



2018 CANADIAN CONSULTING  
ENGINEERING AWARDS

# The City of Calgary Composting Facility

Category A - Buildings





## The City of Calgary Composting Facility

The first and largest of its kind in Canada, the Calgary Compost Facility processes over 145,000 wet tonnes of organic waste and biosolids, diverting 85 million kilograms from landfills per year by converting it into a marketable product—compost. Stantec’s interdisciplinary team—mechanical, electrical, structural, architectural and sustainability—designed the complex systems and the structure housing them, bringing this benchmark project to life and changing how Calgary processes its waste.



# Project Highlights

## Q.1 INNOVATION

In Calgary, nearly 60% of single-family household garbage is made up of compostable waste—Calgary Compost is designed to convert that waste into a viable product. This new facility comprises a processing facility, curing building, and storage building, and accepts up to 100,000 tonnes of organic waste from households around Calgary and up to 45,000 tonnes of biosolids from the Bonnybrook Wastewater Treatment Plant per year. Both are converted to a Category A compost rating from the Canadian Council of Ministers of the Environment (CCME) which be used in any application, including agriculture, residential gardens, and parks.

Following a “design-build-operate” model, the contractors and operational staff were engaged at earlier in the project cycle compared to a traditional “design-bid-build” model. This allowed the integrated team to constantly collaborate on design, constructability, and operability. Stantec’s engineering and architectural teams modeled every component of the building, allowing for advanced Building Information Modeling (BIM) coordination, reducing construction risk through proactive clash detection.

The composting process is highly automated, only requiring a maximum of eight (8) operators within the facility, minimizing exposure to hazardous material. All processes can be controlled digitally through local, interconnected touch screens allowing the operators to remotely control any part of the facility from any screen. During the exothermic decomposition process, the process vessels reach very high temperatures. To take advantage of this heat, ventilation air for the facility is fed over the process vessels, where radiant heat preheats the air prior to delivery within the building.

Stantec implemented many innovative systems to meet and exceed the City’s stringent odour requirements. All air within the vessels, process and curing buildings are captured and routed to 10,000m<sup>3</sup> of biofilter for treatment by odour-eating microorganisms prior to releasing the air. Airflow within the building was tightly designed and controlled using negative pressurization, air curtains, and fast acting equipment to maximize containment.

To remove ammonia in exhaust process air, the air is fed through a scrubber system that converts the ammonia to aqueous ammonium sulfate, which is typically a disposable waste product in other compost and waste treatment facilities. We implemented an innovative process in which the ammonium sulfate is collected, neutralized, and boiled, crystalizing the waste acid. When crystalized, ammonium sulfate is a valuable soil fertilizer that can be used or sold.



## Q.2 COMPLEXITY

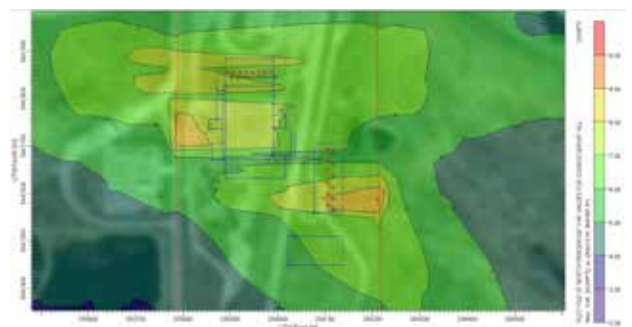
The facility was constructed under a compressed schedule, requiring concurrent design and construction. The contract was awarded in mid-2015 and substantial completion was achieved on schedule just two years later in June 2017 through the collaborative efforts of the integrated team.

Shallow structural foundations were initially considered, but with a tight timeline with winter approaching, this would have been challenging. Ultimately, a mixture of driven steel piles was employed in combination with shallow type foundations throughout the facility, minimizing the amount of soil to be excavated and allowing two foundations crews to work independently.

Heavy wear from loader traffic in many areas required additional slab reinforcement. With in-slab mechanical systems, providing steel reinforcements proved difficult. To reduce the conventional steel required, all slabs were instead fitted with light-weight polypropylene filaments to improve the resilience of the concrete.

Minimizing odour impact on surrounding communities was a key design focus for Stantec. The odour was extensively modeled to ensure the levels were kept low within the plant and surrounding area. The air is strategically contained and circulated through mechanical design and technologies and treated in a biofilter prior to release to the environment.

