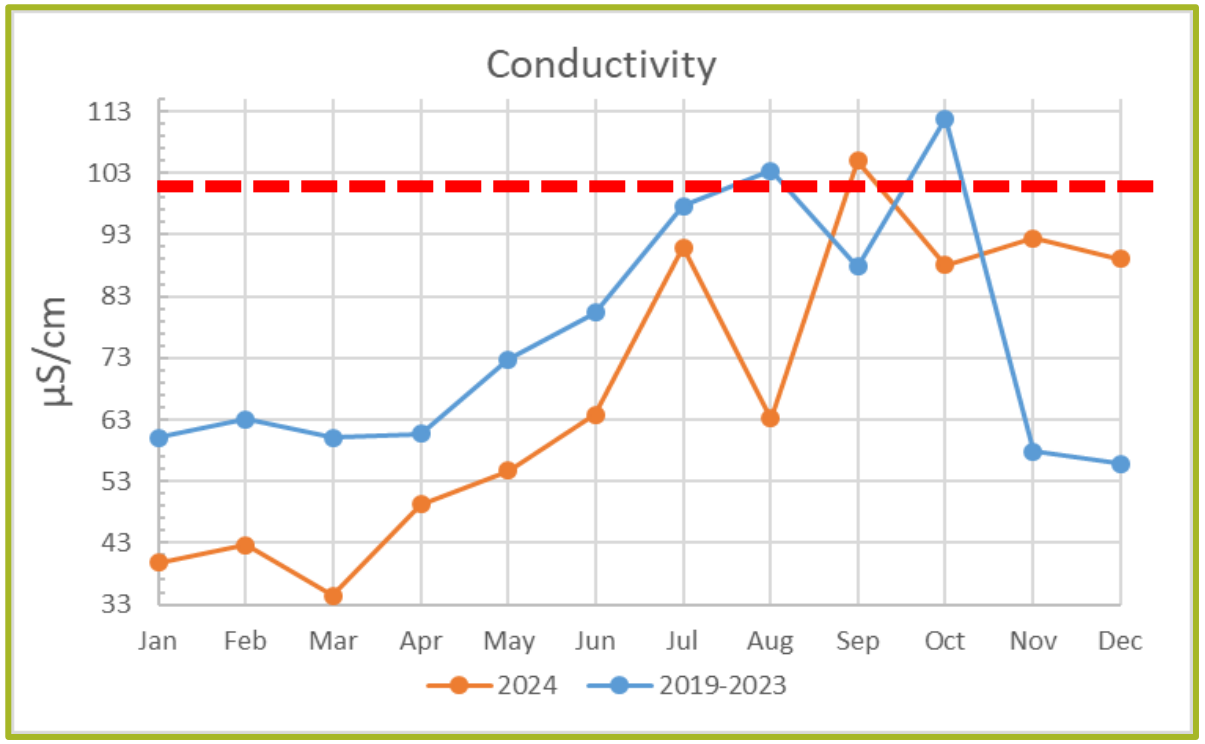
- Monitored since 2003
- Parameters measured: pH, turbidity, temperature, conductivity, DO, TP, LL



Parameter	Status
Turbidity	Stable and in healthy range, lowest median value in the last 6 years.
Temp.	Stable.
TP	Stable and in healthy range.

