"TURBID" WATERS OF THE KAYADEROSSERAS: HUMAN CAUSED OR GLACIALLY INFLUENCED?

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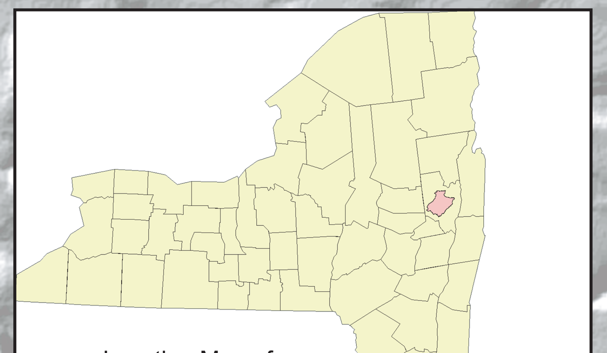
ABSTRACT

Turbidity of streams can be caused by land use change, such as residential or commercial development and agricultural manipulation, or by natural erosion of stream banks. In order to determine the causes of turbidity in the Kayaderosseras Creek Watershed, we choose three sets of paired watersheds that ranged in size from approximately 5.4 km^2 to 14.8 km^2 and one set with areas of approximately 10.8 km^2 and 68.5 km^2. Each pair had comparable basin wide slopes, surficial geology patterns, soil hydrology distributions, and land use patterns. We measured stream discharge and turbidity in each watershed at several different discharges during the fall of 2005. Results showed that discharge per unit area (Q/A) was controlled mostly by soil infiltration capacity and surficial geology, while residential and commercial development seemed to have little effect on the magnitude of Q/A. Although the change in Q/A was minimal for the pair of basins that were dominated by well-drained soils, development was significant (6 and 23%of total basin areas). Generally, turbidity increased consistently with Q/A, with higher turbidity measurements in basins with higher percentages of farming and soils with low infiltration rates and a high potential for runoff.

BACKGROUND

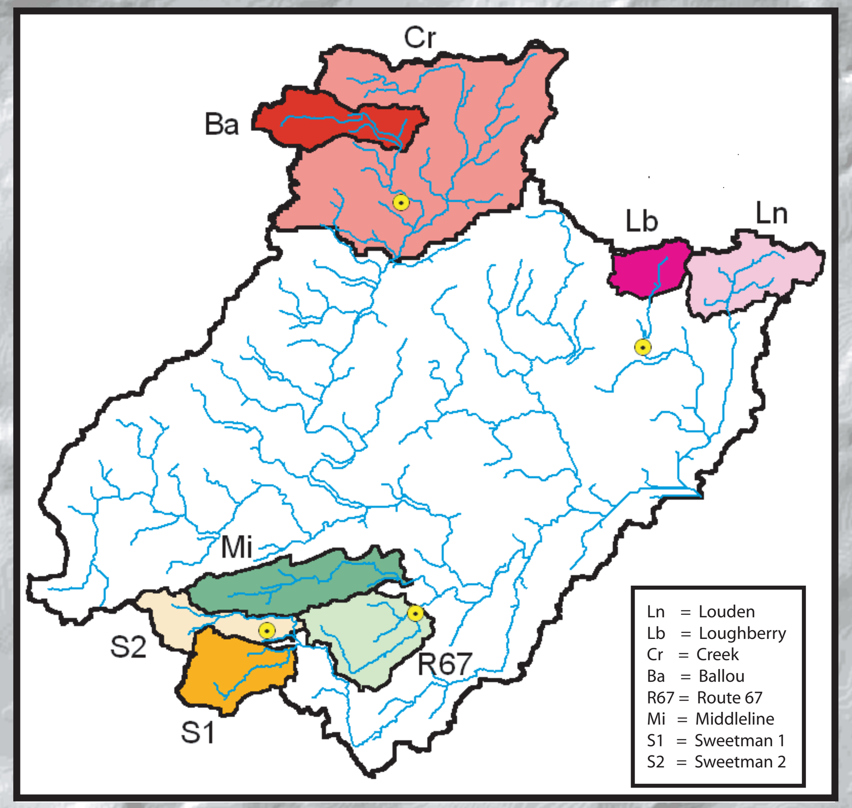
- In order to complement research in the Environmental Studies Program we set out to determine whether turbidity in the Kayaderosseras Creek Watershed is caused dominantly by either land use change or natural erosion of stream banks
- In Saratoga County, NY the rate of land use change, in particular residential and commercial development, has been increasing dramatically over the past three decades while agricultural land area is decreasing
- The soils of the Kayaderosseras Creek Watershed are dominated by glacial and post-glacial geology



