



<b>SUBJECT</b>	<b>UBC GREEN BUILDING ACTION PLAN: PATHWAY TO A NET POSITIVE CAMPUS AND REAP UPDATE</b>
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<b>MEETING DATE</b>	<b>SEPTEMBER 27, 2018</b>
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Forwarded on the Recommendation of the President

**APPROVED FOR  
SUBMISSION**

Santa J. Ono, President and Vice-Chancellor

<b>DECISION REQUESTED</b>	<p><b>IT IS HEREBY REQUESTED that <i>approval be granted for:</i></b></p> <ul style="list-style-type: none"> <li><i>i. the Green Building Action Plan (GBAP) for the UBC Vancouver Campus as a framework for action; and,</i></li> <li><i>ii. amendments to UBC’s Residential Environmental Assessment Program (REAP 3.1) to achieve improved building sustainability performance.</i></li> </ul>
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<b>Report Date</b>	August 1, 2018
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**Presented By** Philip Steenkamp, Vice-President External Relations  
Peter Smailes, Vice-President Finance and Operations  
Michael White, Associate Vice-President Campus and Community Planning  
John Metras, Acting Associate Vice-President Facilities

**EXECUTIVE SUMMARY**

This report provides an overview of the University of British Columbia’s (UBC’s) Green Building Action Plan (GBAP) which outlines a holistic pathway for academic and residential buildings at the UBC Vancouver campus to advance towards making net positive contributions to human and natural systems by 2035. The GBAP plays a key role in pursuit of an exceptional built environment, one that will support the academic mission of teaching, learning and research and contribute to our sustainability goals on the academic campus and within residential neighbourhoods. The Green Building Action Plan is attached as Appendix A.

**DESCRIPTION & RATIONALE**

UBC has been growing rapidly and is projected to significantly increase the number of new building projects, as well as renovations and retrofits of existing buildings in support of the university’s new strategic plan. In 2016, the Board of Governor’s approved UBC’s Climate Action Plan 2020 which called for the development of a green building plan as a key opportunity to reduce energy use, greenhouse gas emissions and total cost of building ownership through the operational life of the buildings. The Green Building Action Plan is also intended to provide guidance to ensure higher levels of building performance that support human and ecological wellbeing.

Incremental improvements in each of the eight component areas of the GBAP will move UBC towards a net positive campus. For both institutional and residential building design, the GBAP provides goals, targets, and actions in each of the following component areas: energy, water, materials and resources, biodiversity, health and wellbeing, quality, climate adaptation, and place and experience. Wherever possible, the GBAP identifies actions and measures where prudent investments leverage a series of co-benefits through a whole-system lens.

In order to achieve the goals and targets in each of the component areas, the GBAP outlines a series of actions to be undertaken with a clear delineation of roles and responsibilities that were defined through extensive consultation. A number of actions in the emergent areas of the GBAP, such as biodiversity or health and wellbeing, are structured as an iterative process where the cycle of research, benchmarking, piloting, implementation, and evaluation help inform policy and enable continuous improvement.

In its ongoing work to advance sustainability and green buildings on campus, UBC has already progressed in several of the GBAP's component areas, particularly energy, water, quality, and some aspects of materials and resources component. This progress has been integrated into existing policies and will be further advanced through the GBAP.

Building operation places a large demand and cost on the consumption of water and energy as well as the associated greenhouse gas emissions. The total utility cost for core and ancillary buildings in 2017 was approximately \$25 million. Continued investments to improve energy and water performance will yield cost-savings for the university that can be invested back into the buildings to achieve further efficiencies. Approximately 97% of UBC's greenhouse gas emissions for core and ancillary operations are generated from the heating of buildings and water. In 2017, UBC as a public sector organization was required to pay a total of \$1.2 million to offset greenhouse gas emissions under the Carbon Neutral Government Regulation. Efficiency measures in the GBAP will help to reduce UBC's annual utility spending and associated carbon offset costs.

Building energy efficiency has long been a focus at UBC and the GBAP will make further improvements by introducing energy reduction targets for institutional buildings which include addressing the energy performance gap with measures such as air tightness testing. Many of the remaining component areas, however, are emerging and will require assessments to determine best practices and opportunities to demonstrate how to effectively address the challenges and opportunities in a cost-effective manner.

The impacts associated with climate change on buildings are becoming more pressing with long-term warming, more extreme weather events and changing precipitation patterns. Many of the cross-cutting actions in the GBAP will help in mitigating climate impacts associated with operation of buildings and will increasingly address adaptive measures including maintaining thermal comfort and introducing more stringent building storm water management measures. For example, establishing appropriate guidelines for green roofs will ensure that future installations address multiple benefits such as managing storm water by reducing runoff, conserving energy, increasing longevity of roof membranes, increasing biodiversity and improving human and ecological environments while also addressing maintenance and operational considerations.

Below are the key directions in each of the component areas which highlight areas where the Green Building Action Plan will advance performance across institutional and residential buildings and set us on the path to creating a net positive campus.

## Institutional Buildings

### Energy

The GBAP will:

- use less energy over time and help achieve net positive greenhouse gas emissions by decreasing building energy demand through passive design, increasing building energy efficiency and supplying energy demands with renewable energy when supported by a positive business case
- design thermally comfortable indoor environments that are responsive to climate change, and support the health, wellbeing and productivity of occupants
- improve building performance by addressing occupant behavior and operator concerns, increasing the stringency of compliance measures, and identifying actions to reduce the energy performance gap

### Water

The GBAP will:

- advance water conservation and efficiency and explore alternative water supply and treatment solutions
- focus on the development of landscape and irrigation design standards to better understand how to manage and conserve water (in alignment with the UBC Water Action Plan)
- develop guidelines for the appropriate use of green roofs and roofs that can temporarily store rainwater
- improve rainwater management at the site and building scale, using low impact design (LID) where possible, to help mitigate the risk of floods and downstream impacts related to cliff erosion and limited storm water infrastructure capacity

### Materials and Resources

The GBAP will:

- incrementally reduce the environmental footprint in materials choices, the handling of these materials, and the waste products generated during construction and occupancy
- require increased building material content transparency in order to make better decisions on material choices
- develop an approach to identifying and reducing the use of building materials considered harmful to human health

### Biodiversity

The GBAP will:

- develop principals and supporting guidelines for building landscapes that address local and regional biodiversity priorities and provide other co-benefits such as human wellbeing
- identify ecological assets through site assessments and identify opportunities to integrate ecological services through whole-system design
- improve the UBC Bird Friendly Design Guidelines for Buildings
- strengthen linkages to research initiatives through engagement, monitoring and assessment

## Health and Wellbeing

The GBAP will:

- provide guidance for building and landscape design that can nurture the mental, physical and social dimensions of wellbeing
- coordinate wellbeing principles, objectives and metrics that will inform site-specific building and landscape requirements with the development of the UBC wellbeing strategy
- review best practices, particularly the WELL Building Standard to help inform building design guidelines

## Quality

The GBAP will:

- analyze and strengthen existing processes and pursue increased compliance with building project goals, UBC Technical Guidelines and UBC's sustainability submission requirements
- clarify performance targets and expectations for the renovation and retrofits of existing buildings

## Climate Adaptation

The GBAP will:

- use the most up-to-date climate data to inform building designs in order to address thermal comfort and resilience to climate change impacts
- focus on a review of best practice for climate adaptation
- integrate actions with future campus resiliency planning for buildings and landscapes

## Place and Experience

The GBAP will:

- promote architectural and landscape designs that outwardly express the social and environmental sustainability aspirations of the University
- review and improve existing plans and processes to integrate place and experience goals
- continue to develop place and experience goals that contribute to the reputation and brand of UBC as a global sustainability leader

## Process

The GBAP will:

- ensure efficient integrated design processes
- make green building requirements accessible and easy to navigate for stakeholders with an implementation toolkit
- reduce the total cost of building ownership by taking a systematic approach to balancing maintenance, operating and replacement/refurbishment costs over the life of the building assets
- consider each building project as an opportunity for teaching, learning and research which supports continuous improvement and can contribute to broader market transformation

## Neighbourhood Residential Buildings

### Energy

The GBAP will:

- use less energy over time and help achieve net positive greenhouse gas emissions by focusing on the alignment of REAP with the BC Energy Step Code and introducing an energy benchmarking monitoring program
- improve understanding of design measures to maintain thermal comfort under future climate conditions
- achieve GHG reductions across the energy demand and supply spectrum at the lowest total cost of ownership

### Water

The GBAP will:

- focus on a water metering and benchmarking strategy to inform the development of landscape and irrigation design standards
- improve rainwater management at the site and building scale, using low impact design (LID) where possible, to help mitigate the risk of floods and downstream impacts related to cliff erosion and limited storm water infrastructure capacity

### Materials and Resources

The GBAP will:

- incrementally reduce the environmental footprint in materials choices, the handling of these materials, and the waste products generated during construction and occupancy
- require increased building material content transparency so we can more fully understand their environmental impact
- develop an approach to identifying and reducing the use of building materials considered harmful to health

### Biodiversity

The GBAP will:

- develop principals and provide guidance for landscapes and green roofs that address local and regional biodiversity priorities and provide other co-benefits such as human wellbeing
- address ecological assets identified in site assessments
- improve bird-friendly design guidelines

### Health and Wellbeing

The GBAP will:

- coordinate guidance for building and landscape design that can nurture the social dimensions of wellbeing
- coordinate wellbeing principles, objectives and metrics that will inform site-specific building and landscape requirements with the development of the UBC Wellbeing Strategy

## Quality

The GBAP will:

- work to ensure new buildings are built to a level of quality that reflects an optimum total cost of ownership for UBC as well as owners and renters of units
- improve the branding of REAP and its link to quality building
- support quality construction in the neighbourhoods to provide superior housing for faculty, staff, students and residents

## Climate Adaptation

The GBAP will:

- use the most up-to-date climate data for building designs in order to address thermal comfort and resilience to climate change impacts
- focus on a review of best practice for building climate adaptation
- integrate actions with future campus resiliency planning for buildings and landscapes

## Place and Experience

The GBAP will:

- promote architectural and landscape designs that outwardly express the social and environmental sustainability aspirations of the University
- continue to develop place and experience goals that will contribute to the reputation and brand of UBC as a global sustainability leader

## Process

The GBAP will:

- leverage and build upon existing processes to ensure that sustainability objectives inform development
- make green building requirements accessible and easy to navigate for stakeholders with an implementation toolkit
- measure the performance of neighbourhood projects, learn from data collected, and integrate new knowledge to evolve existing policies in all component areas of the GBAP
- consider building projects as creating opportunities for teaching, learning and research which support continuous improvement and can contribute to broader market transformation

## Residential Environmental Assessment Program (REAP 3.1)

REAP is a Policy 92 Land Use Rule and UBC-specific green building rating system, administered by Campus and Community Planning and applies to all multi-unit residential buildings in the neighbourhoods. REAP building requirements address the environmental impacts of the building, site and neighbourhood scale. All new residential projects, including private developments and faculty and staff housing are currently required to achieve a minimum of REAP gold certification.

The GBAP will require periodic amendments to REAP over the life of the plan to achieve the desired goals. REAP amendments will be incremental and calibrated to ensure the residential development market can absorb the changes without negative impacts.

This report recommends that the Board of Governors approve the proposed REAP 3.1 amendments which will apply to future residential development in UBC Neighbourhoods. The full set of REAP 3.1 proposed amendments are included as Appendix B of this report.

In summary, the proposed REAP 3.1 amendments contains updates in three areas: Procedures, Sustainable Site and Energy & Atmosphere. The most significant amendments in REAP 3.1 are:

- Alignment with Step 2 of the BC Energy Step Code (see below)
- Refinement of measures that reduce energy demand at the building scale, and where applicable, pursue low carbon energy supply through the neighbourhood district energy system (NDES).
- Update to electric vehicles (EV) charging station requirements to further support use of zero emission vehicles.
- Mandatory commissioning of energy systems to ensure buildings perform in accordance with the design and operational needs

The proposed REAP 3.1 amendments have been posted for public review and comment as per the Land Use Rules. No public comments were received during the 30 day comment period. However, staff received comments from a sustainability consultant after the 30 day comment period which identified a number of minor housekeeping amendments and suggested a reallocation of energy points to reflect the technical and financial resources to achieve these points. These changes are reflected in the amendments attached in Appendix B.

One of the objectives of the REAP 3.1 amendments is to align with the BC Energy Step Code. The Energy Step Code, enacted in 2017, provides a tool designed to help government Authorities Having Jurisdiction (AHJs) and industry achieve better than base building code performance through incremental steps; lower steps (Step 1 and 2) are relatively straightforward to meet and upper steps (Step 3 and 4) are progressively more ambitious in reducing energy use. The proposed alignment with Step 2 provides a balanced approach to achieve the community energy and emission reduction goals at the building and neighbourhood district energy scale.

### Attachments

- Green Building Action Plan – Appendix A
- REAP 3.1 redline showing proposed amendments – Appendix B

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### INSTITUTIONAL STRATEGIC PRIORITIES SUPPORTED

✓ Learning

✓ Research

✓ Innovation

✓ Engagement

International

(Internal / External)

or ✓ Operational

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## **Learning & Research**

The GBAP provides an opportunity to harness the wealth of expertise from academic research at UBC to achieve campus operational goals and to more firmly tie operations to the university's core mission. Teaching, learning and research opportunities have been identified within the framework of the GBAP to help frame policy and investigate technical issues. Through the Campus as a Living Lab approach, UBC provides unique opportunities for academic engagement in the process of planning, design, construction and operations as well as performance monitoring and inhabitant wellbeing. Equally important, the expertise of academic faculty can be leveraged to help fill knowledge gaps and create solutions to challenges, such as climate change adaptation and support of biodiversity in urban areas, which can be piloted at UBC, assessed and used to inform future projects and policies at UBC and beyond.

Campus as a Living Lab building projects pilot innovative approaches while maintaining viable operations, for example the Bioenergy Research and Demonstration Facility (BRDF), the Centre for Interactive Research on Sustainability (CIRS) and Brock Tall Wood House are demonstrations of UBC's global leadership in sustainability.

## **Financial**

The Green Building Action Plan outlines a priority action plan and long-term framework for implementation which can be addressed through existing operational resources and budgets. It is in the University's long term interest to invest in better buildings as this results in long term dividends including healthier, happier and more productive occupants and reducing total cost of ownership.

## **Sustainability**

UBC is recognized as a global leader in sustainability and has been awarded through the Association for the Advancement of Sustainability in Higher Education (AASHE) with two consecutive Gold awards in addition to having the highest number of certified green buildings on a university campus in Canada.

Sustainability is an imperative in planning and implementation activities at UBC, enmeshed in culture and practice. The University has a 25-year record of advancing sustainability on campus, and through that experience has developed a keen understanding of the important role and impact of buildings in environmental and human wellbeing.

UBC's leading green building projects advance higher levels of performance through an iterative approach that allows it to test innovation and integrate research and teaching to inform policy, guidelines and operations. These projects help UBC capture new ideas that inspire people and actions in the move towards a net positive campus, and they also provide a growing body of practical knowledge and experience on advancing green building performance and practices with the potential for broader market transformation.

## **Reputational**

UBC's global leadership in sustainability attracts and retains high-calibre students, faculty and staff to its campus. UBC is also able to secure significant amounts of grant funding because of its reputation to successfully deliver large and complex high performance buildings. UBC has been able to invest its research expertise in green buildings and share the learnings to help support capacity building and market transformation in other campuses and municipal jurisdictions.

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<b>BENEFITS</b> Learning, Research, Financial, Sustainability & Reputational	<p>The Green Building Action Plan will introduce new performance measures which may result in greater capital investment up front and lower operating costs over the life of the buildings. Since UBC owns, operates and maintains many of its buildings these measures are intended to improve long term operational efficiency as well as improve inhabitant experience within the buildings.</p> <p>Innovative approaches are proposed in emergent areas of the GBAP, these will be piloted at a scale where risk can be managed and addressed. Pilot projects will be monitored and assessed to inform campus wide-scale policy and guidelines.</p> <p>Ties to teaching, learning and research on many levels will link research to operations more closely providing opportunity for funding applications related to the process of building planning, design, construction and operations of buildings as well as performance monitoring and inhabitant wellbeing.</p>
<b>RISKS</b> Financial, Operational & Reputational	<p>Through green building demonstration and pilot projects UBC will be able to take on measured risk to help advance the implementation of innovative technologies, systems and materials that support higher performance buildings on its campus and beyond. These pilot and demonstration projects are typically conducted in a controlled environment or implemented at a scale to ensure that the core functions and operations of University buildings will not be negatively impacted.</p>
<b>COSTS</b> Capital & Lifecycle Operating	<p>Energy is an immediate priority area, and two UBC energy costing studies, one for institutional buildings and the other for residential buildings, have been completed and reviewed and supported by UBC Properties Trust. The findings of these studies have been used to inform the energy component area.</p> <p>For all component areas, measures will be piloted and monitored before adopting as a policy to ensure that it can be achieved within the capital budgets allocated to building projects. For some component areas, third party studies have been used to help provide cost input.</p> <p>In general the GBAP will help reduce lifecycle costs through lower utility consumption, avoided environmental control and damage costs, and reduced health costs.</p>
<b>FINANCIAL</b> Funding Sources, Impact on Liquidity	<p>The GBAP will be implemented using existing budgets and resources. There is no impact on liquidity and it is expected that the implementation of the plan will result in reducing total cost of ownership for the university.</p>
<b>SCHEDULE</b> Implementation Timeline	<p>The implementation timeline is 17 years (2018-2035). Actions for staff have been divided into short term (2018-2020), medium term (2021-2015) and long term (2026-2035).</p> <p>The proposed REAP 3.1 Amendments will be implemented upon approval of the Board of Governors.</p> <p>Periodic monitoring of GBAP implementation will be undertaken and the plan will be reviewed and updated every 5 years.</p>

**CONSULTATION** Relevant Units, Internal & External Constituencies

The development of the GBAP has included extensive engagement with UBC Properties Trust, residential developers, consultants, students, faculty, staff and residents as well as green building experts to collect input and develop ideas for the future and better understand stakeholder aspirations linked with green building practices.

- Late 2016: 15 Contributor interviews were conducted to better understand the issues and opportunities.
- January 2017: Two Ideas workshops with both residential and institutional contributors were held to gain input and ideas for the development of the plan.
- 2017-2018: Over 30 focus groups were held to develop the goals and actions that make up the plan, building on the ideas from the interviews and workshops.
- 2017-2018: Refinement of GBAP: communication with technical groups, the steering committee and senior leadership; and faculty and peer review.

<p><b>UBCPT COMMENTS</b> Complete for all reports that include a property component</p>	<p>Review Date</p>	<p>August 14, 2018</p>	<p>Signed off by</p>	<p>Aubrey Kelly, President &amp; CEO</p>
<p>UBCPT supports the adoption of the GBAP and REAP 3.1 as key initiatives to mitigate the environmental impacts of building construction and operation. Policies in these documents may initially prove challenging to meet and may result in some initial construction cost increases, although we have not been made aware of any aspects that would cause critical concern. Consultants and contractors upon whom we rely for successful completion of development projects have indicated that the proposed measures are achievable and will incrementally increase the performance of buildings constructed on campus. We see these policy documents as the logical next step in “raising the bar” for environmentally responsible design and construction.</p>				

# Appendix A

August 9th 2018

# UBC Green Building Action Plan

Pathway to a Net Positive Campus

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## Executive Summary

### Pathway to a Net Positive Campus

The University of British Columbia's (UBC's) Green Building Action Plan (GBAP) is a policy framework that outlines incremental improvements for buildings towards a vision of net positive ecological and human health in pursuit of an exceptional built environment that supports the academic mission of teaching, learning and research. To implement the GBAP, component goals, targets and actions have been developed that will direct university staff to work towards achieving the vision: *By 2035, UBC's buildings will make net positive contributions to human and natural systems.*

### The Scope

UBC's Vancouver campus is located on unceded, traditional xwməθkwəy̓wəm (Musqueam) territory. The xwməθkwəy̓wəm people have been on the University Endowment Lands, present-day Vancouver, and surrounding areas since time immemorial. Today, the 402-hectare Vancouver campus is a mix of institutional academic lands and residential neighbourhoods. Provincial legislation gives UBC's Board of Governors unique powers to manage the development and operation of campus buildings, landscapes and infrastructure.

The scope of the Green Building Action Plan covers institutional and neighbourhood residential buildings at the Vancouver campus. Currently, in this location, UBC owns and operates over 342 institutional buildings,<sup>1</sup> and its residential neighborhoods house 12,000 people in 73 multi-unit residential and mixed-use buildings. UBC is growing rapidly, and it is expected to significantly increase the number of new building projects and existing-building retrofit projects over the next 20 years. How these building projects are designed, constructed and operated will have significant impact on sustainability of the campus and the wellbeing of the people who study, work and live there. The GBAP is intended to provide positive guidance to ensure the design and construction of new buildings, renovations and retrofits achieve higher levels of performance that advance toward the net positive goal for human and ecological wellbeing.

### Plan Structure and Component Areas

The Green Building Action Plan applies a whole-systems approach, bridging eight critical, integrated component areas of building design: energy, water, materials and resources, biodiversity, health and wellbeing, quality, climate adaptation, and place and experience. Ambitious component goals, targets and actions are set for each component area in institutional and residential building categories, and a series of actions for UBC planning and operations staff are outlined. Actions are implemented in

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<sup>1</sup> With an area of over 500 m<sup>2</sup>.

an iterative, continual improvement process and follow a cycle of research, benchmarking, piloting, implementation and monitoring that is necessary to implement the plan and enable continuous improvement of UBC buildings.

UBC has gained experience in some component areas, particularly energy, water, quality and some aspects of materials and resources. However, other component areas are emerging in nature and require foundational work to determine how to effectively address challenges and opportunities, particularly within the areas of biodiversity, healthy materials, climate adaptation, and health and wellbeing.

### **Operations Linked to Teaching, Learning and Research**

The Green Building Action Plan provides an opportunity to harness the wealth of expertise not only from operational and planning departments but also from academic research which will more firmly tie operations to UBC's core mission of teaching, learning and research.

Teaching, learning and research opportunities have been identified within the GBAP's framework to help frame policy and investigate technical issues. Through the Campus as a Living Lab approach, UBC provides unique opportunities for academic engagement with buildings via the processes of planning, design, construction and operations as well as performance monitoring and inhabitant wellbeing. Equally important, the expertise of academic faculty can be leveraged to help create solutions to challenges, such as climate change adaptation and support of biodiversity in urban areas, which can be piloted, assessed and used to inform future projects and policies at UBC and beyond.

### **Policy and Process**

The Green Building Action Plan works across different scales, from building to district, in conjunction with other UBC plans that together require synergistic integration to support UBC's goals. The GBAP will be informed by many UBC and external plans. At the same time, it will provide direction to many UBC plans, guidelines and strategies. For example, the GBAP supports broader biodiversity and health objectives at the building scale through green roofs and living walls, providing tangible health and ecological benefits such as stormwater management.

UBC is in a unique position to explore new and emerging areas of policy for higher building performance. It has the opportunity to advance further than other jurisdictions because, unlike other jurisdictions, it owns and inhabits most of its buildings for a very long time—typically 75 to 100 years. It is in UBC's long-term interest to invest in building better buildings today as this results in long-term dividends, including healthier and happier occupants and lower costs of ownership. The expertise of academic faculty can be leveraged to help create solutions to challenges and fill knowledge gaps used to

inform policies at UBC and beyond. Detailed plans can be implemented by approval of the Board of Governors within the context of the provincially approved Land Use Plan.

### **Institutional Policies and Implementation Measures**

Academic development is guided in a significant way by the Vancouver Campus Plan. The Campus Plan Design Guidelines (Part 3), which integrate sustainability best practices, will need to be reviewed and updated in the next amendment to align with the Green Building Action Plan goals in all component areas.

Existing building renovations and retrofits offer a significant impact in terms of achieving the goals of the GBAP because of the extent of the existing building stock. The GBAP clarifies performance targets and expectations for the renovation and retrofit of existing buildings.

The UBC Technical Guidelines will be the major guiding document to ensure that GBAP objectives for institutional projects are met in all component areas. These guidelines were created to ensure the quality and performance of design, construction, renovation and retrofit of institutional buildings, landscape and infrastructure. Since the guidelines are updated annually, this provides an opportunity to ensure annual integration and alignment with the GBAP.

All new campus construction and renewals at UBC are currently mandated by the Province of BC to be LEED Gold certified. Over the timeframe of the GBAP, necessary updates to the UBC LEED Implementation Guide and consideration of alternative certifications that align with UBC policy objectives (for example, Passive House and Living Building Challenge certification) will be pursued.

The Sustainability Process, which was introduced five years ago to ensure better and more consistent integration of sustainability measures, supports an integrated design process for building projects and was introduced to ensure key design disciplines are brought together to achieve a high level of sustainability performance in a streamlined manner. Integrated design is critical for the success of the GBAP to encourage whole-systems thinking early in the design process. The Major Project Delivery Process at UBC is currently finalizing improvements. A priority action for the GBAP is for better integration of the Sustainability Process into the overall Major Capital Project Development Process in support of a more streamlined process for proponents.

