LAKE PLACID LAKE MANAGEMENT PLAN

Paul Smith's College Adirondack Watershed Institute

Ausable River Association

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The Shore Owners' Association of Lake Placid (SOA) initiated development of the Lake Placid Lake Management Plan, and provided the sole source of funding to support this effort. The Paul Smith's College Adirondack Watershed Institute (AWI) and Ausable River Association (AsRA) have co-led the management plan development. AWI and AsRA conducted all necessary fieldwork, data collection, GIS, and data analysis.

The plan was conceived as a response to shore owners' concerns regarding managing variable-leaf milfoil in Paradox Bay, water quality issues related to septic systems, increased recreational use, and general recognition of the benefit of comprehensive management planning for Lake Placid. The SOA has a long history of effective and engaged stewardship of Lake Placid and their input and participation in developing this plan have been instrumental to its successful completion. David Bumsted, Rusty Hlavececk, Georgia Jones, Christina Lussi, and Scott Donnelly served as the primary liaisons through the process and deserve special recognition for their contributions. The SOA board of trustees and membership also played an essential role in the plan development and were enthusiastic supporters and participants.

Much of the long-term water quality data used to inform the plan development came from the New York State Department of Environmental Conservation (NYS DEC) and the New York State Federation of Lake Associations (NYSFOLA) Citizen Statewide Lake Assessment Program (CSLAP). NYS DEC fisheries staff also provided data on Lake Placid.

We would like to thank Janelle Jones, Lija Treibergs, Elizabeth Yerger, Joline Call, Connor Vara, Danielle Ulrich, & Isaac Stouffer for their contributions to the field, laboratory, and data analysis work conducted. Brendan Wiltse, Brett Wimsatt, Lija Treibergs, and Danielle Ulrich provided the photographs throughout the plan.

During the plan development input was sought from various stakeholders and the public. The following entities have been directly involved in reviewing and providing input on the plan:

- Town of North Elba
- Village of Lake Placid
- Adirondack Park Agency
- New York State Department of Environmental Conservation
- Mirror Lake Watershed Association
- Shore Owners' Association of Lake Placid

The following individuals provided technical input and proofreading of the plan:

- Art Devlin, Village of Lake Placid
- Derek Doty, Town of North Elba
- Megan Phillips, APA
- Erin Vennie-Volrath, NYS DEC
- Davina Winemiller, Town of St. Armand

We thank these individuals for taking the time to read and provide feedback on the plan.

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Executive Summary

Lake Placid is the largest lake in Essex County and is known for its exceptional water quality and scenic vistas. The lake has a surface area of 1,992 acres with 21.9 miles of shoreline. The waters of Lake Placid reach a depth of 151 feet, providing ideal habitat for lake trout, a native cold-water fish. Whiteface Mountain towers above the lake at 4,865 feet in elevation and sits at the top of the watershed boundary.

Lake Placid and its watershed are rich in biodiversity and human history. The SOA have been stewards of the ecological and human history for over 125 years. The organization was established out of concerns over fluctuating water levels in the lake and it's first act was to purchase the dam at the lake's outlet. SOA remain owners of the dam today.

Lake Placid's water quality has benefited from a mostly undisturbed watershed, much of which belongs to the New York State Forest Preserve. A large portion of the shoreline is also protected through the Forest Preserve. Though the development that does exist in the watershed is concentrated along the lakeshore.

Lake Placid has excellent water quality and serves as the source of drinking water for the Village of Lake Placid. An analysis of the available water quality data indicates a long-term decline in transparency. This decline is likely driven by regional recovery in acid rain, as well as climate change. There have also been long-term changes in pH, most recently a significant decline. The cause of the decline is unknown and warrants further investigation.

Lake Placid contains one aquatic invasive species. Variable-leaf milfoil was detected in the lake in 2009 and remains present today. Stewardship efforts at both the village and state boat launches are critical to the prevention of new introductions of invasive species. The management of variable-leaf milfoil in Paradox Bay has varied over the years, recent shifts in harvesting efforts are proving successful and with continued effort it may be possible to eradicate it from the lake.

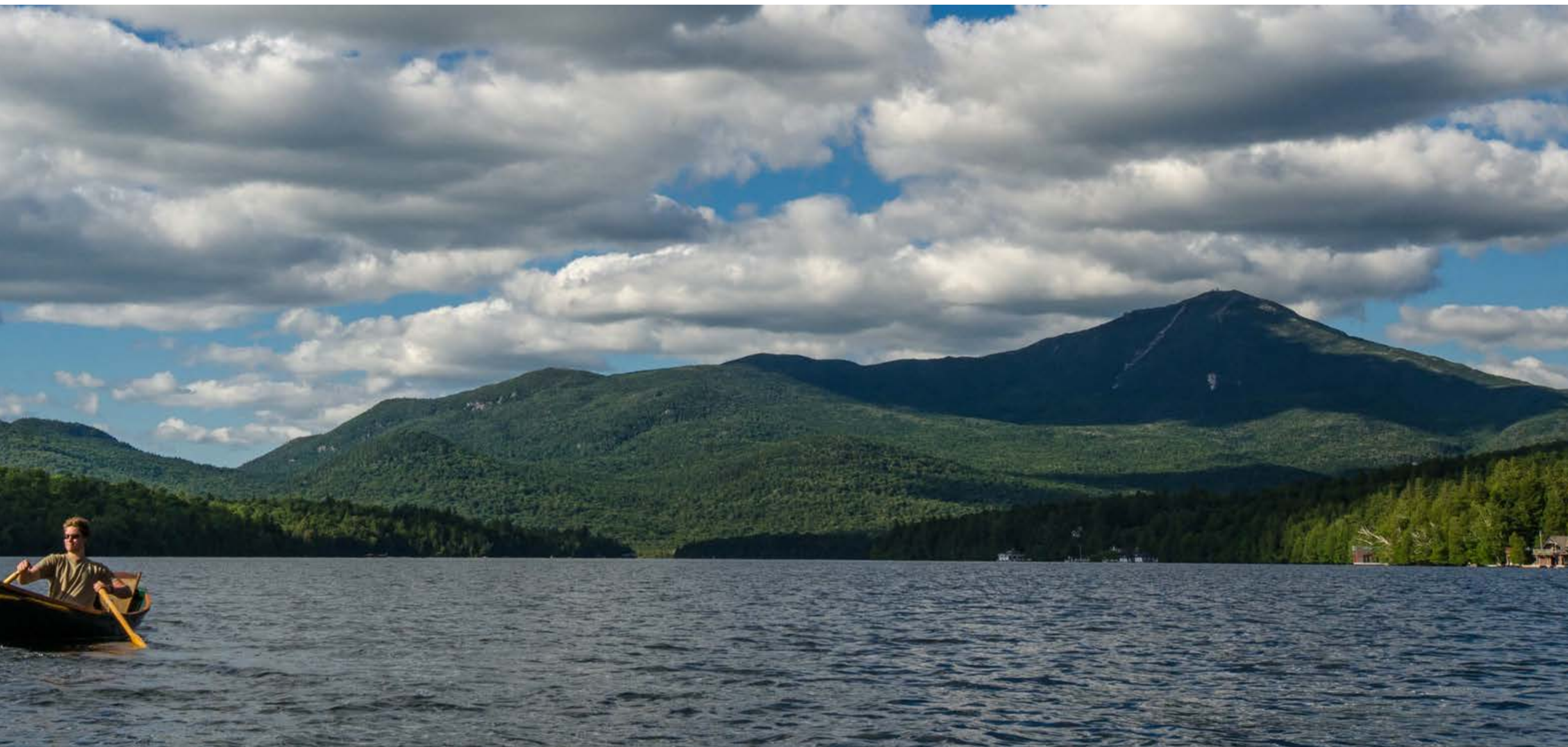
Lake Placid is a popular destination for recreational boaters, and is one of the most heavily visited lakes in the region. Long-term data from the Adirondack Watershed Institute Stewardship Program indicates a significant increase in boaters visiting the lake. Stakeholders have indicated concerns related to boater safety, crowding, and shoreline erosion from boat wakes. Managing the recreational use of Lake Placid is complex and challenging. A lake carry capacity model developed for Lake Placid would help inform stakeholders and guide decision makers.

The land use and development in the Lake Placid watershed has the potential to significantly impact the health of the lake. Strong local laws for septic system siting, inspection, and maintenance

are critical to the protection of this important resource. Though, more work needs to be done to fully understand the impact of septic systems on the lake's water quality. Increased adoption of lake-friendly practices, such as planting shoreline buffers, reducing the use of pesticides and fertilizers, and improving stormwater management are all important to the long-term protection of the lake.

Throughout its history the protection of Lake Placid has fallen on volunteers and local government. In order to address the challenges of invasive species, climate change, managing recreational use, and promoting the adoption of lake-friendly practices a staffed lake manager position is needed. A qualified lake manager would provide the professional expertise necessary to effectively manage and protect this important resource.

Those that love and care for Lake Placid recognize that a healthy lake is essential to maintaining its ecological integrity and economic values. To ensure the health of Lake Placid this plan lays out key recommendations, which serve to guide lake management and planning for years to come.



Introduction

Lake Placid is an iconic Adirondack lake with exceptional water quality situated in the western portion of Essex County, NY. The lake is home to many seasonal and full-time residents and is a major draw for visitors. It serves as the water supply for the Village of Lake Placid, the Town of North Elba, and many of the private camps and residences that surround the lake. It has a healthy population of lake trout (*Salvelinus namaycush*), a native cold-water salmonid in New York State. From an ecological, economic, social, and cultural perspective, such a highly valued resource requires thoughtful management to preserve these values.

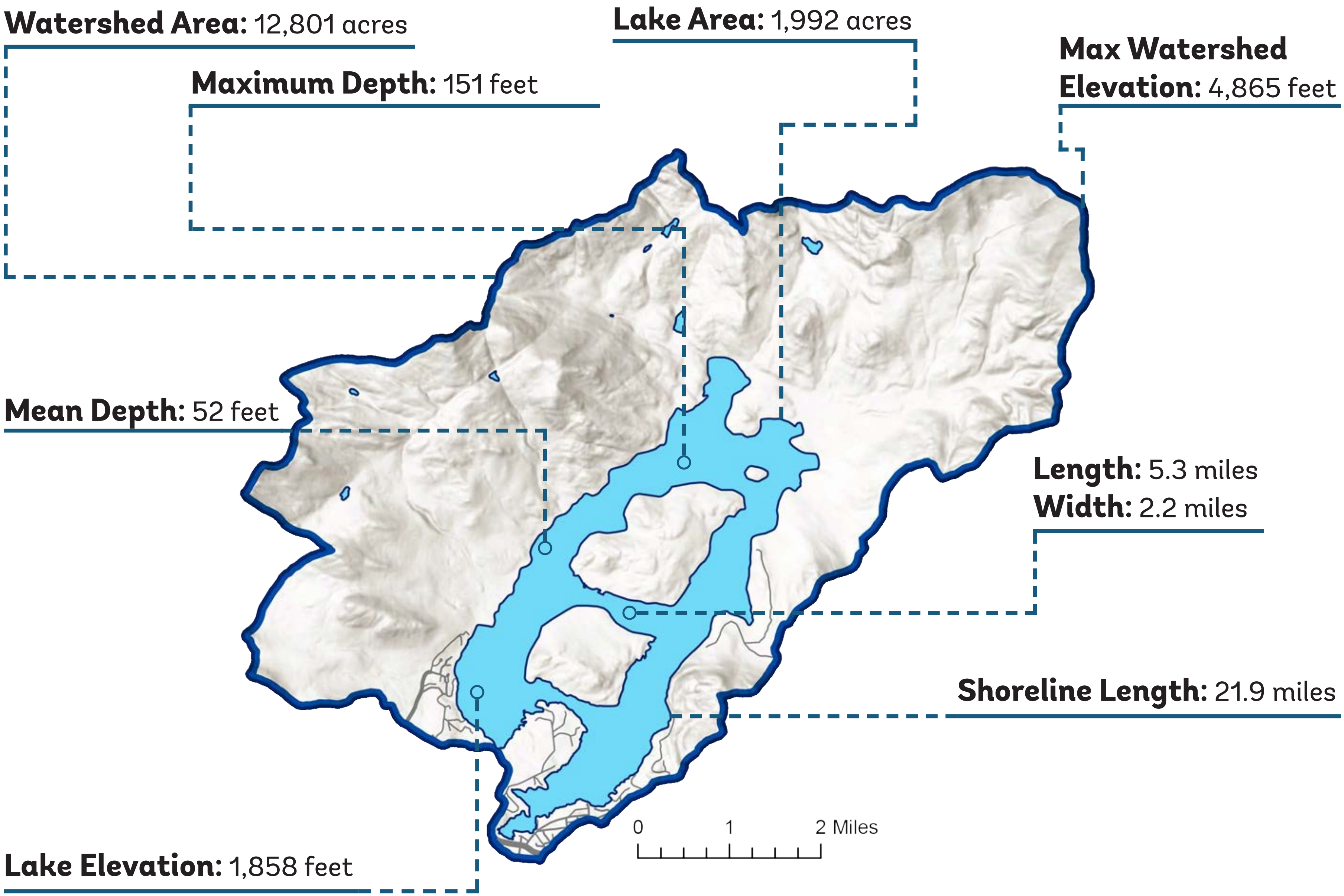
Effective lake management relies on engagement from all stakeholders, ranging from residents and policymakers to state and federal agencies. State and national policymakers and regulators can influence broad-scale drivers of lake health such as acid rain, climate change, and industrial pollution. In many cases, however, the day-to-day protection and management of a lake falls to local government and residents. Invasive species, fisheries management, recreational use, septic systems, shoreline protection, and development are all matters that need to be addressed and managed at a local level.

Lake Placid has a long history of effective stewardship by the Shore Owners' Association of Lake Placid (SOA), Lake Placid Land Conservancy, Village of Lake Placid, Town of North Elba, Adirondack Park Agency (APA), and NYS Department of Environmental Conservation (NYS DEC). The SOA has led these stewardship efforts on Lake Placid for over 125 years. The all volunteer nonprofit organization was founded out of concerns related to water level management. The SOA's first act was to purchase the dam at the lake's outlet to better manage this critical issue. The SOA has led efforts to assess the lake's water quality by commissioning several studies and participates in the Citizen Statewide Lake Assessment Program (CSLAP). They have also been instrumental in managing variable-leaf milfoil in Paradox Bay and preventing further aquatic invasive species introductions to the lake.

In recent years, new challenges and concerns have arisen for Lake Placid. The first aquatic invasive species was detected in 2009, the first harmful algal bloom was documented in 2015, and there are increasing concerns related to effects from increased recreational use of the lake and the long-term quality of the water for drinking. Recognition of these challenges by SOA members spurred the idea of developing this lake management plan. The SOA brought together the Paul Smith's College Adirondack Watershed Institute (AWI) and Ausable River Association (AsRA) to develop the plan with input from the Village of Lake Placid, Town of North Elba, NYS DEC, APA, as well as residents and visitors.

The management plan establishes a framework for sound, data-driven decision-making based on the best available science. Many of the issues and challenges facing Lake Placid will require ongoing adaptive management and further intensive study to understand and adequately manage. The plan provides a baseline for those efforts and builds the contextual information needed to address these emerging challenges properly.

The ancient history of Lake Placid is sparse. Although indigenous peoples were present in the Adirondacks for thousands of years, there is little evidence of permanent settlements.



Map 1. The physical characteristics of a lake and its watershed heavily influence water quality and the ecological communities that rely on it. Lake Placid is a large drainage lake located in the Adirondack uplands. It has a relatively small watershed area to lake surface area ratio. The lake has a maximum depth of 151 feet and a complex bathymetry with four distinct basins. The lake drains over a dam at the southern shore of the western side of the lake. Lake Placid is part of the Ausable River watershed.

One exception is the evidence that the Abenaki and Mohawk tribes used the lake and shores as fishing and hunting grounds, with the discovery of a dug out canoe found at the southern end of the lake in 1960. The entire Adirondack region are the anncestrial grounds of indigineous people with evidence of their occupation of the region going back thousands of years[1].

By the early 1800s, the waters of Lake Placid became very important to relatively recent inhabitants. The lake's waters flow into the Outlet Brook and the Chubb River and eventually into the West Branch Ausable River. Downstream some thirty miles, iron ore was discovered near Clintonville in 1805. Water power was necessary for converting the ore into usable iron products, and the works for doing that were vast for their time. In 1845, the owners of the factories purchased Lot #256 from the State of New York – the lot that includes the natural outlet of Lake Placid. The dam and property were kept in commercial use for about 50 years through many ownerships related to the ironworks.

The original dam at the outlet was probably built around 1846, and its purpose was to hold back the water supply until it was needed downstream to transport logs or provide power when released. By the 1870s, some small homes, hotels, and resorts appeared around the lake. By the 1890s, the ironworks use of the outlet dam lowered the lake level by as much as 6 feet. This, of course, left lakeshore residences docks and boathouses high and dry.

In 1892-93 the Shore Owners' Association of Lake Placid was organized. They purchased the 4-acre dam site, Lot #256 from the Peru Steel Ore Co. and built a new, permanent dam, keeping the lake level consistent. The SOA continues to own and manage the dam. If you tour the lake shore, you will see tree stumps, roots, and whole trees preserved underwater, attesting to the lower water levels of earlier days.

Of interest is the history of the southernmost bay on the lake, known as Paradox Bay. More than 200 years ago, there were references to two ponds, one Paradox, the other Placid. A water flow could be seen exchanging and reversing at short and regular intervals between them. At some point, the channel between the two ponds was deepened and changed the relationship of the once separate but linked ponds. Paradox Pond became a bay of Lake Placid.

The SOA has been, since its founding in 1894, charged with preserving the quality of the shores, the water, safety, and life on the lake. It continues to do so.

Lake Placid is known for it's crystal clear water and exceptional water quality.

Lake Management Plan Goals

The lake management plan is organized under five main goals for the management and protection of Lake Placid. These goals were derived through feedback from stakeholders and analysis of data available for Lake Placid.

1 Maintain excellent water quality and establish monitoring efforts capable of early detection of change.

2 Effectively manage the current infestation of variable-leaf milfoil in Paradox Bay and prevent further introduction of aquatic invasive species to Lake Placid.

3 Manage recreational use of Lake Placid to preserve the lake's ecological, social, and economic values.

4 Limit the impact of development on the lake through increased adoption of lake-friendly practices.

5 Coordinate lake management activities among stakeholders and base decisions on the best available data and most recent science.

Watershed & Landscape Characteristics

Lakes aren't isolated from the landscape, they exist within a watershed, which is the area of land that drains to the lake. Lakes and the lands around them are interconnected. The health of a lake depends on the health of its watershed. Watershed disturbances can lead to water quality problems in the lakes, ponds, and rivers downstream[2]. It is necessary to understand watershed and landscape characteristics to put the current state of a lake in the proper context. Additionally, these characteristics can help guide management decisions and establish realistic expectations for water quality and lake condition.

