For over 110 years, North Bay had drawn its water from Trout Lake – the largest unfiltered water source in Ontario – with chlorine disinfection as the only treatment required. The City proactively examined methods to improve their water supply system and protect the City's drinking water. One option was to implement filtration – either conventional or membrane filtration. Considering the high quality of the source water, another – less costly – option was to implement UV only and apply for an exemption to providing filtration if the province would consider US Environmental Protection Agency (USEPA) filtration avoidance guidelines. The USEPA filtration avoidance guidelines could be considered by the MOE if the source water was considered pure and stable enough, and would be in concert with additional measures for watershed protection. In April 2001, on the day before the USEPA filter avoidance application was to be submitted, a heavy rainstorm caused a large amount of debris from a construction site to enter the source water causing the turbidity of the raw water to rise above 5 NTU for over 12 hours. The Medical Health Officer was forced to institute a week-long Boil Water Alert, scuttling any chances for approval of filter avoidance. The City would now need to implement filtration, which would require a new facility.

The City selected CH2M HILL to perform Conceptual and Detailed Design as well as Services During Construction. In October 2004 the project team met to kick off the design of the new facility. With residents concerned about the cost and visibility of the plant (on Lakeshore Drive, in the center of a residential community), MOE pressure to meet new post-Walkerton regulations as soon as possible, and high expectations from City Council regarding sustainability and long-term economic viability of the solution, the project team needed to secure community support while ensuring that treatment goals were met.

The requirements for multi-barrier protection had significant implications for the community. The City would be required to build a new water treatment plant to provide filtration with the attendant costs from a financial and social perspective. Objections from the community arose almost immediately. A Schedule C Environmental Assessment approved both conventional and membrane treatment to provide multi-barrier protection and recommended conventional treatment. Considered safer and more proven than other technologies, conventional treatment was well understood.

However, CH2M HILL had experience with membrane treatment elsewhere and had observed advantages that might make it a better choice. In a *Treatability Study* report, CH2M HILL provided results of a direct comparison of the two treatment trains. This evaluation showed that overall life-cycle costs for membrane treatment would be lower while treatment efficacy would be similar – if not better. Membrane treatment avoids the use of chemicals required for conventional treatment. Used in conjunction with UV disinfection, membranes provide a very reliable barrier to viruses and bacteria. Cost and safety considerations for chemical storage and disposal are eliminated. A smaller facility footprint and the ability to construct the new plant while keeping the existing plant in operation made membrane treatment a viable choice for the City.

To evaluate potential membrane filtration equipment and vendors, the team planned a pilot program that provided an opportunity for training of City staff and Ontario Clean Water Agency (OCWA) personnel on the membrane process equipment. The evaluation considered technical elements (system operations, maintenance, and technical support) as well as capital and operations costs, projected over a 20-year period, to ensure an informed choice of the most suitable membrane vendor.

CH2M HILL designed the treatment facility in a 3D model which allowed designers, operators, and City staff to virtually "walk through" the plant before any construction began. Use of the 3D design also helped

stakeholders such as City Council and local residents to understand and feel comfortable with the facility planning at an early stage.

During design, CH2M HILL took an integrated approach to managing the building environment by generating innovative, value-based solutions that include sustainable energy efficiency concepts. The heat recovery system takes advantage of the large difference in temperature between the lake and the environment to heat and cool the building. The facility has a large, unobstructed roof surface to collect significant amounts of solar energy. Solar collectors gather heat that is distributed to the system via tankless water heaters circulating hot water through the radiant floor heating system – providing comfortable room temperatures in occupied spaces. The facility has approximately 2000 hP of pumps when operating at full capacity which doubles during peak demand times. Excess heat from this heat-producing process equipment is circulated to other areas of the building in winter to supplement heating.

Achieving community and stakeholder acceptance was crucial to this project. Considering its location within a residential community and the relatively large financial investment in the City's infrastructure, it was essential that stakeholders bought into the project from the beginning. The project team hosted public meetings during the pilot program at the beginning of the project to allow stakeholders to meet the parties involved in the project (City staff, consulting engineers, and membrane vendors), learn about the membrane system, and provide feedback on the design plans.

Additional public open houses were held at key points during the project to present the initial site layout, invite the public to help select exterior finishes, and consult local residents were on the plans for the relocated community park and playground equipment. A Neighbourhood Newsletter distributed during the construction phase provided updates on project status, budget, schedule and the plan forward.

