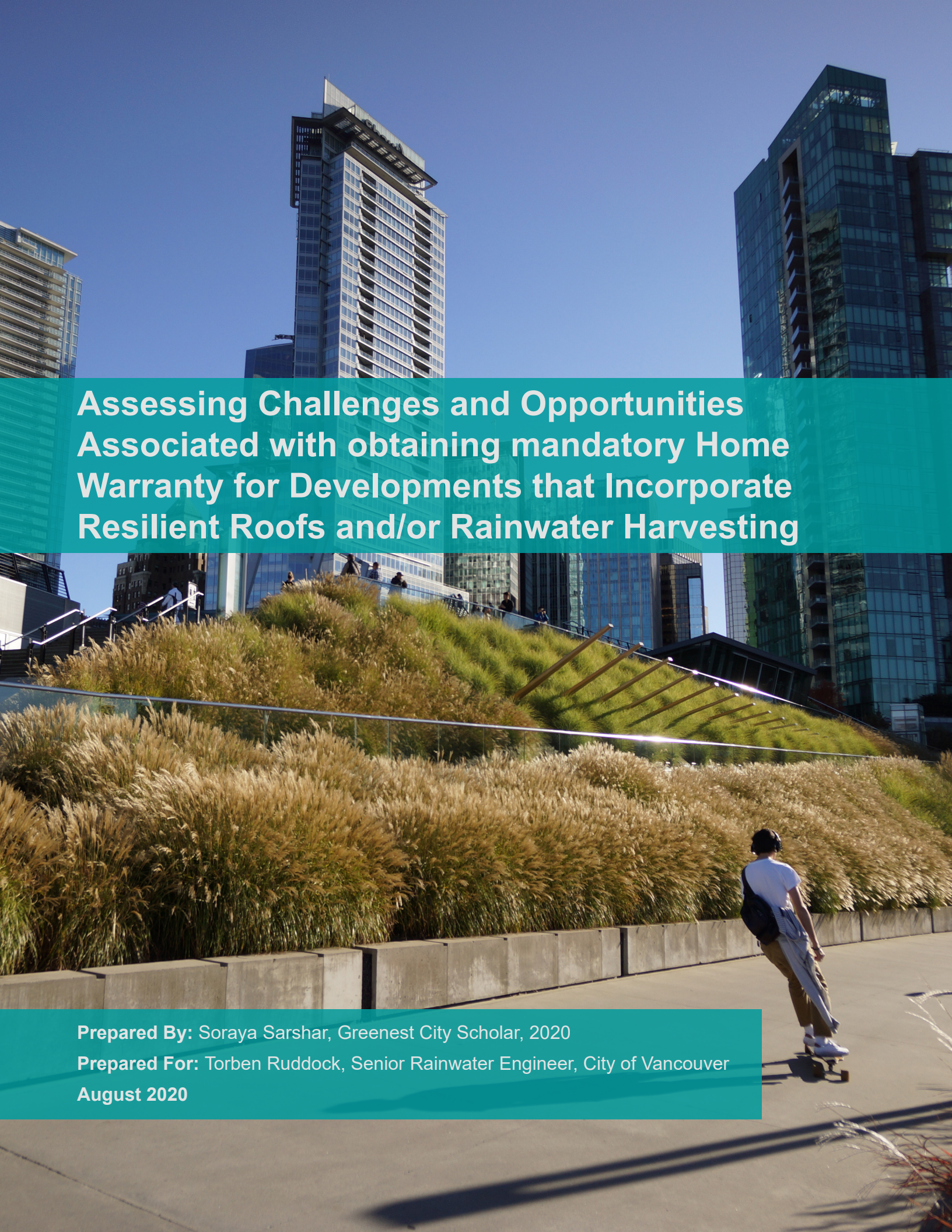

Assessing Challenges and Opportunities Associated with obtaining mandatory Home Warranty for Developments that Incorporate Resilient Roofs and/or Rainwater Harvesting

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Cover Photo: Green Roof Convention Center, City of Vancouver.

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ACRONYMS

BCFSA - British Columbia Financial Service Authority

CSO - Combined Sewer Outflow

CoV - City of Vancouver

GCAP - Greenest City Action Plan

GRI - Green Rainwater Infrastructure

HPO - Homeowner Protection Office

MURB - Multi-Unit Residential Building

RCABC - Roofing Contractors Association of British Columbia

RCS - Rain City Strategy

RWH - Rainwater Harvesting

PROJECT OVERVIEW

In November 2019, the City of Vancouver adopted the Rain City Strategy. The Rain City Strategy is a municipal policy document that provides the City with a long-term outlook for rainwater management practices and services in the face of climate change. The implementation of green rainwater infrastructures (GRIs), such as resilient roofs and rainwater harvesting systems are seen as vital strategies for enhancing Vancouver's climate resilience and encouraging future sustainable water management practices.

There have been several anticipated barriers involved in implementing the Rain City Strategy and GRIs across the City. One identified roadblock is obtaining the mandatory home warranty insurance for new homes that incorporate resilient roofs and/or rainwater harvesting in the Province of British Columbia. This report aims to assess the barriers and challenges at hand and provide recommendations for the City to consider to overcome them.

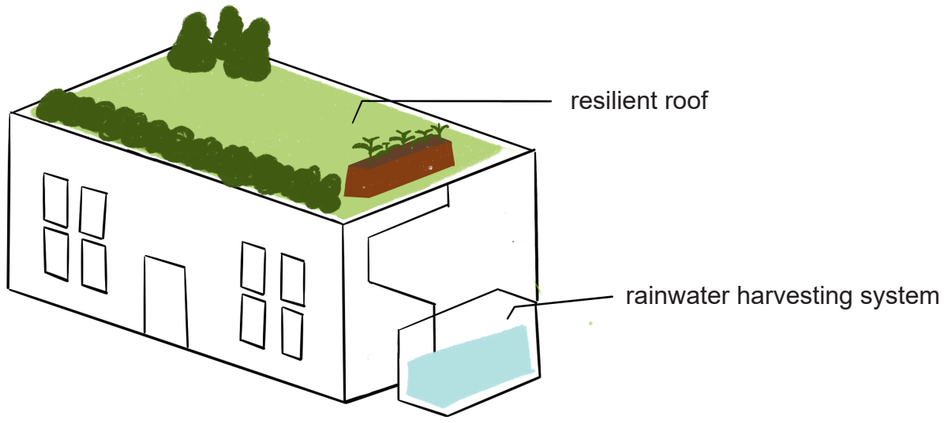


Illustration of MURB incorporating a resilient roof and a rainwater harvesting system.

RESEARCH OBJECTIVES

This research assesses the challenges and opportunities associated with obtaining mandatory home warranty for new multi-unit residential building (MURB) developments that incorporate the following two forms of GRI: resilient roofs and/or rainwater harvesting in Vancouver.

