



Lakeview Water Treatment Plant Phase 2 Expansion (OBM2)

Canadian Consulting Engineering Awards 2016

Project Information

Region of Peel Lakeview Water Treatment Plant Phase 2 Expansion, Mississauga, Ontario, Canada

Completed in September 2014

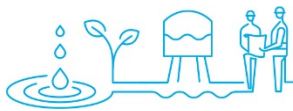
Submitted by CH2M Canada Limited (CH2M), which provided environmental assessments and public facilitation, permitting, design, procurement, contract administration, construction management and inspection, SCADA programming and integration, and commissioning and startup

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Project Outline

Summary

The Region of Peel's Lakeview Water Treatment Plant Expansion Phase 2, completed in 2014, increases capacity to 1,200 ML/d with a 400 ML/d ozone-biological filtration-membrane treatment facility (OBM2). CH2M's advanced design techniques preserve valuable waterfront green spaces by reducing the overall plant footprint required to service current and future community water demand. The expansion project successfully demonstrated a commitment to safety, providing improved equipment access and managed confined spaces at an industry-leading construction cost.

Project Highlights – Responses to Category C Questions

Q.1 Innovation

The Region of Peel- supplies water to 1.3 million consumers in the Cities of Mississauga and Brampton, the Town of Caledon, and neighbouring municipalities in the Greater Toronto Area (GTA) through two water treatment plants (WTPs) as shown in Figure 1. Lakeview, the larger of the two, began operation in 1953 as a 9-million-litre-per-day (ML/d) WTP using conventional treatment and chlorine for disinfection.

Rapid growth in the Region of Peel necessitated significant expansion to meet increasing demands and in 2002, the Region of Peel and CH2M implemented the first phase of expansion with a follow-up phase proceeding in 2008 to increase treatment capacity to 1,200 ML/d by adding a 400-ML/d ozone-biological filtration-membrane (OBM2) treatment facility.

The OBM2 facility was designed using advanced three-dimensional (3D) software, which maximized the preservation of green spaces around the plant by reducing the overall plant footprint. This 3D tool allowed CH2M to optimize design coordination, space utilization, equipment accessibility, and the cost/space savings of a smaller structure. In addition, the 3D model served as a visual (or virtual) tool for the client, construction, and operating staff to have more direct involvement in the design. Using this tool, the design team was able to issue 600 drawings and 1,500 pages of specifications in less than 7 months (Figure 2).