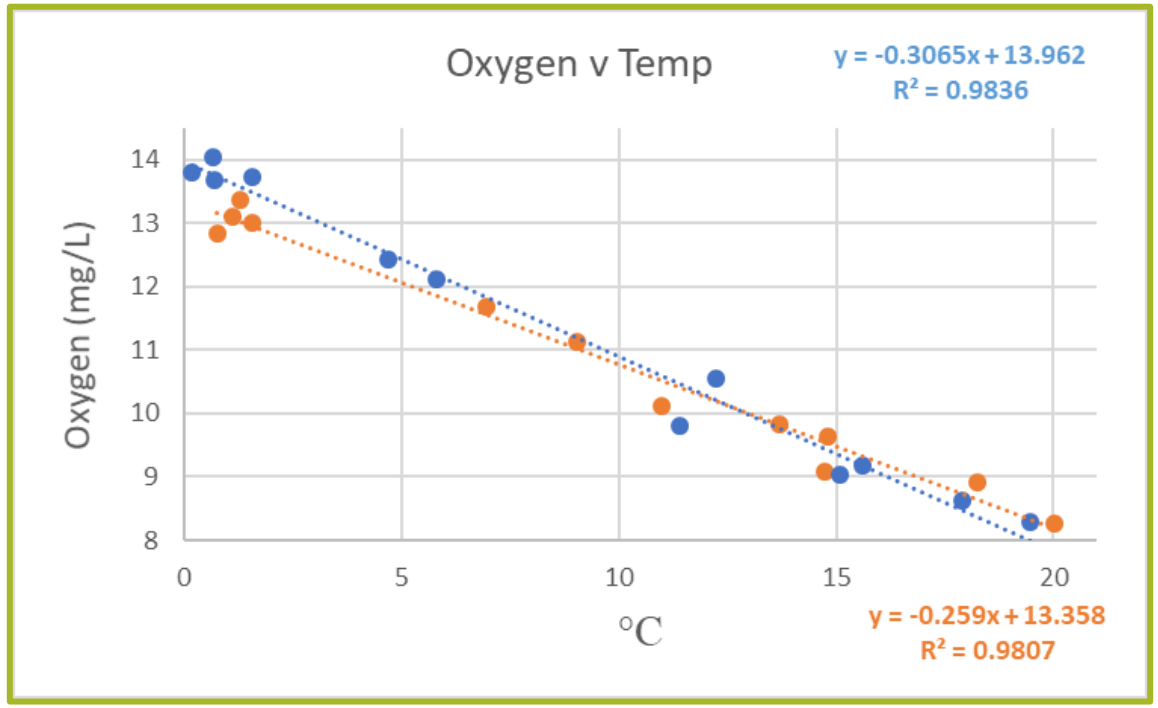
GF-3 Cold Brook: Jan 2019-Dec 2024

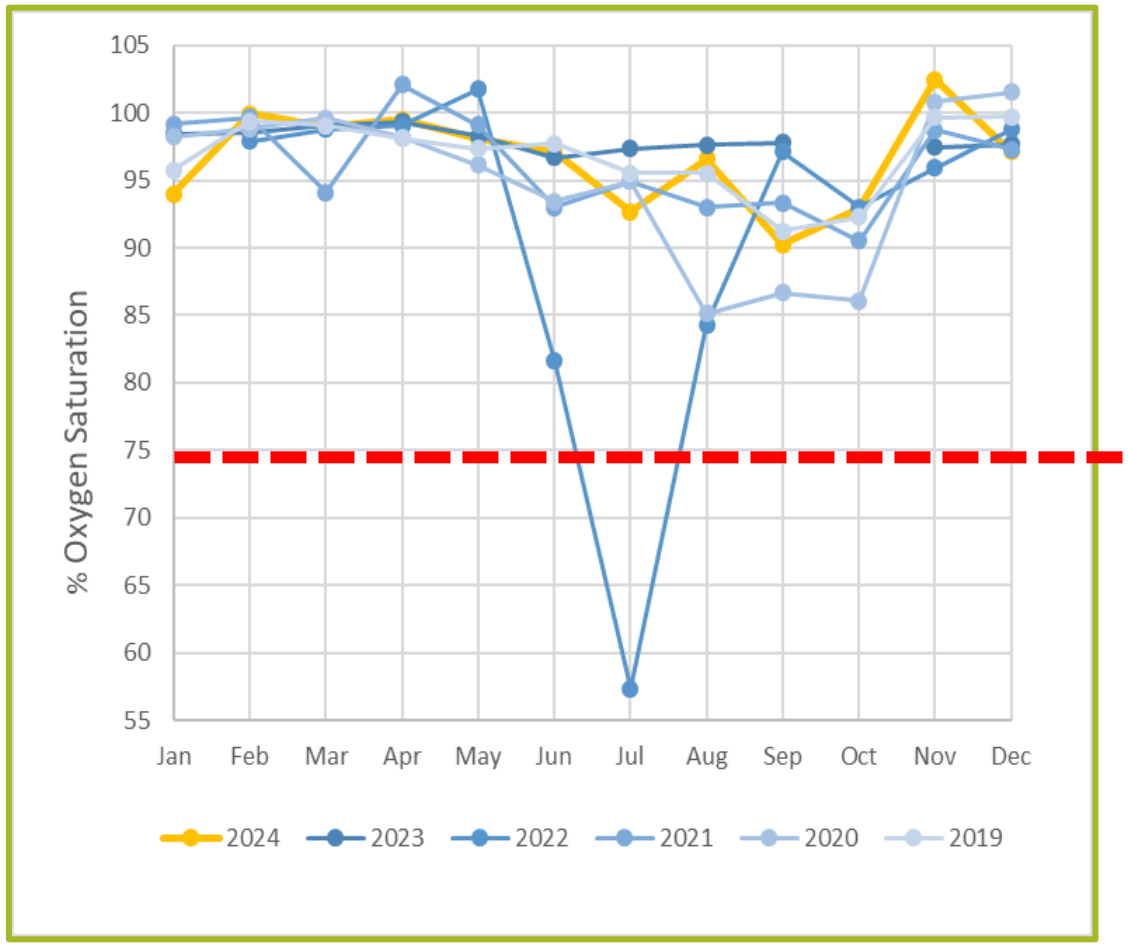




Parameter	Status
pH	pH values in 2024 were greater than in the past 4 years, although all values were within a healthy range.
Conductivity	Overall, conductivity in 2024 was similar to values from 2019-2023. In September 2024, the conductivity standard was exceeded.

GF-3 Cold Brook: Jan 2019-Dec 2024





Parameter	Status
DO (mg/L)	The R^2 value from 2024 (orange) is very close to the R^2 value from 2019-2023 (blue), indicating stable DO (mg/L) values and a strong relationship between DO and temp. All values were within a healthy range.
DO (%)	In 2024, DO % values were similar to values from 2019-2023 and all were within a healthy range.

GF-3 Cold Brook *2024 Data Only

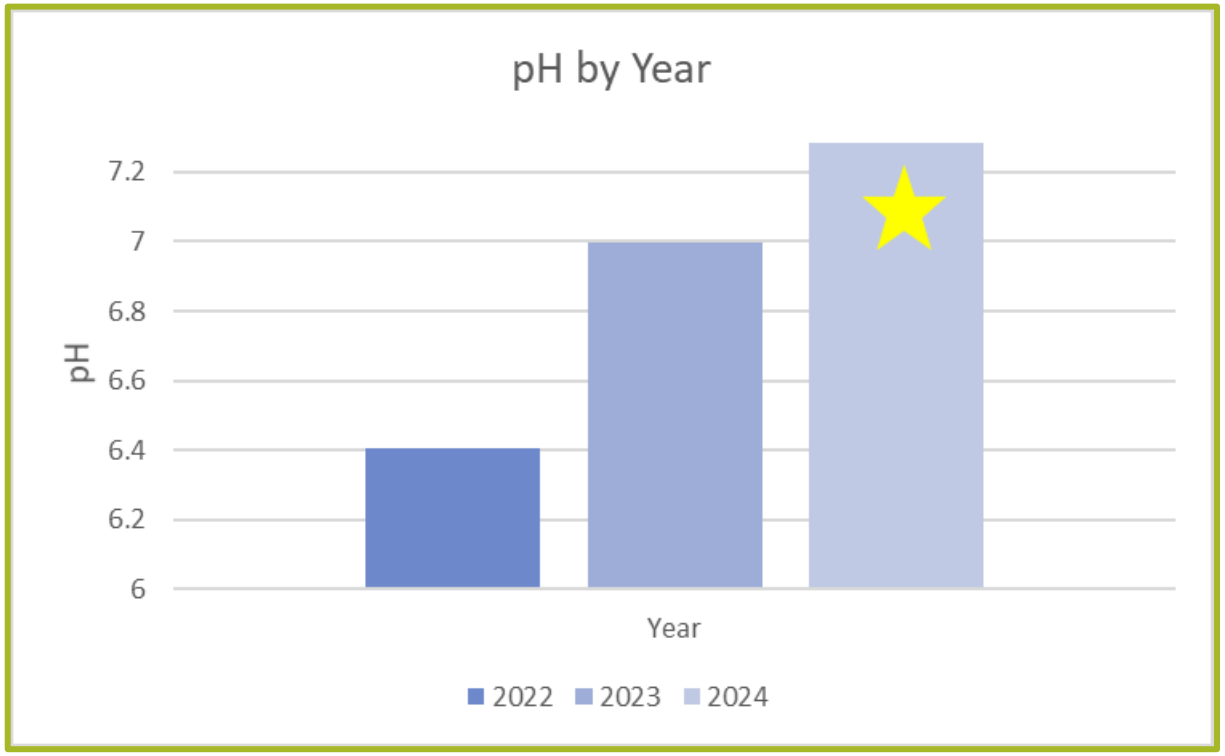
Parameter	Months Sampled	Typical Pristine Surface Water Concentrations	Status
Ammonium	Jan-Oct	< 200 µg/L	In range
Orthophosphate	Jan-Dec	< 10 µg/L	Exceeded standard in Aug
Dissolved Organic Carbon	Jan-Oct	1-10 mg/L	In range
Total Dissolved Nitrogen	Jan-Oct	< 0.5 mg/L	In range
Dissolved Organic Nitrogen	Mar-Oct	n/a	In range
Nitrate	Mar-Oct	< 0.05 mg/L	Exceeded in every month sampled except May
Chloride	Mar-Oct	< 10 mg/L	Exceeded in May, Jun-Oct
Sulfate	Mar-Oct	< 80 mg/L	In range
Sodium	Mar-Oct	< 50 mg/L	In range
Potassium	Mar-Oct	< 10 mg/L	In range
Magnesium	Mar-Oct	1-100 mg/L	Below 1 mg/L every month sampled except Oct
Calcium	Mar-Oct	< 15 mg/L	In range

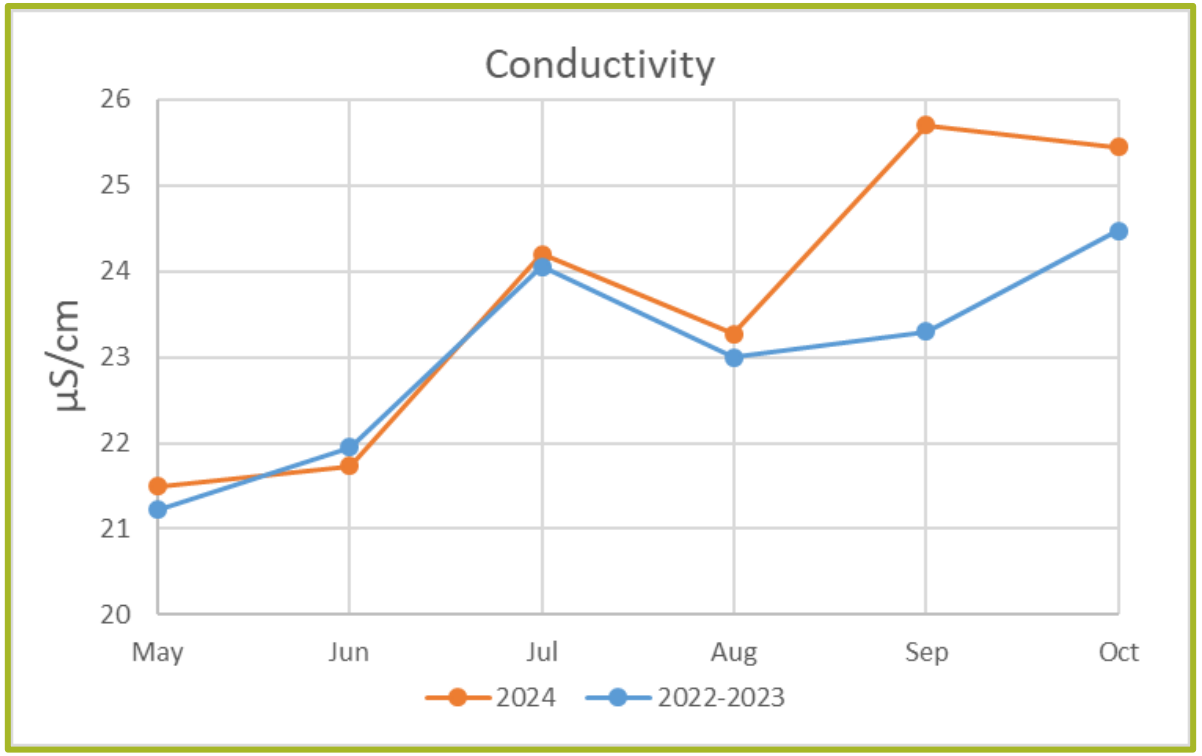
GF-4 Shawtown Brook: May 2022-Oct 2024

- Monitored since 2022
- Parameters measured: pH, turbidity, temperature, conductivity, DO, TP

Parameter	Status
Turbidity	In healthy range, lower in 2024 than in 2022 or 2023.
Temp.	Stable.
TP	Stable and in healthy range. First year sampled where TP did not reach nuisance levels.