Location Map of Kayaderosseras Watershed, Saratoga County, New York

WATERSHED MAPPING AND ANALYSIS

- Using ArcGIS we created twenty three potential subwatersheds of the Kayaderosseras Creek Watershed
- Chose 8 subwatersheds based on similar surficial geology, land use patterns, average basin slopes, and soil hydraulic groups



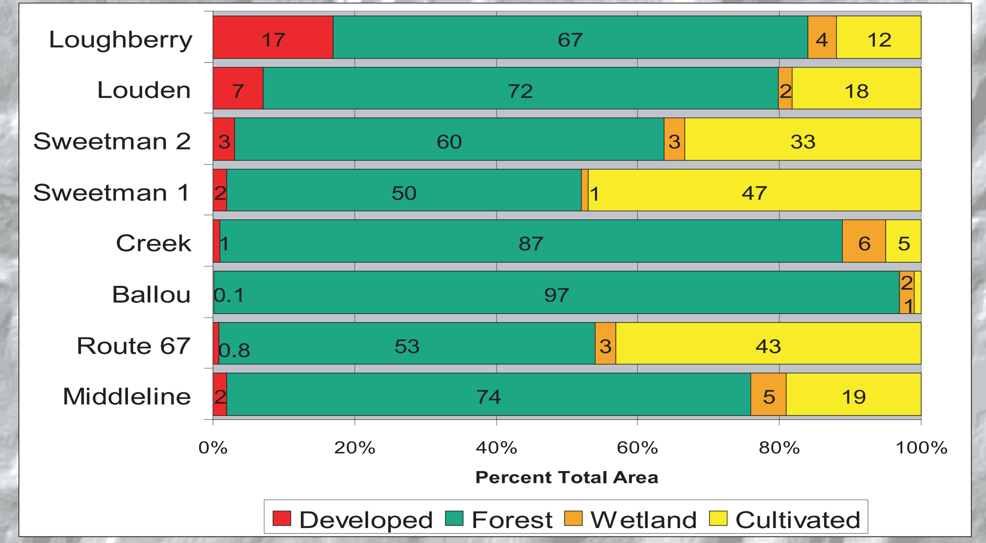
Location of Eight Kayaderosseras Subwatersheds

Subwatershed	Area (km^2)	Mean Slope
Middleline	14.8	2.1
Route 67	13.2	1.9
Ballou	10.8	6.3
Creek	70.7	5.1
Sweetman 1	10.4	2.2
Sweetman 2	8.1	2.2
Louden	12.0	2.2
Loughberry	5.4	2.8