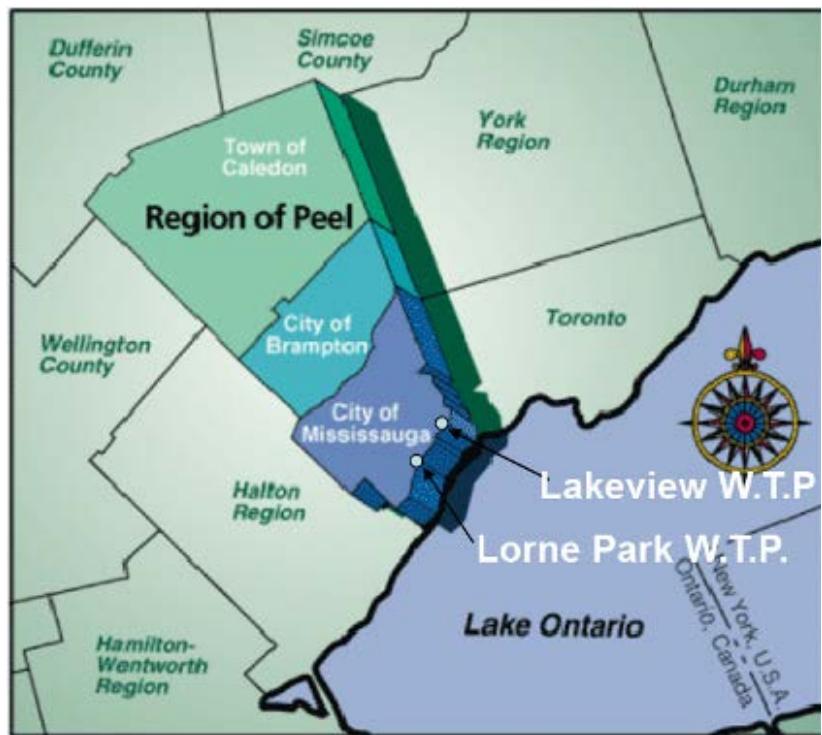


Figure 1. Site location

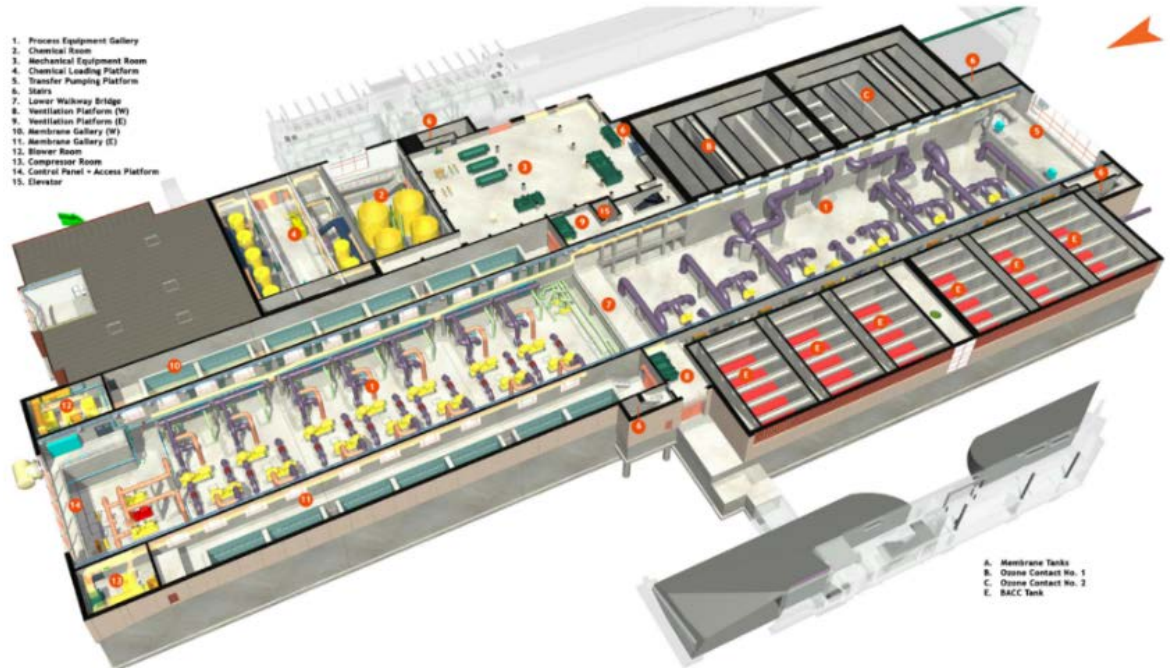
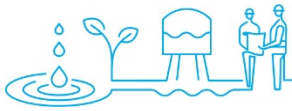


Figure 2. 3D Modelling Optimizes Design Coordination

In typical plant layouts, process areas are divided into individual rooms or isolated spaces as a means of limiting the propagation of fumes, noise, and humidity. This separation is easier to design, but comes at the expense of footprint and cost. At Lakeview WTP, a concerted effort was made to develop a layout optimized for constructability, access, and costs. All major equipment, with the exception of ozone generation, are located in a single, open concept process gallery with overhead crane access. Equipment noise and chemical fumes are managed within the open concept layout, significantly improving costs while providing a safe work environment.



