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Preliminary Biodiversity Assessment of Lakes and Wetlands in the D & H Canal Reservoir Lakes Area, Towns of Thompson and Mamakating, Sullivan County, New York

Draft Final Report

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Prepared for Jessica Lansdale and

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Abstract

At the request of the Lake Communities Alliance (LCA), Hudsonia studied the Delaware & Hudson (D & H) Canal reservoir lakes area with a focus on the lakes and wetlands. LCA is using the information from our study to inform their proposals to the towns of Thompson and Mamakating for the designation of Critical Environmental Areas to protect the water quality, recreational and scenic resources, and biodiversity of this important area. This report summarizes our findings.

Through a combination of field work and review of existing, unpublished or quasi-published information, we discovered important aspects of biodiversity in the area. There are extensive, high quality wetlands, including the east end of Wanaksink Lake, the 100 Acre Bog, Treasure Lake, and others listed in Table 1 (below). Several lakes are known to support plants that are rare statewide or regionally. The timber rattlesnake (listed as Threatened in New York) is present (3 observations). There are several rare or uncommon breeding birds, including bald eagle, osprey, and Canada warbler, as well as uncommon butterflies. Based on the habitats and the rare species just mentioned, it is likely there are many other plant and wildlife species, as well as habitats, of conservation concern that have not been surveyed for. This biodiversity depends on the extensive connected forest, wetland, and lake habitats with generally good water quality and few nonnative weeds.

Introduction

In connection with proposals for the designation of Critical Environmental Areas in the towns of Thompson and Mamakating, Hudsonia was asked by Jessica Lansdale and the Lake Communities Alliance to conduct a preliminary biodiversity assessment of a group of lakes and wetlands in the towns of Thompson and Mamakating, Sullivan County, New York. We refer to these as the Delaware and Hudson Canal Reservoir Lakes or the D & H Canal reservoir lakes (the study area). The study area spans approximately 4 miles northwest to southeast between the hamlets of Rock Hill and Yankee Lake, and includes Wanaksink Lake, Lake Louise Marie, Wolf Lake, Yankee Lake, Treasure Lake, and a number of smaller lakes, ponds, and wetlands (Table 1). CEA designation is not regulatory; it identifies landscapes of particular historic, scenic, or biological importance for consideration under existing State Environmental Quality Revew Act (SEQRA) guidelines.

The study area straddles the town line between Thompson and Mamakating. Water does not recognize political boundaries, and stewardship of the lake and wetland resources can be more effective with inter-town cooperation. This requires separate CEA proposals in each town. Our aim is to document the special biodiversity resources of the area in order to provide a factual, scientific basis for land use planning and conservation of special resources. The purpose of this assessment is to provide the local and state permitting agencies with basic information, recommendations, and guidelines for conserving, stewarding, and enhancing the habitats and biota of the site, especially species of conservation concern that may use the landscape. Information obtained in our study is being shared with the community for the purposes of land use planning and stewardship of the freshwater and related resources.

Biological diversity, or biodiversity, is the variety of life in nature from genes through species up to landscapes and regions. Most ecosystem services (the work of nature that supports human life and the quality of life) depend on biodiversity, and in turn, biodiversity support is in itself an ecosystem service. Wetlands, lakes, streams, meadows, rock ledges, and forests of all kinds are among the habitats providing

crucial biodiversity support as well as non-habitat ecosystem services that include the maintenance of air, water, and soil quality. Hence these habitats merit particularly careful consideration during the process of land use planning. The general approach of Hudsonia's biodiversity assessments was presented by Kiviat and Stevens (2001) for a nearby region. Hudsonia is a public interest, non-advocacy, nonprofit research institute and does not support or oppose land use projects; rather, we make observations, collect data, review environmental documents and scientific literature, and make recommendations for avoidance and reduction of impacts, and enhancement of wildlife, plants, and their habitats, as appropriate. The decisions are then made by the local communities. This preliminary biodiversity assessment of the D & H Canal reservoir lakes study area does not include regulatory wetland boundary delineations, analyses of water or soil, or comprehensive surveys of plant or animal species. We refer to the study area as the D & H Canal reservoir lakes area with the understanding that it covers only a selected portion of the towns of Thompson and Mamakating. This report has no regulatory significance; Hudsonia does not tell communities what to do, rather we analyze and make recommendations for stewardship of important habitats and reduction of ecological impacts to bring greater biological expertise to the planning process.

Study Area

The study area is shown on the United State Geological Survey Yankee Lake, New York, 7.5 minute topographic map sheet published in 1966. Many of the larger lakes and associated wetlands are listed in Table 1 and shown in Figure 1; there are many additional wetlands and smaller ponds in the area. Elevations of the lakes range from ca. 1337 to 1567 feet above sea level (these elevations vary slightly due to lake level regulation). In the general region, elevations greater than about 1000 feet tend to be somewhat cooler and moister than lower elevations (with the exception of extensively rocky areas, such as the Shawangunk ridge, that warm rapidly in the sun). The study area drains westward into the Neversink River and eastward into the Basher Kill and D & H Canal. Both the Neversink River and the Basher Kill are well known as superb environments for biodiversity, including rare freshwater mussels and uncommon and rare birds; these streams also have very important recreational uses that include trout fishing and bird watching. Route 17, a busy highway, bisects the study area from southeast to northwest. Distances between major lakes in the study area are about 500-5000 feet.

The study area belongs to the geological Catskill Mountains. Bedrock comprises shale, sandstone, and conglomerate in two Devonian-age formations (Fisher et al. 1970). Surficial geology is predominantly glacial till of variable composition and generally with low permeability (Cadwell et al. 1989). Limestone bedrock occurs in areas of the Rondout Valley on the west side of the Shawangunk ridge (Moxham 1972), thus it is possible that glacial drift from limestone might influence soils and groundwater locally in the study area.

The Basher Kill is a class-C stream. The Basher Kill tributary, Pine Kill, is classified C(T), and the other tributary, Willsey Brook, C. The Neversink River, at the junctions of the streams draining the western study lakes, is classified B(T). Small streams draining the western lakes are classified B. The stream classifications are from Environmental Resource Mapper (https://gisservices.dec.ny.gov/gis/erm/). "Classification B indicates a best usage for swimming and other recreation, and fishing. Classification C indicates a best usage for fishing." (T) indicates trout waters. (Definitions are from https://gisservices.dec.ny.gov/gis/erm/streamsRiversLakesPonds.html .) Given the use of the Delaware River for water supply below the confluences of the Basher Kill and Neversink River (https://4states1source.org/our-water/), we wonder why these tributaries and their subtributaries are not all classified A. Classification A should recognize *de facto* use for public or quasi-public water supply. The New York State Department of Environmental Conservation, which administers the stream classification system, can be petitioned to upgrade these stream classifications.

