

Water Treatment Plant

August 2020

Under the *NWT Waters Act*, the City of Yellowknife requires a licence from the Mackenzie Valley Land and Water Board (MVLWB) to draw water from local water bodies and to deposit waste into the environment. The City is applying to renew its licence. This factsheet is part of a series designed to provide residents and stakeholders with information on the licence application in support of public engagement.

Background

The City of Yellowknife draws its municipal drinking water from the Yellowknife River.

The water is transported via an underwater pipeline to the City's new Water Treatment Plant on the shore of Yellowknife Bay, treated and tested before making its way to residents of Yellowknife, Ndilo and Dettah via underground water mains, water trucks or summer above-ground water lines.

The City is also licenced to draw a limited amount of water from Yellowknife Bay for maintenance and emergency purposes only.

The Water Treatment Plant, which came on line in 2015, uses the best-available technology. The water treatment process uses a series of membranes which trap particles and contaminants as the water moves through them. After this filtration, the water is chlorinated to neutralize any remaining impurities and fluoride is added.

The Yellowknife Water Treatment Plant is the largest and most complex in the north, so it serves as a training facility for Water Treatment Plant Operator from communities throughout the NWT.

What the Water Licence regulates

The water licence deals primarily with the quantity and quality of water the City takes into the system ("raw water") and the operations of the Water Treatment Plant itself, including how the City deals with the waste created from the treatment process. This includes requirements for:

- Monthly and annual water flow measurements from approved water sources
- Water quality monitoring of raw water sources through the Surveillance Network Program (SNP)
- Quantity and content of waste ("residuals") from the water treatment plant processes
- Other related reporting and actions required by the licence

The Water Licence does not regulate drinking water quality. That is regulated by the Department of Health and Social Services under the NWT Public Health Act. However, we are pleased to note that since we commissioned the new Water Treatment Plant, our treated water quality has been excellent and consistently meets all requirements of the NWT Public Health Act and Health Canada.



Documents to be submitted

The document that will be submitted for this aspect of the water licence is the **Water Treatment Plant Operation and Maintenance Manual**.

This manual describes in detail the water supply that comes into the Water Treatment Plant, how the water is treated using both physical and chemical processes, and how the waste created by this process (residuals) are treated and disposed of. It also deals with all the instrumentation and automation controls that are used at the Water Treatment Plant.

Raw water intakes

The City is seeking approval to draw up to the following quantities for two approved raw water sources:

Yellowknife River (primary)

The City is seeking authorization to draw up to a maximum of 4,000,000 cubic meters per year (up from current annual limit of 3,600,000), and a maximum of 575,000 cubic meters per month (no change from current licence).

Yellowknife Bay (secondary/emergency)

To be used for maintenance of equipment and emergencies only. The City is authorized to withdraw approximately 300 cubic meters per month.

Question and Answer

Under what circumstances can water from Yellowknife Bay be used? What is done to ensure it is safe?

There are only a few reasons that water from Yellowknife Bay can be used:

- *For regular testing and maintenance of the water pumps;*
- *If there is an emergency that requires a shut down of the Yellowknife River water supply, such as a major leak in the pipeline, **for example**; or*
- *If there is a major fire that requires an emergency draw of water from Yellowknife Bay to meet the surge requirement.*

To this point, water from Yellowknife Bay has only ever been used for maintenance purposes.

Arsenic testing is always done prior to drawing water from Yellowknife Bay for any reason. If levels are above the Maximum Allowable Concentration (MAC) from Canadian Drinking Water Guidelines) for Arsenic, which is 0.01 mg/L, maintenance will not be conducted at that time. In the case of emergencies, risk management principles would be applied in consultation with regulators. Water at intake points from all water sources are also tested monthly for arsenic and other compounds.

Water Treatment Plant

Surveillance Network Program (SNP)

The Surveillance Network Program collects and tests raw water regularly. Raw water sampling occurs at two locations: a well located inside Pumphouse 1 for Great Slave Lake water; and a sample port inside the Water Treatment Plant which is pumped from the Yellowknife River.

