

## **Multiple Sources and One Pipe: Using Hydraulic Analysis to Model Source Water Composition Changes in the Arkell Aqueduct**

Dennis Mutti<sup>1</sup>, Michelle Scott<sup>1</sup>, Shawn Hustins<sup>2</sup>, Graham Nasby<sup>3</sup>

<sup>1</sup> C3 Water Inc, 350 Woolwich St. S., Breslau, Ontario, N0B 1M0, Canada  
(\*correspondence: [dennis.mutti@c3water.ca](mailto:dennis.mutti@c3water.ca))

<sup>2</sup> School of Engineering, University of Guelph, 50 Stone Rd. E., Guelph, ON, N1G 2W1, Canada

<sup>3</sup> City of Guelph Water Services, 29 Waterworks Pl., Guelph, Ontario, N1E 6P7, Canada  
(\*correspondence: [graham.nasby@guelph.ca](mailto:graham.nasby@guelph.ca))

### **Keywords:**

Hydraulic Model, Aqueduct, Source Characterization, SCADA, Modelling, UV Treatment

**Format:** 20 minute presentation

**OWWA Program Tracks:** Automation

### **Short Abstract for Program (50 words)**

C3 Water Inc. has developed hydraulic models of the Arkell Aqueduct to estimate transit-times of GW and GUDI-WEF source water from Arkell wellfield to Woods Water Treatment Plant. The model was used to program a real-time SCADA application that is used by Operations to determine when UV treatment is required.

### **Long Abstract (250 Words)**

In the event of a loss of UV treatment capability at the Woods Water Treatment Plant (Plant) in the City of Guelph (City), a contingency plan is required to prevent the introduction of undertreated water into the distribution system. Water is supplied to the Plant through the Arkell Aqueduct which conveys water from both groundwater under the direct influence of surface water with effective filtration (GUDIWEF) and groundwater (GW) sources. Due to the reduced treatment capability during a UV system outage, the introduction of GUDIWEF into the plant needs to be avoided.

One option is to isolate the aqueduct and drain/flush-out the GUDIWEF. During this process, water from GW sources can be introduced to the aqueduct inlet, which will maintain head on the GUDIWEF to be removed. The introduction of GW in this manner will also allow the aqueduct/plant to resume service sooner, once the GUDIWEF water was been drained/flushed-out.

This project involved verifying the feasibility of draining the aqueduct, specifically examining the risk of flooding at the manholes during either a planned UV shutdown or an emergency shutdown. Analysis for both scenarios was done using field tests followed by modeling in PCSWMM. The PCSWMM model was then converted into a time-step Excel model, which was used as the basis for a real-time SCADA application. The SCADA application is now used by the City to determine the composition of source

water entering the plant, and to estimate the time when incoming source water composition changes are expected to occur.

### **Learning Objectives**

1. Understand the importance of source water characterization during a UV treatment system outage.
2. Develop an understanding of the hydraulics of draining an aqueduct and the impacts on travel time from source to treatment plant.
3. Develop an understanding of using PCSWMM to develop a hydraulic model based on field test results.
4. Learn how to develop a time-step Excel model from PCSWMM, and use this as a basis to develop a real-time model in a SCADA system

### **About the Speakers**

**Dennis Mutti, M.A.Sc., P.Eng** brings over 23 years of progressive experience in the municipal water and wastewater industry. He has led projects and programs through all phases of delivery, from conceptualization and planning through design and construction, to start-up, commissioning and optimization. This experience has allowed Dennis to develop a thorough understanding of how to deliver solutions that result in value from the source to tap and tap back to source. Dennis is the President of C3 Water Inc. Contact: [dennis.mutti@c3water.ca](mailto:dennis.mutti@c3water.ca)

**Michelle Scott, B.A.Sc., EIT** is a recent graduate of University of Waterloo and provides water modelling and site services as part of the team at C3 Water Inc.

**Shawn Hustins** is a 4<sup>th</sup> year Engineering Systems and Computing student at the University of Guelph's School of Engineering. He recently completed a SCADA programming co-op placement at City of Guelph Water Services.

**Graham Nasby, P.Eng, PMP, CAP** holds the position of Water SCADA & Security Specialist at City of Guelph Water Services, a publicly-owned water utility located in Guelph, Ontario, Canada. Prior to joining Guelph Water, he spent 10 years in the engineering consulting community after completing his B.Sc.(Eng) at the University of Guelph. He is senior member of the International Society of Automation (ISA) and co-chair of the ISA112 SCADA System Standards Committee. He is a member of both OWWA and WEAO, and currently sits on the OWWA Automation Committee. Contact: [graham.nasby@guelph.ca](mailto:graham.nasby@guelph.ca)