



Introducing the North American Stream Hydrographers (NASH)

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Abstract

North American Stream Hydrographers (NASH) is a non-profit organization focused on the theory and practice of hydrometry. It became formally affiliated with the Canadian Water Resources Association in 2022. This article summarizes the organization's historical development and provides an overview of its activities. All members of the water resources community with an interest in hydrometry are encouraged to get involved via the contact information provided.

Keywords: hydrometry, streamflow measurement, hydrometric data

Introduction

The North American Stream Hydrographers (NASH) is a non-profit organization, composed of working professionals from industry, government, and academia, focused on the theory and practice of hydrometry. Its mission is “to better the understanding of the collection, compilation, and use of hydrometric data, along with providing assurance that data production and analysis have been undertaken with appropriate methods with due care to needs of clients and users of hydrometric data” (North American Stream Hydrographers, 2022).

To support its mission, NASH has the following objectives:

- To collaborate for the transfer of knowledge and techniques for all aspects of hydrometric data collection, processing, analysis, and presentation throughout North America.
- To encourage the investigation, evaluation, and implementation of new techniques and methodologies for hydrometric data.
- To contribute to the knowledge and establishment of standard methodologies for hydrometric data collection, analysis, and dissemination that will allow for ease of data exchange and usage, ease of access to reference material, a shared understanding of data uncertainty, and confidence in the results.

This article provides an overview of the organization in terms of its history, operations and governance, and activities. The objective is to raise awareness of NASH and its activities, and to encourage members of the water resources community to get involved.

History

The concept of NASH originated in 2008 at the Water Survey of Canada Centennial Conference in Penticton, B.C., which drew nearly all of the more than 200 active hydrometric technologists from across the Water Survey of Canada organization. Colleagues in the United States Geological Survey (USGS) were also invited to discuss and develop standard operating procedures for current and emerging technologies used in hydrometry. Take-away messages from this conference included the need for collaboration among industry, government, and academia, and for hydrometric training across the water sectors. As well as being an acronym, the name NASH honours the late educator James Eamonn Nash for his ground-breaking investigations in hydrologic engineering and innovative solutions of hydraulic problems.

The first NASH teleconference was held on May 15, 2009. The first formal meeting was held as a special session at the 2010 Canadian Water Resources Association (CWRA) conference in Vancouver, B.C. The session included 26 oral and poster presentations. A selection of these were published in a special issue of the *Canadian Water Resources Journal* (Dow Ambtman & Hicks, 2012; Guay, Choquette, & Durand, 2012; Hamilton & Moore, 2012; Moore, Hamilton, & Whitfield, 2012; Whitfield, 2012).

Since 2010, CWRA hosted NASH-themed sessions and workshops in conjunction with its annual conferences in 2011 (St. John), 2012 (Banff, joint meeting with Canadian Geophysical Union), 2015 (Winnipeg), 2016 (Montreal), 2017 (Lethbridge), 2018 (Victoria), 2019 (Collingwood), and 2022 (Canmore). This long-standing association with CWRA has now become official, as NASH formally became an affiliate of the Canadian Water Resources Association in 2022. In addition to the NASH sessions held in conjunction with CWRA annual conferences, sessions were also held in conjunction with the American Water Resources Association's annual conference in 2014 (Seattle).

Although NASH was unable to host in-person events during the pandemic, it remained active by building its membership through its Twitter account @Stream_North. It also updated its by-laws to include an expanded executive committee.

Scope of NASH activities

A major focus of NASH is training, testing, and standards development related to both established hydrometric approaches, such as Acoustic Doppler Current Profiler (ADCP) and dilution gauging, and emerging techniques, such as the use of ground- and drone-based image velocimetry. However, the scope of NASH activities addresses a broad range of topics related to streamflow measurement and analysis. In the past, working groups were struck to address the following topics:

- Common data access framework
- Hydrometric standards and training
- Network design
- Flow measurement under river ice
- Streamflow reconstruction
- Uncertainty analysis

Currently active working groups are focused on the following:

- Development of a hydrometric course syllabus and certification program
- Management of long-term data storage related to NASH activities
- Compiling documentation of past NASH activities and events for a publicly available archive

Flow regattas

NASH regularly hosts “flow regattas,” events at which stream hydrographers use a range of technologies to measure streamflow at the same location or set of locations (Figure 1). The goal of the regattas is to allow intercomparison of methods and to raise awareness within the water resources community of the range of methods and technologies available for hydrometric operations. These events have often been organized as workshops associated with the CWRA annual conference.