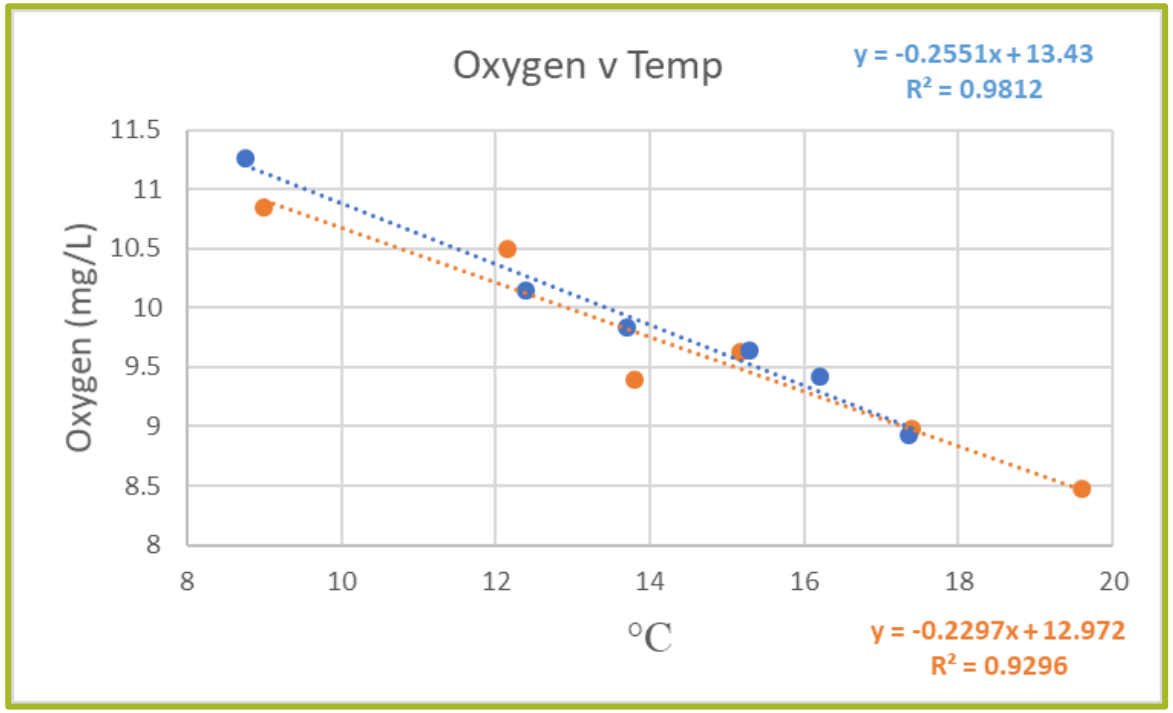
GF-4 Shawtown Brook: May 2022-Oct 2024

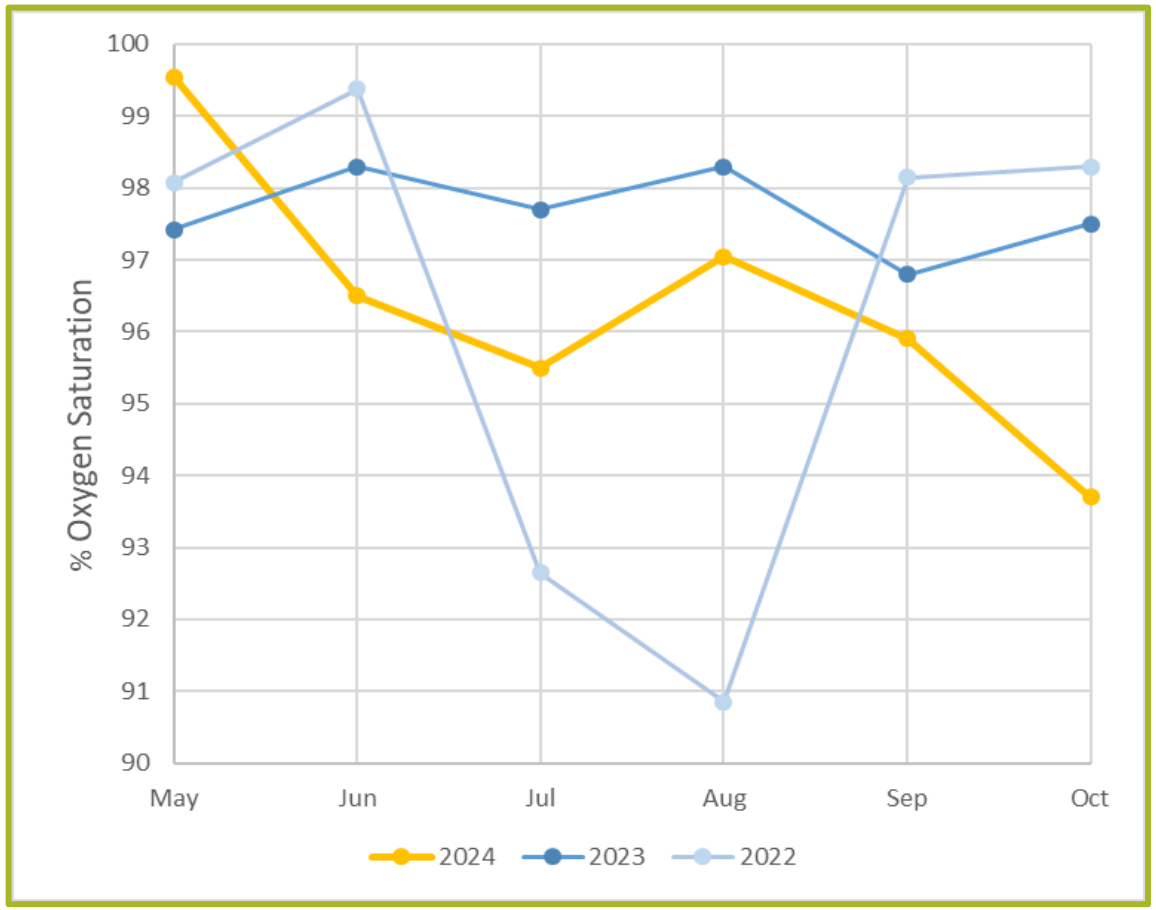




Parameter	Status
pH	pH values in 2024 were greater than in the previous 2 years, although all values were within a healthy range.
Conductivity	Overall, conductivity in 2024 was very similar to values from 2022-2023. All values were within the standard, and relatively low.

