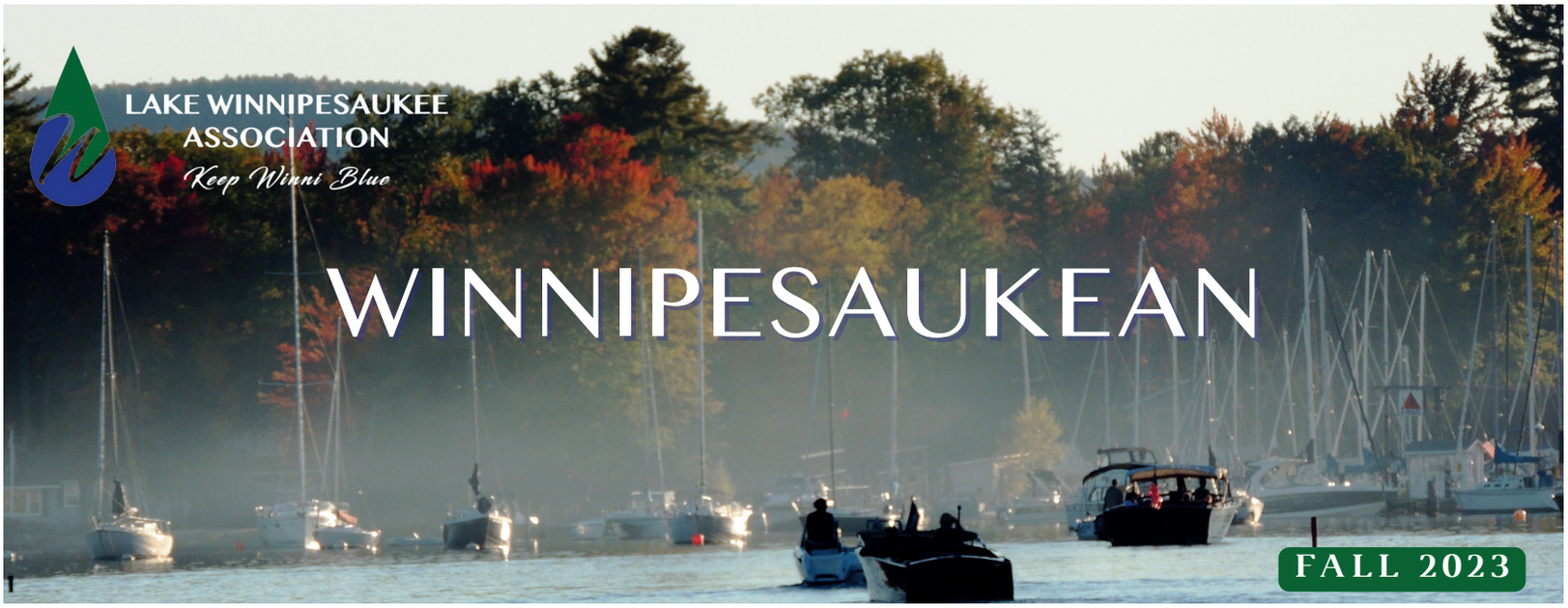


PAUGUS BAY WATERSHED ASSESSMENT

Water Quality in Paugus Bay is of great concern to the City of Laconia as Paugus Bay serves as the City's primary drinking water supply. In recent years, algae blooms containing cyanobacteria have been observed within the Bay, presenting a public health concern as some species of cyanobacteria can release nerve and liver toxins.

Last summer saw the occurrence of stigonematales, a benthic (occurring on the bottom) cyanobacteria on the southwestern shore of Paugus Bay, which persisted for 3 weeks. Algal blooms have also been observed in the Weirs channel, and in Langley Cove.

Photo: Stigonematales on the shoreline

Although a watershed management plan was developed for Paugus Bay in 2010; the plan did not include an estimate of the nutrient (phosphorus) load by land use for each catchment, nor a comprehensive watershed and shoreline survey of potential sites contributing excessive sediment and nutrients into the Bay (continued page 2).