Some areas of policy are emerging and will become integrated with policy over the life of the GBAP. In the areas of biodiversity, health and wellbeing, and climate adaptation, individual policies will be developed that will provide direction to and be informed by the GBAP.

### **Residential Policies and Implementation Measures**

Neighbourhood plans govern development of UBC's campus residential areas. The plans establish specific requirements for the form of building development, density, park space, recreation and transportation land use, all consistent with UBC's Land Use Plan. Future neighbourhood plans at UBC, such as Stadium Road<sup>2</sup> and Acadia Park, will reflect the requirements set forward in the GBAP.

The Residential Environmental Assessment Program (REAP) is a UBC-specific green building rating system that applies to multi-unit residential buildings. REAP building requirements support the movement towards a net positive position—and a reduction of environmental impact at the building site and neighbourhood scales—incrementally, over time. All new residential projects, including private developments and Faculty and Staff Housing, are required achieve a minimum REAP Gold certification. The GBAP proposes four amendments to REAP: REAP 3.1, REAP 3.2, REAP 4.0 and REAP 4.1.

REAP 3.1 applies to Wesbrook Place neighbourhood and refines measures that reduce energy demand at the building scale while pursuing low-carbon energy supply through the Neighbourhood District Energy System (NDES). Electric vehicle charging station requirements will also be updated to further support the use of zero-emission vehicles. The main purpose of this update is to align REAP with the British Columbia Building Code Energy Step Code (BC Energy Step Code). Enacted in 2017, the BC Energy Step Code dictates that municipalities use the incremental steps of the code in regulations if they require higher performance than code. Although UBC is not technically a municipality, Campus and Community Planning has determined that the best approach, legally and politically, is to align REAP energy credits with the BC Energy Step Code to ensure consistency with the rest of the province.

REAP 3.2 will update the weighting of impact areas within REAP (for example, energy, water, materials and resources, or innovation) to align with UBC's current policies. REAP 4.0 will be in place for the Stadium Road neighbourhood, and it will fine tune energy requirements and add requirements for health and wellbeing and biodiversity. REAP 4.1 is anticipated to add incremental improvements in each component area.

There are currently few policies, strategies or programs to guide the retrofitting of buildings within the UBC neighborhoods. As existing residential buildings age, they will require upgrades and retrofits, and this presents an opportunity to set forward performance requirements that achieve the goals of the GBAP for the extensive existing building stock. UBC will work with the University Neighbourhood Association (UNA) and existing residential stratas to develop a retrofitting strategy for the neighbourhoods, which will align with the residential GBAP for UBC-owned and -operated buildings.

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<sup>2</sup> Stadium Road Neighbourhood Plan is currently under development.

### **Making It Happen**

The success of the Green Building Action Plan is dependent on creating capacity with key agents of change, including developers and UBC departments. Successful implementation will require sustained leadership, activity and resources. The GBAP lays the foundation and continued stewardship is required.

The development of the GBAP has included extensive engagement with UBC students, faculty, staff and residents as well as green building experts to develop ideas for the future and better understand stakeholder aspirations linked with green building practices.

The implementation of the GBAP will be an ongoing and evolving process over the next 17 years, involving collaborations between multiple planning and operational departments at UBC and with academic researchers and external partners.

Regular monitoring of GBAP implementation will be upheld and the plan will be reviewed and updated every five years.

### **Costs Associated with the Plan**

Energy is an immediate priority area, and two UBC energy costing studies, one for institutional buildings and the other for residential buildings, have been completed and peer reviewed for the energy component. For all component areas, measures will be piloted and monitored before adopting as a policy to ensure that they can be achieved within the capital budgets allocated to building projects. For some component areas in the GBAP, third-party studies have been used to help provide cost inputs.

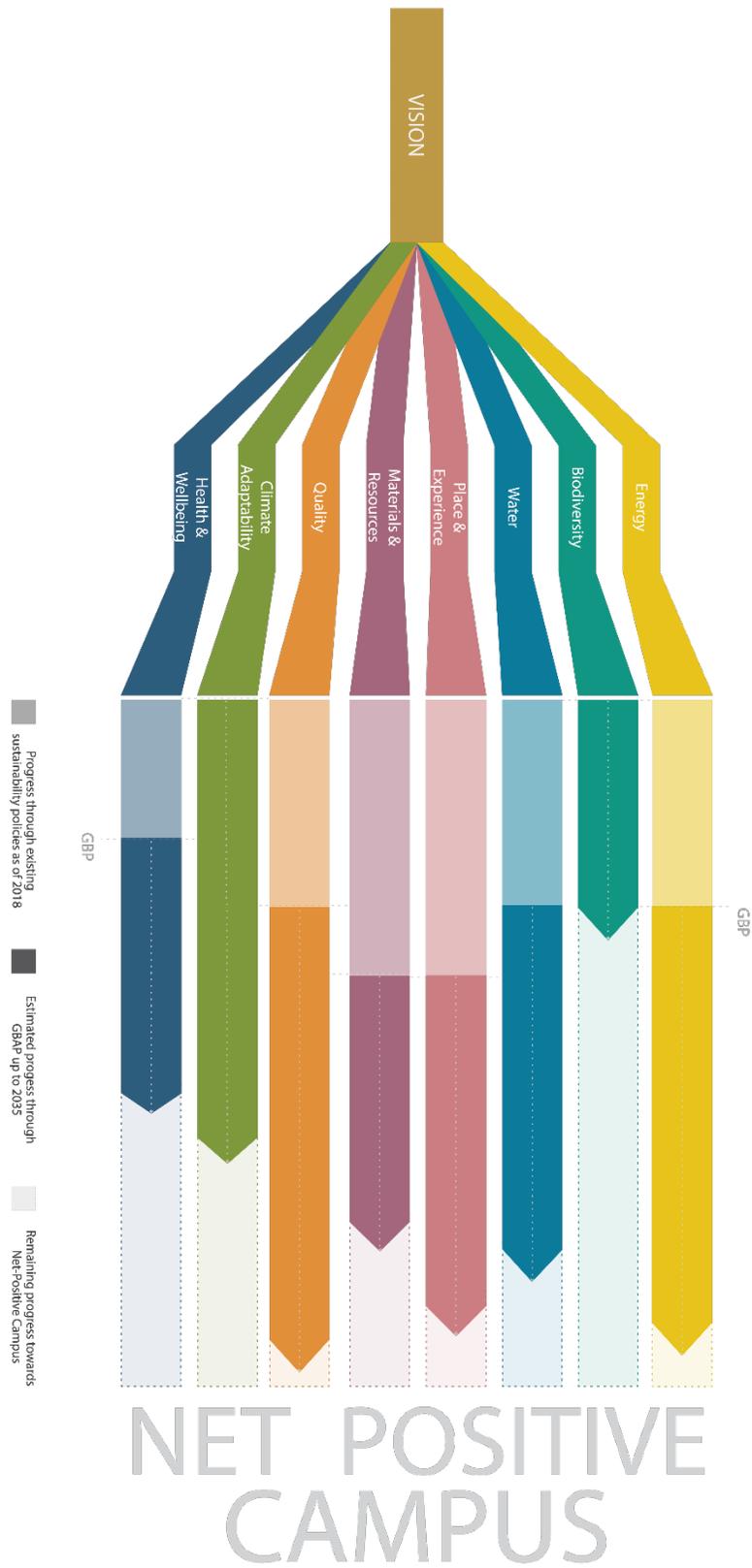
Given the GBAP will pay dividends with lower energy bills, avoided control and damage costs of environmental impacts of inaction, and reduced health costs, there is a good argument for the upfront investments now.

Above all, the GBAP supports the achievement of sustainable environments that enhance wellbeing and excellence for people at UBC and beyond in support of UBC's academic mission.

### **Description of Success**

By 2035, the UBC Vancouver campus's buildings will contribute towards a vibrant and sustainable campus that enhances the wellbeing of people and the environment. UBC will be a global leader and innovator in net positive buildings. The physical campus will be used as a demonstration project through the Campus as a Living Laboratory approach to help with broader market transformation towards net positive buildings. A trajectory will be set for the campus along the pathway to net positive in component areas of building design with processes in place for continuous improvements. Operational improvements will have reduced the carbon footprint towards the net positive goal to be achieved by 2050. Responsible water management will respect the

natural hydrology of the campus and a regional water balance. Materials choices will support continuous improvements in human and ecological health. Biodiversity will flourish and contribute to ecological health and the positive health and wellbeing of the UBC community. Buildings and landscapes will be resilient and capable of adapting to climate change. Operations will be firmly tied to teaching, learning and research to mutually provide progress towards a net positive campus.



# PART 1

## Part 1 Introduction to the Green Building Action Plan

### 1 What is the Green Building Action Plan?

#### Overview

The University of British Columbia's (UBC's) Green Building Action Plan (GBAP) is a policy framework that outlines incremental improvements for buildings towards a vision of net positive ecological and human health in pursuit of an exceptional built environment that supports the academic mission of teaching, learning and research. To implement the GBAP, component goals, targets and actions have been developed that will direct university staff to work towards achieving the vision: *By 2035, UBC's buildings will make net positive contributions to human and natural systems.*

#### GREEN BUILDING ACTION PLAN VISION

By 2035, UBC's buildings will make net positive contributions to human and natural systems.

UBC has a 25-year track record of advancing sustainability on campus, and through that experience has developed a keen understanding of the important role and impact of buildings in environmental and human wellbeing. The GBAP sets an ambitious vision for the campus, while providing processes and iterative steps to achieve it through the development of goals and targets in eight critical component areas of building design: energy, water, materials and resources, biodiversity, health and wellbeing, quality, climate adaptation, and place and experience.

The GBAP has been developed to help align campus development with UBC's strategic directions. The GBAP vision aligns with both the UBC 20-Year Sustainability Strategy, to embed regenerative sustainability<sup>3</sup> across the University, and the UBC Strategic Plan 2018–2028, to create buildings and environments that inspire people, ideas and actions for a better world.

The financial case for the GBAP<sup>4</sup> is growing rapidly, acknowledging the complexity of building development, policy and climate change. Indications are that an investment in green, resilient buildings will pay long-term economic dividends as carbon pricing, health impact costs and future climate change adaptation costs are assessed within the market.

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<sup>3</sup> For the purposes of the GBAP, regenerative sustainability is defined as “net positive contributions to human and natural systems.”

<sup>4</sup> See Costing on page 41.

## **The GBAP Scope**

UBC's Vancouver campus is located on unceded, traditional xwməθwkwəy̓wəm (Musqueam) territory. The xwməθwkwəy̓wəm people have been on the University Endowment Lands, present-day Vancouver, and surrounding areas since time immemorial.

Today, the 402-hectare Vancouver campus is a mix of institutional academic lands and residential neighbourhoods. Provincial legislation gives UBC's Board of Governors unique powers to manage the development and operation of campus buildings, landscapes and infrastructure. This includes the ability to guide future campus development through policy and to set goals and targets for performance in campus plans such as the Green Building Action Plan.

As an academic institution, UBC has a tremendous opportunity for innovation. By combining its core academic mandate of teaching and research with building design and operations, UBC can leverage the expertise of faculty, staff, students and partners to help create solutions to challenges on campus and in the wider community.

In institutional areas, UBC is the owner, operator and regulator of all buildings. In residential neighbourhoods, UBC is the regulator and landowner, and the owner and operator of many multi-unit residential and commercial buildings, with other strata buildings owned by stratas with 99-year leases with UBC. For both areas, UBC serves as the authority having jurisdiction for administering and enforcing the BC Building Code.

The scope of the GBAP includes both institutional and neighbourhood residential buildings at the Vancouver campus (it does not include the Okanagan campus) and provides guidance for the design of the following:

1. Institutional building projects<sup>5</sup>:
  - a. New construction
  - b. Existing building renovations and retrofits (construction costs over \$1 million)
  - c. Landscaping and municipal infrastructure within defined boundaries of a building project
2. Neighbourhood residential and mixed-use residential building projects:
  - a. Private housing developments on land leased from UBC
  - b. Residential rental units (including Faculty and Staff Housing)
  - c. Landscaping and infrastructure within defined boundaries of a building project

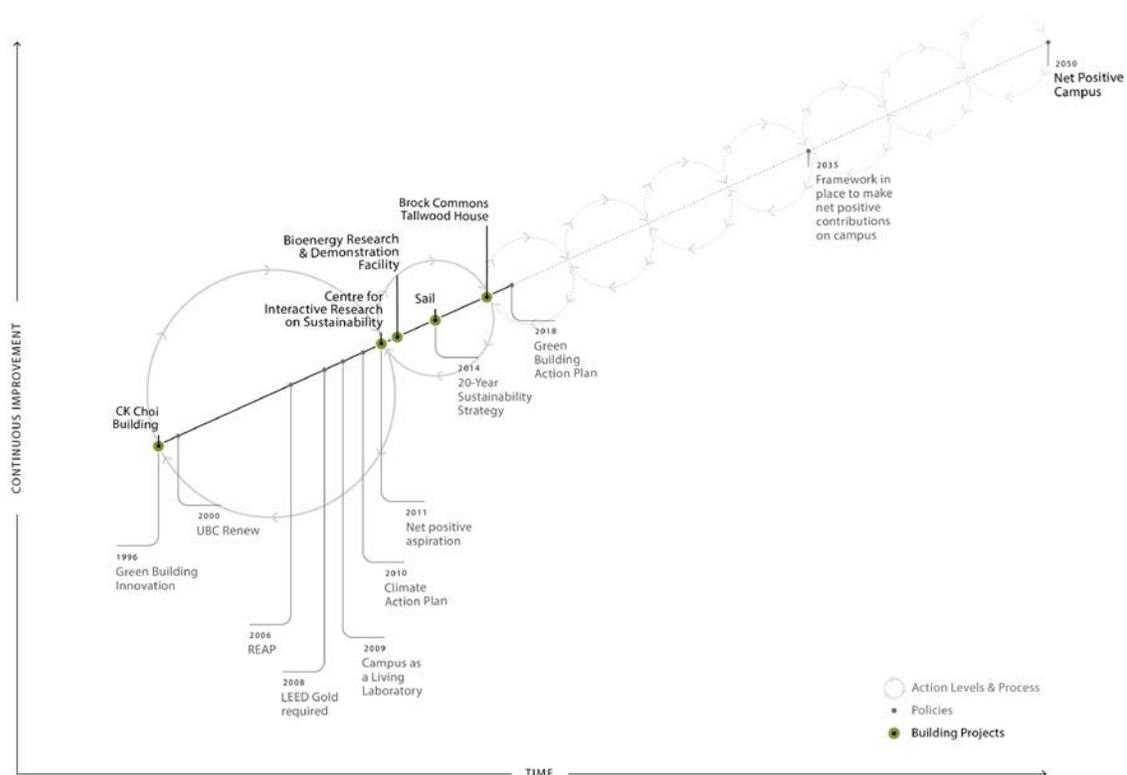


Figure 1. A timeline of UBC's innovation and pilots leading towards the vision of a net positive campus.

## Building on Momentum

Currently, at the Vancouver campus, UBC owns and operates over 342 institutional buildings,<sup>6</sup> including academic facilities, cultural venues, sports and recreation facilities

<sup>5</sup> Including student residences.

<sup>6</sup> With an area of over 500 m<sup>2</sup>.

and student residences. The residential neighbourhoods house 12,000 people in 73 multi-unit residential and mixed-use buildings. UBC is growing rapidly and is expected to significantly increase the number of new building projects and existing-building retrofit projects over the next 20 years. How these building projects are designed, constructed and operated will have significant impact on the sustainability of the campus and wellbeing of the people who study, work and live there.

The ambitions for the next stage of growth at the Vancouver campus are grounded in over 20 years of experience in green building and sustainable projects and policies. Starting in the mid-1990s, UBC was piloting green building projects, like the C.K. Choi building, with the innovative ideas of the time and was establishing the staff expertise and policy frameworks to enable them. This process has advanced over time, with projects like the Bioenergy Research and Demonstration Facility, which responded to low-carbon energy infrastructure needs for the entire campus, and the Centre for Interactive Research on Sustainability, which sought to operationalize regenerative sustainability concepts around environmental and human wellbeing. The more recent Brock Commons Tallwood House has demonstrated innovation in building design and construction techniques, featuring the use of engineered wood products in tall buildings and replicable prefabrication techniques. These projects have continued to inform campus policy and practices over the years, along with requirements like LEED Gold as a minimum standard for academic buildings and equally important operational and retrofit initiatives, like UBC Renew, which have improved the performance of existing buildings.

UBC's leading green building projects are pilots in an iterative approach that allows the testing of innovation and integration of research and teaching with the University operations. They help UBC capture new ideas that inspire people and actions in the move towards a net positive campus, and they provide a growing body of practical knowledge and experience about how to advance green building performance and practices. Recognizing that green buildings offer significant benefits in addition to their contributions to a net positive campus, UBC also acknowledges that there can be significant challenges in their design, construction and operation. The GBAP seeks to address these challenges by using UBC's policies and practices to remove barriers and enable project teams and university staff to create innovative, healthful and sustainable buildings.

Building on this momentum, the development of the Green Building Action Plan has included extensive engagement with UBC students, faculty, staff and residents as well as green building experts to develop ideas for the future and better understand stakeholder aspirations linked with green building practices.

#### **GBAP Engagement Process**

- Late 2016: 15 contributor interviews were conducted to better understand the issues and opportunities.
- January 2017: Two ideas workshops, with both residential and institutional contributors, were held to gain input and ideas for the development of the GBAP.
- 2017–2018: Over 30 focus groups were held to develop the goals and actions that make up the plan, building on the ideas from the interviews and workshops.
- 2017–2018: The GBAP was refined through communication with technical groups, the steering committee and senior leadership and through faculty and peer review.

For a full list of participants see Acknowledgements on page 79.

#### **Teaching, Learning and Research**

Teaching, learning and research opportunities have been identified within the framework of the GBAP to help frame policy and investigate technical issues that need to be addressed. At the same time, UBC recognizes, through its Campus as a Living Lab approach, that an academic institution provides unique opportunities for academic engagement with buildings via the processes of planning, design, construction and operations as well as performance monitoring and inhabitant wellbeing. Equally important, the expertise of academic faculty can be leveraged to help create solutions to challenges, such as climate change adaptation and the support of biodiversity in urban areas, which can be piloted, assessed and used to inform future projects and policies at UBC and beyond.

**Teaching, Learning and Research Levels**

The GBAP relies on the unique opportunities available at UBC to tie the plan for the built environment to teaching, learning and research at three different levels:

**Level 1:** Educational and engagement activities:

These are actions driven by the needs of the Green Building Action Plan and focused on educating and engaging the campus community and external partners in the aspirations, goals, strategies and actions of the GBAP. Examples include website information, green building tours, signage, student events or workshops.

**Level 2:** Small scope research studies:

These are discrete research projects that answer specific questions or address specific gaps in knowledge that are needed to develop policy or guidelines for the GBAP.

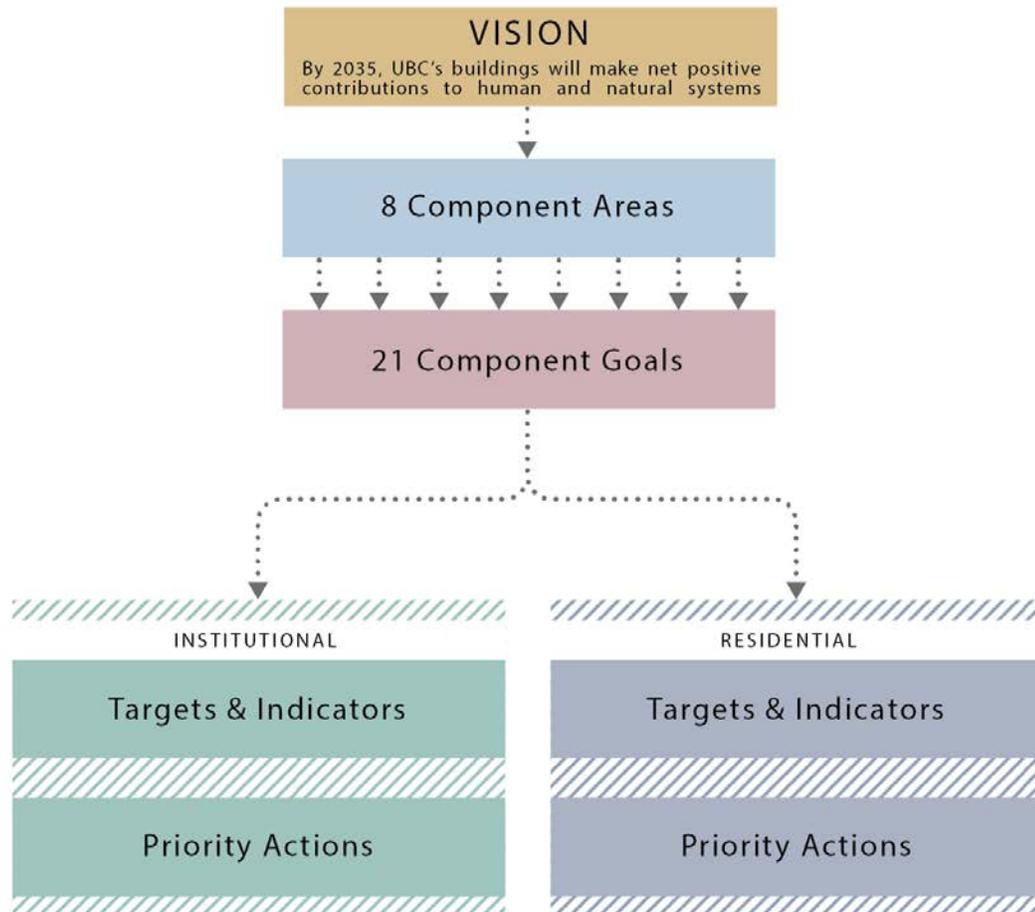
Developed by Sustainability and Engineering staff (or other staff-leads identified in the actions) and supported by UBC, project examples include SEEDs and Sustainability Scholars projects, or using academic courses to explore specific options.

**Level 3:** Large-scale or long-term research projects:

These are research projects with sustained academic involvement that tackle more complex questions or issues, especially in the emerging themes within the GBAP or opportunities around innovative pilot projects. These would provide opportunities for interdisciplinary and applied research projects that could be eligible for external research funding. Lessons and results could be applicable to the region and building industry beyond UBC.

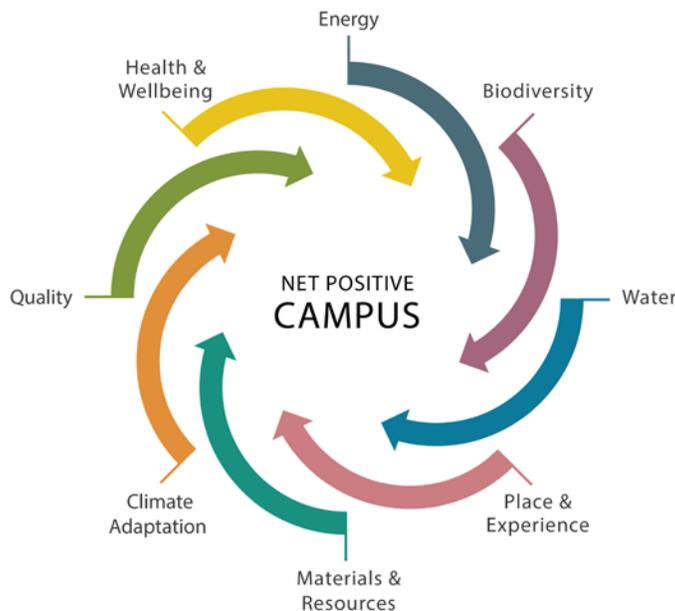
## 2 Overview

### 1. The Plan: Structure



The Green Building Action Plan is intended to be used as a comprehensive and collative document, which provides guidance and direction on the design and construction of new buildings, renovations and retrofits at UBC. Working towards the overall vision, and to achieve specific objectives, it is organized into component areas, each of which include specific component goals and the targets and actions required to achieve them.

The eight key green building component areas are part of a larger system that when approached through integrated and whole-systems thinking will help to advance towards the vision of a net positive campus. The eight components areas are illustrated in the diagram below.



Process (referring to the project development processes and procedures at UBC) is critical to the plan's success and is addressed as a cross-cutting initiative that influences and enables actions in all other component areas.

The GBAP introduces goals in each of the eight component areas, which are intended to work in combination to achieve the overall vision for the campus. These component goals pertain to both residential and institutional sections of the plan.

Targets and indicators have been developed for component areas to hold UBC accountable by monitoring its practices and performance towards the component goals. Targets are SMART (specific, measurable, assignable, realistic and time-related) and indicators measure progress in a more general manner.

In order to achieve the goals and targets in each of the eight component areas, the GBAP outlines a series of actions to be taken by UBC planning and operations staff alongside engagement with academic researchers and students.

Actions within each component area are sorted, with highest-priority actions intended to be completed within five years (short term). Actions are implemented in an iterative, continual improvement process and follow the cycle of research, benchmarking, piloting, implementation, and monitoring that is necessary to implement the GBAP and enable continuous improvement of UBC buildings.

