EXECUTIVE SUMMARY

Lake Winnipesaukee is a 44,586-acre (70 sq.mi.) lake located in central NH, with a 215,133-acre (336 sq.mi.) watershed area that includes the 29,870-acre (47 sq.mi.) Moultonborough Bay watershed and the 5,095-acre (8 sq.mi.) Winter Harbor watershed (see map on page v). Lake Winnipesaukee is classified as an **oligotrophic** lake and is the second clearest lake in New Hampshire. Lake Winnipesaukee supports a thriving population of both cold and warm water species including but not limited to rainbow trout, land locked salmon, lake trout, and small and large mouth bass. The only recorded invasive aquatic plant species present in Lake Winnipesaukee is variable milfoil which was first reported in 1965. Vigilant weed watchers and boaters are helping to keep the lake and its bays and harbors free from additional invasive aquatic species. Lake Winnipesaukee is an important recreational destination for many residents and visitors for boating, fishing, hiking, swimming, and more. The Lake is host to approximately 80 registered bass tournaments annually in addition to the "Winni Derby", a three-day salmon and lake trout derby that attracts approximately 3,000 anglers (Lake Winnipesaukee Association, LWA). The Lake is alive in the winter with an annual "Meredith Rotary Ice-Fishing Derby" held in February that attracts thousands of hard-water anglers (LWA).

Despite its classification as an oligotrophic waterbody, the lake is currently listed on the 303(d) NH List of Impaired Waters due to the occurrence of cyanobacteria. *Gloeotrichia (Gloeotrichia echinulata)* blooms have been observed in Winter Harbor, as well as other embayments on Lake Winnipesaukee, and represent a threat to water quality and lake health. The NH Department of Environmental Services (NHDES) uses a tool called **assimilative capacity analysis** to assess water quality in the context of current state criteria. While the assimilative capacity for Moultonborough Bay and Winter Harbor indicate that all sites attain state designation for high quality waters, a closer look at near-shore sites and land use modeling indicate that both these bays are at risk for continued water quality degradation from future development under current zoning. The combined effects of increased development and climate change will likely continue to exacerbate the prevalence of potentially-toxic cyanobacteria in these waterbodies.

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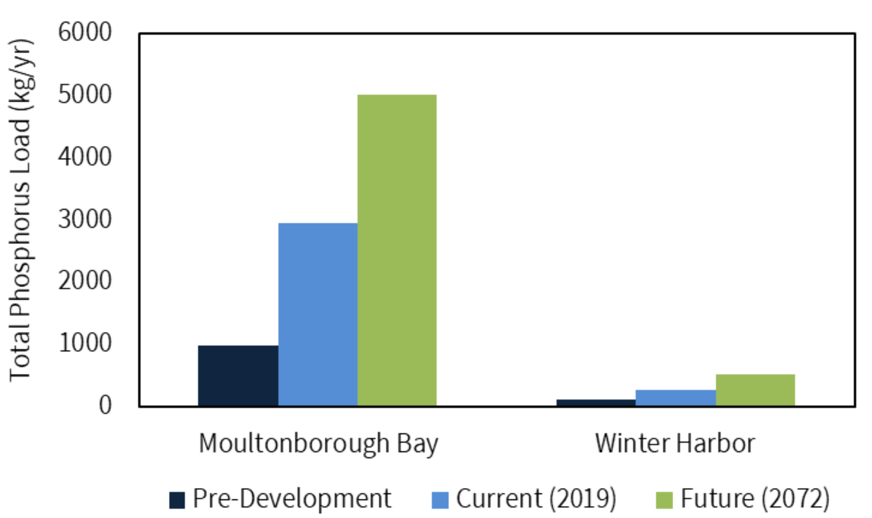
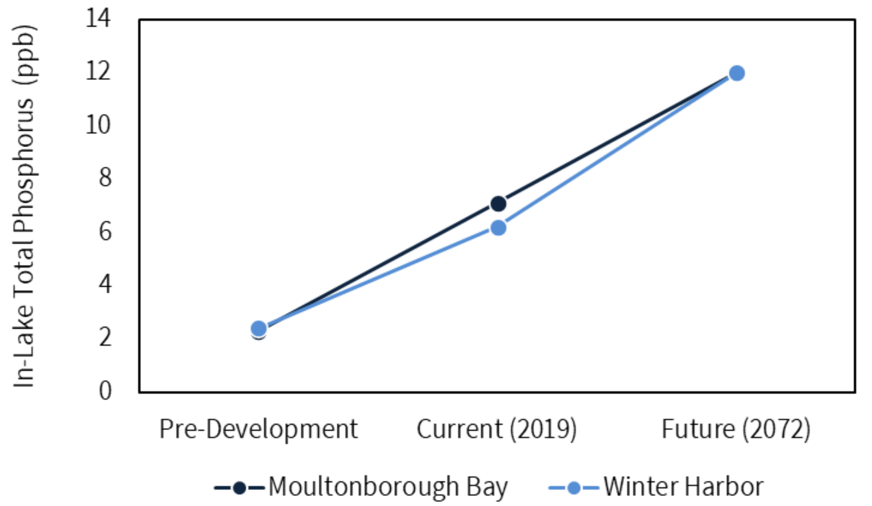
Given the importance of Lake Winnipesaukee as a recreational destination and its current cyanobacteria impairment, the Lake Winnipesaukee Association (LWA), in partnership with the Lakes Region Planning Commission, launched the "Winnipesaukee Gateway" project to bring together restoration and management of the big lake. Through the Gateway, LWA is creating Watershed-Based Management Plans (WMPs) for individual embayments along the lake. Focusing on smaller sub-sections of the big lake can tailor management recommendations to individual communities and water quality concerns. This Plan is written to address the Moultonborough Bay and Winter Harbor watersheds, located in Moultonborough, Tuftonboro, and Wolfeboro on the northern side of the lake. The Moultonborough Bay and Winter Harbor Watershed Management Plan provides a roadmap for improving the water quality of surface waters within the Moultonborough Bay and Winter Harbor watersheds and can be used as a mechanism for procuring funding (e.g., Section 319 grants) to secure actions needed to achieve the water quality goal. The United States Environmental Protection Agency (USEPA) requires that a nine-element watershed plan be created so that communities become eligible for federal watershed assistance grants.