GF-4 Shawtown Brook: May 2022-Oct 2024





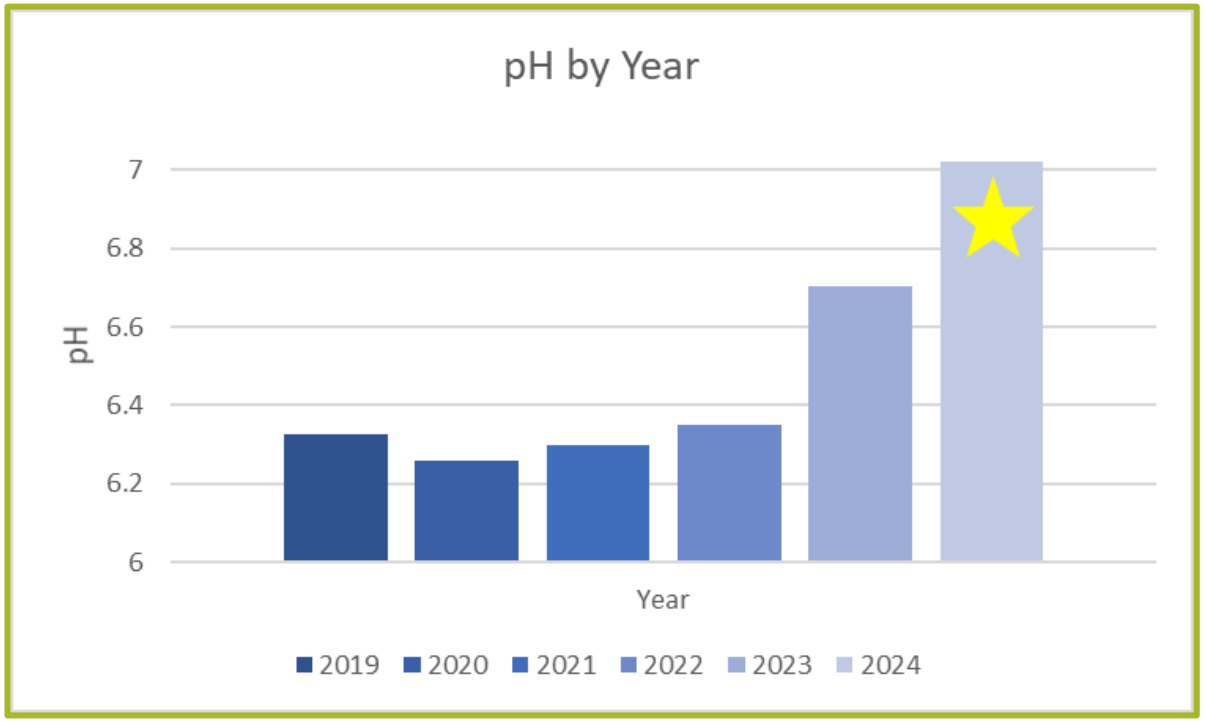
Parameter	Status
DO (mg/L)	The R^2 value from 2024 (orange) is fairly close to the R^2 value from 2022-2023 (blue), indicating stable DO (mg/L) values and a strong relationship between DO and temp. All values were within a healthy range.
DO (%)	DO% values in 2024 were very similar to 2022 and 2023 values, and all were within a healthy range.

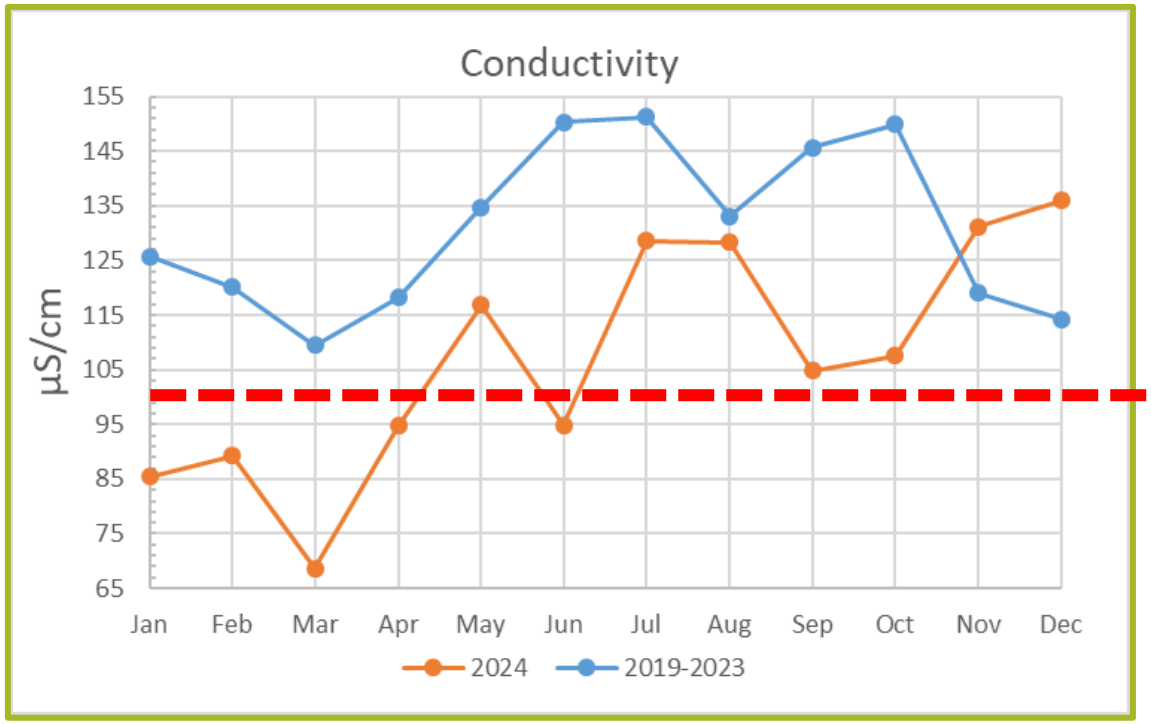
OL-14u Square Brook: Jan 2019-Dec 2024

- Monitored since 2005
- Parameters measured: pH, turbidity, temperature, conductivity, DO, TP, LL

Parameter	Status
Turbidity	Stable and in healthy range, lowest median value since 2019.
Temp.	Stable.
TP	Stable and in healthy range.

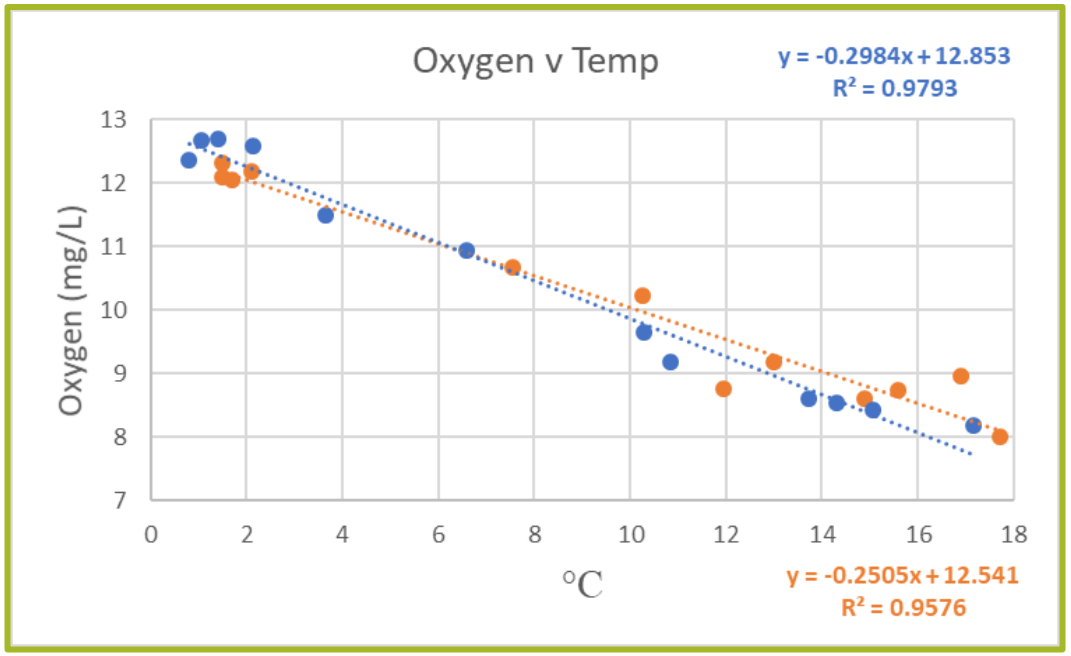
OL-14u Square Brook: Jan 2019-Dec 2024





Parameter	Status
pH	pH values in 2024 were greater than in the past 4 years, although all values were within a healthy range.
Conductivity	Overall, conductivity values in 2024 were lower than those from 2019-2023, with the exception of November and December. In 2024,conductivity exceeded the standard from May through December.

