Monitoring Water Quality in Potash Brook

A Four Year Perspective

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Introduction

Teams of students from the VT EPSCoR programs (Streams Project and RACC) have collected water quality samples at Potash Brook since 2009. This project compares the most recent data from Potash Brook (2012) to the monthly averages for the previous 3 years. Additional information is provided on new research techniques that will develop deeper understanding of water quality fluctuations in the Potash watershed. With this knowledge, appropriate regulations and management strategies could be developed to minimize the impact of large storm events, and their associate influx of pollutants and sediments into Lake Champlain.

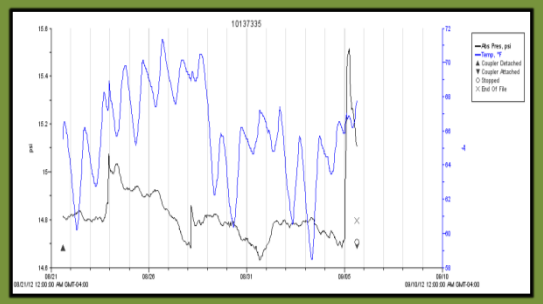
Methods

Water quality samples this year were collected at three-week intervals starting in July and continuing into November. Three 100 mL samples of water were collected and analyzed for **total phosphorus (TP)**. An additional 100 mL blank was poured in the field using phosphorus free water to control for residual phosphorus that might be in the bottles or in the atmosphere. Three individual liter samples of water were also collected for **total suspended solids (TSS)**, a measure of the water's turbidity. All samples were brought to St. Michael's College for analysis. Some of the analysis also took place at Johnson State College.

Soil samples were collected at the site using a borer at several transects. These were shipped to the Ross lab at UVM for analysis.

Stage sensors were installed to measure water and atmospheric pressure. One sensor was installed underwater in PVC housing, the other was secured to a nearby tree using nylon webbing and a camera bag. Data from these sensors were downloaded every three weeks to a shuttle and eventually transferred to a computer for display and analysis.

Stage Sensor Data for Water Pressure and Temperature

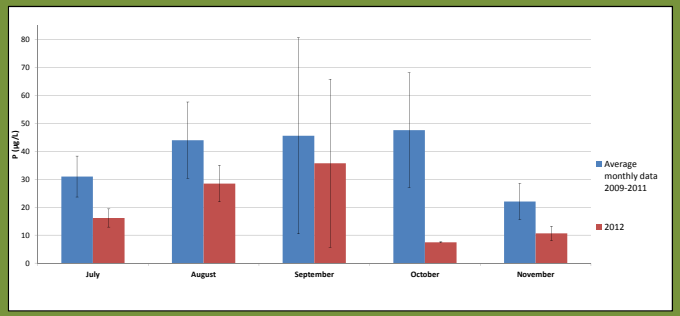


The graph on the left shows the stage center data, and the large spike in water pressure as noted on 9/5/12.

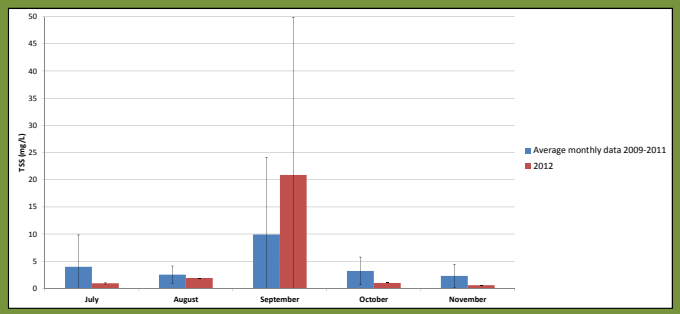
Stage Sensor and Shuttle

Soil Sampling Equipment

Total Phosphorus 2009-2012



Total Suspended Solids 2009-2012

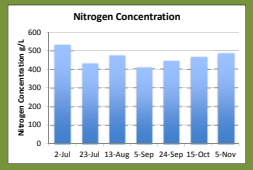


Upstream and Downstream Views of Site

Metrics from Storm Event 9/5/2012

	Average of Replicate Samples
TSS	41.4 mg/L
TP	63.1 µg/L
N	409 µg/L

Nitrogen data showing little fluctuation over time



Results

Data sets were downloaded from the Vermont EPSCoR Streams Project website. Participating institutions in the collection of the data included not only Rice Memorial High School, but also the University of Vermont, St. Michael's College, and South Burlington High School. The data for replicates from 2009 to 2011 were averaged by month. The 2012 averages were added separately for comparison.

Four years is a small window of time relative to the decades needed to measure noticeable trends in climate change. Of the data collected for Potash Brook, one of the most notable was an increase in the concentration of both total phosphorus (TP) and total suspended solids (TSS) in the months of September and October. These are correlated with large rain events when soil erosion is the highest. The soil muddies the water and carries both inorganic and organic phosphorus into the stream and eventually out to the lake.

The sampling that occurred on September 5, 2012 showed a high spike in the average TSS, TP, but no corresponding spike in nitrogen. This was correlated with the highest water of the sampling season, as indicated by the high pressure reading in the stage sensor graph (above). The error bars on the TSS and TP graphs showed the standard deviation in the data set. It should be noted that the highest variability occurred in the same months in which large water events occurred.

Conclusions

The overarching question of the VT EPSCoR RACC asks how the interaction of climate change and land use affects transport of nutrients and water from land into Lake Champlain, and whether this information could be used to alter management of these resources.

Potash Brook has had human impacts since the days of its earliest settlement, with a long history of changing land uses. The data collected over the past four years clearly shows increased TP and TSS loads accompanying large rain events.

According to Alan K. Betts (citing USGS data), precipitation has increased in Vermont by 15-20% in the past fifty years. Large rain events are increasing in frequency and intensity in the northeast, especially in the period of July through December. It is important now more than ever to collect data as one small piece of the larger puzzle connecting climate change and land use practices to water quality.

Acknowledgements

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References

Betts, A.K. (2011), Climate Change in Vermont. Atmospheric Research Report, Prepared for Agency of Natural Resources, State of Vermont. http://www.anr.state.vt.us/anr/climatechange/Pubs/VTCCAdaptClimateChangeVTBetts.pdf.