

BELLEAU LAKE

2017 SAMPLING HIGHLIGHTS

Station – 1 Deep

Wakefield, NH



Blue = Oligotrophic

Yellow = Mesotrophic

Red = Eutrophic

Gray = No Data

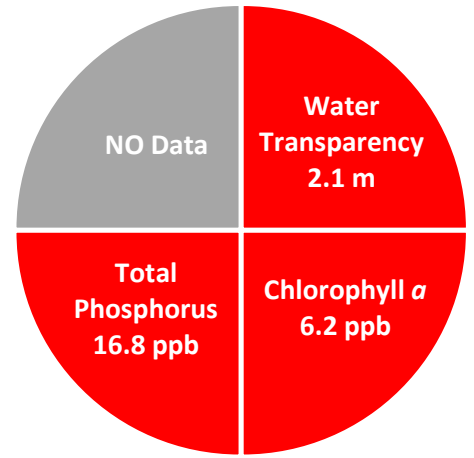


Figure 1. Belleau Lake Water Quality (2017)

Station 1 Deep (Figure 5) was used as a reference point to represent the overall Belleau Lake water quality. Water quality data displayed in Tables 1 and 2 are surface water measurements.

Table 1. 2017 Belleau Lake Seasonal Averages and NH DES Aquatic Life Nutrient Criteria¹

Parameter	Oligotrophic	Mesotrophic	Eutrophic	Belleau Lake Average (range)	Belleau Lake Classification
Water Clarity (meters)	4.0 – 7.0	2.5 - 4.0	< 2.5	2.1 meters (1.9 – 2.3)	Eutrophic
Chlorophyll a ¹ (ppb)	< 3.3	> 3.3 – 5.0	> 5.0 – 11.0	6.2 ppb (3.0 – 9.4)	Eutrophic
Total Phosphorus ¹ (ppb)	< 8.0	> 8.0 – 12.0	> 12.0 – 28.0	16.8 ppb (11.5 – 23.7)	Eutrophic
Dissolved Oxygen (mg/L)	5.0 – 7.0	2.0 – 5.0	<2.0	Not Assessed *	N/A

* Belleau Lake did not develop a deep cold water layer needed to assess dissolved oxygen concentrations.

Table 2. 2017 Belleau Lake Seasonal Average Accessory Water Quality Measurements

Parameter	Assessment Criteria					Belleau Lake Average (range)	Belleau Lake Classification
Color (color units)	< 10 uncolored	10 – 20 slightly colored	20 – 40 lightly tea colored	40 – 80 tea colored	> 80 highly colored	40.8 color units (range: 38.7 – 42.6)	Tea colored
Alkalinity (mg/L)	< 0.0 acidified	0.1 – 2.0 extremely vulnerable	2.1 – 10 moderately vulnerable	10.1 – 25.0 low vulnerability	> 25.0 not vulnerable	8.2 mg/L (range: 7.8 – 8.8)	Moderately vulnerable
pH (std units)	< 5.5 suboptimal for successful growth and reproduction		6.5 – 9.0 optimal range for fish growth and reproduction			7.0 standard units (range: 6.9 – 7.1)	Optimal range for fish growth and reproduction
Specific Conductivity (uS/cm)	< 50 uS/cm Characteristic of minimally impacted NH lakes		50-100 uS/cm Lakes with some human influence	> 100 uS/cm Characteristic of lakes experiencing human disturbances		65.9 uS/cm (range: 63.5 – 67.9)	Characteristic of lakes with some human influence

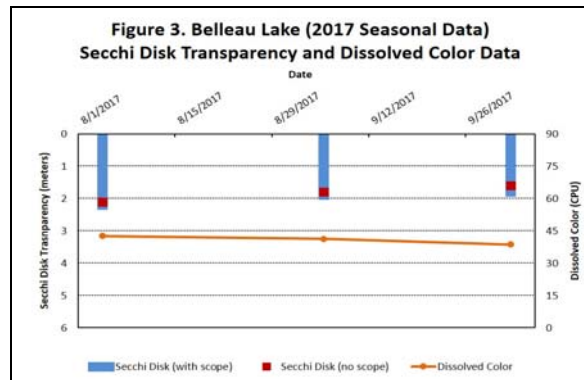
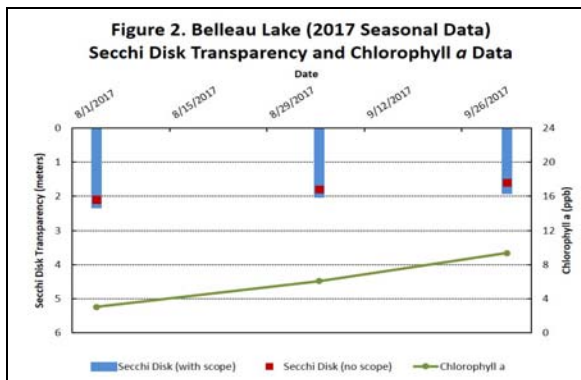


Figure 2 and 3. Seasonal Secchi disk transparency, chlorophyll a concentrations and dissolved color concentrations. Figures 2 and 3 illustrate the interplay among Secchi Disk transparency, chlorophyll a and dissolved color. Shallower water transparency measurements oftentimes correspond to increases in chlorophyll a and/or color concentrations.

