



2020 YUKON ENGINEERING EXCELLENCE AWARD DAWSON CITY WATER TREATMENT PLANT

PROJECT DESCRIPTION:

Dawson City provides residents with drinking water from four wells situated near the confluence of the Yukon and Klondike Rivers. The town's aging water treatment plant did not meet the Guidelines for Canadian Drinking Water Quality and needed to be replaced. The Yukon Government retained Associated Engineering to provide design and construction services for a new water treatment plant for Dawson City.

The plant's design had to accommodate the large changes in water demand during the tourist season. In addition, the plant needed to be energy efficient, reliable, and simple-to-operate. The Yukon Government also wanted a facility that minimizes life-cycle operation and maintenance costs.

Associated Engineering's design team developed a treatment process utilizing cartridge filtration, a treatment technology typically used for smaller water systems, followed by ultraviolet and chlorine disinfection. While cartridge filtration had never been used for a system of this size in Western Canada, the technology is appropriate for this groundwater source, which is low in turbidity and colour. The technology is simple to operate; and eliminates the need for the chemicals typically required in traditional water treatment systems to remove small particles in raw water supplies. The 6 million litre per day plant employs a two-stage cartridge filtration system using 5-micron sized filters, followed by a 1-micron filter to protect against protozoa pathogens.

Cold climate engineering was employed throughout the project, including freeze protection for pipes, to safeguard the water supply during Dawson City's harsh winters when temperatures can drop well below -40°C. Sustainable and resilient by design, water in the plant is heated by an energy-efficient heating system that draws heat from the local biomass plant to supplement traditional oil-fired boilers. Building power is augmented by a solar photovoltaic system in the summer. Employing renewable energy from the biomass plant and solar energy reduces the facility's long-term costs for power and heating.

Analysis of river levels under future climate scenarios showed the facility could be flooded, as the building's lower level is below the future 200-year flood elevation. The new water treatment plant provides an essential service to the community and, hence, has to be protected against flooding. The building's foundation and walls were designed for flood resistance, and electrical and controls equipment were located above the flood level.

The plant fits on a small footprint of two standard residential lots. The team maximized the building footprint by designing a two-story structure and minimizing setbacks on the property, in consultation with Dawson City Council to obtain a special bylaw exemption. Due to limited setbacks to adjacent buildings, fire-rated wall materials were used, and a fire suppression system was installed. The team created a 3D model which assisted with discipline coordination and ensured required components fit in the building footprint.

The cost of treating and distributing water is usually one of a municipality's highest cost. This is compounded in the North where water must be heated to prevent freezing. To reduce energy costs, the design of the facility harnesses energy from the town's biomass District Energy System for heating the building and potable water pipes during the winter for freeze protection. The team designed a solar photovoltaic system to augment power supply in the summer.



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The new treatment plant was designed to provide the town's fire flow, as well as potable water requirements. Through a unique arrangement of piping and valves, the fire pump supply flows are looped within the potable water distribution system. During the winter months, the potable water supply is pumped unidirectionally into the distribution system and water is directed back into the treatment plant for re-heating, thereby providing freeze protection. The system allows water to remain in constant motion throughout the winter months, while allowing fire flow supply to back-feed into the looped system when required. An innovative recessed sump area within the treatment plant provides operators with easy access to all valving and equipment at grade level.

Ultraviolet (UV) disinfection had to be added to the existing plant. The team designed a new UV system for the existing plant, and adapted this UV design for the new facility, so that the UV equipment parts could be reused when the old plant was decommissioned.

Construction detailing, such as wood framing, considered the skills and availability of local trades, thus supporting the local economy, and reducing the need for tradespeople with specialized skills, such as structural welders, to travel to Dawson City. Sustainable building materials included wood frames and dowel laminated timber (DLT) roof panels. The DLT roof also provides sound absorption, reducing exterior noise from the plant operations. Building materials were sourced locally where possible to minimize the carbon footprint of the project, as well as reduce cost and expedite construction.

To reflect Dawson City's rich history linking to Yukon's Klondike Gold Rush, the team consulted with the town's Heritage Advisory Committee during design. The result is a building façade that mimics the Pacific Cold Storage Building, an early 1900's structure, including a circular staircase leading from the front entrance to the second floor to replicate the circular tank that formed part of the original building. The treatment plant's historic character fits in well with the heritage style of its surroundings. The glass windows are triple paned and are low emissivity to increase efficiency. The large windows allow the public to view the facility and gain a better understanding of the water treatment process.

Project and construction planning considered stakeholder consultation, use of local materials wherever possible, as well as the limited construction window of the far North. As a result of this attention to detail, the \$15 million treatment plant was completed under budget and ahead of the Yukon Government's schedule and employed local trades.

Dawson City's new water treatment plant is a model for resiliency and energy efficiency, employing renewable energy for heating and power. The plant employs cartridge filtration for treatment, the largest facility of its type in Western Canada. The innovative application of this technology provides a robust treatment system for the community of 1400 which swells to over 5000 during the summer.

Dawson City residents and visitors will enjoy a safe and reliable source of drinking water for many years to come. Already a local landmark, the architecture of the facility reflects the town's unique character and history.