OL-14u Square Brook: Jan 2019-Dec 2024



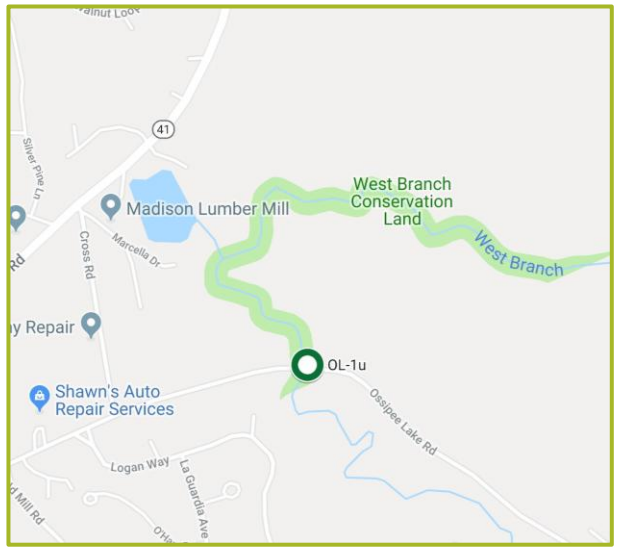
Parameter	Status
DO (mg/L)	The R^2 value from 2024 (orange) is fairly close to the R^2 value from 2022-2023 (blue), indicating stable DO (mg/L) values and a strong relationship between DO and temp. All values were within a healthy range.
DO (%)	DO % values from 2024 were mostly similar to values from 2019-2023, although 2024 values were often slightly higher. All values were in a healthy range.

OL-14u Square Brook *2024 data only

Parameter	Months Sampled	Typical Pristine Surface Water Concentrations	Status
Ammonium	Jan-Jun, Aug-Oct	< 200 µg/L	In range
Orthophosphate	Jan-Dec	< 10 µg/L	Exceeded in Mar, Jul, Oct, Nov
Dissolved Organic Carbon	Jan-Jun, Aug-Oct	1-10 mg/L	In range
Total Dissolved Nitrogen	Jan-Jun, Aug-Oct	< 0.5 mg/L	In range
Dissolved Organic Nitrogen	Mar-Jun, Aug-Oct	n/a	In range
Nitrate	Mar-Jun, Aug-Oct	< 0.05 mg/L	Exceeded in every month sampled
Chloride	Mar-Jun, Aug-Oct	< 10 mg/L	Exceeded in every month sampled
Sulfate	Mar-Jun, Aug-Oct	< 80 mg/L	In range
Sodium	Mar-Jun, Aug-Oct	< 50 mg/L	In range
Potassium	Mar-Jun, Aug-Oct	< 10 mg/L	In range
Magnesium	Mar-Jun, Aug-Oct	1-100 mg/L	Below 1 mg/L Mar-Jun
Calcium	Mar-Jun, Aug-Oct	< 15 mg/L	In range

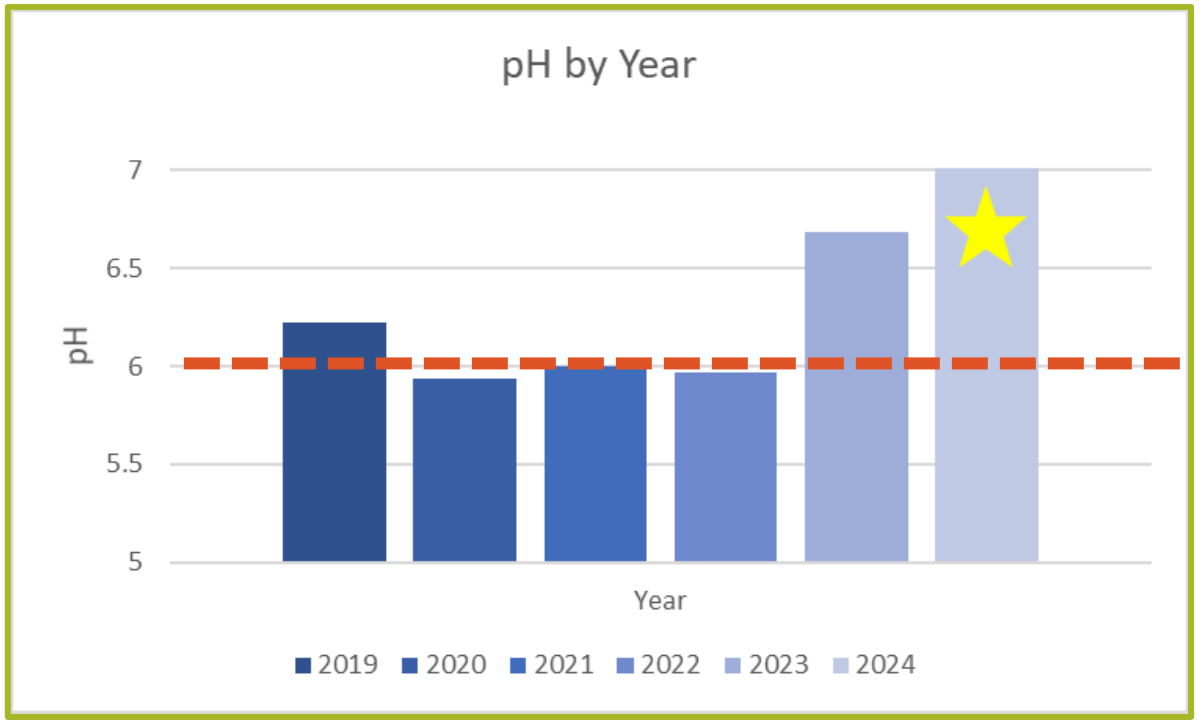
OL-1u West Branch River: May 2019-Oct 2024

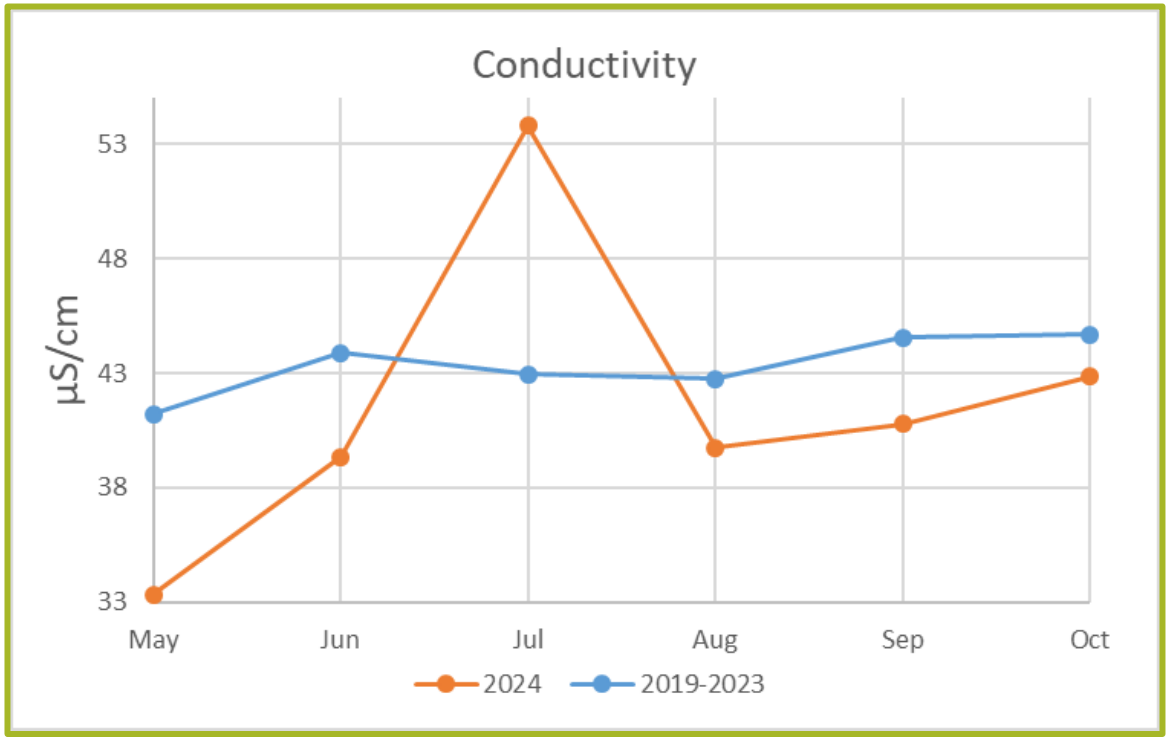
- Monitored since 2005
- Parameters measured: pH, turbidity, temperature, conductivity, DO, TP



Parameter	Status
Turbidity	Stable, in healthy range.
Temp.	Stable.
TP	Stable, in healthy range.

