# Volunteer Lake Assessment Program Individual Lake Reports

## HIGHLAND LAKE, STODDARD, NH

**MORPHOMETRIC DATA**

| | | | | | |
|---|---|---|---|---|---|
| **Watershed Area (Ac.):** | 19,008 | **Max. Depth (m):** | 9.6 | **Flushing Rate ($yr^{1}$)** | 10.3 |
| **Surface Area (Ac.):** | 712 | **Mean Depth (m):** | 1.6 | **P Retention Coef:** | 0.49 |
| **Shore Length (m):** | 25,300 | **Volume ($m^3$):** | 4,721,000 | **Elevation (ft):** | 1294 |

**TROPHIC CLASSIFICATION**

| Year | Trophic class |
|---|---|
| 1993 | MESOTROPHIC |
| 2004 | MESOTROPHIC |

**KNOWN EXOTIC SPECIES**

**The Waterbody Report Card tables are generated from the DRAFT 2014 305(b) report on the status of N.H. waters, and are based on data collected from 2004-2013. Detailed waterbody assessment and report card information can be found at www.des.nh.gov/organizations/divisions/water/wmb/swqa/index.htm**

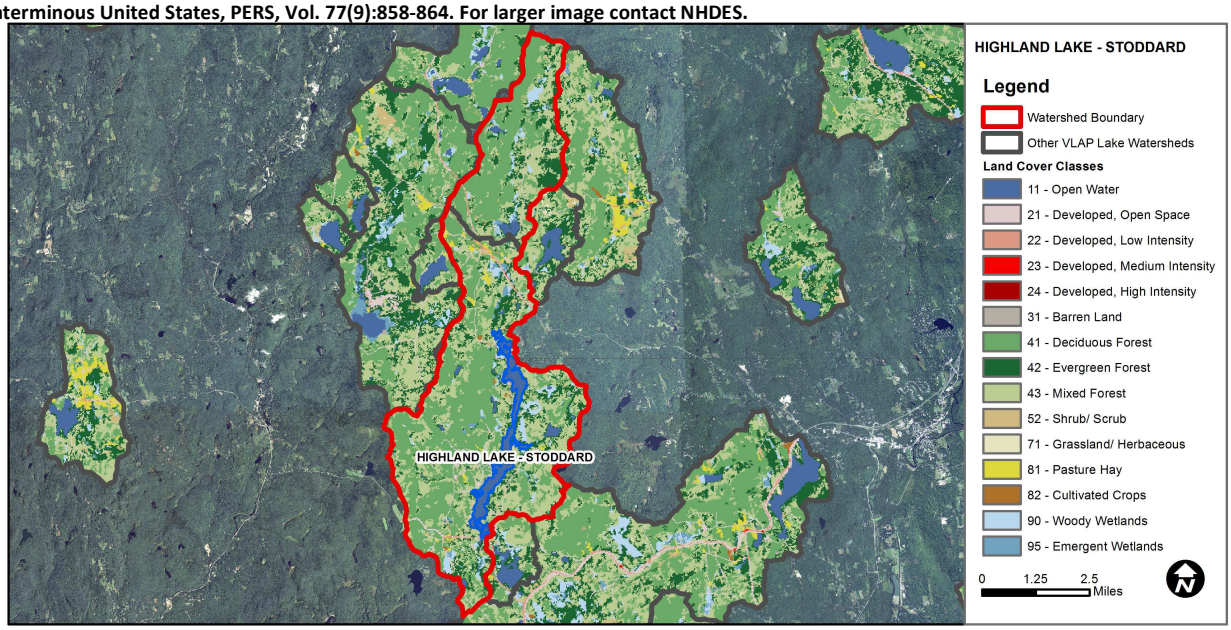
| Designated Use | Parameter | Category | Comments |
|---|---|---|---|
| Aquatic Life | Phosphorus (Total) | Good | The calculated median is from 5 or more samples and is < indicator and > 1/2 indicator and the chlorophyll a indicator is okay. |
| | pH | Bad | >10%, with a minimum of 2, samples exceed criteria, with 1 or more by a large margin. |
| | Oxygen, Dissolved | Very Good | There are a total of at least 10 samples with 0 exceedances of criteria. |
| | Dissolved oxygen satura | Slightly Bad | There are >10% of samples (minimum of 2), exceeding criteria. |
| | Chlorophyll-a | Good | The calculated median is from 5 or more samples and is < indicator and > 1/2 indicator. |
| Primary Contact Recreation | Escherichia coli | Good | There are geometric means and all geometric means are < geometric mean criteria; and there has been a single sample exceedance. |
| | Chlorophyll-a | Very Good | There are a total of at least 10 samples with 0 exceedances of indicator. |

**BEACH PRIMARY CONTACT ASSESSMENT STATUS**

| | | | |
|---|---|---|---|
| HIGHLAND LAKE-HIGHLAND LAKE BOAT LAUNCH | Escherichia coli | Bad | There are >=1 exceedance(s) of the geometric mean and/or >=2 single sample criterion exceedances. One or more exceedance is >2X criteria. |