Watershed characteristics & Hydrology

The Lake Placid watershed is 20 square miles (12,801 acres) and is situated within the Chubb River subwatershed which, in turn, drains to the West Branch Ausable River (Maps 1 & 2). The Ausable River drains to Lake Champlain, which has an 8,234 square mile watershed. Lake Champlain drains through the Richelieu River to the St. Lawrence River, eventually entering the Atlantic Ocean at the Gulf of St. Lawrence. This network of waters and watersheds means that the management and protection of Lake Placid are connected to all of the waters downstream, all the way to the Atlantic Ocean.

The lake and its watershed lie entirely within Essex County, NY. Most of the lake surface and watershed lie within the Town of North Elba. The northwestern portion of the watershed, along with a small area of the lake, including Echo Bay, Loch Bonnie, and the summit of Moose Mountain, fall within the Town of St. Armand. The watershed's headwaters, descending from Whiteface Mountain, lie within the Town of Wilmington. Finally, the far southern shore along portions of Paradox Bay and to the east lie within the Village of Lake Placid (Map 2).

Effective lake management and stewardship require coordination among stakeholders, including local, state, and federal governments. The Village of Lake Placid and the Town of North Elba have jurisdiction over the immediate access points and much of the water body and shoreline making them key local government stakeholders. The New York State Department of Environmental Conservation is also an important stakeholder because it oversees the management of state lands, fisheries, and recreational infrastructure on the lake. The Adirondack Park Agency is a critical managing entity because of its permitting authority for private and public lands. The Town of St. Armand plays an essential role in protecting the shoreline in the vicinity of Echo Bay. Lastly, while a portion of the watershed's headwaters falls in the Town of Wilmington, these lands are under state ownership.

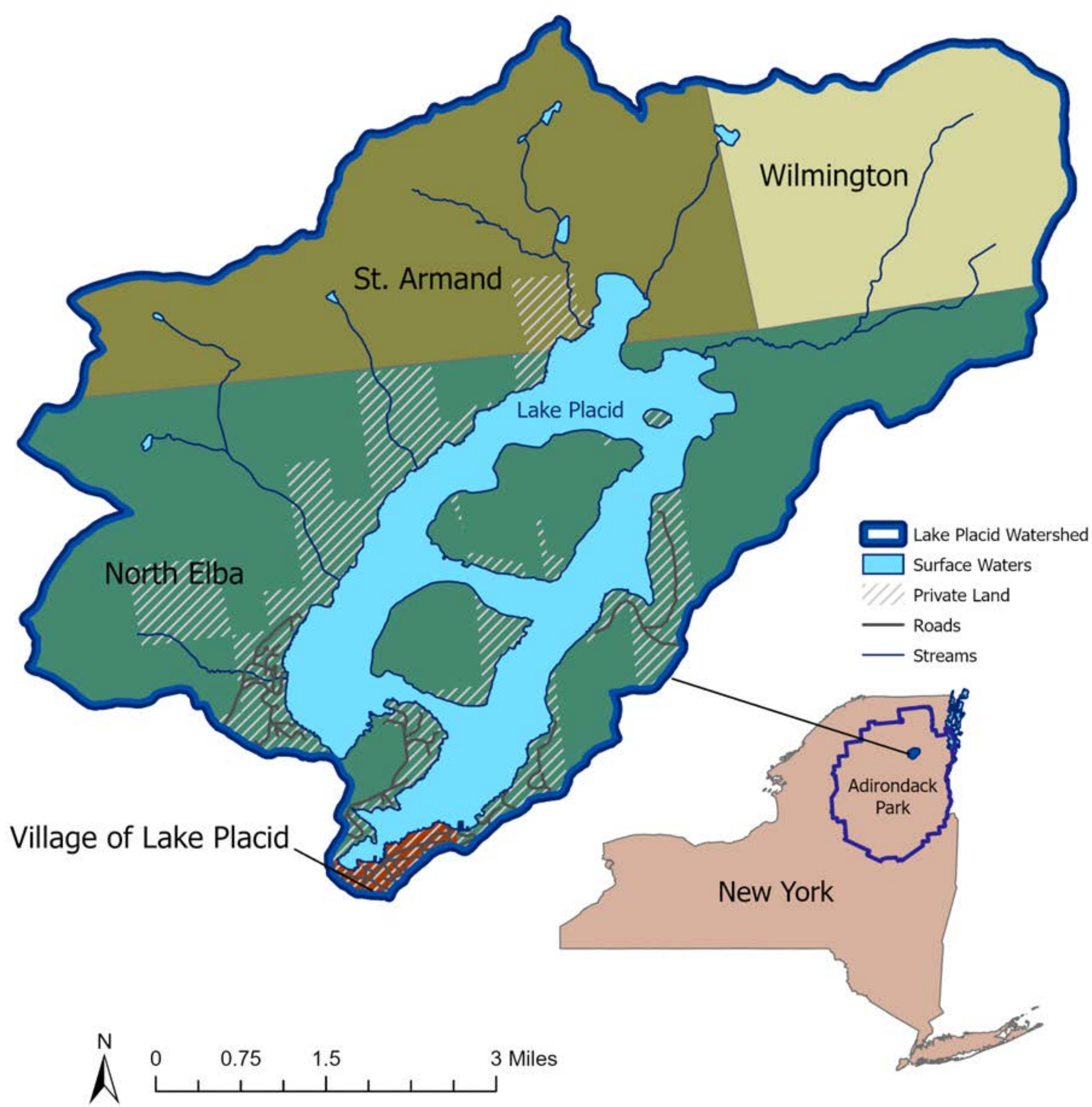
Lake Placid sits in the headwaters of its parent watershed, the West Branch Ausable River. The highest point along the watershed divide is Whiteface Mountain to the north, sitting at 4,865 feet. The watershed divide also touches the summits of McKenzie Mountain, Moose Mountain, Mount Whitney, and several other smaller mountains. The surface of Lake Placid is at an elevation of 1,858 feet. The distance from the summit of Whiteface to the shore of Lake Placid is 2.75 miles, over which the terrain drops just over 2,000 vertical feet. Steep mountainous terrain is characteristic of the Lake Placid watershed, with high mountains descending steeply to the lake below (Map 1).

The steep mountainsides extending down to the shores of Lake Placid make for beautiful scenery but present challenges for development. Steep terrain is more prone to surface runoff and erosion, whether from disturbance associated with construction, impervious surfaces, lawns, or even forested areas during significant storm events. The topography of the Lake Placid watershed requires additional care and stewardship when planning development.

The watershed's steep terrain continues beneath the lake's surface, and steep slopes and deep basins dominate the bathymetry of Lake Placid. The lake reaches its maximum depth of 151 feet just north of Moose Island, while the mean depth of the lake is 52 feet. The dam at the lake's outlet was originally constructed in 1846 and raised the water level by approximately six feet (Map 3).

The great depths of Lake Placid allow the lake to thermally stratify in the

Lake Placid Watershed, Municipalities, and Roads



Map 2. The county and village boundaries found in the Lake Placid watershed, along with the area of private land, and road network. Much of Lake Placid falls in the Town of North Elba. Roads are concentrated around the southern shores of the lake. The shoreline is a mixture of public and private land with the upland areas most public lands that belong to the New York State Forest Preserve.

summertime. A process whereby less dense, warm surface waters "float" on top of more dense cold bottom water[2]. On August 22, 1886, Henry David Thoreau observed this phenomenon in Walden Pond and wrote, "What various temperatures, then, the fishes of this pond can enjoy! They require no other refrigeration than their deeps afford. They can in a few minutes sink to winter or rise to summer. How much this varied temperature must have to do with the distribution of the fishes in it. The few trout must oftenest go down below in summer." The same is true for Lake Placid and is why the lake can support lake trout and other cold-water fish species.

The lake's largest shallow, near shore littoral areas are Paradox Bay and Brewster Bay, areas that were inundated with the outlet dam's construction. The east side of Whiteface Bay, the east side of Echo Bay, the back of McLenathan Bay, the small bay off the northwest side of Brewster Peninsula, and the small bay just to the south of Falls Brook along the western shore of West Lake, also contain shallow littoral habitat with organic-rich sediments. These areas are excellent habitats for aquatic plants, whereas much of the littoral area of Lake Placid is small and dominated by boulders, gravel, and sandy substrate. Organic matter in these areas doesn't readily accumulate, providing less favorable conditions for native or invasive aquatic plant growth (Map 3).

Looking north from the north end of West Lake towards Whiteface Mountain.

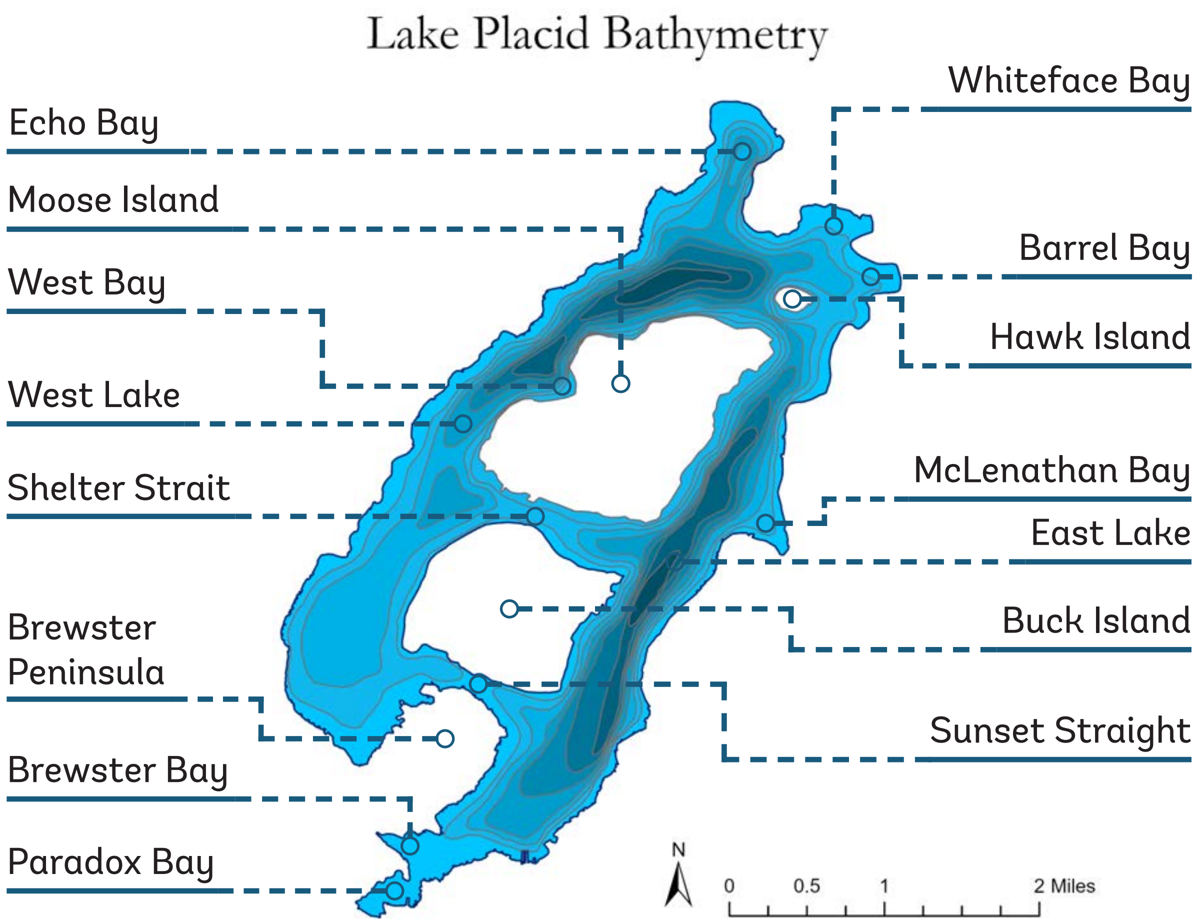
The total shoreline distance, including the three islands, is 21.9 miles. Of this, 8.7 miles, or 40%, is part of the New York State Forest Preserve; the remaining 13.2 miles are privately owned. The watershed is mostly in public ownership, with most of the land classified as Wilderness, but there are also areas of Wild Forest, notably large portions of both Buck and Moose Islands. Wilderness Areas offer the highest level of protection, restricting motorized use and limiting recreational infrastructure development. Wild Forest on the other hand allows for limited motorized use and the development of a greater diversity of recreational infrastructure. Private land is mainly classified as moderate intensity along the shorelines, except for rural use on the islands and northeastern shore. Other portions of the watershed are classified as resource management, low intensity, and hamlet.

The amount of public land within the

watershed, including a substantial portion of the shoreline, provides a degree of protection to Lake Placid. Boat-only access to large swaths of the private lands, particularly along the western shore and islands, means camps located in these areas, along with the northeastern shore, are on residential septic systems. If not properly maintained, these systems have the potential to contribute nutrients and other contaminants to the lake. Private lands and development along the shoreline have the potential for other disturbances to the lake, such as the removal of necessary lakeshore buffers. These transition zones from aquatic to terrestrial habitats are essential for biodiversity, stabilizing shorelines, absorbing nutrients, providing shade, and contributing large woody debris, all essential to lake health.

Geology and Soils

The bedrock geology of the Lake Placid watershed is made up of anorthosite and metanorthosite, with metasedimentary, granitic gneiss, and olivine metagabbro in the Mount Whitney area[3]. The surficial geology is made up of till, till moraine, kame deposits, and bedrock. The kame deposit at the south end of the lake, at the outlet, is responsible for the formation



Map 3. Bathymetric map of Lake Placid, contour intervals are 20 feet. The map is adapted from the NYS Department of Environmental Conservation.

of Lake Placid. This deposit was made at the end of the last ice age (~12,000 years ago) as the continental Laurentide ice sheet retreated, and a remnant glacier was left on the south face of Whiteface. The kame was deposited as the last remnants of the glacier melted. Due to the nature of its formation, Lake Placid is considered a glacial drainage lake[3].

The soils along the shore and lower elevations of the watershed are from the Becket series, which have a slow infiltration rate when thoroughly wet. Overall, these soils have a moderate rate of water transmission. The higher elevations are dominated by soils from

the Rawsonville series, which have similar characteristics in terms of water transmission. The soils are from the Hermon series at the lake's outlet, along with Brewster Peninsula and the southeastern shore. These soils have a high infiltration rate and high rate of water transmission (Map 4).

Bedrock geology and soils play an essential role in the chemistry and biology of lakes. The parent materials and soils of the Adirondacks, including Lake Placid, tend to be nutrient-poor and have low buffering capacity[4]. As a result, most Adirondack lakes have low primary production, and many are sensitive to acid rain. In addition, soils are important to consider when developing land. High infiltration soils are good at limiting surface runoff during rainfall events, but the increased hydrologic connectivity can cause concern when siting septic systems close to surface waters. Conversely, low infiltration soils increase runoff and reduce the efficiency of leach fields.

Large portions of the western shoreline, much of Buck Island, the southern shore of Moose Island, and the northern portion of the eastern shore have soils with slow infiltration rates. These are areas where camps are on septic systems. The presence of many septic systems on soils with slow infiltration rates decreases the likelihood of nutrients and other pollutants making it to the nearby surface waters of Lake Placid.

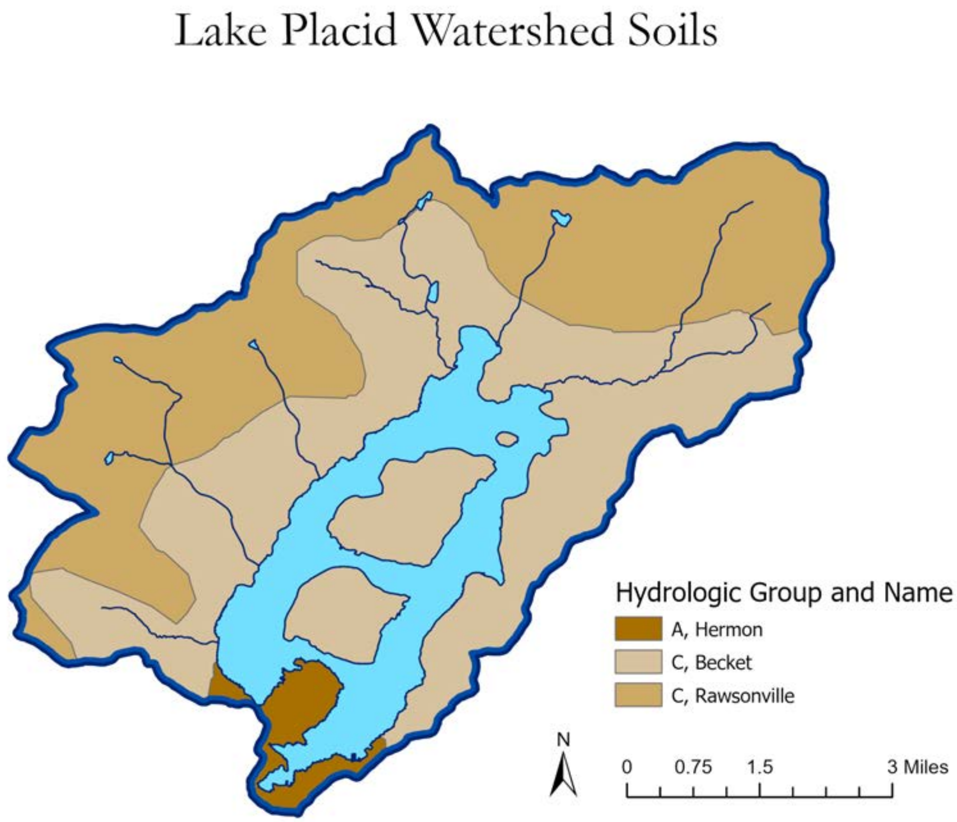
The majority of the watershed (81%) is forested with deciduous forests found at lower elevations near the lakeshore and on the islands, mixed forests in the intermediate elevations, and coniferous forests at high elevations. Development is mainly along the southern portion of the watershed and the western shore, accounting for 1.5% of the total watershed area. Only a tiny part of the heavily developed area of the Village of Lake Placid is within the Lake Placid watershed. However, it is important to note that the development is concentrated along the lakeshore.

With limited watershed development, there is also a limited road network. There are 11.8 miles of public and private roads within the watershed, concentrated along the southern shore of the lake and a portion of the eastern shore. Of this distance, 0.5 miles (4%) is state road, 0.4 miles (4%) is county road, and the remaining 10.9 miles (92%) is a mix of local and private roads.