The Basha Kill wetland and Basher Kill stream are about 5 km southeast of Yankee Lake. The Basha Kill is one of the state's largest freshwater wetlands, dominated by large areas of "soft emergents" (i.e., broad-leaved emergent marsh plants such as pickerelweed that decompose rapidly at end of summer, in contrast to robust graminoid plants like cattails that tend to stand through winter and decompose slowly) and a very important habitat for birds and other wildlife (https://thebashakill.org/basha-kill/). Some of the water birds, dragonflies, larger mammals, and other animals almost certainly move between the Basha Kill and the D & H Canal reservoir lakes, and this kind of connectivity is common and important to the wildlife of wetlands and water bodies.

Five of the lakes were originally constructed as reservoirs and are so identified on the 1966 USGS map cited above and in Table 1. These lakes stored water used to regulate the D & H Canal. For example, Wolf Lake was created in 1840 by damming what was probably a wetland (Youngs no date). (Most artificial lakes and ponds in the Northeast were constructed in low-lying areas with wetlands.) The D & H Canal reservoir lakes no longer serve as reservoirs yet their dams are intact.

There have been several previous studies of the D & H Canal reservoir lakes, mostly focused on water quality with limited attention to aquatic plants and very minor coverage of wildlife. These sources are listed in Table 2. Water level in Lake Louise Marie, at least, is regulated and lowered a few feet episodically for aquatic plant management (Verteramo and Harman no date). Aquatic plant control by various other means may be practiced in some of the other lakes, but we have been unable to find more information. Water levels in the five dammed lakes (Table 1) are lowered in winter to protect docks from the ice (J.M. Lansdale, personal communication).

Methods

This biodiversity assessment is based on six person-days of field work by field biologists Chris Graham and Erik Kiviat; review of available documents related to local biology; examination of satellite imagery (Google Earth Pro), topographic maps, and geologic maps; and discussions with selected local residents and review of their photographs and videos of wildlife. We also searched eBird and iNaturalist for species records of interest. Our field work was restricted to certain areas where we had property access permission or views from public roads. CG and EK paddled Wanaksink Lake on 4 October. CG paddled Lake Louise Marie on 5 October, and CG reconnoitered other wetlands on foot and by car on 13 October 2023. Returning in 2024, CG explored Treasure Lake and the 100 Acre Bog on 25 August, and EK paddled the northern portions of Yankee Lake on 26 August. We were accompanied on some of these field trips by Chelsea Priest (LCA) and Meg Rumplick or Kathryn Natale (Hudsonia).

Table 1. Prominent lakes and wetlands of the study area, not all surveyed during the present study. Many smaller units are not listed or shown on Figure 1. Parentheses indicate a secondary drainage (not field-verified). Elevations are from U.S. Geological Survey topographic maps or Google Earth. Areas estimated using "Add polygon" tool in Google Earth Pro. Names in quotation marks were coined for this report.

Lake	**Elev, ft**	**Area, acres**	**Town**	**Watershed**	**Intermediate waterbody**
"100 Acre Bog" (Wolf Brook MUA[a] in part)	1585	100	Thompson	Neversink?	Various wetlands
Bass Pond	1508	27	Thompson	Neversink	Wolf L
Beaver Lake & Bowers Pond	1504	22, 8	Thompson	Neversink	Fowlwood Brook
"Conifer Swamp" N of Wanaksink L	1535	7	Thompson	Basher Kill?	South Brook Pond?
Davies L	1337	25	Thompson	Neversink	unnamed stream
Division Pond	1515?	22	Mamakating	Neversink (Basher Kill)	Wolf L
"Factory Road Lake" (south of Wolf L)	1500	84	Mamakating	Basher Kill	Pine Kill
L Louise Marie[b]	1528	222	Thompson	Neversink	Davies L
Mastens L	156	103	Mamakating	Basher Kill – D&H Canal (Neversink)	Willsey Br (Wanaksink L)
South Brook Pond	1488	77	Mamakating-Thompson	Basher Kill	South Br
Treasure L[b]	1527	47	Thompson	Neversink	Davies L
Wanaksink L[b]	1509	382	Thompson (Mamakating)	Neversink	Fowlwood Br
Wolf L[b]	1508	294	Thompson (Mamakating)	Neversink (Basher Kill)	unnamed stream (Yankee L)
Yankee L[b]	1438	406	Mamakating	Basher Kill	Pine Kill

[a] Multiple Use Area (a class of DEC-owned lands).

[b] Lakes created by damming ca. 1848-1869 to store water for D & H Canal (see Phraner [2017] for details). Mastens Lake was a natural lake and its water level was not raised although a dam was built for the canal system.

Results

Wanaksink Lake

Much of the shoreline of this lake is developed. There are extensive wetlands in the undeveloped eastern end of the lake. Blueberry Island is a rock outcrop covering about 1.25 acres and densely wooded with great rose bay (*Rhododendron maximum*) thickets beneath American beech, white oak, black birch, sassafras, and other trees, and with exposed bedrock around the shoreline. Although boaters visit the island, there was relatively little litter or vegetation damage when we explored. Wanaksink Lake is labelled "Lords Reservoir" on Fisher et al. 1970.

The October 2016 satellite image on Google Earth shows the wetlands clearly. There are two, more-or-less connected wetlands- the northern one in the east end of the lake-proper, the southern one to the south in a cove off the lake-proper. The south wetland contains part of Fowlwood Brook, the lower reaches of which leave the other end of Wanaksink Lake via the dam spillway. The outer (western) portions of the north wetland contain extensive cattail (*Typha*) marsh (Figure 3) laced with small pools and channels that were navigable by canoe when we visited. The marsh transitions eastward (landward) into an open, floating bog mat with vegetation typical of an acidic bog that includes low shrubs, herbs, and sphagnum (peat) mosses (Figure 2). Moving farther eastward, the open bog is gradually tree-covered. The south wetland has a shallow, open, stony area in its mouth, with abandoned beaver dams, adjoining the lake-proper. Moving upstream (southwest), there is extensive shrub swamp in the middle area of the wetland, and trees (red maple, spruce, balsam fir) dominating the inland (western, upstream) area. There are great rose bay thickets in the woods on and near the undeveloped shorelines (Figure 4).

Table 2. Previous studies (written reports) of the D & H Canal reservoir lakes reviewed for the current report. Full references are in References Cited (below).

Author	Year	Locality	Subject
AES	2015	Yankee Lake	Mammals, birds, reptiles, amphibians
Koch, G.	1979	Yankee Lake	Dam condition
Naczi, R.	2013	Yankee Lake	Plants
Naczi, R.	2021	Yankee Lake	Plants
Prentis, C.	2019	Wolf Lake	Forestry plan, includes stand descriptions
Shaw, W.H.	?	Wolf Lake	Water quality, phytoplankton, plants
Shaw, W.H.	1983	Wolf Lake	Water quality, management
Verteramo, M.	?	Louise Marie, Treasure, Davies lakes	Water quality, plants, management
Weller, M.	2023	Wolf, Bass, Division lakes	Water quality, plants, sediments
Youngs, W.D.	?	Wolf Lake	Water quality, fish

Beaver Lake and Bowers Pond

No information is available on these small lakes.

