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OCTOBER/NOVEMBER 2020

CANADIAN CONSULTING engineer

2020 AWARDS

Samuel De Champlain Bridge Corridor wins Schreyer

Award of Excellence winners span Canada

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October/November 2020
Volume 61, No. 6

Photo courtesy SNC-Lavalin
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features

departments

Next issue:
Campuses, seismic designs and more.

The best of the best

Back in January, when we launched the latest edition of the annual Canadian Consulting Engineering Awards, in partnership with the Association of Consulting Engineering Companies – Canada (ACEC-Canada), we had no idea how different the process would be this year. Indeed, that moment now feels like a lifetime ago.

Consulting engineering firms across Canada were diligently organizing their project entries when the COVID-19 crisis hit. We extended our entry deadlines. In the end, some companies were not able to enter this year, despite their intentions to do so.

Yet, amazingly, our number of completed entries this year, 76, is very nearly the same as last year's record-setting total of 80. In other words, the global pandemic did not put an end to the engineering community's participation in the awards program. On the contrary, that strong level of engagement was one of the few examples I witnessed in recent months that could be described as 'business as usual.'

And not only did the quantity of entries in the competition remain steady, but the quality was outstanding, as you'll see in this issue's showcase of the 20 Award of Excellence winners and three Special Award winners. (Note: no projects won the Outreach or Ambassador Awards this year.)

The slate of winning projects profiled herein ranges from unseen but vital infrastructure to esthetically pleasing works of functional art in the public eye, from careful, painstaking rehabilitations of heritage architecture to bold new ideas given large-scale life. They also span a vast range geographically, from the west coast, the east coast, the far north and many scattered points between (check out the map on page 13).

All this made for what I'm sure you'll agree is a fascinating, eclectic group of projects—not to mention the many non-winning projects also worthy of your attention, which you can find in the updated Showcase of Entries section of our website (canadianconsultingengineer.com).

It was not a normal year, to be sure. Entries had to be submitted digitally, rather than hard copies. Our 12 esteemed jury members had to conduct all discussions and make final decisions via phone and videoconferencing, rather than in person. And most recently, ACEC-Canada presented the awards through a virtual celebration on Oct. 29, rather than hosting a gala in Ottawa as part of a national conference.

Despite all of those unplanned changes, however, we can happily report the program is as vital, prestigious and eye-opening as ever. But don't take my word for it; check out the winning projects for yourself, throughout this special issue.

Peter Saunders

FOR PROFESSIONAL ENGINEERS IN PRIVATE PRACTICE

CANADIAN CONSULTING engineer

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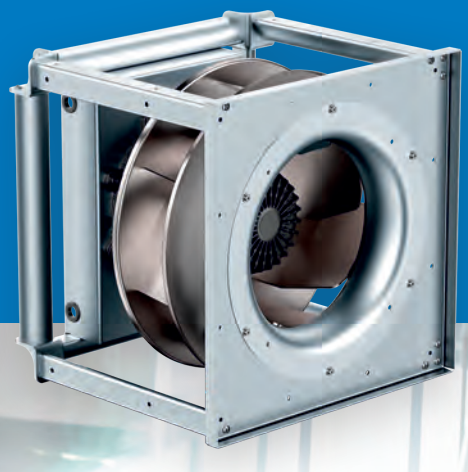

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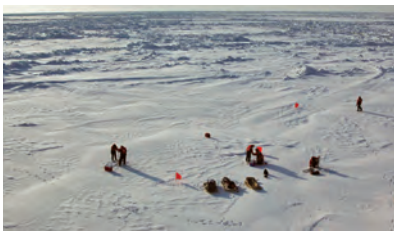

Photo courtesy Stantec

Stantec joins major Arctic research contract

Stantec will support research and development (R&D) organization Battelle on a new 10-year, US$260-million Arctic research support and logistics services (ARSLS) contract for studies in Northern Canada, Alaska, Greenland and other Arctic areas.

Funded by the U.S. government's National Science Foundation (NSF), the contract will see Stantec provide infrastructure and logistics support, including engineering, design and planning services, for new and existing facilities in some of the planet's most remote and challenging locations, weather conditions and terrains.

Stantec is tasked with designing sustainable and resilient research facilities, laboratories and operations centres where Battelle's academic researchers will conduct studies of the Arctic's natural environment and social and cultural systems, so as to understand local changes with downstream effects on the rest of the world and, in turn, the planet's influence on the Arctic. The facilities' key features will include efficient startup and shutdown, reconfiguration and reuse, remote monitoring and automation.

Photo courtesy Transports Quebec

Feds support WSP's Louis-Hippolyte-La Fontaine Tunnel rehabilitation

The federal government will provide more than $427 million toward the $1-billion rehabilitation of Montreal's 53-year-old Louis-Hippolyte-La Fontaine Tunnel, a project for which WSP won the contract last year.

Plans to repair and modernize Canada's longest underwater highway tunnel, a cross-river link built in 1967 to connect the island of Montreal with the South Shore, were first announced in June 2019. The project will involve rehabilitating the infrastructure, modernizing its lighting, electrical, fire protection and other operating systems, reconstructing the Highway 25 roadway between Charron Island and the Sherbrooke Interchange and building new public transit infrastructure along Highways 20 and 25.

The governments of Quebec, Montreal and Boucherville are also financially supporting the project, which has been deemed essential for mobility of people and goods across the region.

IBI Group to design Broadway subway expansion

Toronto-based engineering firm IBI Group will serve as project architect for the expansion of Vancouver's Broadway subway line. The firm is part of the Acciona-Ghella joint venture (AGJV), the preferred proponent team for the project.

British Columbia's government announced the selection of the AGJV on July 17 for the $2.8-billion, 5.7-km long SkyTrain light-rail transit (LRT) design-build-finance (DBF) project. In addition to its role as project architect, IBI will serve as architect and engineer of record for four of six underground stations. The company will also provide design services for road alignments, traffic diversions and street furniture modifications as required to support the new stations.

The track will run from VCC-Clark Station on an elevated guideway for 700 m, then beneath Broadway for 5 km to a new terminus at Arbutus Street. Construction is scheduled to start later this year.

PEIOPLE

JLR

Lucie Dalrymple

J.L. Richards & Associates (JLR) promoted Lucie Dalrymple, P.Eng., to manager of planning and development. She joined the firm in 1992 and has had hands-on involvement in designing and building large residential and commercial sites.

GHD

Malcolm Dixon

GHD named Malcolm Dixon general manager (GM) for Western Canada, overseeing offices in Vancouver, Edmonton and Calgary. The firm established the regional business in anticipation of federal and provincial investments in infrastructure.

Binnie

R.F. Binnie & Associates ('Binnie') promoted Russell Warren, P.Eng., to vice-president (VP) of development and infrastructure. He succeeds Tom Rabey, AScT, PMP, who has been promoted to chief operating officer (COO).

AE

Associated Engineering (AE) is appointing Nadeer Lalji, MBA, P.Eng., general manager (GM) for its Alberta South region. He succeeds Dale Loewen, P.Eng., PMP, who is moving into a new corporate role as business process manager. The transition will be effective Jan. 1, 2021.

CHAIR'S MESSAGE

Celebrating excellence in the consulting engineering industry

Every year, consulting engineering firms complete thousands of projects of all sizes, tackling complex engineering challenges. Through these projects, the industry contributes to social wellbeing and economic growth in ways that are often taken for granted - providing safe and healthy cities, connecting people and businesses, helping to build a strong, competitive and sustainable economy, and protecting and conserving the environment.

During these challenging and unprecedented times, we've been able to count on the consulting engineering industry to continue safeguarding our communities and ensuring the wellbeing of Canadians and people across the globe. This industry has played an important role in meeting the challenges of our new shared reality and has made a difference to the lives of Canadians. Recognizing and celebrating these accomplishments is critical now more than ever. This is the reason the Canadian Consulting Engineering Awards are so important, because they showcase ACEC member firms, celebrate the meaningful difference they make to our communities and society as a whole, and elevate the image and profile of our industry.

On October 29th, the industry came together for a virtual celebration. Over the course of the event, 20 outstanding projects from across Canada were recognized with Awards of Excellence for their ingenuity, technical complexity, their social and economic benefits, and their commitment to sustainability and the environment. From these 20 winners, three were also recognized with a Special Achievement Award for having distinguished themselves for either their environmental stewardship, their impact on the community or their overall technical distinction.

The depth and breadth of these award-winning projects is remarkable. I encourage you to learn more about them to truly appreciate the impact we make as engineering professionals. Each project is included in this special edition of the magazine and will be featured in ACEC-Canada's #20DaysofExcellence social media campaign starting November 2nd. Make sure to follow us on Facebook, Twitter, LinkedIn and Instagram to take part in this month-long celebration of these remarkable projects.

ACEC-Canada also recognized individual accomplishments in the consulting engineering industry during the virtual event. The 2021 Allen D. Williams Scholarship was presented to Julie DiCicco, a rising young professional at Dillon Consulting Limited. Further, for his lifetime contribution to the consulting engineering industry, Andy Robinson received the Beaubien Award. Both are featured in the following pages. A special thank you to the Allen D. Williams Scholarship Foundation and the ACEC Past Chair's Council for their work in selecting this year's winners.

To close, I would like to take this opportunity to express our gratitude to the CCE jury members who committed countless hours to reviewing the project submissions. To our awards partner, *Canadian Consulting Engineer* magazine, we look forward to continuing our collaboration and expanding this important national program. Most importantly, I would like to thank all the firms that participated in this year's awards program; they, along with their clients and other partners and contributors to these projects, all deserve our congratulations.

ANTHONY KARAKATSANIS, P.ENG.
CHAIR, BOARD OF DIRECTORS, ACEC-CANADA

Association of Consulting Engineering Companies – Canada (ACEC-Canada), Tel: (613) 236-0569, info@acec.ca, www.acec.ca. ACEC Member Organizations: Association of Consulting Engineering Companies – British Columbia, Association of Consulting Engineering Companies – Yukon, Consulting Engineers of Alberta, Association of Consulting Engineering Companies – Northwest Territories, Association of Consulting Engineering Companies – Saskatchewan, Association of Consulting Engineering Companies – Manitoba, Consulting Engineers of Ontario, Association des firmes de génie-conseil – Québec, Association of Consulting Engineering Companies – New Brunswick, Consulting Engineers of Nova Scotia, Association of Consulting Engineering Companies – Prince Edward Island, Association of Consulting Engineering Companies – Newfoundland & Labrador.

2020 ACEC Beaubien Award presented to Andy Robinson

Andy Robinson, a former ACEC Chair and the founder of Robinson Consultants Inc. was presented with the industry's highest individual honour as part of the Canadian Consulting Engineering Awards virtual celebration on October 29th.

Andy is a quiet leader who can command the attention of a room with his thoughtful words. He conducts himself as an industry and community leader by the principles that are paramount to him as a professional engineer – integrity, ethical behaviour, and accountability.

Andy received his Bachelor of Science in Civil Engineering from Michigan Tech in 1966. After working as a Project Engineer for a few years, he pursued a master's degree in Water Resources at the University of Waterloo. Throughout his career, his interests focused on municipal infrastructure, environmental, and water resources engineering, with recent emphasis on projects under the Ontario Drainage Act.

While Andy has consulted on thousands of projects over the course of his career, his greatest professional achievement is the creation of his engineering firm, Robinson Consultants Inc. in 1977. He was approximately ten years into his career as a professional engineer when he left his position as Ottawa Area Manager for R.M. Kostuch Associates Ltd. to found his firm. The reputation he had established in the Ottawa area allowed for the firm to grow in size and specialty under Andy's leadership. In 2011, after a transfer of ownership, Andy assumed the role of Chair of the Board of Directors. Today, Robinson Consultants is a multi-disciplinary consulting engineering firm that has over sixty employees, including thirty-two engineers, as well as a diverse team of technologists and support staff.

Throughout his fifty-five-year long career, Andy has given back to the industry through his involvement in several organizations. He has volunteered with ACEC-Canada, Consulting Engineers of Ontario, the Ottawa Chapter of Professional Engineers of Ontario, and the Canadian Water Resources Association. Whether as a Director, Vice-Chair, Treasurer or Chair of the Board, he has led a host of initiatives, including preparation of the industry paper Understanding Public Private Partnerships in Canada, the completion of a new strategic plan and bylaws, presenting to the Inquiry on Federal Water Policy, and conducting negotiations with the City of Ottawa on contract language, procurement policies, and qualifications based selection.

Andy's contributions to the industry have been officially recognized with many awards. In 2017, he was the recipient of the Joe Johnson Sr. Private Sector Award, an Ontario Public Works Association (OPWA) award that recognizes outstanding individual achievement through chapter activity and outstanding corporate achievement. He is also a Fellow of Engineers Canada (FEC), an honour given to individuals who have provided noteworthy service to the profession. Most recently, the American Water Works Association (AWWA) awarded him the Life Member Status Tenure Award in recognition of his membership tenure of thirty cumulative years. Andy has also received a twenty-five years of service recognition from Professional Engineers of Ontario (PEO) and the Province of Ontario.

In addition to his industry commitments, Andy is a passionate community volunteer. In 1998, he became involved with WaterCan (now known as WaterAid Canada). Over the years, he has served in multiple roles including Chair of the Board and Director Emeritus and is presently an Advisory Council Member. His interests in helping with small water projects in rural communities in Africa culminated with a trip with his daughter to Uganda to witness the organization's work firsthand. His passion for his work with WaterAid is evident when he speaks of this experience.

If you asked Andy how he manages to do it all and still find time to play golf, he would likely say it is due to good planning. Those who know him would say it has more to do with having a strong obligation to the community and industry he has been a part of for over fifty-five years. Andy's legacy within the walls of Robinson Consultants and in the industry at large will serve as one of the highest bars a professional engineer could hope to reach.

As the recipient of this year's Beaubien Award, presented annually in recognition of exception service to ACEC and for contributions to the advancement of consulting engineering through professional accomplishments, Andy is recognized by his peers for his exemplary service.

Visit www.acec.ca/beaubienaward to view the Beaubien winner video.

Julie DiCicco wins the 2021 Allen D. Williams Scholarship

The Association of Consulting Engineering Companies-Canada (ACEC) is pleased to announce that the 2021 Allen D. Williams Scholarship has been awarded to Julie DiCicco, M.A.Sc., P.Eng., of Dillon Consulting Limited. Ms. DiCicco was announced as the recipient of this award during the 2020 Canadian Consulting Engineering Awards virtual celebration on October 29th.

Julie believes that engineers and consultants have an obligation to provide innovative and sustainable solutions to their clients, placing capacity building at the forefront of those solutions. A strong advocate for shared learning, she utilizes creative and collaborative approaches to solve today's complex problems and provide long-term benefits to the client and their community.

A 2013 graduate of the Environmental Engineering program at Dalhousie University, Julie went on to complete a master's degree in Applied Science though Dalhousie's Department of Civil and Water Resource Engineering in 2015. Upon graduating, she accepted a position at the Atlantic Policy Congress of First Nations Chiefs Secretariat, an Indigenous not-for-profit organization, assisting with the procurement of funding and project assistance for housing and water and wastewater projects within First Nations communities. During her time at the Secretariat, Julie developed an understanding of Indigenous communities by working directly with Chiefs and Councils, Band Managers as well as water and wastewater operators in First Nations communities across Atlantic Canada.

In 2016, Julie accepted a position at Dillon Consulting Limited as an Environmental Engineer where she led the firm's first communitywide climate change vulnerability assessment for an Indigenous community and Dillon's first use of the PIEVC Protocol, a protocol that projects the probability and severity of future climate change using historical data. Her ability to manage and coordinate large scale projects under various technical disciplines for both municipal and Indigenous clients quickly propelled her into a senior level role, and in March 2020 she assumed the position of National Client Segment Manager (CSM) for Indigenous Communities.