As part of the development of this plan, a build-out analysis, Lake Loading Response Model analysis, water quality and assimilative capacity analysis, and shoreline/watershed surveys were conducted (Section 3). A buildout analysis detects areas within the watersheds with development potential and identifies how much development can occur and at what densities (Section 3.3.3). **The buildout analysis results indicated that under current zoning within Moultonborough, Tuftonboro, and Wolfeboro, 56% (16,770 acres) of the Moultonborough Bay and Winter Harbor watersheds is buildable area and has the potential to be developed.** Upon reaching full build-out – the theoretical point in time when all available land has been developed to the maximum capacity permitted by current local ordinances and current zoning standards – an estimated additional 6,385 additional buildings could be constructed within the watersheds. At a compound annual growth rate of 2.23%, full build-out in these watersheds is estimated to occur by the year 2072 (see figures to the right).

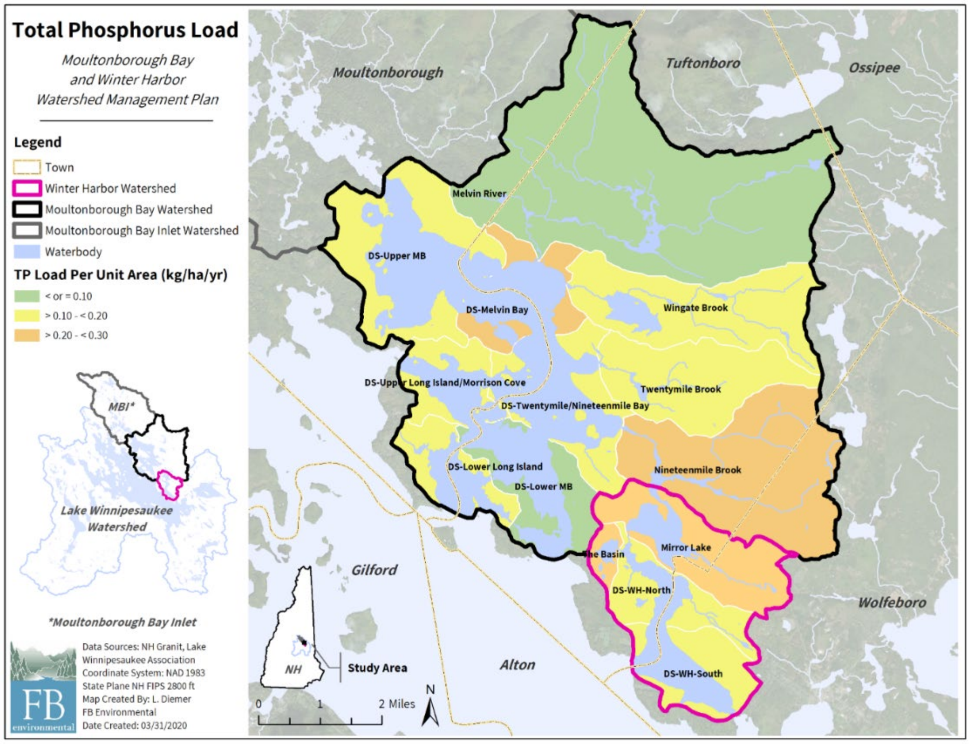




Change in total phosphorus load (kg/yr, **TOP**) and in-lake total phosphorus concentration (ppb, **BOTTOM**) for Moultonborough Bay and Winter Harbor from pre-development to current (2019) to future (2072) conditions.

