



SOLVING SMALL COMMUNITY DRINKING WATER CHALLENGES

2019 Awards Competition | Community Outreach and/or In-House Initiatives



2019 Awards Competition

SOLVING SMALL COMMUNITY DRINKING WATER CHALLENGES

Submission Category: Community Outreach and/or In-House Initiatives



ASSOCIATION OF CONSULTING
ENGINEERING COMPANIES | CANADA

ASSOCIATION DES FIRMES
D'INGÉNIEURS-CONSEILS | CANADA



April 2019



Village of Dzit'lainli (Middle River), BC

SUMMARY

WSP collaborated with RES'EAU-WaterNET researchers to develop an innovative treatment system to improve drinking water for small and remote communities. By removing organics, which impede disinfection and can cause carcinogen formation, the new system reduces chemicals, wastage, and operator time – and provides safer, more reliable water. WSP designed a full-scale treatment plant, lifting a remote community's longstanding boil water advisory, and enabling environmental, social, and economic benefits – ultimately leading innovations towards helping many more communities.

This project received the Lieutenant Governor's Award of Excellence at the 2019 ACEC-BC Awards for Engineering Excellence



Fourteen year boil water notice at the entrance to the Village

PROJECT HIGHLIGHTS

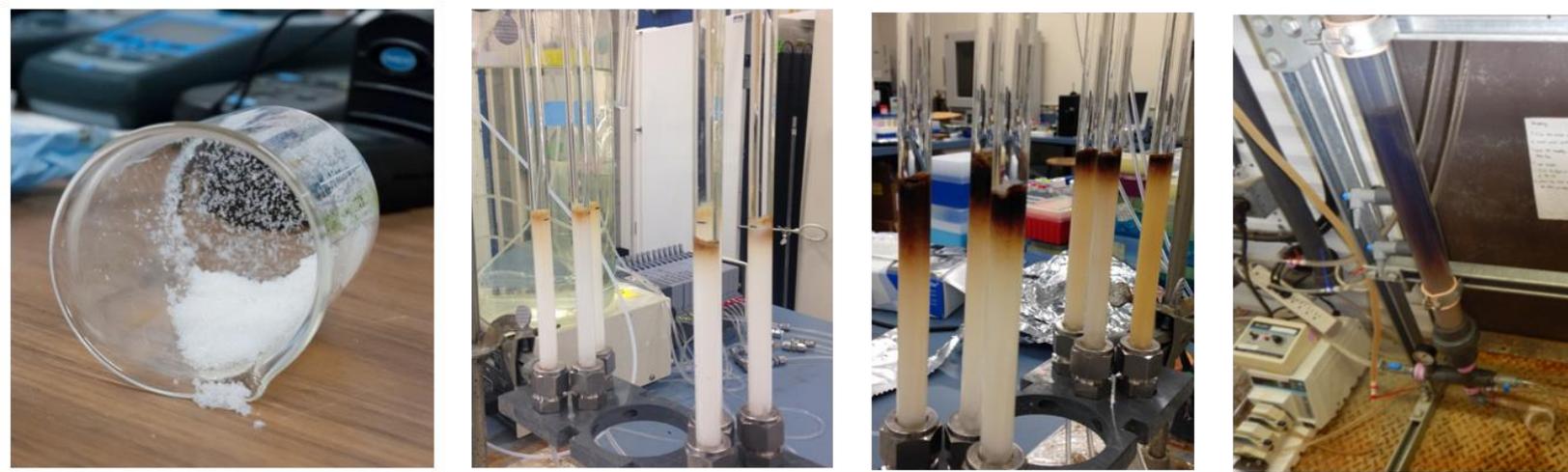
NATURE OF THE PROJECT

Currently, approximately 6 million Canadians are serviced by small drinking water systems (< 500 people), which comprise 77% of the nation's boil water advisories. Organics cause deleterious effects throughout drinking water systems, making tap water not only unpleasant in taste, odour, and colour, but also increasing biological growth in the distribution system, increasing chemical demand, and producing carcinogenic disinfection by-products. Providing treatment for organics in small and remote communities has been an engineering challenge, as traditional technologies include chemical treatment, mechanically complex and expensive nano-filtration, or costly adsorption medias. Additionally, small communities lack the luxury of finding alternative treatable source water, and as such struggle with the social and economic consequences of living under a continual boil water advisory (BWA).

In 2016, after working with communities struggling with these issues, WSP approached researchers at RES'EAU-WaterNET to investigate and pilot test an innovative organics removal process, specifically created for small and remote communities.

The goal was to assess the viability of using a biologically-enhanced ion exchange media to remove organics from surface water, which would require little to no chemical addition, minimize the production of harmful wastewater, and reduce operator oversight by using natural biological processes. This initiative led to the development of a ground-breaking treatment system coined biological ion exchange (BIEX), which harnesses the source water's natural biological elements to provide treatment.

In conjunction with lab work, the team pursued a new approach for the delivery of complex technical engineering projects focused on the end user rather than completing a "check box exercise" -- termed the Community Circle™ approach. The goal of the Community Circle™ is to involve all relevant parties of a water treatment project, from project inception to delivery, encouraging diverse perspectives and collaboration.



