Canadian Consulting Engineering
2021 Engineering Awards
City of Saint John Safe Clean Drinking Water Project – Water Treatment Facility Design
Wood Environment & Infrastructure Solutions
April 2021

**Project Summary**

**Word Count: 75 words (75 words max)**

**The 75-word summary of the project will be used for a video presentation and brochure for the Awards Gala. It is also used by ACEC to showcase consulting engineering to the government and to the public. Please use plain language and avoid technical jargon where possible. The summary should include:**

**- The client and the client's objective**

**- Your role in the project**

**- Project complexity and/or use of innovation**

**- The project's social, economic and/or environmental benefits**

**Wood Response:**

Traditionally Saint John has obtained its potable water from surface sources local lakes with minimal screening and treatment; this caused issues with meeting the Canadian Drinking Water Guidelines consistently. Wood was selected to lead design of the new 75MLD surface water treatment plant with 33ML of new storage reservoirs, 18MLD pumping station and replacement and/or rehabilitation of +/- 30km of piping. 70,000 residents of Saint John directly benefit from this safe water supply every day.

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**Q1. Innovation (40%)**

**Word Count: 393 (400 words max)**

**Briefly introduce your project, i.e. what was done and why? Then explain how it demonstrates the innovative application of engineering principles or techniques. How is it distinguishable from similar projects of its type?**

**Wood Response:**

The City of Saint John had long suffered severe and widely known water quality issues, including complaints about colour and taste, as well as the general aesthetics of the water, which was sourced from nearby surface water bodies. There was also a lot of organic material and disinfection byproducts that they were unable to filter out of the drinking water.

The City's decision to undertake the design, build, operate, finance and maintain (DBOFM) of a new drinking water treatment facility and water storage facilities, industrial raw water separation, transmission and distribution system improvements in East Saint John, and the implementation of a separate groundwater supply system and treatment in West Saint John would address these challenges.

The P3 procurement and delivery model embodied the need for innovation to optimize the indicative design completed by CBCL. The indicative design was assessed to ensure the final, 'approved for construction' Wood E&IS design facilitated the most cost effective construction methods. This ultimately drives the cost and value which makes the project delivery effective. Simple innovative solutions, such as a three (3) way valved drainage system to segregate potential chemical loss during bulk delivery offloading from day to day surface water runoff, resulted in significant cost saving both operationally and during construction. To achieve the facilities energy requirements which exceeds the National Energy Code requirements by 25%, an insulated precast concrete panel was utilized. Demands were placed on the Design Team and the project pre-cast concrete supplier to fabricate a one piece insulated panel system which could be successfully anchored to the building structure. The supplier worked with the Wood E&IS structural team to develop a detail and installation procedure for the pre-fabricated panel connections to the cast in place concrete walls. Through the optimized and coordinated process and civil design, the operational area of the facility was reduced by approximately 5 hectares, resulting in 5 hectares of urban forest on the property and creating an additional minimum 30 metres of vegetated buffer between the facility and the adjacent Little River Reservoir. Additionally, the City's desire to have the facility be used as an educational destination, the Design Team successfully delivered an open and inviting environment considerate of tour routing and passage through the facility structures during site tours.

As Lead Designers, the Wood E&IS Team designed the largest municipal infrastructure project ever undertaken in New Brunswick.

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**Q2. Complexity (20%)**

**Word Count: 248 (250 word max)**

**Complexity and/or use of innovation:**

**Explain any extraordinary problems and conditions that were overcome.**

**Wood Response:**

*Water Treatment Area HVAC* – The ventilation system accommodates all areas of the plant's operations. To meet the requirement to maintain humidity levels of the treatment area in a given range and the large, exposed area of water within the treatment process, providing dehumidification in an energy efficient, cost effective manner and meeting the facilities energy reduction requirements - was a successfully achieved.

*Fire safety through multiple facility levels* – To accommodate operational maintenance requirements, large slab opening accesses from various levels were designed. Adequate fire protection and structural integrity were achieved through the completion of heat generation capacity evaluations and material selection to meet the fire separation requirements throughout the facility.

*Structural challenges* – Backwash and process waste waters are stored in lower level concrete tanks within the treatment building. The solids handling equipment, including a 40 tonne capacity dewatering press, is structurally supported on the top of these tanks. Structural design of the tankage roof had to allow for the equipment but not affect the flow through the tanks or reduce the volume capacity within the tanks.

*Environmental Protection* – The water treatment process utilizes chemicals which pose a risk to the environment. Chemical containment is required in the event of accidental spills during chemical delivery. Wood E&IS designed a chemical containment area and associated drain collection system with a unique three-way valve system to help ensure containment of any chemical spill during offloading of bulk chemicals while allowing discharge of surface water run-off resulting from precipitation or snow melt.

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**Q3. Social & Economic Benefits (15%)**

**Word Count: 248 (250 word max)**

**Explain the social and economic benefits to society provided by your project. Be specific and provide qualitative and quantitative information.**

**Wood Response:**

Water is a fundamental human need. Each person on Earth requires at least 20 to 50 liters of clean, safe water a day for drinking, cooking, and keeping themselves clean. Polluted water isn't just dirty—it's potentially deadly as evidenced by the Walkerton Ontario E.coli outbreak. Historically, the City of Saint John were routinely responding to watermain breaks in the antiquated distribution system and implementing boil water orders.

The Saint John Safe Clean Drinking Water Project (SCDWP) helps ensure the basic fundamental need for safe clean water of consistent quality is met for the 65,000 users accessing the water system in Saint John – improving public health with removal of potentially harmful pathogens and disinfection by-products (DBP) through filtration and treatment.