Benchmarking, monitoring and evaluating are critically important to the success of the GBAP and a monitoring program will need to be developed to support implementation of the plan.

### Continual Improvement Process

**1. Research and review**

to advance knowledge of the component area through staff reviews of international best practices, academic research projects and consultant work.

**2. Benchmark and develop metrics**

to establish standards of measurement for the component area and set levels of performance.

**3. Pilot new approaches and installations**

to test, learn and inform the development of policy and practices.

**4. Implement policy and practices**

to put the experiences of steps 1 to 3 into action and introduce new policy or strengthen existing policy.

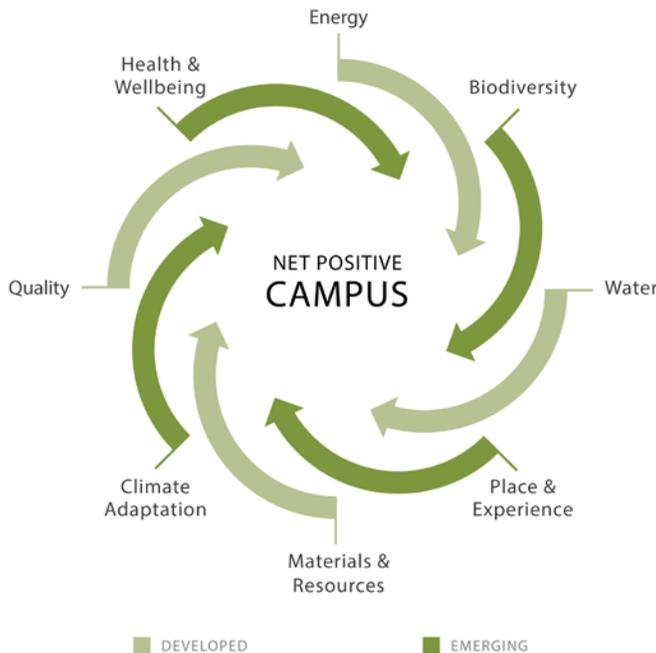
**5. Monitor and Evaluate**

to learn from experience and encourage continuous improvement in UBC's buildings.



## Emerging Component Areas

Sustainability in building policies and practices has been a priority for UBC for over 20 years. During that time, UBC has gained significant experience in some of the component areas, particularly energy, water and quality as well as some aspects of the materials and resources component. This experience has been institutionalized in existing policies such as the UBC Technical Guidelines and the Campus Plan Design Guidelines. However, many of the remaining component areas of the GBAP are emerging in nature and require foundational work to determine how to effectively address the challenges and opportunities within topics such as biodiversity, healthy materials, climate adaptation, and health and wellbeing. In these emerging component areas, a five-year implementation plan will focus on the foundational studies, research and analysis to establish targets and associated actions for achieving the GBAP component goals.



## Energy and Climate Adaptability as Priority Areas

Climate change is an increasingly pressing challenge and major direction for sustainability policy and green building at UBC. The GBAP identifies energy and climate adaptability as priority areas for implementation. By integrating resilience into the built environment, UBC will mitigate the climate impacts of rising temperatures and increased extreme weather events while generating co-benefits across component areas such as energy and water. Building energy efficiency has long been a focus at UBC and through the GBAP, will make further improvements in long-term cost savings and reduced greenhouse gas emissions.

**2. The Plan: At a Glance**

The following pages provide a summary of the component goals, targets and indicators as well as a sample of key priority actions in each component area. For more detail in each component area (including context, key directions, the pathway to net positive and a complete list of priority actions) see Part 2. Note that the priority actions shown here are a sample; the plan in full contains hundreds of actions too numerous to include in the summary.

<b>VISION</b>
<b>Goals</b>
By 2035, UBC’s buildings will make net positive contributions to human and natural systems.
<b>OBJECTIVES</b>
<ul style="list-style-type: none"> <li>• Create an exceptional built environment on campus and in the neighbourhoods that will attract, engage and retain a diverse global community of outstanding students, faculty, staff and community members.</li> <li>• Achieve continuous improvement to ecological and human health, driven by experience and lessons learned from previous plans and projects.</li> <li>• Create a net positive pathway for the design and construction of new buildings, renovations and retrofits over the next 20 years.</li> <li>• Demonstrate UBC’s commitment to leadership and innovation in green buildings across social, environmental and economic dimensions.</li> <li>• Support teaching, learning and research opportunities through academic engagement.</li> <li>• Improve clarity and predictability of process.</li> <li>• Optimize total cost of ownership for buildings.</li> </ul>

<b>PROCESS</b>	
Process is a cross-cutting initiative across all component areas.	
<b>Component Goals</b>	
<ul style="list-style-type: none"> <li>• UBC policies and processes will support the achievement of the GBAP component goals and targets.</li> <li>• GBAP component goals and targets will be communicated and easily accessible to internal and external stakeholders.</li> <li>• UBC will integrate lessons learned from each project to improve building designs.</li> <li>• UBC buildings will be evaluated as opportunities for research, innovation and continuous improvement.</li> <li>• UBC will commit to monitoring and benchmarking building performance to encourage continuous improvement on campus and in relation to industry standards.</li> </ul>	
<b>Targets and Indicators</b>	
<b>Institutional</b>	<b>Residential</b>
<ul style="list-style-type: none"> <li>• <i>Target:</i> 100% of projects will conduct life cycle costing by 2025.</li> </ul>	
<b>Sample Key Priority Actions</b>	
<b>Institutional</b>	<b>Residential</b>
<ul style="list-style-type: none"> <li>• Explore the implementation of a benchmarking platform for energy, emissions, water and waste reporting.</li> <li>• Develop short-term and long-term strategic research opportunity plans to help connect the necessity of physical facilities to the enhancement of UBC’s academic mission.</li> <li>• Align the UBC Technical Guidelines with GBAP requirements through an annual review-and-update process that fully engages stakeholders.</li> <li>• Develop a program to conduct post-occupancy surveys and introduce standard post-occupancy evaluations (in coordination with Major Project Improvement Process) to better understand occupant concerns.</li> </ul>	<ul style="list-style-type: none"> <li>• Develop a process to introduce GBAP requirements for retrofit and renovation projects in neighbourhoods.</li> <li>• Create REAP credits for mandatory benchmarking, performance reviews and post-occupancy surveys.</li> <li>• Develop a sustainability process for new residential construction.</li> </ul>

<b>ENERGY</b>	
<b>Component Goals</b>	
<ul style="list-style-type: none"> <li>• UBC buildings and landscapes will advance the campus towards net positive energy use and greenhouse gas neutrality by reducing energy demand and focusing on site-specific passive design approaches.</li> <li>• UBC buildings will have indoor thermal environments that are comfortable and energy efficient.</li> <li>• UBC will integrate lessons learned to improve building energy performance.</li> </ul>	
<b>Targets and Indicators</b>	
<b>Institutional</b>	<b>Residential</b>
<ul style="list-style-type: none"> <li>• <i>Target:</i> New institutional buildings will meet incrementally reduced energy targets to be Net Positive Ready by 2030.</li> <li>• <i>Target:</i> Reduce average building thermal energy use intensity (TEDI plus DHW) for campus buildings by 50% to 75 kwh/m<sup>2</sup>/yr by 2050.</li> <li>• <i>Target:</i> Reduce the performance gap between modelled and metered energy use in new institutional buildings by 75% within three years of occupancy by 2020.</li> </ul>	<ul style="list-style-type: none"> <li>• <i>Target:</i> New residential buildings will meet energy targets to be Net Zero Ready by 2030 in alignment with the BC Energy Step Code.</li> <li>• <i>Indicator:</i> Increase energy efficiency of existing residential buildings through standards and programs.</li> </ul>
<b>Sample Key Priority Actions</b>	
<b>Institutional</b>	<b>Residential</b>
<ul style="list-style-type: none"> <li>• Implement mandatory incremental energy use intensity (EUI), thermal energy demand intensity (TEDI) and domestic hot water (DHW) targets; consider development of thermal demand (W/m<sup>2</sup>) and GHG intensity (kgCO<sub>2</sub>e/m<sup>2</sup>/yr) targets for tier 1 and 3a projects.</li> <li>• Identify passive and mechanical design requirements for buildings of different uses and space criteria that achieve comfortable indoor environments under predicted future climate conditions.</li> </ul>	<ul style="list-style-type: none"> <li>• Develop GHG intensity targets to ensure cost-effective pathways to zero GHG emissions for buildings connected or not connected to the Neighbourhood District Energy System (NDES).</li> <li>• Mandate incremental energy use intensity (EUI) and thermal energy demand intensity (TEDI) building targets that align with BC Energy Step Code requirements and support the development of the NDES renewable energy centre by 2024.</li> <li>• Mandate whole building airtightness testing and energy modelling in alignment with BC Energy Step Code by 2018 and set airtightness targets by 2020.</li> </ul>

<b>WATER</b>	
<b>Component Goals</b>	
<ul style="list-style-type: none"> <li>• UBC will practise responsible water management and use at the building and site scale by advancing water conservation and efficiency, exploring alternative water supply and treatment solutions and building water supply resiliency.</li> <li>• UBC will use a low-impact development approach to rainwater management at the site scale to mitigate risk and respect the natural hydrology of the campus.</li> </ul>	
<b>Targets and Indicators</b>	
<b>Institutional</b>	<b>Residential</b>
<ul style="list-style-type: none"> <li>• <i>Target:</i> Reduce the water use intensity on campus by 16% in 2025 and 24% in 2030 (relative to a 2017 baseline), resulting in total water consumption remaining at or below 2017 levels despite growth.</li> <li>• <i>Target:</i> Meter and report on water consumption for individual UBC buildings to enhance our ability to make strategic decisions on water conservation by: 1) ensuring all new buildings include water metering, 2) maintaining or replacing existing meters as required, and 3) adding meters where economically viable, over the next five years.</li> <li>• <i>Target:</i> Maximize rainwater management using low-impact development on building sites that are more than 300 m from cliffs.</li> <li>• <i>Indicator:</i> Increase infiltration, retention and detention of rainwater on campus.</li> </ul>	<ul style="list-style-type: none"> <li>• <i>Target:</i> Maximize rainwater management using low-impact development on building sites that are more than 300 m from cliffs.</li> <li>• <i>Indicator:</i> Increase infiltration, retention and detention of rainwater in the neighbourhoods.</li> </ul>
<b>Sample Key Priority Actions</b>	
<b>Institutional</b>	<b>Residential</b>
<ul style="list-style-type: none"> <li>• Implement water metering requirements into (building) policy in alignment with the Water Action Plan.</li> <li>• Develop guidelines for alternative water supply sources and systems in buildings (e.g., rainwater harvesting or water reuse systems) and on-site storage in buildings.</li> <li>• Require all tier 1, 2 and 3a projects to achieve equivalent to LEED v4 Rainwater Management credit, Option 2.</li> </ul>	<ul style="list-style-type: none"> <li>• Develop a water metering strategy (building and suite level) for residential buildings; consider a visualization concept that concurrently educates users.</li> <li>• Develop criteria and guidelines for green roof and blue roof projects, based on rainwater management capacity, co-benefits, maintenance and operation considerations for residential building typologies.</li> <li>• New residential projects to achieve the same rainwater management requirements as institutional projects by 2020.</li> </ul>

<b>MATERIALS AND RESOURCES</b>	
<b>Component Goals</b>	
<ul style="list-style-type: none"> <li>• UBC will prioritize the use of building materials that have net positive environmental impacts.</li> <li>• UBC will support marketplace transformation by designing buildings with materials that are not harmful to human and ecological health.</li> <li>• UBC will support the development of the circular economy by promoting the adaptation, reuse and recycling of materials and products during a building’s lifetime.</li> </ul>	
<b>Targets and Indicators</b>	
<b>Institutional</b>	<b>Residential</b>
<ul style="list-style-type: none"> <li>• <i>Target:</i> Eliminate 100% of UBC-identified building materials in new construction that are known to be detrimental to human health by 2035.</li> <li>• <i>Target:</i> Require all new buildings to be Zero Waste Ready by 2020.</li> <li>• <i>Target:</i> Divert 100% of construction and demolition waste from landfill by 2035.</li> <li>• <i>Indicator:</i> Embodied carbon is calculated for all construction projects.</li> </ul>	<ul style="list-style-type: none"> <li>• <i>Target:</i> Eliminate 100% of UBC-identified building materials in new construction that are known to be detrimental to human health by 2035.</li> <li>• <i>Target:</i> Require all new buildings to be Zero Waste Ready by 2020.</li> <li>• <i>Target:</i> Divert 100% of construction and demolition waste from landfill by 2035.</li> </ul>
<b>Sample Key Priority Actions</b>	
<b>Institutional</b>	<b>Residential</b>
<ul style="list-style-type: none"> <li>• Develop guidelines for making building material choices through research (level 2) that are informed by health impacts based on a review of best practices, market supply, and stakeholder engagement (i.e., list commonly used building materials considered harmful to health in the sourcing, manufacturing, installation, occupancy or end-of-life phase).</li> <li>• Implement policies for reduced embodied carbon in buildings, starting with a requirement to report embodied carbon, followed by incremental reductions.</li> </ul>	<ul style="list-style-type: none"> <li>• Require incremental reductions in the environmental impact of building materials, based on pilots, best practice review and market readiness study.</li> <li>• Create an integrated policy for building materials that considers reduced environmental impact, healthy material requirements, and life cycle analysis.</li> </ul>

<b>BIODIVERSITY</b>	
<b>Component Goals</b>	
<ul style="list-style-type: none"> <li>• UBC will develop highly functioning landscapes at the building and site scales to contribute to biodiversity and natural ecosystem processes.</li> <li>• UBC will engage campus teaching and research opportunities to enhance biodiversity management capacity.</li> </ul>	
<b>Targets and Indicators</b>	
<b>Institutional</b>	<b>Residential</b>
<ul style="list-style-type: none"> <li>• <i>Target:</i> Require 100% compliance to UBC Bird Friendly Design Guidelines for Buildings for new institutional buildings by 2020.</li> <li>• <i>Indicator:</i> Increase opportunities to provide habitat for birds, pollinators and other species.</li> </ul>	<ul style="list-style-type: none"> <li>• <i>Target:</i> Require 100% compliance to UBC Bird Friendly Design Guidelines for Buildings for new residential buildings by 2025.</li> <li>• <i>Indicator:</i> Increase opportunities to provide habitat for birds, pollinators and other species.</li> </ul>
<b>Sample Key Priority Actions</b>	
<b>Institutional</b>	<b>Residential</b>
<ul style="list-style-type: none"> <li>• Develop a set of principles for landscapes and green roofs that consider the following: 1) ability to adapt to climate change, 2) ability to attract pollinators, 3) reduction of invasive species, 4) microclimate suitability (sun, shade, etc.), 5) ability to support passive solar strategies (e.g., provide shade, reduce wind), 6) campus character zones and irrigation zones (green or brown areas), and 7) regional biodiversity priorities.</li> <li>• Engage a consultant(s) to conduct site assessments to identify and assess the ecological assets, endangered and vulnerable species, and environmentally sensitive areas on a campus or neighbourhood scale. Site assessment reports will be used to inform individual project designs.</li> </ul>	<ul style="list-style-type: none"> <li>• Further develop the UBC Bird Friendly Design Guidelines for Buildings and create a mandatory policy in order to reduce the number of bird collisions with buildings.</li> </ul>

<b>HEALTH AND WELLBEING</b>	
<b>Component Goals</b>	
<ul style="list-style-type: none"> <li>• UBC will enhance the mental, physical and social dimensions of wellbeing by making them integral to building and landscape design decisions.</li> <li>• UBC researchers, community stakeholders and building occupants will be engaged in a meaningful and ongoing way to inform building and landscape design decisions around health and wellbeing.</li> <li>• UBC will become a leader in enhancing wellbeing through the built environment within the context of higher education in Canada.</li> </ul>	
<b>Targets and Indicators</b>	
Targets and indicators to be integrated into future updates of the GBAP.	
<b>Sample Key Priority Actions</b>	
<b>Institutional</b>	<b>Residential</b>
<ul style="list-style-type: none"> <li>• Develop health and wellbeing guiding principles for building design that promote physical, mental and social wellbeing (e.g., incorporating social or contemplative space, designing spaces that allow inclusion, incorporating universal design principles, promoting ease of use, incorporating ergonomic principles, developing daylighting requirements, considering acoustic requirements, etc.).</li> <li>• Coordinate with UBC's Wellbeing Strategy in collaboration with UBC Wellbeing to guide how building and landscape design can nurture physical, mental and social dimensions of health and wellbeing.</li> </ul>	<ul style="list-style-type: none"> <li>• Identify metrics for health and wellbeing in residential buildings (e.g., temperature, indoor air quality, daylight levels, acoustic levels, views to exterior, number of indoor plants, etc.).</li> <li>• Update REAP to include health and wellbeing credits.</li> </ul>

<b>QUALITY</b>	
<b>Component Goals</b>	
<ul style="list-style-type: none"> <li>• UBC buildings and landscapes will be durable, reliable and resilient.</li> </ul>	
<b>Targets and Indicators</b>	
<b>Institutional</b>	<b>Residential</b>
<ul style="list-style-type: none"> <li>• <i>Target:</i> Major projects track and achieve their design brief sustainability goals by 2020 (subject to approved changes during design process).</li> <li>• <i>Target:</i> Achieve 100% compliance with UBC Technical Guidelines by 2025 (compliance allows for approved variances).</li> <li>• <i>Target:</i> Achieve 100% compliance with UBC sustainability submission requirements by 2025 (compliance allows for approved variances).</li> </ul>	<ul style="list-style-type: none"> <li>• <i>Target:</i> Achieve 100% compliance with REAP Gold requirements by 2020.</li> </ul>
<b>Sample Key Priority Actions</b>	
<b>Institutional</b>	<b>Residential</b>
<ul style="list-style-type: none"> <li>• Develop a strategy to conduct a full review of the UBC Technical Guidelines to ensure clarity and eliminate redundancies.</li> <li>• Review and investigate opportunities to apply international climate resilience standards, such as the RELi resilience standard, to projects.</li> </ul>	<ul style="list-style-type: none"> <li>• Create a branding strategy for REAP to increase awareness of UBC's sustainable buildings.</li> <li>• Work with real estate agents to ensure all buyers are aware of sustainability benefits associated with buildings.</li> </ul>

<b>CLIMATE ADAPTATION</b>	
<b>Component Goals</b>	
<ul style="list-style-type: none"> <li>• UBC buildings and landscapes will have the resilience to respond to both anticipated and unpredictable changes in climate.</li> <li>• UBC will engage with researchers in a meaningful and ongoing way to inform building policy and guidelines around climate adaptability.</li> </ul>	
<b>Targets and Indicators</b>	
Targets and indicators to be integrated into future updates of the GBAP.	
<b>Sample Key Priority Actions</b>	
<b>Institutional</b>	<b>Residential</b>
<ul style="list-style-type: none"> <li>• Conduct vulnerability assessments of campus buildings, landscapes and infrastructure at periodic intervals.</li> <li>• Coordinate with the campus-wide Resiliency Initiative and climate adaptation strategies, as they evolve based on vulnerability assessments, evaluations and best practice review, by implementing policies on a building and landscape scale that respond to key climate change impact areas (e.g., increased temperature, variable weather patterns, increased flood events, increased smoke, increased peak events, etc.).</li> </ul>	<ul style="list-style-type: none"> <li>• Implement policies (REAP updates, neighbourhood plans) for climate adaptability in the neighbourhood built environment.</li> </ul>

<b>PLACE AND EXPERIENCE</b>	
<b>Component Goals</b>	
<ul style="list-style-type: none"> <li>• UBC buildings and landscapes will provide opportunities for collaboration, innovation and community development to reflect the social and environmental sustainability aspirations of the University.</li> </ul>	
<b>Targets and Indicators</b>	
Targets and indicators to be integrated into future updates of the GBAP.	
<b>Sample Key Priority Actions</b>	
<b>Institutional</b>	<b>Residential</b>
<ul style="list-style-type: none"> <li>• Review the Public Realm Plan goals and guidelines for better coordination and compliance of building landscapes.</li> <li>• Establish additional GBAP place and experience goals, in coordination with Campus and Community Planning, to help express a project’s social, environmental and economic sustainability goals.</li> <li>• Integrate heritage consideration early in the design through mandatory “Statements of Significance” for existing buildings.</li> </ul>	<ul style="list-style-type: none"> <li>• Establish GBAP place and experience goals for buildings and landscapes in coordination with Campus and Community Planning during neighbourhood development (e.g., goal: the design of the building and landscape expresses elements of UBC’s social and/or environmental sustainable design initiatives).</li> </ul>

### 3 Policy and Process

#### 1. Policy Context

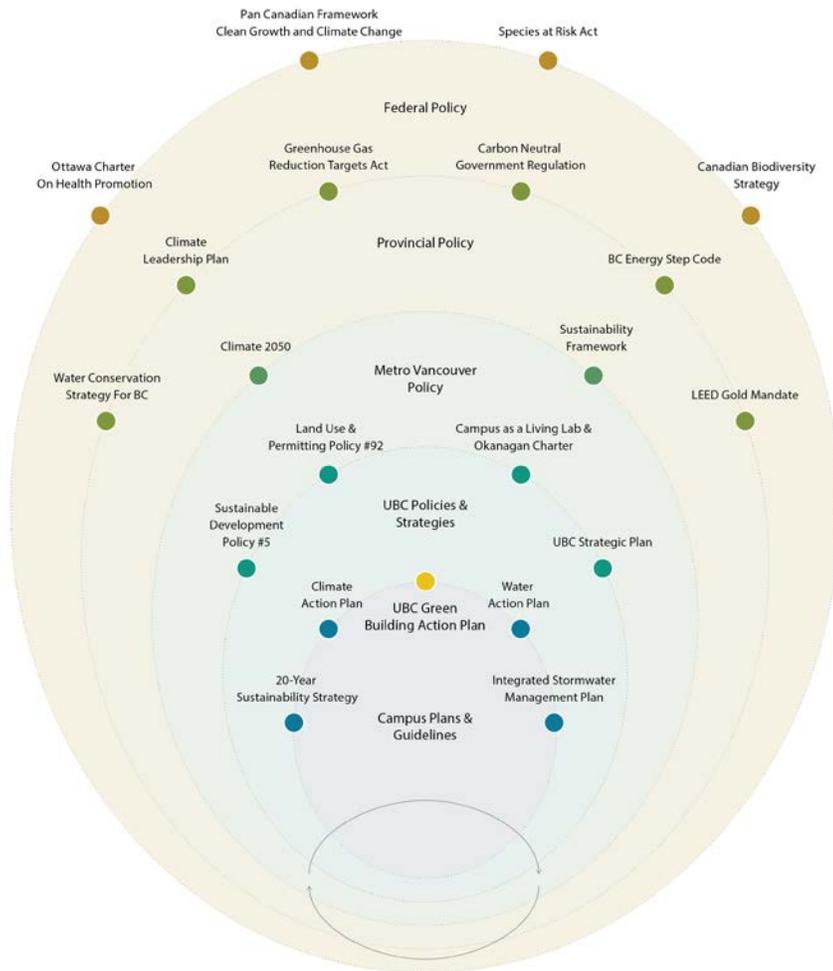


Figure 2. The Green Building Action Plan operates within a broader network of UBC, Metro Vancouver, provincial, and federal policies and plans.

The GBAP sits within a broader network of UBC, Metro Vancouver, provincial and federal policies and plans. Climate change and the need for resiliency are key concerns for all levels of government, along with other significant policies relating to the loss of biodiversity, human health and wellbeing, and resource stewardship. At UBC’s Vancouver campus, development is governed specifically by provincial legislation that gives the Board of Governors unique powers to manage the development and operation of campus buildings, landscapes and infrastructure.

## **Government Policy Responding to Climate Change**

### *Federal*

Canada signed the Paris Climate Change Agreement and has since committed to implement actions that mitigate greenhouse emissions in efforts to keep global average temperature increases well below 2 degrees Celsius. In 2016, Canada implemented a key step towards meeting the Paris Agreement by announcing the Pan-Canadian Pricing on Carbon Pollution. Through the new framework, a price of \$50 per tonne is targeted for 2022. The federal government has committed to working with provinces and territories to develop a “Net Zero Energy Ready” model building code, with the goal that provinces and territories adopt it by 2030.

### *Provincial*

The BC Climate Leadership Plan (CLP) states that the Province is implementing a number of policies to encourage the development of net zero buildings. On April 1, 2018, BC's carbon tax rate increased to \$35 per tonne of carbon dioxide equivalent emissions. The tax rate will increase each year by \$5 per tonne until it reaches \$50 per tonne in 2021. British Columbia enacted the BC Energy Step Code as a voluntary performance-based code that provides local governments the option to adopt an incremental “step” or performance improvement to achieving more energy-efficient buildings that go beyond the requirements of the base BC Building Code. To date, 26 local governments across BC (including the City of Vancouver) have notified the Province on their intent to reference the BC Energy Step Code. Through the Green Building Action Plan, UBC has aligned its residential policy targets with the BC Energy Step Code and has established performance targets for the basic archetypes of institutional buildings.