The low density of roads and development in the watershed means the lake is unlikely to be threatened by road salt, a contaminant of emerging concern in the Adirondack region and Lake Champlain Basin[5]. The lack of concern related to road salt is in stark contrast to Mirror Lake, just a few hundred feet from Lake Placid. Mirror Lake has 26% of its watershed developed and a high density of roads and impervious surface directly adjacent to the lake. As a result, Mirror Lake is one of the most impacted lakes from road salt in the Adirondacks[6].

Wetlands & Significant Natural Communities

There are 220 acres of wetland within the Lake Placid watershed, covering 1.7% of the total watershed area. The most common wetland type is forested needle-leaved evergreen, followed by emergent persistent. The largest wetland areas are associated with Hall Brook along the northeastern shore; almost the entire length of the brook is a forested needle-leaved evergreen wetland. Whiteface Brook and Whiteface Bay are dominated by forested needle-leaved evergreen and emergent persistent wetlands. There are also wetlands associated with Paradox Bay, Brewster Bay, and McLenathan Bay. Wetlands of various cover types are also scattered throughout the uplands; most are associated with ponded waters (Map 5).

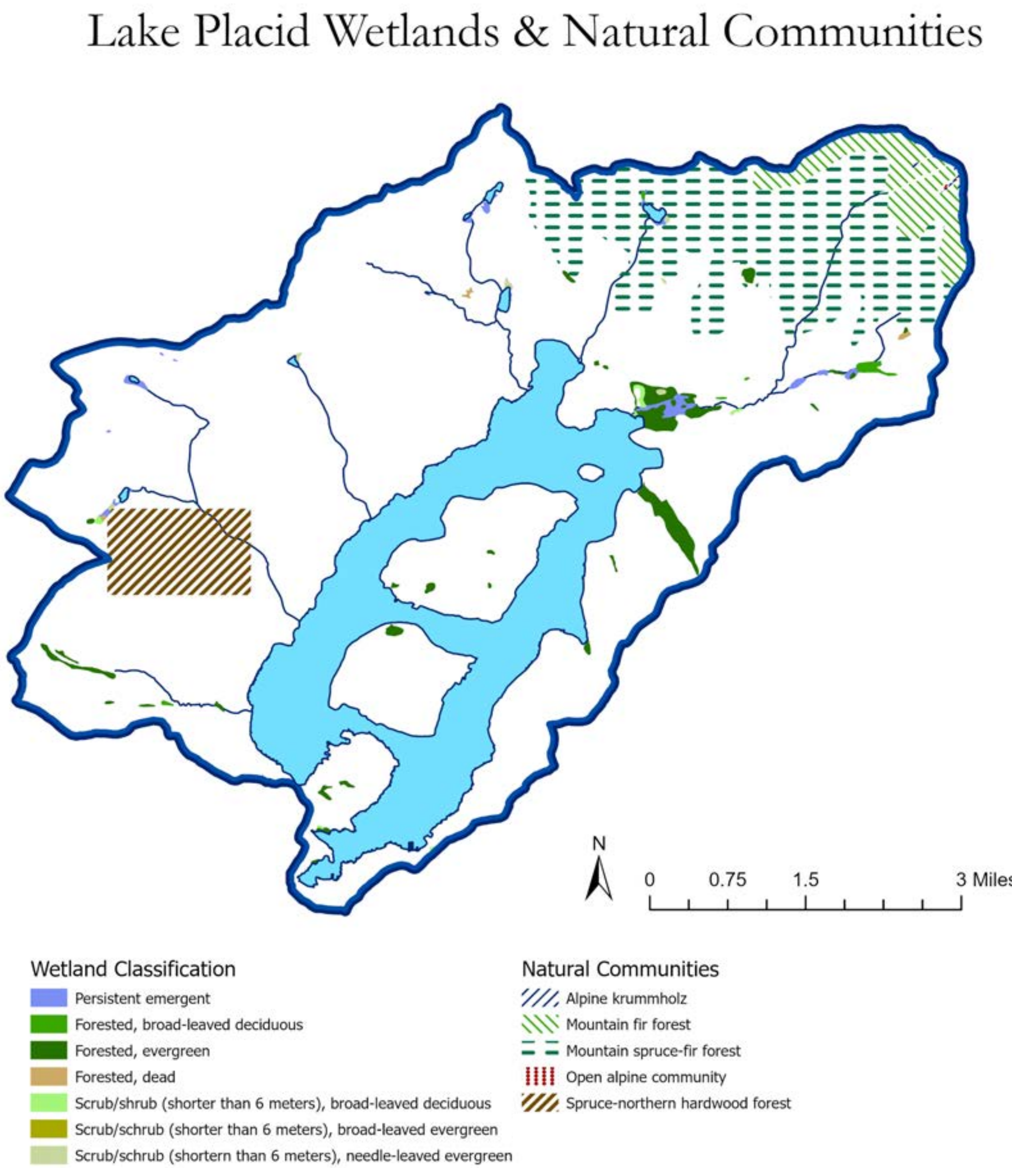


Map 4. Soil types found in the Lake Placid watershed. Group A soils have low runoff potential and high infiltration rates, as well as high rates of water transmission. Group C soils have higher runoff potential and low infiltration rates, especially when thoroughly wet. Group C soils have lower rates of water transmission. Data sources: US Dept of Agriculture, NYS Department of Transportation, ESRI, NASA, NGA, USGS.

Whiteface Mountain is at the headwaters of the Lake Placid watershed and offers magnificent views of the lake below.

Within the watershed, there are also areas of significant natural community occurrences. There is a spruce-northern hardwood forest located on the slopes of McKenzie Mountain that contains old-growth trees with a median age from 135 to 187 years. The oldest tree found in this stand was 368 years old. The upper slopes of Whiteface Mountain are mountain spruce-fir forests with some portions of high quality. This forest type supports the Bicknell's thrush (*Catharus bicknelli*), a species of special concern in New York State (Map 5).

Lake Placid contains a diverse fish assemblage ranging from warm-water fish such as pumpkinseed (*Lepomis gibbosus*) to cool-water species such as smallmouth bass (*Micropterus dolomieu*), rock bass (*Ambloplites rupestris*), yellow perch (*Perca flavescens*), brown bullhead (*Ameiurus nebulosus*), and finally to lake trout, an iconic cold-water fish. The lake also has rainbow trout (*Oncorhynchus mykiss*) and brown trout (*Salmo trutta*), non-native species but highly valued by anglers. NYS DEC reports that brook trout (*Salvelinus fontinalis*) trout are also present in the lake, as well as some of the lake's tributaries.



Map 5. The location and type of wetlands and significant natural communities in the Lake Placid watershed. The rectangular shape of the spruce-northern hardwood forest reflects an imprecise mapping of this particular natural community. Data sources: APA, NY Natural Heritage Program, USGS.

Stakeholder Survey

During the summer of 2020, a survey was distributed to lakeshore residents and visitors to assess how stakeholders view this resource, interact with it, and what they perceive the threats to the lake are. One hundred and twenty-nine unique responses to the survey were received. Of the responses, 58% (75) were from lakeshore owners, and 42% (54) were from individuals who do not own lakeshore property. When asked how far they travel to reach Lake Placid, the most frequent response was 250+ miles (46%, n = 47). Though when broken out based on whether the respondent owns property on Lake Placid, that pattern is the opposite, with the most frequent travel distance for non-property-owning individuals being 0-9 miles (46%, n = 25). There are notable differences in the time spent on the lake between lakeshore property owners and non-property owners. Non-property owners had a median duration of time spent on the lake of 1-3 weeks, while property owners had a median duration of 15-30 weeks. These differences reflect general patterns and trends seen on lakesho property throughout the Adirondack region. Many lakeshore owners reside outside the area and spend some or all of their summers in the Adirondacks. This separation can have important implications in terms of lakeshore property owners being integrated into local policy and decision-making. Conversely, some full-time residents may perceive lakeshore property owners as not a part of the local community.

The majority of stakeholders indicated they utilized Lake Placid for water-based recreational activities, canoeing/kayaking, swimming, and motor boating, in that order. Hiking, water skiing, photography, and fishing also ranked high as activities people partake in but at rates noticeably lower than the top three. When asked about the relative importance of various protection measures for Lake Placid, an overwhelming majority of respondents indicated that all the efforts were "very important." Overall, protecting water quality was rated the highest importance, and improving boater safety was rated the lowest (Figure 1). When asked to indicate the top five areas of concern related to Lake Placid, removing and controlling invasive species received the highest number of responses (67%), followed by water quality (52%), and septic systems (46%). Concerns related to the number of boats or boater behavior ranked lower overall,

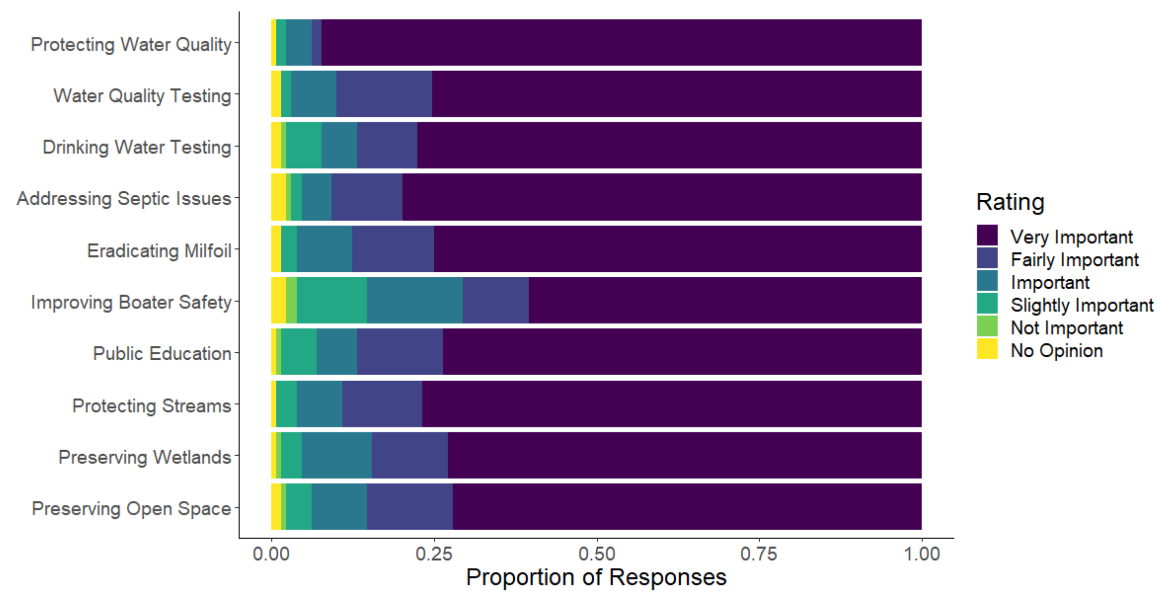


Figure 1. Summary of stakeholder responses to the question "Rate the following in terms of their importance to protecting Lake Placid."

but four of the top ten concerns were associated with the recreational use of the lake (Figure 2; unsafe boating, crowding, boat waves, and boater education). These results generally match the responses related to protection measures. Most stakeholders are concerned about water quality and invasive species and feel the efforts to address these concerns are essential. Boating related concerns ranked lower, as did the importance of addressing these concerns. Nevertheless, most respondents felt that improving boater safety was "very important," which is reflected in boater-related concerns as well.

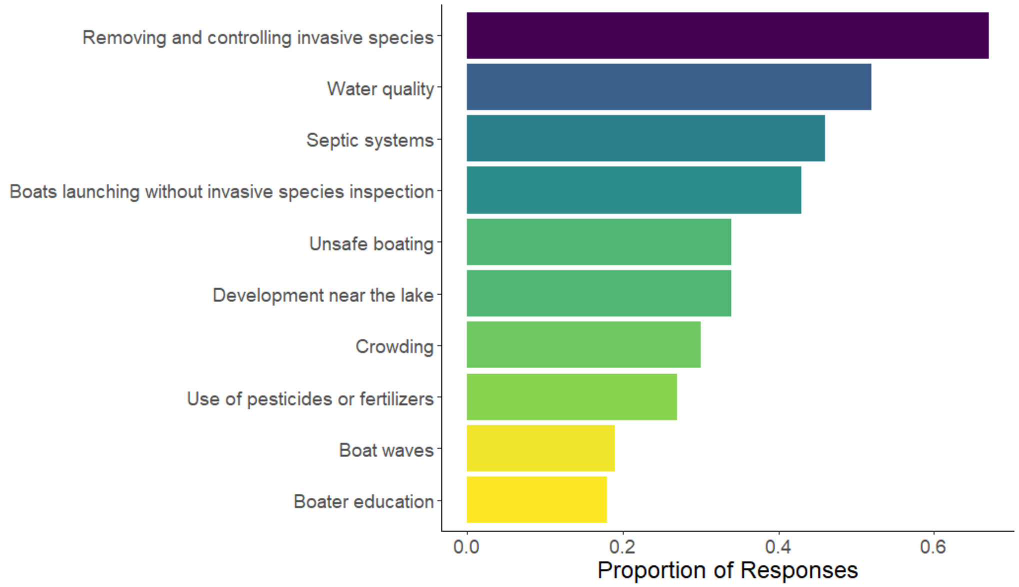


Figure 2. Top ten concerns that were selected in response to the question "Please check the top five areas of concern."

When asked whether the water quality, recreational quality, aesthetic quality, and fishing had declined over the past ten years, there were differences in the perceived trends. There were no clear trends in perceptions of declines in water quality, aesthetic quality, recreational quality, or fishing quality. Slightly more people agreed that water quality, recreation, and fishing were declining, than disagreed. Still, an even larger portion had no opinion or thought they weren't changing. Fishing, in particular, had a large number of people that held no opinion. A larger percentage of respondents disagreed that aesthetic quality was declining than agreed. Despite the unclear indication of whether stakeholders feel the lake is declining, an overwhelming majority, across the board, feel there is greater action needed to address invasive species, faulty septic systems, and educate the public. Finally, there was strong agreement that a lake management plan is needed for Lake Placid (Figure 3).

The stakeholder survey is indicative of a group that has a good understanding of the threats and challenges facing Lake Placid. The water quality of Lake Placid remains excellent, aquatic invasive species are a concern but are being managed well, recreational use appears to be increasing, and there are valid concerns related to septic systems. There seems to be strong support for, and a desire to see further action to address the challenges Lake Placid is facing. Specifically, to maintain the lake's high ecological, economic, and aesthetic values.

In terms of stakeholder perceptions of how well the primary management authorities are protecting Lake Placid, there were mixed, with generally neutral perceptions. The majority of respondents were satisfied with the SOA. However, it should be noted that there is a notable divide between shore owners and non-shore owners. Non-shore owners mostly had no

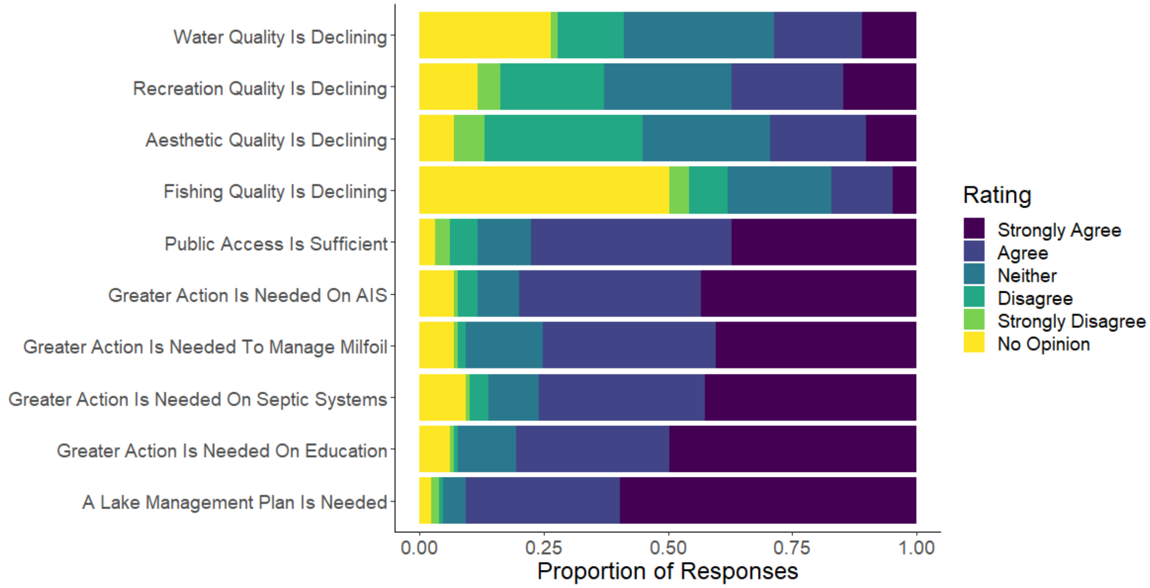
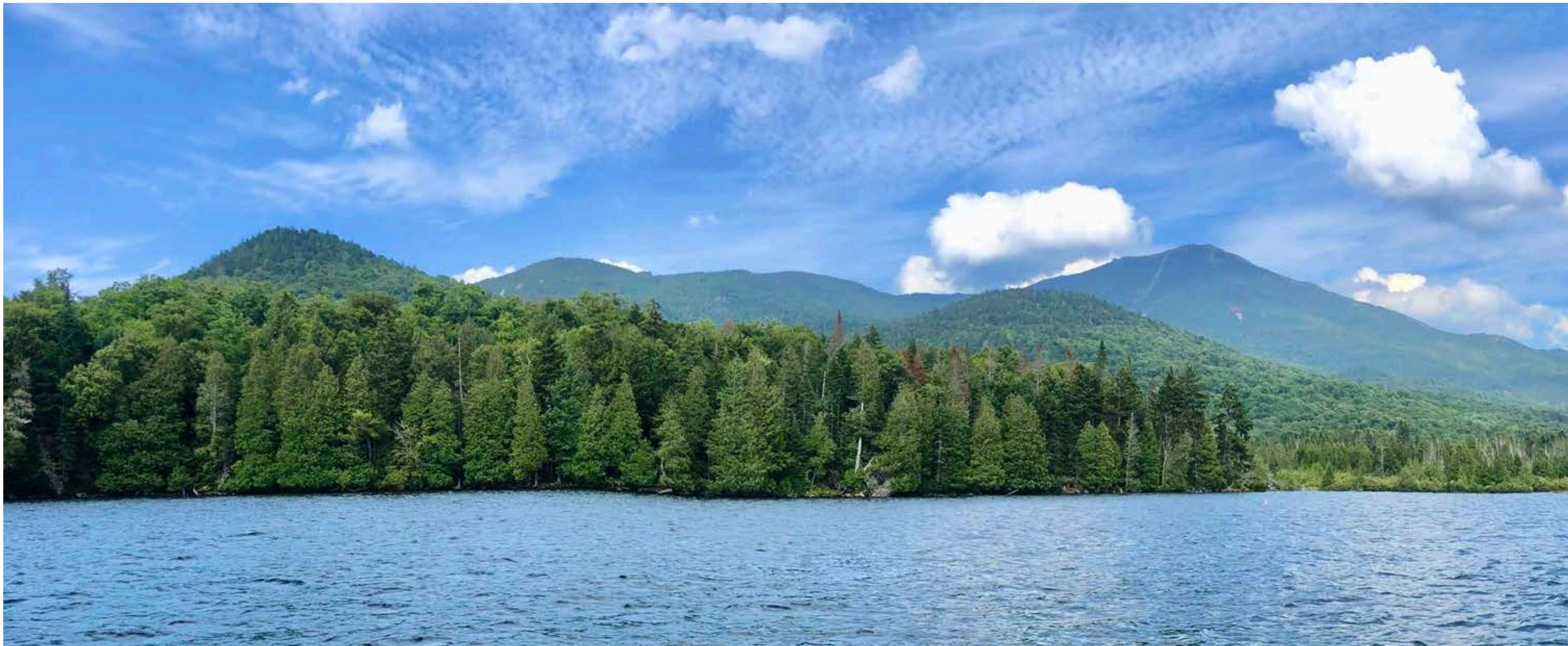


Figure 3. Stakeholder responses to the question "Indicate whether you degree or disagree with the following statements."

opinion or more neutral perceptions. For the other stakeholders, the most frequent response, excluding those with no opinion, was either "neither" or "somewhat satisfied." While there may be room for improvement in the effectiveness of management authorities, overall, the stakeholders did not indicate a strong dissatisfaction with any of them (Figure 4).



