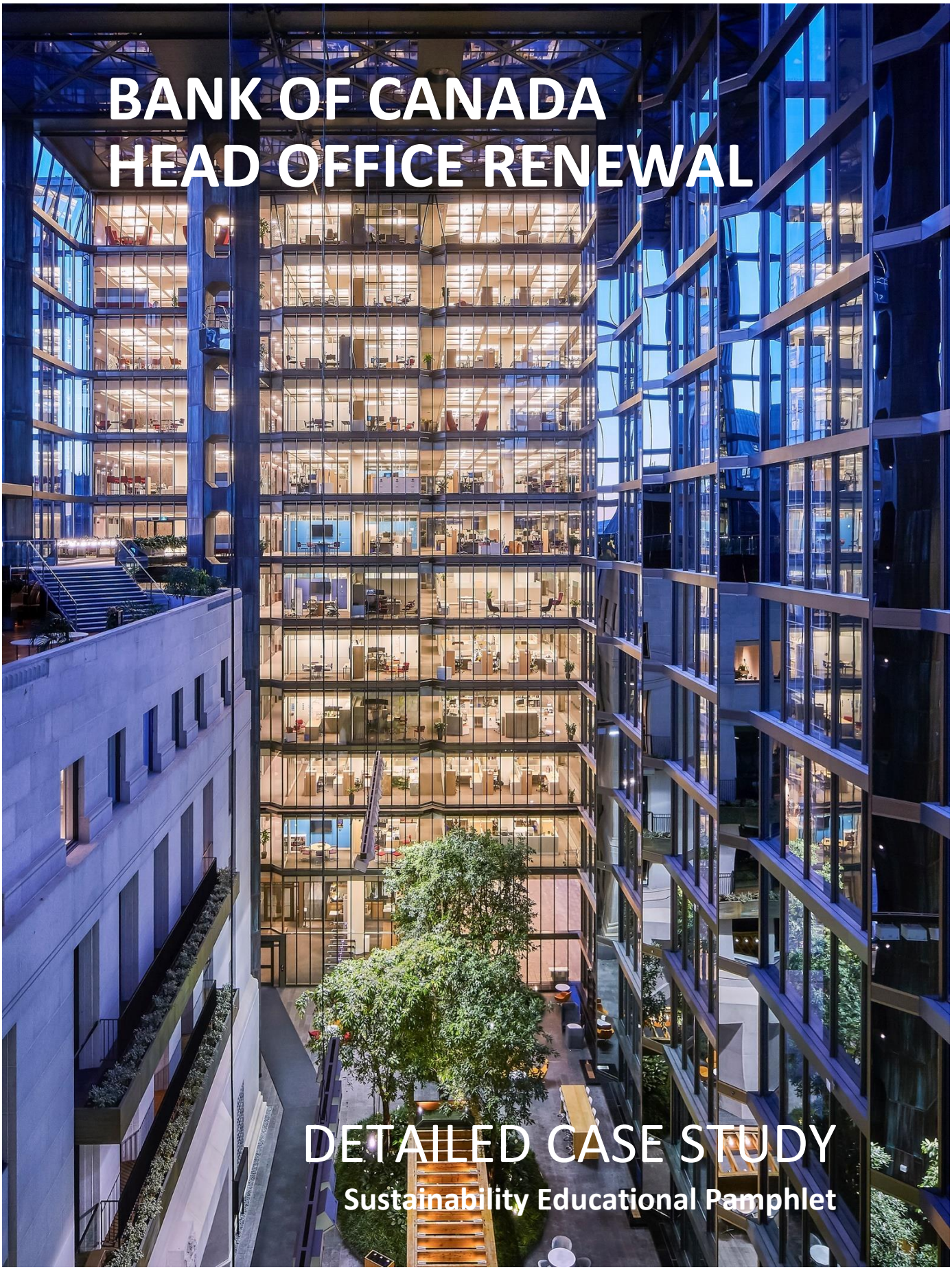


BANK OF CANADA HEAD OFFICE RENEWAL

DETAILED CASE STUDY

Sustainability Educational Pamphlet

1. Project Overview

The Bank of Canada Head Office is comprised of 856, 000 sf of offices and operation space located in downtown Ottawa, Ontario. The Bank was constructed over three major phases: an original structure in the 1930s; a major expansion, including two towers and a connecting atrium (1970s), and the Renewal project between 2012 and 2017.

Two of the major drivers for Head Office Renewal were to address performance and infrastructure deficits of the facility itself; and to modernize and elevate the Bank as a workplace. As of 2011, the facility at 234 Wellington Street was considerably out of alignment with contemporary code and life safety standards. In recent decades, seismologists have begun to recognize that the Ottawa region is a more active seismic zone than previously understood.

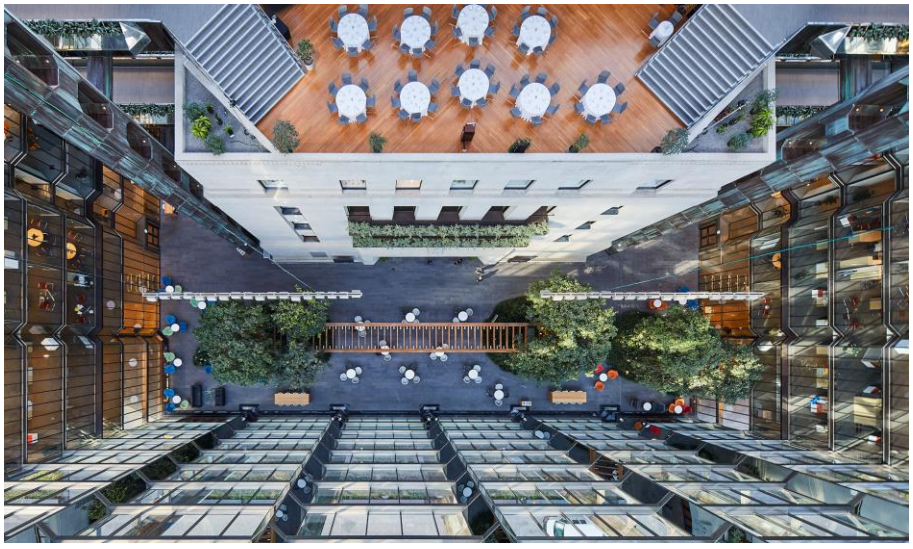
1. Ceremonial (Historic) Entry
2. East Tower Entry
3. West Tower Entry
4. Museum Entry
5. Courtyard
6. Loading
7. Winter Garden Atrium

As a result, the earthquake resistance of the building was about 40% of the contemporary code requirement. The building systems, such as fans, boilers, and generators, were at end of life and the distribution capacity of the systems had become insufficient over the years, as IT systems expanded and building code standards had increased. The building was not equipped with fire sprinklers, except in select areas. In a changing geopolitical context, the physical security of the Bank also required change.

