— PARKING LOT EXPANSE: "NEGATIVE EXTERNAL IMPACTS" ON COLLEGE BROOK —

June 3, 2022

Planning Board
8 Newmarket Road
Durham, NH 03824

RE: 19-21 Main Street – Parking Lot. Formal application for site plan and conditional use for parking lot on four lots and reconfiguration of the entrance. Toomerfs, LLC c/o Pete Murphy and Tim Murphy, property owners.…Map 5, Lots 1-9, 1-10, 1-15, and 1-16. Church Hill District.

Dear Members of the Board,

Some of you will remember my March 11, 2020 slide presentation for the Board's Mill Plaza public hearing (starting about 9:06 PM in the meeting) and my follow-up letter (Robin Mower 3-25-20) in which I noted concerns about the pollutant impacts of runoff from parking lots on College Brook.

Those concerns are also relevant to the proposal to convert a wooded hillside to a parking lot situated between 19–21 Main Street and Chesley Drive. I expand on them below.

Our Conditional Use Permit approval criteria require that **"the nature and intensity of the use, shall not have an adverse effect on the surrounding environment."** The concerns addressed below relate specifically to the nature and intensity of the proposed use:

- Snow removal and de-icers / chloride (road salt): Even the proposed state-of-the-art Stormtech stormwater management system cannot mitigate salt.
- Additional and far-reaching environmental concerns; see attached National Science Foundation (NSF) article "Winter road salt, fertilizers turning North American waterways increasingly saltier" and below excerpt.

Public safety is a concern, but so is the health of College Brook, Oyster River, and Great Bay.

De-icing is a public safety necessity in northern New England. Public safety is not an issue on the currently undeveloped property nor would it be as significant an issue if an alternative development had significantly fewer parking spaces. The "surrounding environment" of our waterbodies would pay the price for the proposed intensity of use.

Chloride and College Brook: already impaired, future chloride load may increase

- Parking lot snow management typically relies on chloride-based de-icers ("road salt")
- Ted Diers, Administrator of the NHDES Watershed Management Bureau, expects that **climate change will result in greater use of road salt**. On February 27, 2020 he told me:
  - With climate change, we will see more storms that will be right at the ice-rain edge, whereas in the past, we had more storms that were pure snow.
  - As we see more ice than snow, we will be using more salt. Freezing rain, with storms at that transition temperature of 30 to 34 degrees, washes salt off, so it must be reapplied.

Robin Mower • 6 Britton Lane • Durham, NH 03824

- "Cl complexes—chloride based deicer usually combined with Na, Ca or Mg—found in road deicers can release heavy metals, affect soil permeability, impacts to drinking water, potential toxic effects to small streams" (*Impacts of Impervious Cover on Aquatic Systems*, Center for Watershed Protection, March 2003) Also see, below, NSF on "cocktail of salts."

- Pollutants can travel through groundwater for years and across surprisingly great distances.
  - Board members may remember Dr. Thomas Ballestero's comments on the Great Bay Kennel proposal's potential impact on the Oyster River. Although referring to pet waste, he noted that "dissolved salts and at least half of the nitrogen that leaves the leach field enters the groundwater below and move with groundwater to a receiving stream. The only 'treatment' of these pollutants really afforded in the groundwater flowpath is dilution."

Parking lots add unique problems.

Vehicle-related contaminants, through emissions, present additional problems to water quality. Fuel additives, e.g., carcinogenic MBTE, are "highly soluble in water and therefore not easily removed once it enters surface or ground water" (*Impacts of Impervious Cover on Aquatic Systems*)

North American waterways are becoming increasingly salty

Excerpt from the National Science Foundation article "Winter road salt, fertilizers turning North American waterways increasingly saltier" (below emphasis added):

