

Safe Water for All

Improving Public Health and Quality of Life Across Canada

VILLAGE OF
MANKOTA



About the Village of Mankota

The Village of Mankota (the Village) is a small, rural community of approximately 200 people, located in southern Saskatchewan near the border of Montana, approximately five hours from Saskatoon. The Village recently became home to a new \$10 million helium plant constructed by the Weil Group. The addition of the plant, whose lead operator is a Mankota local, has become an important element of the local economy.

Though the Village is small, it still provides its residents with critical services, including healthcare and education. Previously, adding to the challenge of providing these services in a remote rural community was the poor quality of local water. Even after treatment the water often contained unacceptable levels of turbidity and high particle count, creating cloudy and hazy water that can hide dangerous pathogens.

In 2016, the Village decided to upgrade its treatment plant and implement Sapphire Water's SIBROM technology, an innovative approach to water treatment that is making communities safer by addressing water quality issues that have spanned decades. The Village received approval for a grant from the federal and provincial governments to upgrade its outdated facility. With this funding, Sapphire Water was able to upgrade and convert the existing plant to a nanofiltration membrane treatment plant with a biological filtration pretreatment.

Water quality challenges in remote communities

While efforts have been made at the policy level to end the water crisis plaguing many rural and First Nations communities, the financial, geographic, and technological challenges of serving remote communities such as Mankota have made ending the threat to public safety more difficult.

High costs

Building and operating water treatment facilities can be cost-prohibitive, requiring expensive transport of materials, fuel, and other supplies. A short labour supply can also pose challenges, not just in constructing the plants, but also in finding qualified operators to maintain the system. The significant ongoing maintenance and operations requirements of conventional systems can also dramatically increase the lifecycle cost of these facilities.

Extreme climate

The extreme environment in many rural towns places tremendous stress on water treatment plant components, leading to equipment failures and plant downtime. According to Health Canada, 83% of boil-water advisories in Canada in 2017 were due to equipment and process-related problems. At Mankota, the facility was already deteriorating, an infrastructure challenge facing many communities across Canada. "The plant is the most critical thing. Without water, we can't go very far," said Mayor Grant Martin.

Poor source water

Conventional technologies utilized by large cities are simply ineffective in treating many of the contaminants in rural water sources that serve remote communities. When the wrong treatment approach is used, the biochemical composition of this water requires significant amounts of chemicals to disinfect and treat, and still often remains undrinkable. In addition, chemicals deliberately added during the treatment process can remain in the final water supply and cause erosion in the water distribution system—leaching other, equally dangerous substances into the water supply.

The Village of Mankota, located in rural Saskatchewan, ended its water quality issues after implementing Sapphire Water's SIBROM technology. Many rural and remote communities continue to suffer from poor water quality and ineffective technology.



Water quality in Mankota

The Village of Mankota receives its raw water from Summercove Reservoir, constructed in 1949 at a site on the Wood River approximately 10 kilometres south of the village. The dam, owned by Saskatchewan's Water Security Agency (WSA), includes an 8.5m high earth fill embankment with a capacity of 1,973 dam³. The last major rehabilitation occurred in 1965.

Until it received approval in 2016 to upgrade its outdated and inadequate water treatment plant, Mankota faced many of the same issues as other remote and rural communities across Canada, especially those in Saskatchewan. According to the WSA's 2016-2017 Annual Report, prior to upgrading to a SIBROM, Mankota was one of several communities whose treatment plants failed to consistently achieve disinfection compliance standards. Proper disinfection is critical in ensuring the safety of drinking water and preventing outbreaks of waterborne disease.

In general, smaller communities are much more prone to boil-water advisories. In 2017, according to Environment Canada, 77% of the boil water advisories in Canada were issued for drinking water systems serving 500 people or less. A remote location and inadequate treatment technologies only exacerbated this problem for Mankota.

Public pressure

Social media has created a platform for community members to voice their concerns publicly and hold leaders accountable. A scan of Mankota's social media since 2016 shows years of frustration among its residents with frequent boil-water advisories and service shut-offs. "Ok, quickly fill up bath tubs etc. and shower fast," reads one message from the Village as the town prepares for another service break. "If any town people need drinking water, come on out and get some. We have lots," reads a message from a community member offering to share his water supply during a boil-water advisory.