The second driver for renewal was a programmatic need, recognizing that the Bank, as a physical workplace, had become obsolete. Both the quality and quantity of meeting space was insufficient for the highly collaborative workforce. Individual workspace was heavily biased to private offices.

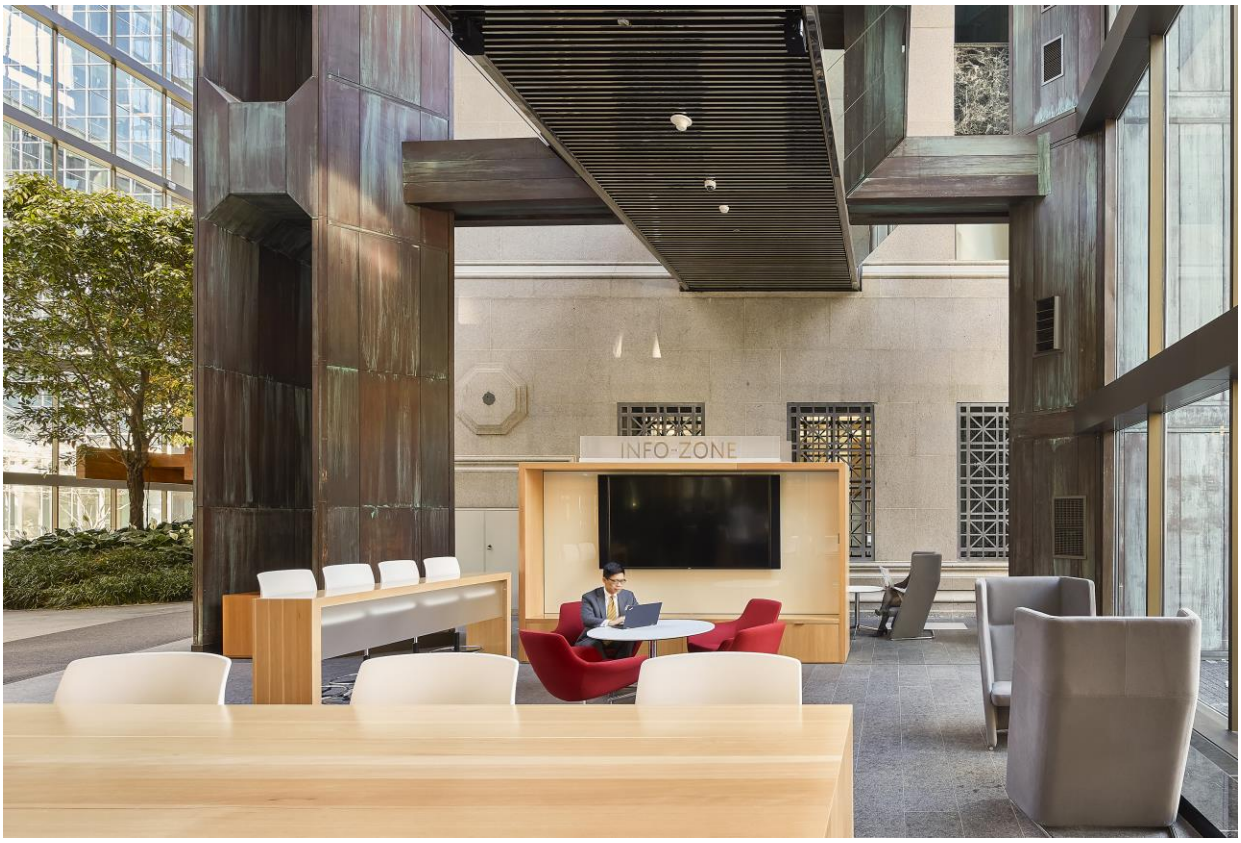
Accomplishing these objectives was essential if the building were to remain relevant as a workplace and the home of Canada's foremost financial institution. Within the twin office towers the floor plates were restored to their original, largely open concept, removing generations of improvised and incongruent partitioning. Seismic upgrades were accomplished “invisibly” by reinforcing the cores of the towers, installing deep rock anchors below the existing foundations, and by reinforcing the distinctive waffle slab structure. The core of the Centre Building was also rebuilt. Systems upgrades were achieved through discrete means using the latest technology to ensure that the exposed structure of the towers remained as Ericson had intended. To achieve this, the design team leveraged the skills of all disciplines. To minimize ductwork, a “dynamic buffer zone” and radiant cooling system were added to address principal heating and cooling needs. This allowed ducts to be sized for ventilation only. The radiant panels conceal this optimized ductwork within the coffers, as well as the retrofitted sprinkler piping. The extensive power and data cabling needs to the modern office are served through a low-profile access floor that promotes long-term flexibility.

To renew the facility as a workplace, the design team developed a modular office design that works with the concrete coffer system. Although rigorous, the planning module allows for a diverse range of enclosure options so that each tower floor has the combination of private offices and collaborative areas to suit its unique requirements. Office partitions and open workstations are constructed with systems furniture to facilitate simple reconfiguration over time.



Robust conference facilities are provided on the lower levels of Centre Building and in a new multi-purpose conference center on B1 East.