Figure 3. Open Concept Process Gallery Promotes Safe Work Environment



A commitment to safety led the team to rethink approaches for equipment access and to manage or avoid confined spaces. Ladders were eliminated from most maintenance areas and replaced by stairs in buried process tanks. Chemical storage tanks have platforms to access equipment on the top of the tanks. The majority of equipment is accessed from a single floor elevation. While ladders may have a lower cost than stairs and platforms, the improved access and subsequent improvement in constructor and operator safety offset these costs (Figure 3).

Q.2 Complexity

The Phase 2 expansion program was divided into 10 separate construction contracts. The scope and duration of each had to be balanced against the need for uninterrupted plant operation, and impacts on water demand resulting from other water infrastructure construction projects within the Region of Peel. The successful completion of OBM2 was a result of successful management of limited space onsite, and simultaneous activities of multiple contractors (Figure 4).



Figure 4. Complex Site Co-ordination for Simultaneous Construction Activities

To better manage these project challenges, the Region of Peel and CH2M partnered with all project contractors, stakeholders, and suppliers. Managing the site, contracts and 100 to 150 construction and support staff during peak periods went beyond inspections, shop drawing review, and issuing payments. CH2M mobilized a team of 12 engineers and construction managers to support construction, instrumentation and control and SCADA integration, and commissioning activities. Proactive communication, coordination, and planning was established



with each party at different levels in each organization. This level of interaction required co-location onsite of site, process, and administration staff to address time-critical issues such as document control; expediency of responses to contractor questions, cost issues, and scope gaps; continuous schedule and progress review with key team members; and in some cases, redesign for schedule and cost gains.



Figure 5. Commissioning Team Celebrating Delivery of OBM2 Water Supply

Systems and processes were commissioned in clusters to facilitate early commissioning while construction was completed in other areas. This approach allowed operators to be involved during commissioning and get hands-on training on each system. The facility was substantially completed in September 2014 with the contract operators running the facility with minimum input from the project team (Figure 5).

Q.3 Social and/or Economic Benefits

The GTA has experienced significant and rapid growth within the last decade facilitated by the Region of Peel's on-time provision of municipal water supply in a fiscally responsible manner. Design decisions and early purchase of major process equipment components promoted construction efficiency and reduced contractor risk, resulting in a lower capital cost per litre of treated water than had been seen to-date in the industry. Treatment process selection and layout provides the Region of Peel with multi-barrier process redundancy that improves the security of treated water supply to existing and future consumers and facilitates future expansion.

To engage and educate the community, the OBM2 treatment plant was designed to facilitate public tours. A tour route was developed early in design and a freight elevator selected to provide full accessibility to most areas of the plant. Openness of layout, natural lighting, and quietness also improves the educational experience.

While it likely seemed unfathomable to designers in 1978 that the Lakeview WTP site shown in Figure 6 one day would be considered as space constrained, the value of access to the waterfront has driven the Region of Peel to



develop a site Master Plan that also accommodates two 600-ML/d pump stations and a 12 emergency power facility with the potential for 2,000 ML/d of treated water to be produced in the original site.



Figure 6. Lakeview WTP Site (1978)



Figure 7. Lakeview WTP Site Master Planned for Maximum Capacity



This will allow the Region of Peel to meet water demands well into the future without occupying valuable waterfront property and protecting adjacent community baseball diamonds and recreational spaces (Figure 7).

Q.4 Environmental Benefits

The Lakeview WTP project site is surrounded by residential, industrial, and recreational areas. The Region of Peel and CH2M worked closely with community stakeholders during the public consultation phase to minimize the environmental impacts not only for the construction, startup, and operation of the OBM2 facility but for future expansions as well.

A primary goal of the Region of Peel was to select treatment processes that minimized both energy and chemical use and would result in a facility having reduced noise, chemical deliveries, truck traffic, and waste production. Minimizing process waste improves the efficiency of the treatment process and the generation of process residuals in the form of coagulant-free, low-turbidity membrane backwash allows for regulatory discharge requirements to be met for return to Lake Ontario without further treatment. The elimination of treatment reduces energy demands and improves air quality through the avoidance of truck traffic for chemical deliveries and sludge haulage and subsequent generation of dust and exhaust.

