A Comparison of Water Quality: Allen Brook and Munroe Brook

Amy Donahue, Ridge Langan and Allison Havens - Rice Memorial High School

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Introduction

Surrounding Environment

Munroe Brook originates in Shelburne between Barstow Road and Governor's Lane with a small portion extending north into South Burlington. The stream flows southwest, under Spear Street then continues north-west where it flows and continues under Route 7. It then empties into Lake Champlain in Shelburne Bay, placing it within the Lake Champlain Watershed. The Automaster car dealership sits on a hill above the Munroe Brook testing site. The surrounding environment is urban and commercial.

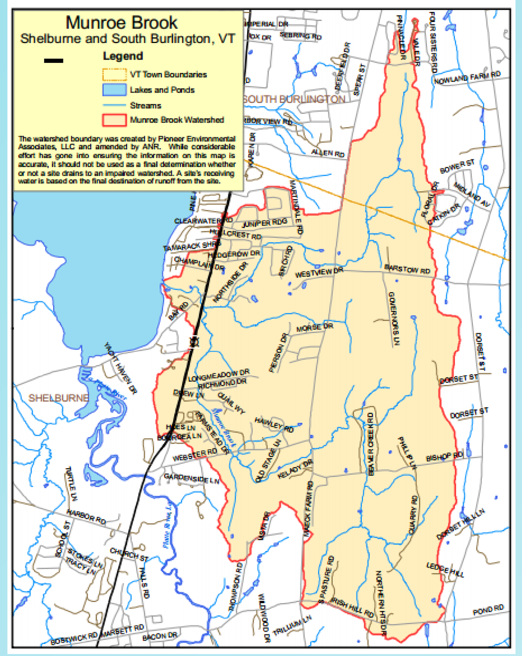
Allen Brook originates above Mud Pond and flows northwest to join the Muddy Brook just before the confluence with the Winooski River, placing it within the Winooski River Watershed. The Allen Brook watershed is Williston's largest, encompassing roughly 6,900 acres. Allen Brook is both agricultural and urban in its' surroundings.

Munroe Brook and Allen Brook are two of Vermont's seventeen waterways listed as "impaired" primarily due to urban stormwater runoff. These waters fail to meet the Vermont Water Quality Standards based primarily on biological monitoring data.

Sources of Total Suspended Solids, Total Phosphorus and Total Nitrogen

- Total Suspended Solids (TSS):
  Development in a watershed leads to increased stormwater runoff, affecting water quality. In developed areas runoff quickly flows off of roofs and paved surfaces instead of infiltrating the soil naturally. The water runoff, picks up pollution and other particles and carries them into waterways. Increased flows during storm events destabilize stream channels and put stream life in jeopardy.
- Total Phosphorus (TP):
  An abundance of dairy cows, beef cattle, chickens, horses, sheep, goats and other livestock produce several tons of manure each year in Vermont. The manure contains high amounts of phosphorus which, when washed into rivers and streams, pollutes the water and eventually contributes to the algae blooms plaguing Lake Champlain. Sources of phosphorus contamination in the environment may also include industrial and municipal wastewater discharges, runoff from fertilized lawns and farmland, failing septic systems, disturbed land areas, drained wetlands, water treatment, and commercial cleaning preparations.
- Nitrogen:
  Sources of nitrogen in waters can come from wastewater treatment plants, runoff from fertilized lawns and cropland, failing septic systems, runoff from animal manure, and industrial discharges. Excess nitrogen can cause overstimulation of growth of aquatic plants and algae. This can lead to clogged water intakes, decreased dissolved oxygen, blocked light to deeper waters, fish kills (affecting animal and plant diversity), and can sicken people or livestock when consumed.