Programmatically the opening of the office floor plates was afforded by consolidating meeting and conferencing functions in the Bank's ground floor and lower levels. This approach animates the building's lower levels and allows a controlled approach to meeting with external guests. The ground floor is characterized as a fluid landscape of spaces for collaborative work and conferencing. In the base of the east tower, the Knowledge Centre provides access to a variety of media sources including print and digital media. In the base of the West Tower, the "Kiosk" offers technology support. Within the original Winter Garden Atrium, a variety of collaborative work scenarios are supported including a Café which provides food, beverage and social interaction. A media area in the atrium supports presentations and consumption of digital media. A variety of meeting rooms and conference spaces are located on the ground and second level of the original 1930's era Bank structure, directly accessible from the atrium.



2. Pursuit of LEED Certification

This project is currently pursuing CaGBC Leadership in Energy and Environmental Design (LEED®) Building Design and Construction 2009. This initiative was established at the very beginning, and Perkins+Will incorporated sustainability consulting and tracking as part of the services.

Under LEED 2009, there are 100 possible base points distributed across six credit categories:

1. Sustainable Sites
2. Water Efficiency
3. Energy and Atmosphere
4. Materials and Resources
5. Indoor Environmental Quality
6. Innovation in Design

Up to 10 additional points may be earned: four additional points may be received for Regional Priority Credits, and six additional points for Innovation in Design (which includes exemplary performance credits for existing credit categories).

Buildings can qualify for four levels of certification:

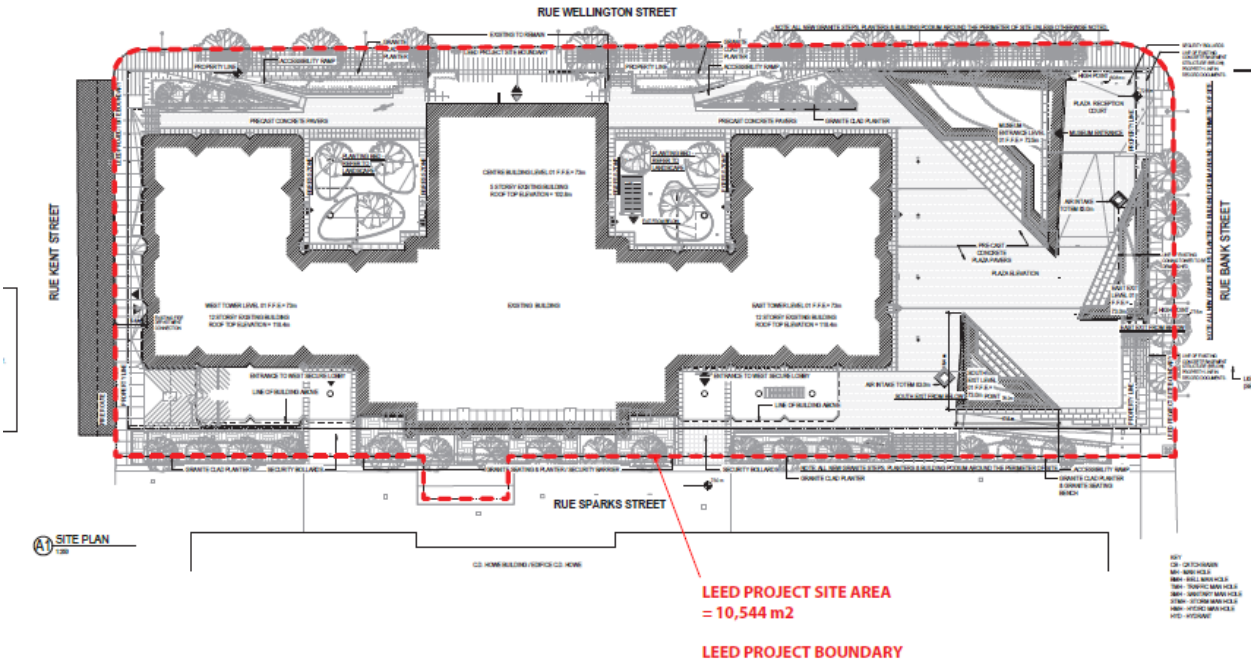
- Certified: 40–49 points
- Silver: 50-59 points
- Gold: 60-79 points
- Platinum: 80 points and above

Each of the performance credits was carefully evaluated when developing the LEED certificaiton strategy for this project, based on the potential environmental impacts and human benefits of each credit. Only the credits which were most suitable and offered the greatest value were selected for this project.

This project is targeting LEED Gold certification.

3. LEED Boundary

A LEED Boundary was established for this project to remain consistent when designing and tracking measures for this project.



4. Storage + Collection of Recyclables

The Bank of Canada undertook a major renewal of its Head Office between 2013 and 2016. The project's first phase was completed in November 2016 and staff were greeted to a modern building when they moved into the spaces starting January 2017.

The Bank of Canada's office is a 79,538 square meter office building with 41.2 square meters which are dedicated to the collection and storage of recycling, located adjacent to the loading dock. In conjunction with the recycling hauler, we have calculated that our office generates approximately 5.0 metric tons of recycled and 0.75 metric tons of composting per month.

Our recycling consists predominantly of paper, but we also have single stream recycling that accommodates five waste streams, paper, cardboard, plastic, metal, and glass. There are two 2-yard bins for cardboard and six 95-gallon bins for recycling. These bins are accessible by both the janitorial services that collect recycling from all floors of the building daily, and the recycling hauler that also picks up these items daily.

On a typical tower floor in the building, there are three recycling collection facility, one in each hallway and a third in the kitchen area. In addition, each workstation has a bin dedicated to paper recycling to provide ease and accessibility of recycling to the employees at their desks. Furthermore, a composting program is in place where compost is collected in each washroom (paper towels), the main kitchen area which prepares food for the cafeteria, coffee shop and catering, and the compost bin located in the cafeteria which is accessible to all staff. Composting is stored in the same room as waste and recycling is collected daily.