One of Julie's passions it to guide others in achieving their professional goals. Her desire to lead and help others has advanced her to a leading role within Dillon's Early Career Development Program (ECD) which motivates young professionals and offers unique learning and development opportunities. Julie's commitment to helping others is further demonstrated by her volunteer work with the firm's Partners Assisting Local Schools (PALS) program. Outside of Dillon, Julie is a registered member of the American Water Works Association (AWWA), and the Atlantic Canada Water and Wastewater Association (ACWWA). Since 2018 she has also served as Magazine Chair for their *Go with the Flow* quarterly publication.

Her passion for helping others understand climate change has also led her to become involved with the Advisory Committee of the Building Regional Adaptation Capacity and Expertise (BRACE) program as a representative for Dillion and ACEC-NB. The BRACE program, administered by Natural Resources Canada (NRCan), works to help increase adaptation and climate change education through workshops, training, and internships.

Julie's dedication to the consulting engineering profession and her community, as well as her passion for climate change solutions and her work in Indigenous communities are the reasons why Julie was selected as the recipient of the 2021 Allen D. Williams Scholarship. Visit www.acec.ca/adwscholarship to view the 2021 Allen D. Williams Scholarship winner video.

The scholarship commemorates Allen D. Williams, past ACEC Chair and founder of Williams Engineering Inc. It provides the recipient with funding to cover registration, airfare and accommodations to attend the annual conference of the International Federation of Consulting Engineers (FIDIC).

CANADIAN CONSULTING engineer

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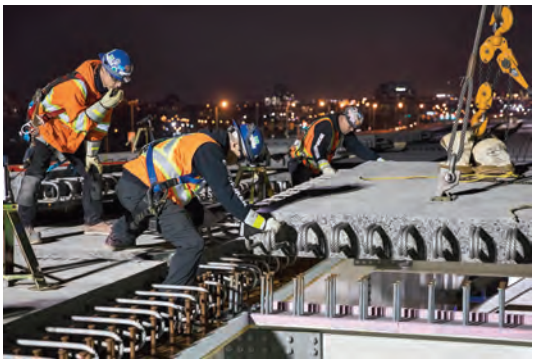
The following pages present the Top 20 Awards of Excellence from the 2020 Canadian Consulting Engineering Awards.

2020 CANADIAN CONSULTING ENGINEERING AWARDS

AWARDS

PRIX CANADIENS DU GÉNIE-CONSEIL



This year marks the 52nd annual edition of the Canadian Consulting Engineering Awards, a program produced jointly by *Canadian Consulting Engineer* magazine and the Association of Consulting Engineering Companies – Canada (ACEC-Canada).

The awards are the longest-running and most important national mark of recognition for consulting engineers in Canada. The following pages present this year's 20 Award of Excellence winners, selected from 76 qualifying entries from across the country.

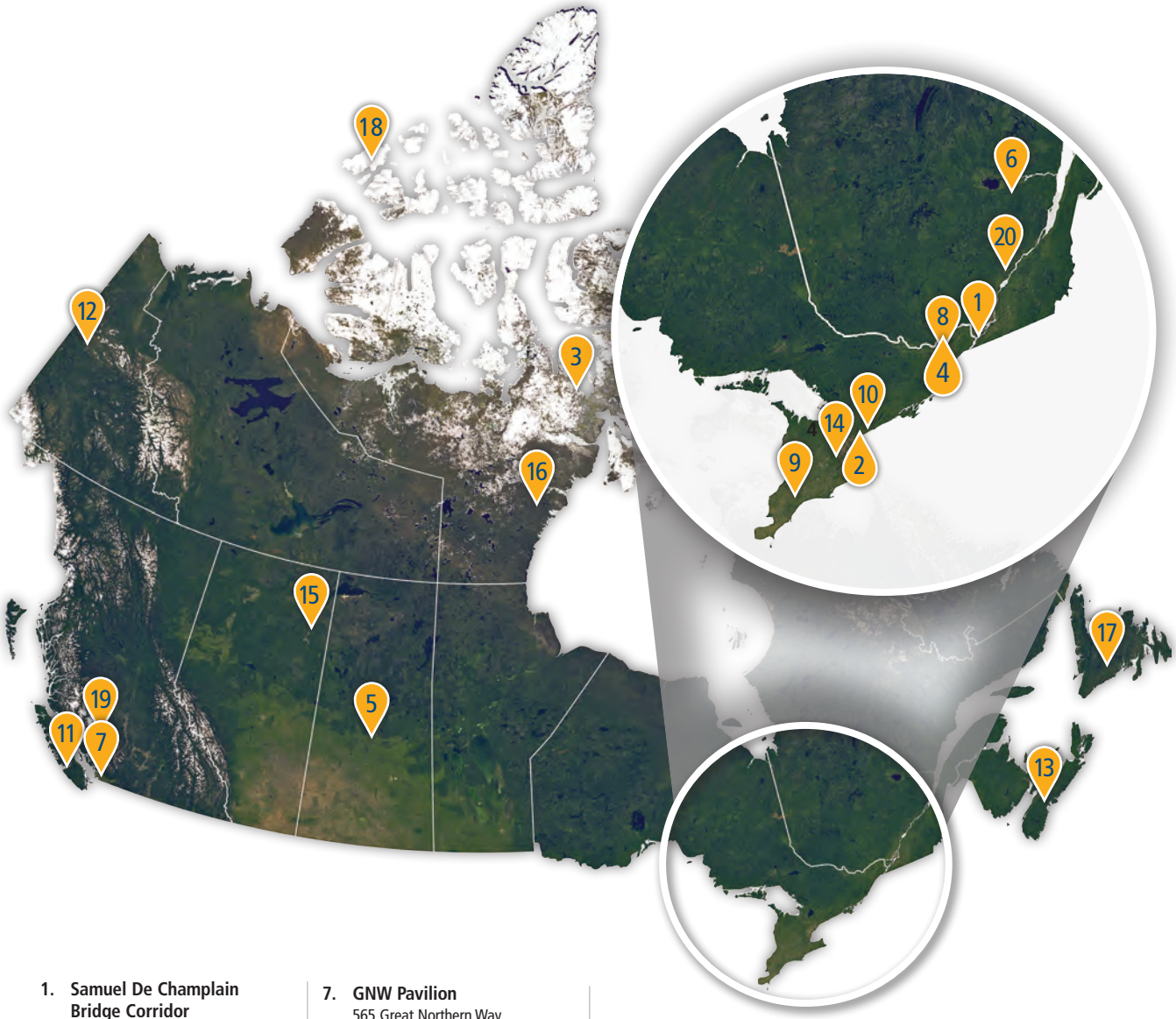
From these top 20 selections, the competition's esteemed jury singled out three for Special Awards.

The **Schreyer Award**, the top prize presented to the project that best demonstrates technical excellence and innovation, went to SNC-Lavalin—on behalf of the Signature on the Saint-Lawrence Group—for Montreal's Samuel De Champlain Bridge Corridor. The jury was impressed not only by the bridge itself, which is already world-renowned, but also by how the project team overcame major issues throughout an accelerated time frame, as they raced to replace the older Champlain Bridge.

The **Tree for Life Award**, presented to the project that best demonstrates outstanding environmental stewardship, went to Morrison Hershfield for Building NX at Toronto's Humber College, a pioneering zero-carbon retrofit that's also on track for Passive House (PH) certification, exemplifying how an existing building can be made significantly more energy-efficient.

Finally, the **Engineering a Better Canada Award**, presented to the project that best showcases how engineering enhances the social, economic or cultural quality of life of Canadians, was presented to Winnipeg-based Accutech Engineering for fast-tracking the construction of Arviligruaq Ilinniarvik School in Kugaaruk, Nunavut, one of Canada's most remote locations and harshest climates, where it serves as a key gathering place for the local community.

The 52nd annual Canadian Consulting Engineering Awards were presented at a virtual celebration on October 29. ***Congratulations to all of our winners!***



1. **Samuel De Champlain Bridge Corridor**
   Samuel De Champlain Bridge
   Montreal, Quebec | p. 16

2. **Building NX, Humber College**
   205 Humber College Blvd.
   Etobicoke, Ontario | p. 22

3. **Arviligruaq Ilinniarvik School**
   Lot 2 Plan 59889
   Kugaaruk, Nunavut | p. 24

4. **West Block Rehabilitation**
   3938 Wellington Street
   Ottawa, Ontario | p. 26

5. **Jim Pattison Children's Hospital**
   103 Hospital Drive
   Saskatoon, Saskatchewan | p. 28

6. **Amélioration des infrastructures de l'Assemblée nationale du Québec**
   1020, rue des Parlementaires
   Québec City, Québec | p. 30

7. **GNW Pavilion**
   565 Great Northern Way
   Vancouver, British Columbia | p. 33

8. **Government Conference Centre Rehabilitation**
   2 Rideau Street
   Ottawa, Ontario | p. 36

9. **Rehabilitation of Historic Blackfriars Bridge**
   Blackfriars Bridge
   London, Ontario | p. 38

10. **Garrison Crossing – Fort York Pedestrian and Cycle Bridge**
    100 Garrison Road
    Toronto, Ontario | p. 40

11. **McLoughlin Point WWTP HDPE Outfall**
    306 Victoria View Rd
    Victoria, British Columbia | p. 42

12. **Dawson City Water Treatment Plant**
    212 5th Avenue
    Dawson City, Yukon | p. 44

13. **Northwest Arm Trunk Sewer Rehabilitation Project**
    450 Cowie Hill Road
    Halifax, Nova Scotia | p. 46

14. **Mid Halton Wastewater Treatment Plant, Micro-Hydro Facility**
    2195 North Service Rd. W.
    Oakville, Ontario | p. 48

15. **Bioengineering Restores Ecological Loss after Wildfires**
    Fort McMurray, Alberta | p. 50

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    Rankin Inlet, Nunavut | p. 52

17. **Grand Falls Dam and Spillway Rehabilitation**
    Grand Falls-Windsor,
    Newfoundland and Labrador | p. 54

18. **Mould Bay Causeway Reconstruction**
    Prince Patrick Island,
    Northwest Territories | p. 56

19. **BCIT North Campus Infrastructure Project**
    3700 Willingdon Ave.
    Burnaby, B.C. | p. 58

20. **Vaudreuil 2022 - Phase I**
    1955, Boulevard Mellon
    Saguenay, Québec | p. 60

Portfolios of all this year's and previous years' entries are showcased at www.canadianconsultingengineer.com/awards/showcase-entries/

Also, for more details about the awards' history and purpose, visit www.canadianconsultingengineer.com/awards/about/

Photo: Anton Shahrai - stock.adobe.com

CANADIAN CONSULTING ENGINEERING AWARDS JURY

This year's jury convened online in June to deliberate over the final round of award selections.

The following are the esteemed members of our jury:

CHAIR

Anne Poschmann, P.Eng., a Queen's University graduate, began her career as a geotechnical consulting engineer with Golder Associates in 1981. There, she played a leading role in providing geotechnical engineering know-how, value engineering and constructability reviews for the development and improvement of transportation and infrastructure in Canada. She was chair of Consulting Engineers of Ontario (CEO) in 2006 and became the first female chair of ACEC–Canada in 2014. Now retired, Anne unwinds on Gabriola Island, B.C., where gardening and whale watching take up her time.

CHAIR'S COMMENTS

Creating and Changing our World through Engineering

In this year of strangeness and new ways, fraught with some level of fear and worry in every walk of life, it was a great pleasure and privilege to serve as chair of the awards committee and be able to spend quality time poring through the project submissions. It was a wonderful way to get grounded, firmly back into reality, realizing again the incredible heights our consulting engineers can take us through their projects.

We, the panel of judges, had to do what everyone else has had to do in these times since mid-March and adjust our ***modus operandi*** to complete the task given to us. Instead of meeting in-person for lively discussion for a day, we deliberated longer on conference calls, diving individually into the submissions before finally 'meeting' virtually for final decisions on the winning projects. It was not as satisfying as our past physical gatherings, but it was efficient overall and perhaps a model for the future.

I congratulate all the teams and companies that submitted projects this year. You are all winners with your exciting contributions to the advancement of engineering in our world of today. The incredible breadth of the projects and quality of designs were breathtaking. Thank you for the time and effort in first completing these projects and then showcasing them, so they can be recognized for what they are: incredible works of engineering genius.

And finally, congratulations to this year's winners. As always, it was not an easy task for the judges to select projects for the Awards of Excellence. And there was much healthy debate among us to land on the Special Award winners, to whom we offer special congratulations. You are to be commended for your exceptional accomplishments with these projects.

One thing the judges noted this year was the number of amazing projects dealing with the rehabilitation of historic buildings and bridges, which reflect everything we want in our world right now, including minimizing environmental impact in comparison to opposed to demolition and rebuilding.

I look very much forward to future years of recognizing engineering excellence with this awards program.

— Anne Poschmann, P.Eng., Jury Chair

Karla Avis-Birch, P.Eng., is vice-president (VP) of GO stations capital delivery for Toronto-based Metrolinx, leading a team with a multi-billion-dollar capital asset portfolio. In her more than 15-year tenure at Metrolinx, she has established its first project controls and design standards office and worked with Infrastructure Ontario (IO) on public-private partnerships (P3s). A civil engineering graduate of Ryerson University who received her P.Eng. designation from Professional Engineers of Ontario (PEO) in 2001, Karla has also been federally appointed by Infrastructure Canada to the Windsor-Detroit Bridge Authority (WDBA) board of directors, which will oversee construction of the new Gordie Howe International Bridge.

Erin Bird, P.Eng., is a leader in the City of Calgary's corporate engineering and energy division of corporate analytics and innovation. With the city for 14 years this fall, her past roles have included project delivery and structural oversight of transportation infrastructure projects, infrastructure planning in water resources and capital project strategy. Previously, she worked for a general contractor on bridge projects, for SNC-Lavalin France and for a small consulting firm in Calgary.

Guy Bruce, P.Eng., is an electric utility expert with 40 years' experience. He retired from SaskPower in 2017 as vice-president (VP) of planning, environment and sustainable development. He has served as chair of the Canadian Electricity Association's (CEA's) generation council and on the board of the Energy Council of Canada. Guy is now an independent consultant in Regina, using his extensive knowledge and a collaborative approach to support several clients, including Saskatchewan's First Nations Power Authority (FNPA), and continues to be a member of the Energy Council of Canada, active in helping people understand the industry.

Jennifer Drake, Ph.D., P.Eng., is an associate professor of civil engineering, cross-appointed with the John H. Daniels Faculty of Architecture, Landscape and Design and the School of the Environment at the University of Toronto (U of T). She is an expert in urban flood management and green infrastructure. Her research group specializes in emerging technologies, including green roofs, rain gardens and permeable pavements. Since 2015, she has served on the board of directors for the Toronto and Region Conservation Authority (TRCA). Jenn was the 2018 recipient of the Professional Engineers Ontario (PEO) Medal for Young Engineer and the 2019 recipient of Engineers Canada's Young Engineer Achieve Award.

Peter Judd, P.Eng., was general manager (GM) of engineering for the City of Vancouver until he retired in 2015. In that role, he oversaw 1,800 employees and a department that provided everything from public works planning and design to construction and maintenance. He led many of the city's green initiatives and spearheaded both Olympic and Paralympic operations during the 2010 Winter Games.

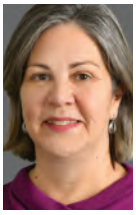
Guy Mailhot, Eng., M.Eng., is a McGill graduate, Fellow of the Canadian Society for Civil Engineering (FCSCE) and Fellow of the Engineering Institute of Canada (FEIC). After working for 15 years for consulting firms in Vancouver and Montreal in bridge engineering, he joined the Jacques Cartier and Champlain Bridges in 1999, where he was principal director of engineering. Under a federal government exchange program, he has been on loan to Infrastructure Canada since 2012, acting for the authority as chief engineer for the Samuel De Champlain Bridge Corridor (note: given this conflict of interest, Guy did not help select the bridge for any awards this year).

