

Table 1. Equipment list

Item
10-L carboy (Nalgene no. 2318-0020) ¹
Quick Disconnect Connector (Nalgene no. 6150-0010) ¹
Pipette tip (100- to 1000-L volume)
1 3/2 one-hole rubber stopper
40 cm length of Plexiglas tubing (5 mm outside diam.)
Tripod with plywood square

¹Nalgene part numbers provided purely for reference. No specific endorsement of Nalgene parts relative to alternative manufacturers is intended or should be implied.

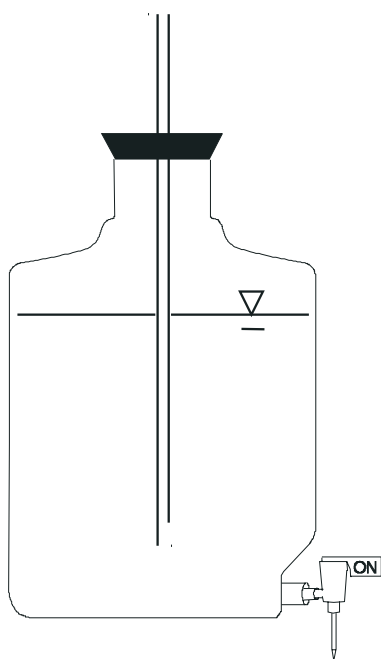


Figure 2. Schematic of assembled Mariotte bottle.

injection rate will be higher than the ultimate steady-state rate until air begins bubbling through the air entry tube. Once “bubbling” begins, the injection rate will be constant. Bubbling can be detected by listening for the distinctive “gurgling” sound that occurs every few seconds. Because the Mariotte bottle will initially drain at a rate higher than the steady-state constant rate, the measured tracer concentration in the stream (e.g., as measured by electrical

conductivity for salt injection) may initially overshoot and then settle down to the steady-state value. To avoid this, a bucket can be used to catch the injection solution until constant flow is established.

The injection rate (q) can be measured using a 100-mL graduated cylinder and a stopwatch. It is important to measure q in the field, since the injection rate via the pipette tip varies with temperature. In addition, the outflow rate is influenced by the orientation of the pipette tip, which depends on the inclination of the support base for the Mariotte bottle, and on the height of the lower end of the bubbler tube. Several trials should be conducted to obtain an average outflow rate. Repeated measurements also allow estimation of the uncertainty for use in error analysis.

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Profile

Dr. Markus Weiler: A New Face in B.C. Hydrology

How and when do hillslopes contribute to streamflow in watersheds? How does residence time of water draining a watershed affect flow pathways and storage as well as water quality? How do natural and human disturbances in forested watersheds change the properties of soils and hence infiltration characteristics and flow paths of water? These are some of the questions that Dr. Markus Weiler, Assistant Professor in the Departments of Forest Resources Management and Geography at the University of British Columbia (UBC), and FRBC Chair in Hydrology since January 2004, is currently investigating.

Dr. Weiler completed his Ph.D. at the Swiss Federal Institute of Technology (ETH) in Zurich, Switzerland in 2001. His dissertation dealt with the experimental identification and numerical modelling of flow in natural soils, to evaluate the effects of macropore flow on runoff generation and to predict flow pathways in watersheds. While at ETH, Markus also collaborated on various consulting projects related to stochastic hydrology, flood hydrology, and impacts of environmental changes on surface and subsurface hydrology.

Weiler spent the last two years in the United States as a postdoctoral researcher in the Department of Forest Engineering at Oregon State

University (OSU). There he worked with Jeff McDonnell on projects dealing with runoff generation in forested catchments, hydrologic processes at the hillslope and plot scales, and impacts of forest management and forest fire on runoff

and nutrient dynamics in the Pacific Northwest (PNW). Working at OSU has provided him with valuable insights into the issues and conflicts related to forestry activities in the PNW. "In Europe, I was taught to work in a completely

"A constructive dialogue between field hydrologists and the hydrologic modelling community will be a key element to better understand the complexity of water flow and solute transport in watersheds."



M. Weiler

M. Weiler transporting flume.

human-influenced environment," he observes. "Working in the PNW is different—it's much like researching a natural environment and dealing with the conflicts between humans and nature."

As FRBC Chair in Hydrology, Weiler has started to develop a research program collaborating with both government and industry. He is now working on a project with Dr. Younes Alila, several partners from the forest

industry, and the B.C. Ministry of Forests regarding how to move beyond the equivalent cut area approach in the B.C. Interior. He is also actively pursuing funding from NSERC for a project to better understand water and solute response in different runoff generation processes. In addition, he is participating in a USDA-funded research project addressing the topographic, hydrologic, and soil biogeochemical controls on CO₂ generation and efflux in watersheds.

A challenge for Weiler is to combine knowledge of detailed hydrologic process at the plot and hillslope scales with the apparently simpler, integrated responses at the watershed scale. Most hydrologists agree that understanding hydrologic processes on all scales is a prerequisite for prediction, especially in ungauged basins. However, the dilemma is how to link detailed process knowledge and observed non-linear behaviour in small-scale hillslopes to the myriad of simultaneously occurring hydrologic processes within large-scale watersheds. To answer these questions, he is following a parallel approach, where obtaining a detailed understanding of small-scale processes guides the development of distributed hillslope models that integrate the complexity of the plot scale (e.g., preferential flow), and large-scale observations. Depending on the temporal and spatial scales, Markus incorporates isotope techniques, artificial tracing techniques, nutrient dynamics, and temperature variation studies. Weiler comments that "a constructive dialogue between field hydrologists collecting data and process information and the hydrologic modelling community will be a key element to better understand the complexity of water flow and solute transport in watersheds."

In addition to research, Weiler lectures on hydrology and watershed processes at UBC. He is also

developing a graduate course on tracer methods in hydrology. This course will address how natural and artificial tracers can be used to better grasp processes in soils, hillslopes,



M. Weiler

M. Weiler installing v-notch weir in culvert.

watersheds, and streams. Dr. Weiler is incorporating both field experiences and up-to-date computer simulation and modelling into his teaching. "I am fascinated by field observation, where we can conceptualize how hydrology really works," he notes. Weiler also hopes to revitalize and extend the graduate program of Interdisciplinary Hydrology at UBC. "The water cycle sustains life and a habitable environment by transporting mass, energy, and substances," he argues. "Thus hydrology should be one of the key elements connecting geo- and biosciences with engineering and social science."

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