More specifically, this report seeks to:

- Identify the perceived and actual barriers and challenges of implementing resilient roofs and/or rainwater harvesting while obtaining the mandatory home warranty insurance
- Investigate potential and realized strategies to overcome these barriers and challenges
- Propose a list of recommendations and opportunities to overcome these barriers and challenges to the City of Vancouver

METHODOLOGY

In order to fulfill the objectives stated above, this research applied the following methodologies:

1. Case Studies -
   Highlighting successful MURB developments that have incorporated resilient roofs and/or rainwater harvesting in Vancouver
2. Stakeholder Interviews -
   Interviewing of key stakeholders involved in the process of green rainwater infrastructure implementation in British Columbia

RESEARCH LIMITATIONS

This report seeks to investigate and inform CoV officials, stakeholders and the general public on the barriers, challenges and opportunities regarding urban green rainwater infrastructure implementation. Limitations to this research include the following:

- The COVID-19 public health pandemic which prohibited in-person interviews and research done on-site at CoV offices due to social distancing measures and at-home quarantining.
- The four-month time frame which limited the amount of stakeholders interviewed. This report represents only a sample of the professionals involved in green rainwater infrastructure implementation in British Columbia.
- Stakeholder diversity. This research was done using the snowball sampling technique, where each interviewee helps identify other interviewees. This research lacks the perspective of certain stakeholders, namely ones in the private sector, as it was initiated by ones in the public sector.

RESEARCH OBJECTIVES

This research seeks to build upon existing work the CoV has advanced to address climate change, rainwater management and green rainwater infrastructure implementation. This report is in direct alignment with the following CoV strategy documents:

- Rain City Strategy (2019)
- Resilient Vancouver Strategy (2019)
- Climate Change Adaptation Strategy Update: Core Actions (2018)
- Vancouver Citywide Integrated Rainwater Management Plan (2016)
- Greenest City Action Plan (2015)

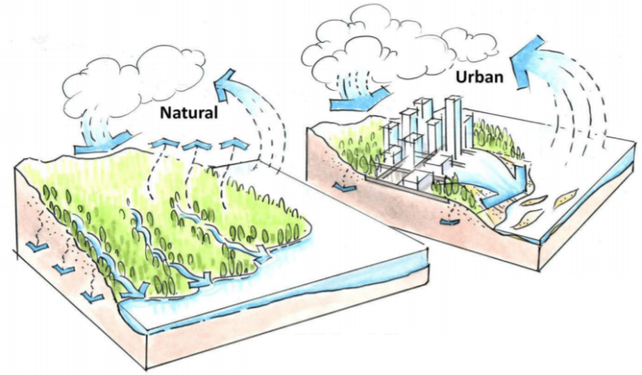
BACKGROUND

CONTEXT

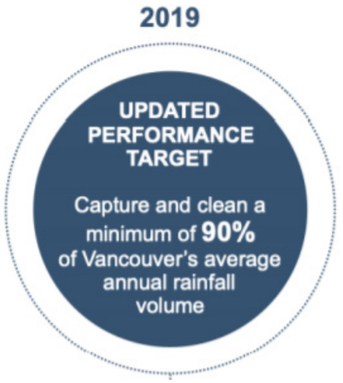
According to global climate projection models by Metro Vancouver, the Lower Mainland is predicted to receive a 5-12% increase in precipitation during extreme rain events induced by climate change by 2050. Furthermore, studies done by the BC Ministry of Environment and Climate Change indicate that extreme precipitation events in areas surrounding Vancouver are to become more likely by 2050, leading to severe consequences, such as loss of life, loss of economic productivity, and loss of infrastructure services that will cause major disruption to daily life. In order to combat these unprecedented rainfall projections and ensure the safety and well-being of the community, the City of Vancouver has adopted several policies to address urban rainwater management.

In October 2019, the City of Vancouver Council approved three motions related to urban rainwater management and blue-green urban systems; the Watershed Revival, the Greenways Plan and the False Creek to the Fraser River Blueway, deeming them necessary components of urbn climate change adaptation (City of Vancouver, 2019e). All three motions relate to an overall vision the City has adopted, entitled the ‘One Water’ approach. The ‘One Water’ approach demands that urban development consider the entire water cycle, from drinking water, to wastewater, to rainwater, surface water and groundwater as one entity (City of Vancouver, 2019d). Methods that encompass the ‘One Water’ approach include the implementation of green rainwater infrastructure, low-impact development and green network planning. These methods represent strategies used in blue-green systems, which by definition help the urban landscape to manage water and land in a way that is inspired by nature and designed to replicate natural function as well as provide ecosystem services (City of Vancouver, 2019e). Blue-green systems provide numerous benefits such as improving water utility system performance, increasing climate resilience, enhancing biodiversity, improving air quality and augmenting recreational spaces and opportunities.

The three motions were furthered supported by the drafts of the Rain City Strategy policy document which was released in November 2019. The Rain City Strategy harmonizes the intentions of the City with regards to blue-green systems by summarizing the precipitation consequences of climate change, the adoption of the ‘One Water’ approach, several pilot projects the City has embarked upon, and action programs the City wishes to pursue such as capturing and cleaning a minimum of 90% of Vancouver’s average annual rainfall volume (City of Vancouver,



Natural and Urban Water Cycles.
(Thomson, 2019, Rain City Strategy)



CoV Rain City Strategy perfomance target visual.
(Rain City Stategy, 2019)

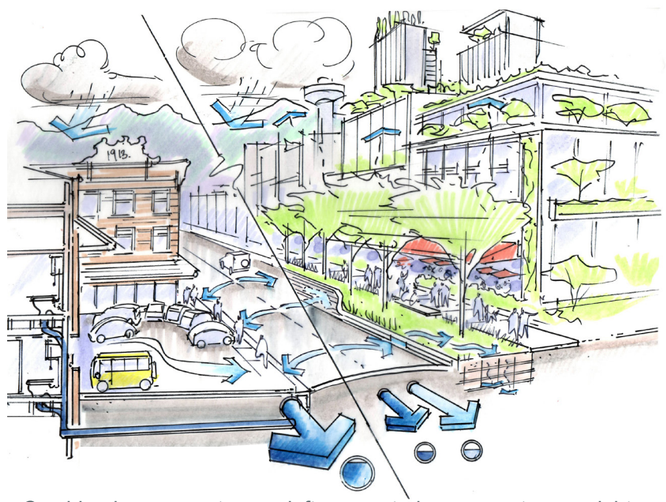
RAIN CITY STRATEGY

In November of 2019, the City of Vancouver adopted the Rain City Strategy (RSC). The RCS is a municipal strategy report that advocates for the transition of becoming a water sensitive city to help communities and ecosystems thrive in the face of climate change. This new approach to water management sees urban rainwater as a resource and not a waste product, to be recycled and utilized within the city (City of Vancouver, 2020d).

The City has been paying special attention to solutions surrounding water utility system performance, such as green rainwater infrastructure and low-impact development, due to its combined sewer system. A combined sewer system is one where stormwater runoff is directed through one pipe and transported with wastewater from homes, businesses and industry. In times of hight precipitation rainfall events, the combined sewer system's capacity may be exceeded and cause untreated excess overflow to empty directly into nearby waterways.This is called combined sewer outflow (CSO). By integrating infrastructure that captures, retains and slows down urban rainwater run-off before entering the sewage system, the City may be able to mitigate the adverse effects of heavy rainfall and separate stormwater from wastewater.

The RCS hopes to achieve this using green rainwater infrastructure (GRI) tools and strategies, such as installing resilient roofs and/or rainwater harvesting on new residential properties.This research hopes to bring forward RCS's intention by further investigating barriers, challenges and opportunities to implementing resilient roofs and rainwater harvesting and help advance and achieve sustainable urban rainwater management.