PAUGUS BAY WATERSHED ASSESSMENT

To assist the City in monitoring and protecting the water quality of the bay, the Lake Winnipesaukee Association has been awarded a Local Source Water Protection Grant through the NHDES Drinking and Groundwater Bureau to conduct an assessment of 5 of the priority catchments in the Paugus Bay watershed, and to work with the Laconia Water Department to expand the water quality monitoring program to include near shore sampling of areas of concern.

Research has shown that developed areas contribute 5-10 times the amount of polluted stormwater runoff than forested areas. This excess stormwater runoff causes water pollution, erosion, and flooding. The two images of Paugus Bay from 1906 and 2015 illustrate the change in the landscape from forested to developed land, and how much more impervious area is present.

Paugus Bay, circa 2015

The 5 catchment areas were selected because they are highly developed and closest to the water department's intake pipe. Highlighted in yellow in the image to the right,

- P4 represents Long Bay and South Down developments, and the Laconia Country Club;
- P5, below P4, is highly urbanized, with 96% in the stormwater system;
- P6 is closest to the intake pipe, with 38% in the stormwater system
- P7 is close to the intake pipe, is where Black Brook empties into the bay, and includes 8 direct discharges to the bay.
- P9 includes the outflow from Langley Brook, and 14 direct discharges to the bay.

Paugus Bay, circa 1906

Once completed, the Paugus Bay Watershed Assessment study will:

- quantify the primary sources of nutrient loading in five catchment areas of the bay
- inventory and prioritize pollution sources in the 5 catchments
- expand and continue monitoring the health of the bay to identify areas of concern
- educate property owners and users of the bay on how to minimize stormwater runoff from their properties
- result in an action plan of strategies for protecting the water quality in the bay, and therefore the drinking water for the City of Laconia

Paugus Bay Selected catchments

LANGLEY BROOK HYDROLOGIC STUDY

Langley Brook is one of four perennial streams that flow into Paugus Bay, Laconia's drinking water source. Located on the eastern side of the Bay, Langley Brook drains a relatively small rural subwatershed area of 660 acres, emptying into Langley Cove at the Christmas Island area on Weirs Blvd.

Sediment buildup in the cove has been occurring for a number of years, creating a sandbar and impeding boat access for residents. Sediment transported via Langley Brook can originate from a variety of sources, including disturbed soil from development in the watershed and eroded sediment from the bank of the stream itself during high streamflow events. In the past twenty years, there have been two notable high streamflow events caused by the breaching of a beaver dam located on a tributary to Langley Brook.

With funding from the NHDES Local Source Water Protection Program, LWA hired FB Environmental Associates (FBE) to conduct a drainage analysis and hydrologic assessment of the Langley Brook catchment to determine the sources of the sediment and nutrient loading so that mitigation actions could be recommended.

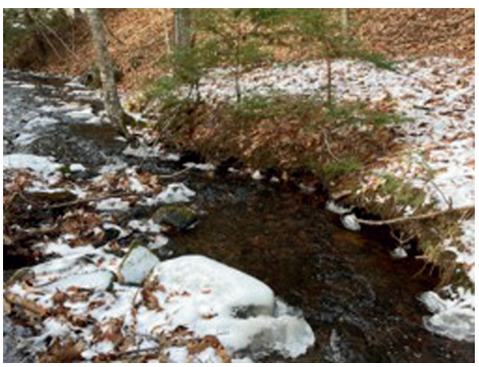
Pollutant load estimates comparing pre-development to current development suggest that human activities in the Langley Brook watershed have generated additional loads of 1,276 lbs. of nitrogen, 235 lbs. of phosphorus, and 54,252 lbs. of sediment to the stream each year.

FBE also performed a geomorphic assessment of four stream reaches to evaluate the stability of Langley Brook.

Langley Cove looking south toward Capri Condos. Red arrow marks the location where Langley Brook comes in under Weirs Blvd.