**WATERSHED LAND USE SUMMARY**

**Fry, J., Xian, G., Jin, S., Dewitz, J., Homer, C., Yang, L., Barnes, C., Herold, N., and Wickham, J., 2011. Completion of the 2006 National Land Cover Database for the Conterminous United States, PERS, Vol. 77(9):858-864. For larger image contact NHDES.**




| Land Cover Category | % Cover | Land Cover Category | % Cover | Land Cover Category | % Cover |
|---|---|---|---|---|---|
| Open Water | 5.2 | Barren Land | 0 | Grassland/Herbaceous | 0.05 |
| Developed-Open Space | 2.58 | Deciduous Forest | 39.23 | Pasture Hay | 0.92 |
| Developed-Low Intensity | 0.59 | Evergreen Forest | 15.01 | Cultivated Crops | 0.1 |
| Developed-Medium Intensity | 0.01 | Mixed Forest | 31.25 | Woody Wetlands | 3.49 |
| Developed-High Intensity | 0 | Shrub-Scrub | 0.58 | Emergent Wetlands | 0.91 |

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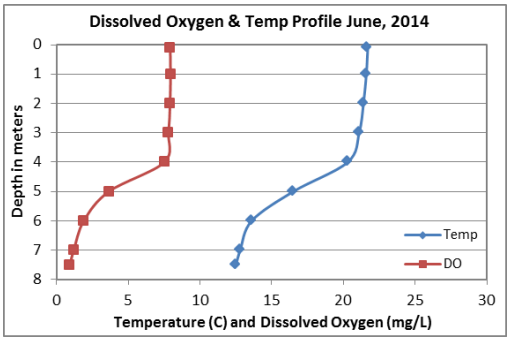
## Highland Lake, North Stn., Stoddard

## 2014 Data Summary

**Observations and Recommendations** (*Refer to Table 1 and Historical Deep Spot Data Graphics*)

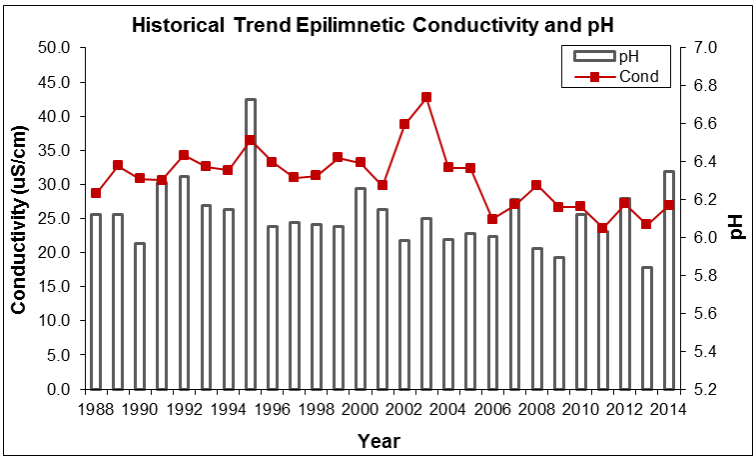
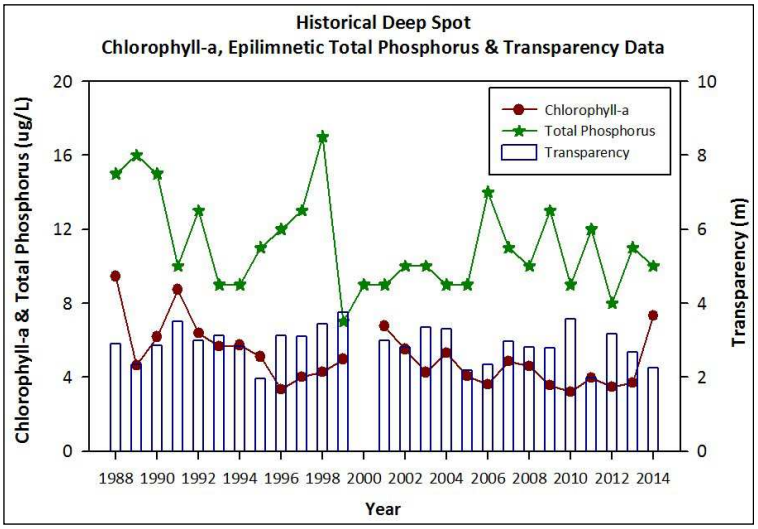
- **Chlorophyll-a:** Chlorophyll levels remained slightly elevated from June through September, increased greatly from 2013, and were greater than the state median. Higher water levels, as noted in June and August, may have provided the extra nutrients necessary for algal growth. Historical trend analysis indicates relatively stable chlorophyll levels since monitoring began.
- **Conductivity/Chloride:** Deep spot and tributary conductivity and chloride levels were generally less than or approximately equal to the state medians. Historical trend analysis indicates significantly decreasing (improving) epilimnetic (upper water layer) conductivity since monitoring began. We hope to see this continue!
- **Total Phosphorus:** Epilimnetic phosphorus remained stable from June to August and increased slightly in September, however average phosphorus levels were low and less than the state median. Historical trend analysis indicates significantly decreasing (improving) epilimnetic phosphorus since monitoring began. We hope to see this continue! Metalimnetic (middle water layer) phosphorus levels were low in June, increased to average levels in August and September. Hypolimnetic (lower water layer) phosphorus levels were average in June and then slightly elevated in August and September likely as a result of phosphorus released from bottom sediments as the summer progressed and dissolved oxygen levels decreased. Barden Pond Bk., and North Inlet phosphorus levels were elevated in June following a significant storm event, and then decreased to average levels in August and September. Pickerel Cove phosphorus levels were average.
- **Transparency:** Transparency was lower (worse) than normal and decreased from June to September. Average transparency decreased from 2013 and was less than the state median. The elevated algal growth likely contributed to the decreased transparency. Historical trend analysis indicates highly variable transparency since monitoring began.
- **Turbidity:** Epilimnetic and metalimnetic turbidities were slightly elevated throughout the summer likely due to the elevated algal growth. Hypolimnetic turbidity increased to elevated levels as the summer progressed, dissolved oxygen levels decreased, and organic compounds accumulated in the hypolimnion. Barden Pond Bk. and North Inlet turbidity was elevated in June following a significant storm event. Pickerel Cove turbidity was slightly elevated in June and September.
- **pH:** Deep spot and tributary pH levels were generally less than the desirable range 6.5-8.0 units. Historical trend analysis indicates relatively stable epilimnetic pH with moderate variability between years.
- **Recommended Actions:** A significant storm event, > 6.0 in. of rain, occurred prior to the June sampling. Barden Pond Bk. and North Inlet experienced elevated turbidity and phosphorus following the storm event. This indicates potential areas of erosion and nutrient pollution in these sub-watersheds. Educate residents on ways to reduce stormwater runoff and erosion from their properties, and to utilize phosphate free fertilizers. DES' "NH Homeowner's Guide to Stormwater Runoff" is a great resource. High water levels may have covered nutrient-rich shoreline areas as well as caused erosion in some areas; this in turn could have contributed to the elevated algal growth and lower transparency. Try to maintain a consistent water level during the summer months to reduce shoreline flooding and erosion. Keep up the great work!