Mean Slopes and Subwatershed Areas

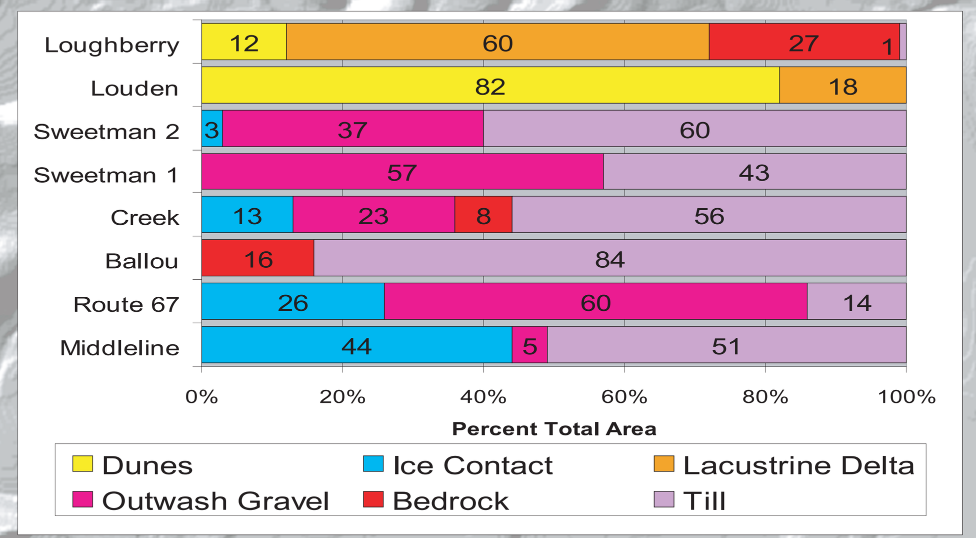
- Watersheds that were considered developed had >2% commercial and residential developed land
- Watersheds that were considered to be dominated by sandy surficial units had >70% combined Lacustrine and Dune units
- Watersheds that were considered to be dominated by a high percentage of C and D hydraulic groups had >61% combined C and D values (high runoff/slow infiltration)
- Watersheds that were considered to be dominated by a high percentage of A and B hydraulic groups had 39-98% combined A and B values (low runoff/fast infiltration)

Percent Area of Land Uses in Eight Kayaderosseras Subwatersheds

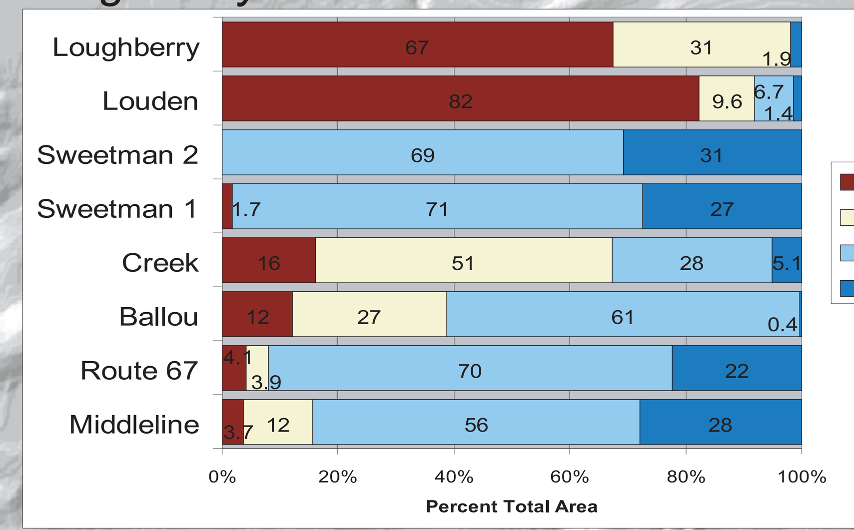


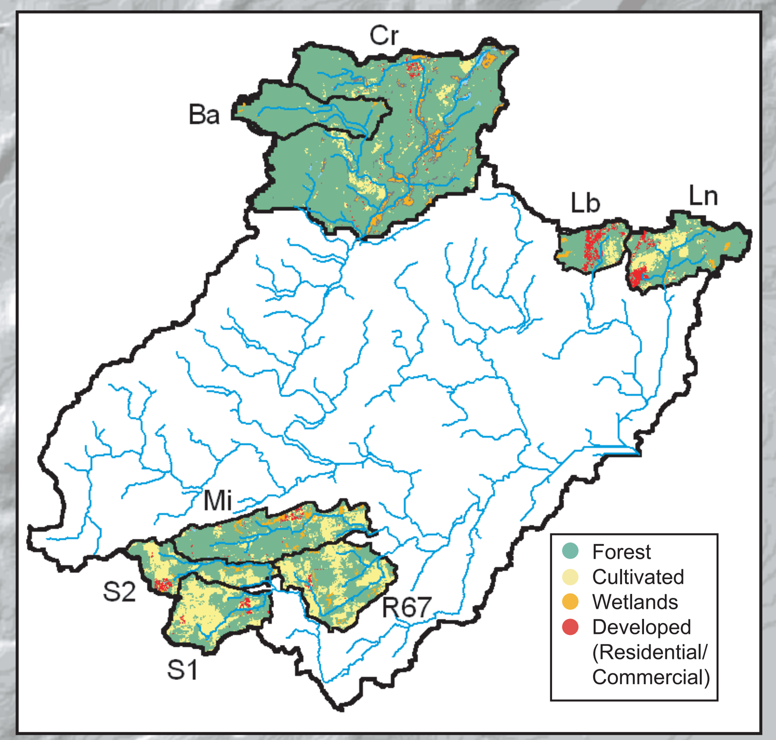
From 1992 USGS Land Use Cover Map of New York State