Rain City Strategy. (City of Vancouver, 2019)



Combined sewer system on left, separated sewer system on right. (Thomson, 2019, Rain City Strategy)

GREEN RAINWATER INFRASTRUCTURE (GRI)

Green Rainwater Infrastructure (GRI) is an umbrella term that encompases many rainwater management approaches and tools that are used to protect, restore and mimic the natural water cycle in urban settings. GRI, or simply, green infrastructure (GI), uses both nature-based solutions, such as increasing vegetation and remediating green space, as well as engineered systems, such as permeable pavements and rain gardens in order to slow, absorb, infiltrate, evaporate and clean urban rainwater run-off.

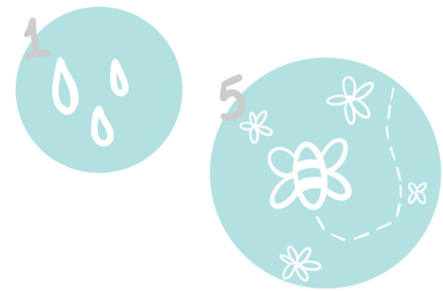
GRI offsets the negative impacts often associated with highly impervious urban development by mimicking natural hydrologic processes and reducing overall imperviousness, thereby decreasing run-off and reducing demand on existing grey infrastructure, and flood risks. Whereas grey infrastructure largely sees rainwater as a waste product, GRI seeks to capture and reuse urban rainfall as a resource. By reducing the amount of grey infrastructure and increasing the amount of green infrastructure in urban settings, a city is more prepared to combate the adverse effects of climate change (City of Vancouver, 2019d).

It is important to note that GRI is most efficient when used at the site-level and incorporated into an integrated water management system. For this reason, on-site GRI interventions such as resilient roofs and rainwater harvesting are vital to capturing and treating urban rainwater. This report investigates the implementation of these two soecifieGRI technologies.

RESILIENT ROOFS

Resilient roofs are roofs that have been designed to manage rainwater, as well as support vegetation. The term 'resilient roofs' encompases green roofs (both extensive and intensive), blue roofs, blue-green roofs and white reflective roofs.

BENEFITS	
1.	Helps absorbs rainwater and manage stormwater.
2.	Helps in mitigating the urban heat island (UHI) effect.
3.	Naturally filters out pollution from both air and water.
4.	Increases urban biodiversity.
5.	Protects the building's membrane from temperature change and UV light, leading to less fissures over time.
6.	Provides aesthetic value to building and neighborhood.
7.	Sequester carbon.



DRAWBACKS	
1.	Costs more to install.
2.	May invite unwanted species, such as rodents, invasive plants and weeds.
3.	Needs monitoring.
4.	Accessibility can be an issue for some tenants.

GREEN ROOFS

Green roofs utilize vegetation on a building to help absorb rainwater, provide insulation for the building and improve biodiversity on-site. A green roof can be found in several locations, such as on the top floor of the building, among the building's lower stories, and on top of the building's parking garage.

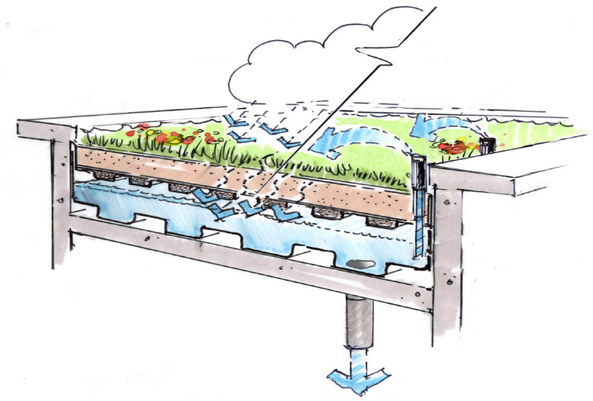
EXTENSIVE GREEN ROOF
An extensive green roof supports small plants with a thin layer of soils. They are typically inaccessible to building users.

INTENSIVE GREEN ROOF
An intensive green roof is one that supports large plants and a thick layer of soil. They are typically accessible to building users.

CONCRETE VS. WOOD FRAME BUILDINGS (NON-COMBUSTIBLE VS. COMBUSTIBLE STRUCTURES)

The ease of implementing resilient roofs, particularly green and blue roofs, varies on the structure and material of the building. There is a large distinction between placing green roofs on wooden frames (combustible structures) versus that of concrete frames (non-combustible structures). Wood is more likely to deteriorate around organic material such as water and soil. This makes implementing resilient roofs on wood frames associated with construction defects. Implementing resilient roofs on concrete structures instead is more widely accepted and trusted in the development industry.

BLUE ROOF
Blue roofs temporarily retain and store rainwater before releasing it to the municipal stormwater system. Blue roofs can be designed to treat rainwater and allow evaporation of stored rainwater.



Resilient Roof.
(Thomson, 2019, Rain City Strategy)

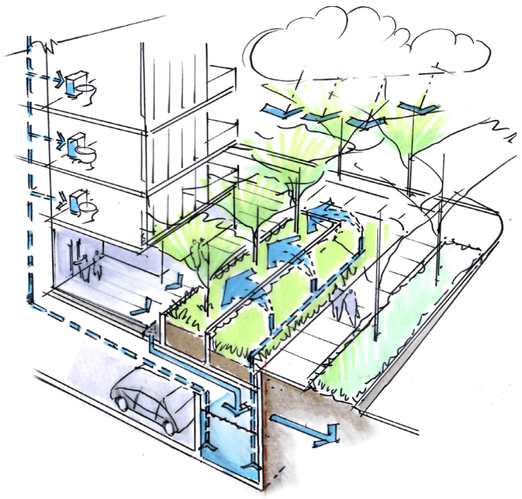
BLUE-GREEN ROOF
A blue-green roof is a blue roof that incorporates vegetation in its design. Blue-green roofs help keep vegetation watered.

RAINWATER HARVESTING (RWH) AND RE-USE

Rainwater Harvesting (RWH) and Re-Use is the practice of collecting rainwater from the building, harvesting, treating and reusing it on site. Harvested rainwater may be re-used for non-potable uses such as toilet flushing, irrigation and cooling of the building and site.

BENEFITS
1. Decreases potable water demand.
2. Decreases water runoff.
3. Decreases energy use.
4. Creases storage water for periods of drought.
5. Reduces strain on munical stormwater systems.
6. Conserves water.

DRAWBACKS
1. Costs more to install.
2. Regular maintenance is required.
3. May have storage/capacity limitations.



Non-Potable Systems.
(Thomson, 2019, Rain City Strategy)

LEAKY CONDO CRISIS

In the 1990s, the province of British Columbia underwent a period called the “Leaky Condo Crisis”. This period marked a time where many wood-frame buildings, especially that of multi-residential developments (strata properties), were damaged by rainwater infiltration along coastal British Columbia. It has been estimated that $4 billion in damage was done to over 900 buildings between the late 1980s and early 2000s (Stueck, 2008).

Problems in the design, installation and construction of these buildings led to water penetration which contributed to rot, delamination of exterior walls and rusting of many homes. Many strata unit homeowners found themselves with defected homes and made to fix building envelope issues (the exterior walls and roof of the building) they were not responsible for. This resulted in thousands of dollars spent on repair costs, creating numerous lawsuits against developers, contractors and architects in the area (Stueck,2008). It is important to note that before 1993, architects and engineers were not required to certify that building designs met the requirements of building codes, nor did they have to review the quality of construction, or certify that the construction had been done in accordance to city building codes. It is estimated that 45% of strata units in B.C. between the years of 1985 and 2000 experienced envelope leak problems (Stueck, 2008).