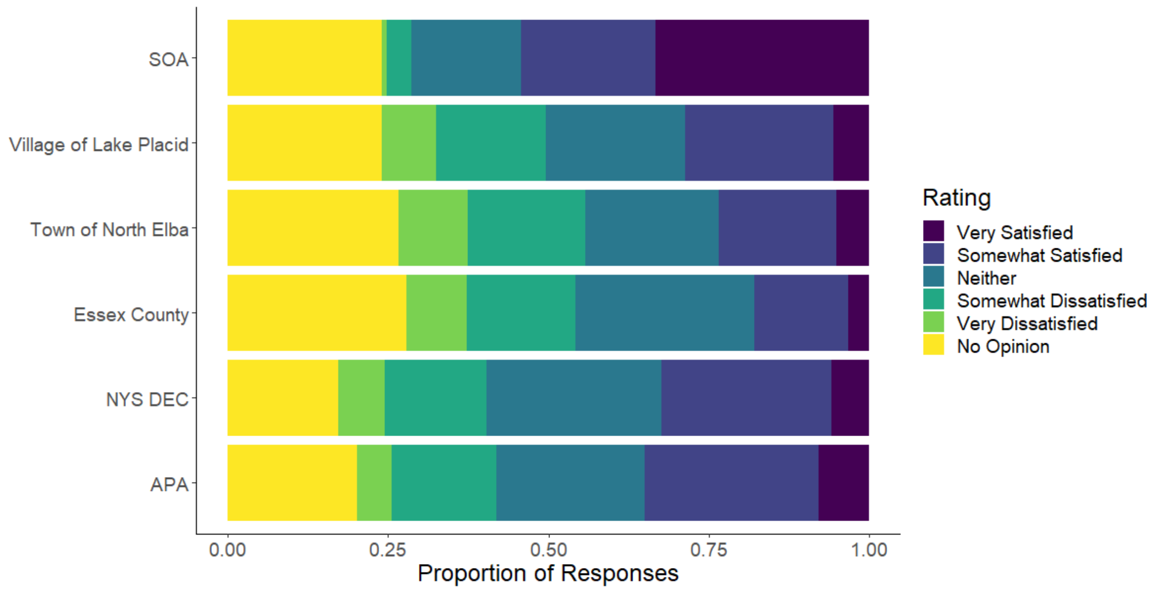


Figure 4. Stakeholder responses to the question "Please rank your satisfaction with how well the principal stakeholders are protecting Lake Placid."

Goal 1: Maintain excellent water quality and establish monitoring efforts capable of early detection of change

The water quality in Lake Placid has been of interest to residents for many decades. Ray Oglesby conducted the earliest known comprehensive assessment in 1971 at the behest of the SOA. Oglesby reported, "Lake Placid exhibited a high level of water quality in terms of transparency, oxygen levels, and low concentrations of phytoplankton and rooted vegetation." He went on to say, "Due to the patterns of land use in the Lake Placid basin, little in the way of man-induced influences would be expected nor were they observed." Although, he did note in the conclusions of his first report that "rigorous inspection and maintenance of waste disposal systems" are essential to maintaining the lake's water quality[7].

Oglesby conducted a second study of Lake Placid three years later and came to essentially the same conclusions, except greater emphasis was made on reducing phosphorus inputs to the lake and controlling erosion from land clearing and construction activities[8]. An additional report from 1981 was produced, but a copy of which has not been obtained. In the early 1980s, Paul Gutmann from the Village of Lake Placid made observations of the pH and conductivity of Lake Placid.

In 1991 Lake Placid was enrolled in the Citizen Statewide Lake Assessment Program (CSLAP); this program is managed by the New York State Federation of Lake Associations in partnership with the NYS DEC. The lake has been enrolled in that program continually ever since. Finally, the Upstate Freshwater Institute surveyed Lake Placid in 2001, which followed the design of the original Oglesby surveys but with more advanced technology[9].

AWI conducted further lake studies as part of the management plan development. A resurvey of the lake following the methodology of Oglesby was made in August 2020, as well as monthly sampling over the deep hole from May through October in both 2020 and 2021. The monthly sampling consisted of surface and bottom water collection and 1-meter vertical profiles of temperature, dissolved oxygen, conductivity, pH, turbidity, chlorophyll, and phycocyanin reflectance. Water samples were processed for pH, conductivity, alkalinity, total phosphorus, nitrate, ammonium, total nitrogen, chlorophyll-a, dissolved organic carbon, chloride, sodium, and calcium at the AWI Environmental Research Lab following standard methods.

In addition to the lake's open water studies, the SOA, working in cooperation with the Village of Lake Placid, has been testing drinking water quality at camps that draw water from the lake since 1982.

AWI Research Associate, Lija Treibergs, sampling Lake Placid in October, 2020.

Transparency

Water column transparency is one of the most basic water quality measurements made. Transparency is measured using a Secchi disk lowered through the water column. This small black-and-white disk has been used to measure transparency since it was invented in 1865 by the Jesuit priest Pietro Angelo Secchi. Generally, Secchi depth is controlled by algal productivity and thus will be reduced in highly productive or eutrophic lakes. Dissolved organic carbon, total suspended solids, colloidal minerals, and color can also influence transparency[2].

Lake Placid has experienced a long-term decline in transparency over the period of record. Secchi transparency has declined, on average, by 3 meters over the past 50 years (Figure 5). Chlorophyll-a is an indirect measure of the amount of phytoplankton, or algae, in the water column. Often, declines in transparency are driven by an increase in phytoplankton, driven by increases in nutrients entering a water body. There is a slight but non-significant increase in chlorophyll-a over this period (Figure 6). The significant decline in transparency and non-significant increase in chlorophyll-a suggests that other factors are driving the reduced transparency observed.

A more likely driver of the change in transparency is a shift in color related to recovery from acid rain. Acid rain reduces the solubility of organic matter in forest soils and therefore reduces its transport to lakes. As a result, during the period when acid rain was occurring in the region, lakes became clearer due to dissolved organic carbon being retained in their watersheds. As acid rain recovery has occurred, many lakes in the area have experienced a reduction in transparency[10].

Data on the color of Lake Placid water from 1991 to the present support the interpretation that the decline in transparency is driven by acid rain recovery instead of other watershed processes. There has been a significant increase in the color of the water over this period, consistent with an increase in dissolved organic carbon.

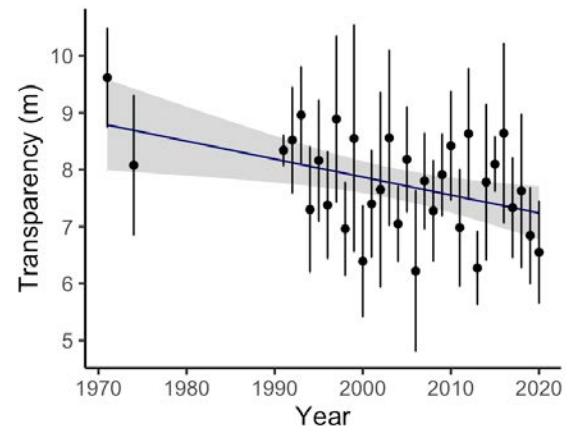


Figure 5. Annual mean (dots) and standard deviation (vertical lines) of Secchi transparency for Lake Placid. The blue fit line is a generalized additive model indicating a significant decline over the period of the record. The gray shading is the 95% confidence interval of the model.

AWI staff traveling out to the deep hole on Lake Placid in the fall of 2021.

Nutrients

Nutrients are essential to all life and healthy ecosystems. In the aquatic environment, the two primary nutrients of interest are phosphorus and nitrogen. Often, phosphorus is the limiting nutrient for primary production, meaning a lack of available phosphorus prevents phytoplankton populations from growing[11]. Therefore, any addition of phosphorus to a lake results in an increase in phytoplankton. In extreme cases, when additional nutrients are added to a water body, it can result in algae blooms, dramatic declines in transparency, and even fish kills.

Adirondack lakes tend to be low in nutrients due to the chemical makeup of the bedrock, soils, and forested landscape. Excess nutrients can come from various sources; agricultural runoff, lawn fertilizers, septic systems, erosion, and municipal wastewater treatment plants. The most likely source of excess nutrients to Lake Placid is lawn fertilizers and septic systems.

Not only is the quantity of nutrients important, but so are their relative proportions. The increased occurrence of harmful algal blooms (HABs) has renewed interest in lake nutrient cycling and possible relationships to HAB formation. The only HAB reported on Lake Placid occured in 2015 and was confirmed to contain toxins. Some studies suggest the ratio of total nitrogen to total phosphorus is an important driver of HAB formation. When this ratio becomes low, nutrient limitation switches from phosphorus to nitrogen, giving nitrogen-fixing cyanobacteria a competitive edge over other algal species[12,13,14]. TN:TP ratios are declining in Lake Placid and occasionally drop below the threshold at which nitrogen-fixing cyanobacteria may become dominant.

Lake Placid has not exhibited long-term trends in nutrients. There is a subtle but not significant decline in total phosphorus over the record (Figure 6). There are also sporadic years with higher than average nutrient concentrations. The chlorophyll-a concentrations in the lake have also shown no long-term trends. Overall, there is no evidence of significant nutrient pollution to the lake at a level that would affect the lake as a whole. Though Lake Placid is large, it is possible that localized issues could exist on the lake that are not detected in the long-term monitoring data.

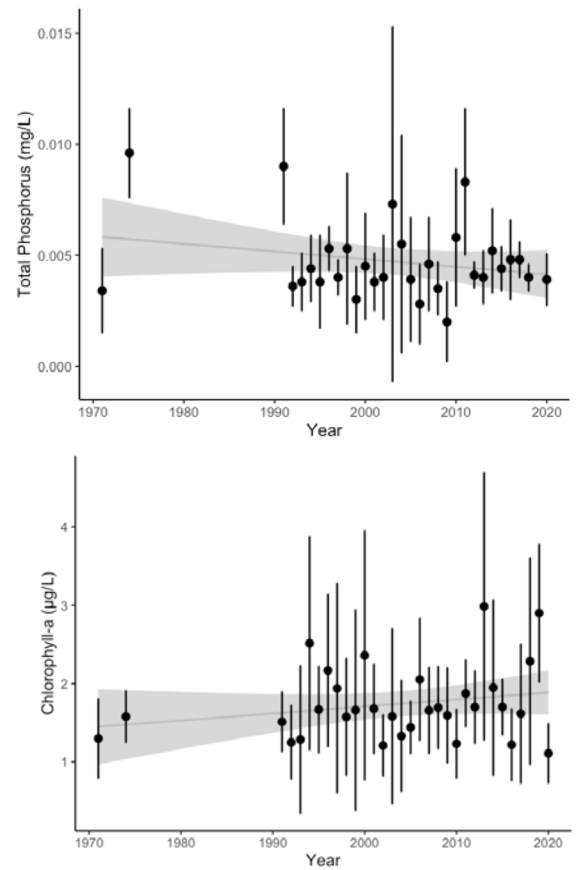


Figure 6. Annual mean (dots) and standard deviation (vertical lines) of total phosphorus and chlorophyll-a for Lake Placid. The light gray line is a generalized additive model indicating no significant change over the period of the record. The gray shading is the 95% confidence interval of the model.

Acidity

Acidity, or pH, is a measure of the hydrogen ion activity in solution; it is measured on an inverse logarithmic scale. High pH values represent lower hydrogen ion concentrations than low pH values, with a 10-fold difference between each unit. The scale ranges from 0 to 14, with 7 being neutral.

Acidity in Adirondack lakes has three primary sources: acid deposition or acid rain, organic acids from evergreen needles and other plant matter, and carbonic acid formed from respiration in soils. Shifts in pH can significantly affect biological and chemical processes in lakes. Many organisms have narrow pH ranges they can tolerate, and when pH strays outside of these ranges, it can result in declines in individual health and, eventually populations. Changes in pH also influence the mobility of ions and heavy metals, resulting in issues related to nutrient availability and toxicity[15,16].

Lake Placid experienced a slow but not statistically significant increase in pH from the early 1970s through the early 2000s. From 2001 to 2009, there was a significant increase in pH, followed by a significant decline from 2011 to the present. The rise in pH experienced over much of the record is consistent with regional recovery from acid rain. The cause of the recent decline in pH is unclear, warranting further investigation. The lake remains circumneutral (pH 6.5-7.5), meaning there is no cause for immediate concern, but if the current trend continues, the lake will be at risk of impairment due to low pH.

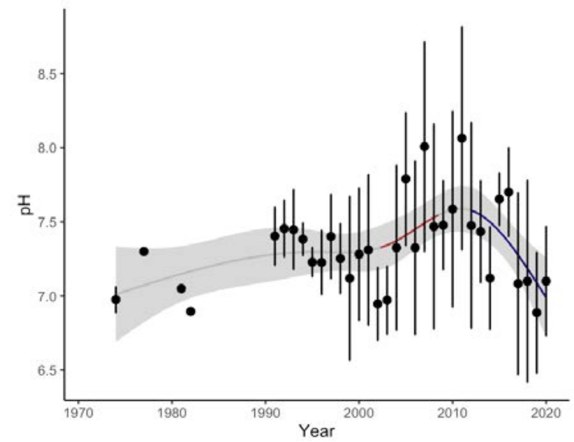


Figure 7. Annual mean (dots) and standard deviation (vertical lines) of pH for Lake Placid. The light gray line is a generalized additive model indicating no significant change over the period of the record, the red line indicates a period of significant increase, and the blue line indicates a period of significant decrease. The gray shading is the 95% confidence interval of the model.

The view of Lake Placid from the dam at the outlet. Whiteface Mountain can be seen in the distance.

Road Salt

Road salt, applied primarily as sodium chloride, is a significant regional pollutant in the Adirondack region. The widespread use of road salt in the area has resulted in regional surface water and groundwater salinization[5]. Nearby Mirror Lake has some of the highest concentrations of sodium and chloride out of all water bodies in the Adirondack Park due to the dense urban development surrounding its shores[6]. A growing body of work demonstrates that federal water quality guidelines are insufficient for protecting aquatic life and that chloride concentration should be below 40 mg/L to preserve ecosystem structure and function[17,18,19]. In the Adirondacks, lakes that are not impacted by paved roads have median sodium and chloride concentrations of 0.4 and 0.2 mg/L, respectively[5]. Mirror Lake's concentrations exceed 40 mg/L, over 160-times higher than unimpacted Adirondack lakes[6].

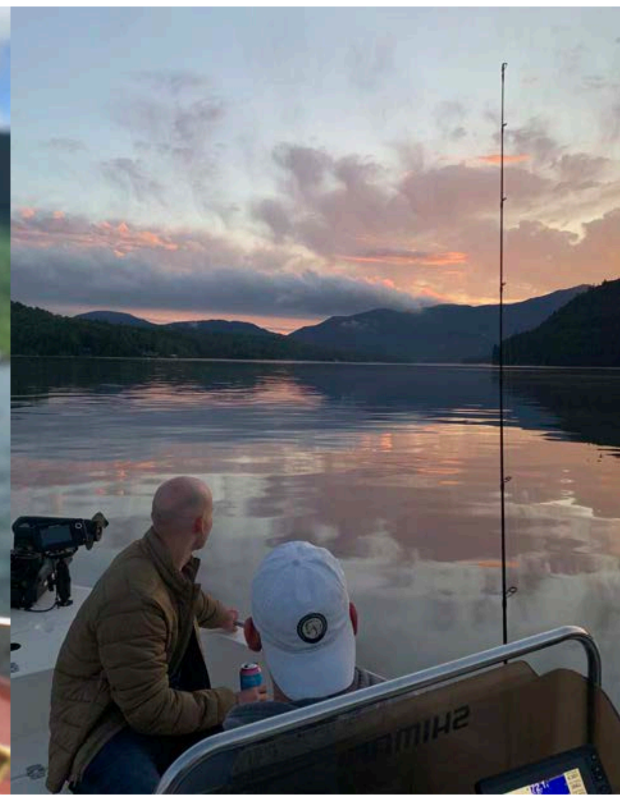
Lake Placid has low development densities and low total road mileage in its watershed. Much of the Village of Lake Placid drains either to Mirror Lake or the Chubb River. As a result, the influence of road salt on Lake Placid is minimal compared to Mirror Lake. The mean surface water chloride concentration for Lake Placid in 2020 was 0.92 mg/L. This concentration is within the range of natural variation for Adirondack lakes, and therefore road salt has no to minimal influence on the lake.

Lake Stratification

Lakes in the temperate part of the world that are deep enough to thermally stratify in the summer typically go through two periods of turnover, or mixing, each year, in the spring and fall. Thermal stratification of the water column occurs because of the combined effects of heat absorption and the unique density properties of water. Stratification is essential because it provides cool and cold-water fishes with suitable habitat during the warm summer months. It also has a variety of effects on the chemistry of a water body[2].

Many lakes across the northern hemisphere are experiencing changes in the timing and duration of stratification due to a warming climate. These changes include shorter periods of ice cover, which has occurred on Lake Placid. Combined, these changes threaten cold water fish species like lake trout and can exacerbate harmful algal blooms (HABs)[20,21,22].