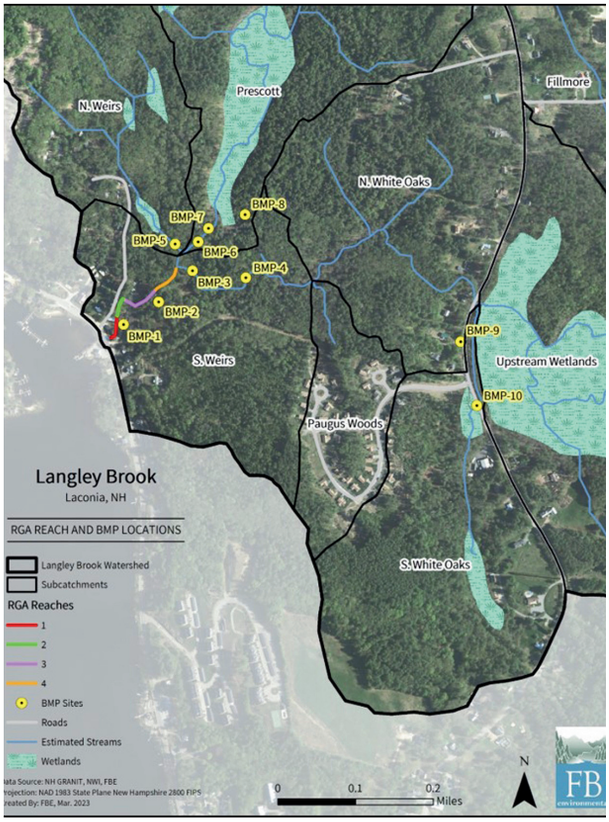
Although a full geomorphic assessment was not conducted on the entire length of the brook, the evaluation of the four reaches suggests that streambank erosion is likely a major contributor to the sediment load and should be addressed.

During the field survey, 10 different locations in the Langley Brook watershed were identified as areas where best management practices (BMPs) could be installed to improve water quality and reduce nitrogen, phosphorus, and sediment loading. The sites include 2 gullies formed by stormwater runoff, 2 dirt roads in need of stormwater trenches, a section of stream lacking a vegetative buffer, a dirt driveway showing evidence of erosion, and 4 areas where the stream needs to be improved to reduce erosion.



LANGLEY BROOK HYDROLOGIC STUDY

BMP Opportunities

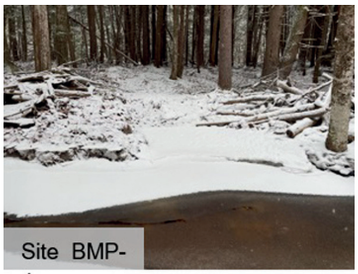


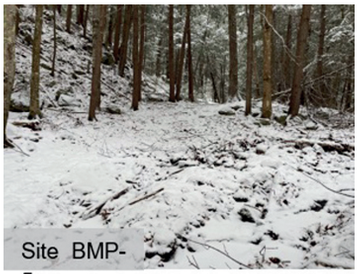
10 Potential BMP sites

- Gully stabilizations (2)
- Stormwater trenches (2)
- Riparian buffer (1)
- Driveway stabilization (1)
- Improved hydrology (4)


Site BMP-9


Site BMP-2


Site BMP-4


Site BMP-5

Conclusions

- Urban and active construction lands cover 20% of the watershed and are responsible for 59% of the nitrogen loading to Langley Brook.
- Septic systems are one of the dominant sources of phosphorus, accounting for 31% of the total phosphorus load. Most of the development in the lower watershed is serviced by sewer, therefore despite having higher or similar percentages of urban area, were not identified as hotspots for phosphorus.
- Dominant sources of sediment to Langley Brook include streambank erosion and runoff from urban areas. The geomorphic assessment indicates the streams are in transition, stressed, or actively in adjustment, suggesting that erosion processes are actively occurring.