Stephen Panciuk, P.Eng., is senior vice-president (SVP) and national engineering professional lead in Marsh Canada's construction practice. Based in Ottawa, he manages the firm's relationships with several engineering associations, frequently speaks at their conferences and annual general meetings (AGMs), is a member of ACEC-Canada's contracts committee and sits on the ACEC-Ontario business resiliency committee.

Joanne Poirier, B. Arch., is an architect with 30 years' experience in management in the municipal sector. She was director of urban planning for the City of Westmount, Que., until her retirement in 2017. She previously spent seven years in architectural private practice, contributing to projects in downtown Montreal. Joanne has expertise in management and conservation of heritage buildings.

Harold Retzlaff, P.Eng., **FCSCE**, is a senior project engineer with Saskatchewan's ministry of highways and infrastructure. He has been with the ministry for more than 35 years and has been involved in the design and construction of several hundred kilometres of highway, guided the planning for numerous highway corridors and developed policies and standards for geometric design and road safety.

Clive Thurston is president of the Ontario General Contractors Association (OGCA). The former owner of a Toronto-based construction company for 12 years, he has also held the position of bylaw/ building official for the City of Brampton, Ont., and was chief building official for Prince Edward County (PEC), Ont. Through OGCA, Clive represents the industry at the Construction and Design Alliance of Ontario (CDAO), a group focused on the renewal of infrastructure and the impact of government regulations.



Judy Wall is president of East Port Properties in Dartmouth, N.S., and has been involved in real estate development for the past 30 years, including many 'firsts' in the industry: the first LEED-certified multi-tenant warehouse in Nova Scotia, the first LEED-certified business park campus in Mount Pearl, N.L., the first LEED Gold and BOMA Best Platinum building in St. John's, N.L., and most recently the first multi-tenant warehouse certified for both design and performance under the Canada Green Building Council's (CaGBC's) new Zero Carbon Building Standard.

SCHREYER AWARD &
AWARD OF EXCELLENCE

Samuel De Champlain Bridge Corridor

SNC-Lavalin

> "There were geotechnical issues, seismic issues, traffic issues, alignment issues, labour disputes … it's a miracle this got done in an accelerated time frame, because the bridge next door was falling down."
> –Jury

When the time came to replace Montreal's Champlain Bridge, the federal government sought to provide high-quality, sustainable and distinctive infrastructure. SNC-Lavalin, the main consulting engineering firm within the Signature on the Saint Lawrence Construction (SSLC) consortium, designed and constructed the multi-billion-dollar project with the help of experts from around the world, who resourcefully managed challenges, including a tight schedule and harsh climatic conditions, and delivered a new bridge with an estimated lifespan of 125 years.

In addition to six traffic lanes and shoulders, the new bridge would include a central corridor dedicated to light rail transit (LRT) and a multipurpose path for active transportation (*i.e.* by foot and bicycle). The project involved rebuilding and upgrading the approaches to the bridge, too, with the redevelopment of a 4.5-km urban federal highway corridor.

With some 50 million vehicles and $20 billion in goods crossing the

bridge each year, it has a very significant regional economic role.

Maximizing efficiency

The project involved the replacement of the old Champlain Bridge with a new 3.4-km long structure comprising three separate decks, supported by 37 piers, and a main cable-stayed portion with a 170-m tall elevation pylon. The new bridge had to be built on an accelerated construction schedule, due to the critical condition of the old bridge, which had to be maintained until the new bridge was complete.

One of the strategies selected by SNC-Lavalin and its consortium partners to achieve these objectives was to maximize the prefabrication of concrete elements and the assembly of steel elements on-site, which required the construction of temporary jetties with high-performance docks geared for marine access along the St. Lawrence River. This strategy balanced speed of construction for the bridge and optimal control over the quality of its components.

Further, several unique pieces of equipment were designed and manufactured to maximize on-site efficiency and productivity, including the following:

- An industrial catamaran for transporting and installing footings and pier starters directly to the bottom of the river, within allowable tolerances.
- A winch barge to transport heavy parts through strong river currents.

Following consultations with stakeholders, the project team helped organize school programs, among other community outreach measures.

Sarens Canada installed a floating foundation.

- A single mounting system–with a mobile lifting beam, transport carts and lifting equipment—to lift the main span of the cable-stayed bridge without impeding commercial shipping traffic in the St. Lawrence Seaway, a vital economic corridor for Canada.

In parallel to the on-site fabrication of the concrete elements, SSLC opted for off-site manufacturing of oversized parts, which were to be transported to the site mostly by road. The deteriorating condition of the old Champlain Bridge and the ring road network, however, led to more restrictive weight limits, forcing the consortium to review its logistics plan, so as not to jeopardize the timely arrival of parts critical to the successful completion of the project.

Consequently, SNC-Lavalin revised the plan to deliver more than 10,000 components—mostly of non-conventional sizes and weights—through different modes of transportation, with a mix of seaway, rail and road shipments.

The initially planned method of construction for the erection of the main span over the seaway was to lift 15 main span segments from the pylon. A major change was made, however, to accelerate construction and complete the infrastructure in a timely manner: a temporary tower was installed east of the seaway to allow for the erection of segments, in parallel, on either side of it.

Vehicular and marine traffic was maintained throughout construction by undertaking various provisions for trade and transit routes for the general population along this key transportation corridor.

Temporary jetties were built to help maximize on-site prefabrication and assembly.

A concrete vision

The consortium used reference designs, three-dimensional (3-D) visualization and animation in collaboration with an architectural review committee to ensure it could deliver a project as envisaged by the federal government.

It was important for this client that the design be consistent with the general principles of the International Federation for Structural Concrete's *fib Bulletin 34 – Model Code for Service Life Design*. This bulletin addresses service life design (SLD) for plain, reinforced and pre-stressed concrete structures, with a special focus on design provisions for managing the adverse effects of degradation.

SNC-Lavalin's experience in geotechnical matters helped SSLC achieve this objective. For example, corrosion time for the concrete was modelled using Software for Transport and Degradation In Unsaturated Materials (STADIUM), which was developed within Quebec.

Other measures to ensure concrete quality included the use of thermal probes, infrared (IR) thermography and numerical analysis, all of which helped assess thermal behaviour and, thus, the risk of the concrete cracking.

Further, to prevent the danger of ice falling from the cables, the consortium conducted new research and designed a custom sheath for the cables.

Ensuring sustainability

Working in partnership with Infra-

PREFAB PRECAST CONCRETE BUILDS ON...

ACCELERATED BRIDGE CONSTRUCTION (ABC)

Public-Private Partnership Government of Canada and the Saint Lawrence Group (SNC-Lavalin, ACS & HOCHTIEF0)
Owner: Infrastructure Canada | **Architect:** Arup Canada - Collaboration with Dissing+Weitling and Provencher Roy | **Engineer:** Stantec and Ramboll

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Prefab Precast Concrete Accelerated Bridge Construction (ABC) uses innovative planning, design, resources, technologies and precast concrete prefabrication techniques to accelerate bridge construction without compromising Quality, Durability and Safety.

A Québec-based Precast Concrete Company supplied 315 pier leg segments; 44 pylon segments; 9,636 deck slabs; 32 box girders; 142 girders; 6,170 square metres (66,415 square feet) of architectural panels; 495 panels for the electrical rooms; and other precast concrete elements including retaining walls, pipes and more.

2020 canadian consulting engineering awards
prix canadiens du génie-conseil

2020 CANADIAN CONSULTING ENGINEERING AWARDS
CPCI congratulates SNC – Lavalin for the winning project: Samuel de Champlain Bridge Corridor Project and our CPCI Member BPDL as the precast concrete product supplier.

For more information on this project: **http://www.cpci.ca/en/about_us/project_month/january_2020/**

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(CPCQA) CANADIAN PRECAST CONCRETE QUALITY ASSURANCE CERTIFICATION PROGRAM

DYWIDAG is proud to be part of the team that built this landmark structure by contributing latest state of the art construction technologies in the field of stay-cables, building on over 150 years of tradition of excellence in the domain of specialty construction systems.

DSI main scope was providing 60 stay cables, size DG-127 in full compliance with latest construction codes and specifications.

DSI solution for pylon anchors, trade name DYNA® Link, allowed optimisation of cable installation while maintaining all the advantages for the architectural and structural parameters of the pylon; this direct linkage solution allows a diversified approach to cross section design of pylons, more flexibility at installation stages and superior cable behavior and service life inspection.

WE MAKE IN
SAFER

SAMUEL DE CHAMPLAIN BRIDGE
©PHOTO REPRINTED COURTESY OF INFRASTRUCTURE CANADA

FRASTRUCTURE

R, STRONGER, AND SMARTER.

structure Canada (the project owner), the SSLC team developed and maintained sustainable practices in the construction of this major infrastructure project.

The team actively implemented relevant measures and achieved the highest level of recognition by the Institute for Sustainable Infrastructure (ISI), Envision Platinum, based on an assessment of the integration of 60 sustainable development criteria. In fact, the project is the first in Quebec to be evaluated by ISI for Envision certification and the first large-scale bridge anywhere in Canada to earn the award.

In addition to the environmental benefits of a 125-year lifespan, a dedicated LRT corridor and active transportation, other measures to minimize the impact of the bridge's construction and commissioning on the environment include the following:

- Use of biodegradable and bio-sourced hydraulic oils for devices working on or near the watercourse.
- Mass reuse of demolition materials, with less than 1.5% sent for disposal.
- Maximized reuse of excavated soils, in accordance with risk assessment for the management of contaminants.
- Improvement and modification to infrastructure providing homes for white-fronted swallows.
- Construction of three passages in the fluvial jetty to allow for fish species migration.
- Implementation of a drainage and piping system to protect sensitive fish habitat areas.
- Minimized light pollution, based on international illumination standards.
- Further architectural lighting adjustments to minimize risk of migratory bird disorientation.
- Special compensation program for greenhouse gas (GHG) emissions.

The project team also collaborated with Infrastructure Canada to consult with a wide range of stakeholders and set up communication lines accordingly, to help ensure the needs of the community were met during construction. Subsequent measures included school programs, funding for cultural events and a shoreline cleanup by project workers.

The ongoing and informative dialogue with stakeholders helped the consortium design and build a major project while maintaining the respect and dignity of the surrounding communities. CCE

Samuel De Champlain Bridge Corridor, Montreal	
Award-winning firm (design and construction):	SNC-Lavalin, Montreal (Richard Munday, P.Eng.; Sevak Demirdjian, P.Eng., M Eng.; Talal Sukkar, MBA, PMP; Alexandre Clouthier, P.Eng.; Carlos Uranga Sarazin, P.Eng.; Nicolas Najjar, P.Eng.; Nicholeta Panousis, B.A., LL.B.; Vicken Libarikian, B.Eng, MBA, CCMAP; Nadia Villeneuve, CRIA; Marthe Robitaille, M. Env.; Raymond Perreault).
Owner:	Infrastructure Canada.
Other key players:	T.Y. Lin International (design services and engineer of record), International Bridge Technologies (design services and engineer of record), FHECOR (design service), AGF Group (supply and installation of reinforcing steel, temporary and permanent accesses), Eurovia/Pavages Chenail (paving supply and installation), Sarens Canada (floating foundation installer), Camille Blais & Fils (piles supply installation), SICE Canada (intelligent transportation system), Grimard Électrique (temporary and permanent electrical works), WSP (engineering services on highway approaches), Beton Prefabrique Du Lac (supply of precast concrete elements), DYWIDAG Group (supply of stay cables elements).

While the bridge lights up in different colours, illumination levels were adjusted to prevent light pollution and interference with bird migration.

Just the *facts*

about Engineers Canada-sponsored Disability Income Replacement Insurance

There's no denying it: to even think about yourself or a close family member becoming disabled – even temporarily – is incredibly unpleasant. But the facts will tell you that it's something to which you should at least give some thought – **so you're prepared, just in case**.

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1 Canada Life and Health Insurance Association, "A guide to disability insurance," January 2016.
2 Parachute, "The Cost of Injury in Canada," 2015.
3 www.disabled-world.com, "Disability Insurance: Benefits, News and Claims," 2017.
4 Based on a percentage of your monthly earnings, while you are disabled and unable to perform your occupation.

Accessible formats and communication supports are available upon request. Visit **manulife.ca/accessibility** for more information.

Underwritten by
The Manufacturers Life Insurance Company

The odds of suffering from a disability before age 65 are **1 in 3**[1]

It's unfortunate, but true: **disabilities are disturbingly common**. Every day in Canada, 165 Canadians are involved in an accident that leaves them partially or totally disabled.[2]

Disability has a **high financial cost**

While disability certainly takes immense physical, emotional and psychological tolls, people who suffer from disability also take a tough financial hit. After all, **nearly 50% of mortgage foreclosures are due to disability**.[3]

To give you an idea, have a look at the total annual cost to Canadians who suffer disabilities caused by different injuries, when you factor in health care costs plus the costs of reduced productivity and other issues:[2]

Description	Total cost ($ Million)
Transport incidents	4,289
Falls	8,680
Fire/burns	366
Unintentional poisoning	1,264
Struck by/against sports equipment	187
Other unintentional injuries	7,127
Violence	1,142
Undetermined intent/other	598

Engineers Canada-sponsored **Disability Income Replacement** insurance can help

Engineers Canada-sponsored Disability Income Replacement Insurance was created exclusively for professional engineering, geoscience and technology association members and their families. This affordable plan can be a huge help while you recover, **covering 6 types of disabilities**. It features **low rates** not available to the general public and provides monthly benefit payments **up to $15,000**.[4] It includes automatic Cost of Living Adjustments, a compassionate care benefit and a waiver of premiums if you're totally disabled for more than 3 months.

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TREE FOR LIFE AWARD
& AWARD OF EXCELLENCE

Building NX

A Building Envelope Commissioning (BECx) program was implemented, including whole building air leakage testing.

Morrison Hershfield

"This really showcases the forefront of engineering in making existing building stock sustainable to meet Canada's carbon reduction targets. These are the buildings of the future."
–Jury

The transformation of the aging Building NX at Toronto's Humber College is the first retrofit in Canada to achieve Zero-Carbon Building Design certification from the Canada Green Building Council (CaGBC) and is currently on track to achieve the first Passive House (PH) EnerPHit certification for a non-residential building in Canada.

A full building envelope retrofit, a solar photovoltaic system and energy-efficient upgrades to heating, cooling and lighting systems, all undertaken while the building remained fully occupied, have turned it into one of the most energy-efficient buildings anywhere in North America.

Morrison Hershfield provided structural, electrical and mechanical engineering, building envelope, PH and code consulting for the project.

Passive design strategies

Previously, Building NX suffered a number of systematic failures, such as air infiltration, water penetration, condensation and temperature fluctuations.

Passive design strategies for the building enclosure were maximized to significantly reduce the heating and cooling required. These focused on the airtightness and thermal continuity of the building envelope, which now features an ultra-high-performance skin, engineered transitions for greater air control to mitigate thermal bridging (especially at wall-to-window, wall-to-wall and wall-to-roof points), high-performance triple glazing in PH-certified window frames and curtain walls, excavation to install exterior

below-grade insulation and removal of an inefficient skylight.

Testing and an extensive Building Envelope Commissioning (BECx) program were implemented throughout construction. This included whole building air leakage testing, which found fewer than the 0.6 air changes per hour at 50 Pa pressure (0.6 ACH50) of the PH Institute's (PHI's) performance threshold for new construction; PHI requires only 1.0 ACH50 for retrofit applications.

The new HVAC system uses local heating and cooling and heat pumps for space conditioning and demand controlled ventilation (DCV) for CO_2 differential control. It decouples the ventilation air from the building's heating and air conditioning, while maintaining fresh air distribution throughout.

Building NX was decoupled from the campus' central utility plant, using an air-source variable refrigerant flow (VRF) system to recover and transfer heat between zones—working like a water-source VRF, but exchanging heat with ambient air instead of using the plant's water loop. Two new air-cooled VRF heat pumps were installed on the roof and fan-coil units were provided for each thermal zone to keep the temperature consistent across the building.