Deep, cold, well-oxygenated, oligotrophic lakes like Lake Placid may serve as climate refugia for cold-water species in a warmer future[23]. Lake Placid exhibits near ideal oxythermal conditions for lake trout and other cool or cold-water species throughout the summer[24]. The cold bottom waters of the lake remain well oxygenated because there is limited primary production due to the low concentrations of nutrients. There is little long-term data for temperature and dissolved oxygen in the lake, making it impossible to assess whether these conditions are changing over time.



Drinking water

Lake Placid serves as the source of drinking water for the Village of Lake Placid and the Town of North Elba. According to county tax records, 135 camps along the lakeshore are not on a municipal water supply. Some of these camps may have drilled wells, but the boat access only camps along the lake's west shore, and on Buck, Moose, and Hawk islands primarily draw their water from the lake. Some of these camps use filters or UV to treat the water before drinking, and others do not use any treatment.

The village closely monitors the municipal water supply per New York State Department of Health guidelines. An annual drinking water report is issued to all water users. These reports indicate no impairments or cause for concern. The SOA works with the village to test raw and treated water from private camps around the lake. Data from this testing is available going back to 1982. Analyzing long-term trends is challenging due to differences in laboratory methodologies, incomplete records of whether the sample was filtered, and incomplete records regarding the type of test. There were concerns regarding increases in coliform bacteria in the lake in the late-1980s and early-1990s. An analysis of the available data indicates no long-term trends in total coliform, which is the most consistent and reliable test in the available data. However, there are individual years and samples with very high values (Figure 8). It is important to note that the presence of coliform bacteria in water does not necessarily indicate human fecal contamination, though it is used as an indicator of increased risk of contracting a harmful pathogen. The available data indicates that Lake Placid's water quality has always been high from a drinking water perspective.

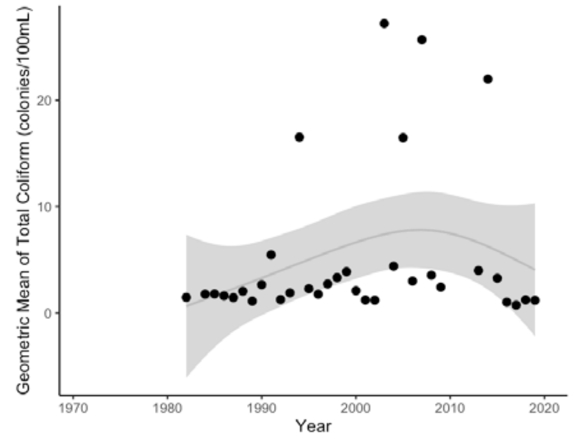


Figure 8. Geometric mean (dots) of total coliform results for raw water from Lake Placid. The light gray line is a generalized additive model indicating no significant change over the period of the record. The gray shading is the 95% confidence interval of the model.

The view of Lake Placid from the dam located at the outlet.

Fish & Wildlife

A full review of the biological diversity of Lake Placid has never been completed. Existing information tells us that the lake is home to primarily native species, some of which are critically important to conserve. The lake is home to diverse native plants, insects, and zooplankton. A general characterization of the aquatic plant community is completed every three years as part of the Adirondack Park Invasive Plant Program's Rapid Response Team surveys. Aquatic plants are concentrated in a few prominent bays where the bathymetry is suitable for accumulating organic-rich sediments. The phytoplankton and zooplankton communities have been characterized in the past by Oglesby and Upstate Freshwater Institute. In each case, the communities are typical of oligotrophic Adirondack lakes.


Common Loon enjoying the waters of Lake Placid.

The lake is well known for its lake trout fishery. The extensive cold, deep, oxygen-rich water of Lake Placid makes it the ideal habitat for cold-water fishes such as lake trout. Although, we don't know a great deal about this population other than there appears to be high angler satisfaction. Additionally, NYS DEC does not stock the lake with lake trout, suggesting the population is wild and self-reproducing. NYS DEC does stock ~10,000 rainbow trout, which are not-native to the Adirondacks, in the lake each year. Brook trout are present in the lake, as well as it's tributaries.

Lake Placid is also home to a population of resident Common Loons (*Gavia immer*). The lake has been surveyed through the NY Loon Census organized by the Adirondack Center for Loon Conservation since 2001, with the exception of 2002 and 2003. Between 3 and 10 adult loons have been observed each year, except in 2006 when zero were observed. Immature birds have only been observed in 2012 and 2015, and chicks were observed just one year, in 2014. The Loon Census is not a comprehensive survey of breeding activity by loons. Given that the census has not consistently identified immature birds or chicks, it warrants further investigation into the breeding status of loons on the lake.

Management Recommendations

RECOMMENDATION	JUSTIFICATION
Continue long-term monitoring through CSLAP and expand monitoring to monthly from May to October, including surface and bottom water samples and vertical profiles of temperature, dissolved oxygen, specific conductance, pH, turbidity, and chlorophyll and phycocyanin reflectance. Monitoring should include dissolved organic carbon and metals analysis.	The long-term declines in transparency and changes in pH warrant further investigation. The addition of dissolved organic carbon and metals data to the water quality monitoring program will help put these changes in context. Vertical profiles are critical to understanding habitat for lake trout and long-term changes associated with climate change.
Continue total coliform and *E. coli* drinking water testing.	Lake Placid serves a source of drinking water for the Village of Lake Placid and local camps. These data are critical to assessing drinking water quality and impacts from septic systems.
Maintain a water quality monitoring database in-house or with a local partner to ensure easy access and data integrity.	Data from CLSAP, AWI, and LPSOA should be maintained in a central database and assessed on an annual basis for changes in water quality.
Analyze water quality data on an annual basis using modern trend analysis capable of early detection of changes.	The early detection and rapid response to changes will resolve issues quickly and save money.
Install a real-time water level and temperature station near the lake's outlet.	Monitoring water temperature and level will allow for a better understanding of climate change impacts on Lake Placid.
Maintain the ice record.	Lake Placid has a long record of ice cover that is an important source of data for understanding climate change impacts on the lake. This data should be submitted to AWI for integration in global lake ice databases.

RECOMMENDATION	JUSTIFICATION
Develop a fisheries monitoring and research plan to better understand the health of the current population of native fishes.	Lake Placid has exceptional habitat for lake trout and will likely serve as a climate refuge for this fish. Having a better understanding of the population will allow for more effective management and conservation.
Monitor Lake Placid for occurrences of Harmful Algal Blooms (HABs) and develop a HAB response plan.	HABs have the potential to threaten the drinking water quality of Lake Placid and an increasing number of HABs have been reported in the region. A monitoring and response plan will allow for the early detection of a HAB should one occur and allow for a coordinated response.
Conduct an all taxa biological inventory of the lake.	A baseline assessment of the biological communities present in the lake will serve as an important baseline for understanding future changes in the lakes ecology.

Goal 2. Effectively manage the infestation of variable-leaf milfoil in Paradox Bay and prevent further introductions of aquatic invasive species to Lake Placid

Aquatic invasive species (AIS) are a significant threat to the economic, recreational, and ecological values of Lake Placid. The introduction of AIS to a water body can reduce local biodiversity, ranging from effects on aquatic plants to zooplankton and fish. The impacts of a single AIS can cascade up and down the food web, altering native ecosystems in many ways. These impacts can result in alterations in the lake ecosystem that impact recreational use, such as impediments to swimming, paddling, and boating due to dense aquatic plant beds, alterations in recreational fish communities, and ultimately decreases in property values[25].

The primary mode of AIS introduction to water bodies in the Adirondack region is by transport on recreational boats as they are moved between water bodies. Boaters can prevent the spread of aquatic invasive species by following the Clean, Drain, Dry standards; clean boats and equipment of any visible mud, plants, fish or animals, drain all water holding compartments, dry boats, trailers, and equipment before use in another water body. The New York State Aquatic Invasive Species Spread Prevention Law, signed into law in 2021, requires boaters to follow these standards. The most effective line of defense is the inspection of watercraft entering and leaving Lake Placid by trained Watercraft Inspection Stewards and, when necessary, decontaminating boats with high-pressure hot water. Lake Placid is fortunate to have a decontamination station adjacent to the state boat launch.

Aquatic Invasive Species Spread Prevention

Lake Placid has participated in the Adirondack Watershed Institute's Stewardship Program since its inception in 2002. The program has evolved considerably over the years. Over that time, 49,773 boats entering and leaving Lake Placid have been observed and inspected by the stewards. The stewards have observed seven aquatic invasive species on boats launching or retrieving from the lake. These include Eurasian watermilfoil (*Myriophyllum spicatum*), variable-leaf

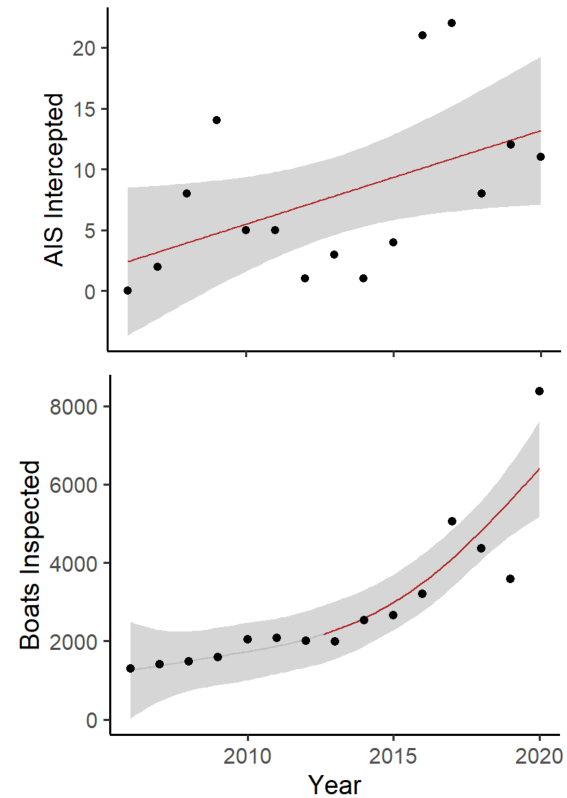


Figure 9. The total number of aquatic invasive species intercepted and boats inspected at the state and village boat launches for Lake Placid. The light gray line is a generalized additive model indicating no significant change, the red line indicates a period of significant increase. The gray shading is the 95% confidence interval of the model.

milfoil (*Myriophyllum heterophyllum*), curly-leaf pondweed (*Potamogeton crispus*), water chestnut (*Eleocharis dulcis*), hydrilla (*Hydrilla verticillata*), quagga mussel (*Dreissena bugensis*), and zebra mussel (*Dreissena polymorpha*). One hundred and seventy interceptions of these organisms have occurred over the program's life. Each one of these interceptions represents a potential new introduction of an AIS to Lake Placid that was stopped.

The number of boats inspected each year has increased dramatically since the program's start. This increase is both a reflection of increased steward coverage and increased boater traffic. However, trend analysis shows that the rise started in 2012, with most growth occurring since 2015. The increase since 2015 can be mainly attributed to increased boater traffic because steward coverage during this time was reasonably consistent. The rate at which boats are introducing AIS has varied, ranging from 0% to 0.88% but has not exhibited any long-term trend. However, the increase in inspections has resulted in a significant increase in AIS interceptions (Figure 9).

Lake Placid contains one aquatic invasive species, variable-leaf milfoil. It was first detected in the lake in 2009, and efforts to manage the infestation have been ongoing since then. It is currently contained in Paradox Bay, and it is assumed that it was introduced from a boat launching at the Village of Lake Placid boat launch.

Paradox Bay is the most vulnerable location on the lake in terms of the establishment of an invasive aquatic plant. The bay itself is shallow (~1.5m deep), with light penetrating to the bottom. The substrate of the bay consists almost entirely of organic-rich sediments that are favorable for rooted aquatic plants. Finally, the concentration of boat traffic from the marina and camps located in the bay increases the likelihood of plants

Table 1. Native plant species observed in Lake Placid during surveys by the Adirondack Park Invasive Plant Program.

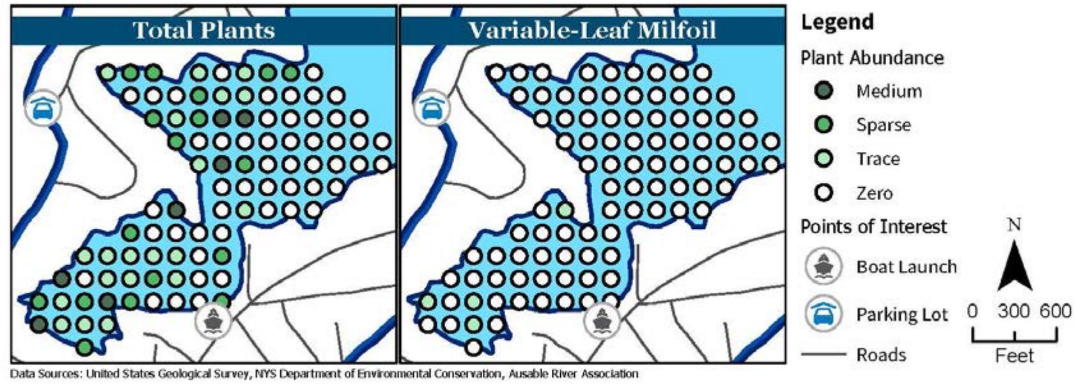
Common Name	Latin Name	Survey Years
Watershield	*Brasenia schreberi*	2020
Spatterdock	*Nuphar variegata*	2017, 2020
Eel grass	*Vallisneria americana*	2017, 2020
Large-leaf pondweed	*Potamogeton amplifolius*	2017, 2020
Robins' pondweed	*Potamogeton robbinsii*	2017, 2020
Common bladderwort	*Utricularia macrorhiza*	2017, 2020
Floating-leaf pondweed	*Potamogeton natans*	2017, 2020
Muskgrass	*Chara* sp.	2020
Hairgrass	*Eleocharis* sp.	2020
Pipewort	*Eriocaulon* sp.	2020
Quillwort	*Isoetes* sp.	2020
Dortman's cardinalflower	*Lobeila dortmana*	2020
Slender milfoil	*Myriophyllum tenellum*	2020
Naiad	*Najas* sp.	2020
Brittlewort	*Nitella* sp.	2020
White water-lily	*Nymphaea odorata*	2020
Small pondweed	*Potamogeton pusillus*	2020
Bur-reed	*Sparganium* sp.	2020

becoming fragmented and spread. Conversely, the substrate, bathymetry, and boat traffic in the vicinity of the state launch are much less favorable for establishing and spreading an invasive aquatic plant.

Aquatic Invasive Species Management

Native species dominate the aquatic plant community in Lake Placid. Starting in 2017, detailed lake surveys have been conducted every three years by the Adirondack Park Invasive Plant Program. Table 1 lists the native plants that have been recorded in Lake Placid throughout these surveys. The plant beds are concentrated in the shallow bays and other near shore areas with organic-rich sediments (Map 7). The apparent reduction in native plant diversity from 2017 (n=17) to 2020 (n=7) is not likely accurate but rather the result of a shift in survey teams and methodologies[26,27].

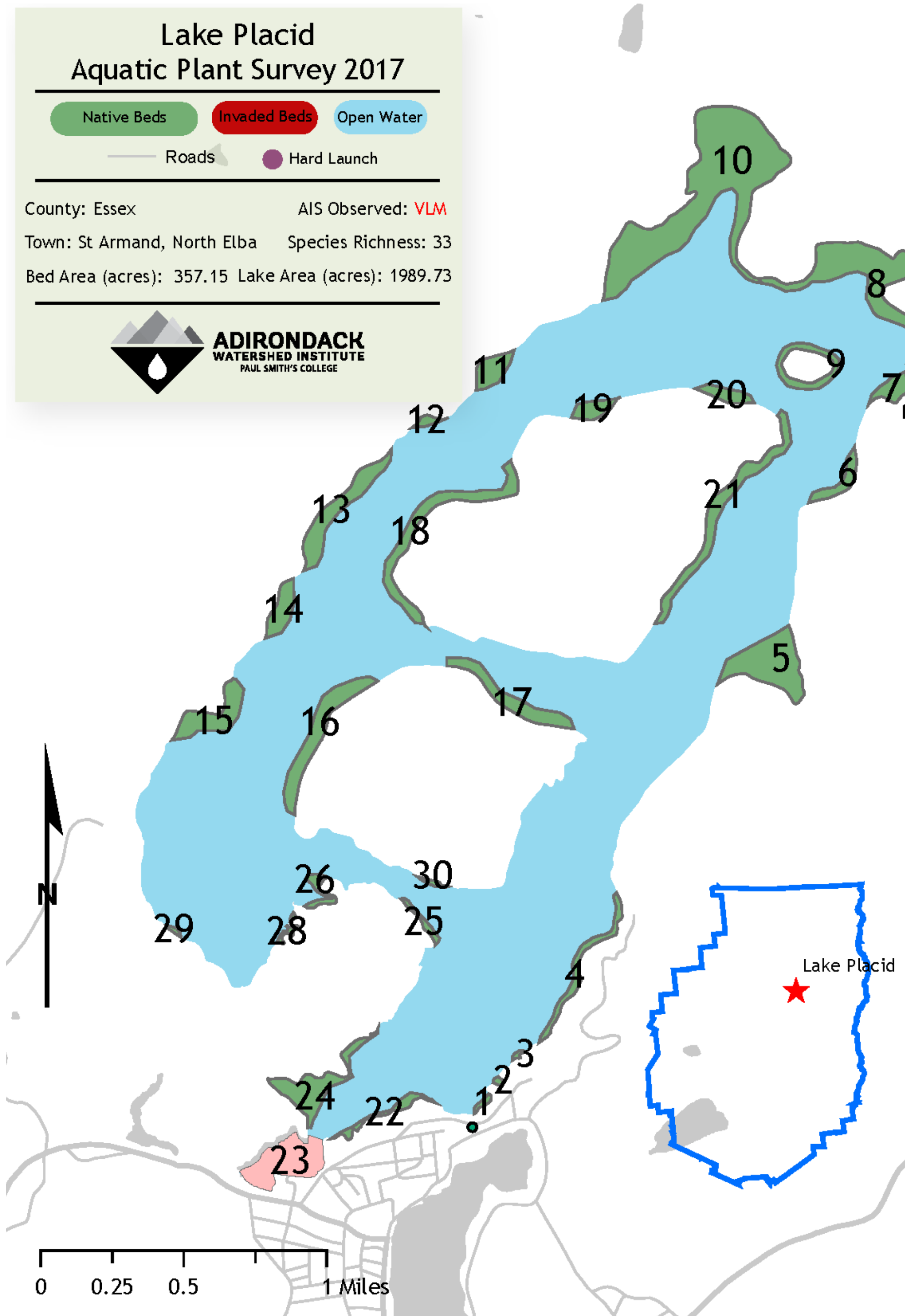
The success of the hand-harvesting efforts in Paradox Bay is difficult to determine due to a lack of long-term record keeping and independent third-party assessments. Concerns arose over the growth of variable-leaf milfoil in 2018 due to a substantial increase in the annual harvest. Several factors may explain this increase. First, there was a limited 1-day harvest in 2017 due to challenges with securing a dive team to conduct the harvesting that year. The limited harvest may have allowed for more growth and the establishment of variable-leaf milfoil in Paradox Bay. Second, previous harvests were conducted in June or early July when aquatic plant growth for the season is ramping up. Harvesting this time of year should result in less mass or volume than harvesting later in the year. In 2018, the harvest occurred in August, contributing to the increased numbers. High harvest numbers continued into 2019, coinciding with a harvest later in the season.