Lake Louise Marie

Lake Louise-Marie has a dam at the northwest corner and very little wetland, and the shoreline is almost all developed. The only substantial section of undeveloped shoreline was a ca. 300 foot stretch on the western shore, just south of Scarborough Circle, that fronts a roughly 2-acre swamp. A mysterious mass,

apparently a floating island of about 2.2 acres, is in the cove between Timber Point Road and Lake Shore Drive East. This island comes and goes in the historic satellite images on Google Earth; in the October 2016 image it appears to be a well-developed floating mat, whereas in some other images it looks like there are just water-lilies or only open water. No island was present in October 2023 when we paddled Louise Marie. Floating peat masses are common in organic-soil wetlands that have been flooded by damming; such masses may float and sink seasonally or in other patterns. Lake Louise Marie is labelled "Mckee Reservoir" on Fisher et al. (1970). The biota of the floating mat should be surveyed after the mat has been at the surface through most of a growing season; such "peat rafts" (Kiviat et al. 2019) can support rare plants as well as providing resting spots for turtles, shorebirds, and other wildlife.

Wolf Lake, Bass Pond, and Division Pond

These three lakes are interconnected. Wolf Lake has little wetland. In 1983, Shaw (no date) noted a "floating island" in the west end; likely this was a peat mass mobilized from the sediments of the former wetland that was impounded to create the lake. The floating island may be the small mass labeled "Baron's Island" on Google Earth. Google Earth images of the last several years consistently show a small island in this area but it is unclear whether this is a rock outcrop or floating peat. Wolf Lake was ranked as "Threatened" on the basis of water quality (Kwiatkowskii et al. 2017). The lake is labelled "Wolf Reservoir" on the Fisher et al. (1970) bedrock map.

Bass Pond is undeveloped. Off the north end is a roughly 40-acre conifer (likely hemlock) swamp. An October 2016 image of the pond on Google Earth shows extensive beds, especially northward, of what appear to be floating-leaved plants, probably water-lilies and watershield as reported by Weller (2023). A treatment that decomposes sediment organic matter to make the bottom less mucky has recently been applied in portions of Wolf Lake and Bass Pond (Weller 2023). Rare plants were reported in Bass Pond (Weller 2023).

Division Pond is also undeveloped and supports rare plants (*ibid.*). We did not have access to these thee interconnected
lakes.

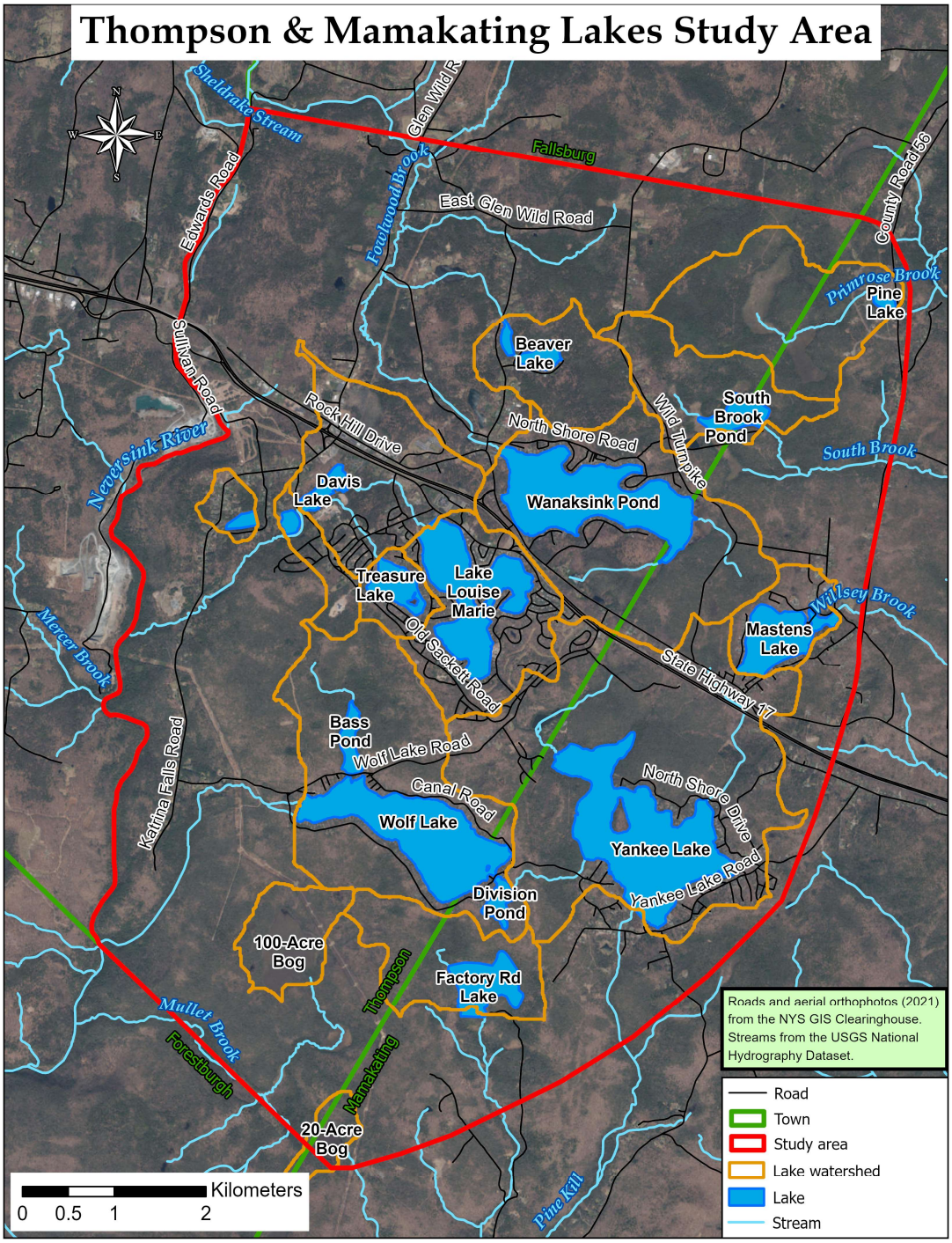

Figure 1. Study area and vicinity, showing prominent lakes, wetlands, and their watersheds. Many additional wetlands and lakes (ponds), and probably many vernal pools, are not shown. The study area boundary is somewhat arbitrary; we have tried to identify those water bodies and wetlands that are near each other and have special biodiversity values. 2 km = 1.25 miles.

Figure 2. Bog portion of the Wanaksink Lake wetland (left) and cranberry (*Vaccinium*) in the bog (right).

