



**FCM Sustainable Community Awards
2010 Winner – Buildings**
City of Campbell River, British Columbia
Population: 29,572



Green Roof Retrofit to City Hall



The rooftop vegetation filters airborne particulate matter.
Photo credit: City of Campbell River

Summary

In working toward its provincial Climate Action Charter commitment of making civic operations carbon neutral by 2012, the City of Campbell River retrofitted its existing city hall building with a new green roof. The new roof not only provides aesthetic appeal, but should also double the lifespan of the existing roof underneath by protecting the membrane from UV radiation, temperature variations, and physical damage. The increased building insulation is anticipated to reduce heating and cooling requirements by 25 per cent. Moreover, by absorbing greenhouse gases (GHGs) and particulate matter, the green roof acts as a carbon sink, and it reduces stormwater runoff by storing rainwater and releasing it slowly through evaporation. This innovative project also has an educational component, and is serving as a catalyst for promoting sustainable building design principles throughout the community.

Background

Located on the scenic eastern shore of Vancouver Island, Campbell River is the island’s fourth-largest community and home to about 30,000 people. The city has been committed to environmental sustainability for some time, and it is currently working toward its provincial Climate Action Charter commitments of carbon neutrality in civic operations by 2012. It has participated in numerous programs with the Federation of Canadian Municipalities, including Partners for Climate Protection (PCP), capacity-building webinars, the Sustainable Communities Conference, and the Sustainable Communities Mission.

Recently, the city established a dedicated Sustainability department, headed by a newly hired sustainability manager and environmental coordinator. The Sustainability department works cross-departmentally to integrate the Green City Strategy into plans, projects, and reporting, and to promote projects such as the green roof, which provided the city with an opportunity to demonstrate leadership, innovative technology, and commitment not only to city council priorities, but also to the green initiatives of senior orders of government.

Since the construction of the City Hall building in 1983, the roof area had been unoccupied. The green roof project aimed not only to add to the visual appeal of the building, but also to increase the functionality of the space, creating a social gathering place for city employees and for the public. Fiscal considerations were also a motivator: the green roof will double the anticipated lifespan of the current roof to 50 years, reducing maintenance costs now and replacement costs over time.

Project Development

This green roof would be the first in Campbell River — and in the whole of northern Vancouver Island. Planning therefore required extensive collaboration between internal municipal staff and external experts. Given the age of the building, attention had to be paid to its strength and its capacity to accommodate a green roof.

A conventional re-roofing consultant and a landscape design consultant jointly developed the initial design in collaboration with staff from the city's Facilities and Supply Management division. Staff from that division also coordinated all other departmental involvement. Structural engineering research determined how best to accommodate the weight and characteristics of the new green roof on the existing building. The Information Technology department ensured that servicing access would be maintained to existing roof-mounted equipment, and the Human Resources department assisted with upgraded safety features that were installed as part of the project. The Sustainability department coordinated public awareness and educational initiatives, the city's Executive Assistant handled communication, and staff at the Campbell River Regional Library and the Campbell River Twinning Society made instrumental contributions to the design of the courtyard garden.

Community Works Funds, administered by the Union of BC Municipalities on behalf of the federal government for environmentally beneficial municipal infrastructure projects, financed the project in its entirety.

Project Implementation

Campbell River's green roof retrofit project was carried out between March and August of 2009, making Campbell River the first municipality in British Columbia to renovate an existing civic building in this manner. Great attention was paid to finding the best ways to integrate innovative technologies and cultural aspects with the specific constraints of installing a green roof on an aging building. The final design combines an extensive upper roof planted in drought-tolerant vegetation (modeled after that of the rocky bluffs of the nearby coastal mountain range) with a sunken interior courtyard built on Japanese garden principles (in recognition of Campbell River's sister city of Ishikari, Japan).

Many steps were taken both to improve access to the roof and to incorporate fall prevention measures that would ensure the safety of social visitors and of staff servicing roof-mounted equipment. The metal rung ladder to the upper roof (insufficient for social circulation or emergency evacuation) was replaced with access stairs that tie into the overall design. Traffic analysis suggested that full-perimeter guardrails would be the best choice for fall protection. The temporary clamp-on rails used during construction were eventually replaced by a permanent guardrail system mounted to the building's concrete exterior using brackets below the cap flashing so that the integrity of the roof membrane would not be compromised. Glazed panels maintain the sightlines to Discovery Passage (between Vancouver Island and Quadra Island) for neighbours to the rear of the building and also help to limit wind damage to the vegetation. Rigid netting on the interior of the panels eliminates bird strikes. The overall design complies with current Workers' Compensation Board and provincial safety regulations.

