WINNIPESAUKEE WINTER HARBOR

2017 SAMPLING HIGHLIGHTS

Station – 15 Winter

Wolfeboro, NH

NH | Extension

Blue = Excellent = Oligotrophic

Yellow = Fair = Mesotrophic

Red = Poor = Eutrophic

Gray = Not Assessed

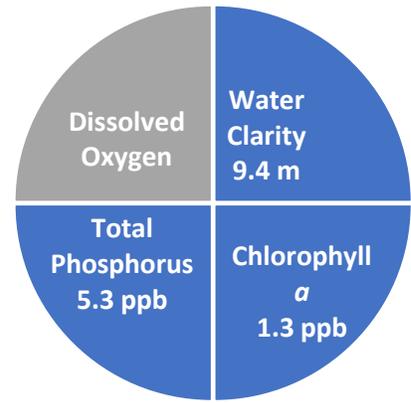| Dissolved Oxygen | Water Clarity 9.4 m |
| Total Phosphorus 5.3 ppb | Chlorophyll *a* 1.3 ppb |

Station 15 Winter Harbor (Figure 8) was used as a reference point to represent the overall Winter Harbor water quality. Water quality data displayed in Tables 1 and 2 are surface water measurements.

Figure 1. Winter Water Quality (2017)

Table 1. 2017 Winter Seasonal Averages and NH DES Aquatic Life Nutrient Criteria[1]

Parameter	Oligotrophic "Excellent"	Mesotrophic "Fair"	Eutrophic "Poor"	15 Winter Average (range)	15 Winter Classification
Water Clarity (meters)	4.0 – 7.0	2.5 - 4.0	< 2.5	**9.4** meters (7.6 – 10.0)	**Oligotrophic**
Chlorophyll *a* [1] (ppb)	< 3.3	> 3.3 – 5.0	> 5.0 – 11.0	**1.3** ppb (0.8 - 2.1)	**Oligotrophic**
Total Phosphorus [1] (ppb)	< 8.0	> 8.0 – 12.0	> 12.0 – 28.0	**5.3** ppb (4.3 – 7.8)	**Oligotrophic**
Dissolved Oxygen (mg/L)	5.0 – 7.0	2.0 – 5.0	<2.0	Not Assessed	Not Assessed

Table 2. 2017 Winter Seasonal Average Accessory Water Quality Measurements

| Parameter	Assessment Criteria					15 Winter Average (range)	15 Winter Classification
Color (color units)	< 10 uncolored	10 – 20 slightly colored	20 – 40 lightly tea colored	40 – 80 tea colored	> 80 highly colored	**6.6** color units (range: 5.3 – 8.8)	Uncolored
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	Not Assessed	Not Assessed
pH (std units)	< 5.5 suboptimal for successful growth and reproduction		6.5 – 9.0 optimal range for fish growth and reproduction			Not Assessed	Not Assessed
Specific Conductivity (*u*S/cm)	< 50 *u*S/cm Characteristic of minimally impacted NH lakes		50-100 *u*S/cm Lakes with some human influence	> 100 *u*S/cm Characteristic of lakes experiencing human disturbances		Not Assessed	Not Assessed
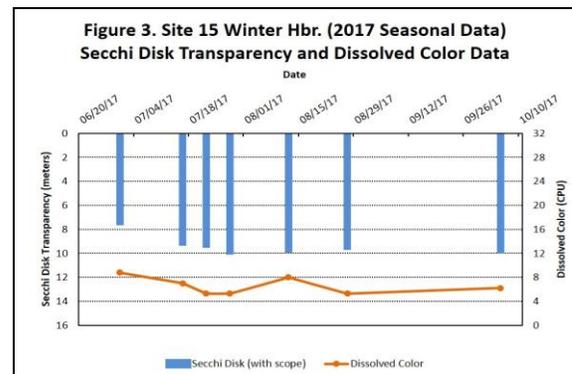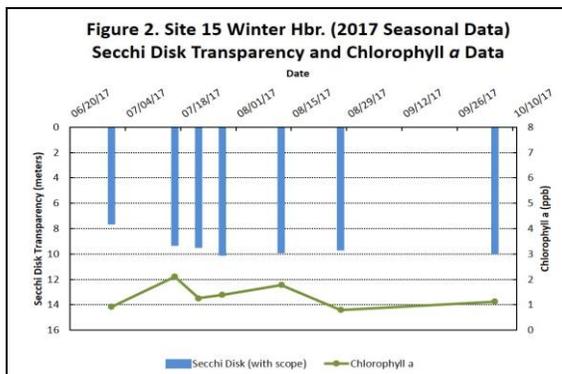
Figure 2 and 3. Seasonal Secchi Disk transparency, chlorophyll *a* and dissolved color concentrations. Figures 2 and 3 illustrate the interplay among Secchi Disk transparency, chlorophyll *a* and dissolved color. Shallower water transparency measurements oftentimes correspond to increases in chlorophyll *a* and/or color concentrations.