Map 6. Results of a point-intercept survey conducted in Paradox Bay and Brewster bay in August 2020.

In 2020, a multiple harvest approach was adopted. Harvesting both early in the season (June) and later in the season (August-September). This approach allows the plants to be hit during multiple parts of their growth cycle and for newly established fragments that may have been missed in the first harvest to be caught in the second. Early data suggests this approach is working, as harvest numbers came down in 2020.

Finally, a point-intercept survey conducted in July 2020 in Paradox Bay and Brewster Bay found a limited occurrence of variable-leaf milfoil (Map 6). The survey was conducted between the first and second milfoil harvest. This survey approach is not good at documenting the occurrence and abundance of rare species but offers an easy-to-repeat objective assessment of aquatic plant abundance in this area. Repeating this survey in the future could help inform the effectiveness of harvest efforts.



0 Absent; 1 Rare (< 5%); 2 Occasional (6 to 15%); 3 Present (26 to 49%); 4 Common (25 to 50%); 5 Abundant (> 50%)

Bed Id	Acres	*Chara sp.* Muskgrass	*Eleocharis sp.* Hairgrass	*Eriocaulon sp.* Pipewort	*Isoetes sp.* Quillwort	*Lobelia dortmanna* Dortmann's cardinalflower	*Myriophyllum heterophyllum* Variable-leaf milfoil	*Myriophyllum tenellum* Slender milfoil	*Najas sp.* Naiad	*Nitella sp.* Brittlewort	*Nuphar variegata* Spadderdock	*Nymphaea odorata* White water-lily	*Potamogeton amplifolius* Largeleaf pondweed	*Potamogeton epihydrus* Ribbonleaf pondweed	*Potamogeton natans* Floating pondweed	*Potamogeton pusillus* Small pondweed	*Sparganium sp.* Bur-reed	*Utricularia vulgaris* Common bladderwort	*Vallisneria americana* Eelgrass
1	0.90	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0.46	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1
3	0.44	0	0	3	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
4	7.88	0	0	4	0	2	0	0	0	0	2	0	0	2	0	2	2	0	0
5	24.54	0	0	4	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0
6	5.26	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
7	5.01	0	0	3	0	0	0	0	0	0	2	0	3	2	0	0	0	0	0
8	41.50	0	0	4	0	0	0	0	0	0	3	0	2	3	0	0	0	0	0
9	7.45	0	0	3	0	2	0	0	0	0	0	0	0	0	0	0	2	0	0
10	92.58	0	0	3	0	2	0	0	0	0	0	2	1	2	0	0	3	0	0
11	6.80	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	1.45	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
13	16.10	0	0	1	0	1	0	0	0	0	0	0	2	0	0	0	0	0	0
14	7.28	0	0	2	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
15	13.01	0	0	4	0	4	0	0	0	0	2	0	0	0	0	0	4	0	0
16	18.04	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
17	13.37	0	0	2	0	1	0	0	0	0	0	0	3	1	0	0	0	0	0
18	19.60	0	0	0	0	2	0	0	0	0	1	0	0	1	0	0	0	0	0
19	4.66	0	0	0	0	0	0	0	0	0	1	0	0	3	0	0	0	0	0
20	4.46	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0
21	18.74	0	0	2	0	1	0	0	0	0	0	0	0	2	0	0	0	0	0
22	4.11	0	0	3	1	0	0	0	0	0	1	0	0	2	0	0	2	0	0
23	20.85	0	2	3	0	0	1	3	2	3	3	0	0	0	3	0	2	2	0
24	15.33	0	0	4	0	0	0	0	0	0	1	0	0	3	0	3	3	0	0
25	1.94	0	0	3	0	0	0	0	0	0	0	0	0	2	0	0	3	0	0
26	3.06	1	0	4	0	0	0	0	0	0	2	0	0	3	0	0	2	0	0
27	0.21	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0.86	0	0	4	0	0	0	0	0	0	2	0	0	4	0	0	2	0	0
29	0.47	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0.79	0	0	2	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0

Map 7. The results of the most recent comprehensive survey of aquatic plants in Lake Placid.

RECOMMENDATION	JUSTIFICATION
Continue participation in the stewardship program managed by AWI, including continuing 7-day coverage at both the village and state boat launches in the summer season.	The number of boats launching and aquatic invasive species intercepted at the boat launches on Lake Placid are increasing. The stewardship program serves as the front lines in the efforts to prevent the introduction of a new aquatic invasive species to Lake Placid.
Develop a system of monitoring AIS infestations in the primary group of water bodies previously visited by boats coming to Lake Placid. Adjust management at the village and state launches accordingly.	Understanding the aquatic invasive species present in the water bodies that boats most frequently travel from will allow for more informed and proactive spread prevention efforts at Lake Placid.
Continue the multiple-harvest approach for variable-leaf milfoil removal in Paradox Bay. Have an SOA board member or lake manager visit with divers during the harvest to assess progress and receive real-time feedback and information.	Given the limited size of variable-leaf milfoil infestation in Paradox Bay, eradication is possible with enough effort. The multipe-harvest approach has proven beneficial and should be continued.
Maintain a database of harvest statistics and review them at the end of each season to plan for the following year.	The variable-leaf milfoil harvest should follow the principles of adaptive management, which utilizes ongoing data collection to guide and inform future management activities.
Conduct a point-intercept survey every three years to objectively assess harvest success.	Establishing an independent system to monitor variable-leaf milfoil provides a method for assessing harvest efforts and can help further guide management activities.
Conduct a rapid survey of littoral areas annually by trained staff to monitor new AIS infestations.	Since variable-leaf milfoil was first detected in 2009 it has been contained to Paradox Bay. Early detection of the establishment of aquatic invasive species at other sites will allow for a rapid response and significant cost savings. In the best case, early-detection rapid-response can eradicate a new invasive species before it becomes established.

RECOMMENDATION	JUSTIFICATION
Develop an AIS rapid response plan.	Prior planning for a new invasive species will allow for a faster ad more effective response if one occurs.
Pilot a mandatory inspection and decontamination program at the village boat launch capable of informing the adoption of a similar program at the state launch.	The village boat launch is the most probable location for the introduction and establishment of a rooted aquatic invasive plant because of the depth and substrate found in Paradox Bay. A mandatory inspection and decontamination program is the best option for preventing a new, and potential much more harmful, aquatic invasive species. A pilot it at village launch could serve as a model for a similar program at the state launch.
Reconfigure boat decontamination station to allow drive-through access to increase ease of use.	Boat wash and decontamination is the only way to ensure a boat is free of aquatic invasive species. The current boat decontamination station requires boaters to back up their boat through a 90-degree turn. Increasing the ease of use of this station will result in significantly more boats being decontaminated and thus decrease the chance of a new invasive species being introduced to Lake Placid.

Goal 3: Manage the recreational use of Lake Placid to preserve the lake's ecological, social, and economic values

Lake Placid is an important recreational resource in the region. According to data from AWI's Stewardship Program, Lake Placid is one of the most heavily visited lakes in the area. The excellent water quality, high water clarity, scenic vistas, and angling opportunities are all reasons visitors are attracted to the lake. Recreational resources must be managed to maintain the integrity of the resource while also providing high-quality visitor experiences.

Local Boating Laws and Regulations

Since 1942, navigation rules on Lake Placid have been regulated through Essex County through the Lake Placid Vessel Regulation Zone. The zone applies to all vessels navigating within 1,000 feet of shore, which includes almost the entire lake except for a small portion in the northwest corner. Elsewhere New York State Navigation Laws apply. The Lake Placid Vessel Regulation Zone regulars boaters within 100 feet of shore, docks, piers, rafts, floats, or moored vessels, and in Paradox Bay to limit their speed to 5 mph. In fog, mist, snow, or heavy rain or when within 100 feet of a canoe, rowboat, or swimmers, vessels are limited to 10 mph. When more than 100 feet but less than 300 feet, vessels are limited to 20 mph. In Sunset Straight, vessels are limited to 15 mph and shall not create a wake. No boat shall exceed 45 mph anywhere in the Lake Placid Vessel Regulation Zone (Map 8). In addition, the regulation zone prohibits jet skis and airplanes.

Lake Carrying Capacity

The recreational use of Lake Placid appears to have substantially increased over the past several years. Analysis of the boat inspection data collected by the stewardship program indicates, on average, a 214% increase in boater traffic from 2015 to 2020 (Figure 10). In addition, four out of the top ten concerns revealed by the stakeholder survey relate to boating and boat safety. Anecdotal reports from residents, visitors, and local officials

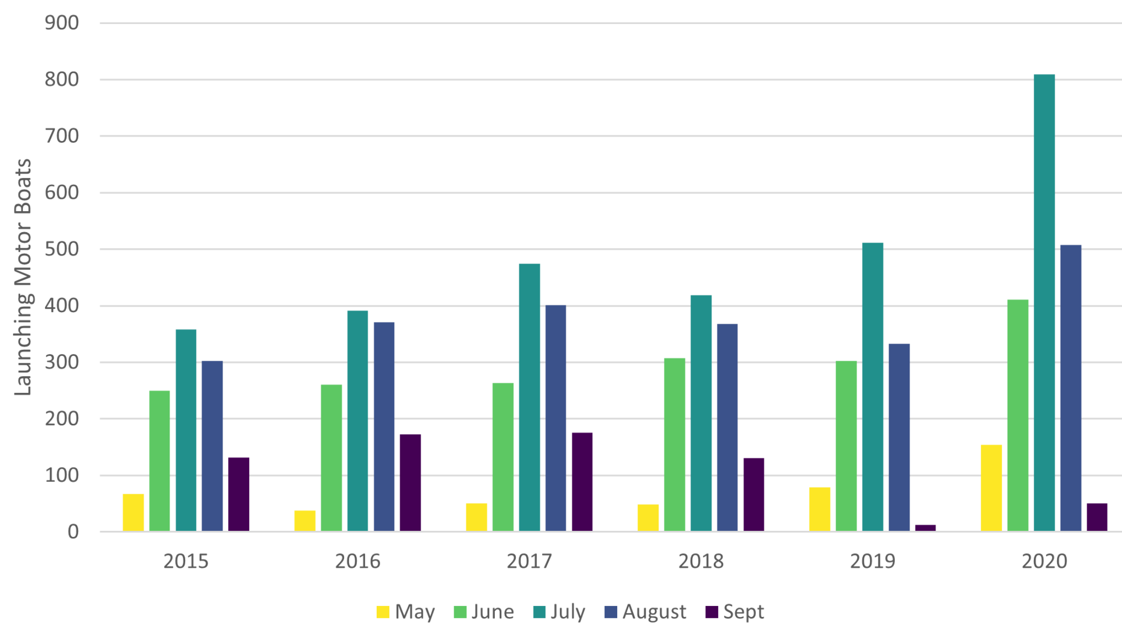
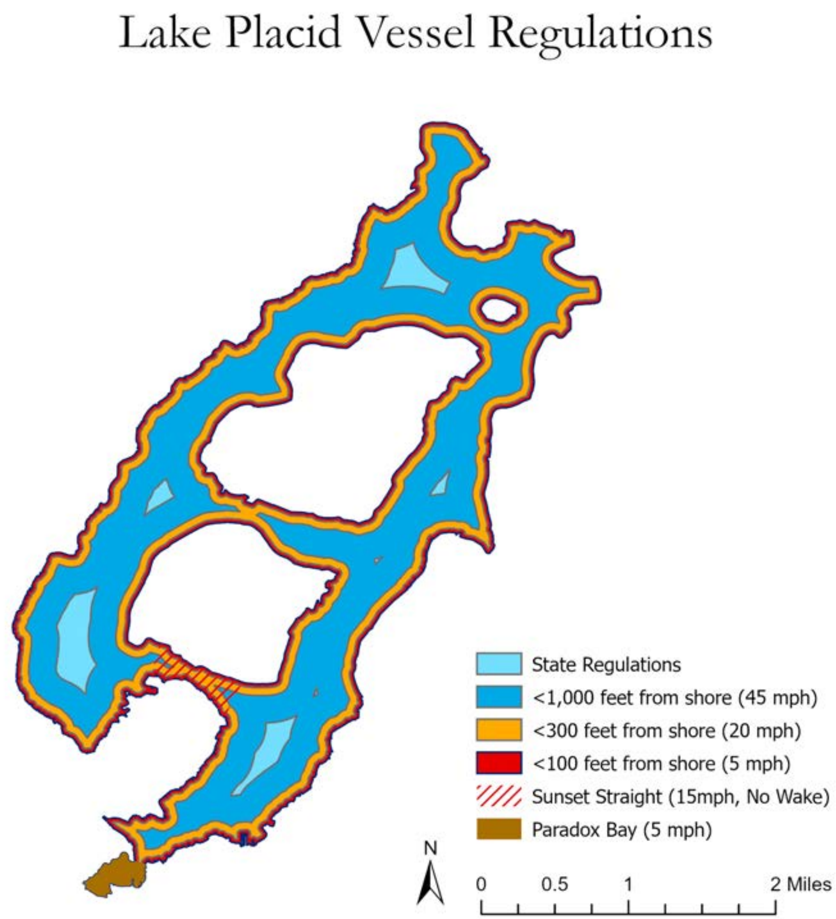


Figure 10. Number of boats launching into Lake Placid from 2015 to 2022, broken out by month. Data is from the AWI Stewardship Program.

indicate concerns regarding the safety of non-motorized craft, shoreline erosion from boat wakes, boat wakes damaging boats in boat houses, disturbance of loons, and a general sense of a change in the character of the lake because of increased recreational use.

Developing a recreational carrying capacity for Lake Placid would help put these changes in use and stakeholder concerns in context. The concept of carrying capacity assumes that any recreational resource can withstand a certain amount of use before being degraded. Determining lake carrying capacity is a complex process that must take into consideration the ecological, social, aesthetic, and infrastructure capacity of a lake[28,29,30,31,32,33,34]. Dawson and Hendee define carrying capacity as "the amount of use an area can tolerate without unacceptable change in conditions[35]." It is important to note that the idea of "unacceptable change in conditions" can be quite challenging to define. Carrying capacity can be viewed through ecological, social, aesthetic, and infrastructure lenses. It is quite possible to exceed carrying capacity in one of these areas while not in the others. In addition, the specific capacity of a resource in terms of visitor numbers is highly dependent on visitor behavior, infrastructure, and social norms. This means that defining carrying capacity in terms of the number of visitors or boats is a moving target. For example, the carrying capacity of Lake Placid would be considered relatively low from an ecological perspective if a large portion of boaters were completely disregarding Clean, Drain, Dry principles. On the other hand, it would be much higher if all boaters followed these principles and proactively utilized the decontamination station adjacent to the state boat launch.



Map 8. Map of the vessel regulations on Lake Placid.

Recreational carrying capacities for lakes have been predominately developed based on acres per boat metrics. The specific number of acres per boat is highly debated. One such study was conducted in 1990 by the LA Group as part of a proposed expansion of a private marina in Paradox Bay[36]. This study used a 15 acre per boat capacity, identifying an ideal carrying capacity of 145 boats. The study included a shoreline survey of boats docked on the lake, totaling 354 motorboats. It also assumed a daily number of boats coming from the two boat launches to peak at 75 boats. Analysis of stewardship data from 2015 to 2020 indicates a maximum daily number of boats launching into the lake of 51. It is important to note that this number is not necessarily representative of the total number of boats on the lake at any given time from the launches. It does not consider boats launched outside of the times a watershed steward was present or the retrieval of boats throughout a given day. In addition, a recount of boats docked on the shoreline in 2020 documented 583 motorboats, a 164% increase over 1990. At peak lake usage in 2020, visiting boaters would have utilized 35% of the carrying capacity. The remaining 65% is available to shore owners, representing 16% of boats docked on the lake.

There are many challenges with using acre per boat metrics to determine the carrying capacity of a lake. Firstly, they assume the boats are evenly dispersed on the lake, which is certainly not the case on Lake Placid. Secondly, they don't fully consider the type of boats used on the lake and how it alters capacity (small outboard motorboat vs. ski or wake boats). Thirdly, they don't take into consideration boater behavior and courtesy. The only major conclusion we can draw relative to the carrying capacity of Lake Placid is that the number of both launching and docked boats has increased substantially over the past several decades.

A more refined approach to addressing lake carrying capacity is to use a limits of acceptable change approach. This approach starts by clearly defining the desirable and achievable resource conditions. Key indicators related to the ecological, social, aesthetic, and infrastructure capacity are identified based on these desired conditions[35]. These indicators could include water quality parameters, loon nesting success, shoreline erosion, wave characteristics, boats launching, docked boats, constable and DEC citations, boating accidents, available parking capacity, boater perceptions, etc. What is most important is to determine the critical set of indicators for Lake Placid and then establish regular data collection efforts so they can be assessed on an annual basis. Once a set of indicators are identified, a series of thresholds or triggers can be established that will be used to guide management actions. A clear set of indicators and

thresholds allows for more transparent decision-making. The public, property owners, local government, and state officials can access and understand the data to drive management decisions. This process is much more intensive than simple acre per boat-based metrics, resulting in better resource protection and management outcomes. Further, there is a much higher likelihood of consensus among stakeholders because the process is data-driven and transparent.

Lake carrying capacity should also inform the laws, regulations, and permits associated with the commercial use of the resource being managed. Local laws can play an important role in managing a recreational resource, as is the case with the vessel regulations on

Lake Placid. The current laws pertaining to the commercial use of the lake should be summarized and reviewed as part of developing and managing a lake's carrying capacity.

The management decisions used to address concerns related to carrying capacity can be viewed from least to most authoritarian. On one end is education, and on the other are restrictions to access. Changes to infrastructure, alterations to boating laws, development limits, etc., fall somewhere in between. Management actions should always start with the least authoritarian option – usually education and outreach efforts – to push an indicator back below a threshold or trigger. For example, investing in boater safety education, invasive species outreach, and lakeshore property stewardship should be made before limiting access or restricting development.