5. Building Reuse

The renewal of the iconic Bank of Canada's Head Quarter's building required extensive renovation to maintain today's safety and security standards, as well as modernize the workplace. History was important, the process was careful to preserve restore the architectural features that make the building unique, such as the traditional interiors of the classical 1938 Centre Building, and Arthur Erickson's beautiful atrium and glass office towers from the 1970s. Erickson's design was inspirational, and provided ques and ideas that are in sync with priorities of current time, such as fluid flow of daylight into interior spaces. Also incorporated ideas of bringing greenery and nature into the interior environment that is important to the occupant wellbeing and comfort, connecting them to nature. Maintaining as much of the structure and feel as possible was critical. This created symbolic spaces where people can work and collaborate as needed and define their vision as an institution.

The project has made widespread use of existing materials in the complex. The entire load-bearing structure has been reused, with some modifications to the lateral-resisting system to meet modern seismic 2 requirements. The podium roof at the Bank of Canada Plaza was also reconstructed to relocate the museum to the East side of the B1 Level, with direct access from the podium roof. Otherwise, reuse of structure included the majority of columns, structural walls, suspended slabs and slabs on grade.

The building's enclosure has been almost entirely retained, including curtain wall systems on both towers and the atrium, and the stone veneer and masonry backup walls comprising the exterior of the historic Centre Building. There were two major reasons for retaining the enclosure. For the Centre Building, the reason was simple; there was no alternative considered, as the enclosure was recognized by the Bank as a historically significant exterior.

The other reason related to the decision to maintain the curtain wall of the towers and atrium. This decision was based on the life cycle cost considerations of the existing curtain wall, which had recently been replaced. By creating a dynamic buffer zone on the interior of each tower floor, the design team was able to introduce a mechanical solution that managed the heat loss and heat gain related to the existing curtain wall, with a much lower capital cost than the upgrading of the curtain wall itself. The related energy performance of the mechanical solution also proved to be an optimal approach from the viewpoint of long-term energy cost.

On the towers, the roof system was replaced over the existing roof deck. The existing copper mansard roof was retained on the Centre Building, again for historical reasons. Select historic interiors in Centre Building were retained, including walls, ceilings, and flooring, as well as interior stone carvings and woodwork. The glulam pergola in the atrium was protected in place and restored. A small amount of mechanical systems were retained, mostly comprised of the storm drainage system. Other systems were replaced in their entirety to meet the performance requirements of a modern office building and because most systems were at the end of their service life.

Online Video which explains the overall project, along with reasoning of building reuse:
https://www.youtube.com/watch?v=AaOQfmXOkOQ

6. Water Savings

According to Canada Green Building Council, Canadians consumption of the public water supply continues to increase. Municipal water intake is the primary source of water for most buildings, Canadians are still one of the largest consumers of water among OECD countries.

Using large volumes of water increases maintenance and life-cycle costs for building operations and increases consumers' costs for additional municipal supply and treatment facilities. Conversely, buildings that use water efficiently can reduce costs through lower fees, less sewage volume, reductions in energy and chemical use, and lower capacity charges and limits.

Efficiency measures can easily reduce water use in average commercial buildings by 30% or more. Depending on local water costs, utility savings can be tens of thousands of dollars per year.

The *LEED® Canada for New Construction* and *LEED Canada for Core & Shell* Water Efficiency (WE) prerequisites and credits encourage the use of strategies and technologies that reduce the amount of potable water consumed in buildings. Many water conservation strategies are no-cost; or provide a rapid payback.

The following is a summary of potable water savings achieved on this project, based on LEED credits and calculations.

1. Prerequisite 1 and credit 3 of the Water Efficiency section encourage increasing water efficiency within buildings to reduce municipal water consumption. As part of the Head Office Renewal project, the water consuming equipment in the building are chosen for efficient water management.

2. The plumbing fixtures installed in the building have the following specifications:
   - Toilets: 4.8 liters per flush (1.1 GPF)
   - Urinals: 0.5 liters per flush (1/8 GPF)
   - General use washroom lavatories: 1.9 LPM (0,5 GPM)
   - Barrier-free washroom lavatories: 3.8 LPM (1 GPM)
   - Kitchenette sinks: 6.8 LPM (1.8 GPM)
   - Showers: 5.7 LPM (1.5 GPM)

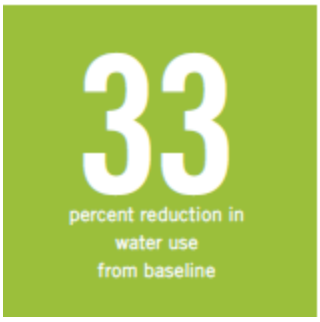
3. The building is divided in three different parts:
   - Center Building: This area contains primarily offices and conference rooms
   - East and West Towers: These towers contain mainly offices and conference rooms
   - Basement Levels: These levels include a gymnasium and fitness area, a museum, security, building management, housekeeping, horticulture, a vault area and a food services facility

4. In this building, there are 1437 full-time equivalent (FTE) occupants. The number of transient occupants is estimated at 303 per day. The number of gym users is approximately 500 per day. The gym is strictly reserved for the Bank of Canada employees.