The leaky condo crisis has now set a precedent around mid to high rise buildings, particularly wood-frame, and rainwater infiltration in Vancouver. For this reason, many in the industry, alongside homeowners, associate high risk with the adoption of new and different technologies involving the building’s envelope. This has been stated as an ongoing barrier to the implementation of many on-site residential GI interventions such as resilient roofs and/or rainwater harvesting.

In consequence, the ‘Leaky Condo Crisis’ of the 1990’s prompted the government of British Columbia to create the Homeowner Protection Act in 1998. The Homeowner Protection Act is designed to protect homebuyers from defected homes and improve the quality of residential construction. It was largely created to remediate the consequences of the crisis and prevent similar issues from happening in the future.

BUILDING ENVELOPE
The physical separator between the outdoor environment and the building. Exposed to air, water, light, heat and noise transfer.

THE HOMEOWNER PROTECTION ACT

The Homeowners Protection Act (or The Act) is a British Columbia provincial legislative act that mandates that every new residential building be provided home warranty insurance in order to be given a building permit by its respective municipality. Implemented in 1998, the Act, originally established by the Homeowner Protection Office (HPO) is responsible for:

- Licensing residential builders and building envelope renovators
- Monitoring the provision of third-party home warranty insurance
- Administering Owner Builder authorizations
- Carrying out research and education to benefit the residential construction industry and consumers

The purpose of the act is to:

- Strengthen consumer protection for buyers of new homes
- Improve the quality of residential construction
- Support research and education respecting residential construction in British Columbia

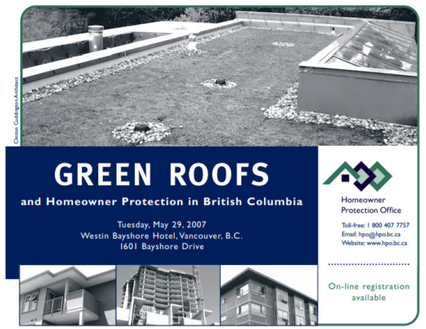
In 2010, the HPO merged with BC Housing under the branch of Licensing and Consumer Services. BC Housing - Licensing and Consumer Services, now acts as a liaison between home warranty insurance providers and developers/builders in the process of building a new home. All new homes are mandated to receive home warranty insurance from a third-party as of July 1, 1999. Insurance companies involved must have been approved by the BC Financial Services Authority (BCFSA), as well as meet all the requirements of the Act. Currently, there are 5 different insurance companies in British Columbia that can legally provide home warranty insurance.

The Act is a minimum standard of coverage that goes by the name ‘2-5-10’. ‘2-5-10’ refers to the mandatory home warranty insurance on new homes including a minimum of:

- 2 years on labour and materials
- 5 years on the building envelope (including water penetration)
- 10 years on structure

In strata properties, the mandatory home warranty insures the individual units, as well as the common property (e.g. exterior walls, windows, floors, roofs, piping and electrical systems that make up an individual units). In the case of resilient roofs and/or rainwater harvesting, these interventions fall under common property of the development and are most concerned with the 5-year building envelope warranty insurance.

The home warranty insurance has exclusions to its policy. These exclusions include landscaping, non-residential detached structures, commercial use areas, roads, curbs, lanes, site grading and surface drainage, the operation of municipal services, septic systems and water quality and quantity (Home Owner Regulations, 1998). Defects related to the following, will also not be covered: normal wear and tear, normal shrinkage of materials from construction, damage caused by insects or rodents, failure of an owner to prevent or minimize damage, and lastly, acts of nature. The Homeowners Protection Act has been regarded as a critical barrier to the establishment of residential GRI within the City of Vancouver (Burrows, 2007).

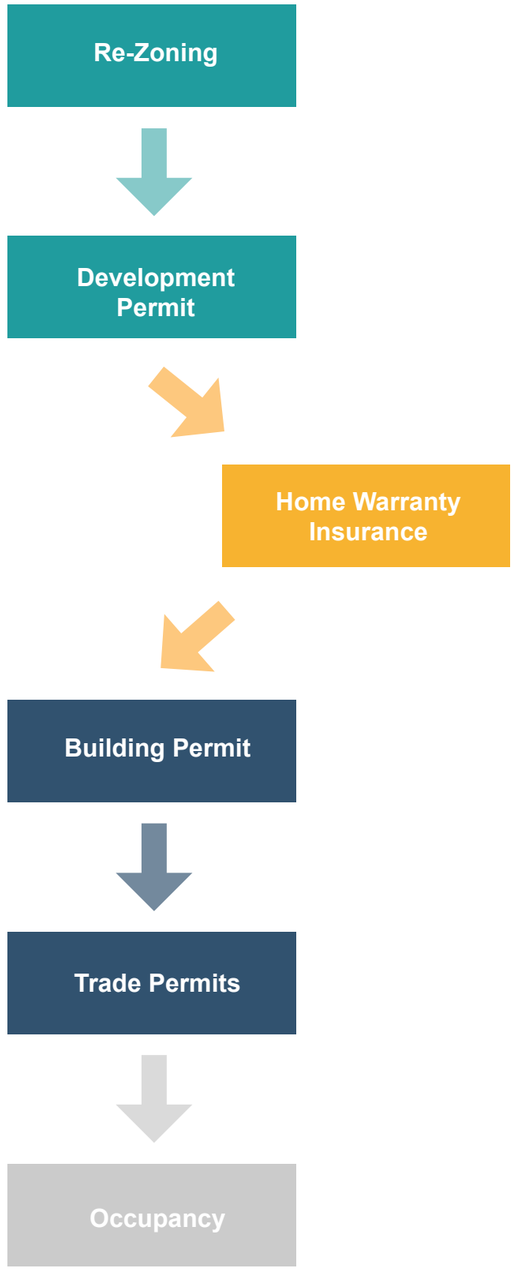


Cover Page of HPO Green Roofs Conference (BC Housing, 2007)

In 2007, the Homeowner Protection Office held a one-day conference to explore issues, barriers and options for residential green roofs in B.C. in regards to the Homeowner Protection.

PERMITTING PROCESS

The following demonstrates a high-level visual of the permitting process for new homes in British Columbia, including the mandatory home warranty insurance:



STRATA COUNCIL ISSUES

Over 1.5 million people live in strata housing in the province of British Columbia (BC Government, n.d.b). Strata housing are multi-unit residential developments which include condos, townhouses, duplexes and strata subdivisions. The province of British Columbia has an ongoing history of several issues concerning strata properties.

STRATA INSURANCE

In recent years, strata insurance has become very expensive. A report by the BCFSA in 2020 reported that premiums of strata insurance have risen on average approximately 50% across Metro Vancouver in the last year. These premiums are expected to continue, with buildings that are considered higher risk to face more significant increases in insurance premiums. The strata insurance market in BC is provided by a private sector, for-profit group of insurers. There are approximately ten companies that insure strata properties in BC, with many of them working at an international scale. The rising costs of strata insurance derives from rising property values in the area, as well as heightened earthquake risks (Morrison, 2020). Strata insurance impacts the housing affordability of homeowners and renters, as well as the cost of individual homeowners' condominium insurance. With insured values ranging from $1 million to $200 million, BCFSA and the Condominium Home Owners Association of BC (CHOA) demand that there be more transparency from strata insurance providers and strategies in order to reduce costs their costs (Gioventu, 2020).