The Automaster car dealership located on a hill above Munroe Brook



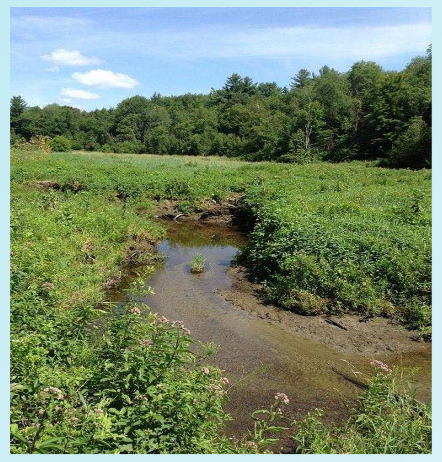
Methods

Field Work

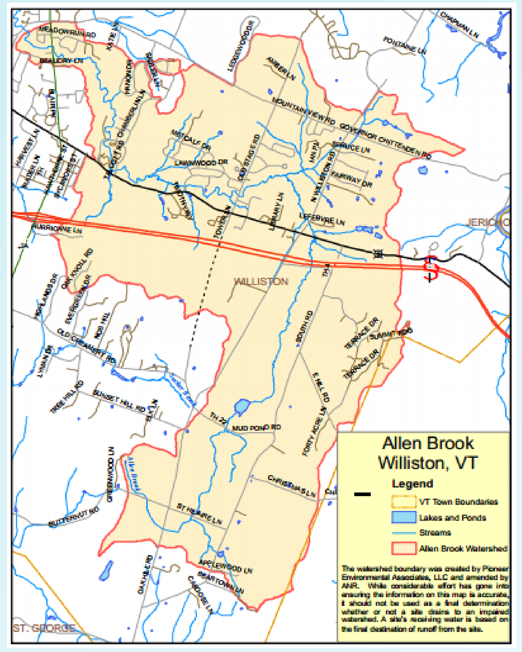
Water samples were collected biweekly from Allen Brook and Munroe Brook from early August through early November. Three samples of total suspended solids and four total phosphorus samples (including a blank) were collected from each site. Samples were sent to St. Michael's college, where they were analyzed for total suspended solids (TSS), total phosphorus (TP), and total Nitrogen (TN). Data was then posted online for analysis.

Analysis of Data

First, several dates were selected based on completeness of data available for both Monroe and Allen Brook. The dates selected 8/17/14, 8/31/14, 9/21/14 and 10/3/14 all had TSS, TP, and TN data available. Next, for each sample date, TSS, TP, and TN data were averaged for each stream site. The average data for each of these stream quality indicators on the selected dates were graphed and analyzed for comparison between streams.