Hazardous run-off called leachate is produced as a product of the composting process and is harmful if released to the environment. To minimize the potential of an environmental release, the leachate, along with greywater from sinks and showers is fully reused within the composting process.





### Q.3 SOCIAL AND/OR ECONOMIC BENEFITS

The first and largest of its kind in the country, the Calgary Compost Facility has greatly impressed clients and municipalities around Canada, cementing Calgary's reputation as a national leader in innovation and sustainability. Through the Green Cart program, the City of Calgary has already begun collecting compostable material from all 320,000 single-family homes for use in the composting facility. Fluctuations in the levels of organic waste to the material are offset throughout the year using up to 45,000 tonnes dewatered biosolids from the Bonnybrook Wastewater Treatment Plant. The composting process within the facility reduces the pathogens within the organic waste and biosolids and results in a valuable commodity to be used and sold by the City. The produced compost will be used to enrich the soil in local farms, parks, and gardens that sustain communities around Calgary and Alberta. While some of the compost will be made available to Calgarians free of charge, the majority will be sold to offset the costs of the program.

The Calgary Compost Facility Education Centre, the facility offers a variety of educational programming and tours for the public and school groups from ages 9-18. The educational programs provide the opportunity for students and the public to learn about topics like city waste diversion programs, composting, and how to reduce personal waste. These educational programs are in high demand and were fully booked in the 2017/18 school year and expected to be in 2018/19.



#### Q.4 ENVIRONMENTAL BENEFITS

The Calgary Compost Facility, in the services it offers, significantly impacts environmental and sustainability issues, diverting waste and reclaiming waste for constructive uses. Even more exciting, the design and systems in the facility in and of themselves address these same issues.

The Calgary Compost Facility is process water negative. Leachate, greywater from the sinks and showers, and other water throughout the entire process are all used to irrigate the compost material when it is in the process vessels. Storm water on the entire site is reclaimed, stored, and reused. The site water management system saves 40 million liters of potable water per year, the equivalent of the annual required drinking water for 40,500 people.

Keeping over 85 million kilograms per year of Calgary's organic waste out of landfills is a huge environmental benefit – reducing landfill land requirements and the production of landfill gases goes a long way to lessening the city's impact on the planet. The use of compost ensures that the nutrients leftover in the organic waste are instead returned to the soil, plants, and crops instead of being wasted in a landfill.

There are significant energy and water savings for the Administration and Education building. Energy-saving technologies such as condensing boilers, exhaust air heat recovery, high efficiency domestic water heaters, and an excellent envelope, resulting in 51% less energy usage than a typical building. Through the integrative efforts of all the team members, we are on track to be LEED® Gold certified as the first LEED® version 4 commercial building for Building Design + Construction in Alberta. Educating the future generations about waste reduction and composting through tours and outreach is also part of the A&E building's goals to build the framework to a more environmentally friendly and sustainable future.







#### Q.5 MEETING CLIENTS NEEDS

The City of Calgary had an extremely tight schedule to be met, with just two years between the contract being awarded in mid-2015 and substantial completion in June 2017. With a “design-build-operate” delivery model, contractors and operation staff were involved early in the design process. This level of collaboration greatly expedited the project timeline and reduced construction issues. Design and construction were often being completed concurrently. The project was substantially completed, on schedule, in June 2017. The facility began accepting organic waste a month later and has steadily been in operation since then.

In 2015, the City approved a revised target of 70% waste diversion by 2025. With the Compost facility, the city has halved the frequency of landfill waste collection from homes to once every two weeks. An expected 85 million kilograms of food and yard waste per year will be diverted from landfills and made into high-quality compost for use within the community. The process, mechanical, electrical, and structural systems have already been handling the compost load for the City over the last year.

The City wanted a transformative project that is on the forefront of innovation and environmental sustainability – and Stantec delivered. Stantec’s engineering and architectural teams designed and modeled every component of the building—from ductwork and structural supports, to process equipment. The design and function of the facility have been heralded as an exemplary benchmark by municipalities around North America. The educational programs offered in the facility are in high demand and were fully booked in the previous school year.

For our interdisciplinary team, this fast-paced project provided an incredible opportunity to design a future-focused facility that will provide significant, positive changes for the Calgary community. This is the type of project that forces us to challenge our boundaries and demonstrates the excellence that can be achieved with seamless collaboration between engineers, architects, composting experts, and builders. We are proud to play a key role in helping advance the vision for a zero-waste city, developing a stronger and more sustainable Calgary.