> …most freshwater salinization research has focused on sodium chloride, better known as table salt, which is also the dominant chemical in road deicers.
>
> But salt has a much broader definition, encompassing any combination of positively and negatively charged ions that dissociate in water. Some of the most common positive ions found in salts—including sodium, calcium, magnesium and potassium—can have damaging effects on freshwater at higher concentrations.
>
> "These 'cocktails' of salts can be more toxic than just one salt, as some ions can displace and release other ions from soils and rocks, compounding the problem," said Kaushal. "Ecotoxicologists are just beginning to understand this."
>
> …"Our study is the first to document a link between increased salinization and alkalinization at the continental scale," said scientist and study co-author Gene Likens of the Cary Institute of Ecosystem Studies and UConn. "Until now, we didn't fully appreciate the role that different salts play in altering the pH of streams and rivers of our country. **Salt content and pH are fundamental aspects of water chemistry, so these are major changes to the properties of freshwater."**

Regards,

Robin

National Science Foundation
WHERE DISCOVERIES BEGIN

News Release 18-002

Winter road salt, fertilizers turning North American waterways increasingly saltier

New findings show need for better regulation of road salt, fertilizers and other salty compounds

Uncovered salt piles near the NSF Baltimore Long-Term Ecological Research site.
Credit and Larger Version (/news/news_images.jsp?cntn_id=244099&org=NSF)

January 8, 2018

This material is available primarily for archival purposes. Telephone numbers or other contact information may be out of date; please see current contact information at media contacts (/staff/sub_div.jsp?org=olpa&orgId=85).

Find related stories on NSF's Environmental Research and Education (ERE) programs at this link <https://www.nsf.gov/news/newsmedia/ENV-discoveries/ERE-discovery-series.jsp> . *Also find related stories on NSF's* Long-Term Ecological Research (LTER) Program site <https://www.nsf.gov/news/newsmedia/ENV-discoveries/LTER-discovery-series.jsp> .

Across North America, streams and rivers are becoming saltier, thanks to road deicers, fertilizers and other salty compounds that humans indirectly release into waterways. At the same time, freshwater supplies are becoming more alkaline or basic, the "opposite" of acidic.

Salty, alkaline freshwater can create big problems for drinking water supplies, urban infrastructure and natural ecosystems. For example, the well-documented water crisis in Flint, Michigan, occurred when the city switched its primary water source to the Flint River in 2014; the river's high salt load combined with chemical treatments made the water corrosive and caused lead to leach from water pipes.

A new study led by National Science Foundation (NSF)-funded researchers is the first to assess long-term changes in freshwater salinity and pH -- a measure of how acidic or alkaline something is -- at the continental scale.

"Such water quality issues as sewage, wastewater and nutrient loading are being addressed," said Tom Torgersen, director of NSF's Water Sustainability and Climate program, which funded the research. "But management of water quality impacts remains a challenge because of our increasing population, the size of our built infrastructure and other factors."

A half-century of data

The analysis draws from data recorded at 232 monitoring sites across the country over the past 50 years and shows significant increases in both salinization and alkalinization. The results also suggest a close link between the two properties, with different salt compounds combining to do more damage than any one salt could do on its own.

"This research demonstrates the value of long-term data in identifying potential threats to valuable freshwater resources," said John Schade, an NSF Long-Term Ecological Research program director. "Without such long-term efforts, widespread and significant degradation of water quality by human activities would remain unknown. Now we can begin to unravel the causes and develop strategies to mitigate potential effects on the environment and public health."

The analysis, which is published in this week's issue of the journal *Proceedings of the National Academy of Sciences*, has implications for freshwater management and salt regulation strategies in the United States, Canada and beyond. Researchers at the University of Maryland (UMD), the Cary Institute of Ecosystem Studies, the University of Connecticut (UConn), the University of Virginia and Chatham University co-authored the study.

"We created the term 'Freshwater Salinization Syndrome' because we realized that it's a suite of effects on water quality," said Sujay Kaushal, a biogeochemist at UMD and lead author of the study. "Many people assume that when you apply salt to roads and other surfaces it just gets washed away and disappears. But salt accumulates in soils and groundwater and takes decades to get flushed out."

Changes in rivers across the country

The researchers documented sharp chemical changes in many of the country's major rivers, including the Mississippi, Hudson, Potomac, Neuse, Canadian and Chattahoochee rivers. Many of these rivers supply drinking water for nearby cities and towns, including some of the most densely populated urban centers along the Eastern Seaboard.