Education

Establishing a successful and defensible lake carrying capacity model takes time and effort. Regardless of whether the lake is currently exceeding its carrying capacity or not, increased boater and shore owner education can improve the recreational experience on the lake and make it more ecologically resilient to further increases in use. There are no organizations with dedicated education and outreach staff focused on Lake Placid. The SOA is an all-volunteer organization and has made commendable efforts to develop and support outreach efforts on the lake. Specifically, the AWI stewardship program demonstrates a highly successful educational program with tangible benefits for the lake. There are opportunities to improve education and outreach on the lake by strengthening primary stakeholders' partnerships. In particular, the Ausable River Association and Paul Smith's College Adirondack Watershed Institute have staff and institutional capacity to support more meaningful educational programing focused on Lake Placid.

The Town of North Elba seasonally hires a lake constable to enforce the boating laws on Lake Placid, but most importantly, this position plays a critical role in boater education and outreach. The constable conducts daily patrols of the lake during the summer season, interacting with boater and educating them about local laws and boater safety. Placed based interactions such as these are an extremely effective form of education.

Consistent, high-quality, education and outreach can be extremely effective at addressing a variety of lake issues. Education is the preferred option when addressing a lake related issue or challenge, whether it recreational, ecological, or social. Other lake associations, such as the Lake George Association and Upper Saranac Foundation, have demonstrated the benefits and successes of dedicated educational efforts. These programs include aquatic invasive species identification workshops, on water lake educational programing, recreational outings focused on natural history, lecture series, and social media outreach. Many of these programs have the added benefit of directly engaging with people, which helps turn them from passive visitors or users to active stewards of the lake.

Management Recommendations

RECOMMENDATION	JUSTIFICATION
Develop a carrying capacity model for the lake based on a limits of acceptable change approach.	There has been a significant increase in the recreational use of Lake Placid and concerns expressed by stakeholders related to that use. The development of a carrying capacity model would put these concerns into context and provide a framework for managing the recreational use of the lake.
Clearly define the desired and achievable resource conditions.	The first step in developing a carrying capacity model is to clearly define the desired resource conditions.
Identify a set of indicators and thresholds capable of characterizing the desired conditions.	Once the desired conditions of the lake have been defined, a set of measurable indicators and thresholds capable of characterizing the current conditions relative to the desired conditions needs to be identified.
Develop a system to monitor the recreational use of the lake regularly.	It is important that the recreational use of the lake is regularly monitored and assessed in order to inform the management of this resource.
Develop a system to study wave action on the lake, specifically as it pertains to boat safety & shoreline erosion from high displacement boats.	Stakeholders have raised concerns about boat safety, damage to boats and docks, and shoreline erosion as a result of wave action from boats. A comprehensive understanding of wave action from recreational boats is necessary to put these concerns into context and then assess the effectiveness of management actions should they be taken.
Develop an education and outreach plan around boater safety and invasive species spread prevention. Work in coordination with local partners to identify target audiences for distribution.	Lake carrying capacity is highly dependent on boater behavior. Increasing education and outreach efforts is the first step when addressing concerns related to the recreational use of a resource.

RECOMMENDATION	JUSTIFICATION
Conduct a review of local and state laws that govern the establishment and operation of commercial enterprises that operate on Lake Placid, including a review of regulatory gaps that may exist. Share this review with local and state government officials and stakeholders.	The specific laws and regulations pertaining to the commercial use of Lake Placid are unclear to stakeholders. A thorough review is necessary to understand how the commercial use of the lake is regulated and where gaps may exist that are critical to the protection of Lake Placid.
Continue to maintain and support a paid Lake Constable position on Lake Placid.	A consistent on-water presence is necessary to educate boaters on laws, regulations, and boater safety. Additionally, this position plays a critical role in boater education and outreach through direct interaction with boaters.
Encourage local government and DEC to increase enforcement efforts and keep a log of enforcement activities.	Law enforcement are a key part of education and outreach efforts, serving on the front lines of interactions with boaters. The number and type of enforcement actions and encounters can be an important indicator of the desired conditions on the lake.

Goal 4. Limit the impact of development on the lake through increased adoption of lake-friendly practices

Land Use and Development

Land use and development can influence the health of a lake substantially. Impervious surfaces flush nutrients and other pollutants to receiving waters, exacerbate flooding, and increase water temperatures[37]. Manicured lawns and agricultural areas can be significant sources of nutrients and pesticides. Septic systems that aren't designed to current standards or maintained properly can be sources of pathogens and nutrients. All alterations to the physical and ecological landscape can negatively impact the lake. Still, by following best practices and using sound management, it is possible to balance development with lake and watershed health.

As new homes and development increase within the Lake Placid watershed, it is essential to minimize impervious surfaces, intercept and manage stormwater runoff, maximize tree cover and native vegetation, especially along the lakeshore, and ensure septic systems meet setback, design, and maintenance standards. Planning for new development should consider soil type, topography, slope, and proximity to wetlands and surface water.

Private and Municipal Waste Disposal

As water is used in camps and homes, it picks up various pollutants such as detergents, chemicals, food waste, human waste, and pathogens. Water needs to be treated before making it back into the environment. Lake Placid's homes and camps are served by privately maintained septic systems and municipal wastewater treatment. These systems, when functioning correctly, are designed to effectively treat this waste to avoid adverse environmental effects. Wastewater disposal is particularly important for Lake Placid because the lake serves as a source of drinking water for over 100 camps, the Village of Lake Placid, and the Town of North Elba.

Many of the camps and homes along the southern shore of the lake are served by the Village of Lake Placid's municipal wastewater treatment plant. Wastewater is piped to a treatment plant located downstream of Lake Placid along the Chubb River, near where it enters the West Branch Ausable River. This system effectively moves the wastewater out of the Lake Placid watershed, eliminating any influence it could have on the lake. It is closely monitored and regulated through the State Pollution Discharge Elimination System (SPDES). At one time, Camp Woodsmoke, at the north end of the lake, also operated under a SPDES permit.

It should be noted, however, that portions of the wastewater system, including sewer lines, are quite old. These lines can fail, allowing wastewater to leach into the ground and possibly the lake. This was made apparent when a leak in downtown Lake Placid during the fall of 2017 resulted in untreated wastewater entering Mirror Lake. The Village of Lake Placid resolved this issue and subsequently invested millions of dollars in replacing or restoring old sewer lines in this area. Aging infrastructure is increasingly a concern in the region and should not be overlooked in relation to the protection of Lake Placid.

Privately maintained septic systems can also be significant sources of pollution to a lake[38]. This concern is especially true

when septic systems were built prior to adoption of modern design standards, have not been adequately maintained and inspected, or suffer from structural failures. An analysis of publicly available tax parcel data indicates that 105 camps on the shores of Lake Placid have septic systems, treating waste from an estimated 315 bathrooms. Conservative estimates of water usage suggest that, combined, these systems are responsible for treating 2-4 million gallons of wastewater each year. In addition, added stress to these systems may be created if camps that were traditionally occupied for short periods of time by a single family are converted to short-term rentals. The amount, type, and pattern of use of a camp, and subsequently its wastewater system, is much different than as a short-term rental.

The New York State Department of Health (NYS DOH) regulates the design and installation of residential septic systems that discharge <1,000 gallons per day. Systems that discharge more than 1,000 gallons per day require a SPDES permit. The Town of North Elba has recognized the importance of ensuring septic systems are designed and maintained to limit their impact on the environment. The town has strong septic system setback requirements (300 feet) for all newly constructed systems; this is greater than the requirements established by the NYS DOH (100 feet). In addition, the Towns of North Elba & St. Armand have a local law requiring septic systems around the lake to be inspected every three to five years, depending on whether the property is a full-time or part-time residence.

The North Elba & St. Armand septic inspection requirements have allowed for greater understanding and oversight of residential systems around Lake Placid. There remains, however, a high level of uncertainty regarding the impact of these systems on the lake. When asked in the stakeholder survey when they last had their septic system pumped out, 34% of shore owners indicated they had not had their system pumped in the last five years or don't know when it was last pumped. In addition, there are several reports of failed or failing systems and outdated systems that are unlikely to meet current standards. A more comprehensive understanding of the location and condition of systems around the lake would allow for better modeling of their impact on the lake and targeted water quality monitoring.

Shoreline Buffers

Vegetated shoreline buffers are essential to the health of a lake. Vegetated buffers provide shade, lower water temperatures, intercept and absorb nutrients and other pollutants, stabilize soils, and provide organic matter to the near shore area of the lake. Lack of vegetation along a shoreline can exacerbate shoreline erosion, increase the chance of algal blooms, and reduce habitat for fish and other organisms.

A detailed analysis of aerial imagery was conducted to assess the extent of shoreline buffers within 70 feet of the lake shore for the entire lake. This analysis shows that the majority of the lake shore (78%) has a natural shoreline buffer (Figure 11). Though, there are areas where there is a much higher portion of mowed or landscaped vegetation within this buffer zone, this is primarily along the lakeshore within the Village of Lake Placid and the southwestern shore of the lake. Shore owners in these areas should be encouraged to plant buffers consisting of native vegetation to help stabilize shorelines, reduce runoff, and provide habitat for native organisms.

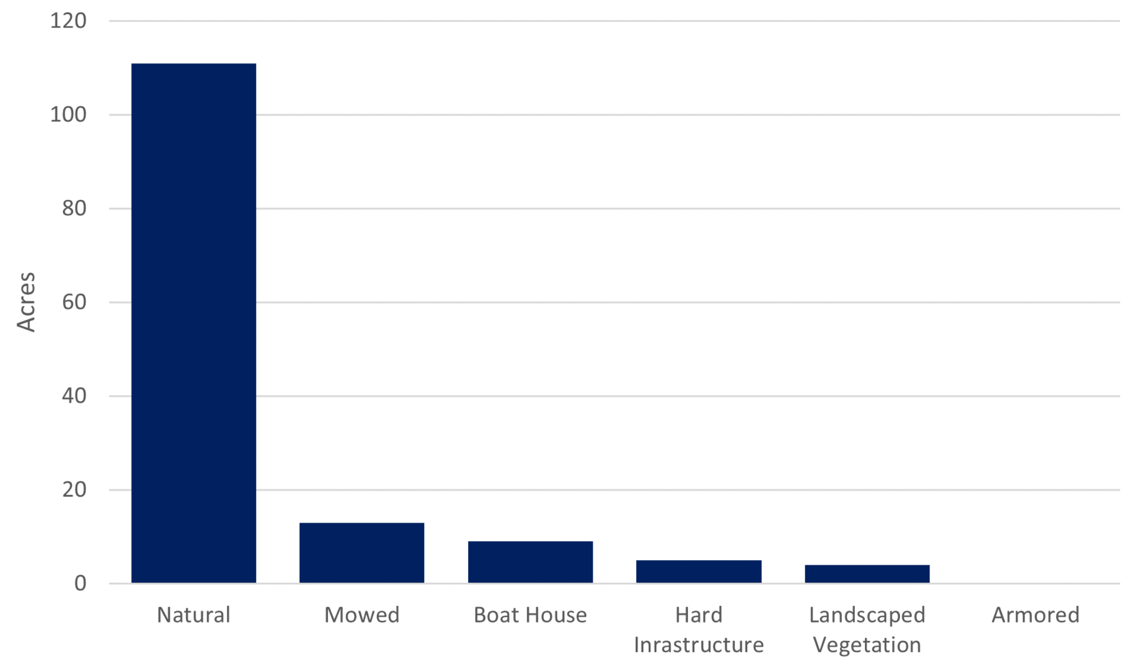


Figure 11. Land cover types by acreage within 70 feet of the Lake Placid shoreline based on aerial imagery from 2018. This includes both public and private land.

Stormwater Runoff

Stormwater runoff from roads, parking lots, driveways, sidewalks, rooftops, and other impervious surfaces quickly runs off these surfaces, picking up pollutants as it makes its way to local streams, lakes, and wetlands. When stormwater management systems are poorly designed or completely lacking, sediment, nutrients, bacteria, pesticides, oil, and trash can flow directly into surface waters. In natural environments, a large portion of rainfall is intercepted by vegetation or absorbed into the soils, substantially reducing surface runoff. In addition, soils and vegetation help absorb and break down nutrients and other pollution.

Elsewhere in New York State, stormwater runoff is a leading cause of water quality impairments and beach closures, primarily due to bacteria contained in the runoff. Allowing stormwater runoff to enter surface waters directly threatens fish and wildlife populations, degrades water quality, and reduces the recreational value of lakes and streams. Proper stormwater management can mitigate these threats but requires careful planning, implementation, and ongoing management.

NYS DEC, APA, the Town of North Elba, and the Village of Lake Placid all have regulations to address stormwater runoff from new development. No state or federal laws address runoff from existing development within the Lake Placid watershed, unless there are significant expansions. Construction activity, in particular, can dramatically increase sediment and pollutant inputs to local streams or directly to the lake.

A thorough review and survey of current stormwater flow paths from roads, bridges, culverts, and outfalls are necessary to understand where to invest in improvements. Even though the development of the Lake Placid watershed is limited and primarily focused along the southern shores of the lake, stormwater can be a significant concern at any property within the watershed that has impervious surfaces that may discharge water to a stream or the lake.

Local Laws

The Ausable River Association reviewed the 2011 joint Land Use Code for the Village of Lake Placid and Town of North Elba for its 2016 NYS Department of State Ausable Watershed Management Plan. At that time, the joint code provided adequate protection for the waterways in the town and village. While improvements in protections can always be identified, community goals prioritize finding a balance between protections and development. Strong regulation that provides thorough protection of water quality and natural water infrastructure requires accurate scientific data and assessment, public participation in code development, access to clear information describing code limits, and rigorous code enforcement.

As of the writing of this report, the existing joint land use code is under review with several proposed changes, some of which have implications for water protection. Most notably, the new proposal includes allowing wastewater systems to be installed less than 300 feet from the shoreline if the existing 300-foot setback isn't possible and suggests an increase in boat house length by 3 feet in response to a DEC recommendation regarding distance from shore, and would require that floating docks be encapsulated to cut down on debris in lakes. The review process is ongoing at the time of this report.

In addition to these local codes, development in the watershed is in part subject to the jurisdiction of the APA. The town and village have APA-approved zoning and subdivision controls but do not have an APA-approved Local Land Use Program.

An abbreviated summary of the local Land Use Code is provided below.

Shorelands, Section 3.6 (pp 36-41):
- Vegetative cutting restrictions along shorelines
- Regulations on lawns, fertilizers, and salt storage
- Development standards: Vegetation retention and clearing, preservation of topographic features, site design, pathways and roads, ancillary structures
- Additional submissions for the review process
- Additional Requirements for subdivisions

General Standards, Section 4.2 (pp 42-46):
- Health and safety: no discharge of sewage or waste material into water, wetland, watercourse, etc.

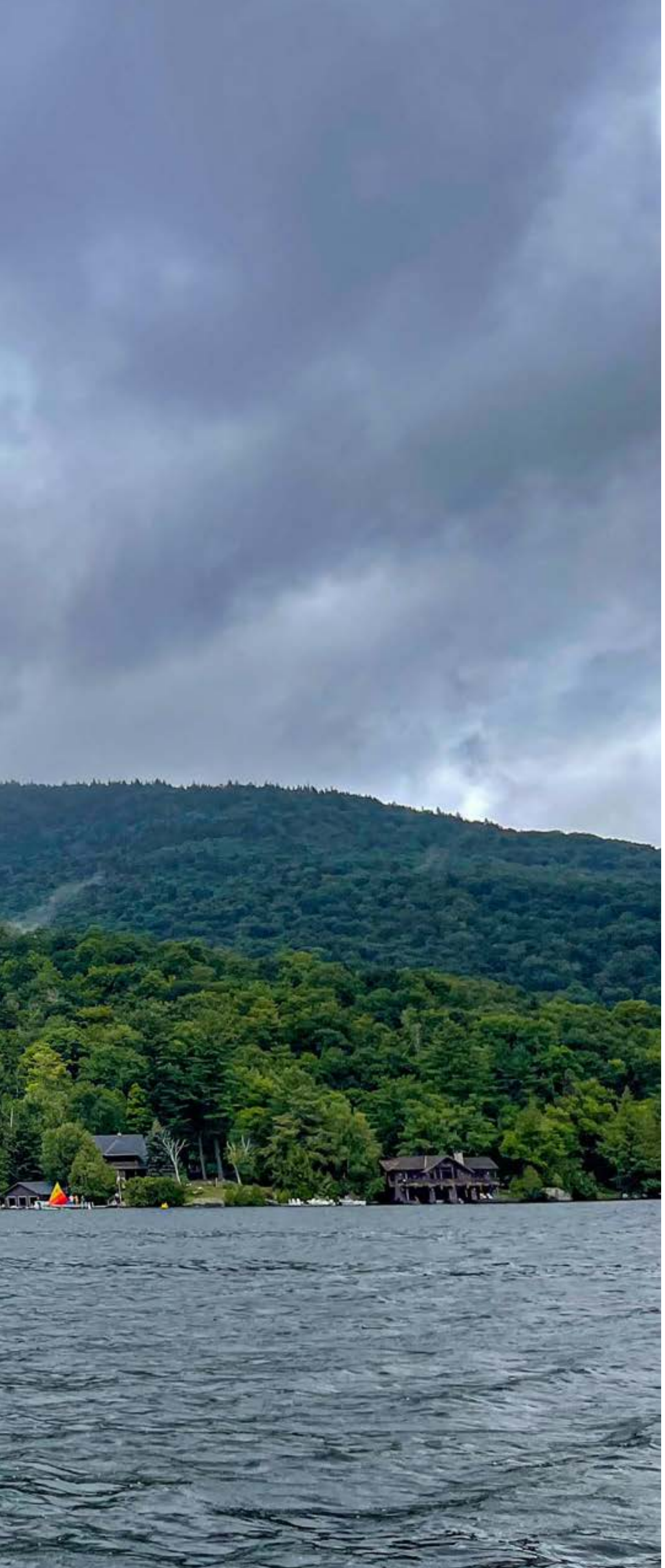
Resource Protection, Section 4.4 (pp 49-52):
- Permit required
- Protection of slopes
- Protection of navigable streams and rivers
- Protection of wetlands: Freshwater Wetlands Act
- Protection of flood hazard areas: construction requirements
- Protection of forest resources

Stormwater Management, Section 4.5 (pp 52-64):
- Project classification: minor and major projects
- Preferred stormwater management methods: natural methods, low impact design
- Additional requirements for minor projects
- Additional requirements for major projects: calculating volumes, design, and location of infiltration systems

Building and Safety Regulations, Section 4.6 (pp 65-71):
- Health, safety, and welfare considerations
- Solid waste disposal
- Construction requirements
- Water supply
- Sewage disposal

Landscape Design, Section 5.2 (pp 73-78):
- General considerations: stabilize slopes, reduce erosion, include stormwater controls
- Preservation of existing vegetation
- Landscaping: use of native species encouraged, wildflowers and groundcovers encouraged as a substitute for lawn

Additional Requirements for Particular Uses, Section 5.5 (pp 90-98):



- Cemeteries
- Commercial Excavation
- Marinas/boat and slip rental facilities

Subdivisions, Section 7.1 (pp 120-140):
- Roadways: Design Considerations: roadway drainage, catch basins, stream crossings, slopes; construction considerations
- Utilities: water supply systems; sewage disposal systems
- Provisions for flooding drainage and runoff
- Re-vegetation

Design Alternatives for residential subdivisions, Section 7.2 (pp 141-144):
- Conservation design

Soils

The Lake Placid watershed is dominated by three soil types (Map 4). Soil is an essential factor to consider when assessing the suitability of a site for specific forms of land use and development. Soil type can significantly influence erosion potential, stormwater flow, septic system function, and nutrient retention. Soil permeability is one of the most important characteristics relative to water quality. The US Depart of Agriculture's Natural Resources Conservation Service divides soils into three hydrologic soil groups. Type A soils are sandy with high permeability, allowing water to move from the surface into the soil matrix quickly. Although, sandy soils are easily eroded when left bare and can be a source of sediment pollution. In comparison, type D soils consist of clay and have low permeability, causing water to pool and runoff.