The retrofit has reduced energy use intensity by 70% to 64 kWh/m^2), heating energy by 97% and associated greenhouse gas (GHG) emissions by 90%. Now the five-storey, 4,500-m^2 building has a peak heating demand similar to a single family home.

Also, the new 25-kW solar PV system will generate an estimated 31,500 kWh per year, more than the building will consume. The excess will be fed upstream.

Among the passive design strategies were triple-glazed windows.

Demonstrating benefits

The Building NX retrofit demonstrates to owners everywhere the benefits of applying PH principles to increase a building's resilience, reduce its energy needs and operational costs and optimize comfort. Its occupants now experience more ideal temperatures, improved indoor air quality (IAQ) and ample daylight.

Humber's own students also participated across multiple program disciplines, with a team of them completing a design in parallel with the actual retrofit. The project team shared knowledge, provided feedback at design presentations and helped faculty evaluate the students' work.

Low-carbon retrofits to existing buildings have tremendous potential to address the effects of climate change. Humber is investing in energy efficiency methodologies and new performance benchmarks to achieve its own ambitious sustainability goals by 2034, such as cutting energy and water use in half and reducing GHG emissions by 30%, and seeks to provide an example to encourage similar projects elsewhere in the future.

As CaGBC puts it, Building NX now serves "as a national example of how to retrofit to zero-carbon." **CCE**

Building NX, Toronto	
Award-winning firm (building envelope consulting, Passive House (PH) sustainability engineering, electrical consulting, structural engineering, mechanical engineering, code consulting):	Morrison Hershfield, Markham, Ont. (Steven Murray, P.Eng.; Alejandro Ortega, P.Eng.; Sylvie Gayed, P.Eng.; Felix Chen, P.Eng.; Dana Scherf, P.Eng; Zane Biblow, P.Eng.; David Kankaras, MBA).
Owner:	Humber College.
Other key players:	B+H Architects, RDH (energy modelling), Bird Construction (general contractor).

ENGINEERING A BETTER CANADA AWARD
& AWARD OF EXCELLENCE

Arviligruaq Ilinniarvik School

Accutech Engineering

The only school in the hamlet of Kugaaruk, Nunavut, which also served as a gathering place for events, was destroyed by a fire on Feb. 28, 2017. The collective loss was keenly felt throughout the hamlet (population: 933) after 30 firefighters battled the blaze for more than 20 hours in temperatures that dropped to -35 C.

This project delivered a new, 4,620-m^2 K-12 school from a blank piece of paper to substantial completion in 24 months, in one of Canada's most remote locations and harshest climates.

Constructing the building on a fast-track basis was challenging. All equipment and materials had to be brought in on the single annual sealift with an icebreaker escort. Construction personnel had to be flown to the site and accommodation and food provided, due to a lack of available local lodging.

"This was one of the most critical pieces of infrastructure among the submissions this year."
–Jury

The fast track

The request for proposals (RFP) was issued on Mar. 31, 2017. The timeline allowed for three months from the date of the contract award to the mid-August departure of the annual sealift, so the team created a phased schedule to address long lead-time items. They were able to design the floor plan, obtain approval, design the structure, review shop drawings and procure, fabricate and ship the structural steel, open web steel joists (OWSJs), concrete, reinforcing steel and all required equipment within those first three months.

As a result, the new school was completed one year ahead of the schedule and on budget. Projects of this size in similar locations would typically require three to four years from design through construction.

By working with the builder, manufacturers and suppliers, the team was able to create an appropriate and efficient design that could be fabricated, shipped and assembled within the timeline. The completion date for the finished building was Aug. 31, 2019, in time for the school year.

Community input

Accutech and other stakeholders worked closely with the community to design an environment that would not merely replace the earlier physical structure, but also provide a building the entire community would be proud of and use for decades to come. There was a heavy focus on community input for layout, use planning and artwork.

The new school features multiple gathering spaces for a range of group sizes, a gymnasium, a canteen and cultural spaces that allow for the transfer of traditional Inuit knowledge and activities.

Uniquely, the building features a 'skin room' designed exclusively for teaching proper harvesting techniques and use of natural materials. Other key custom components include exterior artwork featuring a bowhead whale and a hunter with a kakivak (fish spear) and a monument to the former

school, built with stone repurposed from the original building.

Energy efficiency

It is important to note all of the heating and electricity in Kugaaruk are generated by burning diesel fuel. One of the project's objectives was to reduce the school's total energy consumption (and cost) compared to its predecessor. Electricity costs approximately 116 cents per kWh in Kugaaruk in 2020, compared to only about nine cents per kWh in Winnipeg!

Accutech created energy models for the new facility. Based on those models, the school is expected to use approximately 50% less total energy than a typical Nunavut school of the same size.

This significant decrease in consumption has been accomplished through the following measures:

- A highly energy-efficient building envelope, with high effective thermal resistance values and virtually zero air infiltration.
- A building automation system (BAS) with energy-efficient programmed operation.
- High-efficiency boilers that can easily be maintained by local professionals.
- Conditioning of the power supply to the entire building to minimize spikes and surges and, thus, reduce the potential for damage to sensitive electrical controls.
- Energy-efficient mechanical systems and variable-frequency drives (VFDs) on motors.
- Commissioning and monitoring the performance of the mechanical and electrical systems in the school prior to occupancy, then continuing to monitor and fine-tune these systems' operation through the warranty period to reach energy goals and maintain good building conditions. **CCE**

Arviligruaq Iliniarvik School, Kugaaruk, Nunavut	
Award-winning firm (prime consultant):	Accutech Engineering, Winnipeg (Brent Wall, P.Eng.; Daniel Nenadov, P.Eng.; Michael Linatoc, P.Eng.; Gregory Mirkin, P.Eng.; Luke Swanson, P.Eng.; Anthony Gazzola P.Eng.).
Owner:	Government of Nunavut.
Other key players:	Kudlik Construction (project client), Parkin Architects.

AWARD OF EXCELLENCE

West Block Rehabilitation

Ojdrovic Engineering and John G. Cooke & Associates

The House of Commons now sits under a glazed roof.

Photos by Richard Seck

"Excellent collaboration between architects and engineers—and government leading by example, investing major money in the conservation of a heritage building."
–Jury

The $863-milion restoration and redevelopment of Parliament's West Block was one of the largest heritage building rehabilitation projects anywhere in North America. A new, temporary House of Commons now sits within a structural steel 'forest' and under a glazed roof, where parliamentarians and visitors enjoy a view of the restored and seismically strengthened 19th-century stone masonry building.

Accommodating Parliament

The rehabilitation of Parliament's Centre Block is expected to take at least 10 years. Many other projects have been undertaken across the National Capital Region to accommodate the disruption.

Among these, the largest was the restoration and redevelopment of the West Block for a temporary House of Commons chamber. The project involved rehabilitation, modification and strengthening of the existing heritage masonry building and construction of several underground and aboveground levels within the existing courtyard.

The stone building underwent a seismic upgrade to meet the requirements of today's National Building Code (NBC), but the interventions were kept to a minimum by carefully including existing stone and brick masonry as lateral resisting elements and complementing them with only two new concrete shear walls and two concrete block elevator shafts. The University of Calgary performed tests that used large masonry panels to simulate the exterior walls of the building, so as to determine material property parameters for the analysis of existing walls.

The layout of the structural system is defined by the footprint of the House of Commons chamber in the centre of the courtyard. Two double rows of five structural columns enclose it. The assembly of welded plates that forms the shaft of the columns and branches resembles the fluting of stone columns of Gothic structures and creates lines that extend visually into the branches and open up to distribute the support points.

The branch tips support a three-dimensional (3-D) space truss that forms the overall shape of the roof and ceiling, both glazed to provide natural light.

AWARD OF EXCELLENCE

Minimizing interventions

The most environmentally friendly method of construction is the recycling of existing structures. With this in mind, the West Block project saved as much as possible of the original materials. A minimum intervention approach to the masonry scope of work, for example, led to the reuse of existing stone units, rather than only producing new elements.

During earlier renovations of the West Block, in 1960, asbestos-based thermal insulation was used within the attic space. With this new project, all efforts were made to remove as much of the asbestos-containing materials as possible. In cases where it was not possible to remove it, remaining traces were encapsulated to ensure the protection of future occupants against the health hazard.

Custom grouted steel anchors were used to rehabilitate the existing masonry walls. These were required to ensure an appropriate reaction to seismic forces within the weaker heritage elements. The 'hybrid' design is sympathetic to heritage elements by using their inherent strengths.

Structural analysis of the courtyard roof supported other disciplines' efforts to provide an energy-efficient building. Mechanical engineers, experts in solar effects, lighting consultants and others contributed to the design of the glazed roof pillow, which reduced structural steel in the construction while maintaining safety and adherence to the building code intent. CCE

West Block Rehabilitation, Ottawa	
Award-winning firm (structural engineering consultants):	Ojdrovic Engineering and John G. Cooke & Associates, Ottawa (Nebojsa Ojdrovic, Ph.D., P.Eng., CAHP; John G. Cooke, P.Eng., CAHP; Jane Krisanova, P.Eng.; Grazyna Materna, P.Eng., M.Eng.; Geoff Scott, P.Eng., CAHP; Chris Vopni, P.Eng., CAHP; Bryce Thomassin, Eng., P.Eng., M. Eng.; Chantal Pollard, Arch. Tech; Richard To, P.Eng.l Daniel Jackson, P.Eng.).
Owner:	Public Services and Procurement Canada (PSPC).
Other key players:	Arcop and FGM Architects in joint venture (architecture), Crossey Engineering (mechanical and electrical), Paterson Group (geotechnical), PCL Constructors Canada (construction management), Walters (steel construction).

Photo by Richard Seck, courtesy of Ojdrovic Engineering, structural engineers for the West Block Project.

AWARD OF EXCELLENCE

Jim Pattison Children's Hospital

Photos courtesy Daniels Wingerak Engineering

Daniels Wingerak Engineering

Saskatchewan was one of the few provinces in Canada without a dedicated children's hospital, but this is no longer the case. Following decades of planning, the Jim Pattison Children's Hospital opened in 2019 in Saskatoon.

Daniels Wingerak Engineering served as mechanical engineer for the project. The systems serving the 176-bed hospital needed to meet stringent safety standards while being mindful of energy impact.

In particular, much care was taken in the design of seven Haakon custom central station air handling units, with external and internal redundancies to allow for maintenance without any loss of capacity. The system was designed to be able to absorb multiple simultaneous failures, as well as convert to a 100% fresh air 'pandemic mode' when needed—a feature that was called upon shortly after opening the doors.

"Pandemic mode is impressive with 100% fresh air—and incredible timing!" –Jury

Critical systems

Filtration at the air handlers is critical. For efficiency while reducing pressure drop, innovative Dynamic V8 filters were selected for their long service life (five years) to reduce maintenance, while still providing MERV 15 levels of filtration, at the lowest pressure drop of any filter to reduce energy consumption for continuously operated equipment. The primary filters are backed up by a carbon matrix grid filter to further reduce incoming volatile organic compounds (VOCs).

One major challenge was the cancellation of a new central heating, cooling and generator plant for both the new hospital and an existing, adjacent hospital. This left the completed mechanical design without a source of heating or cooling.

The basement mechanical room was able to absorb the addition of a redundant steam supply, along with flooded vertical heat exchangers, but there was no space in the new hospital for a chiller plant and cooling towers.

Instead, space was found in the existing hospital for new chillers, which were then integrated with the existing plant, whose cooling towers were replaced with larger, shared, redundant fluid coolers.

Heating for the air system is entirely supplied though a Konvekta high-pressure run-around heat recovery system. This allows for 90% heat recovery from all of the building's exhaust streams and process heat (from server and electrical rooms), with 0% cross-contamination. Recovery is so high, no additional heat is required to tem-

per the fresh air consumed by the facility, even during winter. The system saves thousands of dollars and reduces carbon emissions.

The building's heat is generated from redundant steam feeds from an adjacent university. Steam is converted through 'flooded' vertical heat exchangers that reduce consumption by capturing condensate energy, while also eliminating flash steam and condensate pumps.

Cooling supplied by the adjacent hospital's chiller plant achieves full N+1 redundancy and increases operational efficiency. Year-round cooling is made available for both the new and existing hospitals with integrated coils in the new cooling towers.

Venturi-style air valves with dedicated controls are used to allow careful control of airflow and pressure relationships in the building. The plumbing fixtures were selected to meet or exceed health-care codes and minimize infection vectors. A new oxygen generation plant was designed to serve the entire health region.

Distributing air

Another design challenge was the addition of a helipad on top of the hospital's mechanical penthouse, where the building's fresh air intakes could easily draw in contaminated exhaust from helicopters. The solution was to provide intakes on two sides of the penthouse, fully connected to air handlers. Now, if exhaust is detected at one intake, a bank of dampers closes and the air for the hospital is drawn from the other side.

Operating theatres were designed using the latest air distribution technology to reduce secondary site infections. The theatres can control an extended temperature and humidity range to suit the requirements of the surgeons. The suites can be ran as cool as 15 C or as warm as 28 C, any time of the year.

'Construction exhaust' ducts were installed to allow temporary fans to be connected during future renovations, without having to drape hundreds of feet of flexible ductwork through the hospital to a window.

The careful mechanical design for ventilation, heating and cooling enabled the aforementioned pandemic mode, which can be activated with a few keystrokes for the building automation system (BAS). The systems had to be designed to operate normally in temperatures anywhere from -40 to 40 C during periods of 100% outdoor air.

Pandemic mode was quickly implemented during the early days of COVID-19, allowing the hypothetical scenarios of the design process to be tested in the real world. CCE

Jim Pattison Children's Hospital, Saskatoon	
Award-winning firm (mechanical engineers):	Daniels Wingerak Engineering, Saskatoon (Darren Wingerak, P.Eng.; Bob Daniels, P.Eng.; Christopher Conley, P.Eng.; Ryan MacGillivray, P.Eng.; Jeff Frie, A.Sc.T.; Greg Pederson, Engineering Licensee; Heather Hollman, A.Sc.T.; Steve Schiml, A.Sc.T.; Bill Gonari.; Garry Kreller, G.S.C.).
Owner:	Saskatchewan Health Authority.
Other key players:	Henry Downing Architects, ZW Project Management, Entuitive (structural engineering), WSP (electrical engineering), Stantec (low-voltage systems, commissioning), Crosby Hanna & Associates, Graham Construction & Engineering, Suer & Pollon Mechanical Partnership.

AWARD OF EXCELLENCE

Amélioration des infrastructures de l'Assemblée nationale du Québec

WSP Canada

Quebec's National Assembly sought to upgrade its facilities by adding improved spaces for greeting visitors and holding parliamentary commission meetings. WSP's civil and structural engineering services were dedicated to enhancing the existing parliament building's heritage features, creating a new underground pavilion area and enabling more secure access for citizens to the National Assembly.

A need for innovation

Constructed in the 1880s, the parliament building was becoming obsolete and needed to be upgraded and renovated to meet the assembly's present and future needs, given increasing numbers of parliamentary sessions and visitors.

New areas were added without altering the heritage and symbolic character of the historic building. WSP developed the underground reception pavilion under the site's landscaped area.

An elevator in the courtyard provides access to the building's upper floors without altering its heritage façade. A 21-m long tunnel to the reception pavilion was excavated in bedrock directly under the building's main wing, while a 27-m long tunnel was also added to connect the pavilion to the Pamphile-Le May building. In total, 5,300 m^2 of space was added.

The design required innovation. Instead of using conventional membranes to weatherproof the walls adjacent to the rock surface, for example, bituminous foil membranes were installed directly in the formwork before concrete was poured. This technique prevented over-excavating of the rock behind the walls and allowed new foundation walls to be positioned less than 1 m from the

"It's a great, complex project, with lots of structural challenges connecting to an existing heritage building."
–Jury

Excavation in bedrock enabled the addition of tunnels leading to a new reception pavilion.