The CLP also addresses the role that public sector buildings (such as UBC’s institutional buildings) should play in demonstrating leadership by reducing emissions, creating a plan for adaptation, and promoting the use of low-carbon and renewable materials.

### *City of Vancouver*

As a neighbour to the City of Vancouver, UBC is able to leverage the City’s emerging and aggressive energy policies for buildings. For example, the City has a Zero Emissions Building Plan and Renewable City Strategy that set distinct targets for new and existing buildings. Of particular relevance to UBC are the distinct targets for buildings connected to district energy systems, emissions and energy demand targets for all buildings, and how immediate the targets are (for example, office buildings that require rezoning are to be constructed to Passive House levels of energy performance as well as certified LEED Gold v4).

## 2. UBC Policy

UBC’s provincially approved Land Use Plan sets the long-term direction for how the campus grows and changes. The Board of Governors approves detailed policies to carry out the Land Use Plan’s vision. On institutional lands (see Figure 3), these policies include the Vancouver Campus Plan, performance-oriented plans such as the Climate Action Plan and the GBAP, and detailed guidelines such as the Technical Guidelines, all of which guide academic development. In campus neighbourhoods (see Figure 4), UBC’s Board of Governors approves neighbourhood plans, which include specific policy requirements for residential development as well as regulatory rules such as the Residential Environmental Assessment Program (REAP). The GBAP provides direction for these other policies and plans to advance the development of green buildings on the Vancouver campus.

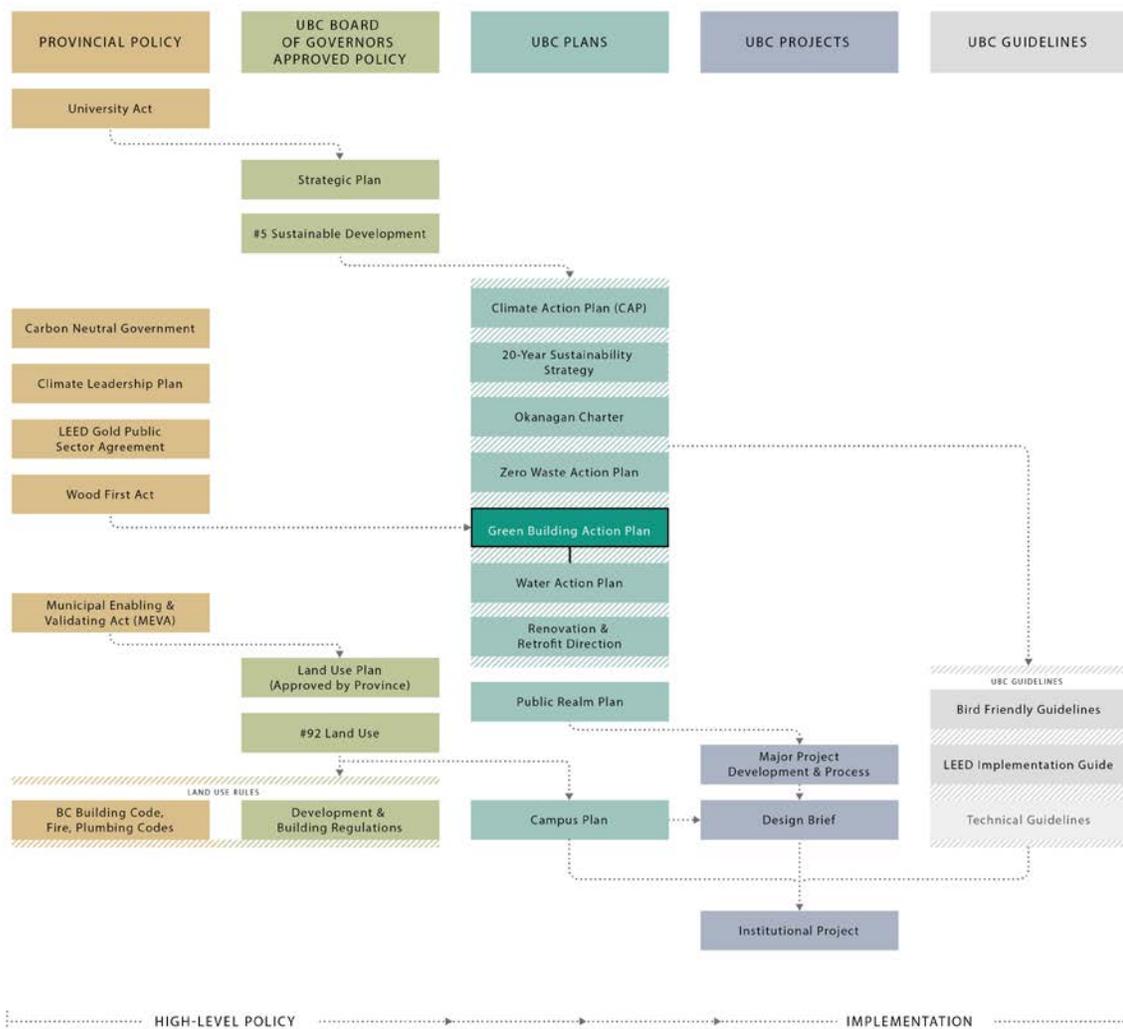


Figure 3. An illustrative diagram of existing UBC policies, strategies, and guidelines that inform the development of institutional buildings.

## UBC Green Building Action Plan | Part 2: The Institutional Green Building Action Plan

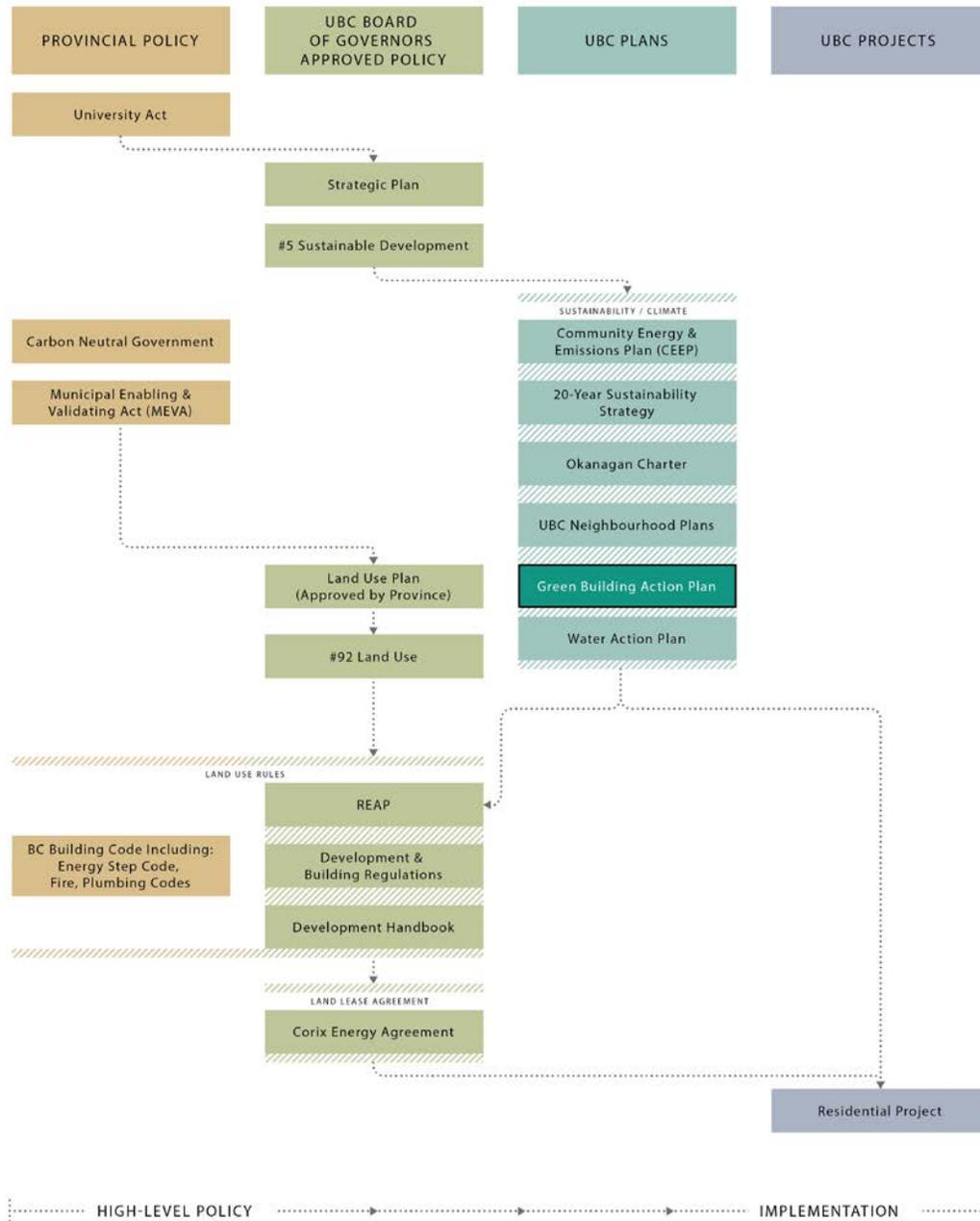


Figure 4. An illustrative diagram of existing UBC policies, strategies and guidelines that inform the development of residential buildings.

The vision of a net positive campus requires actions across scales, beyond the building footprint, and the GBAP therefore integrates with many other plans. The GBAP will guide and is guided by the many other goals outlined in emerging and existing plans related to sustainable development and operations. Emerging plans that will be fully developed over the next five years will support, guide and coordinate with the GBAP in emerging component areas. Existing plans, regulations and guidelines will require coordination or alignment with the GBAP in their next amendment.

# UBC Green Building Action Plan | Part 2: The Institutional Green Building Action Plan

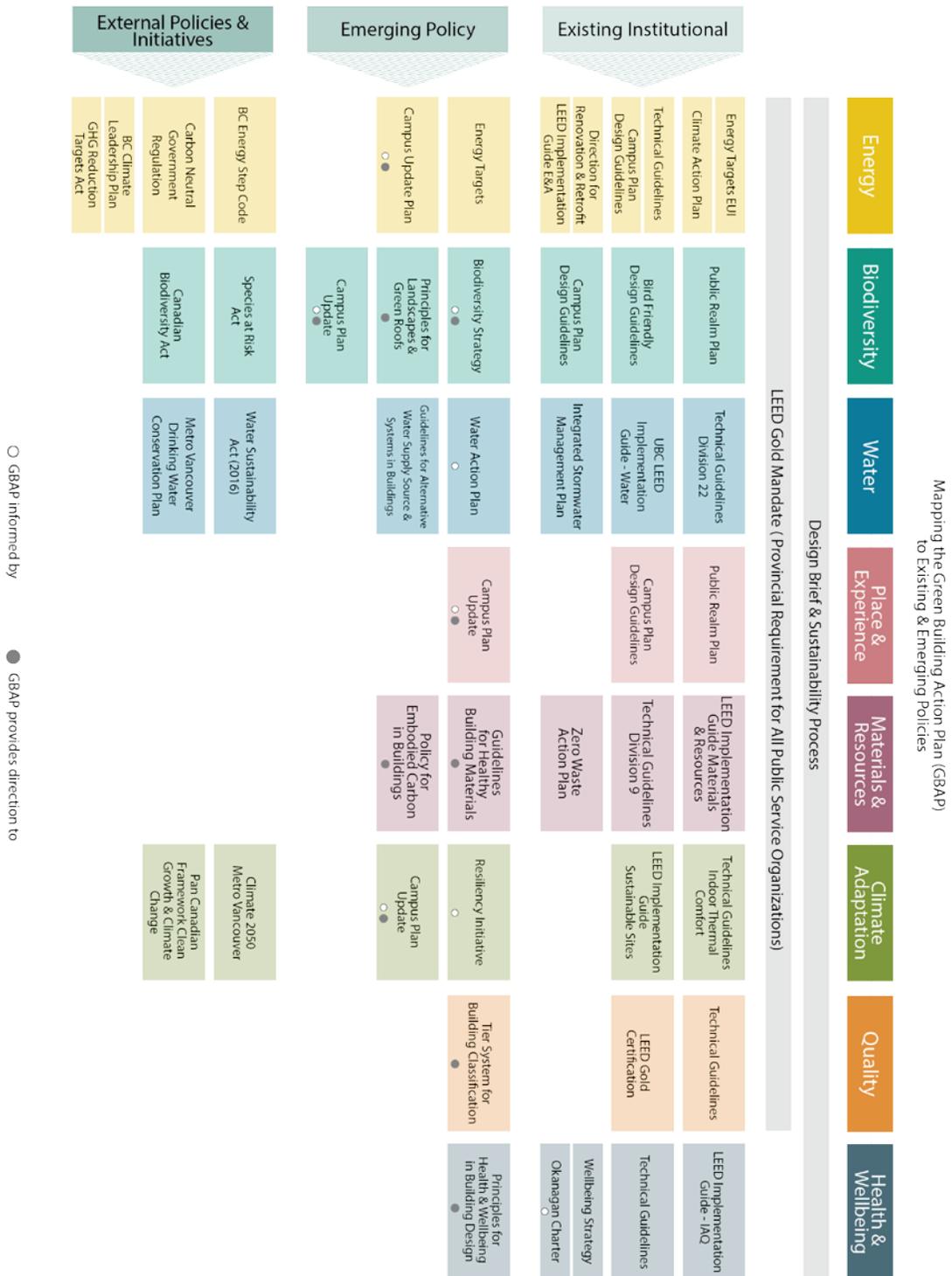


Table 1. Integration of institutional GBAP with external policies and existing and emerging UBC plans.

# UBC Green Building Action Plan | Part 2: The Institutional Green Building Action Plan

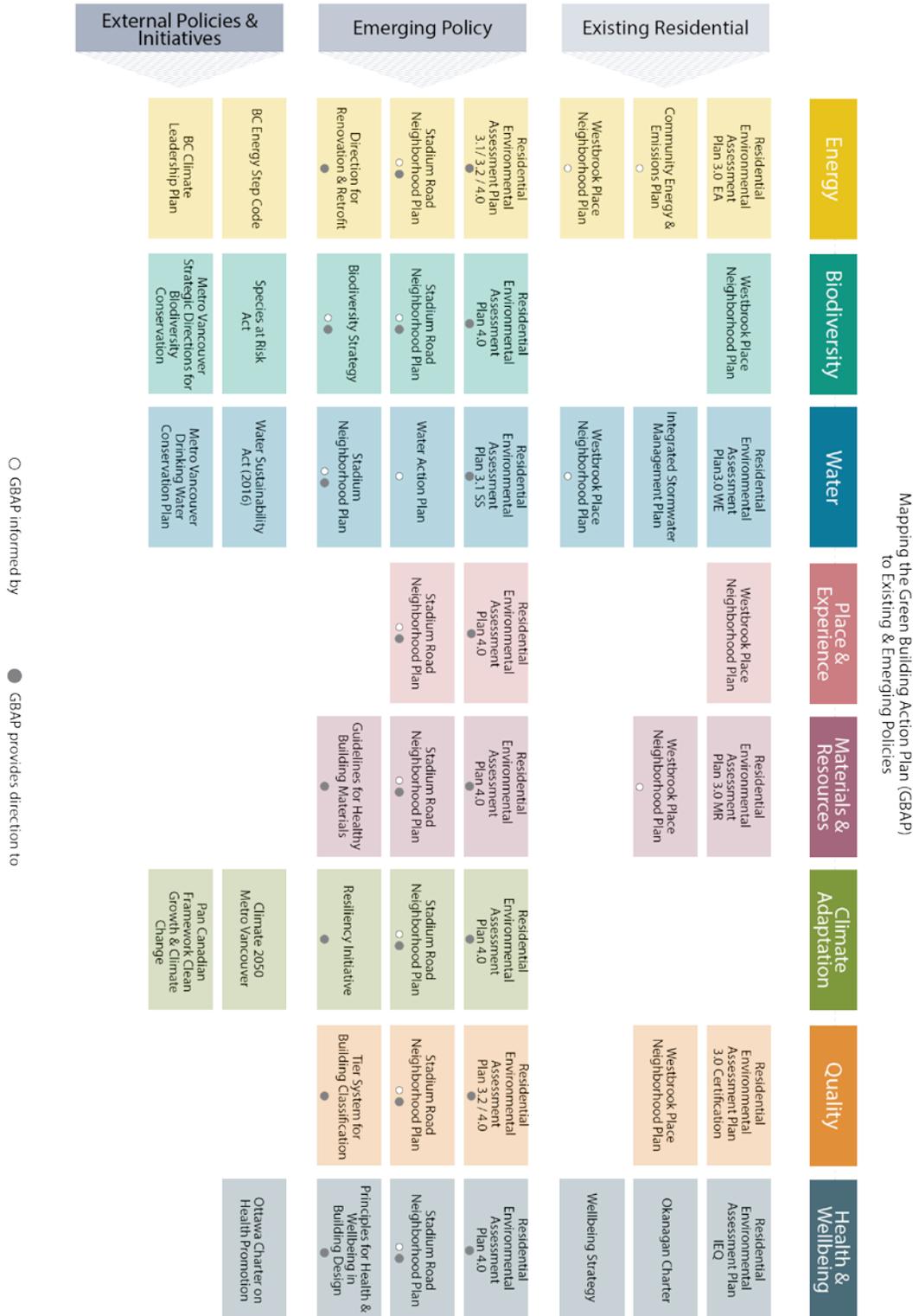


Table 2. Integration of residential GBAP with external policies and existing and emerging UBC plans.

### 3. Emerging Plans

UBC is in a unique position to explore new areas of policy. The expertise of academic faculty can be leveraged to help create solutions to challenges, which can be piloted, evaluated and used to inform policies at UBC and beyond.

Three emerging areas at UBC will eventually be developed into strategies that are relevant to building and landscape design and will inform development of the GBAP: wellbeing, resiliency and biodiversity. UBC Wellbeing is developing a system-wide, holistic and proactive approach that champions physical, mental and social dimensions of health and wellbeing at the University. A Health and Wellbeing Strategy for Building and Landscape Design is being developed that will coordinate with the component goals and actions of the GBAP in the health and wellbeing component area. UBC is in the early stages of working on a Resiliency Initiative in order to prepare the campus for natural and human-made emergencies, and over the next five years more work is expected to be carried out to expand this initiative. Strategies for climate change adaptation and resiliency in buildings will be developed in coordination with the Resiliency Initiative, which will inform the GBAP's climate adaptation component area. Finally, UBC is developing a Biodiversity Strategy through the Campus Biodiversity Initiative: Research and Demonstration (CBIRD). As the Biodiversity Strategy is developed it will coordinate with and inform the component goals and actions of the GBAP in the biodiversity and health and wellbeing component areas.

The Water Action Plan (WAP) is closely linked to the GBAP and is being concurrently developed. Building-related requirements necessitated by the goals of the WAP will be channeled through to the water component area of the GBAP.

### 4. Institutional policies

Academic development is guided in a significant way by the Vancouver Campus Plan. The Campus Plan Design Guidelines (Part 3), which integrates sustainability best practices, will need to be reviewed and updated in the next amendment to support the GBAP goals in all component areas.

The GBAP introduces a tier system for institutional building projects to clearly and accurately identify policy and process requirements associated with new buildings, renovations, fit-outs and retrofits (see table 3).

TIER	DESCRIPTION	AREA/BUDGET
<b>TIER 1</b>	New Buildings - Large	>1,000 m <sup>2</sup> , >\$5M
<b>TIER 2</b>	New Buildings - Small	<1,000 m <sup>2</sup> , >\$5M
<b>TIER 3</b>	Major Project Renovations (a) Renewal (includes envelope and mechanical system upgrade) (b) Other (extensive interior upgrades)	>\$5M
<b>TIER 4</b>	Partial Fit-outs	\$1M – \$5M
<b>TIER 5</b>	System Upgrades (e.g., chiller replacement, controls)	n/a

Table 3. Tier system for institutional building projects.<sup>7</sup>

Existing building renovations and retrofits offer a significant impact in terms of achieving the component goals of the GBAP because of the extent of the existing building stock. The tier system clarifies performance targets and expectations for the renovation and retrofits of existing buildings.

The UBC Technical Guidelines will be the major guiding document to ensure that GBAP objectives for institutional projects are met in all component areas. These guidelines were created to ensure the quality and performance of the design, construction, renovation and retrofit of institutional buildings, landscape and infrastructure. Since the guidelines are updated annually, this provides an opportunity to ensure annual integration and alignment with the GBAP.

All new campus construction and renewals (tiers 1 and 3) at UBC are currently mandated by the Province to be LEED Gold Certified. The UBC LEED Implementation Guide provides direction on which LEED credits are mandatory, optional, or not preferred to align institutional buildings with the University’s sustainability objectives. UBC currently has 19 LEED Certified buildings, with 14 more projects under assessment and pending certification. Over the time frame of the GBAP, necessary updates to the UBC LEED Implementation Guide and consideration of alternative certifications that align with UBC policy objectives (for example, Passive House and Living Building Challenge certification) will be pursued.

The Bird Friendly Building Design Guidelines provide guidance for consultants and project managers to design buildings that aim to greatly reduce bird collisions with glass, one of the largest sources of anthropogenic bird mortality in North America. The Bird Friendly Building Design Guidelines will need to evolve over time to achieve the target outlined under the GBAP’s biodiversity component area.

<sup>7</sup> See Part 2: 1.7 Quality for a table of the full tier system with green building requirements.

The Sustainability Process supports an integrated design process for building projects and was introduced to ensure key design disciplines are brought together to achieve a high level of sustainability performance in a streamlined manner. Integrated design is critical for the success of the GBAP to encourage whole-systems thinking early in the design process.

Major projects are guided through the Sustainability Process, which includes engagement with a diverse group of stakeholders at UBC to identify performance goals in the development of the project design brief (for use by the project design team). Guidance is provided for workshops held at strategic points during design to ensure an integrated approach is followed. Project goals are tracked and reported through construction and into the post-occupancy phase.

The Major Project Delivery Process at UBC is currently under review. A priority action for the GBAP is for better integration of the Sustainability Process into the overall Major Capital Project Development Process.

## 5. Residential Policies

Neighbourhood plans govern development of UBC's campus residential areas. The plans establish specific requirements for building features, park space, recreation and transportation, all consistent with UBC's Land Use Plan. Future neighbourhood plans at UBC are Stadium Road<sup>8</sup> and Acadia Park, and their development will be consistent with Green Building Action Plan policy directions.

REAP (the Residential Environmental Assessment Program) is a Land Use Rule and as such is a key policy driver in the neighbourhoods. REAP is a UBC-specific green building rating system that applies to multi-use residential and mixed-use (residential with commercial at grade) buildings. The fundamental idea behind REAP building requirements is to support the reduction of environmental impact on the building site and neighbourhood scale incrementally over time. All new residential projects, including private developments and Faculty and Staff Housing, are required to achieve a minimum REAP Gold certification.

There are currently few policies, strategies or programs to guide the retrofitting of buildings within the UBC neighbourhoods. As existing residential buildings age they will require upgrades and retrofits, and this presents an opportunity to set forward objectives that achieve the component goals of the GBAP for the extensive existing building stock. UBC will work with the University Neighbourhood Association (UNA) and

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<sup>8</sup> Stadium Road Neighbourhood Plan is currently under development.

existing residential stratas to develop a retrofitting strategy for the neighbourhoods, which will align with the residential GBAP for UBC-owned and -operated buildings.

## 6. REAP Amendments

REAP requires a series of amendments in order to support the full implementation of the GBAP. The following provides a summary of four amendments that will make incremental improvements in all component areas over time:

### 1. REAP 3.1 September 2018

This amendment is only applicable to buildings in the Wesbrook Place neighbourhood (and phase 1 of the NDES).

- a. Align with BC Energy Step Code.
  - a. Building energy targets will be updated to align with Step 2 (note: Step 3 or 4 will be considered as pilot projects).
  - b. Airtightness testing, currently an optional credit, will become mandatory and align with the BC Energy Step Code.
  - c. Energy modelling, currently an optional credit, will become mandatory and align with the BC Energy Step Code.
- b. Mandate building commissioning of energy systems, which is currently an optional credit.
- c. Update stormwater requirements to align with the current Sustainability and Engineering regulatory requirement that all new construction projects must detain the 10-year storm volume and discharge at the 2-year rate on site or at a centralized facility using low-impact development.
- d. Update electric vehicle charging requirements and align with anticipated market demands to support reduced transportation emissions.
  - a. Faculty and Staff Housing: infrastructure for charging stations will be installed to 50% of stalls
  - b. Private developments: infrastructure will be installed for one charging station per dwelling unit
  - c. Electric vehicle infrastructure will include the ability of stations to load manage and load share electricity for charging
- e. Update to include housekeeping edits.

### 2. REAP 3.2 anticipated 2019–2020

- a. Introduce GHG building energy targets.
- b. Introduce mandatory benchmarking and hot water metering (building level) as a credit.
- c. Evaluate overall building insulation target to replace R values for individual building elements.
- d. Review and improve Innovation and Design Process credits.
- e. Rebalance REAP points to reflect UBC's current priorities.