One of the most difficult decisions during design was the realization that the existing children's play park would need to be demolished to allow construction of the new water plant. The design team made a commitment to the community to restore the park and to provide access to the lake. The landscaping design included re-establishment of over 25 new mature trees (blue spruce and sugar maples) to augment existing trees on the property and planting eco-lawns to reduce watering needs.

The North Bay treatment plant is located on a limited site, surrounded by homes and the lake. The construction site was so tight that no staging area was available for equipment. Three staging areas were set up throughout the City to store equipment and materials and were transferred to the site as needed. Construction challenges included working with a high water table which required drainage of the site through 24/7 pumping for over two years.

The CH2M HILL team delivered a world-class water treatment facility that meets public health needs and incorporates innovative and sustainable solutions. Overcoming residents' initial objections and implementing a lasting solution with lower overall lifecycle costs, the plant includes heat pump and process heat recovery systems to supplement the building's cooling and heating processes as well as solar heat capture systems for preheating all of the plant process and potable hot water. These approaches minimize the plant's environmental footprint and provide the best long-term value for the community, and have resulted in building heating savings of up to 85%, cooling savings of up to 38%, and process water heating savings of up to 35%.

Submission to
Canadian Consulting Engineering Awards 2011

North Bay Water Filtration Plant

May 2011


Architectural elements blend in with community

Landscaping includes a children's play park


3D Gallery model


Restricted site required innovative construction techniques


Rooftop solar collectors reduce power consumption


Recirculating excess process heat reduces building heating needs


Gallery as-constructed identical to 3D model

CANADIAN CONSULTING engineer

CH2MHILL®

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Just North Enough to be PERFECT

WBG042911063027TOR

The North Bay Water Treatment Plant is the largest dual-membrane, high recovery plant in North America achieving >99% recovery of the source water.

Building North America's Largest Membrane Treatment Plant – A Story of Sustainability

The City of North Bay sits in a pristine wilderness environment 350 km north of Toronto. For over 110 years, North Bay had drawn its water from Trout Lake – the largest unfiltered water source in Ontario – with chlorine disinfection as the only treatment required. Trout Lake water is characterized by its low turbidity, no color, and low organic levels. Considering the high quality of the source water, the City proactively examined methods to improve their water supply system and protect the City's drinking water. CH2M HILL completed an Engineer's Report and a companion report entitled *Evaluation of UV Disinfection for the North Bay Water Treatment Plant.*

The Engineer's Report considered treatment options that would allow the City to be compliant with Ontario Regulation 459 (one of the recommendations of the Walkerton Inquiry) which established new minimum treatment levels for *Cryptosporidium, and Giardia*, and requiring systems drawing from lake-based water source types to include filtration as part of the treatment train. The Engineer's Report recommended that the City add membrane filtration to its treatment facility. Membrane filtration extracts ultra pure water through microscopic holes in a membrane, while leaving the dirt and particles behind. This type of filtration produces a better quality product, could be made to fit at the existing site, and was judged to be less expensive.

The companion report *Evaluation of UV Disinfection for the North Bay Water Treatment Plant* indicated that it would be possible to achieve compliance with the regulations using UV if the province was willing to consider US Environmental Protection Agency (USEPA) filtration avoidance guidelines. The substitution of UV treatment in place of membrane filtration could be linked to other considerations such as stronger watershed protection programs. The implementation of UV would initially be on an experimental or probationary basis and would be accompanied with in-depth assessment of raw water quality to confirm design engineering considerations.

The UV option would have meant significant cost savings to the community. Estimates costed conventional treatment at $32M with $1M per year in operations and maintenance costs, micro-filtration at $25M and $1M per year in operations and maintenance costs, and UV at $1.6M and $84,000 per year in operations and maintenance costs.

The USEPA filtration avoidance guidelines could be considered by the MOE if the source water was considered pure and stable enough, and would be in concert with additional measures for watershed protection.

In April 2001, on the day before the USEPA filter avoidance application was to be submitted, a heavy rainstorm caused a large amount of debris from a construction site to enter one of the creeks on the north side of Delaney Bay. The debris caused the turbidity of the raw water to rise above 5 NTU for over 12 hours. The Medical Health Officer was forced to institute a week-long Boil Water Alert, scuttling any chances for approval of filter avoidance. The City would now be forced to implement filtration, which would require a new facility. In response to the boil water order, the installation of UV treatment was accelerated as an interim measure.