Figure 3. A portion of the "open" (sparse) cattail marsh in the east end of Wanaksink Lake. This is potential habitat for marsh birds (rails, common gallinule, bitterns, pied-billed grebe, marsh wren) as well as several species of dabbling ducks (e.g., American black duck, blue-winged teal) and other waterbirds.

Figure 4. Coauthor Chris Graham in great rose bay thicket in the edge of the Wanaksink wetland. Shrub thickets are important habitat for birds and other wildlife, and the wildlife use of the study area's rose bay thickets is poorly known.

Treasure Lake

Treasure Lake is one of the smaller study area lakes, located about 500 feet southwest of Lake Louise Marie. The shape of the lake and its wetland components, along with information in Verteramo and Harman (no date), indicated this is a circumneutral bog lake (see generalized descriptions of this habitat complex in Kiviat and Stevens [2001] and a specific example in Kiviat et al. [2019]). This type of lake is characterized by the presence of floating or quaking peat mats supporting wetland vegetation, an underlying peat deposit (composed of partly decomposed organic matter from plants) that is soft and unconsolidated at its surface, near-neutral pH of the central open water, groundwater discharge from the edges with a shallow, sparsely vegetated moat, and other distinctive features (some of these features may be absent in a particular lake). Our reconnaissance of Treasure Lake and information in Verteramo and Harman confirmed this habitat complex. The maximum depth in open water (possibly including some unconsolidated peat?) was 18 feet in 2015. Open water pH ranged from 6.4 to 8.2, with the lower (more acidic) values at depth and higher values near surface (*ibid.*; the highest value may have been increased by algal photosynthesis). Plants that were common in Treasure Lake include leatherleaf, (*Chamaedaphne calyculata*), black huckleberry (*Gaylussacia baccata*), steeplebush (*Spiraea tomentosa*), sheep laurel (*Kalmia angustifolia*), cranberry (*Vaccinium*) (shrubs), white beak-rush (*Rhynchospora alba*), broad-leaved arrowhead (*Sagittaria latifolia*), sundew (*Drosera*), and royal fern (*Osmunda regalis*) (herbs). Plants that are uncommon or rare in the region were pitcher plant (*Sarracenia purpurea*), yellow-eyed grass (*Xyris*), and water bulrush (*Schoenoplectus subterminalis*). The floating mat flora suggests acidic (bog-like) conditions, suggesting the plants are rooted above the circumneutral lake water level.

An owner recently lowered the lake level, which may encourage invasive plants to spread in the lake. A small infestation of water-chestnut (*Trapa natans*), perhaps 40-50 m^2, should be removed by repeated hand-pulling which could take several years (water-chestnut can be hand-pulled, with disposal distant

from water, each summer in late June or July – although an annual plant seeds can remain viable on the bottom for several years) (Kiviat 2008). There is also a localized occurrence of common reed (*Phragmites australis,* almost certainly the nonnative subspecies), that should be identified. Raising the water level to that previous to lowering will help contain the reedbed. More concerning is a proposal for deforestation and residential development that would almost certainly reduce lake quality and exacerbate weed colonization as a result of siltation and nutrient increase in runoff from cleared areas. Treasure Lake is important for birdwatching and fishing (*ibid.*) as well as rare plants and a rare habitat, and has a shoreline that is about half occupied by residential development.

Yankee Lake

This is a large, irregularly shaped lake with developed and undeveloped shorelines. Information about Yankee Lake is in the flora surveys conducted by Naczi (2013, 2021) and the brief wildlife survey by AES (2015), as well as some eBird lists. Naczi found several rare plants and indicators of low-nutrient aquatic habitats in the northern end of the lake (the "Whale's Tail"). Low-nutrient (oligotrophic or near) aquatic habitats are increasingly scarce in our region. We do not know if similar conditions pertain elsewhere in the lake. There is a stand of nonnative common reed (*Phragmites australis* subspecies *australis*) in the northern edge of the Whale's Tail that is associated with a small tributary from a private estate to the north that shows on Google Earth as a highly altered and developed small lake (10 acres) and homestead; this area likely contributed silt and nutrients thus facilitating the establishment and spread of the reedbed.

Numerous large tree stumps and logs, evidently remnants of the forest prior to damming, project from the water (1-2 feet above the reportedly high water level at the time of reconnaissance; Figure 5). Mosses, lichens, and small vascular plants grow on top of many of the stumps and logs; we noted marsh St.-John's wort (*Triadenum*), northern St.-John's wort (*Hypericum boreale*), bulblet water-hemlock (*Cicuta bulbifera*), water-horehound (*Lycopus*), mad-dog skullcap (*Scutellaria lateriflora*), marsh skullcap (*Scutellaria galericulata*), leatherleaf, steeplebush, meadowsweet (*Spiraea alba*), and a pixie lichen (*Cladonia*). Although the plants we identified during our reconnaissance were common species, there is potential for rare plants or lichens on this microhabitat. The likely isolation from herbivores and some competitors may favor species that would not thrive in the midst of better-developed and more extensive vegetation.

The large island is upland (i.e., not wetland, except for a few-yard-wide belt around the shoreline) and is well-wooded with hardwood forest and, in the north and west, conifer-dominated areas. There appears to be little pedestrian use of the island which may favor treading-sensitive forest plants. Yankee Lake is labelled "Yankee Reservoir" on the state bedrock geology map (Fisher et al. 1970).

Figure 5. Emergent tree stump with plants, Yankee Lake.

Several eBird observation lists from Yankee Lake have been posted by S. Roberts. Bald eagle observations on multiple dates in June 2024 (https://ebird.org/tripreport/250159 , https://ebird.org/tripreport/252687 , https://ebird.org/tripreport/266040) suggest nesting nearby, and an observation of an empty nest, potentially after use in the 2024 breeding season, was also posted (https://ebird.org/checklist/S190769315). Red-shouldered hawk (listed as Special Concern in New York) was recorded (https://ebird.org/checklist/S190769315). Also notable are numerous observations of ruby-throated hummingbird 9-12 August 2024 (https://ebird.org/checklist/S190769315). The last may indicate rich food sources such as orange jewelweed flowers in addition to the feeders documented on eBird – hummingbirds at this season are commonly feeding to lay down fat for their September migration.

Mastens Lake

No biological information is available for this water body. It is labelled "Masteng Lake," possibly a typographic error, in Moxham (1972).

"100 Acre Bog"

This wetland apparently lacks a map name, and we call it "100 Acre Bog" because of its size. It is a large wetland lacking open water. The vegetation has a distinctly acidic, northern "flavor" and appears similar to the floating bog portion of the Wanaksink Lake wetlands but less diverse, with leatherleaf, highbush blueberry (*Vaccinium corymbosum*), sheep laurel, swamp azalea (*Rhododendron viscosum*), three-way sedge (*Dulichium arundinaceum*), true sedges (*Carex* spp.), and a quaking sphagnum moss mat. Uncommon or regionally-rare plants include calla lily (*Calla palustris*) and pitcher plant. The 100 Acre Bog is surrounded by oak forest with dense mountain-laurel (*Kalmia latifolia*) or rhododendron, and there is no shoreline development visible. We expect this wetland, with its great extent and distinctive habitat, to be an important plant locality, and it may have unusual breeding birds, insects, and other species of conservation concern.