**NH Water Quality Standards:** Numeric criteria for specific parameters. Results exceeding criteria are considered a water quality violation.
**Chloride:** > 230 mg/L (chronic)
**E. coli:** > 88 cts/100 mL – public beach
**E. coli:** > 406 cts/100 mL – surface waters
**Turbidity:** > 10 NTU above natural level
**pH:** between 6.5-8.0 (unless naturally occurring)

| Station Name | Table 1. 2014 Average Water Quality Data for HIGHLAND LAKE | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Alk. mg/l | Chlor-a ug/l | Chloride mg/l | Cond. uS/cm | Total P ug/l | Trans. m | | Turb. ntu | pH |
| | | | | | | NVS | VS | | |
| Epilimnion | 2.50 | 7.33 | 4 | 27.0 | 10 | 2.25 | 2.53 | 1.17 | 6.35 |
| Metalimnion | | | | 27.7 | 10 | | | 1.24 | 6.03 |
| Hypolimnion | | | | 33.3 | 17 | | | 8.43 | 5.91 |
| Barden Pond Brook | | | | 17.5 | 13 | | | 1.20 | 6.06 |
| North Inlet | | | 5 | 35.8 | 14 | | | 1.81 | 6.10 |
| Pickerel Cove 2 | | | 3 | 17.8 | 13 | | | 1.22 | 5.76 |
| Pickerel Cove Brook | | | | 13.5 | 15 | | | 1.90 | 5.90 |

**NH Median Values:** Median values for specific parameters generated from historic lake monitoring data.
**Alkalinity:** 4.9 mg/L
**Chlorophyll-a:** 4.58 mg/m$^3$
**Conductivity:** 40.0 uS/cm
**Chloride:** 4 mg/L
**Total Phosphorus:** 12 ug/L
**Transparency:** 3.2 m
**pH:** 6.6

### Historical Water Quality Trend Analysis

| Parameter | Trend | Explanation | Parameter | Trend | Explanation |
|---|---|---|---|---|---|
| Conductivity | Improving | Data significantly decreasing. | Chlorophyll-a | Stable | Trend not significant; data show low variability. |
| pH (epilimnion) | Stable | Trend not significant; data moderately variable. | Transparency | Stable | Trend not significant; data highly variable. |
| | | | Phosphorus (epilimnion) | Improving | Data significantly decreasing. |