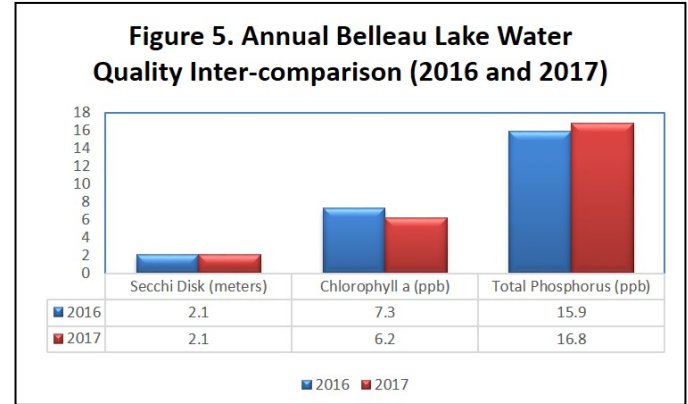
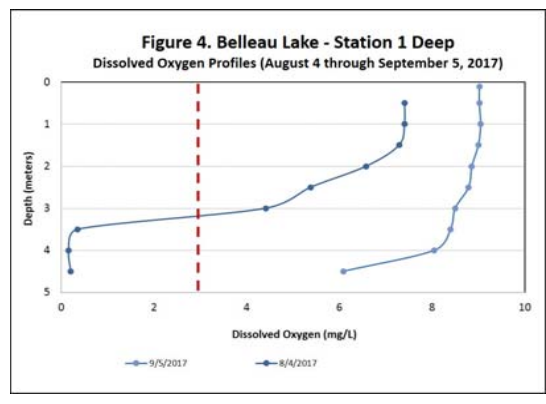
Table 3. Acton Wakefield Watershed Alliance inter-lake water quality comparison (2017 Data)

Lake	Average (range) Secchi Disk Transparency (meters)	Average (range) Chlorophyll <i>a</i> (ppb)	Average (range) Total Phosphorus (ppb)	Average (range) Dissolved Color (CPU)	Average (range) Dissolved Oxygen (mg/l)
Belleau Lake	2.1 meters (range: 1.9 – 2.3)	6.2 ppb (range: 3.0 – 9.4)	16.8 ppb (range: 11.5 – 23.7)	40.8 CPU (range: 38.7 – 42.6)	-----
Great East Lake	11.0 meters (range: 8.7 – 13.5)	0.7 ppb (range: 0.6 – 1.0)	4.4 ppb (range: <2.0 – 8.2)	11.0 CPU (range: 8.4 – 13.5)	8.4 mg/l (range: 8.0 – 9.1)
Horn Pond	7.4 meters (range: 7.0 – 7.9)	1.9 ppb (range: 1.6 – 2.2)	5.9 ppb (range: 4.9 – 6.8)	13.1 CPU (range: 9.7 – 17.0)	3.2 mg/l (range: 0.6 – 6.0)
Lake Ivanhoe	5.6 meters (5.2 – 6.0)	2.1 ppb (range: 1.4 – 3.4)	9.3 ppb (range: 7.6 – 11.7)	6.6 CPU (range: 6.1 – 8.0)	-----
Lovell Lake	6.7 meters (range: 5.3 – 7.7)	2.6 ppb (range: 1.7 – 4.1)	8.1 ppb (range: 6.7 – 10.8)	9.6 CPU (range: 7.8 – 14.2)	3.3 mg/l (range: 0.4 – 7.1)
Pine River Pond	4.9 meters (range: 4.0 – 5.5)	3.9 ppb (range: 2.5 – 4.8)	7.1 ppb (range: 6.0 – 9.3)	21.8 CPU (range: 17.0 – 26.6)	1.7 mg/l (range: 0.2 – 4.3)
Province Lake	3.3 meters (range: 2.8 – 3.8)	3.7 ppb (range: 3.0 – 4.8)	15.3 ppb (range: 13.2 – 17.6)	29.0 CPU (range: 21.9 – 37.1)	-----
Wilson Lake	6.3 meters (range: 5.4 – 7.9)	2.6 ppb (range: 1.5 – 4.4)	6.4 ppb (range: 5.2 – 8.6)	18.4 CPU (range: 10.9 – 27.4)	0.5 mg/l (range: 0.4 – 0.5)

- Water quality data are reported for a deep reference sampling location in each water body
- Dissolved oxygen measurements were collected in the summer (mid-July through mid-September) in the bottom water layer (hypolimnion or metalimnion).
- ----- Indicates the site is too shallow to form a deep water layer (hypolimnion or metalimnion) during the summer months.

Figure 4. Monthly Belleau Lake dissolved oxygen profiles collected between August 4 and September 5, 2017. The vertical red line indicates the oxygen concentration commonly considered the threshold for successful growth and reproduction of warm water fish such as bass and perch.

Figure 5. Belleau Lake annual 2016 and 2017 water quality averages. Secchi Disk transparency is reported as meters while the chlorophyll *a* and total phosphorus results are reported as parts per billion (ppb).



Recommendations

Implement Best Management Practices within the Belleau Lake watershed to minimize the adverse impacts of polluted runoff and erosion on Belleau Lake. Refer to “Landscaping at the Water’s Edge: An Ecological Approach” and “New Hampshire Homeowner’s Guide to Stormwater Management: Do-It-Yourself Stormwater Solutions for Your Home” for more information on how to reduce nutrient loading caused by overland run-off. The Acton Wakefield Watershed Alliance also offers technical assistance to help design and implement erosion control projects that protect and improve water quality.

- http://extension.unh.edu/resources/files/Resource004159_Rep5940.pdf
- <http://des.nh.gov/organization/commissioner/pip/publications/wd/documents/wd-11-11.pdf>
- <http://awwatersheds.org/healthy-lakes/conservation-practices-for-homeowners/>

**Figure 6. Belleau Lake
Wakefield, NH
Deep sampling site and 2017 seasonal average water clarity**



0 0.1 0.2 0.3 0.4 0.5
Miles

Aerial Orthophoto Source: NH GRANIT
Site location GPS coordinates collected by the UNH Center for Freshwater Biology



Extension