The State Department of Environmental Conservation (DEC), which owns and manages the Wolf Brook MUA, in general promotes logging mature forest to create shrubland. This would be inappropriate at Wolf Brook where the integrity of the surrounding forest is important to wetland quality and wildlife; shrubland habitat can be created and maintained in other ways such as by managing abandoned farmland or derelict mining sites (Kiviat 2016).

"Factory Road Lake"

This small lake at the end of Factory Road and south of Wolf Lake, based on satellite imagery, is a bog lake with floating vegetation mats and in the eastern portion tree-dominated wetland. No biological information is available. Given the floristic richness and potential habitat for rare plants and animals at Treasure Lake, also a bog lake, Factory Road Lake bears investigation.

"Conifer Swamp"

North of Wanaksink Lake is a large highbush blueberry bog thicket. This is an approximately quarter-mile long swamp oriented northeast-southwest supporting extensive thickets of highbush blueberry with swamp azalea, mountain-laurel, mountain-holly (*Nemopanthus mucronata*), occasional white pine and red maple, and extensive quaking sphagnum moss carpet. The bog thicket also has a peripheral belt of hemlock-pine-hardwood swamp..

Other Wetlands

There are numerous other wetlands and vernal pools in the study area that are important for biodiversity and have a high potential to support rare species of plants and animals. This includes small wetlands and temporary pools (e.g., < 0.1 acre) which can support large populations of woodland-pool-breeding amphibians and diverse aquatic invertebrates.

Review of Biotic Records

We examined available biological information relevant to the D & H Canal reservoir lakes area.

Timber Rattlesnake

This species is listed as Threatened in New York. Two late-summer rattlesnake observations were recorded in 2013 (AES 2015). One adult was observed at a rock ledge between Yankee Lake and Wolf Lake. The other was a dead individual on Pine Hill Rd south of Yankee Lake. A 19-second video, shot by Jessica Moore Lansdale on 4 July 2023, clearly shows a black-phase adult timber rattlesnake and a road sign on Yankee Lake Road quite close to Wolf Lake (see Lansdale 2023).

Generally, timber rattlesnakes in the Northeast need extensive woodland, deep crevices in the ground or in rock ledges where the snakes can stay moist and keep from freezing in winter, sun-exposed rocky areas near the winter dens where snakes can bask before and after overwintering and gravid females can spend time prior to parturition, and freedom from road mortality, collection, and vandalism killing (Shaw 2019). While we expect timber rattlesnakes to be widespread in the study area, as a longer term goal identifying the den areas and basking rocks habitat would help protect this species. However, once these habitats are found the locations should be kept confidential, if possible, so as not to encourage illegal collection of snakes.

Bald Eagle

Bald eagles are now widespread around Sullivan County lakes (Haas 2019), but their ecology and conservation still require careful attention. Bald eagle was observed fishing and perching at Yankee Lake in September 2013 (Naczi 2013). Bald eagles have been observed and photographed at Lake Louise Marie as recently as 2023. There are reported to be a nest at the Neversink River as well as one north of

Wanaksink Lake (J.H. Haas, personal communication; J.M. Lansdale, personal communication). A nest has been reported near Yankee Lake (see above). Although it is well established that bald eagles use the lakes, it has not been documented whether the eagles favor particular trees for roosts or foraging perches, or if there are areas of the lakes, for example near inlets or outlets, or just below spillways, where open water persists during the ice season and the birds can find dead or injured fish. There could also be unreported nests.

Metabolic energy balance is critical for bald eagles in winter; thus the locations and morning sun exposure of winter roost trees, and the ease of foraging, are important and should be protected from human disturbance. In the Chesapeake Bay, bald eagles used undeveloped shorelines more than developed shorelines for roosting and foraging (Buehler 1990). The eagles avoided pedestrian use within 500 meters (1640 feet), and built areas within 100 m (328 feet) (*ibid.*). Other eagle studies have also found avoidance of human activity at various scales. This information suggests that undeveloped shorelines, such as those at, e.g., the east end of Wanaksink Lake and at Bass Pond and Division Pond, may be more valuable to eagles, especially in winter, than shorelines with numerous residences.

The federal Bald and Golden Eagle Protection Act protects eagles from various human actions including disturbance near active nests. Management guidelines promulgated by the U.S. Fish and Wildlife Service (USFWS 2007), and adopted by the DEC, urge buffers zones of particular widths (generally 100-200 meters, ca. 330-660 feet) between various human activities and bald eagle activities. Different eagle pairs have different degrees of sensitivity to visual disturbance and noise.

Osprey

This fish-eating raptor is listed Special Concern in New York. Ospreys have nested at the electric transmission corridor near Wolf Lake for about the last five years (J.H. Haas, personal communication). The species presumably forages in the lakes and larger streams. Ospreys, like bald eagles, may have nest trees, roosts, feeding perches, and other habitat features that should be protected from disturbance.

Other Birds

The study area in general has high bird diversity including uncommon species (J.H. Haas, personal communication). The Canada warbler (High Priority SGCN) occurs in the area, especially in association with great rose bay thickets (*ibid.*). The bird fauna of rose bay thickets is not well known and may include other rarities or declining species such as American woodcock (SGCN). The hooded warbler, an uncommon species, is often associated with mountain-laurel thickets (*ibid.*). We expect use of open marshes, such as the cattail marsh in Wanaksink Lake (see above), by marsh birds such as marsh wren (uncommon and declining in New York), Virginia rail (uncommon), common gallinule (regionally-rare and probably declining), and pied-billed grebe (New York Threatened). The low-shrub bog thickets could also support rare birds, possibly including sedge wren (High Priority SGCN) and Nashville warbler.

Fish

In 1971, Wolf Lake supported a popular largemouth bass fishery despite apparently poor reproduction of this species (Youngs no date). Treasure Lake, Davies Lake, and perhaps Lake Louise Marie support a largemouth bass fishery (Verteramo and Harman no date). Largemouth bass does well in weedy, shallow, mesotrophic and eutrophic waters. Other fishes recorded for the lakes are common warmwater species. It is not known if any rare fish species occurs in the study area, such as in the bog lake habitats.

Butterflies

The study area supports certain uncommon, perhaps regionally-rare, butterfly species. These include banded hairstreak at Yankee Lake, striped hairstreak at the Marcy South electric transmission corridor near Wolf Lake, and hoary edge near Mastens Lake (J.H. Haas, personal communication). The transmission corridor likely serves as habitat and dispersal pathway for many butterflies of non-forested habitats.