Type "C" soils cover much of the lakeshore and upland areas within the Lake Placid watershed. Areas of the southern portion of the watershed, roughly from Whiteface Inn, all of Brewster Peninsula, Paradox Bay, and north to just beyond the state boat launch, are dominated by type "A" soils. Type C soils have a slow rate of water transmission and moderately high runoff potential. In general, type "C" soils are suitable for septic systems and development but can present challenges in terms of runoff, especially during storm events. Type "A" soils have high infiltration rates and low runoff potential. In the Lake Placid watershed, these soils are found in areas where municipal wastewater treatment is available, which is good because they can present challenges for septic systems. Additionally, the lower runoff potential allows the soils to handle increased runoff from impervious surfaces during storm events.

Roads

Winter road maintenance

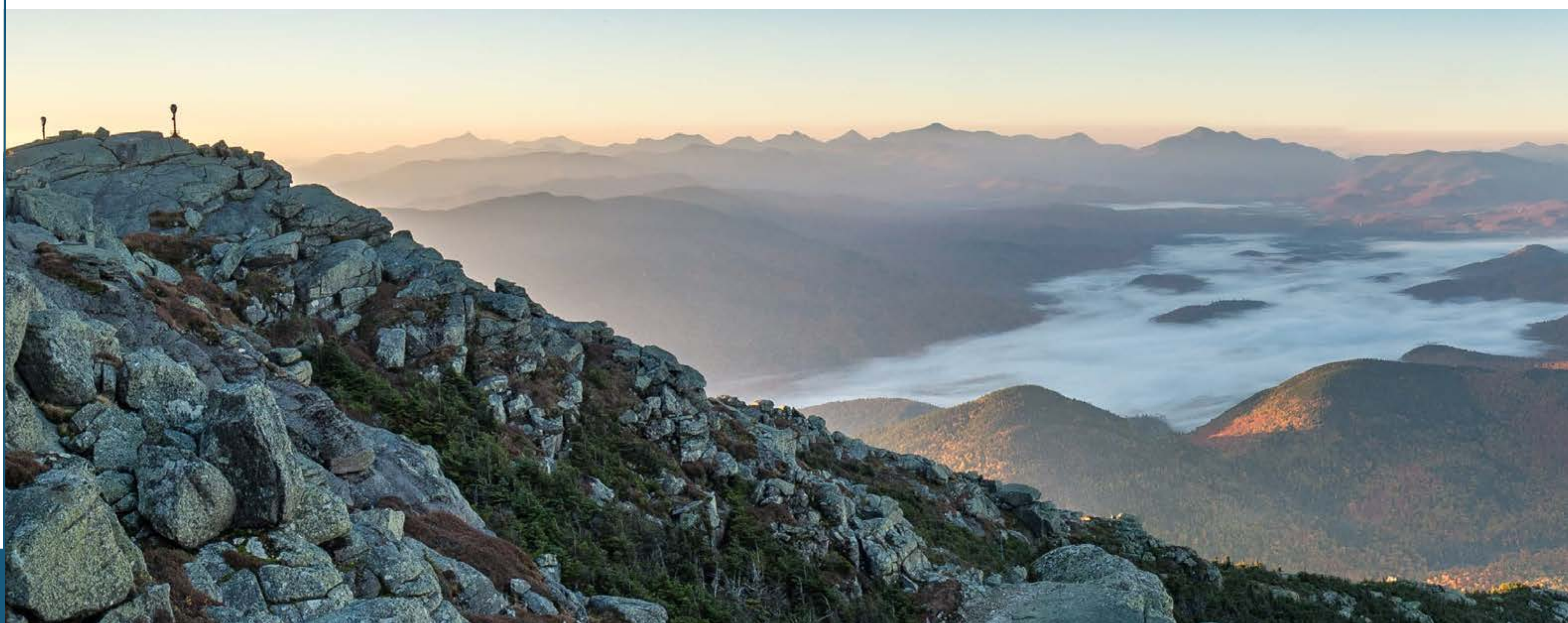
As mentioned previously in the water quality summary, road salt does not have a meaningful influence on the lake's water quality. There are 0.5 miles of state road that drain to the lake. NYS DOT maintains its roads in the wintertime by plowing and applying road salt (sodium chloride) to the road surface. Within the Adirondack region, they are responsible for most of the road salt pollution[5]. Given the short distance of state-maintained roads in the watershed, there is minimal impact on the lake. The remaining 11.3 miles of road are a mixture of county, town, village, and private roads. These roads are maintained by plowing and sanding. Sand applied to the road for traction typically includes 5-10% salt by volume to prevent the sand from freezing in the back of the plow trucks.

The NYS DOT, Village of Lake Placid, and Town of North Elba have all been engaged in salt reduction efforts through the Adirondack Road Salt Reduction Task Force and the Ausable River Association's Salt Use Reduction Initiative. Businesses and private residents are also encouraged to reduce their use of salt on their properties. Even though the salt impacts to Lake Placid are minimal, there can and likely are localized areas of impact from salt-laden runoff as it runs off salted surfaces.

Culverts & Ditches

A review of surface drainage and road-stream crossing incidence was conducted to gauge connectivity challenges and sediment inputs in the Lake Placid watershed.

The North Atlantic Aquatic Connectivity Collaborative (NAACC) database revealed no assessed road-stream crossings in the Lake Placid watershed. A follow-up windshield survey along



all public and publicly accessible private roads identified one culvert in the watershed on Whiteface Inn Lane. This culvert is undersized and has been assessed as a low to moderate constriction by Ausable River Association staff using NAACC protocols. The assessment will be uploaded to the NAACC database for prioritization.

The windshield survey also revealed minimal ditching on primary roads in the watershed and no apparent signs of ditching failure or erosion. Standards for rural roadside ditching, the Rural Roads Active Management Program, developed by the Champlain Watershed Improvement Coalition of New York and approved for use by NY DEC, are freely available. They can assist the village, town, and private landowners or contractors in applying best management practices for installing, upgrading, and maintaining ditching in sensitive environments.

Small sediment plumes apparent on some Google map images may indicate that small to moderate amounts of sediment may be released into the lake from undersized culverts or eroding ditches along private roads or drives in the watershed. A thorough review of drives and water diversion practices on private properties surrounding the lake was beyond this project's scope, and these structures may contribute to lake sedimentation. Should sedimentation prove to be a growing issue for Lake Placid, such a study should be undertaken.

Management Recommendations

RECOMMENDATION	JUSTIFICATION
Ensure collaboration with shore owners on changes to local laws and proposed development in the watershed.	Regular communication among stakeholders is essential to effective management.
Encourage shore owners to plant and maintain vegetative buffers along the lake shore.	Vegetative buffers are critical to lake health. Many shoreline properties have lawns or mowed areas extending directly to the lake shore.
Continue the septic pump out program and coordinated efforts around septic inspections and maintenance.	Regular septic system maintenance is critical to their proper function. The pump out program and inspections are effective proactive measures that prevent system failure.
Develop a comprehensive database of septic system design, age, and maintenance.	These data are essential to understanding and modeling the potential impact of septic systems on Lake Placid. The number and age of systems, along with the lake serving as a drinking water supply, warrants further investigation into the impact of septic systems on water quality.
Maintain and enforce local laws that support strong septic system setback and inspection requirements.	The Towns of North Elba & St. Armand laws related to septic system setback and inspection are models for other communities and are important protective measures. These laws should be maintained.
Monitor the number and use of short-term rentals adjacent to the lake, specifically for camps that are on septic systems.	Short-term rentals have the potential to increase stress on septic systems by increasing the number of users using those systems. Monitoring short-term rentals on septic systems will help inform the relative risk associated with these units and help guide renter education initiatives.

RECOMMENDATION	JUSTIFICATION
Reach out to the New York State Department of Health to request Lake Placid be listed as a priority for septic improvement cost share programs.	Lake Placid has the highest water quality classification in New York State (AA-S) and is the source water for a public drinking water system. Some of the camps around Lake Placid have old out-dated septic systems that would benefit from a cost share program. Upgrading these systems is a necessary preventative measure to protect the water quality of Lake Placid.

Goal 5: Coordinate lake management activities among stakeholders and base decisions on the best available data and most recent science

The long-term protection of Lake Placid requires ongoing and active management of the lake and surrounding resources. Early detection and rapid response to changes in the lake are essential for the lake's health and will cost orders of magnitude less than waiting for issues to become so severe that they impact the ecological, social, and cultural resources of the lake. This type of management is most successful in the long term but requires management of various kinds of data, coordination with stakeholders and partners, and professional expertise in lake management.

Currently, the SOA serves as the primary entity for coordinating lake management-related activities, and this is a lot of work for an all-volunteer organization. The protection of Lake Placid would benefit from a dedicated staff person or partner to serve as a lake manager. A lake manager would bring professional expertise, support, and continuity to the lake protection efforts on Lake Placid. This person would coordinate the water quality monitoring, invasive species spread prevention & management, and recreation management activities on the lake. In addition, they would serve as a representative of the lake at local government meetings, regional partner organizations, and at the state and federal levels. Finally, a dedicated lake manager would be available to rapidly respond to water quality, invasive species, and other concerns on the lake.

Upper Saranac Lake and the Upper Saranac Foundation (USF) serve as a model in the region for effective lake management and the benefits of having a dedicated lake manager. The USF lake manager oversees and coordinates the water quality monitoring, invasive species management & spread prevention, and education & outreach activities. In addition, they attend local government and regional partnership meetings. The lake manager also applies for grants to support lake management activities on Upper Saranac Lake.

An alternative approach would be to establish a strong relationship with a local partner(s) to provide the services of a lake manager. The North American Lake Management Society (NALMS) provides a professional credential to help lake associations and other organizations identify individuals qualified to full-fill lake management duties. Lake Placid would benefit greatly from a NALMS Certified Lake Manager.

"A NALMS Certified Lake Manager (CLM) is a highly competent lake manager who has satisfied the NALMS certification requirements in terms of scientific knowledge as well as professional experiences. CLMs make lake management decisions and/or provide final technical recommendations to legislative bodies or non-technical final decision-makers. Three years minimum of full-time professional experience as a management decision-maker is a prerequisite before the quality of the experience is closely vetted by the evaluators. CLM is the highest professional certification issued by NALMS." - North American Lake Management Society

Management Recommendations

RECOMMENDATION	JUSTIFICATION
Hire and/or contract with a lake professional to assist with lake management decisions, maintenance of water quality and invasive species data, and respond to concerns.	Professional staff will bring consistency and longevity to lake management efforts, including the maintenance of data, coordinating efforts among partners, and providing professional insight and recommendations.
Develop a lake management dashboard to track data related to water quality, invasive species, recreational use, and lake stewardship.	Much of the data collected on Lake Placid is not communicated or shared to stakeholders. A central lake management dashboard would ensure all stakeholders have a common understanding of the health of the lake.

Summary of management recommendations for Lake Placid. Cost is generalized into the following categories based on either one-time or annual expense; low = <$1,000, medium = $1,000 - $10,000, high = >$10,000. Stakeholders identified are either the leads or potential partners. SOA = Shore Owners' Association of Lake Placid, AWI = Paul Smith's College Adirondack Watershed Institute, AsRA = Ausable River Association, VLP = Village of Lake Placid, TNE = Town of North Elba, TSA = Town of St. Armand, NYS DEC = New York State Department of Environmental Conservation, APA = Adirondack Park Agency.

Goal 1: Water Quality

Recommendation	Priority	Cost	Stakeholders
Continue long-term monitoring through CSLAP and expand monitoring to monthly from May to October, including surface and bottom water samples and vertical profiles of temperature, dissolved oxygen, specific conductance, pH, turbidity, and chlorophyll and phycocyanin reflectance. Monitoring should include dissolved organic carbon and metals analysis.	High	Medium	SOA, AWI, AsRA, NYS DEC
Continue total coliform and *E. coli* drinking water testing.	High	Low	SOA, VLP
Maintain a water quality monitoring database in-house or with a local partner to ensure easy access and data integrity.	Medium	Medium	SOA, AWI, AsRA, NYS DEC
Analyze water quality data on an annual basis using modern trend analysis capable of early detection of changes.	Medium	Medium	SOA, AWI, AsRA, NYS DEC
Install a real-time water level and temperature station near the lake's outlet.	Low	Medium	SOA, AWI
Maintain the ice record.	High	Low	SOA, AWI
Develop a fisheries monitoring and research plan to better understand the heath of the current population of native fishes.	Medium	High	SOA, AWI, AsRA, NYS DEC
Monitor Lake Placid for occurrences of Harmful Algal Blooms (HABs) and develop a HAB response plan.	Medium	Low	SOA, AWI, AsRA, NYS DEC
Conduct an all taxa biological inventory of the lake.	Low	Medium	SOA, AWI, AsRA, NYS DEC

Goal 2: Aquatic Invasive Species

Recommendation	Priority	Cost	Stakeholders
Continue participation in the stewardship program managed by AWI, including continuing 7-day coverage at both the village and state boat launches in the summer season.	High	High	SOA, AWI, VLP, NYS DEC
Develop a system of monitoring AIS infestations in the primary group of water bodies previously visited by boats coming to Lake Placid. Adjust management at the village and state launches accordingly.	High	Medium	SOA, AWI, VLP, NYS DEC

Goal 2: Aquatic Invasive Species

Recommendation	Priority	Cost	Stakeholders
Continue the multiple-harvest approach for variable-leaf milfoil removal in Paradox Bay. Have an LPSOA board member or lake manager visit with divers during the harvest to assess progress and receive real-time feedback and information.	High	High	SOA, AWI, VLP, APA
Maintain a database of harvest statistics and review them at the end of each season to plan for the following year.	High	Low	SOA, AWI
Conduct a point-intercept survey every three years to objectively assess harvest success.	Medium	Medium	SOA, AWI
Conduct a rapid survey of littoral areas annually by trained staff to monitor new AIS infestations.	High	Medium	SOA, AWI
Develop an AIS rapid response plan.	Medium	Medium	SOA, VLP, TNE
Pilot a mandatory inspection and decontamination program at the village boat launch capable of informing the adoption of a similar program at the state launch.	High	Low	SOA, VLP
Reconfigure boat decontamination station to allow drive-through access to increase ease of use.	Medium	High	SOA, VLP, AWI, NYS DEC

Goal 3: Managing Recreational Use

Recommendation	Priority	Cost	Stakeholders
Develop a carrying capacity model for the lake based on a limit of acceptable change approach.	High	High	SOA, VLP, TNE, AWI, AsRA, NYS DEC, APA
Clearly define the desired and achievable resource conditions.	High	Medium	SOA, VLP, TNE, AWI, AsRA, NYS DEC, APA
Identify a set of indicators and thresholds capable of characterizing the desired conditions.	High	High	SOA, VLP, TNE, AWI, AsRA, NYS DEC, APA
Develop a system to monitor the recreational use of the lake regularly.	High	High	SOA, VLP, TNE, AWI, AsRA, NYS DEC, APA
Develop a system to study wave action on the lake, specifically as it pertains to boat safety & shoreline erosion from high displacement boats.	High	High	SOA, VLP, TNE, AWI, AsRA, NYS DEC, APA

Goal 3: Manging Recreational Use

Recommendation	Priority	Cost	Stakeholders
Conduct a review of local and state laws that govern the establishment and operation of commercial enterprises that operate on Lake Placid, including a review of regulatory gaps that may exist. Share this review with local and state government officials and stakeholders.	Medium	Medium	SOA, VLP, TNE, TSA
Develop an education and outreach plan around boater safety and invasive species spread prevention. Work in coordination with local partners to identify target audiences for distribution.	High	Medium	SOA, VLP, TNE, AWI, AsRA, NYS DEC
Continue to maintain and support a paid Lake Constable position on Lake Placid.	High	High	SOA, VLP, TNE, NYS DEC
Encourage local government and DEC to increase enforcement efforts and keep a log of enforcement activities.	High	Low	VLP, TNE, NYS DEC

Goal 4: Land Stewardship & Development

Recommendation	Priority	Cost	Stakeholders
Ensure collaboration with shore owners on changes to local laws and proposed development in the watershed.	Medium	Low	SOA, VLP, TNE, TSA
Encourage shore owners to plant and maintain vegetative buffers along the lake shore.	Medium	Low	SOA, VLP, TNE, TSA, AWI, AsRA
Continue the septic pump out program and coordinated efforts around septic inspections and maintenance.	High	Low	SOA, TNE, TSA
Develop a comprehensive database of septic system design, age, and maintenance.	Medium	Medium	SOA, TNE, TSA, AWI
Maintain local laws that support strong septic system setback and inspection requirements.	High	Low	VLP, TNE, TSA
Monitor the number and use of short-term rentals adjacent to the lake, specifically for camps that are on septic systems.	Medium	Low	SOA, VLP, TNE, TSA
Reach out to the New York State Department of Health to request Lake Placid be listed as a priority for septic improvement cost share programs.	Medium	Low	SOA, VLP, TNE, EC, NYS DOH

Goal 5: Lake Management			
Recommendation	**Priority**	**Cost**	**Stakeholders**
Hire and/or contract with a lake professional to assist with lake management decisions, maintenance of water quality and invasive species data, and respond to concerns.	High	High	SOA, VLP, TNE, AWI, AsRA
Develop a lake management dashboard to track data related to water quality, invasive species, recreational use, and lake stewardship.	High	Medium	SOA, AWI, AsRA

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