MINOR CLAIMS

On the other hand, insurers are incurring losses. Strata corporations are responsible for maintaining the common property of the building. Strata corporation's responsibilities include, having common property inspected before each part of the warranty expires (i.e. 2,5, and 10 years), notifying the warranty provider and building of possible defects, monitoring repairs with particular attention to the building envelope and conducting general maintenance and monitoring. A strata corporation may hire a property manager to do the above. Reports of many minor claims have resulted in loss of profit for strata insurers. These small claims are often related to water damage due to poor building maintenance practices and initial construction material quality. Water damage from plumbing leaks and failures account for approximately 46% of total claim costs since 2017 (Morrison, 2020). Due to the high volume of minor claims among strata properties, it is evident that proper, ongoing maintenance practices have not been practiced. These minor claims create an overall loss in profitability in the housing market. The BCFSA 2020 interim findings report states that strata insurers may be additionally absorbing costs due to the lack of clarity surrounding the mandatory home warranty insurance and its coverage. This leads to confusions with respect to accountability among members in the industry.

The BCFSA has stated that the strata insurance market is an unhealthy market which does not meet the goals of sustainability, affordability or availability. The BCFSA report articulates that a healthy market ensures that consumers' needs are met by the products, while innovation is made readily available, at affordable pricing and where customers are treated fairly. In sum, the current state of the BC strata insurance market is not fulfilling the needs of British Columbia, nor is it profitable for the insurance industry and is in need of reform.

STAKEHOLDER INTERVIEWS

STAKEHOLDER INTERVIEWS

Stakeholders involved in the various stages of GRI implementation in the province of British Columbia were interviewed for this research. These interviews help better understand the perceived and actual barriers and challenges to obtaining home warranty insurance for resilient roofs and RWH. Stakeholders were additionally asked to list potential opportunities, recommendations and/or suggestions with regards to GRI implementation whichh is discussed later in this report.

Stakeholders were selected based on a snowballing research technique from initial contacts provided by the Integrated Water Management branch at the City of Vancouver. Participants spanned both the public and private sector, including BC Housing representatives, home insurance providers, professional engineers, green infrastructure providers and development managers. A copy of the general questionnaire used to conduct semi-structured stakeholder interviews can be found in Appendix I.

Interview Participant	Organization or Position
1	BC Housing Representative
2	City of Vancouver Engineer
3	BC Housing Representative
4	Home Warranty Insurance Provider
5	BC Housing Representative
6	BC Housing Representative
7	Green Infrastructure Provider
8	Non-Profit Development Manager
9	Non-Profit Development Manager
10	Green Infrastructure Provider
11	Private Sector Engineer

CATEGORIZATION OF BARRIERS AND CHALLENGES

When listing the perceived barriers and challenges in regards to obtaining the mandatory home warranty insurance for developments that incorporated GRI, stakeholders were asked to categorize them in the following groups:

SOCIO-POLITICAL BARRIERS

BIOPHYSICAL-TECHNICAL BARRIERS

11 STAKEHOLDERS

SOCIO-POLITICAL BARRIERS

Perceived socio-political barriers relate to the resource allocation and capacity of the existing governance structure with regards to the implementation of GRI. Moreover, if greenspace and/or green infrastructure is not already seen as a priority by the governing structure through stated policies and strategies, it is unlikely to be implemented (Byrne & Yang, 2009). This includes, but is not limited to:

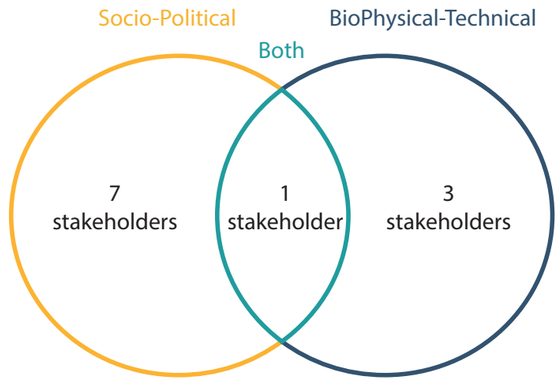
Socio-Political Barriers
Infrastructure cost
Political will
Municipal and/or provincial politics/policies (i.e. The Homeowner Protection Act)
Fear or lack of confidence in GRI technology
Citizens' attitudes and values
Understanding, awareness and perception of GRI
Lack of standards and processes in place
Perceived risk in consumer protection for new homeowners

BIOPHYSICAL-TECHNICAL BARRIERS

Perceived biophysical-technical barriers involve the biophysical and/or technical capabilities of the green rainwater infrastructure technology. Careful site selection, assessment, monitoring and management is included in these perceived barriers (Byrne & Yang, 2009). This includes, but is not limited to:

BioTechnical-Physical Barriers
Maintenance and monitoring of GRI
Potential construction defects of GRI
Current GRI technology design not robust enough
Lack of supply and compentency in local industry (i.e. designers, regulators, builders, providers, maintenance and supply)
Size of building and/or GRI
Structure of building

RESULT OF STAKEHOLDER CATEGORIZATION



BARRIERS & CHALLENGES

Several actual and perceived barriers and challenges were identified when discussing GRI implementation of resilient roofs and/or RWH and mandatory home warranty insurance in Vancouver. The main barriers, challenges and concerns are summarized below:

LISTED SOCIO-POLITICAL BARRIERS:

1. **Lack of confidence in the building industry and the progression of green infrastructure technology.** There is an evident lack of trust in the building industry from various stakeholders where precedents of cost-cutting, cheap materials and lack of supervision has led to the construction of defected homes in BC (e.g. 'the leaky condo crisis'). For this reason, many do not trust the industry, particularly developers and builders, to take on new technologies, such as green infrastructure interventions.

2. **Small and uncompetitive green infrastructure market.** There is a lack of local experts in the field, including green infrastructure installers, providers and maintenance teams, making the supply of green infrastructure technology minimal in the region.

3. **Tenant engagement and responsibility of maintaining and monitoring GRI.** Oftentimes, MURBs will be maintained by a property manager and/or strata council members. These property managers and/or strata members are not made aware or educated on the upkeep of their building's GRI, leading to complications and defects of the building. This heavily deters developers and builders from initially installing the GRI.

4. **Complexity and length of process.** Many stakeholders voiced the concern of having to navigate a complex and long process to receive home warranty insurance while incorporating a resilient roof and/or RWH on their new development. This was particularly prevalent for non-profit development managers who aimed to incorporate sustainable initiatives alongside their community projects. Specific concerns over lack of communication between multiple organizations (e.g. Roofing Contractor Association of British Columbia) and the municipality, as well as complicated regulatory barriers were mentioned. In cases where rezoning was involved, some stakeholders experienced year-long delays to their developments.

5. **Health authority regulations.** Stakeholders raised concern over the inconsistencies and lack of consensus from health authority regulations (e.g. Vancouver Island Health Authority) on the water quality and water quantity needed from alternative water sources such as RWH.

6. **Overall public perception of green roofs.** In the particular case of green roofs, there is a general perception that this infrastructure creates more risk for water penetration in the building envelope, causing leakage. Many stakeholders attribute the leaky condo crisis for this perceived assumption.

7. **Lack of awareness and education amongst other stakeholders.** Overall, stakeholders believe there is a lack of awareness and education on GRI within the development industry. This includes a lack of local best practices and standards for installation and maintenance, lack of knowledge on public health and safety risks for tenants, and general benefits and downfalls of GRI implementation in residential homes.