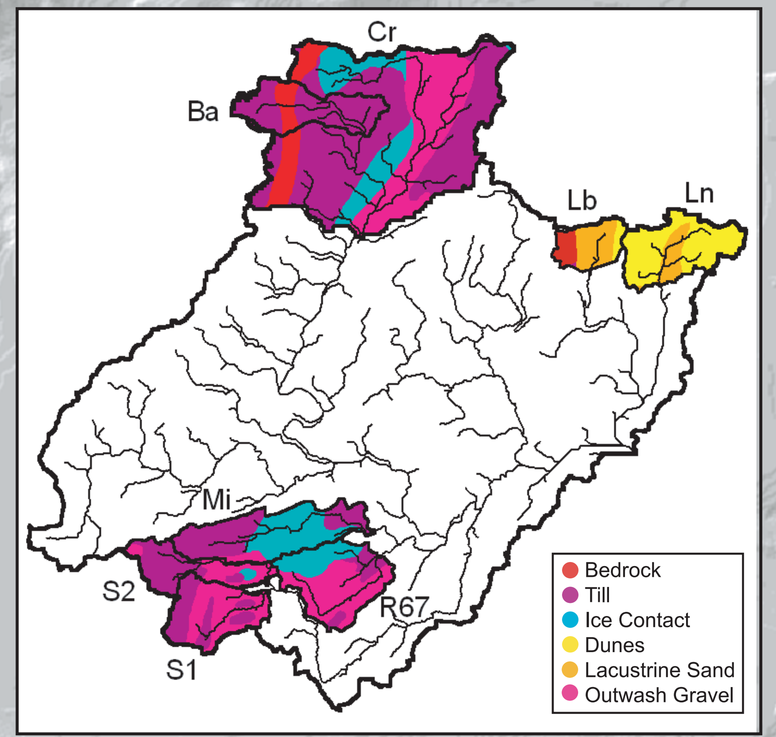
Percent Area of Surficial Units in Eight Kayaderosseras Subwatersheds