Rare Plants

Rare plants have been reported in Bass Lake, Division Lake, Wolf Lake, Treasure Lake, Davies Lake, and Yankee Lake. A large population of *Potamogeton diversifolius,* an S1-Endangered species in New York, was reported in Bass Lake, Division Pond, and Wolf Lake, but is rare in Wolf Lake, which has a fully developed shoreline, compared to the other two lakes, which are undeveloped. *Potamogeton bicupulatus* is an uncommon, northeastern segregate of *P. diversifolius* (FNA, no date); this taxon, reported from Yankee Lake (Naczi 2021) may be the same taxon as *P. diversifolius* in Bass-Wolf-Division lakes (Weller 2023). Populations of *Utricularia radiata*, S2-Threatened, were reported in Bass Lake (Weller 2023) and Yankee Lake (Naczi 2021). Spiny hornwort (spiny coontail, *Ceratophyllum echinatum*), uncommon and possibly regionally-rare, was reported from Davies Lake (Verteramo and Harman no date), and we found this species in Wanaksink Lake. Current status of rare plants in New York is from Ring (2023); statewide, each plant species is ranked from S1 (rarest) to S5 (most frequent).

The SOLitude report on Wolf, Bass, and Division lakes (Weller 2023) and the report about Louise Marie, Treasure, and Davies lakes (Verteramo and Harman no date) omit discussion of the status or conservation of rare plants. Given extant data on the plants of several lakes, and our own observations in several of the lakes, the whole D & H Canal reservoir lakes study area is important for conservation of rare plants as well as the relatively low-nutrient habitats that support many of them. Naczi (2013, 2021) emphasized that several plant species found in Yankee Lake indicate low nutrient levels and good water quality; some of these species have been reported from other lakes of the study area. Naczi's surveys were conducted in the undeveloped northern end of Yankee (the "Whale Tail"). The "high-quality" plants, or plants indicating a high-quality habitat, with good water quality and low nutrient levels, found in Yankee Lake were lesser waterwort *(Elatine minima), s*piny-spored quillwort *(Isoetes echinospora),* low watermilfoil *(Myriophyllum humile),* rose pogonia *(Pogonia ophioglossoides),* snailseed pondweed *(Potamogeton bicupulatus),* northern snailseed pondweed *(Potamogeton spirillus),* floating burreed *(Sparganium fluctuans),* and little floating bladderwort *(Utricularia radiata).* Low watermilfoil was also reported in Treasure Lake (Verteramo and Harman no date). Floating burreed was reported in Wolf Lake and Division Pond (Weller 2023), and we identified it in the east end of Wanaksink Lake. "*Elatine* sp." was reported from Treasure Lake (Verteramo and Harman no date), and was likely *E. minima*.

Water Quality

Land use impacts on lake and wetland water quality, including through the medium of nutrient enrichment, are well known (e.g., Trebitz and Herlihy 2023). **"**pH, conductivity, nitrogen and coverage of aquatic plants has increased in Wolf Lake since the late 1980s, suggesting the lake is no longer weakly acidic. It is not known if the change in nitrogen and plant coverage is related to the other water quality changes. None of the other CSLAP indicators has exhibited any significant changes over this period." (Kwiatkowskii et al. 2017). This change may be due to the degradation of peat soil and plant materials following damming and flooding of a wetland, as well as input of plant nutrients (especially nitrogen and phosphorus) from shoreline development. The treatment to decompose organic sediments may also be contributing to an increased nutrient level.

SOLitude (Weller 2023) did not address the trophic status of Wolf Lake. Certain of the plants reported suggest that the lake is still relatively infertile which is an increasingly unusual condition of surface waters in our region and worthy of conservation attention in and of itself. The CSLAP report (Kwiatkowskii et al. 2017), using multiple indicators, however, suggests that Wolf Lake is mesotrophic (medium nutrient levels) approaching eutrophic (high nutrient levels). Nutrient loading as a consequence of shoreline and watershed development is a well known phenomenon in northeastern lakes, and oligotrophic lakes, ponds, and wetlands are becoming increasingly uncommon due to nutrient inputs from agriculture, livestock, construction, lawn maintenance, sewage treatment, and atmospheric deposition.

At the time of our paddling reconnaissance of Wanaksink Lake, the open shallow water was clear enough to afford good views of the stony bottom in several feet of water (e.g., near Blueberry Island). We saw sparse growths of submergent vascular plants and sparse benthic filamentous algae. The algal growth suggested mesotrophic (medium nutrient level) conditions, although we hesitate to be definitive based on this one visual indicator.

Some general recommendations for protecting water quality in residential lakes include avoiding fertilizer and pesticide (herbicides, insecticides, fungicides) use near the water, planting or leaving more vegetation mass between the water and lawns or ornamental plant beds, keeping organic wastes (tree leaves, lawn clippings, shrub prunings, garden waste, compost) away from the water or locations where runoff can easily carry nutrients to the water, parking vehicles away from the shoreline, keeping pet waste away from the water, and situating barbecues and fire rings away from shorelines. Other practices to reduce impacts on wildlife are avoiding the use of rodenticides (especially outdoors), minimizing use of outdoor lighting and using lamp types that attract night-flying insects less, and reducing outdoor noise. Dead trees and dead branches, standing or downed, should be left as-is except where they may threaten a structure, path, or parking area. Organic wastes and dead wood can be built into brush piles, away from lake and structures, for wildlife shelter. House cats should be kept indoors and dogs leashed or fenced when outdoors; pets should be fed indoors.

Wildlife Habitat

Habitat can be generalized (e.g., “low nutrient lake” or “conifer swamp”), or specific to a particular species or group of organisms (e.g., “potential spotted turtle habitat”). Bird observations (eBird 2024), and the plants reported, suggest good quality habitat for waterfowl. Nine species of migrant ducks have been observed in spring and fall on Wanaksink Lake, some in large numbers, as well as two grebes and one loon species, all three uncommon to rare migrants in our region (eBird 2024). Diverse migrant waterfowl have also been observed on Wolf Lake (J.M. Lansdale, personal communication).

The great rose bay thickets around undeveloped shorelines and on Blueberry Island (Wanaksink Lake) could support uncommon or rare breeding birds, small mammals, or insects. Conifer stands in some of the wetlands (e.g., “Conifer Swamp” north of Wanaksink Lake) could support uncommon or rare northerly-ranging songbirds such as alder flycatcher, northern waterthrush, Nashville warbler, and Canada warbler.

Wetlands in the east end of Wanaksink Lake and the 100 Acre Bog have enough cranberry (*Vaccinium* sp.) to serve as host for the regionally-rare bog copper butterfly. Other rare invertebrates, such as certain dragonflies and moths, could also occur in the wetlands. The cattail marshes are potential habitat for pied-billed grebe (New York Threatened), common gallinule, Virginia rail, and marsh wren – all uncommon to rare in the region. The waterbird species on the Wanaksink bird list (eBird 2024) suggest that open water habitats, with diving birds (diving ducks, etc.), have been the focus of birdwatching, and that the wetlands

have been overlooked, perhaps because they are difficult of access. Thus there may be undocumented rarities there.

