TURBIDITY MONITORING IN THE STRAIGHT AND CANNON RIVERS USING A TURBIDITY TUBE

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Purpose of Study: To test the use of the turbidity tube, to compare the turbidity of two rivers, and to observe the change in turbidity with weather and seasons.

Monitoring Location: During the summers of 1996 and 97, turbidity measurements were taken at the Straight and Cannon Rivers prior to their confluence in Faribault. Both rivers flow through parts of the city upstream of the sampling sites. The Cannon above the confluence flows through a series of dammed lakes, one of which is about 1/4 mile upstream of the sample site and is surrounded by a park with turf. Other small lakes flow into the Cannon River in this glacial moraine area. The river's average fall is 2 ft. per mile.

The Straight River's average fall is 7 ft. per mile. The closest upstream dam is in Owatonna, 27 river miles away. The Straight R. flows through an intensively farmed and drained landscape, but for several miles upstream of the sample site it is mostly surrounded by a wooded corridor. In 1996 the sample site was downtown, but it was judged to be too close to a storm sewer, so it was moved about 1/2 mile downstream in 1997.

Methods: The tube used by CRWP is made from a clear plastic fluorescent light protector and a white plumbing cap, which fit together without glue. A black and white secchi disk design is drawn on the bottom of the cap, and centimeters are marked on the tube. A sample of water is poured into the tube, and the height of the water is adjusted until the mark on the bottom can no longer be seen. Higher levels indicate clearer water; lower levels indicate more turbid water. Turbidity was read in centimeters. Testing was done approximately weekly and during or after rains.

Results: The turbidity results were compared with rainfall data from the Faribault area. Graphs of turbidity vs. rainfall are attached.

Turbidity during snowmelt season cleared up each year, and during May both rivers were very clear even on rainy days. Through the rest of the summer, the rivers responded differently.

The Cannon became turbid in June (<30 cm) and remained that way throughout the summer. The water of the Cannon was a yellow-brown color with no coarse sediment. During the summer the Cannon River water frequently contained individual algae filaments which did not appear to affect the turbidity readings. The presence of dams upstream may be preventing coarse sediments from reaching the sample site, but the cause of the yellow-brown color is not known.

The Straight showed a dramatic response to rain events, especially those of an inch or more. During the heaviest rains it contained coarse sediment that settled to the bottom of the sampling container. After one storm, even a centimeter of water obscured the bottom of the tube. The river cleared up after a number of days without heavy rain, but silt could be seen on the bottom and silt shoals have formed in some places.

Discussion: Water clarity is an important indicator ecologically as well as psychologically, and a turbidity tube is an easy and inexpensive way to measure it. The turbidity tube can be used to find where and when erosion problems are greatest, to test the effectiveness of erosion and stormwater control measures, and to find sediment loading sites. For best results, comparisons should be made between places and/or times, and measurements should be taken frequently.

The turbidity monitoring showed that erosion appears to be well controlled during mild rains. The heaviest storms of the season appear to be the primary cause of soil movement. When algae blooms occur in the lakes, the Cannon River is affected also. The Cannon water should be checked for microscopic algae, organic matter and fine sediments to see if they are contributing to the turbidity.

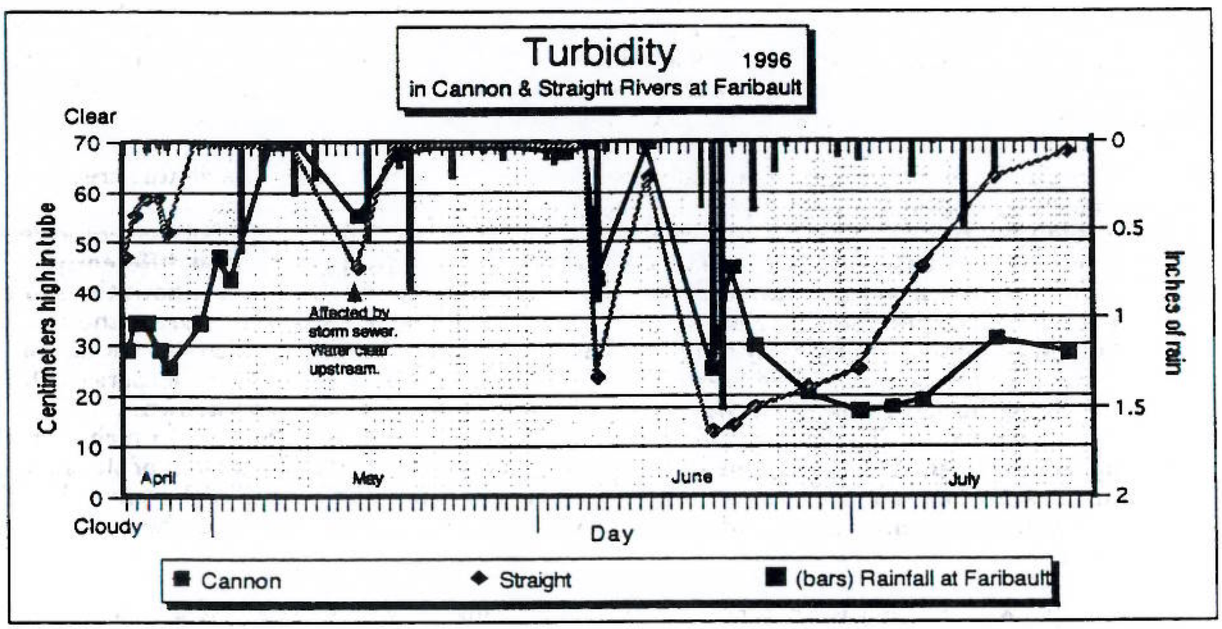
Im pr ovements that could be made in the monitoring technique include better calibration, more representative rainfall data, and more sample sites.