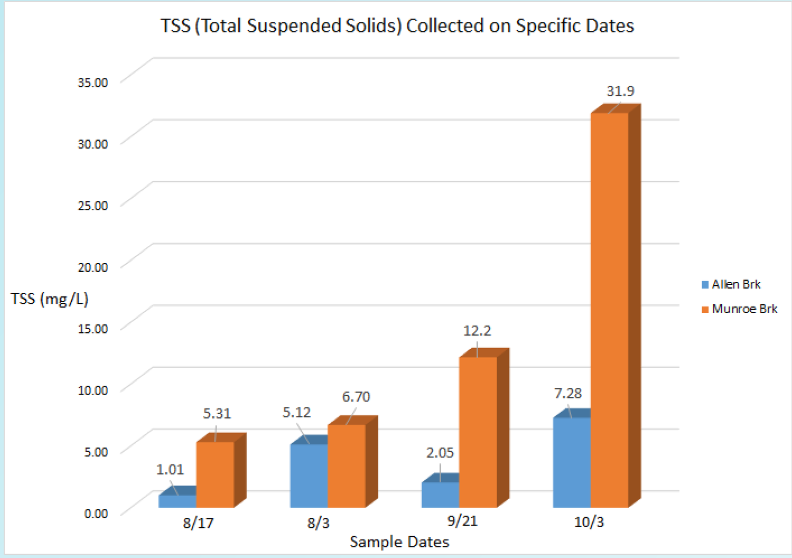
Allen Brook

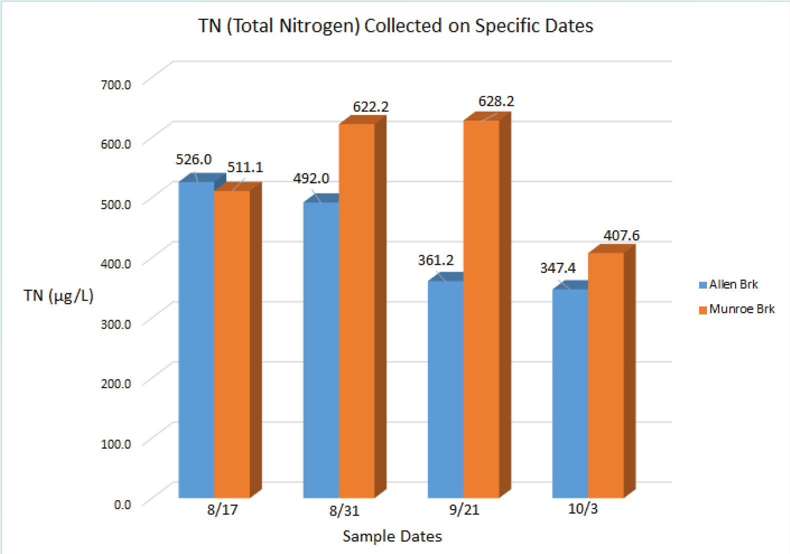


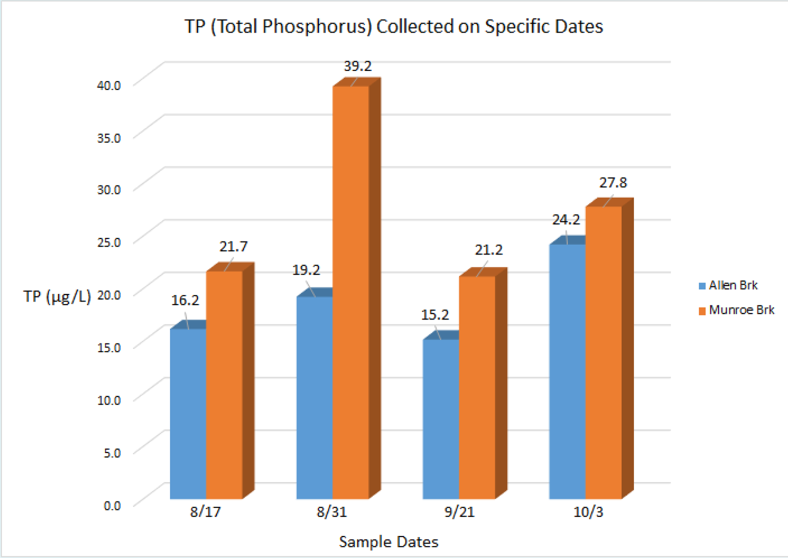
Analysis

Total Amounts of Suspended Solids, Phosphorus, and Nitrogen Collected on Specific Dates

	AB 8/17	MB 8/17	AB 8/31	MB 8/31	AB 9/21	MB 9/21	AB 10/3	MB 10/3
TSS (mg/L)	1.01	5.31	5.12	6.7	2.05	12.2	7.28	31.9
TP (µg/L)	16.2	21.7	19.2	39.2	15.2	21.2	24.2	27.8
TN (µg/L)	526	511.1	492	622.2	361.2	628.2	347.4	407.6







Analysis and Conclusion

With the exception of 8/17/14 TN levels, Munroe Brook was consistently higher for TSS, TP and TN levels on all sample dates when compared to Allen Brook.

Both Munroe Brook and Allen Brook are located in developed, urban areas and are vulnerable to the harmful effects of runoff. At the Munroe Brook site, the area surrounding the stream is principally commercial, while the Allen Brook site is mainly agricultural and residential. The samples analyzed for this comparison occurred in August, September and October, months of medium to high precipitation (see chart below). The more commercialized nature and higher traffic flow near Sherburne Road off the Munroe Brook site may account for the higher levels of TSS, TP and TN found as compared to Allen Brook. It was predicted that levels of TP would be higher at Allen Brook, as a cow's pasture is located on either side of the Allen Brook testing site. Unexpectedly, Munroe Brooks levels were consistently higher, perhaps due to the highly developed nature of the area surrounding the site.

Average Monthly Rainfall - Burlington Region

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2014	2.45	1.83	1.88	3.66	3.94	4.35	5.54	**2.05**	**1.63**	**4.17**	1.98	2.85	36.33

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