To adapt to the building's age constraints, the typical 10 cm of growing medium found on many green roofs had to be modified to a shallower 5 cm. As a result, plant species had to be carefully selected for their ecological suitability. The mixed planting uses more than 1,000 shrubs, succulents, ferns, wildflowers, and groundcover plants, including Oregon grape, stonecrop, tiger lily, coastal strawberry, deer fern, blue rocky mountain fescue, salal, licorice fern, sword fern, clematis, and honeysuckle. The installation team used banded patterns of plantings, including 15,000 sedum plugs and 1,200 square feet of wildflowers. Two Japanese maples were planted in the interior courtyard.

The project contributes to several integrated sustainability goals of Campbell River's Green City Strategy (protecting watersheds, reducing GHG emissions, and achieving compliance with the B.C. Climate Action Charter), and mechanisms to measure the results of the project have been put into place. Technology offers little help in this regard, and so the city has been calculating the approximate amount of airborne particulate matter based on known uptake volumes for plant species growing on the roof and the rate of GHG absorption through photosynthesis. The city has also been monitoring its utility bills to estimate energy savings from the improved insulation. The vegetation and growing medium on the roof retain rainwater and release it through evaporation, limiting stormwater runoff.

Social benefits are being measured by observations of use by staff and visitors, by interest expressed about tours of the roof, and by comments from the public and neighbouring property owners. The project has created a social gathering space and an optional meeting space for city hall employees, improving the work environment. Monthly staff barbecues in the courtyard regularly draw more than 30 people.

Campbell River shares information about the green roof retrofit project through educational tours, press releases, information on the city's website, a Frequently Asked Questions handout, discussions with direct contacts in other cities, and participation at various municipal conferences and events.

Results

- The rooftop vegetation filters fine airborne particulate matter at a rate of approximately 500 kilograms annually. The specially-selected plant species are one and one-half times more effective at removing CO₂ from the air than are other drought-tolerant species.
- The total reduction in runoff volume through retention and evaporation is estimated at 20 per cent.
- The life of the underlying conventional roof is expected to be extended by about 25 years, reducing the capital costs of replacement by about \$90,000.
- With vegetation covering more than half its surface, the green roof meets LEED® requirements for "heat island" reduction, and HVAC energy savings of 25 per cent are possible. Based on a more conservative 12.5 per cent estimated reduction, savings of \$106,000 are expected over the life of the roof, with an accompanying two-tonne reduction in GHG emissions.
- Minimal annual operating costs of \$500 to care for the drought-tolerant species of the green roof are offset by a reduction in maintenance costs for the underlying conventional roof.
- The total lifecycle cost savings associated with the green roof are valued at \$196,000 using 2009 dollars and electricity rates.

Lessons Learned

- **PUT SYSTEMS IN PLACE EARLY TO MEASURE RESULTS.** Amber Zirnhelt, Campbell River's Sustainability Manager, notes that the city is finding it "fairly difficult to track energy savings exactly, as we didn't have a metering system in place before the project began." Installing a meter on the building's electric furnace one year before the green roof installation would have provided baseline data. Installation of a water meter would have enabled tracking of stormwater runoff retention.
- **ENLIST A CHAMPION.** Staff in the Facilities and Supply Management division took a leadership role, investigating opportunities for innovation when it came time to replace the existing roof. Other municipalities would benefit from having a similar project champion willing to do background research and to steer the project from initiation to completion.
- **COMMUNICATE THE VISION EARLY AND WELL.** Campbell River prepared various materials to communicate aspects of the green roof as needed, but earlier preparation would have better

engaged the community. Having a comprehensive education and communications package in place before the retrofit would have reduced negative public perceptions about the benefits and costs. Staff should be well-versed in the innovative aspects of the project so that they can showcase those aspects.

- ENSURE THAT ALL SAFETY PRECAUTIONS ARE TAKEN INTO ACCOUNT. The needs for fall prevention measures and for improved roof access were identified mid-way through the project, but could have been addressed earlier. Jason Decksheimer of the Facilities and Supply Management division says, "Complications were mostly caused by the building's design and changes in safety standards from the time certain components were built."

Related and Future Initiatives

An educational display that explains the composition, technology and functioning of the roof will be in place before the grand opening celebrating the green roof. The city is also training staff to provide green roof tours, and the mayor will conduct weekly tours during his "open door" sessions. Campbell River's corporate Green Team plans to use the green roof for social and educational opportunities, including internal team meetings and public demonstrations of composting, rain barrel use, and vegetable gardening.

With interest in other potential building retrofits having been sparked, momentum is accelerating for building any new civic structures to LEED standards, possibly with green roofs. The Fire Hall is a strong candidate for having a green roof incorporated into its eventual redesign. The city also recently assessed five municipal buildings for possible solar hot water installations.

Partners and Collaboration

Union of British Columbia Municipalities
Province of British Columbia (Climate Action Charter and Climate Action Toolkit)
British Columbia Institute of Technology
Canada Mortgage and Housing Corporation
Campbell River Regional Library
Campbell River Twinning Society – Ishikari
Federation of Canadian Municipalities

Contact Information

Amber Zirnhelt, Sustainability Manager
City of Campbell River, B.C.
250-286-5742
amber.zirnhelt@campbellriver.ca