Results of the build-out analysis, as well as a septic system survey were used to run a land-use model, or Lake Loading Response Model (LLRM), that estimated the pre-development, current, and projected future amount of total phosphorus being delivered to Moultonborough Bay and Winter Harbor (Section 3.3.2). Based on model analysis of pre-development, current, and future water quality conditions, both Moultonborough Bay and Winter Harbor are at risk for continued water quality degradation from future development under current zoning. The model results show that watershed runoff combined with baseflow was the largest phosphorus loading contribution across all sources to Moultonborough Bay and Winter Harbor. **Future loading estimation indicate that total phosphorus loading may increase by 70% at full build-out (estimated as early as 2072)** within the watershed. Water quality degradation of the basins will likely be accelerated by additional phosphorus loading from the watershed and internal sediments. Modeled total phosphorus load was highest for the direct drainage to Melvin Bay, the Nineteenmile Brook sub-watershed, the Mirror Lake sub-watershed, and the area draining to the Basin (see map on the following page). These additional model results can help watershed managers prioritize restoration efforts in areas with greater total phosphorus input to the lake.

To identify possible sources of pollution across these two watersheds, watershed and shoreline surveys of Moultonborough Bay and Winter Harbor were completed in 2019 (Section 3.5.4). The field surveys identified **107 pollutant sites** in the watershed and **717 high to medium impact rated shoreline properties**. Watershed sites have been prioritized for remediation based on the estimated total phosphorus load reduction from the recommended action, the cost, and the observed site impact. Finally, as part of development of this plan, recent water quality data for key parameters – dissolved oxygen, temperature, secchi disk transparency, total phosphorus, and chlorophyll-a – have been summarized and this summary is available in Section 3.2.



A map of modeled current total phosphorus (TP) load per unit area (kg/ha/yr) for each sub-watershed in the Moultonborough Bay and Winter Harbor watersheds. Watershed managers can use TP loading maps to help prioritize restoration.

An Action Plan (Section 5.2) with associated timeframes, responsible parties, and estimated costs was developed in collaboration with the steering committee. Completing the action items set forth in the Action Plan will help achieve the water quality goal and objectives set by the watershed community. Management strategies for achieving the water quality goal and objectives involve using a combination of structural and non-structural Best Management Practices (BMPs), as well as an adaptive management approach that allows for regular updates to the plan (refer to Section 4). More specifically, this Plan includes the following key recommendations for success:

(1) **Enhance the existing baseline lake and tributary monitoring program** with increased volunteers to ensure consistency in data collection at existing sampling stations.
(2) **Expand the water quality monitoring program** to include sample collection in the spring (immediately following ice-out) and during turnover in the fall. Consider collecting winter data under the lake ice for phytoplankton enumeration and speciation.
(3) **Support nearshore investigative studies** aimed at identifying localized sources of phosphorus in cyanobacteria hotspots.
(4) **Address priority pollutant sites** and identify funding for the three conceptual BMP concept designs completed through this planning process. Identify funding for remaining high priority watershed and shoreline pollution sites.
(5) **Review the gaps in municipal ordinances**, outlined on pages 70-71, and identify strategies for strengthening town ordinances in each community that will improve natural resource protection.
(6) **Enhance watershed resident education and communication of local land ordinances** and actionable best management practices for private property.

The success of this plan is dependent on the continued effort of volunteers, and a strong and diverse steering committee that meets regularly to coordinate resources for implementation, review progress, and make any necessary adjustments to the plan to maintain relevant action items and interim benchmarks. Measurable milestones (number of BMP sites, volunteers, funding received, etc.) should be tracked by a steering committee and reported to the NHDES on a regular basis.

A reduction in nutrient loading is no easy task, and because there are many diffuse sources of phosphorus reaching the rivers, lakes, and ponds from existing residential development, roads, septic systems, and other land uses in the watershed, it will require an integrated and adaptive approach across many different parts of the watershed community to be successful.