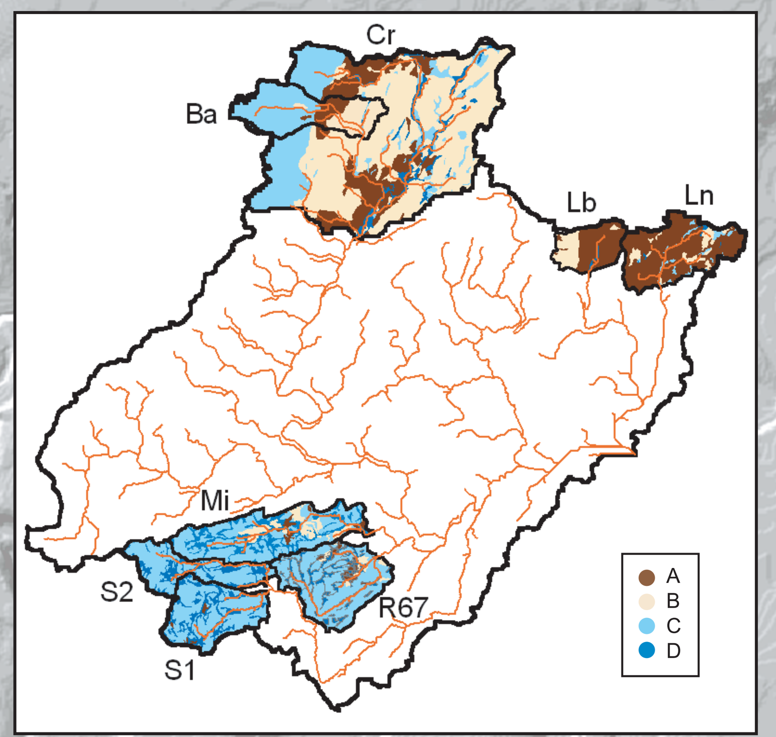


Percent Area of Hydro ID Soils in Eight Kayaderosseras Subwatersheds









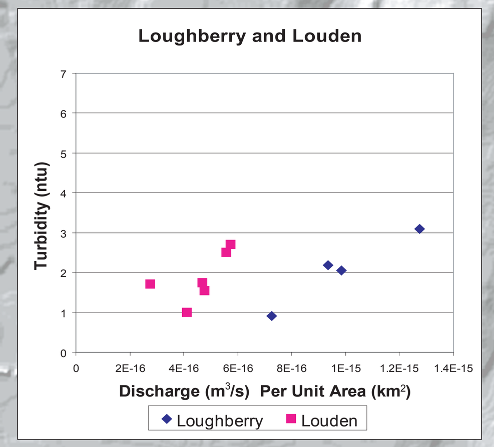
A = Low Runoff Potential, High Infiltration
B = Moderately Low Runoff Potential and Infiltration
C = Moderately High Runoff, Slow Infiltration
D = High Runoff Potential, Very Slow Infiltration

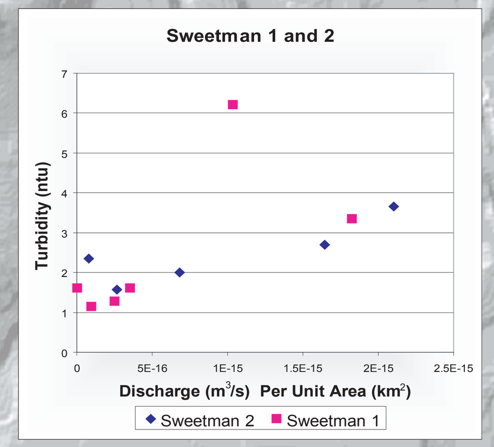
DISCHARGE AND TURBIDITY MEASUREMENT

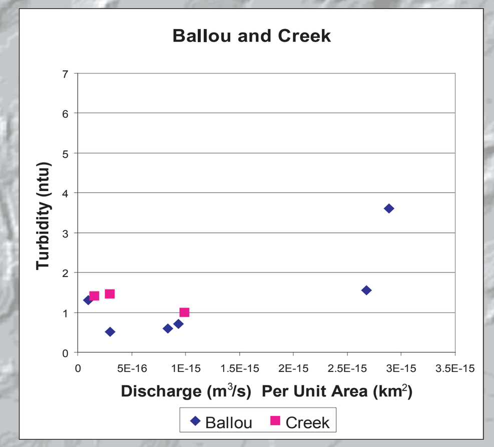
- Rain gauges were put near each pair of watersheds to monitor precipitation rates
- Turbidity was measured twice, up-road of each watershed site with a turbidimeter
- Stream velocity was measured at two separate cross sections that were representative of the total stream reach at each of the eight sites
- Turbidity and discharge were measured on seven different occasions over the span of eight weeks, during base-flow and post-storm events

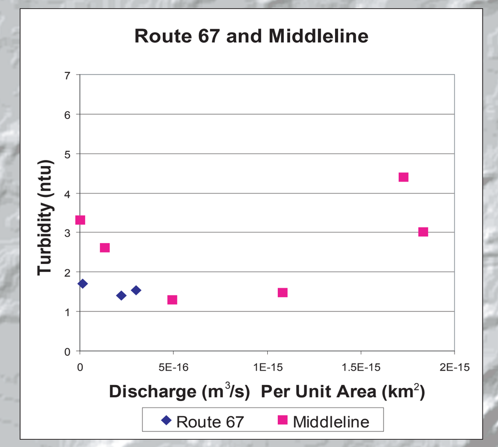
? Discharge was calculated by multiplying stream velocities measured with a Marsh-McBierny flow-mate and digitized cross-sectional areas