Recommendations

1. **Stormwater Runoff** - implement the recommended BMPs, perform a watershed survey to identify more BMPs, conduct outreach to landowners.
2. **Septic Systems -** create a septic system database, upgrade any failing septic systems, investigate the feasibility of extending sewer to White Oaks Road, consider adopting city ordinances for septic, conduct outreach to landowners.
3. **Streambank Erosion** - perform a detailed stream geomorphic assessment, implement stormwater control measures to slow down runoff, carry out streambank restoration projects for problem areas.

2023 CYANOBACTERIA SUMMARY

As the old saying goes, "April showers bring May flowers," but what about June storms? While we anticipated that these storms would create optimal conditions for cyanobacteria blooms in July or August, thankfully, 2023 did not produce a record year for cyanobacteria on Lake Winnipesaukee.

This summer, we experienced two advisories on the big lake, both in Blackey Cove, which connects Lake Winnipesaukee with Lake Kanasatka. Additionally, we had several alerts issued in various areas across the lake, but only for Gloeotrichia. There were other advisories and alerts within the watershed - on Lake Kanasatka, Lake Wentworth, and Crescent Lake, all of which drain into Winnipesaukee.

Blackey Cove, 8/17/2023

While we were relatively fortunate in terms of cyanobacteria, this summer was the wettest on record for New Hampshire, receiving over 21 inches of rain, which is eight inches above the average. Low-pressure systems moved across the state, which led to more instability, cloud cover, and thunderstorm capability. These heavy storms have a significant impact on our rivers, streams, and lakes, particularly when the ground is fully saturated.

As the volume of water in these systems increases, it carves out culverts, stream banks and shorefront areas, pulling in sediment and excess nutrients like phosphorus, which is a known driver of cyanobacteria blooms.

Sunlight is another factor that influences cyanobacteria growth, as these photosynthetic microorganisms require the sun to obtain energy. When sediment is suspended in water, water clarity decreases, and sunlight cannot penetrate the water column. This could be one reason why we did not see as many cyanobacteria blooms on Winnipesaukee this summer.

Cyanobacteria Reports on Lake Winnipesaukee

	2018	2019-2021	2022	2023
Alerts	0	0	3	4
Advisories	1	0	4	2

Another factor that affects all aquatic biological growth, including algae, cyanobacteria, and plants, is the average ice-out date shifting earlier in New Hampshire. These seasonal changes allow more sunlight to penetrate into the water column earlier in the season, which could promote biological growth. 2023 delivered a unique and somewhat unexpected narrative for Lake Winnipesaukee. While we successfully evaded a significant cyanobacteria outbreak, we grappled with the ramifications of record-breaking rainfall and its impact on the lake's ecology. The interplay of weather, climate shifts, ecological dynamics and human influence continue to shape the future of our beloved lake, reminding us of the delicate balance we strive to maintain through education and stewardship of our important natural resources!

Alton, 6/17/2023

ECO-FRIENDLY FALL CLEANUP TIPS

As summer transitions into fall, Lakes Region residents are actively tending to their yard chores and getting ready to winterize their summer toys, all in preparation for the impending snowy season. Implementing lake-friendly practices into your cleanup routine protects water quality, preserves our aquatic ecosystems, and demonstrates responsible stewardship of the waterbodies we get to enjoy year-round!

Leave the Leaves

According to the EPA, yard debris and leaves account for 13% of the country's total solid waste - a total 33 million tons annually! Removing leaves also removes vital wildlife habitat. Did you know that wooly bear caterpillars, luna moths, and bumble bees overwinter in fallen leaves before emerging in the spring? Take these actions to protect our pollinators and other invertebrates.

- Leave a thin layer of leaves on your lawn and distribute others in flower beds or gardens to add important nutrients to your soil.
- Too many leaves? Pile them up around trees to suppress weed growth and provide moisture retention.
- NEVER blow or rake leaves into the lake. Although they are a natural component in our lakes, an abundance of them can increase nutrient levels and contribute to algae and plant growth.

Time for your Septic Check!

- If you have a septic system, schedule a fall inspection and maintenance to prevent leaks and contamination of groundwater that may flow into the lake.