- f. Rebrand REAP with an emphasis on the quality of buildings.
- 3. REAP 4.0** anticipated 2020–2022 with phase 2 NDES  
This amendment is intended to be in place for Stadium Road neighbourhood and phase 2 of the NDES.
- a. Align with the BC Energy Step Code at optimum level in balance with NDES to achieve a low-carbon community at the lowest cost of ownership.
  - b. Increase compliance measures for REAP submittals, including REAP site inspections.
  - c. Update landscape requirements to consider change in climate and biodiversity.
  - d. Update building material requirements to achieve objectives related to lower embodied carbon, lower environmental impact, and the elimination of Red List materials.
  - e. Establish an optimal service life of buildings to minimize rebuilding and the use of new building materials (with their associated environmental impact).
  - f. Include health and wellbeing considerations as credits.
- 4. REAP 4.1 Acadia Park neighbourhood**
- a. Implementation of incremental improvements in each component area.

## 4 Implementation

The implementation of the GBAP is going to be an ongoing and evolving process over the next 17 years, involving collaborations between multiple planning and operational departments at UBC as well as academic researchers. Part 2 describes the intentions, priorities and approaches to address each of the component areas for institutional and residential buildings. Some of these actions are iterative and interdependent, others are sequential. In some cases, the first actions are exploratory in order to determine how to proceed with developing specific targets or the best order of the actions. The series of actions proposed allows for piloting and innovation and increased institutional confidence in pursuit of the ambitious potential of the GBAP.

Summary matrices of all GBAP component goals, targets and actions are shown in Appendix A (institutional buildings) and Appendix B (residential buildings). The summaries outline how the goals and targets in each component area will be achieved through a series of detailed actions and includes department responsibilities and their associated timelines.

A monitoring program to support implementation of the GBAP will be developed and the plan will be reviewed and updated every five years.

### Resourcing

Both a lead and support UBC department have been identified and resourcing requirements are indicated in the appendix matrices. In some instances, these responsibilities may shift over time or as new processes and tools are developed as part of the implementation process.

### Costing

Various sources have been used to help provide cost input in some of the component areas in the GBAP:

- **Energy:** UBC energy costing studies for the institutional campus and the residential neighbourhood developments have been completed and peer reviewed. The studies indicate costing for incremental energy performance in buildings and have provided guidance for building energy targets.

In institutional developments, the study results show that nearly all packages of energy efficiency measures result in positive net present value using current and forecasted utility rates over a 30-year time frame.

On the residential side, the study shows the energy targets proposed for REAP 3.1 (BC Energy Step Code - Step 2) indicate an incremental capital cost increase of 0.1% for low-rise and 0.9% for high-rise buildings.

- **Health and Wellbeing:** A third-party study<sup>9</sup> conducted by the World Green Building Council shows that staff in office buildings are the most valuable resource in most organizations, typically accounting for 90% of business operating costs. As such, even a 1% improvement in productivity can have a major impact. This indicates there is likely a significant benefit to improving health and wellbeing aspects of building design and improving the health of occupants to increase productivity and learning.
- **Biodiversity:** According to an Australian third-party study,<sup>10</sup> implications suggest that contact with nature may provide an effective, population-wide strategy in the prevention of mental ill health, with potential application for sub-populations, communities and individuals at higher risk of ill health. With a high priority on student mental health, this study indicates that contact with nature has a strong link to student productivity and learning.

Costing of specific measures will be completed over the GBAP time frame and will be vetted through the GBAP Steering Committee prior to implementation of policy changes. At the current time, an overall costing exercise is not a part of the plan.

Given the GBAP will pay dividends in the future with lower energy bills, avoided control and damage costs of the environmental impacts of inaction, and reduced health costs, there is a good argument for the upfront investments now.

### Description of Success

By 2035, the UBC Vancouver campus buildings will contribute towards a vibrant and sustainable campus that enhances wellbeing and excellence for people. UBC will be seen as a global leader and innovator in net-positive buildings. The physical campus will be a demonstration project through the Campus as a Living Laboratory approach to help in broader market transformation toward net positive buildings. A trajectory will be set for the campus along the pathway to net positive in eight component areas of building design, with processes in place for continuous improvement (see Figure 5). Operational improvements will reduce the carbon footprint towards the net positive goal, which will be achieved by 2050.

Responsible water management will respect the natural hydrology of the campus and a regional water balance. Material choices will support continuous improvements in human and ecological health. Biodiversity will flourish and contribute to ecological health and the positive health and wellbeing of the UBC community. Buildings and

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<sup>9</sup> World Green Building Council. Building the Business Case: Health, Wellbeing and Productivity in Green Offices (2016).

<sup>10</sup> Maller, C., Townsend, M., Pryor, A., Brown P & St Leger, L. Healthy nature healthy people: 'contact with nature' as an upstream health promotion intervention for populations (2006).

landscapes will be resilient and capable of adapting to climate change. Operations will be firmly tied to teaching, learning and research to provide mutual progress towards a net positive campus.

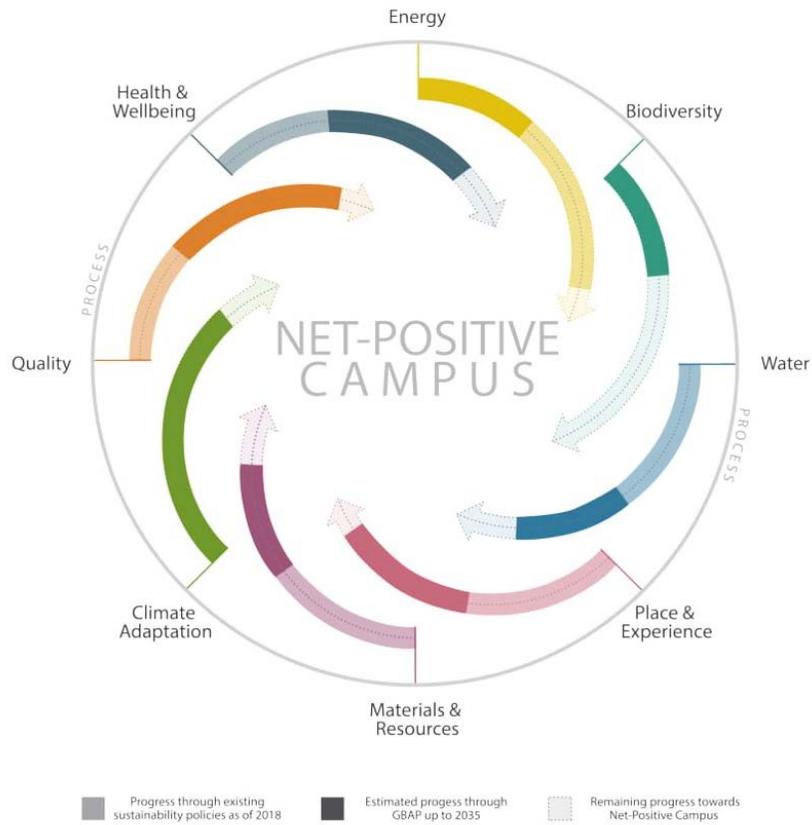


Figure 5. An illustrative diagram of the current level of progress on each GBAP component area and the estimated progress needed to achieve a net positive campus.

## PART 2

## Part 2 Institutional and Residential Plans

Part 2 of the Green Building Action Plan contains the detailed descriptions of the context, pathway to net zero, key directions and priority actions for all the GBAP component areas for both institutional and residential buildings.

### 1. The Institutional Green Building Action Plan

A description of each component of the institutional GBAP is presented. The component goals, selected priority actions, targets and indicators are shown with an explanation of the context and key directions. **A more detailed version of the institutional action plan is shown in Appendix A.**

#### 1. Process

##### *Component Goals*

1. UBC policies and processes will support the achievement of the GBAP component goals and targets.
2. GBAP component goals and targets and will be communicated and easily accessible to internal and external stakeholders.
3. UBC will integrate lessons learned from each project to improve building designs.
4. UBC buildings will be evaluated as opportunities for research, innovation and continuous improvement.
5. UBC will commit to monitoring and benchmarking building performance to encourage continuous improvement on campus and in relation to industry standards.

##### *Context*

Effective and efficient process is a foundational aspect of planning at UBC.

##### *Key Directions*

The GBAP will be achieved by ensuring effective and efficient processes are upheld. Green building requirements will be clearly accessible for stakeholders through a web page linking to relevant requirements. During project development, UBC has recognized (through the Major Project Improvement Process) that increased emphasis on reducing the total cost of ownership for UBC's buildings, as well as on many other green building objectives, is an important approach that will benefit UBC in the long run.

Following the success of Campus as a Living Lab and SEEDS, the idea of considering each building project as an opportunity for teaching, learning and research will help connect the necessity of physical facilities to the enhancement of UBC's academic mission.

***Five-Year Implementation Plan – Short-Term Priority Actions***

- Explore the implementation of a benchmarking platform for energy, emissions, water and waste reporting.
- Create a GBAP requirements web page that links to all relevant policies and tools for easy accessibility by stakeholders.
- Develop a more refined life cycle costing tool and/or an approach to be used by consultants during the building design process.
- Ensure the Major Capital Project Development Process achieves the process and sustainability objectives of the GBAP by improved integration of the current Sustainability Process.
- Relate level 3 research opportunities to GBAP component goals to increase alignment of research and operations by creating a list of potential opportunities.
- Develop a decision-making tool template for tier 1 and tier 3 projects to determine project priorities.
- Develop short-term and long-term strategic research opportunity plans to help connect the necessity of physical facilities to the enhancement of UBC’s academic mission.
- Ensure that project design briefs (which describe UBC’s project goals to consultants) are developed by an appropriate stakeholder group so that lessons learned by Building Operations are incorporated into building design.
- Align the UBC Technical Guidelines with GBAP requirements through an annual review and update process that fully engages stakeholders.
- Update UBC Advisory Urban Design Panel requirements to include sustainability objectives and targets.
- Develop a program to conduct post-occupancy surveys and introduce standard post-occupancy evaluation (in coordination with the Major Project Improvement Process) to better understand occupants’ concerns.

***Targets and Indicators***

Target: 100% of projects will conduct life cycle costing by 2025.

**2. Energy**

***Component Goals***

- |   |
|---|
| <ol style="list-style-type: none"><li>1. UBC buildings will advance the campus towards net positive energy and greenhouse gas neutrality by reducing energy demand and focusing on site-specific passive design approaches.</li></ol> |
|---|

2. UBC buildings will have indoor thermal environments that are comfortable and enhance health and wellbeing.
3. UBC will integrate lessons learned to improve building energy performance.

*Context*

Buildings are the greatest sources of energy use and greenhouse gas emissions (GHG) on campus. Reducing building energy use will lower costs for the University (energy costs and carbon offset costs) and reduce GHG emissions, aligning with UBC’s Climate Action Plan (CAP).

The Academic District Energy System (ADES) is one of UBC’s signature initiatives to substantively reduce greenhouse gas (GHG) emissions. The original aging steam heating system at this campus was replaced with a hot water–based system that will heat approximately 130 buildings. The Bioenergy Research and Demonstration Facility, built in 2012, houses the process of using renewable biomass to generate thermal energy for heating campus buildings. The Campus Energy Centre is the primary energy source for the hot water district energy system, producing thermal energy (hot water). Through its evolving Climate Action Plan, UBC will continue to advance towards an ambitious greenhouse gas emission reduction target of 67% by 2020 and 100% by 2050. Reductions in building energy use and associated greenhouse gas emissions are a key aspect of the Green Building Action Plan, and the plan will be a leader in shifting the marketplace to low-carbon solutions.

*Pathway to Net Positive*

Through the Climate Action Plan, UBC has committed to a 67% reduction in GHG emissions by 2020 and 100% by 2050 at the campus scale. Both existing and new UBC institutional buildings will play their role in achieving the CAP goals, as shown in the illustrative graph below, alongside an increase in the supply of renewable energy from the ADES.

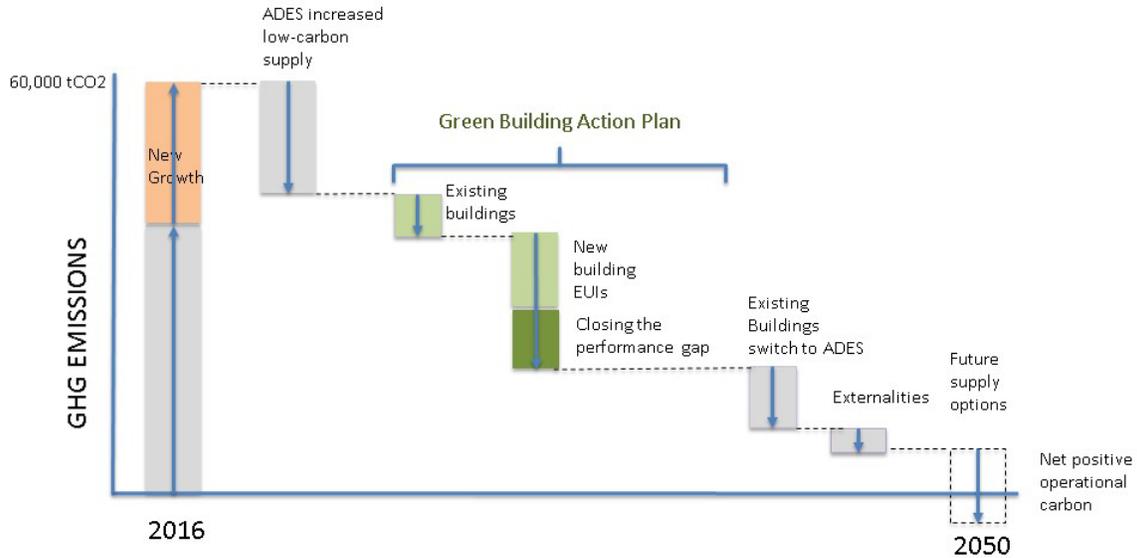


Figure 6. An illustrative graph of UBC's greenhouse gas (GHG) emissions in institutional developments and the role of the GBAP in reaching net positive operational carbon by 2050.

### Key Directions

UBC's new buildings and renewal projects (tier 1, 2 and 3a) will incrementally use less energy over time and achieve net positive GHG emissions by decreasing energy demand through passive design, increasing energy efficiency and meeting energy needs with renewable energy supply through the ADES. Energy targets for different building types and the anticipated incremental reduction over time is shown in Table 4. Energy targets will be developed individually for each project to reflect the mixture of uses and refined during design development. Existing building retrofits (tiers 3b, 4 and 5) and ongoing operations will look to increasing energy efficiency and switching fuel to lower-carbon sources where possible.

### Pathway to Net Positive

UBC is committed to improving building performance by understanding occupant behavior and operator concerns and by increasing the stringency of compliance measures (such as requirements for airtightness testing and improved modelling of thermal bridging) to close the gap between predicted and actual energy use. UBC Energy and Water Services monitors building energy performance and works to identify actions (such as control upgrades) to improve performance and reduce the energy performance gap.

In addition to having ambitious energy targets, designing thermally comfortable indoor environments that are resilient to climate change is necessary to provide welcoming spaces that enhance the health and wellbeing of occupants.

Institutional Energy Targets												
	Student Housing			High-Intensity Science Building			Low-Intensity Science Building			Office, Classroom and/or Library		
	TEDI	DHW	EUI	TEDI	DHW	EUI	TEDI	DHW	EUI	TEDI	DHW	EUI
<b>Current</b>	40	30	130	65	15	380	45	15	200	40	5	140
<b>2020</b>	30	30	120	55	15	370	35	15	190	30	5	130
<b>2025</b>	20	30	110	45	15	360	25	15	180	20	5	120
<b>2030</b>	15	30	95	35	15	350	15	15	170	15	5	115

Table 4. Energy targets for tier 1 and 3a institutional buildings.

### Five-Year Implementation Plan – Short-Term Priority Actions

- Identify passive and mechanical design requirements for buildings of different uses and space criteria that achieve comfortable indoor environments under predicted future climate conditions.
- Develop cost-effective low-carbon cooling strategies (including consideration of district cooling) to address thermal comfort needs at UBC.
- Establish mandatory incremental energy use intensity (EUI), thermal energy demand intensity (TEDI), and consider development of thermal demand (W/m<sup>2</sup>) and GHG Intensity (kgCO<sub>2</sub>e/m<sup>2</sup>/yr) targets for tier 1 and tier 3a projects.
- Require whole-building airtightness testing in alignment with BC Energy Step Code.
- Develop and implement a Smart Building Strategy and revise Monitoring Based Commissioning and Commissioning Technical Guidelines with results from the Smart Commissioning pilot projects.
- Develop a strategy and implement policies and procedures during building design to improve operability and maintainability as well as reduce the cost of ownership of energy-related systems in new construction projects.

### Targets and Indicators

Target: New institutional buildings will meet incrementally reduced energy targets to be Net Positive Ready by 2030.
Target: Reduce average building thermal energy use intensity (TEDI plus DHW) for campus buildings by 50% to 75 kwh/m <sup>2</sup> /yr by 2050.
Target: Reduce the performance gap between modelled and metered energy use in new institutional buildings by 75% within three years of occupancy by 2020.

## 3. Water

### ***Component Goals***

- |   |
|---|
| 1. UBC will practise responsible water management and use at the building and site scale by advancing water conservation and efficiency, exploring alternative water supply and treatment solutions and building water supply resiliency. |
| 2. UBC will use a low-impact development approach to rainwater management at the site scale to mitigate risk and respect the natural hydrology of the campus.   |

### ***Context***

In the Lower Mainland of BC there exists a relative abundance of water. However, there are still times when water supplies are low or deficient. With the impacts of climate change, even more frequent periods of drought in future summer months as well as more frequent intense and severe rainfall in the winter are expected. UBC will be a leader in conserving water and will improve rainwater management by managing this valuable resource and supporting the regional water balance between water use and rainfall.

### ***Pathway to Net Positive***

Although the University has made great strides in increasing water use efficiency, it is committed to continual improvements in monitoring and research to better understand how water is used, the potential for water reuse strategies, the role UBC should play in the greater region in the event of water emergencies, and how best to adapt to increased droughts brought on by climate change. The GBAP will align with and integrate building and landscape guidance called for in the (concurrent) Water Action Plan.

Rainwater management will be envisioned, designed and built as a holistic system of Low-impact development with green roofs and at-grade solutions combined for new building projects and, where possible, for renewals. Low-impact development (LID) recommendations for UBC include: reduced hard surfaces, thicker top soil, climate-adaptive landscapes, bioswales, French drains and rain gardens. On building sites more than 300 meters from the cliffs, the opportunity to use LID will be optimized; a more cautious approach is required closer to the cliffs to mitigate the risk of cliff erosion.

### ***Key Directions***

GBAP priority actions focus on a water metering and benchmarking strategy and the development of landscape and irrigation design standards. Green landscapes and irrigation design standards will be updated to incorporate drought-resistant plantings and more suitable trees. Irrigation will be tailored to specific plant requirements across the campus to ensure responsible water use. Total cost of ownership and life cycle costing analysis will be used to assess water feature designs as well as their ongoing water and energy use and operation and maintenance requirements.

Rainwater management priority actions include improving LID site rainwater management to help mitigate the risk of floods and cliff erosion on campus as well as developing criteria and guidelines for the use of green and blue roofs.

***Five-Year Implementation Plan – Short-Term Priority Actions***

- Investigate opportunities to reduce cooling tower water use in existing and new buildings.
- Develop criteria and guidelines for green roof and blue roof projects, based on rainwater management capacity, co-benefits, life cycle costs, and maintenance and operation considerations.
- Implement water metering requirements into (building) policy in alignment with the Water Action Plan.
- Review and update plumbing fixture efficiency requirements for new buildings and retrofits to current leading practice.
- Update landscape design standards and associated irrigation design standards.
- Develop guidelines for alternative water supply sources and systems in buildings (e.g., rainwater harvesting or water reuse systems) and on-site storage in buildings.
- Promote the use of seasonal rainwater features in policy which do not use potable water and consider life cycle costs.
- Require all tier 1, 2 and 3a projects to achieve the equivalent to LEED v4 Rainwater Management credit, Option 2.

***Targets and Indicators***

Target: Reduce the water use intensity on campus by 16% in 2025 and 24% in 2030 (relative to a 2017 baseline), resulting in total water consumption remaining at or below 2017 levels despite growth.
Target: Meter and report on water consumption for individual UBC buildings to enhance our ability to make strategic decisions on water conservation by: 1) ensuring all new buildings include water metering, 2) maintaining or replacing existing meters as required, and 3) adding meters where economically viable, over the next five years.
Target: Maximize rainwater management using low-impact development on building sites that are more than 300 m from cliffs.
Indicator: Increase infiltration, retention and detention of rainwater on campus.

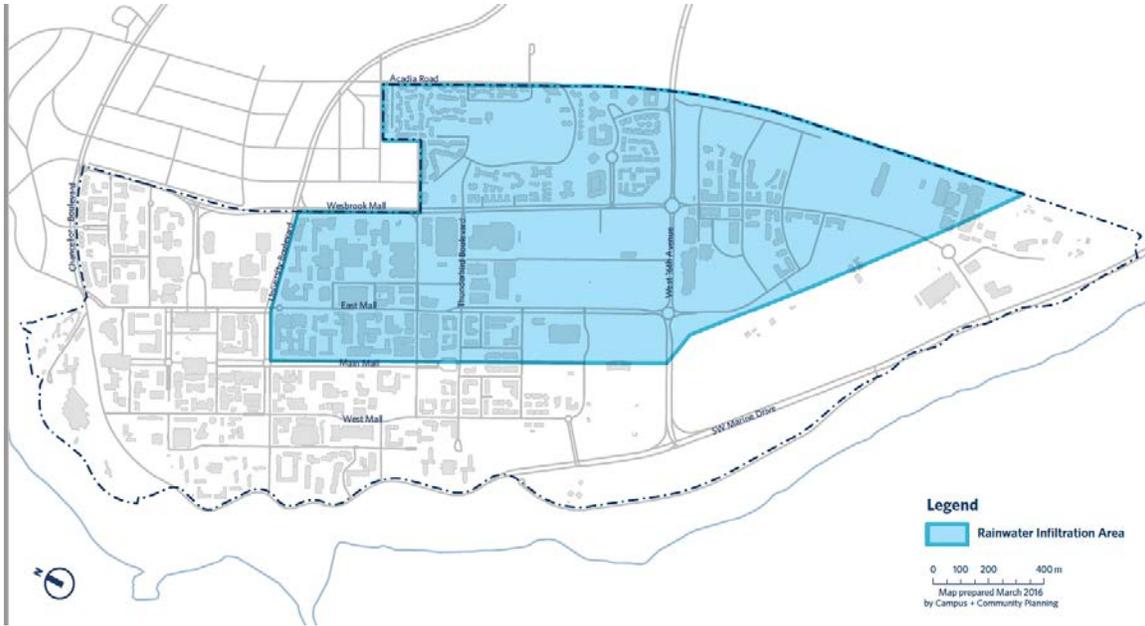


Figure 7. A plan of improved rainwater infiltration area across campus. Source: [UBC LEED Implementation Guide for Building Design and Construction v4 \(2016\)](#).

#### 4. Materials and Resources

##### **Component Goals**

- |  |
|--|
| 1. UBC will prioritize the use of building materials that have net positive environmental impacts.   |
| 2. UBC will support marketplace transformation by designing buildings with materials that are not harmful to human and ecological health.                            |
| 3. UBC will support the development of the circular economy by promoting the adaptation, reuse and recycling of materials and products during a building’s lifetime. |

##### *Context*

UBC has policy in place to reduce the environmental footprint in its material choices, the handling of these materials and the waste products generated during construction and occupancy (UBC LEED Implementation Guide and UBC Technical Guidelines). To work towards the materials and resources component area goals, policy will need to be implemented incrementally over the GBAP time frame to update to current practice and to reflect continuous improvement.

##### *Pathway to Net Positive*

Between 2004 and 2014, UBC had an average yearly expenditure of approximately \$64 million worth of construction materials. By shifting material choices based on environmental and health impacts, UBC can continue to reduce the negative environmental and health impacts of the University’s buildings and play a significant

role in moving the marketplace towards net positive impacts.

*Key Directions*

UBC will minimize the environmental footprint in its material choices, the handling of these materials and the waste products generated during construction and occupancy. The GBAP will require material transparency through environmental product declarations and will prioritize materials with low levels of embodied carbon. The requirements for environmental performance of materials will be incrementally increased over time. The GBAP will develop an approach to identifying building materials considered harmful to health based on reviews of best practices and a market supply analysis.

***Five-Year Implementation Plan – Short-Term Priority Actions***

- Review current operational waste recycling infrastructure guidelines to maximize adaptability over time and improve diversion rates (e.g., location, access, frequency, size, etc.)
- Review current metrics and benchmarks for construction waste in order to reduce total amount of waste produced. Consider project size, structure, and typology.
- Undertake staff and faculty engagement to develop a targeted and realistic approach to the use of life cycle assessments for new construction projects (based on experience gained with Brock Commons Tallwood House’s full life cycle assessment and life cycle cost pilot).
- Develop guidelines for making building material choices through research (level 2) that are informed by health impacts based on a review of best practices, market supply, and stakeholder engagement (i.e., list commonly used building materials considered harmful to health in the sourcing, manufacturing, installation, occupancy or end-of-life phase).
- Develop guidelines for building design adaptability and deconstructability.
- Develop a process for piloting and monitoring innovative building products in design and construction practices that reduce life cycle impacts.
- Mandate the incremental reduction of environmental impact in building materials through pilots and best practice review.
- Implement policies for reduced embodied carbon in buildings, starting with a requirement to report embodied carbon, followed by incremental reductions.