LONG-TERM TRENDS

WATER CLARITY: The Winter Harbor – Site 15 Winter water clarity measurements, measured as Secchi Disk transparency, have been collected over a span of nine sampling seasons. Due to the limited number of years sampled (less than ten) a trend analysis was not performed on the Secchi Disk transparency data.

CHLOROPHYLL: The Winter Harbor – Site 15 Winter chlorophyll *a* concentrations, a measure of microscopic plant life within the lake, have been collected over a span of nine sampling seasons. Due to the limited number of years sampled (less than ten) a trend analysis was not performed on the chlorophyll *a* data.

TOTAL PHOSPHORUS: The Winter Harbor – Site 15 Winter total phosphorus concentrations, the nutrient most responsible for microscopic plant growth, have been collected over a span of three sampling seasons. Due to a limited number of years sampled (less than ten) a trend analysis was not performed on the total phosphorus data.

COLOR: Color is a result of naturally occurring "tea" color substances from the breakdown of soils and plant materials. Color data have been collected over a span of eight sampling seasons. Due to a limited number of years sampled (less than ten) a trend analysis was not performed on the color data.

Figure 4. Winter Harbor - Site 15 Winter (1996-2017) Long-term Secchi Disk Transparency and Chlorophyll *a* Data
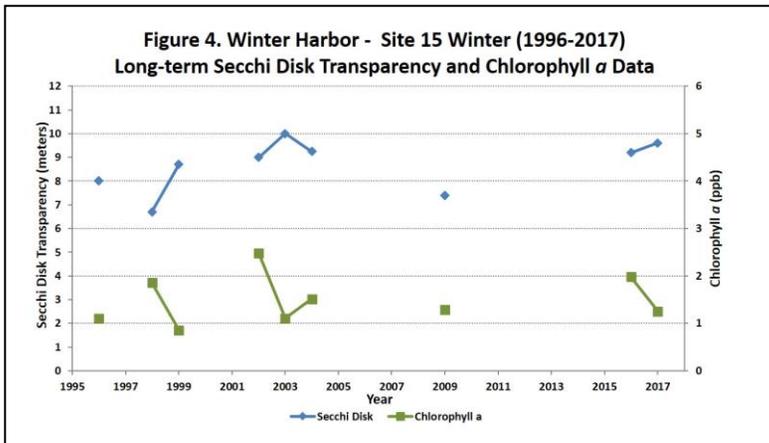
Figures 4 and 5. Changes in the Winter Harbor water clarity (Secchi Disk depth), chlorophyll *a*, dissolved color and total phosphorus concentrations measured between 1996 and 2017. **These data illustrate the relationship among plant growth, water color and water clarity. Total phosphorus data are also displayed and are oftentimes correlated with the amount of plant growth.**

Figure 6. Annual Winter Harbor Water Quality Inter-site Comparison (2017)