Boat Maintenance

- If you have a boat or personal watercraft, ensure that it's well-maintained to prevent oil and fuel leaks. Clean the hull and equipment away from the water.
- Ask your marina about putting a bilge sock in your boat for next spring/summer. Many offer this as an option on your maintenance checklist. It's inexpensive, and an easy way to keep oil and gas from leaking into the lake.

Limit Chemical Use

- Instead of fertilizers, consider alternative options such as aeration, thatch removal and adding native plantings.

Plant a Lakefront Buffer

- Maintain a buffer zone of native plants and grasses between your property and the lake. These plants help filter pollutants, prevent erosion, and provide habitat for wildlife.

INVASIVE SPINY WATER FLEA MAKES UNWELCOME NH DEBUT IN LAKE WINNI

In a concerning development, biologists from the New Hampshire Department of Environmental Services (NHDES) confirmed the presence of a new aquatic invasive species to New Hampshire. The spiny water flea (Bythotrephes longimanus), a microscopic zooplankton native to Europe and Asia, was first discovered in the Broads area of Gilford in mid September. Subsequent sampling identified its presence in Alton and Wolfeboro areas of the lake, suggesting a recent infestation.

A Transatlantic Stowaway

The spiny water flea is no stranger to the United States, having first made its appearance in the Great Lakes in the 1980s. It's believed that this tiny but unwelcome visitor found its way to Lake Winnipesaukee through the inadvertent actions of transient boaters who had visited waterbodies harboring the species. Live organisms or their eggs may have hitched a ride on recreational or fishing gear or found refuge in the live wells or bilge of boats.

No Cure, Only Prevention

One of the most alarming aspects of the spiny water flea invasion is that there are no effective treatments to control its spread once it becomes established. Prevention remains the only management option. Preventing its introduction into uninfested waterbodies is paramount. This is accomplished by rigorously adhering to the state law (RSA 487), which mandates cleaning, draining, and drying all vessels and recreational gear after leaving a waterbody.

NHDES biologists have been vigilant in monitoring for the spiny water flea for the past eight years, anticipating its eventual arrival. Kirsten Hugger, an Aquatic Ecologist with NHDES, noted, "Invasive species are very good at spreading to new locations." The monitoring program, initiated in 2016, was a proactive response to the potential introduction of the spiny water flea due to boater traffic. Nonetheless, its presence is still a disappointing reality.

Thankfully, the spiny water flea poses no direct threat to human health. However, it can be a nuisance for anglers when it accumulates on fishing lines. More significantly, it can disrupt aquatic food webs by altering the plankton community, which, in turn, can impact fish populations. Native fish species may face challenges as the spiny water flea, at high densities, competes with native zooplankton, a critical food source for these fish.

CLEAN off any plants, animals and algae found on boats, trailers, and other recreational gear, and dispose of it away from a waterbody. This includes anything attached to fishing line, tackle and nets and other equipment used in fishing activities. Pressure washing with hot water is recommended. For fishing and other gear, inspect and remove any organisms you find and wash with soapy and/or hot water. Dispose of unwanted bait and associated water in the trash or on land away from water, rather than dumping it in the waterbody.

DRAIN your boat, bait buckets, bilges, live wells, and other water-holding equipment away from the waterbody, leaving all drains in the open position during transport.

DRY anything that comes into contact with the water for at least five days.

LAKE WINNIPESAUKEE ASSOCIATION
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MAKE WAVES FOR WINNI

For the last 3 years, Alexis Wallace has trained year-round to complete a benefit swim in support of LWA's mission to protect the water quality and natural resources of Lake Winnipesaukee.

This year, dealing with long-haul effects from Lyme disease, 72 yr. old Alexis wasn't sure she would be able to complete the 3 mile goal she had set. But with a little help from her friends, and Trexler's Marina, Alexis and team completed the swim from Trexler's to the end of Long Island.

Photo Caption: Make Waves for Winni Relay Team; from left to right Jane Papageorge, Alexis Wallace, Janelle Macone, Deb Macone.

Not only did the team have fun - they raised over $3,000 for the cause!

Many thanks to everyone who supported Alexis' swim!!