According to Kaushal, most freshwater salinization research has focused on sodium chloride, better known as table salt, which is also the dominant chemical in road deicers.

But salt has a much broader definition, encompassing any combination of positively and negatively charged ions that dissociate in water. Some of the most common positive ions found in salts -- including sodium, calcium, magnesium and potassium -- can have damaging effects on freshwater at higher concentrations.

"These 'cocktails' of salts can be more toxic than just one salt, as some ions can displace and release other ions from soils and rocks, compounding the problem," said Kaushal. "Ecotoxicologists are just beginning to understand this."

The study is the first to simultaneously account for multiple salt ions in freshwater across the United States and southern Canada.

The results suggest that salt ions, damaging in their own right, are driving up the alkalinity of freshwater as well.

Significant increase in salinity

Over the time period covered by the study, the researchers concluded that 37 percent of the drainage area of the contiguous United States experienced a significant increase in salinity. Alkalinization, which is influenced by a number of different factors in addition to salinity, increased by 90 percent.

"Our study is the first to document a link between increased salinization and alkalinization at the continental scale," said scientist and study co-author Gene Likens of the Cary Institute of Ecosystem Studies and UConn. "Until now, we didn't fully appreciate the role that different salts play in altering the pH of streams and rivers of our country. Salt content and pH are fundamental aspects of water chemistry, so these are major changes to the properties of freshwater."

The causes of increased salt in waterways vary from region to region, Kaushal said.

In the snowy Mid-Atlantic and New England, road salt applied to maintain roadways in winter is a primary culprit. In the heavily agricultural Midwest, fertilizers -- particularly those with high potassium content -- also make major contributions. In other regions, mining waste and weathering of concrete, rocks and soils releases salts into adjacent waterways.

"We found that the pH of some rivers started increasing in the 1950s and '60s -- decades before the implementation of acid rain regulations," said Michael Pace, an environmental scientist at the University of Virginia and a co-author of the study. "We also observed increased salt concentrations in the Southeast, where they don't apply road salts. These surprising trends presented a puzzle that our team worked to solve."

In the water-starved desert Southwest, where salt concentrations have historically been very high, Kaushal and his colleagues documented an overall decrease in salinity over time.

The researchers attribute the decrease to a variety of factors, including changes in land and water use, coupled with an effort on the part of Western state and local governments to reduce salt inputs and improve water resource management strategies. For example, in 1973, the seven Western states included in the Colorado River Basin created the Colorado River Basin Salinity Control Forum to support salinity control efforts.

New salt pollution management strategies needed

Kaushal noted that many strategies for managing salt pollution already exist. Evidence suggests that brines can be more efficient than granulated salt for deicing roads, yielding the same effect with less overall salt input. Pre- salting before a major snow event can also improve results.

"Not all salts are created equal in terms of their ability to melt ice at certain temperatures," Kaushal added. "Choosing the right salt compounds for the right conditions can help melt snow and ice more efficiently with less salt input, which would go a long way toward solving the problem."

Kaushal also said that many Mid-Atlantic and Northeastern cities and states have outdated and inefficient salt-spreading equipment that is overdue for an upgrade.

The researchers note similar issues with the application of fertilizers in agricultural settings. In many cases, applying the right amount of fertilizer at the right time in the season can help reduce the overall output of salts into nearby streams and rivers.

And more careful urban development strategies -- primarily building farther from waterways and designing better storm water drainage systems -- can help reduce the amount of salt washed away from weathered concrete, the scientists say.

The study co-authors believe there's also a need to monitor and replace aging water pipes throughout the country that have been affected by corrosion and scaling, or the buildup of mineral deposits and microbial films. Such pipes are particularly vulnerable to saltier, more alkaline water, which can increase the release of toxic metals and other contaminants.

"The trends we are seeing show that we need to consider the issue of salt pollution and take it seriously," Kaushal said. "These factors are something we need to address to provide safe water now and for future generations."

-NSF-