There are intermittent woodland pools (vernal pools; see Kiviat and Stevens 2001) in the study area. We expect many of these pools to support pool-dependent amphibians. The most common and widespread such species are wood frog and spotted salamander. Uncommon species that could occur are marbled salamander, Jefferson salamander, blue-spotted salamander, and four-toed salamander. Marbled (Species of Special Concern), blue-spotted, and four-toed salamanders are all Species of Greatest Conservation Need in New York.

We observed two river otters in one of the lakes, and otters have been observed in the lakes by local residents. River otters maintain large home ranges, and individuals are likely to use large groups of lakes and streams in the study area. The number, proximity, and size of the lakes, along with their varied open water and wetland habitats, suggest a habitat complex favorable for many of the more mobile amphibious wildlife species.

Lichens

Although we were unable to survey lichens, an important element of biodiversity, photographs and a video by Jessica Lansdale (personal communication) show abundant, large rock tripes on boulders near Wolf Lake (Figure 6). Rock tripes, including *Umbilicaria* and related genera, only thrive where air quality is good (especially where sulfur dioxide levels are low) and there is no physical disturbance from climbing or other activities. The beauty of rock tripes, and their decline in nearby areas, have been described eloquently by Smiley and George (1974) and Kimmerer (2020).

Figure 6. Rock tripe lichens near Wolf Lake. Photo by Jessica Moore Lansdale, 2023.

Discussion

The D & H Canal reservoir lakes study area stands out for the lake and wetland habitats and the biodiversity they support, including a number of rare plants and wildlife. This area may be unusual overall although comparative information about the biology of other areas in Sullivan County is sparse (with the exception of the Basha Kill and Neversink River, well known for rare species). Even if not unique, the environments of the study area are important and merit special attention to biodiversity and its conservation. Undeveloped lake shores and islands, low-nutrient habitats, and wetlands surrounded by forest or thickets, among other habitats,, are critical for the maintenance of rare wildlife and plants, and other biodiversity (such as lichens and mosses).

Water Quality

Protection of water quality, and specifically reducing excessive inputs of plant nutrients (especially nitrogen and phosphorus) and soil particles (frequently called "silt" although typically a mixture of silt, clay, and sand is involved), are paramount in maintaining the water supply, aesthetic, and recreation values of surface waters as well as their support of biodiversity. As a result of human activities, both locally via stormwater runoff and globally via atmospheric deposition, many surface waters in New York have undergone *cultural eutrophication* –nutrient enrichment or fertilization. In general, the D & H Canal reservoir lakes have maintained relatively low nutrient levels, although in some cases nutrients may be approaching undesirable levels. Because many plants and animals are adapted to low nutrient levels (see Yankee Lake, above), many species will become very rare or disappear if lakes and other waters become too enriched.

The treatment to break down sediment organic matter in Wolf Lake and Bass Lake (Weller 2023), using "MD Pellets" and "MuckBiotics," may be releasing plant nutrients into the water column, which would be detrimental to overall water quality. Information on the manufacturer Web site asserts both sediment organic matter decomposition and nutrient level reduction which seems contradictory, and we can find no independent scientific information about these products or their mode of action. Moreover, we question the necessity of reducing organic sediments, with the exception of improving the shallow ends of swimming areas. The only research we can find on this sediment treatment (Lee et al. 2019) was conducted by the manufacturer and by lake management companies, not by independent scientists. Even this research, in a laboratory study, shows short-term pulses of nitrogen compounds following application of the materials (MD Pellets and MuckBiotics), and the manufacturer's Safety Data Sheet for MuckBiotics does not reveal the chemical or microbiological ingredients. Sediment organic matter stores carbon, thus mitigates anthropogenic climate change, as well as being at the base of the food web that supports biodiversity.

Effluent from the community sewage treatment plant serving the Lake Louise Marie residences is discharged to Davies Lake, reportedly increasing vascular vegetation and the development of algal mats in the receiving water (Verteramo and Harman no date). Water is withdrawn from Louise Marie and treated for drinking.

Removal of part of the bog mat vegetation has been suggested for recreation access to Treasure Lake (Verteramo and Harman no date). We strongly recommend that wetland vegetation or sediment removal in Treasure Lake, or any lake or wetland, if it is necessary at all, be strictly limited to creation or maintenance of narrow boating channels which can also serve for angling. Contrary to statements in the report (*ibid.*), dense submergent and floating-leaved vegetation *per se* is not adverse to fish; water quality is usually more important, and the data in Verteramo and Harman (no date) suggest good water quality in

the lake. It should also be noted that removal of vegetation or sediment from lakes or wetlands typically requires permits.

Water management and land use impacts on water quality in the Basher Kill are already a concern (https://www.delawareriverkeeper.org/sites/default/files/apr%2010%20hearing%20action%20alert.pdf , https://thebashakill.org/wp-content/uploads/2017/03/BKAA-History-40-Years.pdf). The increase in impervious surfaces (e.g., roofs, parking lots, driveways), and water pollution (silt, nutrients, petroleum hydrocarbons, etc.) from construction sites, are among the water quality impacts associated with land use change.

Rare Plants

The occurrence, and possibly restriction, as far as is known, of rare plants to the portions of the lakes that have undeveloped shorelines suggests that residential shoreline development kills these species or degrades their habitat. This effect is likely due to physical alteration of soils as well as sediment and nutrient pollution in stormwater runoff and shallow groundwater. Therefore, protection of currently undeveloped shorelines may be important for conservation of biodiversity. Other undeveloped shorelines and water bodies should undergo detailed surveys of flora and certain animal groups. Development of lake shorelines with buildings and docks is a well known cause of reduction in aquatic plant diversity (e.g., Beck et al. 2013).

Great Rose Bay

We found the great rose bay (great laurel or rhododendron) thickets striking and potentially important for biodiversity. In a Maryland study area, bird abundance and species richness (population density and number of species) were greatest in streamside great rose bay – hemlock vegetation compared to areas lacking rose bay (Gates and Giffen 1991). In the southern Appalachians, great rose bay was considered a *foundation species* with a large influence on ecological processes (Dudley et al. 2020). We recommend that the rose bay thickets at Wanaksink Lake, Yankee Lake, and elsewhere in the study area be surveyed for breeding birds, small mammals, moths and certain other insects, mosses, and lichens. Similar abundance of great rose bay is believed not widespread in Sullivan County (J.H. Haas, personal communication).