Project Achievements

- *99%+ membrane efficiency*
- *Zero discharge to Trout Lake*
- *Sustainable design reduced energy needs*
- *Eliminated requirement for increased sewer capacity and wastewater treatment*
- *Overcame community objections to facility site and project costs*
- *Construction of facility on restricted site in residential neighbourhood*
- *Educational facility promotes ongoing understanding of need for water treatment by residents and council*

Support for a New Facility

In October 2004 the project team met to kick off the design of the new facility. With residents concerned about the cost and visibility of the plant (on Lakeshore Drive, in the center of a residential community), MOE pressure to meet the new regulations as soon as possible, and high expectations from City Council regarding sustainability and long-term economic viability of the solution, the project team needed to secure community support while ensuring that treatment goals were met.

The requirements for multi-barrier protection had significant implications for the community of North Bay. The City would be required to build a new water treatment plant to provide filtration with the attendant costs from a financial and social perspective. Objections from the community arose almost immediately.

"Generations of my family have drunk Trout Lake water and we've never been sick."

"Don't increase my taxes to pay for a treatment plant that we don't need."

"I don't want to look across our beautiful lake – or across the street – and see some industrial facility."

In accordance with MOE requirements, the City completed a Schedule C Environmental Assessment of the treatment processes required for a replacement plant. The EA approved both conventional and membrane treatment to provide multi-barrier protection and recommended conventional treatment. Considered safer and more proven than other technologies, conventional treatment was well understood.

However, CH2M HILL had experience with membrane treatment elsewhere and had observed advantages that might make it a better choice. In a January 2003 Treatability Study report, CH2M HILL provided results of a direct comparison of the two treatment trains. This evaluation showed that overall life-cycle costs for membrane treatment would be lower while treatment efficacy would be similar – if not better.

Conventional filter treatment requires coagulation with the use of chemicals. A City by-law specified that spent chemicals could not be discharged back to Trout Lake but would need to be directed into the sewer system. Discharge flows from conventional systems are significantly higher so upgrades to the sewer system would have been required along with changes to the wastewater treatment plant to deal with the aluminum and heavy metals discharged by the treatment processes. Alternatively, the City could have considered adding a residuals treatment facility but this would have required a larger footprint. The site of the existing water facility was constricted on all sides with no additional land available.

Value Engineering

Two value engineering (VE) sessions were held to: evaluate the most appropriate filtration treatment alternative; and to review the preliminary design for thoroughness and opportunities to optimize the design.
VE sessions allowed the owner and stakeholders to develop a detailed understanding of the project's complexity and cost factors and allowed the team to evaluate critical design features including site layout, chemical usage, efficiency targets, and administration space needs. A member of City Council participated in both VE sessions which promoted involvement with the project and an increased level of comfort with the proposed solution.

Membrane treatment avoids the use of chemicals altogether. Used in conjunction with UV disinfection, membranes provide a very reliable barrier to viruses and bacteria. Cost and safety

considerations for chemical storage and disposal are eliminated. A smaller facility footprint and the ability to construct the new plant while keeping the existing plant in operation made membrane treatment a viable choice for the City.

To properly evaluate potential membrane filtration equipment and vendors, CH2M HILL and the City of North Bay planned a two-month long trial. The pilot program used raw source water from Trout Lake with a total flowrate of 1.2 ML/d. In addition to assessing suppliers, the pilot program allowed the design team to gain experience with all products specifically related to performance on Trout Lake source water. This also provided an opportunity for training of City staff and Ontario Clean Water Agency (OCWA) personnel on the membrane process equipment.

Four vendors were pre-selected to perform the pilot program: Pall Canada, US Filter / Memcor, Zenon Environmental, and Ionics Corporation. Three of the four vendors submitted bids, which were evaluated by the City's cost and technical evaluation teams made up of representatives from CH2M HILL, OCWA (existing water plant operator), the City of North Bay, and a member of City Council.