The first regatta was held in 2013 at Mosquito Creek in North Vancouver, BC, where the focus was on



Figure 1. Measurement of streamflow at Spray River near Banff during the 2022 regatta by an Acoustic Current Profiler (ADCP) (left panel) and an Acoustic Velocimeter (ADV) mounted on a wading rod (right panel). Photo credit: Derek Brzoza

dilution gauging methods. The second regatta was held in 2017 at the Alberta Irrigation Technology Center in Lethbridge, AB. That event was held in conjunction with the CWRA annual conference and had a focus on small flows. Two flow regattas were held in 2018. One was associated with the Environmental Flow Needs Conference in Kelowna, BC, which was hosted by the Okanagan Basin Water Board and the CWRA BC Branch in partnership with Okanagan Nation Alliance. The other was associated with the CWRA annual conference in Victoria, BC. In 2019, a flow regatta associated with the CWRA annual meeting in Collingwood, ON, attracted both national and international participants.

These in-person hands-on events were postponed in 2020 and 2021 due to the pandemic but resumed at the CWRA annual conference in 2022 with the help and collaboration of the Water Security Agency of Saskatchewan, the Governments of British Columbia and Alberta, Water Survey of Canada, the Coldwater Research Laboratory, and the commercial sponsors.

An ongoing NASH project is to collate and share the data collected during the regattas to provide a robust data set for evaluating the relative precision and accuracy of different flow measurement techniques. A working group is currently exploring options for managing and storing the data.

Courses

In support of knowledge sharing, education, and development of best practices, NASH offers introductory courses on hydrometry for professional development with a focus on established technologies such as ADCP and dilution gauging, as well as emerging technologies such as radar, rising bubble method, and image velocimetry. For example, NASH hosted a workshop on “Introduction to Hydrometric Data Collection” at the 2022 CWRA National Conference in Canmore. The workshop focused on the considerations required for a robust stream gauge installation, including stage measurements, benchmark and datum considerations, collection of flow measurements, and hydraulic controls. The workshop was held over two days and had both a field and classroom component. This structure allowed participants to conduct flow measurements and later apply quality assurance and quality control procedures to the collected data and grade the quality appropriately.

A longer-term goal is the development of a Hydrometric Certification Program in which participants can develop their skills through learning standard operating procedures and best practices in hydrometry. Such a certification program has been requested through the various water sectors and NASH is investigating the creation of such a program through a committee that includes members involved in hydrometric programs at both provincial and federal levels.

Contact information and how to get involved

Current information about NASH and its activities can be found at <https://nash.cwra.org/>. Those interested in NASH and its activities are encouraged to join the email list on the NASH website.

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Websites

Allaire, J.J. 2022. *quarto: R interface to 'Quarto' Markdown publishing system*. <https://CRAN.R-project.org/package=quarto>

North American Stream Hydrologists (NASH). Canadian Water Resources Association. <https://nash.cwra.org/>

Müller, K. 2020. *here: A simpler way to find Your files*. <https://CRAN.R-project.org/package=here>.

R Core Team. 2021. *R: A language and environment for statistical computing*. Vienna, Austria: R Foundation for Statistical Computing. <https://www.R-project.org/>

Xie, Y. 2021. *knitr: A general-purpose package for dynamic report generation in R*. <https://yihui.org/knitr/>.

References

Dow Ambtman, K., & F. Hicks. 2012. Field estimates of discharge associated with ice jam formation and release events. *Canadian Water Resources Journal*, 37(1):47–56. doi:10.4296/cwrj3701868

Guay, C., Y. Choquette, & G. Durand. 2012. Hydroacoustic doppler technology: A key element in the improvement of winter hydrometric data quality. *Canadian Water Resources Journal*, 37(1): 37–46. doi:10.4296/cwrj3701867

Hamilton, A.S., & R.D. Moore. 2012. Quantifying uncertainty in streamflow records. *Canadian Water Resources Journal*, 37(1):3–21. doi:10.4296/cwrj3701865

Moore, R.D., A.S. Hamilton, & P.H. Whitfield. 2012. North American Stream Hydrographers [NASH] Special Issue. *Canadian Water Resources Journal*, 37(1):1–2. doi:10.4296/cwrj3701863

Whitfield, P.H. 2012. Why the provenance of data matters: Assessing fitness for purpose for environmental data. *Canadian Water Resources Journal*, 37(1):23–36. doi:10.4296/cwrj3701866