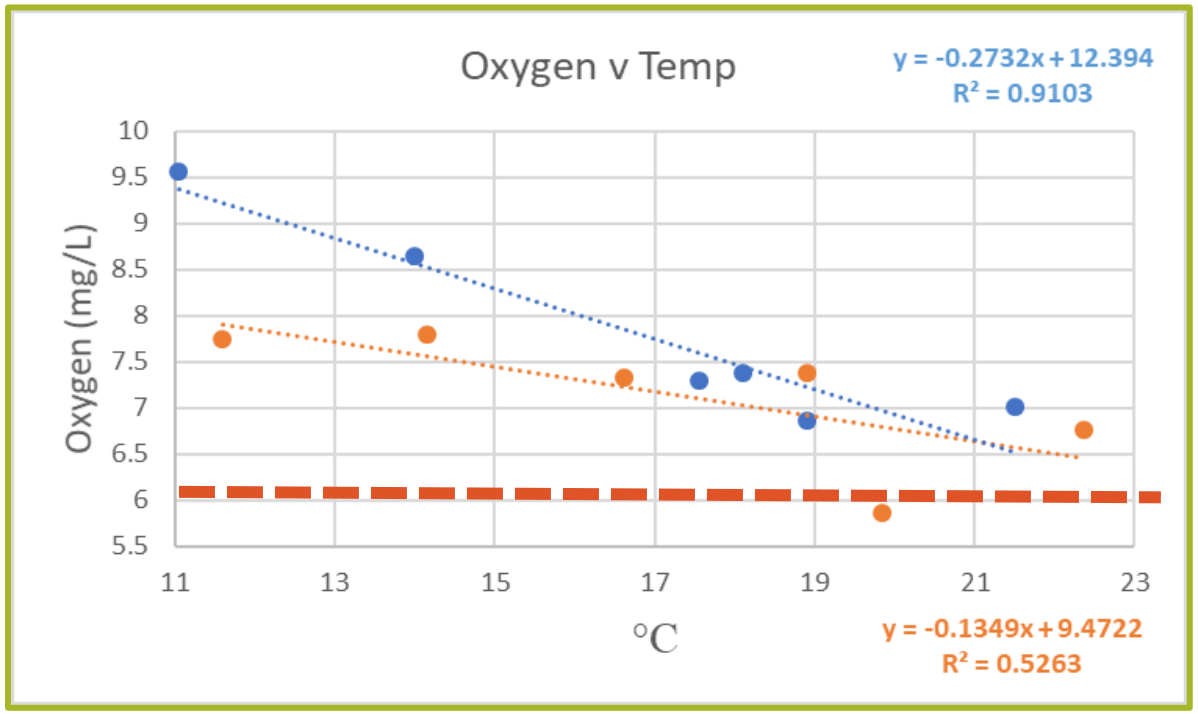
OL-1u West Branch River: May 2019-Oct 2024

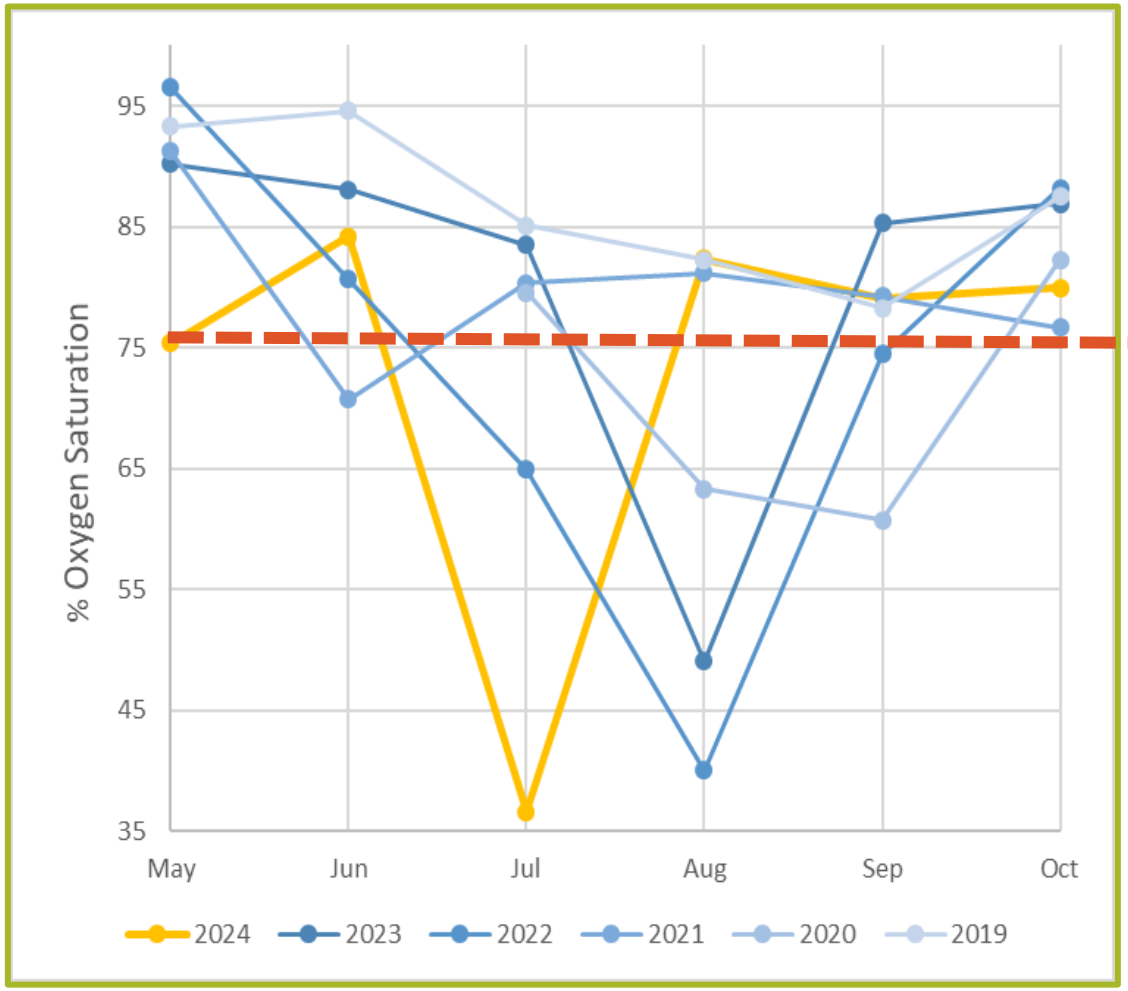




Parameter	Status
pH	pH values in 2024 were greater than in the previous 4 years, with the pH in 2019, 2023 and 2024 entering into the standard (6-8) range.
Conductivity	Overall, conductivity in 2024 was lower than in 2019-2023, with the exception of July. All values were within a healthy range.

OL-1u West Branch River: May 2019-Oct 2024

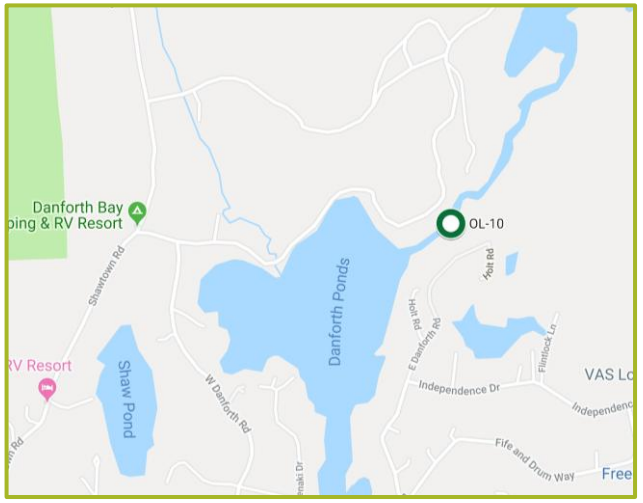




Parameter	Status
DO (mg/L)	The R^2 value from 2024 (orange) is smaller than the R^2 value from 2019-2023 (blue), which may indicate a weaker relationship between the parameters at this site in 2024. 2024 DO (mg/L) values were slightly decreased from 2019-2023 values, and fell below the standard at one point, in July.
DO (%)	DO % values in 2024 were similar to values from 2019-2023. In July of 2024, DO% values were below the standard.