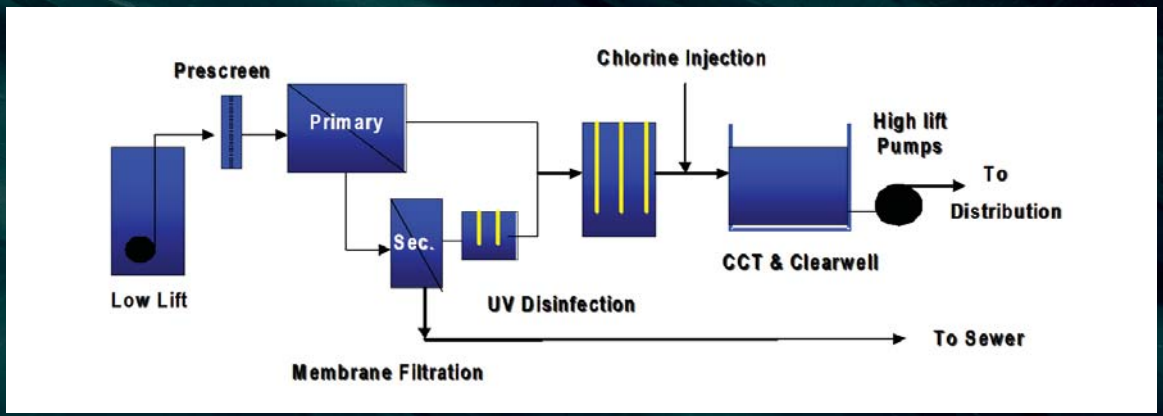
The evaluation considered technical elements (system operations, maintenance, and technical support) as well as capital and operations costs, which were projected over a 20-year period, to ensure that the teams could make an informed choice of the most suitable membrane vendor. After an extensive review of the proposals, the City selected Pall as the membrane supplier.

Treatment Train

The North Bay plant operates using a multi-barrier approach to meet treatment goals. The primary barrier is Pall Corporation's Aria Microfiltration system. This membrane filtration system is made up of 11 parallel membrane racks, each equipped with dozens of pressure vessels that house thousands of hollow-fiber membranes. These membranes provide an effective barrier to physically separate the various contaminants in North Bay's drinking water.

The secondary treatment barrier is the UV disinfection system, which inactivates organisms such as ***Cryptosporidium and Giardia*** *that are present in the water using high intensity light. The water is then injected with chlorine to kill off any viruses and bacteria that are able to bypass the previous systems. The raw water for the plant is drawn from an intake pipe that extends 300 m off the shore into Delaney Bay, approximately 21.5 m below the water surface. An average of 42 million liters (ML) of water runs through the plant every day, with a maximum daily flow of 79.5 ML.*

The primary membrane system filters the raw water with the secondary membrane system filtering the non-chemical backwash water from the primary system. This strategy minimizes the plant wastewater quantity to less than 1% of the feed water flowrate.



Seeing it in 3D

CH2M HILL designed the treatment facility in a 3D model. Three-dimensional design has been part of the company's standard delivery platform for over a decade. The 3D model is built by incorporating design information from individual disciplines into a design-independent platform and generating a fully realized spatial representation of the facility. Detailed information on the location and integration of every facet of the design allowed the team to instantly detect any interferences early in the design process.

The completed 3D model allowed designers, operators, and City staff to virtually "walk through" the plant, allowing them to identify potential conflicts, and visualize the space before any construction began. Use of the 3D design also helped stakeholders such as City Council and local residents to understand and feel comfortable with the facility planning at an early stage.

3D Model of Membrane Gallery

Membrane Gallery as-constructed

Leadership in Bottom-Line Sustainability – Environmental, Financial, and Social Perspectives

During planning for the new treatment plant, the City established that sustainability needed to be a key factor in design. Environmental protection was paramount to protect Delaney Bay, Trout Lake and related waterways. North Bay had also instituted a by-law requiring zero discharge to the lake from all water users. Although an exemption could have been considered for infrastructure so vital to the community's health, City Council sought to lead by example by respecting the by-law and made zero discharge a design requirement for the new water treatment plant.

During design, CH2M HILL took an integrated approach to managing the building environment by generating innovative, value-based solutions that include sustainable energy efficiency concepts such as: Reduce Energy Consumption by maximizing Heat Recover and Transfer, Integration of plumbing, HVAC and Process Systems, and Utilization of Building Management System to promote energy efficiency.