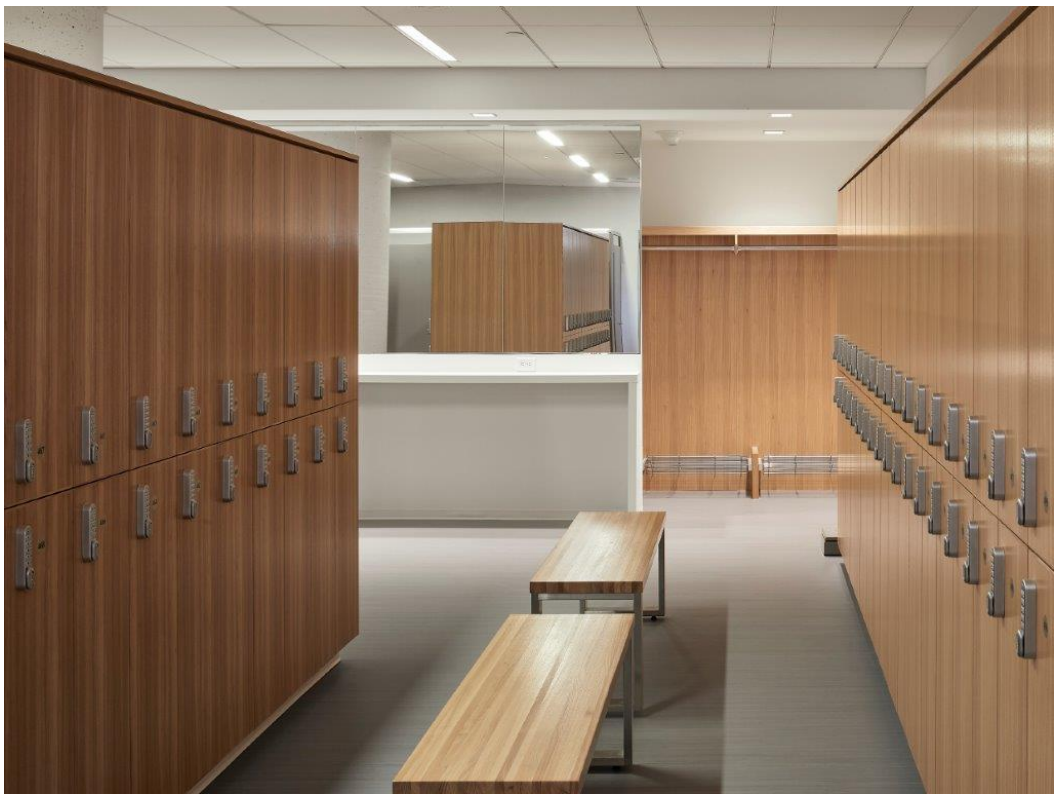
5. We assume that the population in the building is comprised of 50% male and 50% female occupants.

6. To calculate the total number of shower uses per day, first we consider that 10% of the FTE occupants use the showers daily (Table 2A in the Guide reference, section WE prerequisite 1). In addition, 35% of the 500 daily gym users will also use the showers. Thus, we consider a total of 350 shower uses per day (10% of 1437 FTE + 35% of 500 gym members = 319 uses per day), which equates to approximately 20% of the 1437 FTE occupants.

7. Concerning the barrier-free washroom lavatories, we assume that 1% of the FTE occupants and transients require this type of installation. This value is based on the statistic that in Canada, 1% of the population use wheelchairs. We also assume that a certain number of non-wheelchair users will also use these washrooms. For this reason, we calculate that a total of 5% of the FTE occupants and transients will use the barrier-free washrooms.



8. Accordingly, the potable water use reduction is **33%**.



7. Indoor Environmental Quality

LEED EQp1 minimum indoor air quality performance must conform to ASHRAE 62.1-2004. The present document summarizes the compliance to diverse sections of this standard:

Section 4 – Outdoor Air Quality:

The building is located in Ottawa. The contaminants measured are O_3, $PM_{2.5}$, NO_2, CO and SO_2. The concentration level measured hourly are not alarming and are under the norms established by the EPA. The table below demonstrates the levels measured. The sampling results were taken from the downtown station of Ottawa and can be consulted on this following site http://www.qualitedelairontario.com/. Near the building, there is no existing neighbors emitting contaminants that could alter the actual data.

Pollutant	Concentration in 1 hour
O_3	41 ppb
$PM_{2.5}$	2 µg/m^3
NO_2	3ppb
CO	.19 ppm
SO_2	0 ppb

Section 5 – Systems and Equipment:

Paragraphs 5.3 and 5.7 – There are no contaminants generated by equipment therefore there is no need for local capture of the contaminants nor the need of exhaust ducts that convey potentially harmful contaminants elsewhere.

Paragraph 5.5 **-** Unless indicated otherwise, the ventilation ductworks are made of galvanized steel, equipped with acoustic insulation or thermal insulation when needed. All of these surfaces comply with the requirements of resistance to mold growth and erosion. The exhaust ductworks for the kitchen are in welded black steel while the exhaust for the dishwasher are in stainless steel.

Paragraph 5.6 **-** The outside air intakes are designed to respect the minimum separation distance found in table 5.1 of the standard: the principal louvers, the bird screens and the access door to facilitate the cleaning. The dimension of the louvers is designed to have less than 500 ft/min air speed to avoid the possibilities of water or snow washouts.

Paragraph 5.8 - The combustion appliance of the thermal power plant is supplied with fresh air by a dedicated mechanical ventilation. The combustion gas of these appliance, in addition to the direct fired jet units dedicated to the compensated air of the kitchen extractor, are evacuated directly outside through chimneys.

Paragraph 5.9 - The filtration sections of the air treatment units have prefilters of MERV 8 minimum efficiency and some of them have a cartridge filter of MERV 13 efficiency. The decentralized systems like the heat pumps have filters of MERV 8 efficiency. For the kitchen extractor, the compensated outside air is filtered by MERV 8 filters. The filters efficiency complies with the ASHRAE 52.2-1999 norm.

Paragraph 5.10 - The design of the air conditioning systems respects the criteria established by the ASHRAE Fundamentals for a condition of 0.4% in conditioning and 99.6% in heating by using the meteorological data of the nearest station. In the conditioned zones, the HVAC systems are always designed to maintain a maximum of 80% humidity. The overall air balancing of the building is maintained at positive pressure to avoid air infiltration even if some rooms are in negative pressure.

Paragraph 5.11 and 5.12 - All drain pans are triple sloped within unit and fully drainable and condensate drains are installed with slopes without sag minimum 1% to ensure no standing water. The intermediate drain pans are installed to allow for cleaning and removal of each coil individually, without any damage to the unit's casing. All single or multiple rows coils are equipped with an access door no less than 18 in. to allow cleaning if needed.