AWARD OF EXCELLENCE

building's existing walls.

Advanced surveying techniques using point clouds were used to plot the positions and features of the stonework before dismantling and restoring the site's monumental exterior granite stairways.

Complex challenges

The engineering work behind the underground installations near and under the heritage buildings represented a significant technical challenge.

The excavation work required blasting the bedrock at a depth of approximately 10 m and, since the excavation area was located near a historic masonry building, WSP monitored vibrations to prevent deformations to the structure.

The construction of the tunnel running under the building required the installation of major temporary and permanent supports during the excavation work to addition bear the loads of interior and exterior walls. Another criterion was ensuring the building's blast resistance, which was accounted for in the design of concrete walls, slabs and columns and a glazed wall.

Additional benefits

Since the construction of the new reception pavilion, key parts of the building—including the 'blue room' (national assembly hall), restaurant and library—are now more accessible to visitors with mobility impairments.

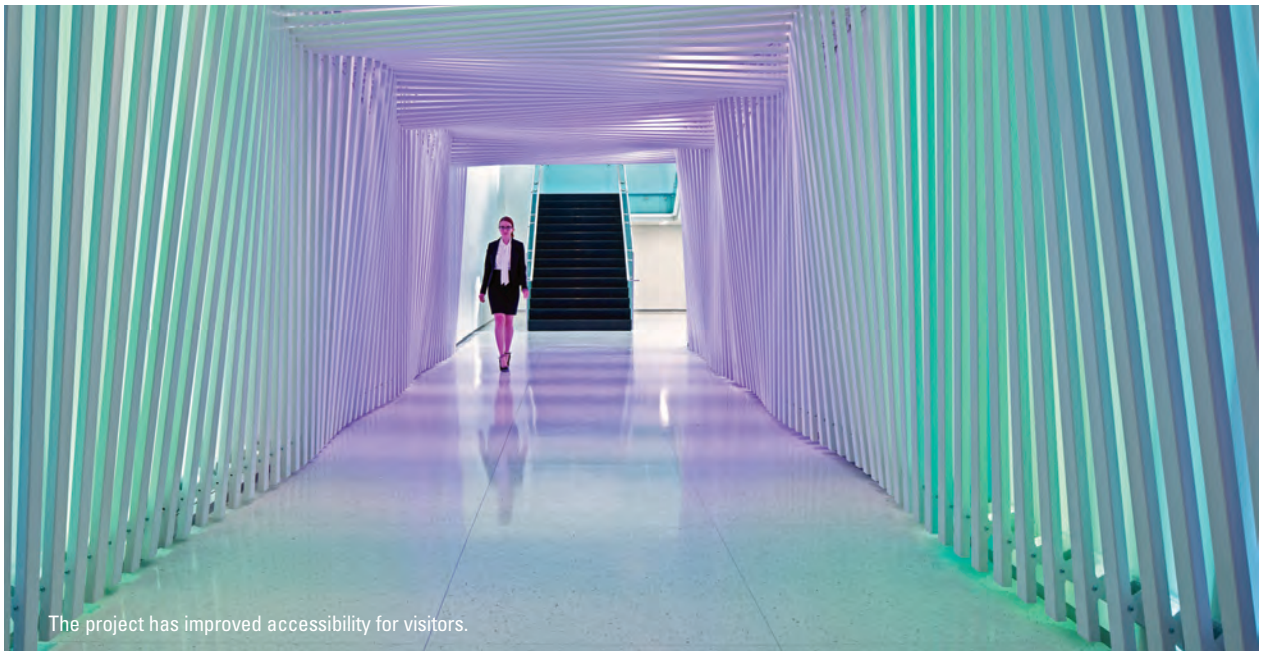
The pavilion has earned silver Leadership in Energy and Environmental Design (LEED) certification. Local materials with recycled content were used wherever possible, including structural steel components made of 75% recycled materials integrated into concrete mixes using ternary cement, which incorporate residual industrial materials like silica flume and fly ash to reduce greenhouse gas (GHG) emissions generated by production. The new mixes used in the footings, walls and columns reduced Portland cement content by 30%.

To meet the client's schedule and construction budget, the project was carried out through an integrated design process, including construction management, to ensure a high level of control. All of the designs were developed through a group effort to meet the project's functional and technical requirements.

Also, by closely monitoring and managing the project's many construction packages, it was possible to reassign parts of the overall budget as needed to complete certain phases. This was the case, for instance, when designing the tunnel to link the parliament building and the library.

The project added not just the tunnels and reception pavilion, but also interpretation areas and two new parliamentary commission meeting rooms, all while preserving the facility's heritage and architectural integrity. CCE

Amélioration des infrastructures de l'Assemblée nationale du Québec, Quebec City	
Award-winning firm (civil and structural engineering consultant):	WSP Canada, Montreal (André Bety, Ing.; Martin Dubé, Ing.; Christian Cossette, Tech.; Nadia Perreault, Tech.; Félix Demers, Ing.; Pierre Houde Mclean, Tech.; Jean-Thomas Fiset-Marois, Ing.; Dany Boisjoli, Tech.).
Owner:	Assemblée nationale du Québec.
Other key players:	GLCRM Architectes and P Roy Architects (joint venture), CIMA+ (mechanical/electrical), Pomerleau (construction), CSP Consultants en sécurité (security).



The project has improved accessibility for visitors.

AWARD OF EXCELLENCE

GNW Pavilion

Photo by Robert Stefanowicz

The GNW Pavilion is an artistic sculpture, shaped to form an upside-down Japanese lotus flower, built adjacent to the Emily Carr University of Art + Design and PCI Developments' new office building in Vancouver. As structural engineering consultants, the team at RJC Engineers used digital modelling to help develop a hybrid timber-steel structure to support the pavilion's complex shape.

Photo by Robert Stefanowicz

Modelling the vision

Lululemon founder Chip Wilson tasked the architects at Perkins + Will with designing the concept for the pavilion, which serves as a gathering place with a coffee shop inside. The red flower-shaped design was selected to stand out in the transformation of an industrial neighbourhood.

RJC was brought on board to explore alternative options to solid mass timber, which had proven impractical for the project. Given the unique shape of the sculpture, the team decided to incorporate a curved wooden dome structure, supported on five inner petals, constructed of curved glulam members, that carry the gravity and lateral loads. The wooden shell for the lower portion of the roof would provide an efficient structure for gravity loads.

The five outer curled petals then became secondary, constructed from engineered wood and supported on the lower dome and petals. Seven glazing columns support the hybrid timber-steel dome.

RJC Engineers

> "It's a beautiful structure that opens dialogue with the public domain; very appropriate for an art and design school."
> –Jury

AWARD OF EXCELLENCE

Throughout the project, RJC also worked closely with digital modeller and fabricator Spearhead to support the architectural vision and maximize the benefits of prefabrication, shipping and simple erection. As they collaborated, Spearhead modelled each idea to fit into the structure.

Then, the completed digital model went on to drive computer numerical control (CNC) machinery that cut all of the individual pieces of wood and steel.

Addressing complexities

Among the project's complexities were the selection of materials to create the double curvature of the petals and the design of the steel moment connection at the top compression ring to allow the glulam members to shrink unrestrained.

Some simplifications were made so a typical single curvature glulam member could form the ribs of each lower petal. To create the double curvature, laminated veneer lumber (LVL) was selected to span horizontally between the curved glulam ribs, as the unique shapes could be custom cut from large sheets of LVL.

The glulam ribs of the upper dome created a challenge at the peak. A ring with a 6-ft diameter was required to suitably connect all of the arched glulam members at that point, due to their size. There was also a need for a moment connection at the wood/steel interface that would not restrain shrinkage of the glulam. A unique screwed base, combined with a rocking top connection, met these requirements.

The project entailed about 40 prefabricated sections comprising more than 7,000 individual pieces of wood and steel, all CNC-cut with very tight tolerances. Erection of the main structure took just under a month.

Benefits of the system

Although it may not be apparent, there is an underground parkade that supports the pavilion. As the layout of the petals could not follow a regular parking column grid, RJC used wood as a light material to reduce the transfers required to support the structure. This allowed the support to be designed with less concrete and rebar.

Another benefit of the chosen system is the lack of interior columns, which allows complete flexibility for use of the space. Digital modelling allowed each of the 7,000 members to be cut uniquely, minimizing the amount of material needed and thus avoiding waste.

In these ways, the team was able to turn a complex design into a light, efficient, buildable structure, within a reasonable budget. CCE

GNW Pavilion, Vancouver	
Award-winning firm (structural engineering consultant):	RJC Engineers, Vancouver (Grant Newfield, P.Eng.; Colin Gilbert, EIT).
Owner:	PCI Developments.
Other key players:	Spearhead (digital modeller and fabricator), Perkins + Will (architects), Nemetz (S/A) & Associates (electrical), Integral Group (mechanical and sustainability), Level 5 Consulting (envelope), Ledcor Group (construction), Keith Panel System (metal installer).

Photo courtesy Spearhead

Prefabrication of wooden and steel sections was key to the process.

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AWARD OF EXCELLENCE

Government Conference Centre Rehabilitation

John G. Cooke & Associates

New concrete shear walls were added.

"What earned the project high marks was the combination of rehabilitating a heritage structure in one of Ottawa's busiest intersections with a significant seismic upgrade."
–Jury

Public Services and Procurement Canada (PSPC) needed to repurpose an Ottawa heritage building as the temporary home of the Senate and for future multi-purpose use. Structurally, this involved masonry conservation, seismic upgrading, new floor plates and an addition.

Creative solutions were demanded to balance heritage conservation with current building codes. After being closed to the public for more than 55 years, the building is a part of the community again, with regular guided tours.

Conserving heritage features

The original building was finished in 1912 and housed Ottawa's central railway station until the 1970s, when it was repurposed as a government conference centre. This is how it functioned until the current project began in 2014. John G. Cooke & Associates served as the project's structural and masonry conservation engineering consultants.

Along with the design of an east addition, structural upgrades were made within the existing building. These included a seismic upgrade that integrated the existing stone and brick masonry walls as lateral resisting elements, instead of simply as gravity walls, allowing for cost-effective space savings by significantly reducing the number of new concrete shear walls needed.

The team also upgraded high heritage main floor plates from the underside of the slab, allowing the floors' finishes to remain untouched. Additional usable floor space was accomplished by designing new first-floor structures within both ends of the general waiting room (GWR) block. These had to be completely independent of the heritage building, so steel moment frames were used to laterally support the floor plates.

A new multi-level floor structure was constructed in the concourse block. Within the ticketing block, the existing structure was demolished, enabling full basement excavation, during which shoring for the existing perimeter walls could not bear on grade.

So, permanent beams from the new first and second levels were designed to also perform as shoring beams for the masonry during demolition, significantly saving shoring costs.

Existing beams and columns were reinforced to the fullest extent possible where increased capacity was required.

Seismic upgrade

Masonry conservation was required for both the seismic upgrade and for long-term building maintenance. A hybrid was constructed of the existing masonry shear walls and new concrete shear walls.

When integrating the existing masonry shear walls into the floor plates, to tie the diaphragms together, grouted anchors were used, as they were the most appropriate and technically advanced option when considering load capacity versus compatibility with weaker masonry materials.

The hybrid seismic design minimized the amount of new structure that was required.

A sustainable solution

The government conference centre rehabilitation project involved many sustainable design strategies, such as the following:

1. Salvaging existing stones and brick for reuse within the project.
2. Prioritizing upgrades to existing structures over replacements.
3. Minimal intervention through structural design.
4. Halving the amount of new materials introduced to areas where a shoring design could be incorporated into the permanent building structure.
5. Reducing the size of the new addition by incorporating new floor plates within the existing structure.
6. Using similar and compatible materials with proven durability and longevity.

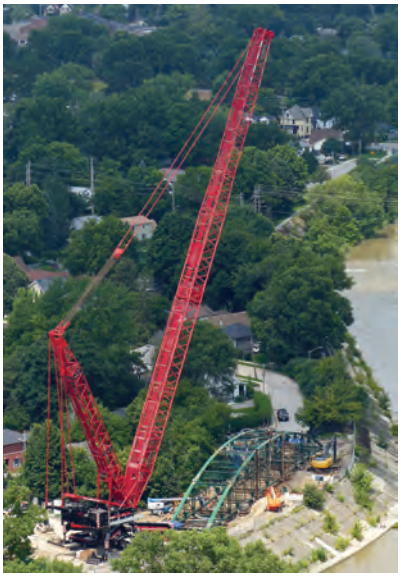
The Senate occupied the new space in early 2019. Within Ottawa, this building reportedly ranks second for the most original heritage finishes, behind only East Block on Parliament Hill. CCE

Government Conference Centre Rehabilitation, Ottawa	
Award-winning firm (structural engineering consultants):	John G. Cooke & Associates, Ottawa (Lisa Nicol, P.Eng.; Grazyna Materna, P.Eng.; Aleksander Szulc, P.Eng.; Melanie Belair, Dip. Arch. Tech.; John Barton, C.E.T.; Pascal Léveillé, EIT.; Lindsay McWhinnie, P.Eng; Yudi Sun, P.Eng.; John Cooke, P.Eng.; Mary Cooke, C.Tech).
Owner:	Public Services and Procurement Canada (PSPC).
Other key players:	KWC Architects and Diamond Schmitt Architects (joint venture), ERA (heritage architects), Crossey Engineering (mechanical, electrical), PCL Constructors Canada (construction management), Golders Associates (geotechnical).

AWARD OF EXCELLENCE

Rehabilitation of Historic Blackfriars Bridge

Dillon Consulting



Returning the bridge to its site required the largest mobile crane the city had ever seen.

"The project team conserved a beautiful heritage structure, ensuring the old methods of construction were used and the original form restored."
–Jury

Constructed in 1875 over the Thames River in London, Ont., Blackfriars Bridge remains one of North America's oldest surviving wrought-iron bowstring arch-truss bridges. The city retained Dillon Consulting to rehabilitate it, adding strength while preserving its character.

To replace or restore?

Since the days of horse and buggy, Blackfriars Bridge has served London not only functionally as a crossing for vehicles, but also as an iconic community symbol. Connecting the city's central business district to the Blackfriars heritage conservation district, the arch-truss bridge represents the peak of wrought iron metal construction, just before steel emerged as the dominant material.

In 1948, Dillon was commissioned to repair and strengthen the bridge, which provided a second service life of more than 70 years. By 2010, the city was considering replacing it and called on Dillon again to conduct a multi-faceted risk assessment.

The next phase involved a detailed, arm's-length inspection and evaluation, followed by immediate short-term repairs. This work provided critical insight for Dillon to lead an environmental assessment and consider options ranging from removal and replacement to a non-functional replica. The public embraced the strategy of rehabilitation.

The detailed design and construction strategy combined almost-forgotten techniques with modern technologies. Hot riveting methods from the mid-1900s were brought back. Replica members were fabricated and integrated into the original bridge.

Dillon recommended lifting the bridge off its bearings, disassembling it, shipping it to a fabrication facility for rehabilitation, then returning it to the site for assembly and erection. This process required the largest mobile crane ever used in London. The construction phase was accomplished in 18 months.

Old meets new

Wrought iron is a heterogeneous material with impurities, which limited the project's fabrication options and eliminated most welding approaches. For this reason, old-world hot riveting techniques were brought back. Where needed, modern button-headed tension control bolts provided an historic appearance without compromising performance.

Computerized machining was used to create replicas of the smoothly rounded wrought-iron cruciform members distinctive to the original forging methods. Dillon applied finite element analysis to the critical arch-to-tie connection at the bearing. Customized adjustments were required to address extensive dimensional inconsistencies of the original members.

The logistics of removing, assembling and erecting the bridge involved

AWARD OF EXCELLENCE

a custom field assembly table, field welding of tension ties, tilt-up erection methods, temporary shoring for cross-members and a 45-m radius scheme for the massive crane.