An attempt was made to calibrate the tube in Nephalo turbidity units. The tube was brought to the State Health Dept. lab and filled with various concentrations of standard solution. A logarithmic curve of height vs. turbidity was generated. The tube was then brought to the

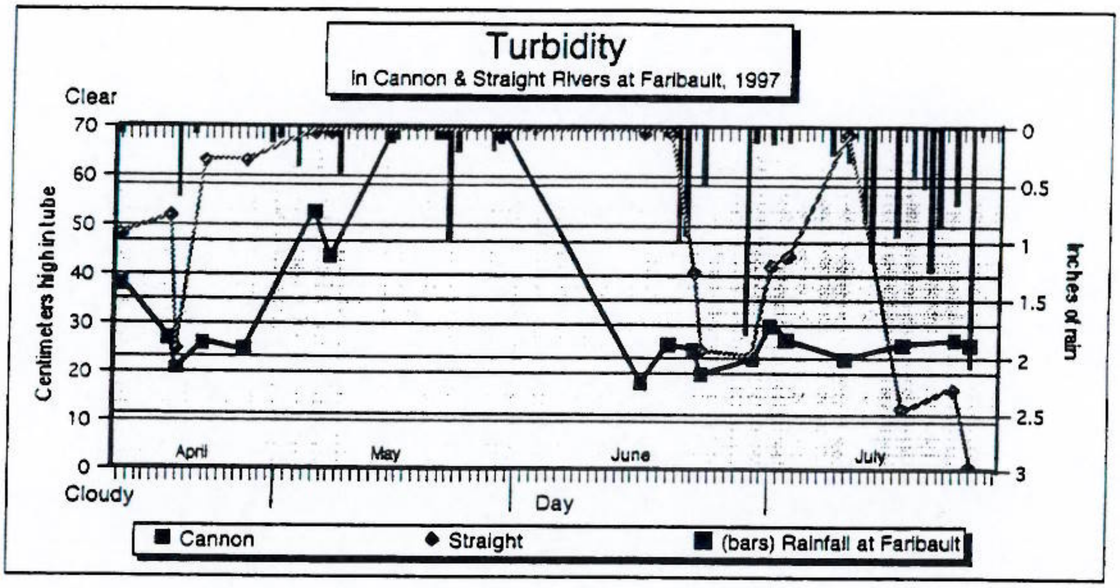
Owatonna wastewater lab and calibrated using turbid water created by adding soil to water. Another logarithmic curve was generated, but the two were quite different. Our theory as to the reason for the diffferences is that a turbidity meter reads light that has been scattered to the side. The standard solution will scatter more light than the dirty water because the color of the standard solution is whitish, while the dirty water contains the dark colored soil. This dark matter will absorb light instead of scattering it.

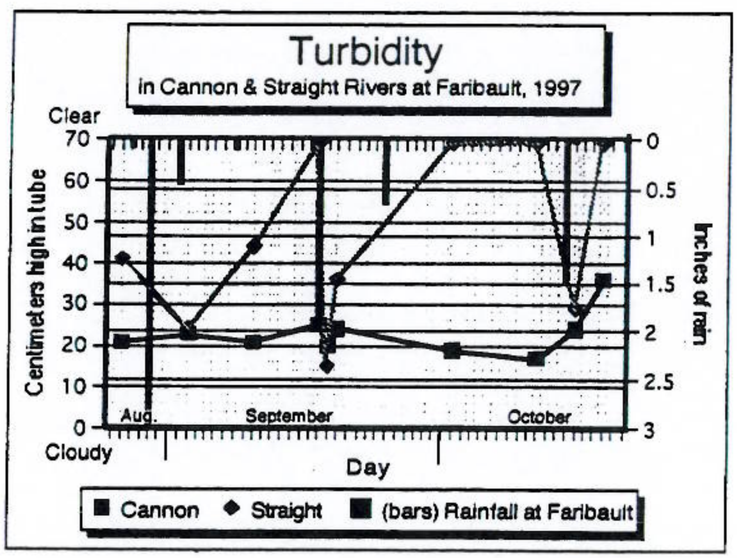
The use of rainfall data from Faribault is questionable because the rivers drain watersheds extending far from Faribault. Rainfall data from Waterville (upstream on the Cannon) and Medford (upstream on the Straight) were examined and sometimes differed greatly from the Faribault readings; however, they may be no more representative of the whole watershed. More closely-spaced rain gauges would allow an overall watershed average to be calculated.

Turbidity sampling at various points on the rivers and their tributaries would give a better picture of the sources of the problems.



Turbidity tubes are read by pouring water into the tube until a black and white design on the bottom of the tube is obscured. The number of centimeters of water in the tube is then recorded. Cloudy, or turbid, water will obscure the design sooner than clear water.


Turbidity
in Cannon & Straight Rivers at Faribault, 1997
Clear
Cloudy
Centimeters high in tube
Inches of rain
70
60
50
40
30
20
10
0
0
0.5
1
1.5
2
2.5
3
April
May
June
July
Day
Cannon
Straight
(bars) Rainfall at Faribault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Aug.
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Cannon
Straight
(bars) Rainfall at Faribault