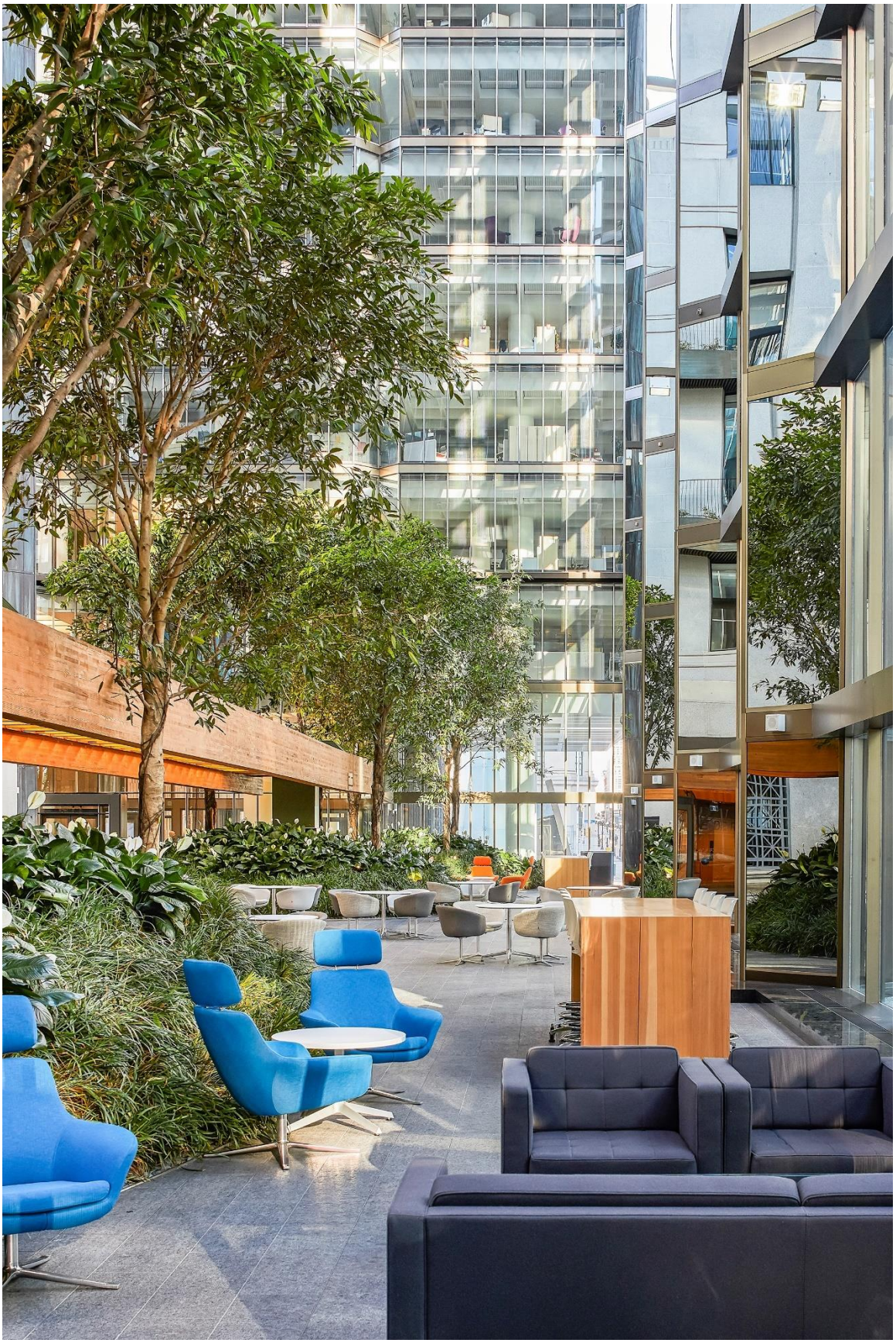
Paragraph 5.13 - Water used for humidification steam system comes from a softened water network and the nozzles have been installed at a distance that take in consideration the absorption distance.

Paragraph 5.14 - The air handling units are equipped with access doors of width no less than 18 inches and their installation allow maintenance and adequate cleaning of each component. The decentralized equipment is easily accessible to facilitate the maintenance and the replacement of the filters.

Paragraph 5.15 - The building envelope is higher in resistance than those established by the actual operating codes. The systems conveying cold substances are isolated and equipped with vapor barrier.

Paragraph 5.16 – Not applicable. There is no attached parking garage.

Paragraph 5.17 – The air admitted to the zones is considered as Class 1 for air with low contaminant concentration, low sensory-irritation intensity, and inoffensive odor. The air admitted in most zones are recirculated. The conference rooms, the private offices, the atrium, the Noel Terrace and many areas of the basement are supplied by systems with 100% fresh air. Exhaust air is designed for the washrooms, the janitor rooms and the electrical rooms.



8. Outdoor Air Delivery and Monitoring

The objective of LEED EQ Credit 1 of the category ‘‘Outdoor Air Delivery Monitoring’’ is to ensure that ventilation system monitoring can promote occupant comfort and well-being, notably in terms of air quality. The design strategy enabling the control of outside air delivery responding to the requirements of the credit is described here.

In general, the following strategy has been applied:

- For densely occupied spaces, the project will provide CO2 monitors generating an alarm to the automated system controls and transmitted to the building operator when the conditions vary by 10% or more from the setpoint.
- For non-densely occupied spaces, direct outdoor airflow measurement will be provided with an accuracy of plus or minus 15% of the design minimum outdoor air rate.

For the building automated systems, the CO2 transmitter has a detection range of 0 to 2000 ppm with a 3% accuracy and time-response of under 60 seconds. The CO2 set point that shouldn’t be exceeded is of 1000 ppm, as required by the guidelines of LEED Credit Interpretation Request no. 14, which allows to fix the default value of CO2 of the outside air at 400 ppm for an urban zone. Thus, the limit is fixed for a maximum differential of 600 ppm between the interior and the exterior. These probes issue an alarm to the building automated system when the level of CO2 surpasses the indicated limit (see the building automation & integration – field control devices section 2.3 and section 3.7).

9. Indoor Environmental Comfort

Thermal Comfort – Conformance to ASHRAE 55-2004

The present narrative describes the hypothesis used for the thermal comfort calculations, which demonstrates the conformance to the ASHRAE 55 norm.