DISCHARGE-TURBIDITY CORRELATION

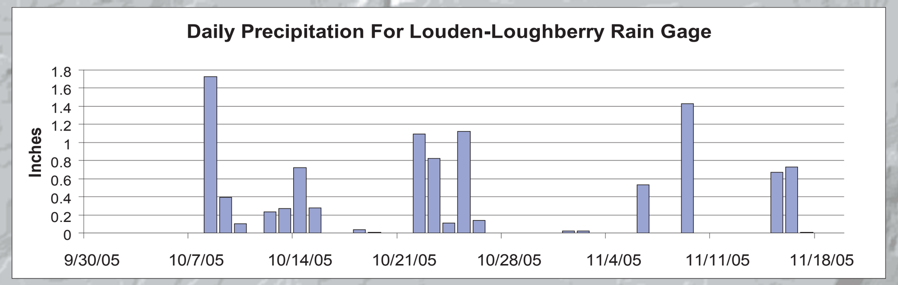


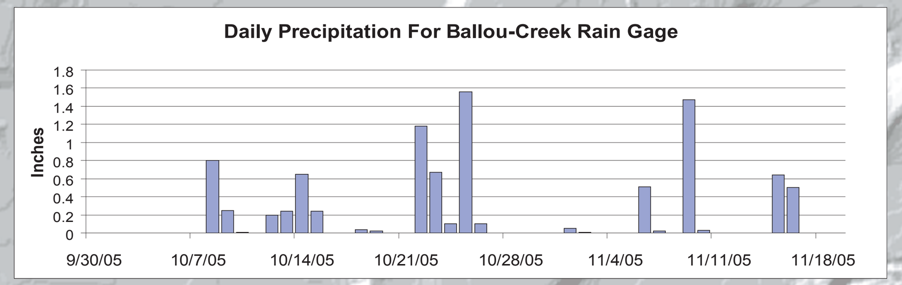


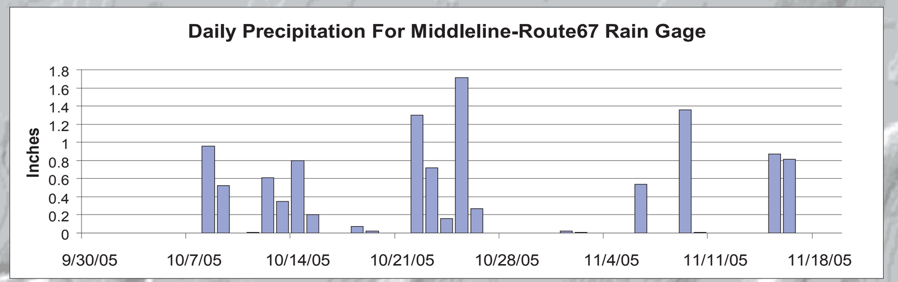


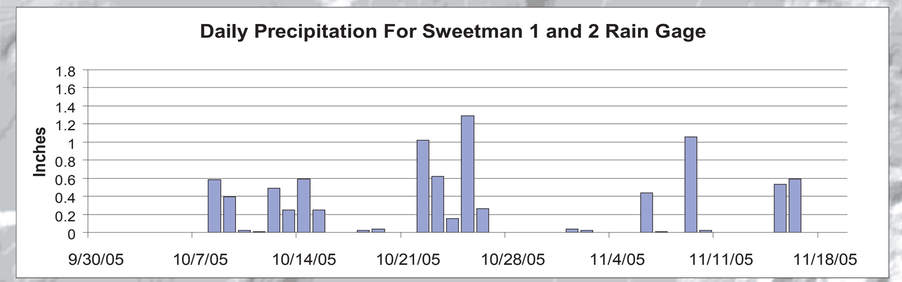


DAILY PRECIPITATION DATA

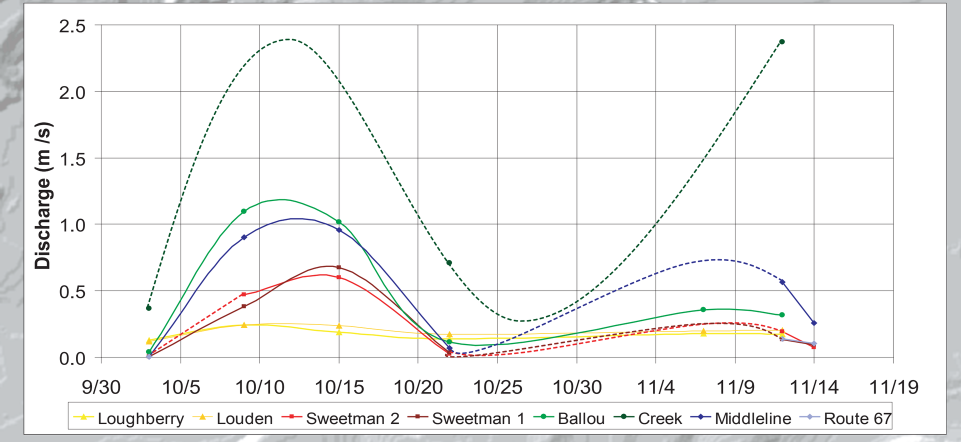








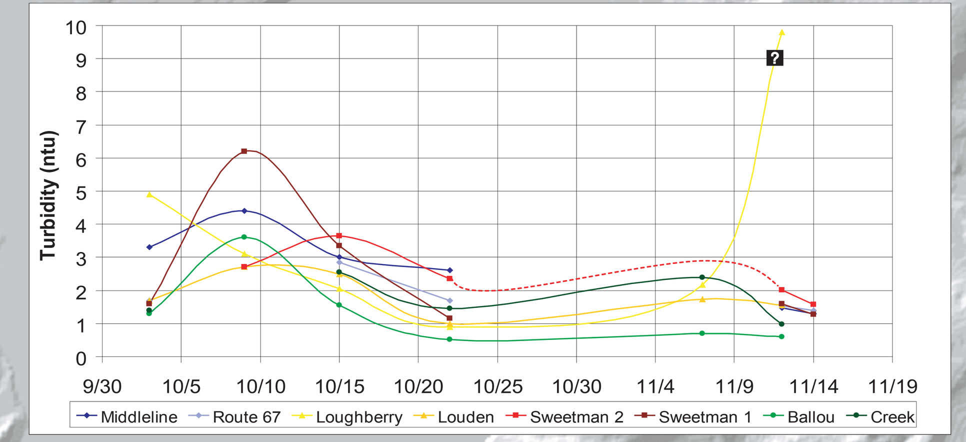
DISCHARGE RESULTS AND CONCLUSIONS



Discharge Levels Between 10/3 and 11/14

- Loughberry and Louden: sandy basins with mostly A soils remain fairly constant during base-flow and storm event periods due to low runoff potential and high infiltration rate of soils
- Middleline, Route 67, Sweetman 1 and 2: silty, agricultural basins with mostly C and D soils are flashy basins with high discharge during storm events and very low discharge during base-flow periods due to moderate to high runoff potential and slow to very slow infiltration rates
- Ballou and Creek: basins dominated by till but only 33-61% of C and D soils proved to be flashy but less so than basins with mostly C and D soils

TURBIDITY RESULTS AND CONCLUSIONS



Turbidity Levels Between 10/3 and 11/14

- The highest turbidities were generally recorded at Middleline, Route 67, and Sweetman 1 and 2, watersheds that had significant cultivated areas
- Ballou, Creek, Louden, and Loughberry usually had low relative turbidities with the exception of two high turbidities at Loughberry during base-flow conditions (these were assumed to be anomalous)
- High turbidity is governed by the presence of significant cultivated areas and a prevalence of C and D soils
- Loughberry and Louden, the watersheds with the highest land area percentage of development, had fairly low turbidities throughout the two month period

ACKNOWLEDGEMENTS

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