Various stages of BIEX research

In 2018, through combining a new treatment technology and a collaborative project implementation approach, this work culminated in the implementation of the world's first BIEX treatment plant, and enabled the pilot community to lift the 14-year BWA.

KEY OBJECTIVES

- Develop an organics removal technology for water treatment in small and remote communities that utilizes natural biological processes, requires minimal consumables and chemicals, produces minimal waste, and is simple for operators; and
- Integrate a collaborative, community-based process to successfully implement the technology in a small, remote community with a history of water supply issues and boil water advisories, ultimately creating a model that can bring applicable benefits far beyond the pilot community. In 2018, through marrying a new treatment technology and a collaborative project implementation approach, this work culminated in the implementation of the world's first BIEX treatment plant that allowed the Nation to lift the 14-year BWA.



New BIEX water treatment plant installed next to the existing water treatment plant

EFFORT AND COMPLEXITY OF THE PROJECT

WSP's drinking water project team was committed to solving the challenges facing small and remote communities, which are often burdened with difficult-to-treat source waters. One of these communities was the remote Village of Dzit'lainli (Middle River), BC, which had been on a boil water advisory for 14 years after multiple failed attempts to treat the source water high in organics. The team applied internal funding in 2013 to work with UBC to research organic treatment methods that could solve issues affecting 6 million Canadians serviced by small water systems.

WSP's team engaged future engineers at UBC, introducing them to key problems the industry faces. This engagement resulted in top researchers across Canada collaborating to develop solutions, leading to five graduate theses and field pilot testing at a water treatment plant in Laval, Quebec, and ultimately benefiting the remote Village of Dzit'lainli. The Village enthusiastically collaborated in the development and testing of this breakthrough technology, and the operator worked directly with the researchers to test the BIEX technology on the source water, fostering future sustainability.

WSP's engineers, researchers, Indigenous Services Canada (ISC), and the First Nation's Health Authority (FNHA) conducted regular site visits to this remote Village to meet with the residents and the operator to discuss previous failed attempts at treating the water, alternative solutions, and goals for the plant. Teams collected, hauled, and experimented with the source water, conducting an extensive series of tests.

The project team worked for four years with the Village's operator who steadfastly collected samples and was instrumental in the pilot system setup and operations. The team's efforts allowed the researchers to develop and prove the treatment method, thereby optimizing the process before advancing to a full-scale water treatment plant.

With this innovative research, methodology, and implementation, in 2018 WSP developed a design for the world's first full-scale BIEX water treatment system for Dzit'lainli. The novel system removes the organics and eliminates the carcinogenic by-products, which were forming when the chlorine reacted with the organics. The design makes the process more environmentally sustainable, increases operational efficacy, and improves water safety and reliability.

WSP conducted numerous site visits after the plant's construction, and met with the operator to review initial operations and plant performance. With the successful implementation of the BIEX system, Dzit'lainli Village was allowed to lift the 14-year BWA.



Project partners inspecting the BLEX plant

Operators removing the boil water advisory sign

SOCIAL, ECONOMIC AND ENVIRONMENTAL BENEFITS

Innovations developed and applied towards solving the water supply problems of Dzit'lainli Village can benefit numerous remote and small communities across Canada. The technological advances WSP led will ultimately improve environmental conditions and sustainability – alongside citizens' lives, community, and prosperity.

SOCIAL SUSTAINABILITY:

Dzit'lainli Village Residents lived under a BWA for 14 years, causing many to move away from the community due to difficult living conditions. Since the BWA was lifted, residents anticipate improved conditions will encourage more people to stay in, or return to, the community, inspiring renewed connection with ancestral lands and a more thriving, vibrant community.

ECONOMIC SUSTAINABILITY:

Minimized Operational Costs: The source water's natural biology consumes the organics, minimizing consumables and reducing the cost of purchasing, delivering, and disposing of treatment chemicals; accordingly, it reduces the costs of safety training and equipment for handling hazardous chemicals.

Economic Development: Having safe drinking water at the tap lays the foundation for the Village to develop economically. With reliably safe, clean drinking water, tourism and related opportunities can grow, creating new jobs and economic drivers within the community.

Flexible System Design: As the BLEX system is the first in the world, WSP designed the system with maximum flexibility to allow the system to be run in different modes depending on water quality and at a range of flow rates depending on the demand of the Village.



Operators outside of the new water treatment plant

Collecting samples for analysis by UBC

ENVIRONMENTAL SUSTAINABILITY

A BIEX treatment system limits chemical use to standard table salt. Routine backwash waste contains only those natural elements removed from the water along with the natural biological organisms used in treatment, and subsequently, can be discharged to a septic system for further natural treatment.

Having safe drinking water on tap eliminates the community's reliance on bottled water, reducing plastic waste and reducing the carbon footprint of transportation to and from the remote community to purchase water bottles and recycle used bottles.

Typical filtration plants would produce a concentrated and unsightly wastewater sludge that would either be treated on site with lagoons, treated via a complex mechanical system, or discharged to the sewer system. Since the BIEX system produces no sludge, the treatment process is self-contained and does not require additional wastewater treatment.

WSP's achievement of the BIEX initiative will improve environmental sustainability and benefit the lives and livelihoods not only in the pilot community, but also for many more small and remote communities across Canada and beyond.

SOLVING SMALL
COMMUNITY
DRINKING WATER
CHALLENGES

wsp