Many components required a careful merging of original details with modern code requirements. The latticed members from 1875 required batten plates for load sharing, for example, while the original railing needed regulatory authority permission for its lattice infill to be preserved. The original stone masonry abutments were stabilized using lightweight cellular concrete backfill and refined analysis.

The bridge was reconstructed without entering the water for temporary support at any stage over the project's eight-year period.

Community celebration

The original bridge patent signs were lost over the years. Using photographic records, replica plaques were cast out of remnant wrought iron reclaimed from the bridge. A gateway sign was installed across the roadway, using letters also forged from reclaimed iron. And a plaque was installed commemorating the Canadian Society for Civil Engineering's (CSCE's) 2016 designation of the bridge as a national historic civil engineering site.

A viewing plaza was added to provide a vantage point, connecting to parks and roadways. The plaza features a public monument constructed from bridge remnants, along with interpretive signage.

On Dec. 1, 2018, there was a reopening ceremony and celebration for the bridge. To echo the 1875 opening, the mayor and local dignitaries traversed the bridge by horse and carriage. CCE

Rehabilitation of Historic Blackfriars Bridge, London, Ont.	
Award-winning firm (prime consultant):	Dillon Consulting, London, Ont. (Chris Haines, MBA, P.Eng.; George McCluskey, P.Eng.; Brian Huston, P.Eng.; Jeff Matthews, P.Eng.; Curtis Watson, P.Eng.; Will Hayhoe, P.Eng.; Leighann Braine, OALA, CSLA).
Owner:	City of London, Ont.
Other key players:	McLean Taylor Construction (general contractor).

AWARD OF EXCELLENCE

Garrison Crossing

Pedelta Canada

On behalf of Toronto, CreateTO, awarded the Garrison Crossing design-build project to Dufferin Construction in 2015 to provide a link from the city's Stanley Park to the historic site of Fort York and the waterfront, crossing above two of Canada's busiest rail corridors. Pedelta served as lead designer.

Construction started in August 2016 and the crossing opened to the public in October 2019. Pedelta designed two pedestrian and cycle bridges, using duplex stainless steel for the entire structure to ensure long-term durability. The crossing is designed to last at least 75 years.

"The bridges are over two of Canada's busiest rail lines and the innovative use of stainless steel for long-term durability reduces the need for maintenance."
–Jury

A tale of two bridges

The structural systems selected for both bridges were similar, with the geometry differing slightly.

The north bridge has a single, 52-m long span. Its arch has a maximum height over the deck elevation of 9 m and is connected to the tie-girder at both ends and by two families of inclined hangers that cross each other once. This system allowed for relatively slender cross-sections and a lighter structure.

The south bridge required its own design to accommodate a 5-m elevation difference. The best fit for the site constraints was a one-span arch connected to a V-shaped pier on the south end. This system transforms the thrust of the arch into a set of axial forces in the pier.

Specifying stainless steel

This project marked the first time duplex stainless steel has been used for the entire structure of a bridge anywhere in North America.

Stainless steel is recognized as a sustainable material with a lower environmental impact than carbon steel, due to reduced CO_2 emissions during fabrication, lightweight construction, low need for maintenance and one of the highest rates of recycling of any material.

When evaluating the use of stainless steel from an investment perspective, one of the key points considered

at the preliminary design phase was its life-cycle cost. The higher capital cost of stainless steel would be offset by the extended durability, due to its increased corrosion resistance and resulting reduction in maintenance, which in turn would reduce the overall cost of ownership (TCO).

The bridges will be permanently exposed to a potentially corrosive environment and de-icing salts in the winter. Given the corrosion resistance of duplex stainless steel, through, the structure's maintenance requirements can be limited to regular pressure washing with water to remove the accumulated salts.

Due to a lack of specific Canadian codes for the design of stainless steel structures, the design strategy was to comply with the loading and safety requirements of the Canadian Highway Bridge Design Code and the provisions of the Stainless Steel Eurocode for matters relating to structural capacity.

Stainless steel is not a difficult material to work with, but it is somewhat different from carbon steel and should be treated accordingly. Pedelta prepared a specific material and fabrication testing and inspection plan for the project. Testing was conducted by specialized firms.

Minimizing impact

The bridges were conceived to minimize interference with the rail lines beneath them. A key element of this strategy was to minimize the number of iterations of construction mobilization.

The substructure was placed out of the rail corridor's right of way, maintaining a vertical clearance of 7.44 m. Consideration had to be given to the protection, safety and security of both the railway operations and the pedestrians and cyclists using the crossing.

Another challenge was to achieve an appropriate 'landmark' quality for the crossing in its heritage setting. The south approach lands on the Fort York Garrison Common, which is historically significant as one of the most important battlefields of the War of 1812. To minimize the visual impact on the cultural heritage of Fort York, the bridge and approach ramp in Garrison Common were designed with a compact footprint. CCE

The crossing comprises two bridges, extending from Toronto's Stanley Park in the north to Fort York in the south.

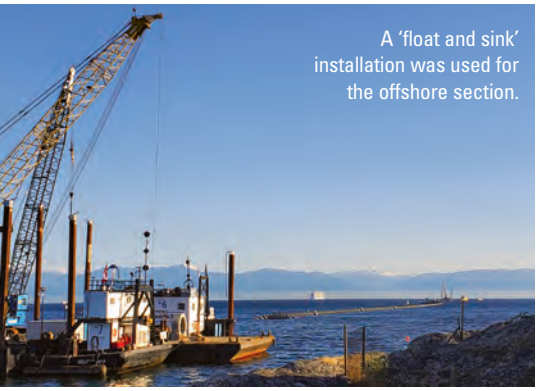
The crossing traverses two of Canada's busiest rail corridors.

Garrison Crossing, Toronto	
Award-winning firm (prime consultant, bridge design and structural engineering):	Pedelta Canada, Toronto (Juan Sobrino, PhD, P. Eng., ing, PE; Javier Jordan, P.Eng., PE; Raluca Badanau, BSc.).
Owner:	CreateTO, on behalf of City of Toronto.
Other key players:	Dufferin Construction, DTAH (landscape design and architect), Mulvey & Banani International (architectural lighting design and electrical), Golder (geotechnical and environmental), Archaeological Services (heritage) McMillan Associates Architects (project manager for CreateTO).

AWARD OF EXCELLENCE

McLoughlin Point WWTP HDPE Outfall

AECOM



A 'float and sink' installation was used for the offshore section.

"This record-setting project was notable for minimizing ecological damage and saving time and money."
–Jury

Before completion of the new McLoughlin Point wastewater treatment plant (WWTP) in Victoria, the Capital Region District (CRD) was discharging raw sewage into the ocean from two outfalls. After decades of public controversy over unsustainable waste management, construction of a new outfall for the WWTP would instead facilitate discharge of treated effluent.

Early concepts included reusing existing outfalls, which would have required twinning conveyance pipelines to pump stations, an additional 1.2 to 4.2 km of underground infrastructure and lift station pumps to overcome limiting hydraulics. By installing a new outfall at the plant site instead, the additional infrastructure would not be needed, reducing initial conveyance system and ongoing operating costs.

For this purpose, AECOM and joint venture (JV) partner Graham Construction designed and built North America's largest solid-wall high-density polyethylene (HDPE) outfall pipe, 1.92 km long, in two distinct segments.

Inshore segment

The inshore segment's section of steel pipe was microtunnelled through bedrock. A 'wet exit' technique avoided the use of expensive cofferdams and limited disruption to the sensitive intertidal marine environment.

To prevent deterioration from corrosive seawater, the pipe was treated with an abrasion-resistant epoxy overlay, the tunnel annulus was filled with a calcium nitrite grout. Also, the interior of the pipe was treated with a polyurethane (PU) coating to prevent internal corrosion.

The tunnel was installed between a shore-based launch shaft, blasted into the bedrock to a depth of approximately 8 m below sea level, and an exit trench, blasted offshore approximately 10 m below sea level.

A tunnel boring machine (TBM) was driven offshore into the exit trench and into the ocean. A specially designed bulkhead door was then sealed shut. A blind flange was installed in the launch shaft and the pipe was flooded. The TBM then disconnected from the pipe string and floated to the surface.

Offshore segment

The offshore segment consisted of solid-wall HDPE pipe, designed for a 'float and sink' installation.

To resist the effects of ocean currents, wave-induced energy and buoyancy, a total of 350 reinforced concrete weights, each approximately 11,000 kg, were installed along the pipe at 4 to 6 m apart. Permanent fasteners were constructed of corrosion-resistant materials, such as superduplex stainless steel, silicon bronze and titanium.

Designed for installation

Design work included determining ocean-induced forces, using 100 years of wind data, as well as current velocities at a nearby monitoring mooring. Stability analysis determined the mass required to keep the pipe stable on the ocean floor.

Installation force analysis was also undertaken, as the highest stress the pipe would undergo would be from bending during installation. The analysis determined a safe bend radius during the float and sink operation and determined a pipe 'end pull' of up to 100 metric tonnes was required.

A multi-port diffuser was designed to achieve an initial dilution of the effluent of 100:1 for low current speeds during unstratified winter con-

AWARD OF EXCELLENCE

ditions and to convey anticipated peak flow of 5.1 m^3/s by gravity, with allocations for storm surge and sea level rise. Temporary diffuser closures were designed to be pressure-tight, allowing for pressurization of the pipeline during sinking, so the diffuser could be installed as part of the main outfall.

An internal sealing system for the 36 diffuser ports was designed to withstand pressures up to approximately 3 bar. Once on the bottom, these seals were removed by a remotely operated underwater vehicle (ROV).

Protecting the environment

Given stringent environmental regulations, near- and far-field modelling of the treated effluent plume was completed to ensure adequate dispersion. To meet such dilution criteria throughout the entire 75-year flow development of the treatment system, wide 'duckbill valves' were selected for the 36-port diffuser.

While on-bottom disturbance was minimal, compensatory restoration of an equivalent footprint of the outfall was required in accordance with a Fisheries & Oceans Canada regulation. This was achieved by salvaging blast rock from the outfall exit trench to create habitat reefs adjacent to the construction site.

Fisheries & Oceans Canada was concerned the outfall could permanently embed in the soft sea bottom, creating a barrier for the movement of the Dungeness crab. For safe passage, fibre-reinforced plastic bridges were added along the pipe. CCE

McLoughlin Point WWTP HDPE Outfall, Victoria	
Award-winning firm (design engineer of record):	AECOM, Winnipeg (Chris Macey, PEng.; Marv McDonald, CET; Jordan Thompson, PEng.; David Houghton, PEng.; Rob Dill, PE; Dominique Brocard, PhD, PE; Robert Vail, PE; Bruce Ford, MRM, RPBio).
Owner:	Capital Regional District (CRD).
Other key players:	(Graham Construction (joint venture partner), Michels Canada, Lorax Environmental (fairfield modelling), Arhipelago Marine (marine life survey), Sea View Marine Services (marine mammal and acoustic monitoring), Vancouver Pipe Driving, Russ Fogel (subcontractor), CanPac Marine Services (subcontractor).

AWARD OF EXCELLENCE

Dawson City Water Treatment Plant

Associated Engineering

Dawson City's water treatment plant is a model for efficiency, using renewable energy for heating and power. As the largest facility anywhere in Western Canada with cartridge filtration, it provides robust treatment for a community of 1,400 that typically swells to more than 5,000 during the summer. And the new facility's landmark architecture reflects the town's character and history.

"The plant was completed with lots of care and good engineering techniques." –Jury

Opportunities for improvement

When the town's 40-year-old treatment plant for drinking water was struggling to meet Guidelines for Canadian Drinking Water Quality, the Yukon Government sought to replace the aging facility. The new facility needed to treat water drawn from four wells near the confluence of the Yukon and Klondike Rivers, as groundwater supply there is at risk to contamination.

The Yukon retained Associated Engineering to provide design and construction services for a new plant. After evaluating various processes, the design team recommended cartridge filtration as appropriate for the groundwater source, which is low in turbidity and colour.

The technology is simple to operate and eliminates the need for chemicals typically used in traditional water treatment systems. Since they are washable and reusable, the cartridges only need to be replaced about twice a year, a significant benefit given Dawson City's

remote location and limited access to supplies.

To treat 6 million L per day, the plant's two-stage cartridge system uses 5-micron filters, along with a 1-micron filter to protect against protozoa pathogens. The treatment process also includes ultraviolet (UV) and chlorine gas disinfection.

Cold-climate engineering was essential to ensure water would not freeze pipes during winters when temperatures can drop below -40 C. Heat is drawn from a local wood chip biomass plant to supplement traditional oil-fired boilers. Exterior piping is insulated and heat-traced. During commissioning, water was constantly circulated through the underground pipes and adjacent reservoir to avoid freezing.

In the summer, the building's power supply is augmented by a solar photovoltaic (PV) system.

Through a unique arrangement of piping and valves, the town's fire pump supply flows are looped within the potable water distribution system. During the winter months, this water supply is pumped unidirectionally into the distribution system and water is directed back into the treatment plant for reheating to prevent it from freezing. This system ensures water remains in constant motion during the winter, while allowing fire flow supply to back-feed into the looped system when required.

Flood protection

Situated on the confluence of the Yukon and Klondike Rivers, Dawson City has been subject to large-scale flooding in the past. As an essential service, the plant needs to be protected accordingly.

Analysis of river levels in future climate-change scenarios showed flood levels exceeded the building's ground elevation. Thus, the building's foundation and walls were designed to resist a 200-year flood and all sensitive electrical equipment and controls were installed on the second floor.

In the winter, water is directed back into the treatment plant for reheating to prevent freezing.

Localized construction

The plant fits on a small footprint of two standard residential lots, which the team maximized by designing a two-storey structure and minimizing setbacks, working in consultation with Dawson City Council to obtain a special bylaw exemption. And given the limited setbacks for the plant's adjacent buildings, fire-rated wall materials were used and a fire suppression system was installed.

To reflect Dawson City's history, including the Klondike Gold Rush, the deisng team consulted with the town's heritage advisory committee. The result is a façade that mimics the Pacific Cold Storage Building, an early 1900s 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.

Building materials included wood frames and dowel laminated timber (DLT) roof panels, sourced locally where possible to reduce transportation costs, minimize the project's carbon footprint and expedite construction. The DLT roof also offers sound absorption, reducing exterior noise from the plant operations.

The $15-million plant was completed under budget and ahead of the Yukon Government's schedule. Planning and design began in 2016, construction in 2018 and then commissioning in 2019—and by the end of that year, locals were drinking water from the largest municipal cartridge filtration system in Western Canada. CCE

Dawson City Water Treatment Plant, Dawson City, Yukon	
Award-winning firm (lead consultant):	Associated Engineering, Edmonton (Steven Bartsch, P.Eng.; Matt Lozie, P.Eng.; Richard Annett, C.Eng, P.Eng.; Louis De Lange, P.Eng.; Jared Suwala, P.Eng.).
Owner:	Yukon Government.
Other key players:	Kobayashi + Zedda Architects, Tetra Tech (geotechnical) Wildstone Construction Group (contractor).

AWARD OF EXCELLENCE

Northwest Arm Trunk Sewer Rehabilitation

Robinson Consultants

With CIPP, on-site fabrication and installation were feasible without disrupting the public's use of the shoreline during construction.

"This challenging project, which broke several Canadian records, was completed on a very tight schedule, caused minimal disruption to the neighbourhood and saved considerable money compared to alternate methods."
–Jury

Halifax Water required the renewal of an inaccessible, 100-year-old, large-diameter, 4,000-m long trunk sewer that was exfiltrating into the Northwest Arm inlet, a major recreational and natural asset, during rain events.

Robinson Consultants was tasked with restoring both the sewer's structural integrity and its intended flow capacity, extending its service life up to 75 years, removing debris, creating a corrosion barrier and eliminating contamination of the coastline. The project was executed in a cost-effective manner while significantly reducing social and environmental impacts.