***Targets and Indicators***

Target: Eliminate 100% of UBC-identified building materials in new construction that are known to be detrimental to human and ecological health by 2035.
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Target: Require all new buildings to be Zero Waste Ready <sup>11</sup> by 2020.
Target: Divert 100% of construction and demolition waste from landfill by 2035.

*Indicator:* Embodied carbon is calculated for all construction projects.

## 5. Biodiversity

### **Component Goals**

1. UBC will develop highly functioning landscapes at the building and site scale to contribute to biodiversity and natural ecosystem processes.
2. UBC will engage campus teaching and research opportunities to enhance biodiversity management capacity.

### *Context*

Biodiversity is the richness of plant and animal species, their ecosystems, and the ecological processes that sustain them. Enhancing biodiversity by nurturing natural systems provides for a range of ecological services: local and global climate regulation, water supply retention, erosion and sediment control, hazard mitigation, pollination, habitat functions, waste decomposition and treatment, human health and wellbeing, food and renewable non-food products, and cultural benefits. The natural systems of UBC are a critical component of the University's identity and support community health and wellbeing. Ecological processes cross scales, beyond the boundary of a building site.

### *Pathway to Net Positive*

A net positive approach involves nurturing UBC's natural systems that provide for a range of important ecological services, which are typically undervalued. Biodiversity is an emergent component of the GBAP. Through the Campus Biodiversity Initiative: Research and Demonstration (CBIRD), UBC will conduct research and develop partnerships with regional organizations and will take essential steps to understanding biodiversity on a regional scale and UBC's potential role in the region.

Natural systems are a critical component of the University's identity and support the place and experience component area. The biodiversity that these systems support is part of community health and wellbeing and helps to sustain mental and physical health. The ability of natural systems to help UBC adapt to climate change is an additional co-benefit.

### *Key Directions*

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<sup>11</sup> Buildings fully meet the most recent version of the [Recycling Infrastructure Guidelines for UBC Buildings](#) and the UBC Technical Guidelines related to waste and recycling requirements.

Priority actions for biodiversity focus on developing principals and providing guidance for landscapes and green roofs that consider the ability for the planted installations to support regional biodiversity priorities and provide other co-benefits. Building and landscape projects will need to address ecological assets identified in campus-scale site assessments, bird-friendly design guidelines will require improvement, and linkages to research initiatives will need to be strengthened.

### ***Five-Year Implementation Plan – Short-Term Priority Actions***

- Review and research national and international best practices, incorporate findings into guidance for current development projects, and use findings to provide background for policy development that guides metrics at a building and landscape scale. (Include a review of Canada's goals based on the Convention on Biological Diversity, Sustainable Sites Initiative (SSI) and Strategic Directions for Biodiversity Conservation in the Metro Vancouver Region<sup>12</sup>).
- Engage a consultant(s) to conduct site assessments to identify and assess the ecological assets, endangered and vulnerable species, and environmentally sensitive areas on a campus or neighbourhood scale. Site assessment reports will be used to inform individual project designs.
- Establish partnerships between research and operations through participation in CBIRD and related Level 1 and 2 SEEDS projects.
- Identify and monitor key biodiversity metrics at the site and building scale to determine baseline conditions and rates of change based on research studies and crowd-sourcing (e.g., YardMap, eBird, BirdVis, iTree, etc.)
- Develop a set of principles for landscapes and green roofs that consider the following: 1) ability to adapt to climate change, 2) ability to attract pollinators, 3) reduction of invasive species, 4) microclimate suitability (sun, shade, etc.), 5) ability to support passive solar strategies (e.g., provide shade, reduce wind), 6) campus character zones and irrigation zones (green or brown areas), and 7) regional biodiversity priorities.
- Determine site-specific biodiversity requirements for each development project based on the neighbourhood-wide site assessments and principles identified above.
- Reflect the CBIRD vision and values in policy development.
- Based on review of the Library Gardens SSI pilot project, investigate the adoption of the Sustainable Sites Initiative as the required rating system for significant landscape projects.

### ***Targets and Indicators***

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<sup>12</sup> Working Together for the Georgia Basin. Strategic Directions for Biodiversity Conservation in the Metro Vancouver Region (2008).

Target: Require 100% compliance to UBC Bird Friendly Design Guidelines for Buildings for new institutional buildings by 2020.
Indicator: Increase opportunities to provide habitat for birds, pollinators and other species.

Note that, based on foundational studies and data gathering identified in the GBAP actions, further targets and indicators will be integrated into future updates of the GBAP.

## 6. Health and Wellbeing

### **Component Goals**

1. UBC will enhance the mental, physical social dimensions of wellbeing by making them integral to building and landscape design decisions.
2. UBC researchers, community stakeholders and building occupants will be engaged in a meaningful and ongoing way to inform building and landscape design decisions around health and wellbeing.
3. UBC will become a leader in enhancing wellbeing through the built environment within the context of higher education in Canada.

### *Context*

UBC's campus environments, both built and natural, play a vital role in the physical, mental and social wellbeing of all students, staff and faculty. Well-designed spaces can: work to promote physical activity; enable social connections; improve productivity, learning, and overall health; foster equity and inclusion; and promote accessibility and ease of use. Since the Okanagan Charter<sup>13</sup> was adopted, UBC has committed to incorporating health and wellbeing into all aspects of campus culture and operations.

### *Path to Net Positive*

Prioritizing health and wellbeing is foundational to the success of individuals and the overall community at UBC, and it is closely linked to biodiversity and place and experience component areas. A system-wide holistic and proactive approach that champions wellbeing is currently in development through UBC Wellbeing, a collaborative effort that aims to make the University a better place to live, work and learn.

### *Key Directions*

The GBAP will provide guidance for how building and landscape design can nurture the mental, physical and social dimensions of well-being. Wellbeing principles, objectives

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<sup>13</sup> Okanagan Charter: An International Charter for Health Promoting Universities and Colleges (2015).

and metrics that will inform site-specific building and landscape requirements will be integrated into the GBAP in full coordination with the development of the UBC Wellbeing Strategy.

Foundational work in this emerging component area will include review of best practices, particularly the WELL Building Standard (through a pilot study to identify specific WELL Building Standard guidance that is aligned with UBC priorities).

#### ***Five-Year Implementation Plan – Short-Term Priority Actions***

- Review research and best practices for physical, mental and social health and wellbeing in buildings.
- Develop health and wellbeing guiding principles for building design that promote physical, mental and social wellbeing (e.g., incorporating social or contemplative space, designing spaces that allow inclusion, incorporating universal design principles, promoting ease of use, incorporating ergonomic principles, developing daylighting requirements, considering acoustic requirements, etc.).
- Identify metrics for health and wellbeing (e.g., temperature, indoor air quality, daylight levels, acoustic levels, views to exterior, number of indoor plants, healthy working postures, etc.) and develop targets and performance measures.
- Develop a strategy for all projects to include considerations of ergonomics, universal access requirements, and how users of different sizes and abilities will interact with the environment (e.g., conduct table-top drawing simulations or mock-ups, analyze risks, and engage building occupants for feedback).
- Test the WELL Building Standard against existing buildings (e.g., Earth Sciences Building) in a pilot study and identify WELL Building Standard credits and best practices that are aligned with UBC priorities.
- Coordinate with UBC's Wellbeing Strategy in collaboration with UBC Wellbeing to guide how building and landscape design can nurture physical, mental and social dimensions of health and wellbeing.
- Incorporate health and wellbeing strategies into policies and design briefs for building and landscape projects.
- Establish relationships with off-campus partners to advance the connection between research and practice for health and wellbeing in buildings.

#### ***Targets and Indicators***

Targets and indicators will be developed based on foundational studies and data gathering identified in the GBAP.

## **7. Quality**

### ***Component Goals***

1. UBC buildings and landscapes will be durable, reliable and resilient.

*Context*

Quality is defined as that which makes a building reliable, durable, resilient, comfortable, dependable, and a contributor to the UBC brand.

UBC requirements for building quality are communicated through the UBC Technical Guidelines. UBC prioritizes durability for buildings and products that maximize life cycle and the total cost of ownership while meeting the functional requirements of building users. Durable materials are preferred that minimize the need for new resources and their cost of operation and maintenance in the building’s lifetime. Components, finishes, equipment and systems that require minimal maintenance and exhibit a high level of maintainability and long-term reliability are preferred.

*Key Directions*

To improve quality, UBC will analyze and strengthen existing processes. Increased compliance with project goals, UBC Technical Guidelines and UBC Sustainability Submission Requirements will be pursued.

To improve clarity, the green building requirements have been identified for each tier and are as follows:

TIER	DESCRIPTION	AREA/ BUDGET	GREEN BUILDING REQUIREMENTS
<b>TIER 1</b>	New Buildings - Large	>1,000 m <sup>2</sup> , >\$5M	<ul style="list-style-type: none"> <li>• Green building certification</li> <li>• Energy target</li> <li>• UBC Technical Guidelines</li> <li>• Life cycle costing focus</li> <li>• Sustainability Process</li> </ul>
<b>TIER 2</b>	New Buildings - Small	<1,000 m <sup>2</sup> , >\$5M	<ul style="list-style-type: none"> <li>• Energy target</li> <li>• UBC Technical Guidelines</li> <li>• Life cycle costing focus</li> <li>• Sustainability Process</li> </ul>
<b>TIER 3</b>	Major Project Renovations (a) Renewal (includes envelope and mechanical system upgrade)	>\$5M	(a) <ul style="list-style-type: none"> <li>• Green Building Certification</li> <li>• Energy target</li> </ul>

	(b) Other (extensive interior upgrades)		<ul style="list-style-type: none"> <li>• UBC Technical Guidelines</li> <li>• Life cycle costing focus</li> <li>• Sustainability Process</li> </ul>
			<p>(b)</p> <ul style="list-style-type: none"> <li>• UBC Technical Guidelines</li> <li>• Life cycle costing focus</li> <li>• Meeting with S&amp;E</li> </ul>
<b>TIER 4</b>	Partial Fit-outs	\$1M – \$5M	<ul style="list-style-type: none"> <li>• UBC Technical Guidelines</li> <li>• Life cycle costing focus</li> <li>• Meeting with Sustainability and Engineering</li> </ul>
<b>TIER 5</b>	System Upgrades (e.g., chiller replacement, controls)	n/a	<ul style="list-style-type: none"> <li>• UBC Technical Guidelines</li> <li>• Life cycle costing focus</li> </ul>

Table 5. Tier system with green building requirements for institutional building projects.

In collaboration with UBC Project Services, Properties Trust, and Infrastructure Development, the GBAP clarifies performance targets and expectations for the renovation and retrofits of existing buildings. UBC prioritizes full renewal of aging buildings (tier 3a) rather than demolition and replacement, which can result in significant savings in construction costs, new materials, and environmental impact, and reduces UBC’s deferred maintenance debt. Renewal can also preserve significant buildings while creating state-of-the-art facilities, helping to foster a sense of place and UBC’s identity. Other major renovations (tier 3b) may involve only partial building renovation and upgrade, or renovations in support of significant changes to academic activities. Smaller renovations (tier 4) that support asset management or academic need have reduced requirements. System upgrades (tier 5) occur as needed during the service life or to specifically improve building performance and are typically geared to reduce UBC’s deferred maintenance debt.

***Five-Year Implementation Plan – Short-Term Priority Actions***

- Review and investigate opportunities to apply international climate resilience standards, such as the RELi resilience standard, to projects.
- Undertake a Greenest City Scholars study of the RELi resilience standard to identify the credits and best practices that align with UBC priorities.
- Develop review process for Owners Project Requirements.

- Require LEED documentation to be submitted to UBC at design, construction, and final review stages.
- Develop a strategy to conduct a full review of the UBC Technical Guidelines to ensure clarity and eliminate redundancies.

**Targets and Indicators**

Target: Major projects track and achieve their design brief sustainability goals by 2020 (subject to approved changes during design process).
Target: Achieve 100% compliance with UBC Technical Guidelines by 2025 (compliance allows for approved variances).
Target: Achieve 100% compliance with UBC sustainability submission requirements by 2025 (compliance allows for approved variances).

**8. Climate Adaptation**

**Component Goals**

1. UBC buildings and landscapes will have the resilience to respond to both anticipated and unpredictable changes in climate.
2. UBC will engage with researchers in a meaningful and ongoing way to inform building policy and guidelines around climate adaptability.

*Context*

Through historical evidence and future modelling we know that temperatures will continue to rise as a result of climate change. For the Lower Mainland, modelling predictions indicate that there will be long-term warming, more extreme weather events, changing precipitation patterns and rising sea levels.<sup>14</sup> These changes mean an increased risk of flooding, damage from storms, and overheating during summer highs. Changes to the design, construction and renovation of buildings and landscapes will be required to adapt to these future impacts. Without action, UBC’s livability and economic prosperity goals are at risk.

Climate adaptation could be achieved through a change in approach to different aspects of building design, including: building form and orientation, building envelope, roof design, shading and glazing design, internal layout, interior environment, service infrastructure, exterior spaces, and the relationship between indoor and outdoor space. A key change at UBC is it that buildings will need to be designed for human comfort in the higher temperatures expected in our region over the building’s lifetime.

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<sup>14</sup> [Metro Vancouver. Climate Projections for Metro Vancouver \(2016\).](#)

### *Pathway to Net Positive*

The broader UBC Resiliency Initiative will develop principles, objectives and metrics to guide adaptation in buildings and landscapes and address policies and guidelines that respond to risk across different scales – building, neighbourhood, campus and region. UBC will partner with regional partners including Metro Vancouver and the City of Vancouver to coordinate strategies.

Climate adaptation actions can provide multiple or synergistic benefits. For example, improved building envelopes can have multiple benefits, including reduced thermal heat transfer, reduced energy costs, reduced GHG emissions and improved thermal comfort. However, this must be balanced with the potential for increased cooling needs in future warmer temperatures resulting from these tight building envelopes.

Adaptation actions intersect with other components, including water and energy. For example, water conservation is a climate adaptation strategy that helps to reduce impacts from hotter, drier weather in future summers. For buildings, design measures such as shading, orientation, glazing and ventilation help to reduce energy demands and provide thermal comfort in hotter, drier summers.

As we make investments in our buildings, it is imperative that our designs, retrofits, operations and maintenance respond to adaptation needs. The cost of no action, both from a future retrofit and public safety perspective, could be much higher than proactively planning infrastructure to be resilient to future climate change impacts.

### *Key Directions*

UBC will ensure buildings and landscapes adapt to a changing climate by using the most up-to-date climate data to guide building design and retrofits. Priority actions focus on a review of best practice for adaptation and identifying and conducting vulnerability assessments of infrastructure, including buildings, landscapes and stormwater infrastructure. GBAP actions will be integrated with an emerging campus Resiliency Initiative, when available, which will develop principles, objectives and metrics to guide adaptation in buildings and landscapes. Additional guidance in the water and energy components sections address specific approaches to climate adaptation.

### ***Five-Year Implementation Plan – Short-Term Priority Actions***

- Review current research and best practices for climate adaptation strategies in buildings.
- Identify climate adaptation research opportunities for buildings and landscapes on a local, regional and global scale.
- Conduct vulnerability assessments of campus buildings, landscapes and infrastructure at periodic intervals.
- Integrate early guidance on climate adaptation measures into project design briefs.
- Coordinate with the campus-wide Resiliency Initiative and climate adaptation strategies, as they evolve based on vulnerability assessments, evaluations and best

practice review, by implementing policies on a building and landscape scale that respond to key climate change impact areas (e.g., increased temperature, variable weather patterns, increased flood events, increased smoke, increased peak events, etc.).

- Incorporate aspects into building and landscape designs to serve campus-wide emergency response preparedness in coordination with key departments, including Infrastructure Development and Risk Management Services.
- Update GBAP once the Resiliency Initiative is adopted.

### *Targets and Indicators*

Targets and indicators will be developed based on foundational studies and data gathering identified in the GBAP.

## 9. Place and Experience

### **Component Goals**

- |  |
|--|
| <ol style="list-style-type: none"><li>1. UBC buildings and landscapes will provide opportunities for collaboration, innovation and community development to reflect the social and environmental sustainability aspirations of the University.</li></ol> |
|--|

### *Context*

The Campus Plan and the Public Realm Plan have played major roles in creating a sense of place on campus since their implementation. Through these plans UBC already has ambitious and successful place-making policy and is looking for improvements and synergies with other green building component areas to carry through to new developments.

### *Pathway to Net Positive*

Place and experience is a component of the GBAP that specifically promotes architectural and landscape designs that outwardly express social and environmental sustainability aspirations of UBC.

This component is emerging in nature, examples might include:

- Celebrating natural systems (e.g., University Boulevard stormwater feature)
- Using locally appropriate materials (e.g., First Nation House of Learning use of locally selected timbers)
- Fostering social connection and cohesion through design of exterior and interior spaces (e.g., the exterior/interior knoll at the Nest)
- Building elements that tell a story and learning landscapes (e.g., rainwater leaders that show water collection at CIRS)

- Exposing building systems creatively (e.g., Campus Energy Centre boilers)

### *Key Directions*

Design has a role to play in telling the sustainability story of the building and landscape and communicating their unique identities. Design can also express human and ecological wellbeing by teaching about the processes or systems within the building and by expressing their presence. Expression can also be more abstract and creative, which communicates sustainability in a less literal manner (e.g., through art installations or playful demonstrations). It is important that buildings and landscapes serve the larger aspiration of producing positive, memorable and personally relevant experience, especially given the potentially limited time students are in attendance.

### ***Five-Year Implementation Plan – Short-Term Priority Actions***

- Identify short- and long-term student-led initiatives that contribute meaning and memory associated with buildings and landscapes.
- Review the Public Realm Plan goals and guidelines for better coordination and compliance of building landscapes.
- Establish additional GBAP place and experience component goals, in coordination with Campus and Community Planning, to help express a project's social, environmental and economic sustainability goals.
- Integrate heritage considerations early in the design through mandatory “Statements of Significance” for existing buildings.
- Analyze and improve existing design and development processes for strengths and weaknesses in integrating the GBAP place and experience component goals in project design objectives.

### ***Targets and Indicators***

Targets and indicators will be developed based on foundational studies and data gathering identified in the GBAP.

## 2 The Residential Green Building Action Plan

A description of each component of the residential GBAP is presented. The component goals, selected priority actions, targets and indicators are shown with an explanation of the context and key directions. **A more detailed version of the residential action plan is shown in Appendix B.**

In the residential neighbourhoods, REAP (the Residential Environmental Assessment Program) is the key policy driver. REAP is a UBC-specific green building rating system that applies to multi-use residential and mixed-use (residential with commercial at grade) buildings. The fundamental idea behind REAP building requirements is to support the reduction of environmental impact at the building site and neighbourhood scale incrementally over time. All new residential projects, including private developments and Faculty and Staff Housing, are required to achieve a minimum REAP Gold certification.

### 1. Process

#### ***Component Goals***

1. UBC policies and processes will support the achievement of the GBAP component goals and targets.
2. GBAP component goals and targets will be communicated and easily accessible to internal and external stakeholders.
3. UBC will integrate lessons learned from each project to improve building designs.
4. UBC buildings will be evaluated as opportunities for research, innovation and continuous improvement.
5. UBC will commit to monitoring and benchmarking building performance to encourage continuous improvement on campus and in relation to industry standards.

#### *Context*

Effective and efficient process is a foundational aspect of planning at UBC.

#### *Key Directions*

It is important to leverage and build upon existing processes to ensure that sustainability objectives inform development from project inception to post-occupancy performance tracking. The University needs to start measuring the performance of projects in the neighbourhoods, learn from data collected, and integrate new knowledge into existing policies in all component areas of the GBAP.

Tying operations into teaching, learning and research through short- and long-term strategic research opportunity plans will help connect the necessity of physical facilities to the enhancement of UBC's academic mission.

**Five-Year Implementation Plan – Short-Term Priority Actions**

- Develop a process to introduce GBAP requirements for retrofit and renovation projects in neighbourhoods.
- Create REAP credits for mandatory benchmarking, performance reviews and post-occupancy surveys.
- Develop a sustainability process for new residential construction.
- Create a GBAP requirements web page that links to all relevant policies and tools for easy accessibility by stakeholders.
- Update to REAP 3.1 for BC Energy Step Code alignment.
- Update to REAP 4.0 based on component area priorities in time for the development of the Stadium Road neighbourhood with stakeholder review.
- Update the UBC Advisory Urban Design Panel requirements to include sustainability outcome requirements.

**2. Energy**

**Component Goals**

1. UBC buildings and landscapes will advance the campus towards net positive energy and greenhouse gas neutrality by reducing energy demand and focusing on site-specific passive design approaches
2. UBC buildings will have indoor thermal environments that are comfortable and enhance health and wellbeing.
3. UBC will integrate lessons learned to improve building energy performance.

**Context**

Buildings provide nearly 30% of regional GHG emissions<sup>15</sup> and nearly half of emissions from the UBC residential neighbourhoods.<sup>16</sup> To achieve improved energy performance and emission reductions along with other sustainability objectives, UBC established the Residential Environmental Assessment Program (REAP) in 2007 as a Land Use Rule.

To identify an energy and GHG reduction pathway in residential neighbourhoods, UBC developed a Community Energy and Emissions Plan (CEEP) in 2013 to set ambitious

<sup>15</sup> [Metro Vancouver. Greenhouse Gas Factsheet \(2013\).](#)

<sup>16</sup> UTOWN@UBC. Community Energy and Emissions Plan (2013).

goals for energy and emission reductions. The CEEP identifies an energy and emissions reduction strategy that will result in a 100% reduction in building GHG emissions by 2050. To achieve this target, the CEEP recommends the establishment of a low-carbon Neighbourhood District Energy System (NDES), improved energy performance measures through REAP, and the implementation of a building retrofit program.

The objective of the NDES is to provide heat and hot water with reduced GHG emissions by providing low-carbon thermal energy for UBC residential neighbourhoods, including Wesbrook Place, East Campus, Acadia Park and Stadium Road. District energy is currently in phase 1 of its development, serving Wesbrook Place using temporary natural gas boilers. Phase 2 implementation will use an alternate energy source, currently contemplated as waste heat recovery from TRIUMF or interconnection with the ADES, which is expected to occur in 2024.

UBC is currently working on the balance between building performance and the business case for the development of the low-carbon NDES.

More recently, the Province of BC has instituted the BC Energy Step Code to define a pathway to net zero-ready buildings by 2032. The federal Pan Canadian Framework defines a similar pathway.

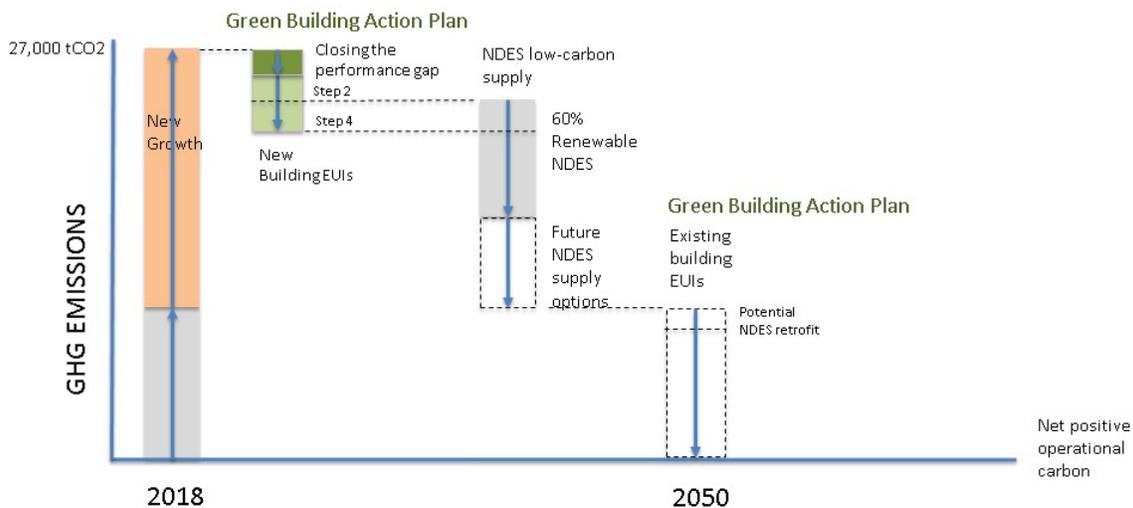


Figure 8. An illustrative graph of UBC's greenhouse gas (GHG) emissions in residential developments and the role of the GBAP in reaching net positive operational carbon by 2050.

### Pathway to Net Positive

The CEEP identifies an energy and emissions reduction strategy that will result in a 100% reduction in building GHG emissions by 2050. To achieve this target, the CEEP recommends the establishment of a low-carbon Neighbourhood District Energy System (NDES), improved energy performance measures through REAP, and the implementation of a building retrofit program. In 2015, the BC Utilities Commission approved the establishment of phase 1 of a low-carbon energy utility—the UBC NDES.