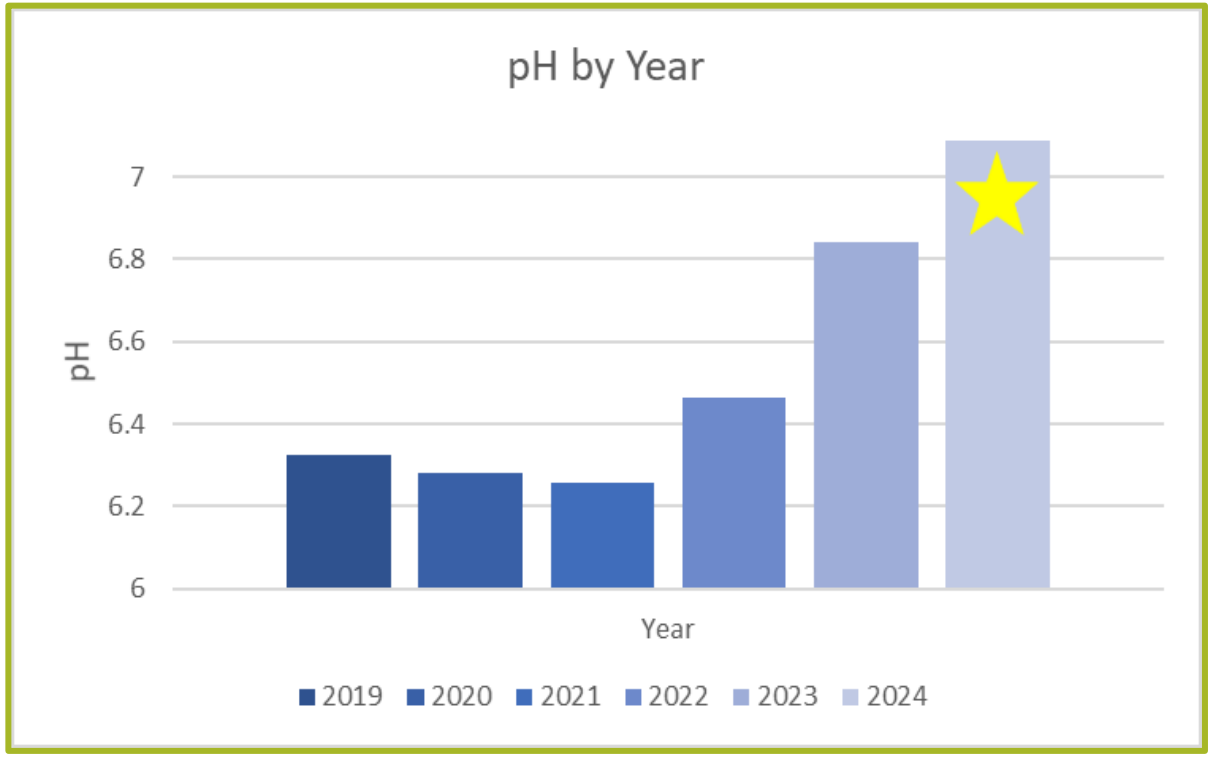
OL-10 Huckins Pond Outflow: May 2019-Oct 2024

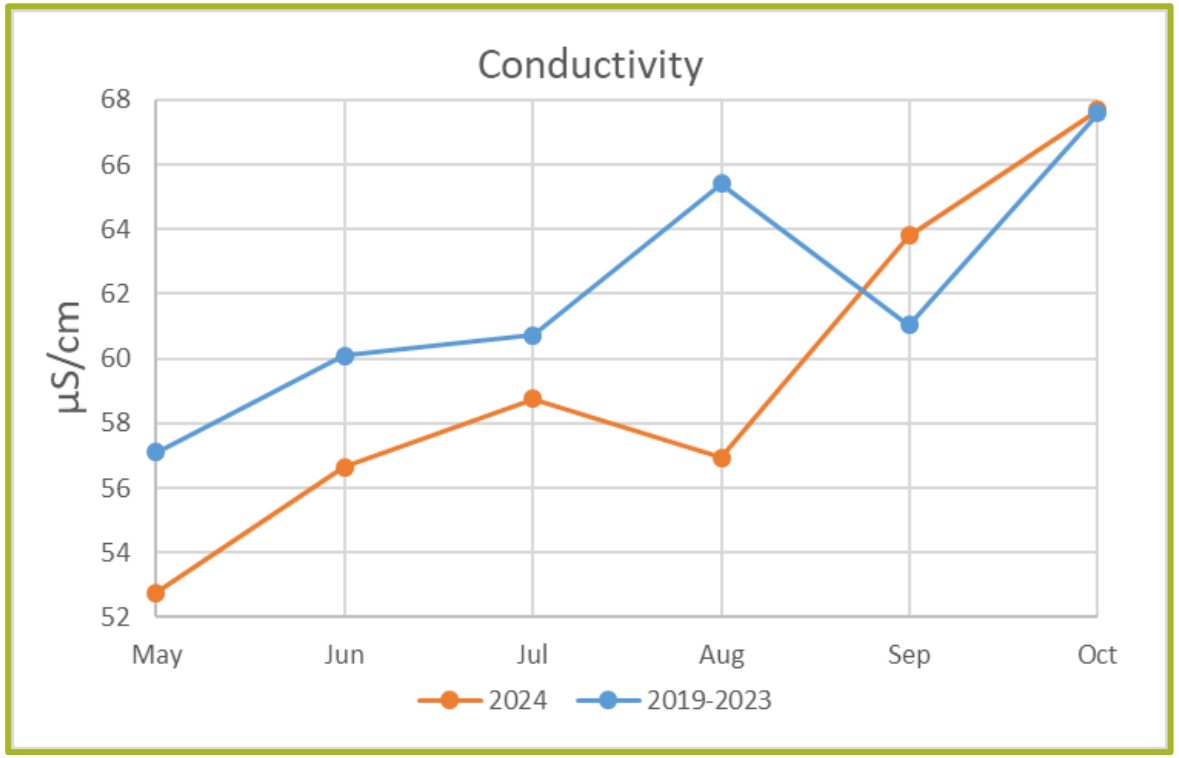
- Monitored 2003-2007, since 2013
- Parameters measured: pH, turbidity, temperature, conductivity, DO, TP



Parameter	Status
Turbidity	Stable and in healthy range, lowest median value since 2019.
Temp.	Stable.
TP	Stable and in healthy range.

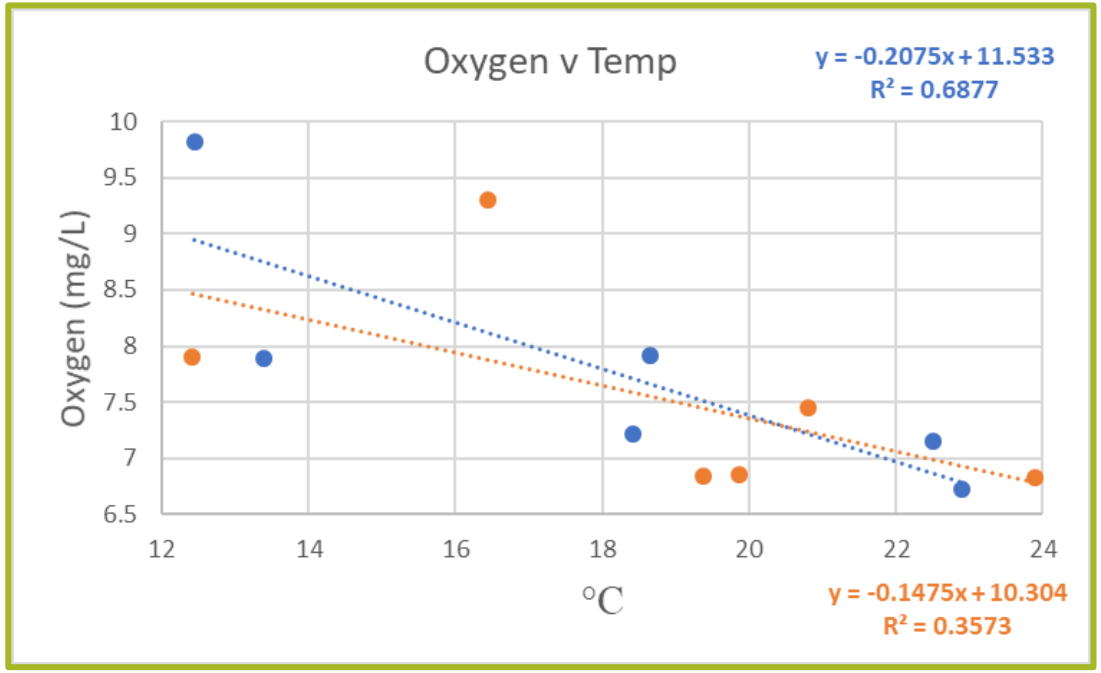
OL-10 Huckins Pond Outflow: May 2019-Oct 2024