The Village has been transparent and proactive on social media, communicating directly with its residents in collectively managing water quality challenges. However, as critical as open communication may be, it is at best a crisis management tool—not a solution to the water quality issues facing communities.

The Sapphire Solution

Mankota's old conventional coagulation and filtration water treatment system was no longer performing optimally. The community decided to investigate options to upgrade their system. The water treatment system would have to treat poor quality surface water high in total dissolved solids (TDS), hardness, manganese, total organics, and turbidity.

The engineering consultant initially piloted a direct Reverse Osmosis system, which failed to meet the Canadian Drinking Water Quality Guidelines (CDWQG). Realizing they would need a more effective approach, Sapphire Water piloted a SIBROM system, which was successful in producing water that met the CDWQG.

"The main advantages that set SIBROM technology apart from conventional approaches to water treatment are low operating costs and reduction of fouling throughout the water treatment plant and the distribution system," said Dan Rodrigue, president of Sapphire Water. The SIBROM system produces biological stable drinking water, which contains no energy sources or nutrients to support downstream microbial growth.

The Sapphire Advantage

- Clear, clean, safe, biologically stable water
- Minimal downstream contaminants
- Chlorine usage reduced by 90%
- Dramatic reduction in operating costs



Cost-Effective Technology

The Village faced budgetary constraints regarding the capital cost of the SIBROM project. Knowing it was the best solution to provide a reliable source of safe and clean water to the area, Sapphire Water, the mechanical contractor, and the engineering consultant worked together to provide the lowest possible overall cost for this project.

Sapphire Water worked directly with a mechanical contractor rather than a general contractor to provide a more efficient billing process. With the cost-savings realized, a SIBROM system was within the Village's budget, and they could proceed with the project.

The operating costs of a SIBROM system are much lower than conventional systems for three main reasons. First, because the biological filtration reduces fouling of the system, there is no need for clean-in-place (CIP) cleanings and backwashing of the RO membranes. The SIBROM system also has a much lower requirement for chlorine and antiscalent (up to 90% less than conventional systems). Lastly, the highly automated system reduces labour costs. "I used to have to go in on a weekly basis and spend an entire day cleaning a filter. Now, I go in and do a 15-minute clean on the filter and that's it," said Rob Dave, the plant operator. The water is virtually chemical free, inert, and has excellent aesthetic qualities.

Eliminating downstream impacts

The SIBROM technology produces highly stable or inert drinking water. With the use of a mineral contactor for pH adjustment, the resulting water does not corrode piping, dramatically reducing the stress on the distribution system and minimizing service disruptions. It also prevents downstream biofilm growth in the distribution system.

Chlorine reduction

Another key advantage is that Dissolved Organic Carbon (DOC) is totally removed from the treated water by the SIBROM process. The absence of DOC greatly improves the effectiveness of the chlorination process. Typically, chlorine usage is reduced by up to 90% in water treatment plants that have converted to the SIBROM process, providing lower chemical requirements and operating costs.

The SIBROM technology also handles fluctuations in feedwater quality much more readily and efficiently. "Feedwater quality can change with the wind. Previously, by the time I had made changes to the system to handle fluctuations, the feedwater quality would have already changed again," said Rob. "Operation is so much simpler, and the system is easier to fine tune," he continued.

According to Rob, the clean, clear water now available to the community has invited very positive feedback and pride from Mankota residents. Upon completion of the SIBROM system in Summer 2018, the boil water advisory was finally lifted just days ahead of Mankota's 90th birthday. **Through its Facebook page, the Village shared an important update:**

**"The Village of Mankota now has water we can be proud of
and we are extremely happy that this project is over,
and we can now all enjoy the great new water!"**

About Sapphire Water

Sapphire Water International is a Canadian company specializing in the design and implementation of long-term, leading-edge water and wastewater treatment systems for small and remote communities of up to 1,000 in population. Through its SIBROM technology, Sapphire Water delivers water to these communities that exceeds all international water quality guidelines. There are 20 full-scale SIBROM plants in operation and three under construction in Western Canada in 2018.