8. **Development pressure in the City of Vancouver.** There is increasing pressure

in Vancouver to develop housing, and to build it fast. With the housing market at an all time high, MURBs are being proposed now more than ever (Gold, 2020). For that reason, many in the industry believe there are more cost-cutting, fast-tracked and negligent practices being conducted. This does not create a conducive environment to design and build pilot projects that incorporate new GRI interventions that may be more time-consuming and/or detail-oriented.

9. The initial and ongoing cost of GRI infrastructure on new homes

GRIs are generally more expensive than that of status quo residential development. This additionally cost, alongside the cost of maintening the GRI deters many from installing them. With land prices increasing in Vancouver, and expensive construction costs, it is not economically feasible to add GRIs to development designs despite the multiple environmental and health benefits.

10. Home warranty insurance exclusions.

The homeowner protection act lists a number of exclusions to its warranty that could be applied to GRIs. Examples are exlusion of insurance for water penetration, acts of nature and leakage (BC Housing, n.d.).

LISTED BIOPHYSICA-TECHINCAL BARRIERS:

1. **High risk development.** Home insurance providers have expressed limited willingness to provide home warranty insurance for residential buildings with GRI, particularly green roofs, due to previous undesirable experiences.

2. **Availability of space on roof.** Many stakeholders expressed concern over the crowdedness of a MURB roof. Other building utilities such as HVAC, electrical and stair exits can often be found here. Both resilient roofs and RWH are oftentimes implemented on the roof of the building, however, they may also be placed elsewhere (e.g. a podium, parking lot, exterior of the building).

3. **Wooden frame buildings.** It was mentioned several times that the incorporation of resilient roofs, in particular green roofs, and RWH are incompatible with wooden frame buildings as the accumulation of vegetation and water can cause deterioration of wood if the building membrane is not sealed correctly. Subsequently, there is less pushback on implementing resilient roofs on concrete framed buildings.

4. **Installation difficulty.** Due to GRI being a newer technology, certain stakeholders are concerned with the initial difficulty and lack of experience in its installation. If a problem or mistake occurs, this can affect the remaining building process and timeline.

5. **Lack of maintenance and monitoring.** Many developers and builders do not have a maintenance and monitoring program to implement upon completion of GRI for a new development. For this reason, GRI interventions can become bigger problems down the road due to the fact that they need ongoing attention even after the building is constructed.

6. **Coastal climate of British Columbia.** Stakeholders believe that Lower Mainland simply receives too much rainfall to safely capture, treat and control rainwater management on-site, especially on residential developments where residents are more at risk.

CASE STUDIES

SALT - 1308 HORNBY STREET

Photo by Soraya Sarshar

AT A GLANCE

Location: Downtown

Building Type: Mixed-use residential

Date Completed: 2014

Interventions: Green Roof & Stormwater Management

Certification: LEED-NC Gold

Zoning: CD-1 (502)

Key Players:

Developer -
Concert Properties

Architect -
Richard Henry - Architects &
Bingham Hill Architects

LEED Consultant -
Recollective Consulting inc.

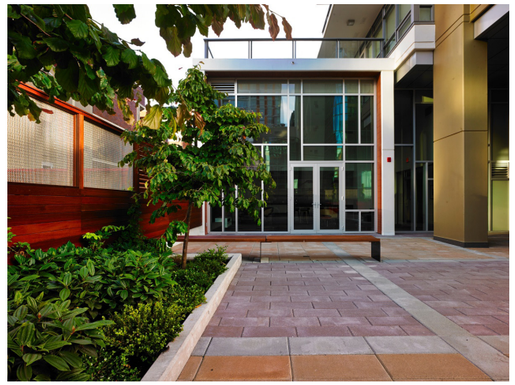
Landscape Architect -
PWL - Partnership Landscape Architects

Commissioning Authority -
Morrison Hershfield

BACKGROUND

Back in 2014, the City of Vancouver had more lenient sustainability standards for MURBs. It is for that reason that Concert Properties is seen as an industry leader as this project voluntarily chose to go above industry standards at the time. It is the first LEED Gold building by Concert properties in BC (Green Building Audio Tours, n.d.b). This mixed-use development has 33 floors that encompass 197 strata units, with 5 commercial units on the ground floor. This building includes a multitude of sustainable initiatives, such as an electric vehicle car-share, locally sourced and manufactured materials, as well as the omission of air conditioning. The facade of the building reads the sentence: “We must cultivate our gardens” vertically along the north-facing exterior wall.

Image: Condo in Vancouver, n.d.
https://www.condoinvancouver.ca/salt



Images: Green Building Audio Tours, n.d.
https://greenbuildingaudiotours.com/buildings/salt_1308_hornby

GREEN ROOF

On the second floor of this concrete building, an intensive green roof can be found in the communal outdoor courtyard. Native and adaptive trees and shrubs have been planted, alongside a dedicated urban agriculture area for residents. The green roof covers 198 sqm of the development, with 20% of the overall site covered in vegetation (Green Building Audio Tours, n.db). The second-floor green roof helps absorb stormwater, as well as cool down the building, while providing amenity space for residents.

STORMWATER MANAGEMENT

The building additionally holds a stormwater treatment process. Concert Properties were the first to use this particular stormwater tank in Canada, called the ‘Jellyfish Filter’ (Green Building Audio Tours, n.d.b). This tank helps capture and treat suspended solids so that the water leaving the building places less of a burden on the municipal stormwater system. Additionally, onsite rainwater is collected and retained for irrigation, which saves up to 50% of potable water building use (Green Building Audio Tours, n.d.b).

Images: Green Building Audio Tours, n.d.
https://greenbuildingaudiotours.com/buildings/salt_1308_hornby

AT A GLANCE

Location: Oakridge

Building Type: Mixed-use residential

Date Completed: 2014

Intervention: Green Roof

Zoning: CD-1 (527)

Key Players:

Developer -
Cedar Development Corporation

Architect -
GBL Architects

LEED Consultant -
Sustainability Solutions Group

Landscape Architect -
Eckford & Associates

Building Envelope Engineer -
Aqua-Coast Engineering Ltd.

Environmental Consultant -
D. Kelly Environmental Consulting Ltd.

Commissioning Consultant -
C.E.S. Engineering

PRELUDE - 6311 CAMBIE STREET

Photo by Soraya Sarshar

BACKGROUND

This development was one of the first to emerge from the BC Cambie Corridor Plan. It is a 6.5 floor, 52 strata unit residential building with 4 commercial units on the ground floor. The building is on track to achieve LEED silver standing (Green Building Audio Tour, n.d.a). Its sustainability initiatives include, electric vehicle charging stations in the parking lot, use of recycled building material and an education program for strata members to better

GREEN ROOF

The property has a landscaped intensive green roof on its rooftop. The green roof is equipped with native and adaptive plants that are drought tolerant, reducing the consumption of water. The stormwater management system additionally includes a stormceptor, alongside its vegetated roof, which captures and treats 90% of all rainwater that falls on site. Finally, the patio is equipped with a barbeque for communal social gatherings.

Images: Yang, n.d.
https://www.360homephoto.com/a/w205271

Images: dexterpm, n.d.
http://dexterpm.ca/listings/6311-cambie-street-504/

RECCOMENDATIONS

RECCOMENDATIONS

1. **Create specialized education programs for different stakeholders involved in the process.**[1]

Education has been a key recommendation among stakeholders' interviews. With many interviews stating that various stakeholders in the residential development process are misguided on the technicalities of GRI interventions and their respective implementation process. Groups that may benefit most from a specialized educational program include:

- **Builders and developers.** Informing builders and developers on local best practices and guidelines could help mitigate uncertainty and doubt during the installation process of a GRI, such as resilient roofs and/or RWH. It could additionally bring down the cost of GRI installation over time, as developers and builders will become more familiar with these newer systems. A 'Green Rainwater Infrastructure Builders Breakfast' carried out by BC Housing has been proposed.