The compact process layout and elimination of the need for expansion of the existing process waste treatment facility maximizes on-site availability for future expansion needs.

Discharge to Lake Ontario makes use of an existing unused raw water intake thereby protecting the quality of the nearshore without impacting exiting aquatic habitats with additional in-lake construction.

Energy use and subsequent greenhouse gas emissions are minimized through the use of natural lighting extensively in the form of windows and skylights. (Figure 8). Excess heat from equipment (motors, blowers, and compressors) is re-used to reduce the energy required to heat the building

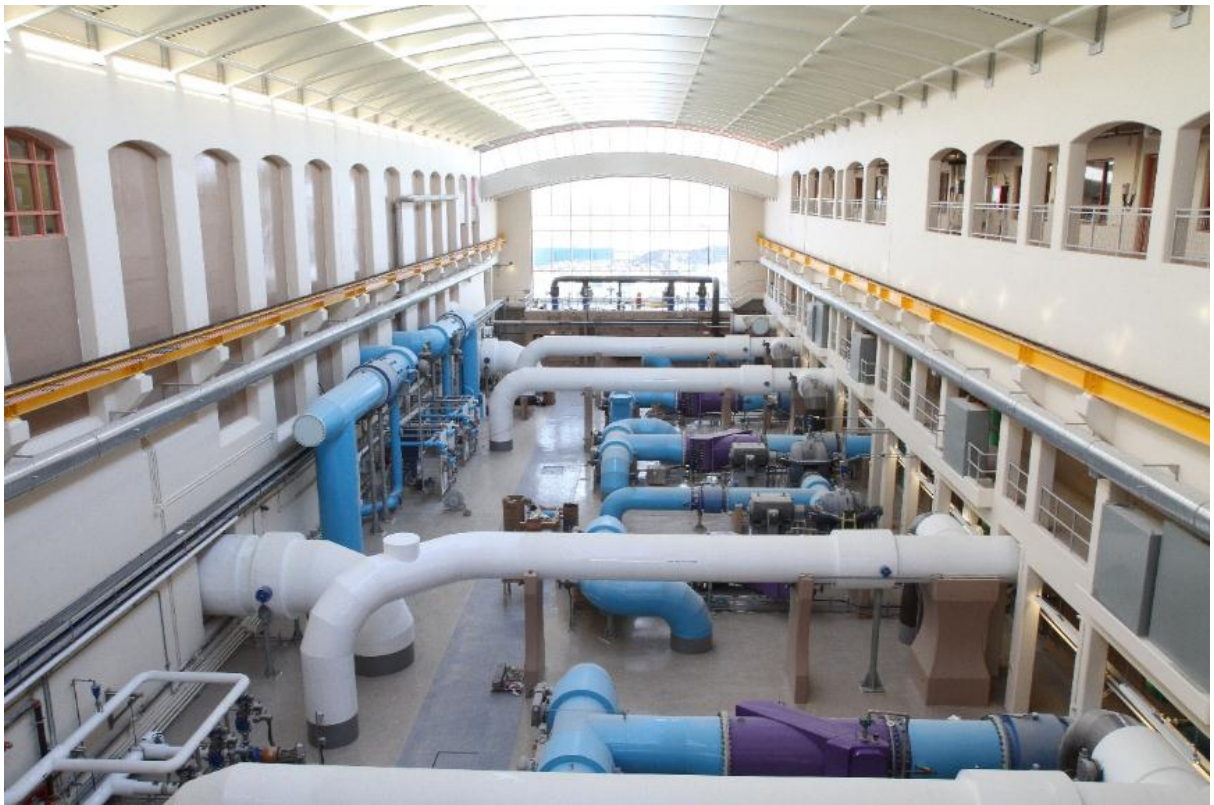


Figure 8. Natural Lighting Reduces Plant Energy Demand



Q.5 Meeting Client's Needs

As with many other municipalities in large urban centres, the Region of Peel faces the challenge of providing safe and aesthetically pleasing drinking water to a fast-growing population. For its new plant expansion, the Region of Peel's goals were to achieve the best water quality and meet more stringent regulatory requirements while optimizing operations and maintenance with the use of automated control. New automation systems were installed and tested 1 year ahead of schedule for maximum effectiveness. Operators were provided with a simulation of the fully tested system 6 months prior to commissioning, therefore developing a level of comfort with the process and providing invaluable feedback to the team. (Figure 9).