Sustainable Savings

- *Building Heating – 85%*
- *Building Cooling – 38%*
- *Process Water Heating – 35%*

Leveraging Trout Lake Water Temperatures

The heat recovery system takes advantage of the large difference in temperature between the lake and the environment to heat and cool the building. The mean temperature of Trout Lake water is between 2 and 6 degrees Celsius year round while the outdoor temperature typically ranges from -20 to + 20 °C, with extremes from -30 to + 30 °C. Heat exchangers transfer heat (or cold) from the lake water to glycol circulating in the heat pumps. The system uses Heat Recovery Units (HRU's) and Air Handling Units (AHU's) (with and without heat pumps) for better heat transfer efficiency. Radiant floor heating is used to heat task areas at very high efficiency. In addition, the large concrete mass of the building (the structure contains over 3,000 m^3 of concrete and 82 tonnes of rebar) holds heat effectively increasing efficiency.

Heat Recovery and Increased Efficiency

- *Total Heating Demand for Plant = 388 kW*
- *Total Heat Savings = 137 kW (35%)*
- *Total Cooling Demand for Plant = 104 kW*
- *Total Cooling Savings = 40 kW (38%)*
- *Process Water Heating – 35%*

Solar Collectors Reduce Heating Bill

North Bay's winter season provides a great deal of sunlight and the facility has a large, unobstructed roof surface to collect significant solar energy.

Heat from sunlight is transferred to the glycol-filled tubes in the solar collectors (which can reach up to 250 °C). Solar heat is distributed to the system via tankless water heaters circulating hot water through the radiant floor heating system– providing comfortable room temperatures in occupied spaces. All water in the plant is preheated using solar energy. Tankless heaters provide on-demand heat to the process cleaning system, reducing the energy requirements for this process, and for domestic use.

Using Renewable Energy Sources

- *Total Process Water Heating Load is 215 kW*
- *Solar Heating Contribution = 75 kW (35% savings)*

Reduce, Reuse and Recycle Process Heat

The North Bay facility has approximately 2000 hP of pumps when operating at full capacity (24/7). This doubles during peak demand times. Excess heat from this heat-producing process equipment is circulated to other areas of the building in winter to supplement heating. The membrane modules themselves are an efficient temperature exchange system – acting like huge heat exchangers. Heat pump systems also recirculate air through a membrane process blower air heat exchanger to salvage heat from this unit process and aid heating and cooling of the building. The building itself is designed to provide increased insulation (R-values of 20 in the walls and 40 in ceilings), requiring less heat in winter and maintaining cool temperatures in summer.

Reusing Process Heat

- *Total Heating Load is 388 kW*
- *Pump (90) and Compressor/Blower Room (5) contribution = 95 kW*
- *Blower Process Air contribution = 19 kW*
- *Total Savings = 114 kW (29%)*

Rooftop solar collectors reduce energy burden.

A Good Neighbour

Achieving community and stakeholder acceptance was crucial to this project. Considering its location within a residential community and the relatively large financial investment in the City's infrastructure, the team knew there would be opposition from residents and it was essential that they bought into the project from the beginning. The project team hosted a public meeting during the pilot program at the beginning of the project to allow stakeholders to meet the parties involved in the project (City staff, consulting engineers, and membrane vendors). Open house boards provided background to the project, a schematic of the planned process, and an overview of the project. The open house included presentations by the membrane manufacturers and hands-on tours of the membrane pilot plant.

Additional public open houses were held at key points during the project to present the initial site layout, invite public comment on proposed exterior finishes; and consult local residents were on the plans for the relocated community park and playground equipment. A Neighbourhood Newsletter distributed during the construction phase provided updates on project status, budget, schedule and the plan forward. A construction public open house was held with Contractors and City Representatives to explain the construction process, the schedule, traffic diversions, and to provide an opportunity for residents to discuss their concerns with the project team.

With houses across the street and on either side of the plant (30 m away from its closest neighbour), it was essential to gain support of local residents during the design phase. And it was imperative that architectural design helped the plant to "fit in" visually.

The architectural design used concepts and themes such as interesting roof lines, window walls, and varying masonry units to help integrate the new building within the residential area. The exterior colour scheme is a light sand colour with grey/blue accents. The architectural coloured masonry, siding, and roofing complement the colour scheme and were selected with neighbourhood residents voting during open houses to help select elements that ensured the plant blend in visually with the surrounding community. Skylights, operable windows, and a window wall add natural light and improve the building's appearance.