- **Strata council members and property managers.** It has been mentioned many times that strata council members, alongside property managers, need to do a better job at maintaining and monitoring on-site GRI interventions. This will not only ensure better performance of the systems, but will also help the systems and the building last longer. Many strata council members and property managers however have little knowledge of building envelope issues and GRI technologies. A 'Green Infrastructure Maintenance and Monitoring Toolkit' administered through CHOA and supported by BC Housing could help prepare strata council members and property managers to better identify and mitigate GRI issues promptly and on site.

- **Home warranty insurance providers.** Many stakeholders have expressed concern over the misguidance of home warranty insurance providers and their perceived risk of GRI implementation, especially on residential developments. An educational information guide on GRI benefits and drawbacks written and delivered by BC Housing may inform warranty providers on the actual versus perceived risks of GRI implementation, as well as encourage their uptake in residential developments.

2. **Create an ongoing best practices guide for local multi-unit residential building (MURB) developments that incorporating GRI.**[2]

An ongoing best practices guide will help share knowledge and facilitate dialogue on local industry standards for GRI implementation. This guide should include lessons learnt from seasoned industry members, detailed instructions on installations, maintenance and monitoring check-ins, as well as recommendations for best quality material (ex. piping, vegetation, plant containers, etc.). Issues and/or lack of trust often occur when teams are installing a GRI for the first time. A best practices guide may provide first-time installation team additional support and guidance, as well as resources to find geographically appropriate solutions and standards.

3. **Recommended and/or mandated warranties from other third-parties involved.**[3]

Home warranty insurance providers are more likely to provide insurance for building designs that incorporate resilient roofs and/or RWH if other third-party warranties are allotted to the development project. This could include warranties from associations such as RCABC for water leak detection, third-party building envelope consultants and/or GRI providers and installers. A proprietary system by GRI providers (such as green roof providers and installers) would give home warranty insurance providers additional confidence in insuring the project. Obtaining these warranties before applying for home warranty insurance would be the responsibility of the developer, and as of now, are done solely on a voluntary basis.

4. **Amending Home Protection Act wording and exemptions.**[4]

A home warranty insurance provider brought attention to the vague wording used in the Act concerning building envelopes and water penetration. It is as follows,

Statutory protection

23 (1) A residential builder or an owner builder and a vendor of a new home are both deemed to have agreed with the owner of the new home, to the extent of labour, materials and design supplied, used or arranged by the residential builder, owner builder or vendor, that the new home, except to the extent prescribed by regulation,

(b) is free from defects in the building envelope, including defects resulting in water penetration, and will remain so for a period of at least 5 years after

(Part 8.23, Homeowner Protection Act, 1998)

This ambiguous wording creates substantial uncertainty over the responsibility of water damage issues regarding building envelopes and those responsible if something were to occur. It was mentioned that such wording could easily lead to a legal claim situation for minor issues.

Additionally, the Act lists several exemptions to the insurance in regards to waters use and vegetation that could be interpreted as GRIs:

Permitted exclusions — general

10 (1) The following may be excluded by a warranty provider from home warranty insurance:

(a) landscaping, both hard and soft, including plants, fencing, detached patios, planters, gazebos and similar structures;

(f) the operation of municipal services, including sanitary and storm sewer;

Permitted exclusions — defects

11 (1) A warranty provider may exclude any or all of the following items from home warranty insurance:

(h) accidental loss or damage from acts of nature including, but not limited to, fire, explosion, smoke, water escape, glass breakage, windstorm, hail, lightning, falling trees, aircraft, vehicles, flood, earthquake, avalanche, landslide, and changes in the level of the underground water table which are not reasonably foreseeable by the residential builder;

(Part 2.10 & Part 2.11, Homeowner Protection Act, Regulations, 1998)

In consequence, this deters insurance providers, as well as the development industry, from taking innovative steps in sustainable development such as incorporating resilient roofs and/or RWH systems. A reconsideration of the words used in the Act by amendment or the addition of an appendix with regards to newer technologies such as these GRIs may provide clarity for those involved and help progress the development industry in incorporating greener practices.

5. **Designated authority overseeing of the GRI process.**[5]

Many stakeholders have expressed concern that there is no one 'entity' that oversees the process of a resilient roof and/or RWHbeing implemented in a MURB development

from start to finish. Several members of the process have expressed frustration over the change of hands that incorporating a GRI entails. It has been suggested that one person take on this role, such as the architect, the roofing contractor and/or the GRI installer to avoid confusion at the various stages of development. This would ensure that there is a 'point person' from beginning to end. In all, a designated authority would help distinguish responsibility should anything go awry and overall provide more assurance and guidance to those the involved in the process.

6. Implementation of a maintenance and monitoring program.[6]

Maintenance and monitoring has been seen as hugely important to the performance and lifecycle of both resilient roof and/or RWH systems. A maintenance and monitoring program executed by the City may help GRIs function to their full capacity, as well as provide additional support for their upkeep and preservation. Strata councils are largely responsible for the maintenance of on-site resilient roofs and/or RWH systems, with little to no knowledge on how to maintain these operations. A maintenance and monitoring manual developed for laypeople, as well as for developers and builders, mandated by City could help prevent undesirable issues, as well as inform citizens of GRI, their benefits and how to appropriately interact with them. A monitoring system would help the City stay informed on local GRIs, their performance, upkeep and create an inventory to refer back to.

RECCOMENDATIONS IN ALIGNMENT WITH THE RAIN CITY STRATEGY STREETS & PUBLIC SPACES (S&PS) ACTION PLAN AND BUILDING & SITES (B&S) ACTIONS PLAN:

1 S&PS - 15 Industry Capacity Building & Public Engagement

2 B&S-09 Industry Capacity Building — Fostering Industry Excellence

3 B&S-04 Mid- and High-Rise Structures — Assessing New & Existing Building Opportunities

4 B&S-01 Advance Rainwater Management Policies and Regulations— Supporting Implementation Through New and Existing Policies and Regulations

5 S&PS-14 Shift in City Process & Capacity Building

6 S&PS-10 Green Rainwater Infrastructure Operation and Maintenance Program

OTHER CONSIDERATIONS

1. A public database of GRIs implemented across the City[7]

The City and those involved in its development process could benefit from an open-source database that lists all GRIs installed across the City (on both private and public properties). In conjunction with a city GRI monitoring system, this database could retain critical information on aspects such as system performance, material use, installation procedure and maintenance practices. This would additionally provide an inventory of precedent studies for developers and builders to refer to, as well as allow the general public to become more aware of the green infrastructure interventions found within their built environment.

2. Adopt best practices and guidelines from Europe

Several stakeholders suggested that the City of Vancouver look toward and engage with European cities that have succeeded in implementing substantial amounts of green infrastructure. Projects and city plans found in Berlin, Germany, Copenhagen, Denmark and Rotterdam, Netherlands were among the ones discussed. A collaboration and/or professional network with a European city that has implemented a similar policy document to CoV's Rain City Strategy could help city staff members (particularly those in the Green Infrastructure and Integrated Water Management branches) find solutions and overcome barriers quickly and effectively. The European green infrastructure market is approximately 50 years older than that of Vancouver's, making it an ideal environemnt to engage in.