Conditions in cooling and heating

The conception of the cooling air systems respects the criteria established in ASHRAE Fundamentals for a condition of 0.4% in cooling and a condition of 99.6% in heating by using the meteorological data of the nearest station. In the cooling zones, the HVAC systems are designed to maintain a maximum of 80% of relative humidity at all times.

Surfaces Temperature

The surfaces like the walls, the flooring and the ceiling are considered at the same temperature than the ambient temperature. The following table presents the envelope characteristics.

The temperature at the middle of the windows have been evaluated to 19 °C for an outside temperature -29 °C, and of 20 °C for an outside temperature of 32 °C. The ambient temperature is maintained at 22 °C for the occupants near the windows. Below are the characteristics of the envelope.

Characteristics of the Envelope		
Description	RSI (m^2K/W)	Shading Coefficient (SC)
Curtain Wall – Ground and Mezzanine	2.0	0.16
Curtain Wall – Other levels	2.44	0.27
Existing Windows – Centre Building	2.5	
Interior Windows – DBZ (12mm clear)	1.47	0.69
Skylights	1.35	0.42
Exterior Walls	20.4	-
Roofs	33.3	-

Thermal Comfort: Survey

To meet the requirements of credit IEQc7.2 LEED NC-2009, the owner submitted to the CaGBC a commitment letter indicating that a survey on thermal comfort will be distributed amongst the occupants and that corrective measures will be established in the case of an insufficient satisfaction rate.

SAMPLE: Thermal Comfort Survey

This anonymous survey assesses staff and occupant comfort in the Bank of Canada Head Office. Your response assists the building's Operation and Maintenance staff learn more about where the building needs improvement, and where it is performing well. The long-term vision for the building includes energy efficient spaces with good indoor environmental quality, in which all staff and occupants can work comfortably.

This survey is part of data-gathering for the building's Operation and Maintenance team, which will lead the way to cost savings, improved environmental impact and enhanced staff comfort and wellness. Thank you for your participation.

Section 1 - Background Information

Note, if you have more than one area you spend your time, please respond based on the area you're currently in.

1. Which area do you spend most time in?

   ☐ Library ☐ Gymnasium ☐ Pool ☐ Fitness Area

   ☐ Fitness Studio ☐ Office Area ☐ Lobby ☐ Multipurpose Rooms

2. Does the area you spend most time in have windows? If so, check applicable direction(s).

   ☐ North ☐ South ☐ Northwest Corner

   ☐ East ☐ West ☐ Northeast Corner

   ☐ Southwest Corner ☐ Southeast Corner

3. Which of the following do you use to adjust or control in your environment? (check any that apply)

   ☐ Window blinds or shades ☐ Thermostat ☐ Portable heater

   ☐ Room air-conditioning unit ☐ Portable fan ☐ Ceiling fan

   ☐ Adjustable air vents ☐ Windows ☐ Other

   If other, please describe _____

4. What articles of clothing are you wearing currently? (check any that apply)

   ☐ Trousers ☐ Shorts ☐ Sweatpants ☐ Jeans ☐ Leggings

☐ Skirt ☐ Nylons ☐ Long-Sleeve Shirt ☐ T-Shirt ☐ Tank Top

☐ Sweatshirt ☐ Sweater ☐ Vest ☐ Jacket ☐ Blazer

☐ Socks ☐ Sneakers ☐ Dress Shoes ☐ Boots ☐ Sandals

5. What activities do you partake in within your environment? (check any that apply)

☐ Sitting ☐ Standing ☐ Light Walking ☐ Brisk Walking

☐ Running ☐ Fitness Class ☐ Weight Lifting ☐ Labour Work

Section 2 – Comfort Assessment

The following questions refer to the current conditions/ your comfort level at the time you are completing this survey.

Date: _____ *Approx. Temperature Outside:* _____

Time: _____

	Very Dissatisfied	Mostly Dissatisfied	Somewhat Dissatisfied	Neutral	Somewhat Satisfied	Mostly Satisfied	Very Satisfied
Temperature/Thermal Comfort	☐	☐	☐	☐	☐	☐	☐
Background Noise/Acoustical Comfort	☐	☐	☐	☐	☐	☐	☐
Lighting Comfort/Quality	☐	☐	☐	☐	☐	☐	☐
Building Cleanliness	☐	☐	☐	☐	☐	☐	☐
Air Quality	☐	☐	☐	☐	☐	☐	☐

Please use this space to further describe any areas marked as dissatisfied:

_____

_____

Would you like maintenance staff to follow up with any issues noted above?

☐ Yes ☐ No

If yes to the above, please include your email address here:_____

Section 3 – Seasonal Comfort, Winter and Summer

The following questions refer to your general perception of thermal comfort in your office throughout the winter and summer months.

1. In the winter months, how satisfied are you with the temperature in your area?
   - ☐ Very Satisfied
   - ☐ Mostly Satisfied
   - ☐ Somewhat Satisfied
   - ☐ Neutral
   - ☐ Somewhat Dissatisfied
   - ☐ Mostly Dissatisfied
   - ☐ Very Dissatisfied

   a) If you are dissatisfied, would you describe the temperature as too hot or too cold?

   ☐ Too Hot ☐ Too Cold

   b) If you are dissatisfied, do you feel like you have to use a personal fan or space heater to stay comfortable? (check all that apply)

   ☐ Space Heater ☐ Personal Fan

2. In the summer months, how satisfied are you with the temperature in your office?
   - ☐ Very Satisfied
   - ☐ Mostly Satisfied
   - ☐ Somewhat Satisfied
   - ☐ Neutral
   - ☐ Somewhat Dissatisfied
   - ☐ Mostly Dissatisfied
   - ☐ Very Dissatisfied

   a) If you are dissatisfied would your office describe the temperature as too hot or too cold?