Constraints

The Northwest Arm Trunk Sewer (NATS) was one of the most challenging cured-in-place pipe (CIPP) rehabilitation projects ever completed in North America. Several Canadian records were broken in the completion of this project, including the longest single continuous CIPP installation length at 682 m.

The project's engineering scope included closed-circuit television (CCTV) inspection, condition assessment, feasibility study, constructability, detailed design, tendering, contract administration and site inspection for the rehabilitation of more than 4,000 m of combined trunk sewer, ranging from 1,200-mm diameter round pipe to 1,200 x 1,500-mm arch pipe, located in some of the most difficult-to-access residential terrain in Halifax.

The NATS alignment meanders along the inlet's shoreline anywhere from 0 to 10 m from the water's edge and is landlocked by a Canadian National (CN) Railway track with bridge access only. In terms of access challenges, it is located mainly on built-up, multimillion-dollar historic residential waterfront properties, steep shoreline slopes, 100-year-old load-restricted CN bridges and a hydroelectric corridor.

The project was financed by the Clean Water and Wastewater Fund (CWWF) with an ambitious timeline for completion. While a typical project of this size and magnitude would take more than 12 months of planning and engineering, the team was able to successfully complete all such requirements in seven months to meet the schedule.

Non-standard design

CIPP design standards under ASTM F1216, *Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube*, are based on circular

Northwest Arm Trunk Sewer Rehabilitation, Halifax	
Award-winning firm (prime consultant):	Robinson Consultants, Ancaster, Ont. (Kevin Bainbridge, A.Sc.T.; Patrick Moskwa, P.Eng.; Ian Doherty, P.Eng.).
Owner:	Halifax Water.
Other key players:	CBCL (hydraulic modelling and mechanical engineering).

sewers. This project required a unique approach to develop a non-circular CIPP design for arch-shaped portions of the sewer, which totalled approximately 2,000 m in length.

The team assessed the pipe cross-section in three distinct components: arch top, vertical sides and dished bottom. The design parameters for each of these individual components were established, along with equations to identify the CIPP thickness required to meet the expected loads. This methodology expanded upon the traditional limitations of CIPP technology.

Logistical challenges

Due to the challenges presented by the sewer's off-street path through residential backyards (whose owners were engaged during the project) and steep terrain, approximately 3,000 m of the total 4,000 m of CIPP was installed from just four small access footprints, at lengths in excess of 400 m compared to typical lengths of 100 to 150 m.

Further, on-site CIPP fabrication was required to limit the weight of material trucks, so they could enter the area over the aforementioned load-restricted bridges.

The sewer's existing condition also required removal of more than 750 m^3 of heavy debris from five access locations. In some cases, this meant pulling debris over lengths in excess of 500 m.

An appealing alternative

CIPP is a structurally sound pipe installed within an existing pipe. The typical methodology of open-cut pipe replacement through the shoreline would have had heavier social, environmental and economic impacts. The installation of a new pipe would have required the excavation of a 4,000-m long, 4-m wide and 8-m deep trench, removing 80,000 m^3 of earth and rock, damaging terrestrial and aquatic habitats along the coast.

It is estimated the cost savings of using CIPP were between 50 and 60% versus replacement and the construction period was reduced by six to eight months. While some minor excavation was needed at existing maintenance holes, no linear length of sewer pipe required excavation. The public was able to continue to use the recreational shoreline during construction and the risk of spilling sediment and other contaminants into the inlet was reduced. CCE

AWARD OF EXCELLENCE

Mid Halton Wastewater Treatment Plant: Micro-Hydro Facility

HATCH

"The engineering around this concept was impressive. Transforming a waste treatment plant into a resource recovery facility spoke to the ingenuity of the project."
–Jury

An effluent outfall tunnel was built at the Mid Halton Wastewater Treatment Plant (WWTP) to accommodate increased capacity. The plant is 4 km from Lake Ontario and 40 m higher elevation, allowing a micro-hydro system to be installed in the outfall to generate power, reducing the WWTP's carbon footprint and energy costs.

Generating energy

The Region of Halton engaged Hatch to provide engineering services for phases four and five of its WWTP expansion project, including the new outfall to convey treated effluent to an offshore diffuser field.

The micro-hydro facility was incorporated within the drop structure that transfers effluent to the deep, tunnelled outfall. Flows entering the structure can be directed to the micro-hydro facility or bypassed to energy-dissipating baffles, then into the outfall.

A 700-kW turbine was selected to generate electricity 'behind the meter.' The facility reduces the amount of electricity the region needs to purchase and, thus, reduces the plant's operating costs.

The amount of energy generated by the facility depends on the amount of flow directed to it, from the lower effluent flows of the present WWTP up to the higher, maximum-capacity flows in its expected full buildout condition. When flows exceed the facility's capacity, the excess is discharged via the baffle side of the drop structure.

Based on post-commissioning results, which represent the lower end of anticipated future energy production, the micro-hydro facility has been reliably producing more than 3,000 kWh of electricity each day, meeting a significant portion of the WWTP's total energy needs.

Design and systems

The WWTP's expansion increased its average daily flow from 75 million to 125 million L/day. Future capacity will reach 400 million L/day.

A review determined only Ossberger could provide a single turbine capable of handling the ranges anticipated. A robust supervisory control and data acquisition (SCADA) control system, with multiple failsafes, was required to ensure safe operation of the turbine and, if necessary, safe and quick shutdown in response to sudden flow reductions.

Inside the 10-m diameter shaft, half of the space was required for the effluent baffle drop system, leaving a restricted area, 30 m below ground, to accommodate the micro-hydro facility.

Necessary air circulation to and from the baffle side of the structure was achieved with piping under each baffle shelf, connected to a closed manifold system on the micro-hydro side of the shaft. This was the first-known use of piped venting for a baffle drop system anywhere in the world. CCE

Mid Halton Wastewater Treatment Plant: Micro-Hydro Facility, Oakville, Ont.	
Award-winning firm (prime consultant):	Hatch, Mississauga, Ont. (Carl Bodimeade, P. Eng.; Marc Gelinas, P.Eng.; Satish Bhan, P.Eng.; Andrew Bridgeman, P.Eng.; Karl Sigl; Mark Wilkinson, P.Eng.; Grace Ning, P.Eng.; Stephan Gazzola, CET; Andrew Kuronen, P.Eng.; Remo Bonin, CET).
Owner:	Regional Municipality of Halton.
Other key players:	Strabag (general contractor), E.S. Fox (mechanical/electrical subcontractor), Hydro ECI (micro-hydro electrical and controls subcontractor), Ossberger (turbine supplier).

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AWARD OF EXCELLENCE

Bioengineering Restores Ecological Loss After Wildfires

Associated Engineering

Alberta's 2016 Horse River Wildfire devastated Fort McMurray and other areas in the Regional Municipality of Wood Buffalo (RMWB). In total, more than 500,000 hectares of land were incinerated. And many areas lost vegetation and soil function and saw increases in runoff and erosion.

As part of the immediate emergency response, trees and shrubs were clear-cut to create firebreaks and prevent further spread. The equipment altered natural drainage patterns, compacted existing soils and reduced the ability for these areas to absorb water, causing drainage to flow to erosion-prone areas.

"A clever solution, done with lots of care." –Jury

Recognizing the potential for future flooding and landslides, RMWB retained Associated Engineering to prioritize and restore damaged sites. The resulting erosion and drainage control project demonstrated a broad-scale application of bioengineering.

Deciding where to begin

Engineers and environmental scientists conducted a preliminary assessment, which identified more than 300 damaged sites. Field data was combined with light detection and ranging (LIDAR) and infrastructure datasets to develop a matrix for prioritization. After developing evaluation criteria

and a rating system, Associated Engineering prioritized 14 sites, predominantly ravines and deep slopes, which posed the most risk to property and the environment.

Traditional engineering requires heavy equipment for construction that would further damage the sensitive environment, particularly in sloped areas where access would be challenging. So, the team recommended bioengineering as the primary erosion repair strategy, augmented by conventional engineering.

Bioengineering for landscape and watershed restoration can mimic natural processes, conditioning soil and establishing live plants to accelerate and promote natural revegetation of damaged areas. Live stakes use poplar and willow species, both of which offer resilience to fires. At erosion sites, slope lengths are shortened through surface roughening and new vegetation can increase infiltration. The resulting landscape is more resilient to climate change and will recover faster from events like flooding.

Such work had never been used on such a large scale, but with one of the 14 priority areas comprising four hectares, there would be significant benefits. Live stakes planted by hand would not cause major disturbances to environmentally sensitive areas, with no heavy equipment required in waterways.

There would also be cost savings. The largest site, the four-hectare Conn Creek Ravine, represented a cost of $1.36 million. Using the more traditional erosion protection approach of riprap to cover the same area would have cost an estimated $4 million.

A combined approach

Due to the diversity of terrain, the team had to evaluate and develop unique combinations of bioengineering and conventional engineering for each site.

The bioengineering techniques included surface roughening, dense live toe staking along creeks, live silt fencing, live poplar staking, wattle fences (short retaining walls built of live cuttings on steep slopes) and live pole drains (bundled cuttings in shallow trenches to direct drainage). These were integrated with traditional solutions, such as culverts and riprap.

Integrating bioengineering with traditional engineering benefited remediation.

Live cuttings had to be collected while plants were dormant from September to May. They were planted using hand tools, avoiding the need to isolate creeks and salvage fish. Construction took place during periods of low flow, so crews could perform live staking along the toe zone of creeks without working in the water.

As local contractors did not have bioengineering experience, Associated Engineering trained all of those who were bidding on the project, to allow for a competitive process. The workshop included classroom and hands-on fieldwork to familiarize the contractors with the various bioengineering techniques and the scope of the project.

Rapid results

After one growing season, the community was already seeing the benefits of restoration. The new plantings took root, filling in the firebreaks and bare sites with new foliage. The restored sites no longer experienced erosion and runoff.

The plantings are self-sustaining, requiring little to no maintenance (*e.g.* watering or cutting). As they continue to establish themselves, they will create conditions that promote later seral (*i.e.* intermediate) species to grow, further stabilizing the soil and increasing ecological functions.

The project restored almost seven hectares impacted by the wildfire, setting the stage for additional work in the area, by demonstrating the success of bioengineering on a broad scale and by building capacity for the local construction industry to continue. CCE

Bioengineering Restores Ecological Loss After Wildfires, Fort McMurray, Alberta	
Award-winning firm (prime consultant):	Associated Engineering, Edmonton (Jason Vanderzwaag, P.Eng.; Vicki Rose, P.Eng.; Kristen Andersen, P.Biol. PWS, CPESC; Jordan Lucas, BIT; Tyson Buckley, LAT, AT, AALA).
Owner:	Regional Municipality of Wood Buffalo (RMWB).
Other key players:	Polster Environmental Services (environmental), Thurber Engineering (geotechnical).

AWARD OF EXCELLENCE

Meliadine Mine Cogeneration Plant

BBA

"This project is an excellent example of value engineering that goes beyond simply meeting the client's immediate needs."
–Jury

Agnico Eagle wanted an efficient, eco-friendly and cost-effective way to power its Meliadine gold mine in Nunavut's Rankin Inlet. To address this need, BBA designed a 28-MW cogeneration plant, along with thermal and electrical systems. The high-performance generators and heat recovery system led to a total estimated energy efficiency of more than 80% and reduced diesel consumption by 4.5 million L per year in comparison to other, conventional cogeneration plants.

Making the right investment

The mine is about 25 km north of Rankin Inlet and can only be accessed by sea and air. Supplying power to remote facilities can be challenging and Agnico Eagle was looking for an economically viable and socially acceptable solution.

BBA proposed to optimize the heat recovery process, given the highly variable electrical and thermal loads. In the end, the project was completed on time and on budget.

In the past, mining companies have tended to minimize their capital investment. In this case, however, BBA recommended a 720-rpm diesel generator, which entailed a higher initial cost than other options, but would offer better performance. Up to 24 MW of thermal energy could be recovered to heat all buildings on the main site and still meet much of the underground mine's demand.

Mining operations in the north are typically powered by Arctic diesel. Natural gas, a lower-carbon alternative with 25% fewer greenhouse gas (GHG) emissions, is generally not feasible because (a) demand is insufficient in remote areas and (b) it would be enormously expensive to store.

Nevertheless, BBA made it possible to easily convert the plant to natural gas in the future, if feasible, and integrate wind power to help further reduce GHG emissions.

The generator BBA recommended and integrated into the design was 5% more efficient than those used in conventional power plants, reducing annual diesel costs by $2.5 million. And the 'free' and clean heat recovery in the winter achieved up to 80% efficiency, saving an additional $2 million on diesel costs against the industry standard.

AWARD OF EXCELLENCE

Complex logistics for the Far North

In a region where temperatures can drop below -50 C, BBA had to design a highly reliable electrical and thermal system. Site access was also a challenge because boats could only be used after the ice melted, leaving a very short window to deliver the project's materials, and there was no port, so equipment would have to be unloaded directly onto the shore.

Working n collaboration with the client, BBA used a modular approach to the construction logistics, which involved prefabricating some of the power plant buildings. This reduced on-site labour and increased worker comfort.

The project team also optimized the sequencing of work activities to take advantage of the warm season. Given long delivery times, the generator was ordered first.

Normally, given the generator's significant size, the main facility would be built around it after its arrival at the job site. In this case, however, the building was instead built upstream first, so employees could start to work as soon as possible, protected from the weather. The large equipment would then be installed through strategic openings.

On-site lifting capacity was limited.

Responsible resource management

The Meliadine mine has a major socioeconomic role in the region, employing nearly 500 workers. Agnico Eagle and the Kivalliq Inuit Association (KIA) signed an Inuit Impact and Benefit Agreement (IIBA), which then guided the process of purchasing equipment for the power plant.

To further support the workers' comfort and safety, BBA suggested (a) installing an acoustic ceiling to reduce ambient sound levels by 50%, (b) modifying the power plant's stack design to improve air quality and (c) designing one of Canada's safest off-grid power systems with respect to reducing arc flash hazards.

By opting for cogeneration, Agnico Eagle showed a commitment to reducing the mine's environmental impact. A series of efficiency measures at the site have reduced GHG emissions by 12,000 t per year.

Further, by opting for a thermal system that uses water instead of glycol, not only did the team provide a more efficient means of delivering heat, but they also reduced the environmental risk in the event of a spill. CCE

Meliadine Mine Cogeneration Plant, Rankin Inlet, Nunavut	
Award-winning firm (engineering consultant):	BBA, Mont-Saint-Hilaire, Que. (Stéphan Landry, P.Eng.; Louis-François Gagnon, P.Eng.; Nicholas Allen, P.Eng.; Mathieu Robichaud-Dion, P.Eng.; Mathieu Lapointe, P.Eng.; Éric Boulianne, Tech.; Luc Bérubé, P.Eng.; Yanick Labrie; Charles-Étienne Lafleur, P.Eng.; Elyse Blais).
Owner:	Agnico Eagle.
Other key players:	n/a.

AWARD OF EXCELLENCE

Grand Falls Dam and Spillway Rehabilitation

HATCH

"We are impressed they were able to accomplish so much in such a short time and avoid risk to the environment and public safety."
–Jury

Built in 1909, Newfoundland's Grand Falls Dam eventually deteriorated to the point where remedial repairs were required. The contractor, Pennecon, asked Hatch to devise a rehabilitation scheme to replace an existing design that posed constructability and safety concerns. Hatch met this challenge with a new design within a month.

One of the keys to the success of the new concept was the application of advanced hydrotechnical principles, which demonstrated the earlier design's 10 inflatable gates could be replaced with a simple passive, stepped overflow weir immediately downstream of the existing spillway. Hatch's solution eliminated constructability and safety concerns associated with the original design.

Advanced computational fluid dynamics (CFD) analyses were performed to verify the ogee-shaped weir's discharge capacity and energy dissipation step heights, so as to better suit the contractor's preference for formwork that further reduced costs and improved the schedule.