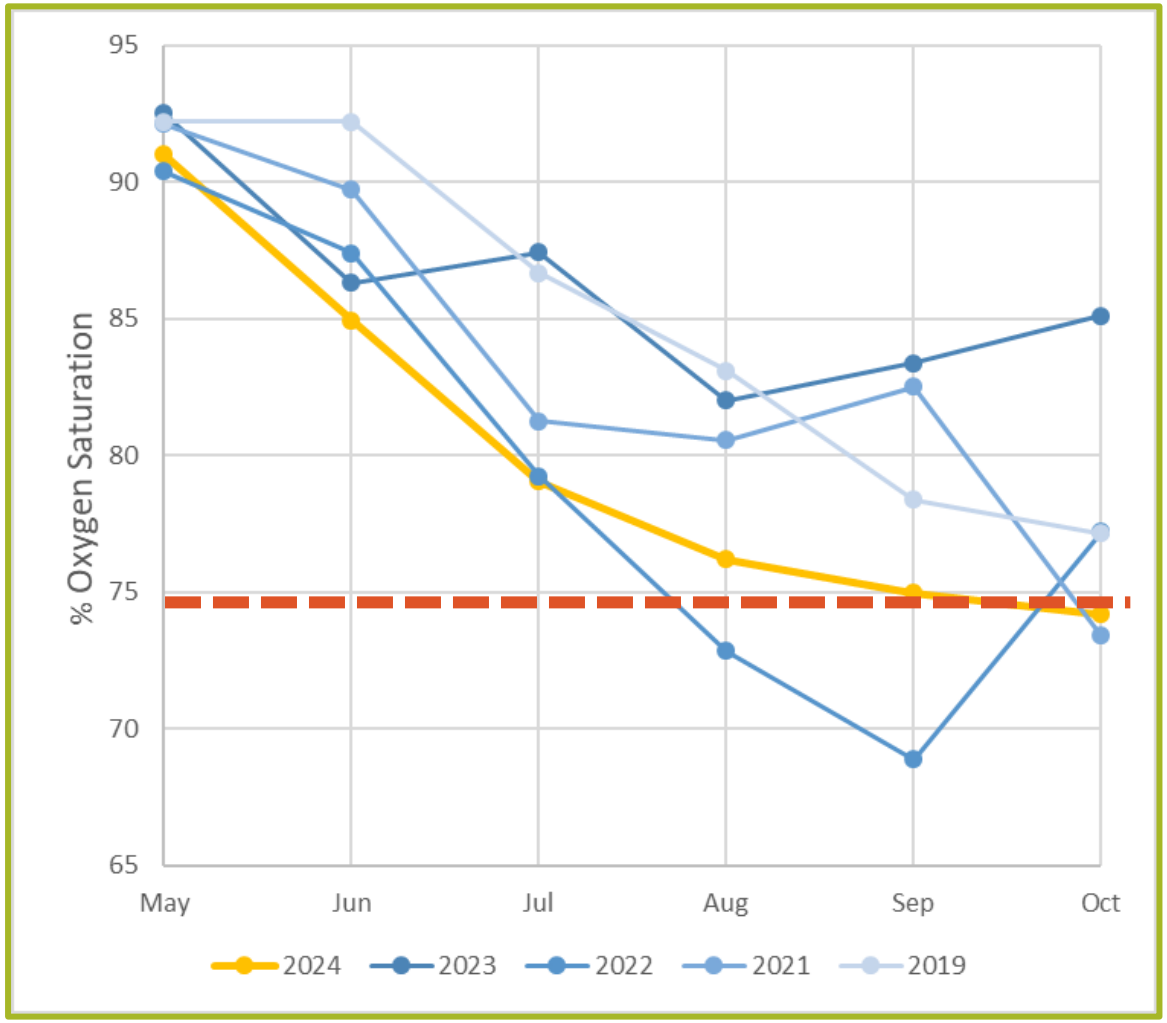




Parameter	Status
pH	pH values in 2024 were greater than in the past 5 years, although all values were within a healthy range.
Conductivity	Overall, conductivity in 2024 was lower than combined values from 2019-2023, with the exception of September. All values were within a healthy range.

OL-10 Huckins Pond Outflow: May 2019-Oct 2024





Parameter	Status
DO (mg/L)	The R^2 value from 2024 (orange) is smaller than the R^2 value from 2019-2023 (blue), although both are relatively small values. This may indicate a weaker relationship between the parameters at this site. All values were within a healthy range.
DO (%)	DO % values in 2024 were mostly similar to values from 2019-2023, although 2024 values were slightly lower than some previous years. In October of 2024, DO % dipped very slightly below the standard.

OL-9u Cold Brook: May 2019-May 2024

- Monitored 2005- May 2024
- Parameters measured: pH, turbidity, temperature, conductivity, DO, TP

GMCG and RIVERS volunteers no longer have access to this site as of May 2024. Feedback will determine if we pursue an alternative site representing this section of Cold Brook .

Overview of Findings

The majority of parameters tested fell within the acceptable limits for surface waters set by the New Hampshire Department of Environmental Services (NHDES) and/or the Environmental Protection Agency. Our findings do not indicate any trends or incidences of acute concern.

Across **all sites visited**, pH was higher in 2024 than in the previous five years. While there were no instances of pH values falling outside of the healthy range, the trend is nonetheless worth paying attention to.

At **GF-1**, **OL-1U**, and **OL-10**, the relationship between DO (mg/L) and temperature was weaker in 2024 than from 2019-2023, indicating oxygen levels are being increasingly influenced by factors other than temperature.

At **GF-3** and **OL-14U**, nitrate and chloride consistently exceeded pristine surface water standards. Orthophosphate also occasionally exceeded at both sites. Notably, none of these parameters neared concentrations that would be of acute concern for ecosystem/ human health.

At **OL-1U**, both DO (mg/L) and DO% fell below the standard of >6 mg/L and >75% in the month of July.

The conductivity standard of < 100 µS/cm was exceeded:

- At **GF-1** in September.
- At **GF-3** in September.
- At **Ol-14U** from May-December, although values were lower than from 2019-2023.

What steps can Freedom take to protect its waters?

At Home

- Encourage residents to get their septic systems regularly checked and maintained
- Use Best Management practices (BMPs) for proper disposal of chemicals and waste materials

On Roads

- Reduce salt application on roadways, especially near bodies of water and sensitive habitats, like wetlands
  - Consider brining: an equally effective and more environmentally conscious method for keeping roads clear

In Town

- Monitor the effectiveness of culverts, and work to replace those posing as safety and environmental hazards (frequent flooding, erosion of surrounding earth, partial collapse, etc.)
- Maintain riparian areas (aka Streamside Management Zones) and monitor habitats near bodies of water for major changes

THANK YOU FOR YOUR TIME!

AmeriCorps

GREEN MOUNTAIN CONSERVATION GROUP

Report respectfully submitted by:
J. Emerson, *Water Quality Coordinator*
E. Revenaugh, *AmeriCorps Water Quality Resources Assistant*