Phase 2 planning is in progress and will include a fuel switch from temporary natural gas energy centres to a renewable energy centre in 2024.

To achieve improved performance and consistency with other BC jurisdictions, REAP 3.1 energy targets will be aligned with Step 2 of the BC Energy Step Code targets. Step 2 calls for an EUI of 130 kwh/m2/yr and a TEDI of 45 kwh/m2/yr .

Costing studies commissioned by UBC and the Province of BC demonstrate that BC Energy Step Code targets are cost effective for developers to Step 3 of the code (Table 6). The implications of the Step 2 target for REAP considers impacts on future demand and a utility rate for the NDES. The studies identified positive paybacks up to Step 3 of the code, on a life cycle costing basis (net-present value, including energy cost savings).

Typology	Step Code Level	UBC Study		BC Housing Study
		Low	High	Average
Low Rise	Step 1	0.0%	0.0%	0.0%
	Step 2	0.0%	0.1%	0.5%
	Step 3	0.5%	1.1%	0.6%
	Step 4	2.3%	4.1%	2.6%
High Rise	Step 1	0.0%	0.0%	0.0%
	Step 2	0.4%	0.9%	0.4%
	Step 3	0.5%	1.4%	0.8%
	Step 4	2.3%	4.1%	2.4%

Table 6. Incremental capital costs based on costing studies by UBC and the Province of BC.

### Key Directions

To ensure residential development is on a pathway to achieving net positive energy and GHG emissions, the GBAP’s priority actions focus on the alignment of REAP with the BC Energy Step Code. This includes the implementation of an energy benchmarking monitoring program intended to provide feedback on the realized performance of REAP energy targets and the NDES. Improving the understanding of design measures to maintain thermal comfort under future climate conditions is an emerging priority. A key objective is to achieve GHG reductions across the energy demand and supply spectrum at the lowest total cost of ownership.

### Five-Year Implementation Plan – Short-Term Priority Actions

- Undertake a study to identify envelope and mechanical design options that achieve comfortable indoor environment under predicted future climate conditions, with priority emphasis on passive approaches where feasible.

- Review feasibility of developing and implementing REAP requirements for existing buildings.
- *Target:* New residential buildings will meet energy targets to be Net Zero Ready by 2030 in alignment with the BC Energy Step Code.
- Implement an energy benchmarking system as part of an ongoing monitoring program.
- Develop GHG intensity targets to ensure cost-effective pathways to zero GHG emissions for buildings connected or not connected to the NDES.
- Develop energy efficiency education programs, including a quick-start for strata councils, to support building owners and residents in partnership with the UNA.
- Mandate incremental energy use intensity (EUI) and thermal energy demand intensity (TEDI) building targets that align with BC Energy Step Code requirements and support the development of the NDES renewable energy centre by 2024.
- Mandate whole building airtightness testing and energy modelling in alignment with BC Energy Step Code by 2018 and set airtightness targets by 2020.
- Develop a program to inform building owners of energy performance through benchmarking reporting by 2020.

**Targets and Indicators**

Target: New residential buildings will meet energy targets to be Net Zero Ready by 2030 in alignment with the BC Energy Step Code.
Indicator: Increase energy efficiency of existing residential buildings through standards and programs.

**3. Water**

**Component Goals**

1. UBC will practise responsible water management and use at the building and site scale by advancing water conservation and efficiency, exploring alternative water supply and treatment solutions and building water supply resiliency.
2. UBC will use a low-impact development approach to rainwater management at the site scale to mitigate risk and respect the natural hydrology of the campus.

*Context*

In the Lower Mainland of BC there exists a relative abundance of water. However, there are still times when water supplies are low or deficient. With the impacts of climate change, even more frequent periods of drought in future summer months as well as more frequent intense and severe rainfall in the winter are expected. UBC will be a leader in conserving water and will improve rainwater management by managing this

valuable resource and supporting the regional water balance between water use and rainfall.

#### *Pathway to Net Positive*

Although the University has made great strides in increasing water use efficiency, it is committed to continual improvements in monitoring and research to better understand how water is used, the potential for water reuse strategies, the role UBC should play in the greater region in the event of water emergencies, and how best to adapt to increased droughts brought on by climate change. The GBAP will align with and integrate building and landscape guidance called for in the (concurrent) Water Action Plan.

Rainwater management will be envisioned, designed and built as a holistic system of low-impact development with green roofs and at-grade solutions combined for new building projects and, where possible, for renewals. Low-impact development (LID) recommendations for UBC include: reduced hard surfaces, thicker top soil, climate-adaptive landscapes, bioswales, French drains and rain gardens. On building sites more than 300 meters from the cliffs, the opportunity to use LID will be optimized; a more cautious approach is required closer to the cliffs to mitigate the risk of cliff erosion.

#### *Key Directions*

GBAP priority actions focus on a water metering and benchmarking strategy and the development of landscape and irrigation design standards. Green landscapes and irrigation design standards will be updated to incorporate drought-resistant plantings and more suitable trees. Irrigation will be tailored to specific plant requirements across the campus to ensure responsible water use.

Rainwater management priority actions include improving LID site rainwater management to help mitigate the risk of floods and cliff erosion on campus as well as developing criteria and guidelines for the use of green and blue roofs.

#### ***Five-Year Implementation Plan – Short-Term Priority Actions***

- New residential projects to achieve the same rainwater management requirements as institutional projects by 2020.
- Institute a residential building benchmarking program for water consumption.
- Develop a water metering strategy (building and suite level) for residential buildings; consider a visualization concept that concurrently educates users.
- Develop building landscape and associated irrigation design standards for upcoming neighbourhoods based on low impact development.
- Develop a strategy that coordinates building landscape rainwater management with rainwater management in the public realm.

- Develop criteria and guidelines for green roof and blue roof projects, based on rainwater management capacity, co-benefits, maintenance and operation considerations for residential building typologies.
- Promote the use of seasonal rainwater features in policy which do not use potable water and consider the life cycle costs for strata owners.

**Targets and Indicators**

Target: Maximize rainwater management using low-impact development on building sites that are more than 300 m from cliffs.
Indicator: Increase infiltration, retention and detention of rainwater in the neighbourhoods

**4. Materials and Resources**

**Component Goals**

1. UBC will prioritize the use of building materials that have net positive environmental impacts.
2. UBC will support marketplace transformation by designing buildings with materials that are not harmful to human and ecological health.
3. UBC will support the development of the circular economy by promoting the adaptation, reuse and recycling of materials and products during a building’s lifetime.

*Context*

UBC has policy in place to reduce the environmental footprint in its material choices, the handling of these materials and the waste products generated during construction and occupancy (REAP). To work towards the materials and resources component area goals, policy will need to be implemented incrementally over the GBAP time frame to update materials credits to current practice and improve over time.

*Pathway to Net Positive*

By shifting material choices based on environmental and health impacts, UBC can continue to reduce the negative environmental and health impacts of the University’s buildings and play a significant role in moving the marketplace towards net positive impacts.

*Key Directions*

The GBAP will require material transparency through environmental product declarations and will prioritize materials with low levels of embodied carbon. The requirements for environmental performance of materials will be incrementally increased over time. The GBAP will develop an approach to identifying building

materials considered harmful to health based on reviews of best practices and a market supply analysis.

**Five-Year Implementation Plan – Short-Term Priority Actions**

- Develop guidelines for building materials considered harmful to health in their use or manufacture, based on best practice review, stakeholder engagement and consideration of market supply.
- Require incremental reductions in environmental impact of building materials, based on pilots, best practice review and market readiness study.
- Implement design service life requirements for new construction projects.
- Create an integrated policy for building materials that considers reduced environmental impact, healthy material requirements and life cycle analysis.

**Targets and Indicators**

Target: Eliminate 100% of UBC-identified building materials in new construction that are known to be detrimental to human and ecological health by 2035.
Target: Require all new buildings to be Zero Waste Ready <sup>17</sup> by 2020.
Target: Divert 100% of construction and demolition waste from landfill by 2035.

**5. Biodiversity**

**Component Goals**

1. UBC will develop highly functioning landscapes at the building and site scales to contribute to biodiversity and natural ecosystem processes.
2. UBC will engage campus teaching and research opportunities to enhance biodiversity management capacity.

**Context**

Biodiversity is the richness of plant and animal species, their ecosystems, and the ecological processes that sustain them. Ecological processes cross scales beyond the boundary of a building site. Enhancing biodiversity by nurturing natural systems provides for a range of ecological services: local and global climate regulation, water supply retention, erosion and sediment control, hazard mitigation, pollination, habitat functions, waste decomposition and treatment, human health and wellbeing, food and renewable non-food products, and cultural benefits. The natural systems of UBC are a

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<sup>19</sup> Buildings fully meet the most recent version of the Recycling Infrastructure Guidelines for UBC Buildings and the UBC Technical Guidelines related to waste and recycling requirements.

critical component of the University's identity and support community health and well-being.

The neighbourhood areas of campus are comprised of both private and public landscape areas. Thoughtful master planning of these landscape areas offers the greatest potential to maintain or re-establish the natural systems that are essential to the health of environments. As owner of the public realm, and planner and regulator of campus neighbourhoods, the University can achieve a systems-based approach to incremental landscape development within the framework of private sector development.

Through REAP and the neighbourhood plans, UBC has set out requirements related to biodiversity. Requirements for drought-tolerant and -adapted landscapes are mandated in REAP. Elements like greenways (connection to larger habitat areas), green edges, tree retention and parks, and bird-friendly design guidelines for buildings are integrated into existing neighbourhood plans.

#### *Pathway to Net Positive*

A net positive approach involves nurturing UBC's natural systems that provide for a range of important ecological services, which are typically undervalued. The Green Building Action Plan supports and is expected to integrate with an emergent Biodiversity Strategy for the campus as a whole. This strategy will identify principles, objectives and metrics that will inform site-specific building and landscape requirements for integration in updates to the GBAP. The strategy will leverage partnerships with Metro Vancouver and City of Vancouver to ensure alignment with their biodiversity strategies.

Natural systems are a critical component of the University's identity and support the place and experience component. The biodiversity that these systems support is part of community health and wellbeing and helps to sustain mental and physical health. The ability of natural systems to help UBC adapt to climate change is an additional co-benefit.

#### *Key Directions*

Priority actions for biodiversity focus on ensuring that major residential project address ecological assets identified in neighbourhood site assessments, developing principles for landscapes and green roofs, and improving bird-friendly design guidelines.

Updated credits in REAP Version 4 and future neighbourhood plans will be based on review of best practices and guidelines, such as the Sustainable Sites Initiative. Specifically, the GBAP will provide guidance for landscapes and green roofs that consider the ability for the planted installations to support regional biodiversity priorities and provide other co-benefits.

#### ***Five-Year Implementation Plan – Short-Term Priority Actions***

- Require all major projects to address a neighbourhood-wide site assessment that identifies important ecological assets, endangered and vulnerable species and environmentally sensitive areas.
- Establish partnerships between research and operations through participation in CBIRD (Campus Biodiversity Initiative: Research and Demonstration) and related Level 1 and 2 SEEDS projects.
- Develop a set of principles for neighbourhood landscapes and green roofs that consider the following: ability to adapt to climate change, ability to attract pollinators, microclimate suitability (sun, shade, etc.), ability to support passive solar strategies (e.g., provide shade, reduce wind), irrigation zones (green/brown areas), and regional biodiversity priorities.
- Further develop UBC Bird Friendly Design Guidelines for Buildings and create a mandatory policy in order to reduce the number of bird collisions with buildings.

**Targets and Indicators**

Note that, based on foundational studies and data gathering identified in the GBAP actions, further targets and indicators will be integrated into future updates of the GBAP.

Target: Require 100% compliance to UBC Bird Friendly Design Guidelines for Buildings for new residential buildings by 2025.
Indicator: Increase opportunities to provide habitat for birds, pollinators and other species.

**6. Health and Wellbeing**

**Component Goals**

1. UBC will enhance the mental, physical and social dimensions of wellbeing by making them integral to building and landscape design decisions.
2. UBC researchers, community stakeholders and building occupants will be engaged in a meaningful and ongoing way to inform building design decisions around health and wellbeing.
3. UBC will become a leader in enhancing wellbeing through the built environment within the context of higher education in Canada.

**Context**

UBC’s neighbourhood environments, both built and natural, play a vital role in the physical, mental and social wellbeing of all students, staff and faculty. Well-designed spaces can work to promote physical activity, enable social connections, improve productivity, learning, and overall health, and foster equity.

### *Pathway to Net Positive*

A system-wide holistic and proactive approach that champions wellbeing is currently in development through UBC Wellbeing. UBC Wellbeing is a collaborative effort that aims to make the University a better place to live, work and learn.

Prioritizing health and wellbeing is foundational to the success of individuals and the overall community at UBC and provides co-benefits to the biodiversity and place and experience components.

### *Key Directions*

The GBAP will coordinate guidance for how building and landscape design can nurture the social dimensions of wellbeing. Wellbeing principles, objectives and metrics, rooted in this strategy, that will inform site-specific building and landscape requirements will be integrated into the GBAP.

### ***Five-Year Implementation Plan – Short-Term Priority Actions***

- Identify metrics for health and wellbeing in residential buildings (e.g., temperature, indoor air quality, daylight levels, acoustic levels, views to exterior, number of indoor plants, etc.).
- Update bicycle storage requirements in policy through stakeholder engagement and recommendations made in the study Making Spaces: Bicycle Storage in Multi-Unit Residential Buildings on the University of British Columbia Campus.<sup>18</sup>
- Update REAP to include health and wellbeing credits.
- Develop amenity spaces that respond to community needs and are flexible and adaptable over time.

### ***Targets and Indicators***

Note that, based on foundational studies and data gathering identified in the GBAP actions, further targets and indicators will be integrated into future updates of the GBAP.

## **7. Quality**

### ***Component Goals***

- |  |
|--|
| 1. UBC buildings and landscapes will be durable, reliable and resilient. |
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<sup>18</sup> Smith, C. Making spaces : Bicycle storage in multi-unit residential buildings on the University of British Columbia Campus. (2017).

### *Context*

Quality is defined as that which makes a building reliable, durable, resilient, comfortable, dependable, and a contributor to the UBC brand.

UBC intends to continue to build innovative neighbourhoods that support a strong sense of community and, through their development, contribute financially in a significant way to the University endowment.

Quality construction for neighbourhood buildings is required through REAP and the neighbourhood plans. REAP mandates sustainability requirements that improve the quality of life for residents, such as the requirement for low-emitting materials on the interior of buildings. The neighbourhood plans have requirements for the exterior appearance and cladding materials of buildings that are aesthetically appropriate and have attributes of increased durability compared to typical multi-unit residential buildings.

### *Key Directions*

UBC will work to ensure new buildings are built to a level of quality that reflects an optimum total cost of ownership for UBC as well as owners and renters of units. UBC intends to improve the branding of REAP and its link to quality building.

UBC supports quality construction in the neighbourhoods to provide superior housing for faculty, staff, students and residents, and this reflects well on the University's reputation.

### ***Five-Year Implementation Plan – Short-Term Priority Actions***

- Create a branding strategy for REAP to increase awareness of UBC's sustainable buildings.
- Work with real estate agents to ensure all buyers are aware of sustainability benefits associated with buildings.

### ***Targets and Indicators***

Note that additional quality targets and indicators will be integrated into future updates of the GBAP.

Target: Achieve 100% compliance with REAP Gold requirements by 2020.
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## **8. Climate Adaptation**

### ***Component Goals***

- |   |
|---|
| 1. UBC buildings and landscapes will have the resilience to respond to both anticipated and unpredictable changes in climate.             |
| 2. UBC will engage with researchers in a meaningful and ongoing way to inform building policy and guidelines around climate adaptability. |

*Context*

Through historic evidence and future modelling we know that temperatures will continue to rise as a result of climate change. For the Lower Mainland, modelling predictions indicate that there will be long-term warming, more extreme weather events, changing precipitation patterns and rising sea levels.<sup>19</sup> These changes mean an increased risk of flooding, damage from storms and overheating during summer highs. Changes to the design, construction and renovation of buildings and landscapes will be required to adapt to these future impacts. Without action, UBC’s livability and economic prosperity goals are at risk.

Climate adaptation could be achieved through a change in approach to different aspects of building design, including: building form and orientation, building envelope, roof design, glazing design, internal layout, interior environment, service infrastructure, exterior spaces and the relationship between indoor and outdoor space. A change at UBC is that building will need to be designed for human comfort in the higher temperatures expected in our region over the building’s lifetime.

*Pathway to Net Positive*

The broader UBC Resiliency Initiative will develop principles, objectives and metrics to guide adaptation in buildings and landscapes and address policies and guidelines that respond to risk across scales—building, neighbourhood, campus and region. UBC will partner with regional partners, including Metro Vancouver and the City of Vancouver, to coordinate strategies.

Climate adaptation actions can provide multiple or synergistic benefits. For example, improved building envelopes can have multiple benefits, including reduced thermal heat transfer, reduced energy costs, reduced GHG emissions and improved thermal comfort. However, this must be balanced with the potential for increased cooling needs in future warmer temperatures resulting from these tight building envelopes.

Adaptation actions intersect with other components, including water and energy. For example, water conservation is a climate adaptation strategy that helps to reduce impacts from hotter, drier weather in future summers. For buildings, design measures such as shading, orientation, glazing and ventilation help to reduce energy demands and provide thermal comfort in hotter, drier summers.

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<sup>19</sup> [Metro Vancouver. Climate Projections for Metro Vancouver \(2016\).](#)

As investments are made in UBC’s buildings, it is imperative that designs, retrofits, operations and maintenance respond to adaptation needs. The cost of no action, both from future retrofit and public safety perspectives, could be much higher than proactively planning infrastructure to be resilient to future climate.

### *Key Directions*

UBC requirements for residential development in REAP will ensure buildings and landscapes adapt to a changing climate by using the most up-to-date climate data to guide building design and retrofits. Priority actions focus on review of best practice for adaptation and identifying and conducting vulnerability assessments of residential infrastructure, including buildings, landscaping and stormwater infrastructure. GBAP actions will be integrated with an emerging campus Resiliency Initiative, when available, which will develop principles, objectives and metrics to guide adaptation in buildings and landscapes. Additional guidance in the water and energy component areas address specific approaches to climate adaptation.

### **Five-Year Implementation Plan – Short-Term Priority Actions**

- Review current research and best practices for climate adaptation strategies in residential buildings.
- Identify climate adaptation research opportunities for buildings and landscapes on local, regional and global scales.
- Conduct vulnerability assessments for neighbourhood buildings and infrastructure.
- Coordinate with the campus-wide Resiliency Initiative for climate adaptation strategies, as they evolve, by implementing policies on a building and landscape scale that respond to key climate change impact areas.
- Implement policies (REAP updates, neighbourhood plans) for climate adaptability in the neighbourhood built environment.

### **Targets and Indicators**

Note that, based on foundational studies and data gathering identified in the GBAP actions, further targets and indicators will be integrated into future updates of the GBAP.

## 9. Place and Experience

### **Component Goals**

1. UBC buildings and landscapes will provide opportunities for collaboration, innovation and community development to reflect the social and environmental sustainability aspirations of the University.
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### *Context*

UBC already has ambitious and successful place-making policy and is looking for improvements and synergies with other themes to carry through to new neighbourhoods. UBC Campus and Community Planning is responsible for long-range and current planning, which includes regulating development that supports the University's strategic directions through planning initiatives and day-to-day activities.

### *Pathway to Net Positive*

Place and experience is a component of the GBAP that specifically promotes architectural and landscape designs that outwardly express social and environmental sustainability aspirations of UBC. This component area is emerging in nature. Examples of strategies might include:

- Celebrating natural systems (e.g., greenway water feature on the east side of Wesbrook Place).
- Using locally appropriate materials (e.g., use of wood at Sail)
- Fostering social connection and cohesion through the design of exterior or interior spaces (e.g., exterior courtyards at Dahlia and Magnolia)
- Building elements that tell a story and learning landscapes
- Exposing building systems creatively

### *Key Directions*

Design has a role to play in telling the sustainability story of the building and landscape and communicating its unique identity. Design can also express human and ecological wellbeing by teaching about the processes or systems within the building or by expressing their presence. Expression can also be more abstract and creative, which communicates sustainability in a less literal manner (e.g., through art installations or playful demonstrations). It is important that buildings and landscapes serve the larger aspiration of producing positive, memorable and personally relevant experiences, especially given the potentially limited time students are in attendance.

### ***Five-Year Implementation Plan – Short-Term Priority Actions***

- Establish GBAP place and experience component goals for buildings and landscapes in coordination with Campus and Community Planning during neighbourhood development (e.g., component goal: the design of the building and landscape expresses elements of UBC's social and/or environmental sustainable design initiatives).

### ***Targets and Indicators***

Note that targets and indicators may be integrated into future updates of the GBAP.

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### Green Building Action Plan Team

- John Madden, *Director, Sustainability and Engineering, Campus & Community Planning*
- Penny Martyn, *Green Building Manager, Sustainability and Engineering, UBC Campus and Community Planning*
- Angelique Pilon, *Director, Urban Innovation Research, UBC Sustainability Initiative (USI)*
- Ralph Wells, *Community Energy Manager, Sustainability and Engineering, Campus and Community Planning*
- Jennifer Whelan, *Green Building Plan Research Assistant, Sustainability and Engineering, Campus and Community Planning*
- Christa Yeung, *Green Building Plan Research Assistant, Sustainability and Engineering, Campus and Community Planning*

### Steering Committee

- Michael White (chair), *Associate Vice President, UBC Campus and Community Planning*
- Helen Burt, *Associate Vice President, UBC Office of the Vice President, Research and Innovation*
- Alan Ehrenholz, *President, Alma Mater Society*
- Ron Holton, *Chief Risk Officer, UBC Risk Management Services*
- Ron Kellet, *Director and Professor, UBC School of Architecture and Landscape Architecture*
- Aubrey Kelly, *President and CEO, UBC Properties Trust*
- Hugh Kerr, *Vice President of Development, Polygon Homes*
- Karyn Magnusson, (former) *Managing Director, UBC Building Operations*
- John Metras, *Managing Director, UBC Infrastructure Development*
- Andrew Parr, *Managing Director, UBC Student Housing and Hospitality Services*
- Pam Ratner, *Vice Provost and Associate Vice President, Enrolment and Academic Facilities, Office of the Provost and Vice-President Academic*
- Adam Rysanek, *Assistant Professor of Environmental Systems, Director of Energy, Technology, and Architecture Lab, School of Architecture and Landscape Architecture*
- Jennifer Sanguinetti, *Director, UBC Project Services*
- Peter Smailes, *Treasurer, UBC Treasury*
- James Tansey, *Associate Professor, UBC Sauder School of Business*
- Kavie Toor, *Senior Director of Facilities, Recreation, and Sport Partnerships, UBC Athletics and Recreation*
- David Woodsen, *Managing Director, UBC Energy and Water Services*

### Technical Advisory Group

- Matt Dolf, *Well-Being Initiative Director, UBC Office of the Vice President, Students*
- Bud Fraser, *Senior Planning and Sustainability Engineer, UBC Sustainability and Engineering*
- Dean Gregory, *Landscape Architect, UBC Campus and Community Planning*
- Scot Hein, (former) *Urban Designer, UBC Planning and Design*
- Orion Henderson, (former) *Director of Energy Planning and Innovation, UBC Energy and Water Services*

## UBC Green Building Action Plan | Acknowledgements

- Julie Pett, *Climate and Energy Engineer, UBC Energy and Water Services*
- John Sacre, *Superintendent Asset Stewardship, UBC Building Operations*
- Craig Shirra, *Development Manager, UBC Properties Trust*
- Mike van der Laan, *Community Planner, Campus and Community Planning*
- Ralph Wells, *Community Energy Manager, Sustainability and Engineering, Campus and Community Planning*

### Peer and Faculty Review Group

- Cynthia Girling, *Professor, UBC School of Architecture and Landscape Architecture*
- Scot Hein, (former) *Urban Designer, UBC Planning and Design*
- Ron Kellet, *Director and Professor, UBC School of Architecture and Landscape Architecture*
- Martin Nielson, *Principal, Dialog*
- Andrew Pape-Salmon, *Executive Director, Building and Safety Standards Branch, Office of Housing and Construction Standards, Ministry of Municipal Affairs and Housing*
- Daniel Roehr, *Assistant Professor, Landscape Architecture, UBC School of Architecture and Landscape Architecture*
- Kathy Wardle, *Director of Research, Associate Principal, Perkins & Will*

### Institutional Workshop Facilitators

- Katie Pease, *Partner, Synapse Strategies*
- Dave Waldron, *Partner, Synapse Strategies*