The design was also specifically tailored to ensure there would be no interruption to power generation,

AWARD OF EXCELLENCE

ensuring reliable delivery to the community and revenue to the owner, Nalcor.

The resulting design met all current dam safety requirements, was significantly less expensive than the original design, provided the required discharge capacity, had virtually no environmental impacts, eliminated construction safety issues associated with the original design, allowed the work to be completed in one construction season and reduced future operational and maintenance costs.

First of its kind

The original concept's complicated and expensive cofferdam design was replaced by a first-of-its-kind flashboard cofferdam that would be installed in less than a week, require no in-water work, cause almost no leakage throughout construction activities and reduce stress on the environment during efficient removal.

The team also collaborated to develop a formless concrete placement technique for the ogee-shaped weir. This too helped reduce costs and improve the schedule.

The team developed a formless concrete placement technique for the ogee-shaped weir.

Addressing challenges

Some significant challenges were addressed during construction.

First, when the bedrock foundation was exposed, it was found to be composed of high-quality but highly irregular granitic rock. The original roller-compacted concrete concept had to be changed to conventional concrete, with a new redesign, specifications and drawings fast-tracked in weeks to address the complexities of the irregularities. Throughout construction, ongoing assessments and adjustments were made to ensure the dam's base width met design requirements as the actual foundation was exposed.

Seepage through the dam was found to be much greater than originally thought, with exceptionally highly concentrated flows through eroded areas and lift joins that precluded effective concrete placement. It was not feasible to seal the leakage without lowering the head pond, which would have (a) reduced power generation significantly and (b) required new environmental approvals, resulting in project delays.

The solution involved an innovative 'plumbing' system within the body of the dam to collect seepage water at its source, control it during concrete placement and discharge it at the toe of the dam.

This cost-effective measure had no effect on the project's schedule and enhanced stability by reducing the seepage pressures at the interface between the existing and new spillway.

Supporting the fishery

Prior to Hatch's involvement in the project, one of the 10 inflatable gates had been installed. The operation of this gate led to concerns its high flows could impact fish passage during the spawning season.

To address this issue, Hatch's team developed a model of the fishway and undertook CFD modelling to determine if any remedial works were required to protect the salmon fishery. The results of the analysis showed the observed high velocity and turbulent flows only occurred near the water's surface, compared to those at depth along the riverbed before the gate's installation.

As such, the team concluded the inflatable gate had improved the potential for fish passage and there was no need for remedial measures. Ongoing monitoring has confirmed this conclusion. CCE

Grand Falls Dam and Spillway Rehabilitation, Grand Falls-Windsor, N.L.	
Award-winning firm (EPC design engineer, construction supervision and on-site quality control.):	Hatch, Niagara Falls, Ont. (C. Richard Donnelly, P. Eng.; Hooman Ghassemi, P. Eng.; Michael Rosales, P. Eng.; Alfred Breland, P.Eng.; Bethany Hepner, P. Eng.; Jerry Westermann, P. Eng.; Scott Bradshaw; Doug Strickland; Kari-Lyn Nielsen).
Owner:	Nalcor.
Other key players:	Pennecon Heavy Civil.

AWARD OF EXCELLENCE

Mould Bay Causeway Reconstruction

Englobe

"Very sophisticated risk management and project delivery under difficult conditions."
–Jury

Mould Bay is the site of a former high Arctic weather station (HAWS) on the Northwest Territories' Prince Patrick Island, one of the least accessible locations in Canada. Environment and Climate Change Canada, as the owner, and Public Services and Procurement Canada (PSPC), as the client, retained Englobe to manage the reconstruction of a causeway over Station Creek that connected the station to an airstrip.

The goal was to complete the work before 2020, at which point the client could proceed to the next phase of an environmental assessment and possible rehabilitation of the site.

Logistical challenges

The greatest challenges were related to site access and logistics. Six types of aircraft, including a Lockheed C-130 Hercules, were used to transport equipment (culverts, excavator, floatable dams, vehicles, etc.) to the site.

Careful planning was required to co-ordinate flights, loading and unloading. A short operating window and restrictions for aquatic culvert installation work associated with the fish spawning period presented challenges. With uncertain flying conditions, any minor oversight in planning could affect the schedule.

A delay in the initial mobilization, associated with unfavourable weather and the unavailability of some carriers, made Englobe miss an opportunity to position machinery using an ice bridge over the 30-m wide creek. Instead, the team recommended installing a pre-engineered modular bridge.

Bringing the bridge

The bridge would need to be transported by air, but ideally not require the C-130 Hercules cargo aircraft, which would significantly increase costs. It was also important to mobilize before the airstrip itself thawed.

The project management team identified a suitable bridge. Detailed engineering and client approval of shop drawings were completed in just 11 days.

A Mabey Compact 200 modular bridge was transported using four flights of a Lockheed L-188 Electra aircraft and installed on schedule.

Protecting the environment

The 50 years of operation of the HAWS, from 1948 to 1997, had a significant environmental impact. The site is contaminated with hydrocarbons, heavy metals and polychlorinated biphenyls (PCBs). The buildings contain asbestos and lead paint.

Upgrading the access road is a key milestone toward environmental remediation. Measures were taken to avoid the dispersion of sediment near any watercourse. Filters were used to protect fish during the pumping work to dry out the work area.

To prevent oil spills, response kits were strategically positioned and containers were stored in watertight basins. To avoid cross-contamination, previously identified contaminated areas were marked out to prevent traffic over them. All waste generated by the project was transported and disposed of outside the site.

Community participation

Eighteen employees joined from the neighbouring communities of Kugluktuk and Ulukhaktok, representing approximately 30% of the workforce. They were actively involved in health and safety initiatives and mentoring.

Approximately $250,000 went to local Inuvialuit companies. Overall, some $4.1 million was injected into the economy. Any remaining equipment and consumables were demobilized in the community of Inuvik.

Public consultations in Sachs Harbour, Ulukhaktok and Inuvik presented employment and economic spinoff opportunities. CCE

Mould Bay Causeway Reconstruction, Prince Patrick Island, N.W.T.	
Award-winning firm (prime consultant):	Englobe, Laval, Que. (Alexandre Leclair, P.Eng.; Katheryne Budd; Jacquelin Marin; Mathieu Levesque; Benoit Lefebvre; Jeremy Houle; Johanna Huard).
Owner:	Environment and Climate Change Canada.
Other key players:	Stantec (consultant), Challenger Geomatics (surveyor), Algonquin Bridge (modular bridge supplier).

Specifier's Literature Review

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AWARD OF EXCELLENCE

BCIT North Campus Infrastructure Project

R.F. Binnie & Associates

Rain gardens and seating areas for students were added along the new English Walk.

As aging electrical infrastructure at the north campus of British Columbia Institute of Technology (BCIT) in Burnaby, B.C., neared the end of its serviceable life and posed a critical risk of failure, R.F. Binnie & Associates provided project management and acted as the owner's representative in delivering upgrades.

Consequently, BCIT became the first educational institution anywhere in Canada to earn an Envision award from the Institute for Sustainable Infrastructure (ISI).

Project management process

BCIT is one of the largest post-secondary institutions in its province, with ambitious plans for future growth. In 2015, however, a condition assessment of underground utilities found much of the existing infrastructure needed to be replaced. To address these findings, BCIT set up the North Campus Infrastructure Project (NCIP) to deliver a $50-million upgrade, ensure reliable power supply and distribution and establish a foundation for future development.

Binnie's project managers addressed business continuity (competing construction and cutovers without affecting scheduled campus programs, courses and services), safety (co-ordinating with BCIT's campus programs), risk management (tackling unknown conditions with underground infrastructure) and stakeholder management (extensive communications). On a regular basis, the team also needed to balance the benefits of additional, maintenance-deferring improvements against scope creep and increasing project costs. Binnie tracked risk items throughout the project while ensuring the budget could be maintained.

The project managers focused on creating personal connections with key stakeholders, meeting with each of them to understand their priorities, constraints and requirements relating to to their individual buildings and programs. This became an iterative process.

The teams successfully completed the project—including the installation of nine new electrical substations, 5.5 km of new linear infrastructure and corresponding streetscape and landscape improvements—several months ahead of schedule and on budget.

> "Sustainability seemed to be a major driver and, from a social point of view, the project improved campus life."
> –Jury

Integrated design

The project posed a high degree of difficulty in terms of completing the necessary scope within a short timeline while keeping the campus fully open and without affecting scheduled courses and activities. To address this challenge, BCIT and Binnie worked together to implement an integrated

design model for delivering the NCIP.

The goal was to accelerate the design process and mitigate constructability challenges by ensuring the early involvement of the general contractor. Indeed, Binnie worked with BCIT on a detailed request for proposals (RFP) to ensure the right general contractor was brought on board, based on expertise, capacity, innovation and value.

Earning the Envision Award

BCIT also wanted a positive impact on staff, students and local communities, which led to goals established through ISI's Envision framework.

Sustainability was front and centre. BCIT emphasized improving stormwater management (SWM) infrastructure, including the integration of rainwater gardens. There were also environmental benefits from efficient lighting and transformers.

The Envision framework measures sustainability in such categories as climate, resilience, nature, resource allocation, quality of life and leadership. ISI's design tools were used to identify sustainable approaches.

There were economic and social elements that contributed to meeting ISI's framework, such as increased campus walkability (covered walkways, new green spaces, an outdoor event/activity space and the transformation of English Street to English Walk), an improved streetscape (to accommodate pedestrians, cycling and vehicular traffic on Carey Avenue and Smith Street), improved operational efficiencies (reductions in unplanned maintenance costs) and alignment with the BCIT Campus Plan, BC Jobs Plan and BC Skills for Jobs Blueprint.

In 2019, the NCIP became the first educational institution in Canada to earn an Envision Award. It won at the gold level. CCE

BCIT North Campus Infrastructure Project, Burnaby, B.C.	
Award-winning firm (project manager):	R.F. Binnie & Associates, Burnaby, B.C. (Richard Bush, P.Eng. PMP, MBA; Jhonathan Martinez, P.Eng., PMP).
Owner:	BCIT.
Other key players:	Stantec (prime consultant), Pinchin (environmental and hazmat consultant).

AWARD OF EXCELLENCE

Vaudreuil VB 2022 – Phase I

HATCH

Rio Tinto sought an alternative to closing its Vaudreuil Works alumina refinery in Saguenay, Que., in 2022. The refinery is the largest centre of inorganic chemistry in Canada, converting bauxite into alumina, using the Bayer process, and storing discarded bauxite residue in a special residue disposal area (RDA).

Constrained by the RDA's capacity, the mining company engaged Hatch in 2016 for engineering, procurement and construction management (EPCM) services through to pre-operational verifications (POVs), from a prefeasibility study (PFS) to final project delivery, to either expand the RDA or open a new one, achieve filtered residue with at least 70% solids content and maintain the facility's operations.

The team delivered the project one month ahead of schedule and below the estimated cost, ensuring the plant's viability.

"This project will have positive, long-lasting impacts for the environment and become a global benchmark for the industry."
–Jury

Key priorities

With the RDA's capacity posing a constraint to the expansion of the operational life of the plant, the scope of the project's first phase—launched in 2018—involved transporting the residue via pipelines to a filtration facility and moving disposal to existing RDA sites by conveyor.

The entire plant's operations depended on timelines. Any delay in project implementation and any future operational issues would affect the refinery's production, due to its limited storage capacity for residue.

In June 2019, the client asked Hatch to accelerate the delivery of the first filtered residue, to assist operations. Once a detailed execution plan was workshopped, the first red mud was filtered on Oct. 24 of that year, four weeks ahead of the baseline deterministic schedule.

The budget was also important to the client. Hatch was awarded a mandate to complete the PFS with an incentive to reduce the project's total installed cost (TIC). The final cost was well below the approved budget.

Another key priority was zero harm. A customized health, safety and environment (HSE) mobile app was developed to simplify declarations while matching Rio Tinto's manage-

AWARD OF EXCELLENCE

With industrial filtration enabling dry stacking, the site's construction footprint was reduced.

ment systems.

Another initiative, the Stop and Seek program, encouraged employees to stop and ask for assistance when confronted with potential hazards. Participants were rewarded with a symbolic medal. For each medal, a donation was made to a local charity. In total, the program provided $32,450 to the community.

The results of these initiatives included no recordable or lost-time injuries for approximately 550,000 hours worked.

Environmental measures

The project involved a variety of environmental initiatives:

- Designing and delivering the work in compliance with environmental permits obtained from Quebec's ministry of the environment and the fight against climate change, which required conservation and protection of wetland environments and noise reduction throughout construction and for the new facility.
- Investing in compensatory measures by cleaning, developing and enhancing the Saint-Damien rangeland wetland, in accordance with the ministry.
- Providing a dedicated environmental resource on-site during civil works activities to ensure wetlands protection and compliance with soil and material management requirements.
- Promoting the vision with local contractors to deliver a successful project with no harm.

Bauxite residue dewatering

Bench tests, plant visits and research resulted in the selection of industrial filtration as the facility's new bauxite residue dewatering technique.

Filtration applies mechanical pressure to dewater bauxite residue, so it can be stored more easily. The technique has the advantage of allowing dry stacking to reduce the site's footprint, but also takes only 17 minutes, rather than the three years required for the previous storage process. And it is the most environmentally friendly technology in the alumina industry, to date.

Early filtration identified solids content of just over 73%, exceeding the minimum target of 70%. CCE

Vaudreuil VB 2022 – Phase I, Saguenay, Que.	
Award-winning firm (EPCM):	Hatch, Mississauga, Ont. (Sébastien Lévesque, Ing. (OIQ); Marc Dubois; Steeve Simard; Bruno Gauthier, Ing. (OIQ); Louis Barriere, Ing. (OIQ); Michel Bouchard; Franck David, P. Eng.; Philippe Orsini, Ing. (OIQ); Luc Lepage; Bernard Courchesne, P.Eng.; Guillaume Leblanc; Isabelle Lajeunesse, P. Eng.; Giacomo Corbo; Beatrice Nazui; Lérie Labrosse; Louis-Antoine Johnson, Ing. (OIQ); Stéphane Raymond, Ing. (OIQ); Joe Petrolito, M. Ing., PMP).
Owner:	Rio Tinto.
Other key players:	n/a.

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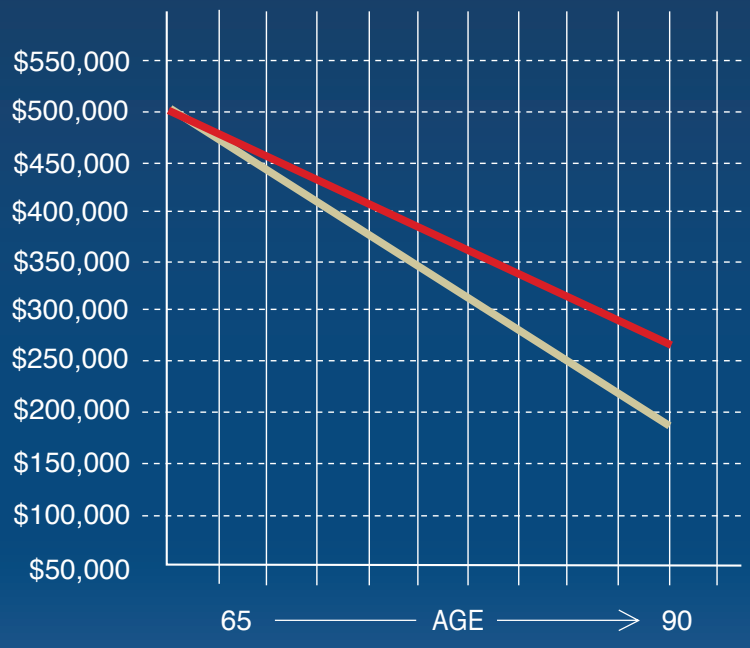

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