

## MIDDLE RIVER STREAMFLOW

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Photo 1 - Middle River as it enters the Bras d'Or Lake

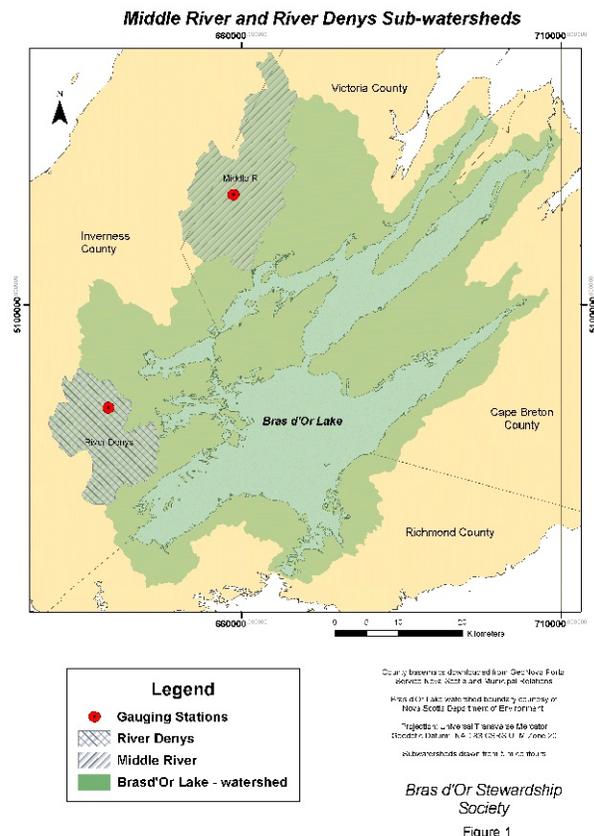
As a Canadian society we are gradually becoming more knowledgeable about the importance of water through high profile issues such as: global impacts (climate change), selling our water (blue oil), contamination of water supplies (Walkerton), terrorism (911), impact by industrial legacies (Sydney Tar Ponds, Devco mine workings), and impact by flooding (during November and December of 2010). Yet the Bras d'Or Lakes watershed in large measure mirrors the rest of the country in the minimal emphasis placed to date on understanding the bigger issues. How much fresh water do we have? Where is it? How much is replenished each year? What is the quality of the water? How much must be left to sustain natural ecosystems? How does fresh water input impact coastal marine environments? The bottom line is:

You cannot effectively manage what you do not understand!

You can't effectively allocate when you don't know how much you have!!

To answer some of those questions requires a commitment of monies to undertake water monitoring and research. To better assess fresh waters in our streams requires installation of stream gauging stations which continuously monitor how much water is moving through the channel-called stream flow or discharge. The longer the monitoring period, the greater our ability to see changes due to storm flows and drought, seasons and years, as well as longer term climate change.

In the 2,512 km<sup>2</sup> watershed which directs runoff from rainfall into the Bras d'Or Lake, there are only two, government (Provincial/Federal) sponsored, relatively recently installed stream gauging stations, managed by Environment Canada. One is located on the Middle River at MacLennans Cross (station 01FF001). It started monitoring in 2004. The other is on River Denys at Big Marsh (station 01FG001), which started monitoring in 2006. The location of these stations and their respective watersheds are shown on Figure 1. The information collected at the Middle River Station represents approximately 38.3 % of the Middle River watershed, the information collected at the River Denys Station collects data for only 6.8% of the River Denys watershed! Together they measure fresh water inflow over only 5% of the Bras d'Or Lake watershed.



The gauging stations continuously monitor the change in water level in the streams and the technicians take that data and change it to a streamflow or discharge. Photo 2 shows typical low summer flow at the Middle River gauging station on September 16, 2006. This is compared with the larger fall storm flow event in Photo 3, which shows the peak storm flow on December 15, 2010. This flow caused much flooding and destruction adjacent to the river, perhaps also to the stream channel. The high flow event was the largest storm event by far, over the 6 year monitoring period. This same storm event caused significant damage in the Northeast Margaree River. It was greater than a one in one hundred year streamflow event at that site (gauging station in place since 1916).



Photo 2 - September 16, 2006



Photo 3 - December 15, 2010

As hydrologists and hydrogeologists one of things we do with this data is to see how the flow changes with seasons by plotting the average stream flow for each day - called a "hydrograph". The one for 2009 is shown in Figure 2. It shows streamflows decreasing during the winter snow period. Spring melt results in higher flows of the spring freshet (can you see two peaks? why?), which then gradually decline during the summer months to their lowest levels in August and September. These gradually increase during the fall rains. During 2009 year the average annual stream flow was 4.8 m<sup>3</sup>/s (or 288,000 litres per minute - or 63,300 gallons per minute), ranging between 0.9 and 40 m<sup>3</sup>/sec.

Imagine how much fine sediment is transported to the Lake during these high flows! Granted they are short duration events where fast moving, sediment laden water from the upper portions of the watershed, erodes stream channels and banks. But assuming a minimum of 40m<sup>3</sup>/sec flowing out of the Middle River and a suspended sediment load of 310 mg/L (results of our sampling on December 15, 2010), that would be in the order of 1000 tonnes of fine sediment, with its attached bacteria, nutrients and metals, flowing past the gauging station in one 24 hour high flow event. Surely sediment loads would be even higher downstream, as the water picks up more flow and additional sediment passing easily eroded river banks and then enters the Lake.

Once the fast moving water from the river reaches the Lake, velocities slow and with time, the sediment settles out of the water column, to accumulate on the Lake bottom (see photo 1). Depending on the time of year, sediment accumulation may have more or less impact on the marine habitat. Will fish eggs be smothered or bottom dwellers be impacted? Is this a good event from the perspective of the Lake and its inhabitants? Or not? These are questions for marine ecologists, exemplifying the need for interdisciplinary research.

River systems vary depending on their geology (bedrock and overburden). Sediment loads and peak velocities will differ from river to river, depending on the geologic material within stream banks, the size of the catchment area (watershed), topography, slope, and land use among many parameters. For example during the same peak flow on December 15, 2010, the total suspended sediment in the Humes River was only 8 mg/L.

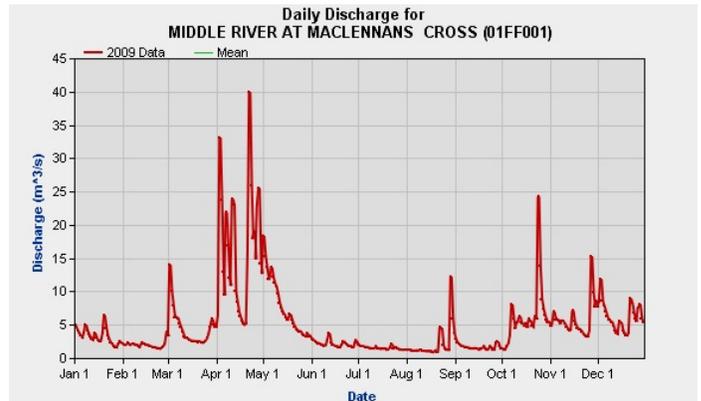


Figure 2 - Courtesy of Environment (website below)

Certain stream gauging stations on Cape Breton, as well as across the country have been defined as real time stations where you can quickly access the water level information. The gauging stations in the Middle River and in River Denys are on that list. They can be accessed at <http://www.wateroffice.ec.gc.ca>

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