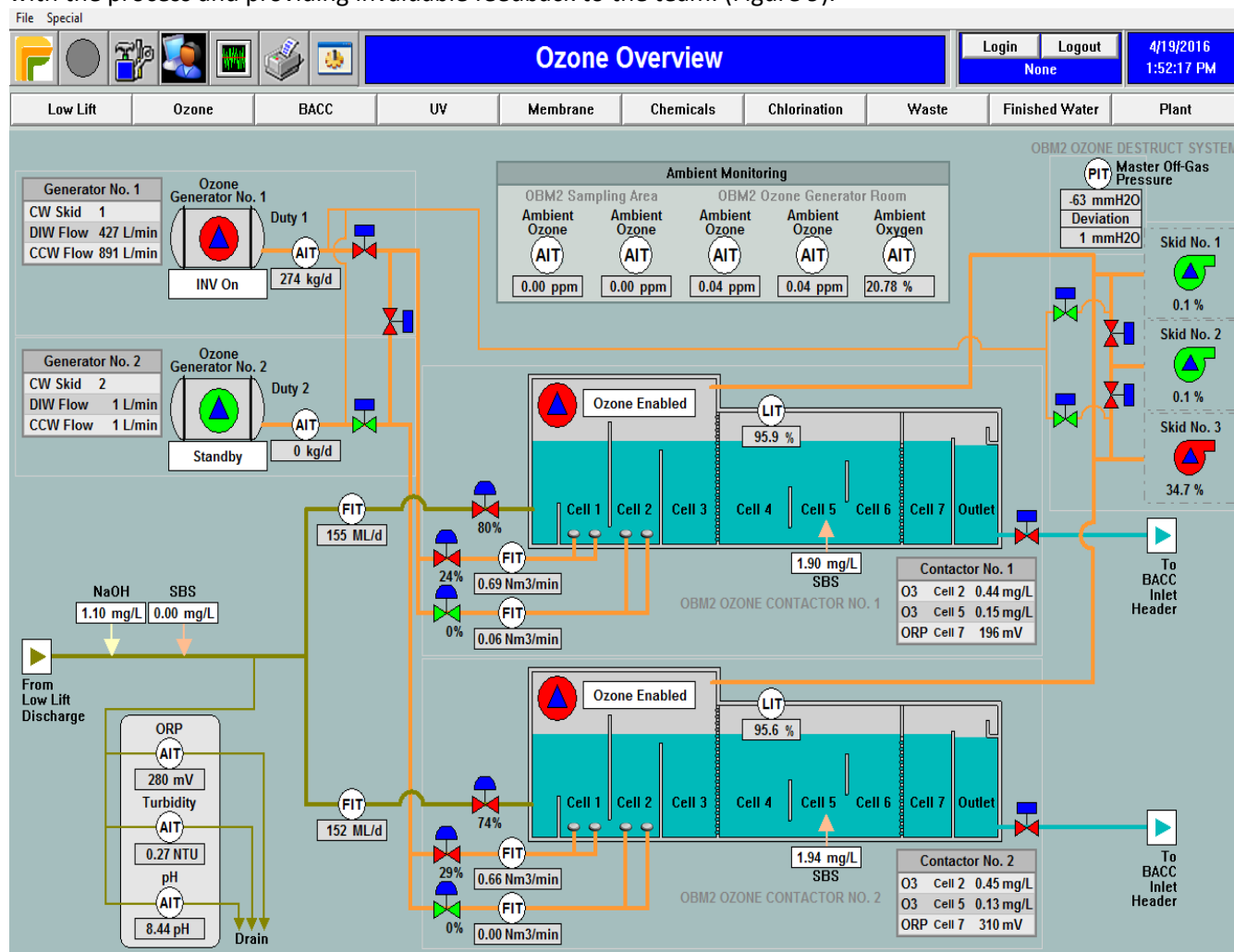
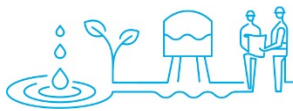