One of the most difficult decisions during design was the realization that the existing children's play park would need to be demolished to allow construction of the new water plant. The design team made a commitment to the community to restore the park and to provide access to the lake. The landscaping design included re-establishment of over 25 new mature trees (blue spruce and

Designed by Our Community – For Our Community

The project team invited residents of the community to participate in the evaluation process through open houses where each of the vendors demonstrated the membrane pilot equipment. Mockups of the facility design were displayed with samples of the brick, roofing, and architectural choices. Residents voted on the samples they would like to see used in the facility design.

sugar maples) to augment existing trees on the property. The neighbourhood children's park was relocated to the north side of the property. To minimize the use of potable water for landscape irrigation, environmentally friendly lawn seed mixtures were selected. These ecolawns require minimal watering – as little as once or twice per month – which can usually be provided through natural rainfall.

Continuing Education

Generations of North Bay residents who had been satisfied with the quality of their drinking water might have objected to the expense and inconvenience of constructing a new water treatment plant. Gaining community support for the project has come through community understanding and ongoing education on the need for water treatment. The plant design made provision for public tours with an engineered pathway that follows the treatment process from start to finish. The pathway incorporates display stops that explain how the drinking water is treated as well as viewing windows for areas that are secured from public access. The plant features coloured pipe wraps to indicate their contents (which is coordinated with the display stop signage). The educational facility includes a fully-equipped training room.

NORTH BAY

City of North Bay
Update - Construction of the Drinking Water Filtration Plant
May, 2008

Background Information

Why build this facility?

Construction of a new water filtration plant in the City of North Bay is the result of a new regulation instituted by the Ministry of the Environment resulting in the need to install filtration on the North Bay water supply system.

New Plant Design

A key element of the design includes a multi-barrier approach for treatment of the biological contaminations that are possible from a surface water source. The heart of the new treatment plant is Pall Corporation's membrane filtration system which was selected based on the results from pilot testing on Trout Lake water at the existing plant. The Pall two-stage membrane system will treat 99% of the plant's feed water into drinking water. The recovery efficiency of the treatment process is vital to conserving the quality of Trout Lake drinking water. The new plant will combine membranes, ultraviolet disinfection (UV) and chlorination to provide quality drinking water. The entire process will be controlled by state of the art instrumentation and automated controls that are linked to the distribution system's computer monitoring system.

How is the project funded?

Funding for this $45.5 million project has come from several sources including: Canadian Ontario Municipal Rural Infrastructure Fund (COMRIF), the Northern Ontario Heritage Fund Corporation; and the City of North Bay (surcharge added to water rates over a 20-year period).

Who is the building contractor of the new plant?

In March 2006, North Bay City Council awarded Torbear Contracting Ltd. of Woodbridge, Ontario the general contract to build the new water filtration plant. City staff with the assistance of CH2MHill Canada Limited, the design engineers for this project have provided construction management and contract administration services.

Work Completed to Date

Site work activity began early April 2006 and has progressed over the past two years. The majority of work to date has focused on construction of the building structure which is now complete and contains over 82 tonnes of rebar and 3000m^3 of concrete placed and finished. Major works completed include the installation of all 13 membrane filtration racks and installation of all 5 high lift pumps (350 HP each) that will feed drinking water to the City distribution system.

Water Treatment Plant Construction Site July 2007

Is construction on schedule?

Construction projects of this magnitude often encounter issues which lead to delays, both avoidable and unavoidable. This project was originally scheduled for completion March 2008, yet due to delays, this date has been postponed approximately 8 months. Currently, the construction is steadily progressing and the general contractor has ramped up their efforts on site. As you may have noticed, many of the trades are working on weekends. The City's construction management staff is doing everything possible to facilitate completion of the project as soon as possible.

Construction on a Tightly Constricted Site

The North Bay treatment plant is located on a limited site on Lakeshore Drive, surrounded on all sides by homes and the lake. The construction site was so tight that no staging area was available for equipment. Three staging areas were set up throughout the City to store equipment and materials and were transferred to the site as needed.