This P3 delivery model enabled these benefits to be delivered to customers years earlier than would have otherwise been possible through a traditional project delivery method. A Value for Money analysis conducted by Price Waterhouse Cooper (PWC) indicated that a value (cost savings) of $24.1M could be realized by the City by procuring the project as a P3 verses a traditional procurement model.

During execution, the SCDWP was the largest active water infrastructure project in the Maritime region and the largest project undertaken in New Brunswick.

The SCDWP design delivery consisted of 17 person years of effort from Wood E&IS staff and our sub-consultants.

The City proudly features the treatment plant as a center piece to their drinking water supply system. The project can be viewed at: https://www.youtube.com/watch?v=MXqRSWditXI.

**Q4. Environmental Benefits (15%)**

**Word Count: 231 (250 word max)**

**Explain how your project addresses environmental/sustainability issues.**

**Wood Response:**

The design of the treatment facility layout was optimized to minimize the operational footprint of the facility, with the objective to reduce tree clearing and increase buffers between the facility and adjacent environmental features, including neighboring residential properties The desire to further minimized disturbance to the on-site urban forest was further achieved through the reduction of the operational area of the facility by approximately 5 hectares resulting in 5 hectares of urban forest on the property and creating an additional minimum 30 metres of vegetated buffer between the facility and the adjacent Little River Reservoir.

The project design for the 23.9 km of transmission main incorporated trenchless HDPE relining to over 10 km of the existing 600 mm cast iron for water transmission main which dates to the 1800's. This enabled the transmission mains to be rehabilitated with backfilling and reinstatement limited to launching and receiving pits, reduced greenhouse gas emissions and minimized construction related impacts to businesses and residents along the construction corridor.

Another environmental achievement Wood accomplished was the design of the twin raw water intakes. The intakes which had to meet strict Department of Fisheries and Oceans criteria associated with design of water intakes in fish habitat. The design of the intake screens had to ensure fish present in the Latimer Lake raw water source reservoir are not negatively impacted by the intake water velocities and associated flows.

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**Client Needs Met (10%)**

**Currently 250 words (250 word max)**

**Explain the client's main project goals and how you met them.**

**Wood Response:**

The former municipal water system served residential, commercial and industrial water customers with treatment consisting of coarse screening and chlorination. The unfiltered surface water contained significant amounts of disinfection by-products, at levels that often exceed those prescribed by current standards and posed a potential risk to public health.

The City had identified a source of quality groundwater and constructed three (3) production wells in the South Bay area of West Saint John. As part of the Project, the water system was separated to provide certain large industrial users with untreated water, thereby reducing the volume of water requiring treatment.

The Project was undertaken to address these issues and ensure City residents have a reliable supply of safe, clean drinking water which meets Canadian and New Brunswick standards. In so doing, the citizens of Saint John will enjoy good quality water which meets their expectations in regard to taste, odour, health and safety.

The Project was procured through a P3 delivery model where design progressed in parallel with construction, permitting the project delivery to be fast tracked. The procurement model fosters engineering innovation as all aspects of the engineering design are scrutinized to ensure it is cost effective to construct, robust enough to fulfill the operational requirements and meet hand back criteria at the culmination of the operations.

The owner provided the PCWP team with an indicative design and it was up to Wood E&IS, in collaboration with the constructor, to optimize the engineering design and develop value added engineering solutions.

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*Figure 1: New Groundwater Supply Pumphouse and Standby Electrical Generation located in Island View Heights.*

*Figure 2: Interior of the New Groundwater Supply Pumphouse*

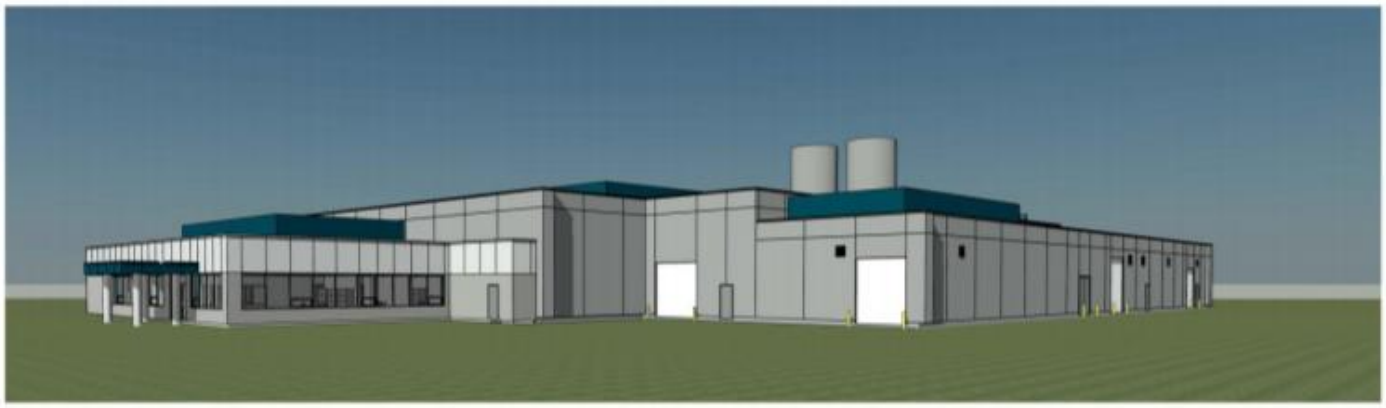

*Figure 3: Architectural Rendering of the New Drinking Water Treatment Plant*

*Figure 4: New Water Treatment Plant and Storage Reservoirs*


*Figure 5: New Water Treatment Plant Storage Reservoirs overlooking Little River Reservoir*

*Figure 6: Mixing and Flocculating Tanks Prior to Solids Removal in Dissolved Air Flotation*