3. CoV GRI list of trusted teams and practitioners[8]

Many stakeholders, particularly those involved in helping provide home warranty insurance, mentioned the importance of having a trusted team be apart of a development project that may incorporate resilient roofs and/or RWH. Individuals and teams that have a history of successful green developments are more likely to have GRIs accepted in their designs than others. For this reason, it would be beneficial for the City of Vancouver to create a list of 'trusted teams and practitioners' who have a history of successful developments that incorporate GRIs and multiple years of experience. This could additionally create a consulting network for newer teams entering the green infrastructure market. As of now, it is more common that larger, more expensive developments are able to pass more innovative and greener designs. A public-facing GRI contact list could help diversify the market.

4. Separate by-laws for individual GRIs[91011]

In July 2018, the City Council passed a motion to draft policy in order to mandate green roofs on all new commercial, institutional, industrial, and multi-family residential developments (Councillor Carr, 2018). Since then, no follow-up has been made publicly available. Separate by-laws for implementation of specific GRIs could help the city better mandate green infrastructure installation and fulfill the goals of the Rain City Strategy. New by-laws that hone in on the details of different GRIs could help them become more prolific across the City.

5. Incentives from the City of Vancouver[12]

Currently, there are no direct incentives for developers and/or builders to incorporate GRIs in their MURB developments. Several incentives have been suggested by interviewees, such as from development cost levies (DCLs), bonus densities, community amenity contributions (CACs), as well as a Green Rainwater Infrastructure development grant to help encourage sustainable building.

6. ‘Green Builder’ Certificate Program[13]

A local certified education program specialized in teaching GRI installation, maintenance and monitoring for builders and contractors could benefit the industry immensely while adding an additional regulatory piece to the green development process. A joint program with the British Columbia Institution of Technology (BCIT) and the City was discussed by City staff.

OTHER CONSIDERATIONS IN ALIGNMENT WITH THE RAIN CITY STRATEGY STREETS & PUBLIC SPACES (S&PS) ACTION PLAN AND BUILDING & SITES (B&S) ACTIONS PLAN:

7 S&PS-06 Green Rainwater Infrastructure Pilot and Demonstration Project Program

8 S&PS - 15 Industry Capacity Building & Public Engagement

9 B&S-06 Resilient Roofs Program

10 B&S-05 Rainwater Harvesting Program - Building on Existing Policy

11 B&S-01 Advance Rainwater Management Policies and Regulations— Supporting Implementation Through New and Existing Policies and Regulations

12 S&PS-12 Citywide Green Rainwater Infrastructure Financial Planning and Sustainable Funding Program

13 B&S-09 Industry Capacity Building — Fostering Industry Excellence

CONCLUSION

The City of Vancouver’s Rain City Strategy calls for a shift in how the City utilizes its urban water systems and strategizes to take on a more holistic and integrated approach to rainwater management. With the adoption of GRIs, the City could help combat the adverse effects of climate change, while improving water quality, enhancing biodiversity, sequestering carbon and mitigating flooding. For a wet and rainy city such as Vancouver, water-sensitive urban design should be a priority.

This research brings awareness on the barriers and challenges faced with obtaining home warranty insurance for new residential developments that incorporate resilient roofs and/or rainwater harvesting. By engaging with several stakeholders and exploring local case studies, this research was able to create a list of recommendations and suggestions for the City to consider and address them. In order to see this research through, the list of recommendations provided must be adopted by various members involved in the process by way of policy change, behavioural change and ideological change.

As the world becomes more urbanized and climate change becomes an increasing global concern, cities are now more responsible than ever to explore every avenue that may ensure the safety and well-being of their residents and resources. The implementation of GRIs such as resilient roofs and rainwater harvesting in new homes is a vital part of that plan.

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APPENDIX

I.Inteview Questionnaire

Introducing Myself
I am a second-year Master's student in the School of Community and Regional Planning (SCARP) at the University of British Columbia. I am currently a Sustainability Scholar **researching the challenges and opportunities associated with obtaining home warranty for resilient roofs and/or rainwater harvesting on new residential developments.** I am personally very interested in ecological planning and the implementation of green infrastructure. I hold a Bachelor's of Arts & Science (B.A.&Sc.) in Environmental Science and Urban Geography from McGill University which I received in 2018.

Context
This research **focuses on the challenges and opportunities associated with obtaining the mandatory home warranty for new homes that may incorporate resilient roofs (blue, blue-green, green roofs) and/or rainwater harvesting (RWH)/**

With regards to **Home Warranty Insurance,** this research focuses particularly on the following aspects of the warranty:

- Multi-residential units (strata properties)
- Their common areas (roofs and plumbing systems)
- 5-year building envelope warranty

This excludes:

- Single-family dwellings
- Owner-built homes

This interview is expected to take 30 minutes.

Do you mind if I record this interview for personal purposes?

Information on Interviewee
Please describe your role and an overview of what you do.

Experience on Topic
Do you have experience with cases of new homes that have incorporated resilient roofs or rainwater harvesting and have received the mandatory home warranty insurance? Do you have experience with cases that have not? Please elaborate on your experiences and any challenges/barriers or opportunities that you may have come across.

Perceived and Actual Barriers:

BC Housing -

What are some reasons why **BC Housing Staff Members**, may be deterred from encouraging rainwater harvesting and/or resilient roofs on new residential developments?

Developers/Builders -

What are some reasons why the mandatory home warranty insurance may deter **developers and/or builders** from incorporating resilient roofs and/or rainwater harvesting in their new residential developments?

Insurance Providers -

What are some reasons why **home warranty insurance providers** may be deterred from providing insurance to new development that incorporate resilient roofs and/or rainwater harvesting?

Categorization of Perceived and Actual Barriers/Challenges:
Overall, how would you categorize the above-barriers?

As social-political (this includes, but not limited to)?:

- Fear/Lack of confidence in green infrastructure technology
- Provincial and municipal politics/policies (ex. Homeowner's Protection Act)
- Lack of standards and process in place
- Perceived consumer protection for new homeowners
- Cost

Or bio-physical/technical (this includes, but not limited to)?:

- Maintenance (with special attention to the 5-year insurance for the building envelope)
- Potential construction defects
- Current green infrastructure design (not robust enough)
- Lack of local industry design/construction/maintenance supply and competence
- Size
- Structure
- Climate (Vancouver is very rainy)

Opportunities/Suggestions/ Recommendations:
What do you believe should change in the process and standards of the BC Homeowner Protection Act and its mandatory home warranty insurance in order to simplify and streamline the process of implementing resilient roofs or rainwater harvesting (alongside other green infrastructure interventions)?

- Could this include creating cases that are excluded by the Act or its regulations (ex. Rental or affordable housing)?

In an ideal world...
In an ideal situation, how would the process of receiving home warranty for a new development that incorporates resilient roofs (green and/or green-blue roofs) and rainwater harvesting look like to you?

Other Contacts (Research Snowballing Technique):
Would you be able to refer me to anyone else in **BC Housing** that is involved in this process, has experience in it, or knows the Home Owner's Protection Act more in-depth?

Would you be able to direct me to **authorized home warranty insurance providers** who have experience and/or responsibility for home warranty insurance that includes new developments with these interventions?

Would you be able to direct me to **developers/builders/green infrastructure providers** that have experience with projects that have these interventions?

End of Interview
Thank you very much for your time!

Subject to change based on the interviewee.