With the lake so close to the building, it was apparent that the ground water table would be a concern during digging – especially for deeper structures such as the chlorine contact tanks and wet wells. Water was so close to the surface that the structure would have started to float. Construction would require either building a barrier around the entire construction site to keep out the water or lowering the water table of the site using continuous pumping. The team opted for the latter solution and used a ground dewatering system to lower the water table onsite for 2 years while the building was constructed. The extracted water had to be treated for fine particle removal prior to discharge into Trout Lake. Interlocking concrete caissons poured within a trench around the building were used to prevent additional water from entering the site during construction.

The North Bay water treatment facility was located on a restricted site bound on the east side by Trout Lake and on the North and South sides by neighbouring residences. Constructing the new treatment plant on the same site meant that both plants would need to operate at the same time during the construction overlap. The two plants would utilize the same raw water intake and discharge to distribution system.

It was extremely important to ensure that the new plant was ready prior to decommissioning the existing plant. Due to the current regulations, this meant that the Commissioning Team had to be ready with a perfectly thought out plan for the start up of the plant. The operational checkout of all equipment was facilitated by integrating an overflow/recirculation connection which allowed the plant to be fully functioning and tested out without pumping water to the distribution system. Prior to the actual switch over, complete disinfection of all equipment was done in recirculation mode. The Operating Authority (OCWA) isolated the existing plant, shut off operations and directed treated water from the new plant into the distribution system.

Establishing a tie-in to the discharge lines provided some major challenges because of the fact that it was on the high pressure side of the system. Shutting down this line would cut the water supply off from houses that were directly adjacent to the plant site. Planning was critical to ensure the shortest possible shutdown, eliminating chances of water contamination, and anticipating the possibility of an existing pipe failure during the operation. The team was able to design a strategy that allowed for a two staged tie-in process that reduced the risk of all factors without any major issues.

The facility is located on a tight site within a residential community.

To enable construction on a high water table, the site was trenched and drained with 24-7 pumping over 2 years.

Smart planning transferred excess heat from spaces that did not need it to spaces that did.

Window walls and architectural materials leverage natural light and a beautiful view to make great interior spaces.

The building was designed to blend into thiis residential neighbourhood. The community contributed to selection of architectural materials during facility open houses.

The landscaping plan integrates the facility into the neighbourhood, restoring the children's play park, using eco-friendly ground cover, and providing lake access for the community Blue Sky Sailing Club.

The North Bay Water Treatment Plant is an example of sustainability concepts used to lower overall life-cycle costs and garner community support.

Exceeding Expectations

The CH2M HILL team delivered a world-class water treatment facility that meets public health needs and incorporates innovative and sustainable solutions. Overcoming residents' initial objections and implementing a lasting solution with lower overall lifecycle costs, the plant includes heat pump and process heat recovery systems to supplement the building's cooling and heating processes as well as solar heat capture systems for preheating all of the plant process and potable hot water. These approaches minimize the plant's environmental footprint and provide the best long-term value for the community. These approaches resulted in building heating savings of up to 85%, cooling savings of up to 38%, and process water heating savings of up to 35%.

CH2M HILL, in conjunction with Trow Engineering and local specialty subconsultants were able to deliver this project under budget. The Grand Opening of the facility was held in August 2010 where City and Consultant staff provided tours of the facility. Stakeholders of muncipal, provincial and federal government branches were in attendance to officially open the facility.

Director David Euler expressed his appreciation to the project team: "The City of North Bay is very pleased to have our Water Treatment plant fully commissioned. Although the Contractor took much longer than anticipated, the project was delivered under budget which says a lot about the quality of the design and the contract documents. Mike [Blair] and his team at CH2M HILL provided great support throughout the project."

Design Delivered On-Time and Under Budget

- *Authorized budget: $1,089,0814*
- *Final budget: $1,080,830*

- *Original schedule: May 2006*
- *Final schedule: May 2006*

However, the true success of the North Bay Water Treatment Plant can only be expressed by the reaction of the community for whom it was built.

"It blends into the neighbourhood."

"Now I understand why we needed this."

"You can see it from across the lake. It sort of looks like a house."

"I didn't understand why there was so much complexity, why there was dust on the ground so long – I get it now."

The North Bay Water Treatment Plant was officially opened in August 2010. Funded by the Government of Canada, Province of Ontario, and City of North Bay, this facility is a shining example of financial, environmental, and social sustainability.