Forestry

The forestry report for the Wolf Lake Inc. lands (Prentis and Creagan 2019) assumes certain wildlife habitat goals. Different forest management regimes produce different habitats for different wildlife species. The kind of forestry recommended (which is essentially commercial forestry, rather than conservation management) is problematic. Apart from affecting the habitats and biodiversity in the forests themselves, the active management recommended in the plan, especially logging and even trying to inhibit the mountain-laurel (*ibid.*), would likely produce a lot of silt- and nutrient-laden runoff to the lakes, exacerbating the existing problems with water quality, weed vegetation, and biodiversity loss. The rationale for forest management is creating young forest habitat for wildlife. Kiviat (2016) reviewed the issues associated with clear-cutting mature forest to create young forest and suggested an alternative to address this habitat goal. If protection of lake and wetland quality (and of the Neversink River and the Basher Kill) are paramount, commercial timber or pulp harvest, or any large-scale forestry management, must be assessed carefully to minimize adverse impacts to habitats and species. Mature and old growth forests, in many cases, continue to sequester and store large amounts of carbon (Keeton 2018), which is important for mitigating climate change, as well as supporting species of wildlife and plants not found in other habitats. We suggest that allowing forests to reach ages of 100-plus years with minimal or no

harvest would provide carbon storage service as well as supporting wildlife that would not thrive in younger forests.

Critical Environmental Areas

Critical Environmental Areas (CEAs) would be designated by town agencies under the State Environmental Quality Review Act. A CEA has no regulatory effect and does not *per se* create any constraints on land use. The Lead Agency (usually the Town Planning Board) would review a land use proposal more carefully if the proposal is located in a CEA. Hudsonia recommends CEA designations for this study area (portions in both towns) because of its exceptional biodiversity, good water quality, influences on downstream water courses, recreational importance, and historic significance. The Lake Communities Alliance is nominating CEAs in both towns (Thompson and Mamakating).

Given the sensitivity of lakes, streams, and wetlands to shoreline development and other land use impacts (e.g., Soranno et al. 2015), it would make environmental sense to scrutinize new land use proposals on a larger scale, i.e., the cumulative impact of multiple land use projects on water quality and biodiversity. SEQRA requires cumulative impact analysis in connection with a permit application as long as the claim of cumulative impact is reasonably documented (Thornton 1991). A watershed is one useful basis for cumulative impact analysis inasmuch as activities in a watershed combine to influence downstream waters. The small watersheds of the individual study area lakes are shown in Figure 1, and the study area overall is within the watersheds of the Basher Kill and Neversink River.

Invasive Aquatic Plants

The lake associations should continue their rules regarding cleaning boats to reduce the likelihood of accidental introductions of aquatic weeds. In 2017, Kwiatkowskii et al. stated there were no "aquatic invasive plants" in Wolf Lake or other nearby lakes. Common reed, presumed to be the nonnative Old World subspecies (*Phragmites australis* ssp. *australis*), is present in small areas of Yankee Lake and Treasure Lake, where there is concern about spread and degradation of habitat for other plants (Verteramo and Harman no date, Naczi 2021). The reedbed at Yankee Lake is associated with an influent from an up-stream developed area (*ibid.*). Water-chestnut (*Trapa natans*) is present in a small area of Treasure Lake and should be controlled by hand-pulling annually in late June or July, with disposal of harvested material upland distant from surface waters.

Flora

None of the existing information about the D & H Canal reservoir lakes study area includes a comprehensive flora survey. Spotty information is available, in the reports cited (Table 2), about submergent and floating-leaved plants in a few of the lakes, but practically nothing on emergent plants. Likewise, except for the tree data in the forestry report for the Wolf Lake area, there has been no survey of terrestrial (upland) flora. Because rare plants have been reported in a few of the lakes and wetlands, mostly without specimen documentation, there is an urgent need to conduct a thorough survey of the flora in and around the lakes. Management techniques, including chemical herbicides, weed harvesting, and hydro-raking, should not be considered until there is a better understanding of both rare native plants and weedy native or nonnative species.

Wetland Extent

The artificial (i.e., dammed) lakes were mostly or all constructed on former wetlands. This was and is common practice in the Northeast, because damming wetlands usually requires little excavation, and

water is available. Many lakes in the region were created this way, resulting in a large loss of wetland. As a result of damming, as well as drainage and filling of wetlands, at least half of New York's former wetland acreage has been lost. This has compromised the ecosystem services provided by wetlands, including (depending on the local characteristics) water storage and regulation of downstream flow, maintenance and improvement of water quality, evapotranspiration that cools the local environment, carbon sequestration and storage, and biodiversity support which includes habitat for large numbers of plant and animal species. These services are provided by all sizes of wetlands, down to seasonal pools covering only a few square yards, although a particular wetland may not provide all the services of wetlands collectively. Given the general loss of wetlands in the region, whether or not each lake was created on preexisting wetland, protecting existing wetlands has great importance: hence our focus, in part, on the functions and values of the wetlands in the study area.

Trails

Currently there are few foot trails in the study area. If new trails are planned, they should generally not follow shorelines, because those are hotspots of biological activity. A trail can end at (or have a spur that reaches) the shoreline, with an observation platform or blind in one spot, leaving the rest of the shoreline undisturbed. There are too many social trails on Blueberry Island (Wanaksink Lake); half of them could be blocked off to help protect the vegetation and soil.

Other Threats

The most important threat to biodiversity, as well as human use and enjoyment, of the lakes and wetlands is degradation of water quality from influences in the rather small watersheds (Figure 1). Any activities that result in increases in suspended sediments and plant nutrients (especially nitrogen and phosphorus) in the streams, wetlands, and lakes would be deleterious to habitat quality and aesthetics. Increase of impervious surfaces (roofs, roads, etc.) is a potential threat by increasing stormwater runoff and reducing the function of soils and vegetation in physically and chemically filtering stormwater.

Clearing, or even selective logging, of forest would result in increased inputs of sediment and nutrients to surface waters. The extensive forests of the study area are protecting water quality, storing carbon, providing habitats for wildlife and plants, and contributing to a healthy environment for people.

Increased traffic of road vehicles, and use of heavy equipment, would almost certainly cause increased mortality of turtles, snakes, frogs, salamanders, owls, dragonflies, butterflies, small mammals, and other wildlife. In addition to potential improvements to local roads, the proposed widening of Route 17 through the middle of the study area would represent a threat of increased highway mortality of wildlife.

Questions

Would the DEC be receptive to a petition to upgrade waterbody classifications in the study area? This could confer a *de facto* classification of A on the streams and lakes of the study area. Class A waters are suitable for drinking water supply (with treatment) and in theory are more aggressively regulated by the DEC. A classification upgrade would help to protect local water supply (e.g., from Lake Louise Marie) as well as downstream water use. An upgrade would also help protect the values of, for example, low nutrient surface waters in the lakes and acidic bogs, for plants and wildlife.

Given the occurrence of rare aquatic plants, scarce low-nutrient aquatic habitats, at least moderate use by water birds, and listed wildlife (bald eagle, timber rattlesnake), and the interconnectedness of the D & H

Canal reservoir lakes due to stream connections and probable animal movements, should further land use decision-making be preceded by a cumulative impact assessment? Possibly a Generic Environmental Impact Statement (EIS) could accomplish this purpose. We recommend that LCA work with an environmental attorney to explore this option.

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