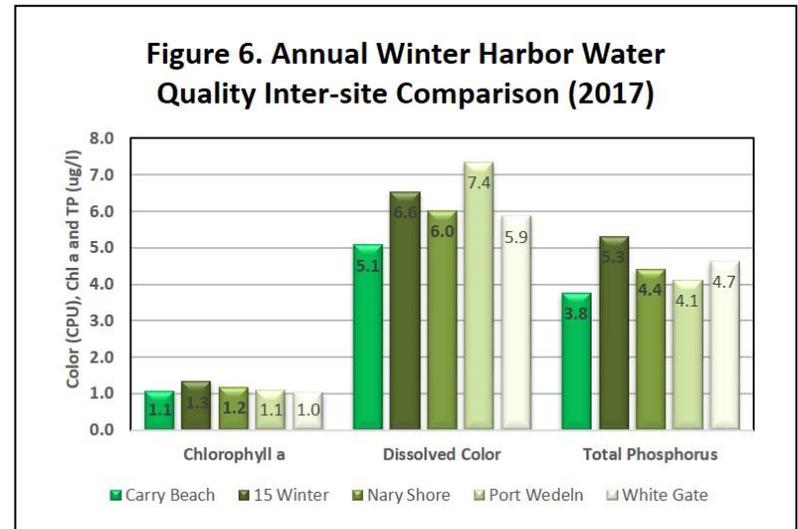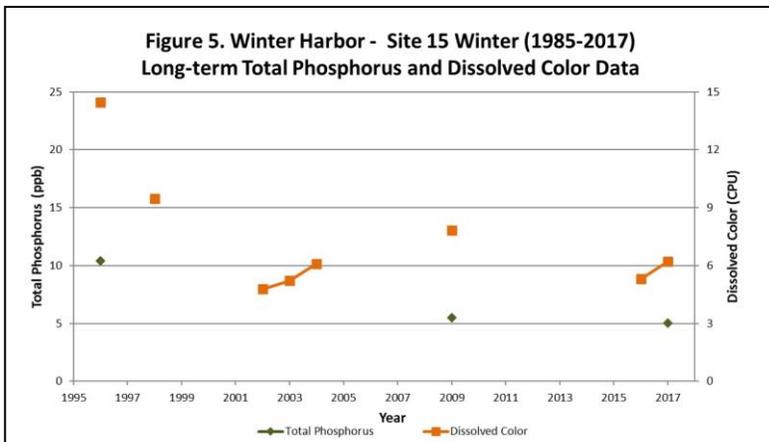Figure 5. Winter Harbor - Site 15 Winter (1985-2017) Long-term Total Phosphorus and Dissolved Color Data

Figure 6. Site 15 Winter surface water total phosphorus inter-site comparison. *While subtle differences exist, total phosphorus concentrations are similar between sampling sites.*

Figure 7. Winter Harbor dissolved oxygen profile collected on August 25, 2016. The vertical red line indicates the dissolved oxygen concentration commonly considered the threshold for successful growth and reproduction of cold water fish such as trout and salmon. *The August 25, 2016 readings are the most current dissolved oxygen data available for Site 15 Winter Harbor.*

Figure 7. Winter Harbor - Site 15 Winter Dissolved Oxygen Profile (August 25, 2016)
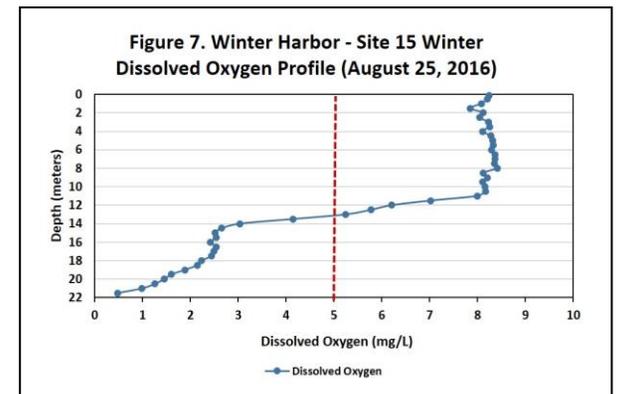
Recommendations

Implement Best Management Practices within the Lake Winnipesaukee watershed to minimize the adverse impacts of polluted runoff and erosion into Winter Harbor. 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.

- http://extension.unh.edu/resources/files/Resource004159_Rep5940.pdf
- http://des.nh.gov/organization/commissioner/pip/publications/wd/documents/wd-11-11.pdf

Figure 8. Lake Winnipesaukee - Winter Harbor South
Wolfeboro, NH
2017 sampling sites and seasonal average water clarity

15 Winter Harbor
Secchi Disk Transparency = 30.7 feet

Port Wedeln

Nary Shore

White Gate

Carey Beach

N
W E
S

0   0.4   0.8   1.2   1.6 Miles

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