   ☐ Too Hot ☐ Too Cold

   b) Do you ever use a personal fan or space heater to stay comfortable? (check all that apply)

   ☐ Space Heater ☐ Personal Fan

Section 4 – Quality of Space

The following questions refer to your general perception of the quality of your office space.

1. How satisfied are you with the quality of your area of work?
   - ☐ Very Satisfied
   - ☐ Mostly Satisfied

☐ Somewhat Satisfied ☐ Mostly Dissatisfied

☐ Neutral ☐ Very Dissatisfied

☐ Somewhat Dissatisfied

2. Can you see out of a window from area of work when seated?

   ☐ Yes ☐ No

3. Do you consider your workspace to be well day-lit?

   ☐ Yes ☐ No

4. Do you have windows that open?

   ☐ Yes ☐ No

5. Is the temperature control in your space user friendly and clear?

   ☐ Yes ☐ No

6. If you are dissatisfied with quality or your environment, what are the reasons?

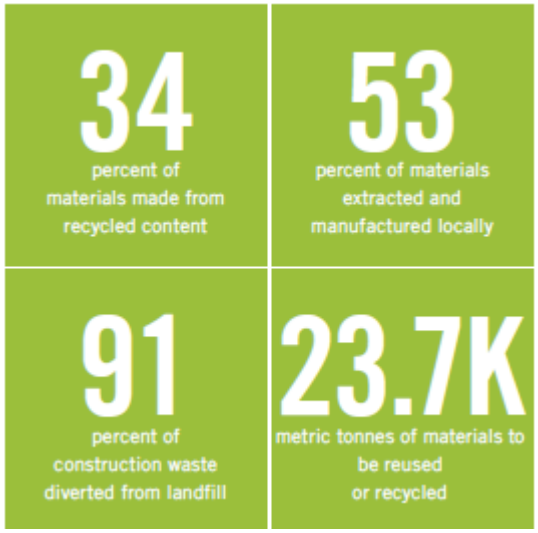
   ☐ Too Small ☐ Low Daylight ☐ No Windows

   ☐ Windows don't open ☐ Too Stuffy/ Poor Air Quality

   ☐ Poor lighting quality ☐ Acoustic Quality

10. Materials & Resources

According to the Canada Green Building Council, materials selection plays a significant role in sustainable building operations. During the life cycle of a material, its extraction, processing, transportation, use, and disposal can have negative health and environmental consequences, polluting water and air, destroying native habitats, and depleting natural resources. Environmentally responsible procurement policies can significantly reduce these impacts. Consider the relative environmental, social, and health benefits of the available choices when purchasing materials and supplies. For example, the purchase of products containing recycled content expands markets for recycled materials, slows the consumption of raw materials, and reduces the amount of waste entering landfills. Use of materials from local sources supports local economies while reducing transportation impacts.



The Bank of Canada's Head Office features:

Diverting Construction Waste from Landfill:

Over **91%** of construction waste on this project has been diverted from landfill (that's over 23,000 metric tons of waste diverted). Construction and demolition generate enormous quantities of solid waste, this was mitigated on this project through a comprehensive Construction Waste Management Plan, working through dedicated and committed trades and waste haulers, recyclable materials were recovered and redirected back to the manufacturing process.

Use of Recycled Content in Construction Materials:

This project has achieved **33.04%** recycled content of materials, by cost. The top five major contributors of Recycled Content on this project were the following:

1. Structural and Miscellaneous Steel (75% recycled content)
2. Metal Doors and Frames (75% recycled content)
3. Steel Studs and Tracks (88.5% recycled content)
4. Access Flooring System (41% recycled content)
5. Carpet (44.5% recycled content)

Reduction in Landfill Waste: One of the biggest environmental problems we face is having very limited space in landfills. Space at landfills is limited and efforts must be taken to divert resources that we can be reused. Not only will materials occupy significant room without ever breaking down, but they could also be reused for something else in the future. By working with recycled materials

like these, this reduces the amount of bulk waste that entering our landfills and rather acts as a part of the solution.

Sourcing materials with recycled content: Purposely selecting materials with recycled content reduces the amount of materials that would have otherwise been destined to landfill. In addition, Earth does not have an unlimited supply of raw materials and resources required to produce virgin material. Each time new materials are generated without the use of recycled content, the more we are depleting our finite, natural supply. Embracing the concept of recycling these materials right now will help to ensure that we reduce the depletion of raw resources and maintain a supply for future generations. Use of recycled materials protects the earth and ensures that we, and all those who come after us, will be able to continue to develop these materials.

Use of Regionally Sources Construction Materials:

53.8% of all construction materials by cost was locally sourced. This ensures the use of local materials and reduces the transportation demand of materials across long distances.

- Local = extracted and manufactured within an 800KM radius of the project if shipped by road
- Extracted and manufactured within 2,400KM if shipped by rail or water

According to the Canada Green Building Council, the use of regional building materials reduces transportation activities and associated pollution. Trucks, trains, ships, and other vehicles deplete finite reserves of fossil fuels and generate air pollution. It also is important to address the source of raw materials used to manufacture building products; some are harvested or extracted far from the point of manufacture, also contributing to air and water pollution associated with transportation.

Supporting Environmentally Responsible Forest Management:

This project uses over **80%** of all wood-based construction materials which are sources from responsible forests, bearing the FSC certification. Forest Stewardship Council certified 'FSC' forests are managed with consideration for people, wildlife and the environment. The FSC label ensures that trees which are harvested, are replaced or allowed to regenerate naturally.

According to the Canada Green Building Council, the negative environmental impacts of irresponsible forest practices can include forest destruction, wildlife habitat loss, soil erosion and stream sedimentation, water and air pollution, and waste generation. The Forest Stewardship Council (FSC) standard incorporates many criteria that contribute to the long-term health and integrity of forest ecosystems. From an environmental perspective, the elements of responsible FSC-certified forestry include sustainable timber harvesting (i.e., not removing more timber volume than replaces itself over the cutting interval, or rotation), preserving wildlife habitat and biodiversity, maintaining soil and water quality, minimizing the use of harmful chemicals, and conserving forests of high conservation value (e.g., endangered and old-growth forests).