Treatment and processes

Raw water goes through four main steps before it leaves the Water Treatment Plant:

- 1) **Micro-strainer system:** Strainers that remove larger particulate matter (bigger than 300 microns) from the raw water before it gets to the membranes. This pre-treatment helps protect the membranes so they are more efficient and don't require cleaning as often.
- 2) **Membrane microfiltration system:** Water is pushed through a series of membranes. The membrane surfaces collect any small particles, contaminants, or pathogens and the filtered water flows through. The membranes are made up of hundreds of densely-packed strands that look a bit like bundles of dry spaghetti.
- 3) **Sodium hypochlorite system:** This is a chlorine-based disinfectant that neutralizes any remaining pathogens such as bacteria and viruses. The sodium hypochlorite is produced on site and is injected into the water after membrane filtration using automated metering pumps to ensure consistency and accuracy. Sodium hypochlorite is much less toxic than the chlorine gas used in the past, so it is safer for employees and the public.
- 4) **Fluoridation System:** Fluorosilicic acid is added to the water using metered pumps. Fluoride is commonly added to drinking water to improve dental health.

Treatment residuals

The water treatment process creates different types of waste, called "residuals" that must be properly managed and disposed of. Residuals primarily come from the process of cleaning the membranes.

This process involves sending the water that contains contaminants through to a process which has a few main steps.

- 1) A coagulant is added which neutralizes the charges of the particles so they will clump together more easily.
- 2) Using a process called flocculation mixing, the particles are gently mixed together in a way that helps clump the particles together so they will separate and sink more easily.
- 3) The clumps then accumulate on diagonal settling plates in a thickener tank, and once they become large enough, will fall from the plates and settle on the bottom of the tanks. This sludge is then drawn out of the thickener tank with a pump.
- 4) The volume and appearance of the thickened sludge is then recorded and put into the sanitary sewers for waste disposal through the Fiddler's Lake Treatment System.
- 5) The water that remains is put back through the whole treatment system.



Other topics of interest

- **Overflows:** The water licence also regulates how the Water Treatment Plan deals with emergency overflows into Yellowknife Bay if required. There are many safeguards in place to mitigate the occurrence and impact of an overflow and these are uncommon events.
- **Arsenic testing:** Samples from both the Yellowknife River and Yellowknife Bay are tested by a third-party lab on a monthly basis. Samples from Yellowknife Bay are also tested on-site by City staff before all maintenance activities.
- **Reservoir Leak:** The City has been working to address a known leak in the treated water reservoir. The project was tendered twice in 2019, but there were no bidders. We are investigating alternatives to get the work done in 2021.
- **Yellowknife River intake pipeline replacement:** Raw water from the Yellowknife River is transported to the Water Treatment Plant via an aging, 8.5-kilometer underwater pipeline. The line — inspected every two years by divers — begins about 1.5 kilometres from the bridge crossing the Yellowknife River, proceeds past islands like Jolliffe Island, and ends at the plant. In 2019, the City secured \$25.8 million through Infrastructure Canada’s Disaster Mitigation and Adaptation Fund (DMAF) to replace the pipeline and make upgrades to intakes and pumphouses #1 and #2. The plan is to build the new line and decommission the old pipeline, but leave it place to minimize the disturbance of sediment.
- **Screens on water intake pipes:** Fisheries and Oceans Canada regulates the size and screen design of the mesh that covers the ends of the pipes used to draw water into the system. This is to ensure that fish are not caught in the intake or harmed by the screens. As part of the planned replacement of the submarine intake line from the Yellowknife River, all screens will be checked to ensure they meet the current Fisheries and Oceans requirements and replaced if necessary.

Have questions or comments?

The City will be posting more information on each of the components of the water licence renewal at www.yellowknife.ca/WaterLicenceRenewal and will be soliciting feedback from interested residents and stakeholders via email, letter and our online engagement tool [PlaceSpeak](#).

Additional details on engagement opportunities will be provided in the weekly Capital Update and via Twitter and Facebook.

Questions related to the renewal process can be directed to Madison Warren, Municipal Engineer at waterlicence@yellowknife.ca.