Figure 9. SCADA simulation



The advanced water treatment processes provided in the OBM2 construction provides an enhanced water quality that meets more stringent objectives than the Ontario Drinking Water Standard for some established parameters, including disinfection to address emerging concerns and reflect regulatory advancements elsewhere (Figure 10).

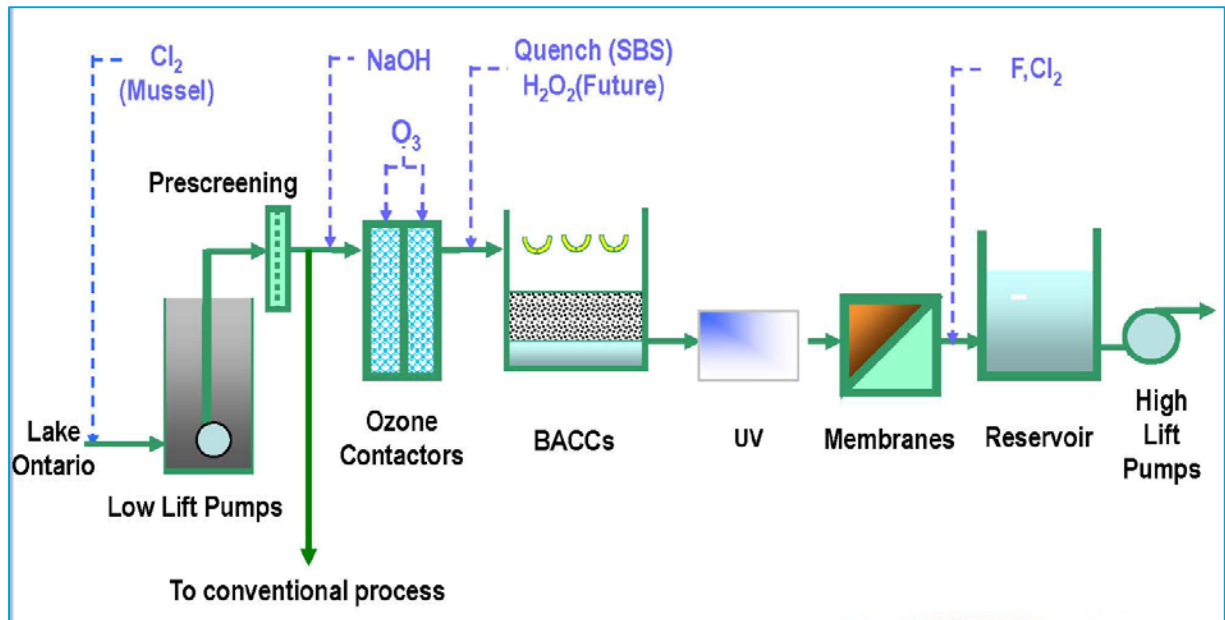


Figure 10. Multi-barrier Enhanced Water Treatment for Lakeview WTP

The selection of the treatment process was key in meeting these objectives. The Region of Peel and CH2M performed a comprehensive selection process comparing more than 20 treatment alternatives. At the end of the selection process, a combination of ozone, biologically active carbon, membrane filtration, and ultraviolet disinfection were deemed to offer the best value for water quality, performance, environmental footprint, social benefits, and cost efficiency.

The treatment processes have been housed in a plant facility that has been designed to be compact, functional, energy efficient, and comfortable to work in.