### Institutional Workshop Participants

- Russel Acton, *Principal, Acton Ostry Architects*
- Catherine Alkenbrack, *Director of Facilities Planning, UBC Infrastructure Development*
- Christina Bollo, *Postdoctoral Fellow, UBC School of Architecture and Landscape Architecture*
- Helen Brennek, *Project Manager, WSP Group*
- Christian Cianfrone, *Principal and Building Energy Practice Lead, Morrison Hershfield*
- Joe Dahmen, *Assistant Professor, UBC School of Architecture and Landscape Architecture*
- Matt Dolf, *Well-Being Initiative Director, UBC Office of the Vice President, Students*
- Doug Doyle, *Associate Director of Municipal Engineering, UBC Sustainability and Engineering*
- Erica Frank, *Professor, UBC School of Population and Public Health*
- Bud Fraser, *Senior Planning and Sustainability Engineer, UBC Sustainability and Engineering*
- Marsha Gentile, *Director of Sustainability, Ledcor Construction*
- Dan Giordano, (former) *Development Manager, UBC Properties Trust*
- Dylan Heerema, *Analyst, Pembina Institute*
- Scot Hein, (former) *Urban Designer, UBC Planning and Design*
- Orion Henderson, *Director of Energy Planning and Innovation, UBC Energy and Water Services*
- Stuart Hood, *Managing Principal, Integral Group*
- Matt Horne, *Climate Policy Manager, City of Vancouver*
- David Kiloh, *Director of Facilities and Building Services, UBC Student Housing and Hospitality Services*
- Marian Lis, *Manager of Special Projects Mechanical, UBC Building Operations*
- Gerry McGeough, *Director, UBC Planning and Design*
- Janet Mee, *Director, UBC Access and Diversity*
- Grant Miller, *Director of Planning, UBC Development Services*
- Thomas Mueller, *President and CEO, Canada Green Building Council*
- Martin Neilsen, *Principal, DIALOG*
- Jeff Nulty, *Municipal Landscape Architect, UBC Building Operations*
- Jennifer O'Connor, *President, Athena Sustainable Materials Institute*

## UBC Green Building Action Plan | Acknowledgements

- Marc Ostry, *Principal, Acton Ostry Architects*
- Abigail Overduin, *Ergonomics Advisor, UBC Human Resources*
- Andrew Pape-Salmon, *Executive Director, UBC Building and Safety Standards*
- Julie Pett, *Climate and Energy Engineer, UBC Energy and Water Services*
- Dave Poettcker, *Development Manager, UBC Properties Trust*
- Dave Ramslie, *Principal, Integral Group*
- Jon Salter, *Postdoctoral Fellow, UBC School of Architecture and Landscape Architecture*
- Jennifer Sanguinetti, *Director, UBC Project Services*
- Joanne Sawatzky, *Director of Green Building Services, Light House*
- Akua Schatz, *Director of Advocacy and Development, Canada Green Building Council*
- Malcolm Shield, *Project Manager, C40 Cities*
- Mike Thayer, *Architect, UBC Building Operations*
- Kavie Toor, *Senior Director of Facilities, Recreation, and Sport Partnerships, UBC Athletics and Recreation*
- Graham Twyford-Miles, *Principal, Stantec*
- Kathy Wardle, *Associate Principal and Director of Research, Perkins & Will*
- Michael White, *Associate Vice President, UBC Campus and Community Planning*
- David Woodson, *Managing Director, UBC Energy and Water Services*
- Jessica Woolliams, *Sustainability and Outreach Lead, BC Government Real Property Division*

### Residential Workshop Facilitators

- Katie Pease, *Partner, Synapse Strategies*
- Dave Waldron, *Partner, Synapse Strategies*

### Residential Workshop Participants

- Kathy Barr, *Director of Property Management, UBC Properties Trust*
- Leanne Bilodeau, *Associate Director of Sustainability Operations, UBC Okanagan Campus*
- Jessica Lea Carson, *Geographic Historical Researcher, Musqueam First Nation*
- Brittany Coughlin, *RDH Building Science*
- Norm Couttie, *President, Adera Development Corporation*
- Joe Dahmen, *Assistant Professor, UBC School of Architecture and Landscape Architecture*
- Matt Dolf, *Well-Being Initiative Director, UBC Office of the Vice President, Students*
- Doug Doyle, *Associate Director of Municipal Engineering, UBC Sustainability and Engineering*
- Bud Fraser, *Senior Planning and Sustainability Engineer, UBC Sustainability and Engineering*
- Andrea Frisque, *Senior Building Performance Engineer, Stantec*
- Dan Giordano, *Development Manager, UBC Properties Trust*
- Troy Glasner, *Principal, E3 Eco Group*
- Dean Gregory, *Landscape Architect, UBC Campus and Community Planning*
- Scot Hein, (former) *Urban Designer, UBC Planning and Design*
- Orion Henderson, (former) *Director of Energy Planning and Innovation, UBC Energy and Water Services*
- Travis Hickford-Kulak, *Director of Energy Services, Corix*
- Scott Kennedy, *Principal, Cornerstone Architecture*
- Hugh Ker, *Vice President of Development, Polygon Homes*
- David Kiloh, *Director of Facilities and Building Services, UBC Student Housing and Hospitality Services*
- Micah Lang, *Senior Green Building Planner, City of Vancouver Planning, Urban Design, and Sustainability*
- Oliver Lang, *Principal and Creative Director, Lang Wilson Practice in Architecture Culture*
- Wilma Leung, *Senior Manager, BC Housing Technical Research and Education*

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- Brendan McEwen, *Sustainability Manager, City of Richmond*
- Grant Miller, *Director of Planning, UBC Development Services*
- Jeff Nulty, *Municipal Landscape Architect, UBC Building Operations*
- Jennifer O'Connor, *President, Athena Sustainable Materials Institute*
- Andrew Pape-Salmon, *Executive Director, BC Building and Safety Standards*
- Megan Pohanka, *Director of Market Development, UBC Properties Trust*
- Jon Salter, *Postdoctoral Fellow, UBC School of Architecture and Landscape Architecture*
- Joanne Sawatzky, *Director of Green Building Services, Light House*
- Wegland Sit, (former) *Sustainability Manager, University Neighbourhoods Association*
- Michael White, *Associate Vice President, UBC Campus and Community Planning*
- Sophia Xian, *Manger, Housing Programs, Housing and Relocation Services*
- Paul Young, *Director of Planning and Design, UBC Properties Trust*

### **Process Institutional Focus Group**

- Barbara Gordon, *Senior Planner, UBC Infrastructure Development*
- Jennifer Sanguinetti, *Director, UBC Project Services*
- Kathy Wardle, *Associate Principal and Director of Research, Perkins & Will*

### **Energy Institutional Focus Groups**

- Blair Antcliffe, *Energy Engineer, UBC Energy and Water Services*
- Jamee DeSimone, *Climate Action Planner, UBC Sustainability and Engineering*
- Bud Fraser, *Senior Planning and Sustainability Engineer, UBC Sustainability and Engineering*
- Jeff Giffin, *Energy Conservation Manager, UBC Energy and Water Services*
- Orion Henderson, *Director of Energy Planning and Innovation, UBC Energy and Water Services*
- David Kiloh, *Director of Facilities and Building Services, UBC Student Housing and Hospitality Services*
- Marian Lis, *Manager of Special Projects Mechanical, UBC Building Operations*
- Julie Pett, *Climate and Energy Engineer, UBC Energy and Water Services*
- David Poettcker, *Development Manager, UBC Properties Trust*
- Andrew Porritt, *Senior Engineer, Technical Services, UBC [Building Operations](#)*
- Vladan Prodanovic, *Senior Instructor, Department of Chemical and Biological Engineering*
- John Sacre, *Superintendent Asset Stewardship, UBC Building Operations*
- Jennifer Sanguinetti, *Director, UBC Project Services*
- Joshua Wauthy, *Energy Conservation Engineer, UBC Energy and Water Services*
- Jason White, *Mechanical Technical Specialist, UBC Building Operations*

### **Energy Residential Focus Groups**

- Norm Connolly, *Community Energy Manager, City of New Westminster*
- Jamee DeSimone, *Climate Action Planner, UBC Sustainability and Engineering*
- Graham Finch, *Principal, RDH*
- Gary Hamer, *Residential Specialist Engineer, Conservation and Energy Management, BC Hydro*
- Orion Henderson, *Director of Energy Planning and Innovation, UBC Energy and Water Services*
- Chris Higgins, *Green Building Planner, City of Vancouver*
- Wilma Leung, *Senior Manager, BC Housing Technical Research and Education*
- Julie Pett, *Climate and Energy Engineer, UBC Energy and Water Services*
- Vladan Prodanovic, *Senior Instructor, Department of Chemical and Biological Engineering*
- Jon Salter, *Postdoctoral Fellow, UBC School of Architecture and Landscape Architecture*
- Wegland Sit, *Sustainability Manager, University Neighbourhoods Association*
- Paul Young, *Director of Planning and Design, UBC Properties Trust*

**Water Use Institutional Focus Group**

- Bud Fraser, *Senior Planning and Sustainability Engineer, UBC Sustainability and Engineering*
- Cynthia Girling, *Professor, UBC School of Architecture and Landscape Architecture*
- Barbara Gordon, *Senior Planner, UBC Infrastructure Development*
- Hannah Land, *Green Labs Energy and Water Programs Coordinator, UBC Sustainability and Engineering*
- Jennifer Lippa, *Senior Facilities Planner, UBC Infrastructure Development*
- Julie Pett, *Climate and Energy Engineer, UBC Energy and Water Services*
- Ryan Zeils, *Assistant Professor, UBC Department of Civil Engineering*

**Stormwater Institutional and Residential Focus Group**

- Sahar Badiie, *Graduate Student, UBC School of Architecture and Landscape Architecture*
- Steven Conrad, *Adjunct Professor, UBC Institute for Resources, Environment and Sustainability*
- Doug Doyle, *Associate Director of Municipal Engineering, UBC Sustainability and Engineering*
- Dean Gregory, *Landscape Architect, UBC Campus and Community Planning*
- Loretta Li, *Professor, UBC Department of Civil Engineering*
- Gunilla Oberg, *Professor, UBC Institute for Resources, Environment and Sustainability*
- Aleksander Paderwski, *Manager of Mechanical Utilities, UBC Energy and Water Services*

**Materials Institutional Focus Group**

- Joe Dahmen, *Assistant Professor, UBC School of Architecture and Landscape Architecture*
- Matt Dolf, *Well-Being Initiative Director, UBC Office of the Vice President, Students*
- Bud Fraser, *Senior Planning and Sustainability Engineer, UBC Sustainability and Engineering*
- Jay Hiscox, *Senior Project Manager, UBC Project Services*
- Zahra Teshnizi, *Research Project Coordinator, UBC USI*
- Bi Xiaotao, *Professor, UBC Chemical and Biological Engineering*
- Ivana Zelenika, *Postdoctoral Fellow, UBC Institute for Resources, Environment and Sustainability*

**Materials Residential Focus Group**

- Jeremy Field, *Project Manager, E3 Eco Group*
- Siobhan Finan, *Student, Resource Management*
- Bud Fraser, *Senior Planning and Sustainability Engineer, UBC Sustainability and Engineering*
- Adam Rysanek, *Professor, UBC School of Architecture and Landscape Architecture*
- Blair Satterfield, *Professor, UBC School of Architecture and Landscape Architecture*
- Zahra Teshnizi, *Research Project Coordinator, UBC USI*
- Ivana Zelenika, *Postdoctoral Fellow, UBC Institute for Resources, Environment and Sustainability*

**Biodiversity Institutional and Residential Focus Group**

- Peter Arcese, *Professor, UBC Forest and Conservation Sciences*
- Cynthia Girling, *Professor, UBC School of Architecture and Landscape Architecture*
- Dean Gregory, *Landscape Architect, UBC Campus and Community Planning*
- Jeffrey Nulty, *Municipal Landscape Architect, UBC Building Operations*
- Liska Richer, *SEEDS Manager, UBC Community Development*

**Health and Wellbeing Institutional and Residential Focus Group**

- Matt Dolf, *Well-Being Initiative Director, UBC Office of the Vice President, Students*

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- Abigail Overduin, *Ergonomics Advisor, UBC Human Resources*
- Liska Richer, *SEEDS Manager, UBC Community Development*

### ***Place and Experience Institutional and Residential Focus Group***

- Scot Hein, (former) *Urban Designer, UBC Planning and Design*
- Gerry McGeough, *Director, UBC Planning and Design*

**Graphics and Design** by Ion Brand Design and Paula Martinez Rubio

**Photos** provided by UBC Campus and Community Planning and Philip Bertogg

## Glossary

- **circular economy:** An industrial system that is restorative and regenerative by design as opposed to the traditional linear economic model (to make, use, and dispose). A circular economy model aims to extend the lifespan of products, components and materials through innovative design, reuse, refurbishment, adaptation and recycling to ultimately minimize disposal.
- **community energy and emissions plan (CEEP):** A document prepared by a local government and/or community that outlines: (a) the jurisdiction's historical energy sources, energy demand and resulting emissions (often referred to as an energy profile); (b) the jurisdiction's future energy and emissions targets; (c) the jurisdiction's strategy for meeting energy and emissions targets. In the UBC context, the CEEP applies to the areas within the University Neighbourhoods Association (UNA) community.
- **district energy:** District energy systems produce steam, hot water or chilled water at a central plant and distribute it to buildings to provide space and water heating and/or cooling.
- **greenhouse gas (GHG) emissions:** Gases emitted from fuel combustion and other sources that contribute to the greenhouse effect and global warming. These include carbon dioxide, methane, nitrous oxide, ozone and chlorofluorocarbons.
- **low-impact development (LID):** Systems and practices that use or mimic natural processes that result in the infiltration, evapotranspiration or use of stormwater in order to protect water quality and associated aquatic habitat.
- **net positive:** A mode of development that gives more back to human and ecological systems than it takes. This approach focuses on generating mutual benefits to humans and the environment as opposed to only attaining net zero negative impacts. See also *regenerative sustainability*.
- **net zero:** A state in which balance is achieved between carbon-emitting activities and actions that reduce or offset emissions from those activities, so that net annual emissions are equal to zero.
- **regenerative sustainability:** Refers to a systems-based approach and practice that produces net positive contributions to human and natural systems. The principles of regenerative sustainability guide the vision of the Green Building Action Plan and the development of buildings at UBC. See also *net positive*.
- **resilience:** The ability for systems, buildings, landscapes and people to anticipate, adapt and recover from the effects of climate change.
- **water use intensity:** The amount of water used per unit of population, currently indicated by full-time equivalent.

# Appendix B



a place of mind

THE UNIVERSITY OF BRITISH COLUMBIA

# RESIDENTIAL ENVIRONMENTAL ASSESSMENT PROGRAM (REAP 3.1)

*Make UBC a living laboratory in environmental and social sustainability by integrating research, learning, operations, and industrial and community partners.*

**UBC Place and Promise - Goal**

*Create a vibrant and sustainable community of faculty, staff, students and residents.*

**UBC Place and Promise - Goal**

*As part of its responsibility as an educational and research institution and as a signatory to both the Halifax Declaration and the Talloires Declaration by the University Presidents for a Sustainable Future, UBC provides leadership by demonstrating the means to a sustainable community on campus.*

**UBC Policy #5 – Sustainable Development**

*UBC's goal is "to utilize its land resource to support academic activities and to build an endowment through the development of an integrated community in an environmentally sound fashion, consistent with regional objectives."*

**UBC Land Use Plan**

*This vision is about a university community, and adjacent park, that strives to balance ecological health, economic viability, and community. These components are all equally valued and, through careful planning, will lead to a community that will serve as a model for living, working and learning in harmony.*

**UBC Land Use Plan – Vision**

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## PART 1: LAND USE RULES

### 1.0 Preamble

The UBC Residential Environmental Assessment Program (REAP) is a framework for mandating and measuring sustainable building practices for market-based and staff/faculty/student residential developments located in Neighbourhood Housing Areas at UBC's Vancouver campus. Developed by UBC, REAP is integrated into the community planning and development approval process, and plays a key role in the build out of UBC's Neighbourhood Housing Areas. REAP is similar in structure to other green building rating systems such as LEED®, but is uniquely designed for application to multi-family residential buildings built in UBC's Neighbourhood Housing Areas.

In addition to the general objectives set out above, the objective for establishing REAP is to ensure that multi-family residential projects built in UBC's Neighbourhood Housing Areas are of higher quality and have lower environmental impacts than standard construction in BC's Lower Mainland region, with the goal to benefit both individual consumers and the UBC community as a whole.

### 1.1 Definitions

In this Land Use Rule:

- (a) "**Director of Planning**" means the person employed by Campus & Community Planning who is responsible for overall administration of the development and review process for development in UBC's Neighbourhood Development Lands (as at the adoption of this Land Use Rule, the Director of Planning and Development Services (Vancouver));
- (b) "**Director of Sustainability**" means the person employed by Campus & Community Planning who is responsible for overseeing sustainability initiatives and engineering planning functions for developments in UBC's Neighbourhood Development Lands (as at the adoption of this Land Use Rule, the Director of Sustainability and Engineering);
- (c) "**REAP Checklist**" means the checklist set out in Part 2 of this document;
- (d) "**Reference Guide**" means the details of the credits available pursuant to REAP, as set out in Part 3 of this document;
- (e) "**Campus & Community Planning**" means the department of UBC, as at the adoption of this Land Use Rule named Campus and Community Planning that is responsible for long-range planning, land use regulations, campus and landscape design, licensing and permits, and managing programs that cover sustainability initiatives to transportation and community-building activities; and
- (f) "~~Campus Sustainability~~**Sustainability and Engineering, Campus & Community Planning**" is the unit within Campus & Community Planning that coordinates the University's operational sustainability initiatives.

## 1.2 Regulations

- (a) The requirements set out herein are integrated with the permitting processes administered by Campus & Community Planning pursuant to the Development Handbook (which is another Land Use Rule). If there is a conflict between this Land Use Rule and the Development Handbook, the Development Handbook governs.
- (b) All persons developing multi-family residential projects in any of UBC's Neighbourhood Housing Areas must:
  - (i) participate in REAP by submitting the statements and checklists and other information described in Section 1.3 (Procedures), at the times and in the matter described therein; and
  - (ii) achieve at least a **REAP Gold Certification**, which means achieving all of the mandatory credits and earning at least the number of points set out in Part 2 of this document, the REAP Performance Levels and Checklist, and obtaining certification of same by Campus Sustainability Sustainability and Engineering, Campus & Community Planning.
- (c) The REAP Performance Levels and Checklist and the Reference Guide do not form a part of the REAP Land Use Rule. The Vice-President Finance, Resources and Operations may, in consultation with the Director of Planning, Director of Sustainability and UBC Properties Trust, amend (in whole or in part) the REAP Performance Levels and Checklist and the Reference Guide. Such amendments must be reported to the Land Use Committee at its next regular meeting.
- (d) Section 1.3 (Procedures) sets out the person or unit of the University to whom REAP submissions are to be made. That person or unit shall review each submission and may:
  - (i) seek additional information and clarifications from the project architect (or other responsible party); and
  - (ii) provide to the applicant interpretations of the requirements contained in any performance category.
- (e) The Director of Planning (or his/her designate), may:
  - (i) grant a waiver or variance, or accept an equivalency; and
  - (ii) publish on the Campus and Community Planning website, standardized interpretations of the requirements contained in any performance category.
- (f) The Director of Planning may permit a project to seek certification pursuant to an alternative green building rating system (e.g. LEED®), provided that:
  - (i) the Director of Planning must identify a minimum certification to be achieved by the project pursuant to that alternative rating system and once established, such minimum certification shall be binding upon the applicant; and
  - (ii) section 1.3 (Procedures) shall continue to apply, as adapted for the approved alternative rating system by the Director of Planning (or his/her designate).
- (g) If this Land Use Rule, the REAP Performance Levels and Checklist, and/or the Reference Guide including any interpretations published pursuant to section 1.2(e)(ii) are amended after an applicant has submitted a development permit in accordance with the Development Handbook and this Land Use Rule, the amendments do not apply to the project unless the applicant agrees that the amendments do apply.

- (h) If an applicant is not satisfied with a decision made pursuant to this Land Use Rule, the applicant may appeal the decision to the Associate Vice President, Campus & Community Planning, who will issue a final decision on the matter.

### 1.3 Procedures

~~Summary~~ As detailed below, during the course of ~~planning and construction, and the permitting processes required throughout, the project architect (or other responsible party) will be responsible for reviewing and monitoring REAP application and reporting to project development,~~ a series of project REAP submissions are required to be made to Campus & Community Planning. ~~After review and approval of submissions at each stage detailed below, UBC will certify the REAP level attained.~~ REAP documentation submission requirements are integrated into the permitting process administered by Campus & Community Planning pursuant to the Development Handbook.

REAP ~~submission requirements are as follows:~~ certification involves 5 stages:

1. REAP submission with Pparcel tender documents -with a Sustainability Statement describing the development and a statement describing of how REAP credits will be applied.
2. REAP submission with Development Permit Application -identifying the REAP Checklist credits to be attempted and including payment of REAP application fee at the time when a Development Permit application is made to Campus and Community Planning.
3. REAP submission with Building Permit Application -including an updated REAP Checklist of credits with all necessary documentation, and an updated Ssustainability Sstatement.
4. REAP submission with Occupancy Permit Application including an updated REAP Checklist of credits with all necessary documentation, and an updated sustainability statement.
- 1-5. Certification will be issued when all requirements have been met, as detailed below.

- (a) **REAP submission with parcel tender documents:** Developers are required to submit a "Sustainability Statement" with parcel tender documents that: ~~describes how their development; explaining how the development will be designed to achieve high environmental standards; and the ways in which they propose to apply REAP and earn credits in the six performance categories.~~

**Submission:** Sustainability Statement  
**Format:** Electronic format  
**Submit to:** Campus & Community Planning

- (b) **REAP Submission with Development Permit Application:** The ~~project~~ architect (or other responsible party) is required to submit: a REAP Checklist verifying ~~their~~ compliance with the ~~program~~ REAP rating system and identifying the REAP credits they will attempt in their development, ~~at the time when a Development Permit application is made to Campus & Community Planning.~~ The REAP Checklist must identify that the development will ~~attempt to achieve at least target a minimum of~~ REAP Gold. ~~This checklist will be reviewed by Campus Sustainability for comment to Campus & Community Planning and will be included in the package submitted to the Development Permit Board.~~

**Submission:** REAP Checklist  
**Format:** Electronic format (REAP Checklist-Excel spreadsheet)  
**Submit to:** Campus & Community Planning

- (c) **REAP Submission with Building Permit Applications:** The ~~project~~ architect (or other responsible party) is required to submit an updated REAP Checklist and all the required Building Permit documentation as well

~~as including~~ an updated Sustainability Statement at the time that a Building Permit application is made to Campus & Community Planning. These submissions will provide the documentation necessary for ~~Campus Sustainability~~Sustainability and Engineering, Campus & Community Planning to verify compliance with the mandatory and optional credits that have been incorporated into the project, and to verify that, at minimum, REAP Gold will be achieved. The REAP BP Checklist and documentation can be submitted a maximum of 3 times.

**Submission:** updated REAP Checklist, all documentation identified throughout this document as “Documentation: Submit at the Building Permit Phase”, updated Sustainability Statement

**Format:** Electronic format (REAP Checklist-Excel spreadsheet; documentation with separate folders for each credit).

**Submit to:** ~~Campus Sustainability and Engineering, Campus & Community Planning~~

**Review Time:** 15 business days after document completion check

Campus Sustainability

~~(c)~~(d) **REAP Submission with Occupancy Permit Applications:** The ~~project~~ architect (or other responsible party) is required to submit an updated REAP Checklist and all the required Occupancy Permit documentation as well as an updated Sustainability Statement at the time ~~of that~~ Occupancy Permit applications are made to Campus & Community Planning. If an Occupational Permit application contains a substantive amount of information yet portions of the credit documentation are not available by the time of Occupancy Permit application submission, then a written statement must be submitted with such Occupational Permit application that identifies: (a) the missing documentation; (b) the reasons for the delay; and (c) the expected timeline for receipt and submission of such unavailable documentation. -These submissions will provide the documentation necessary for ~~Campus Sustainability~~Sustainability and Engineering, Campus & Community Planning to verify compliance with the mandatory and optional credits that have been incorporated into the project, and to verify that, at minimum, REAP Gold will be achieved. The REAP Occupancy Permit Checklist and documentation can be submitted a maximum of three times.

**Submission:** updated REAP Checklist, all documentation identified as “Documentation: Submit at the Occupancy Permit Phase”, updated Sustainability Statement

**Format:** Electronic format (REAP Checklist-Excel spreadsheet; documentation with separate folders for each credit).

**Submit to:** ~~Campus Sustainability and Engineering, Campus & Community Planning~~

**Review Time:** 15 business days after document completion check~~Campus Sustainability~~

~~(d)~~(e) **REAP Certification:** Documentation submissions will be reviewed and verified by ~~Campus~~SustainabilitySustainability and Engineering, Campus & Community Planning. Final certification will be awarded when the project is complete, all documentation is complete, and occupancy is granted.

## PERFORMANCE LEVELS

REAP assesses the performance of building projects based on the number of points that are earned by meeting the requirements of credits distributed across seven performance categories. There are four levels of performance that can be achieved, with REAP Gold being the minimum standard.

Building projects need to achieve **all** of the mandatory credits and earn at least 45 points from the optional credits, including the required EA GOLD performance requirements, in order to achieve a REAP Gold certification. In order to receive points for a credit, the stated requirement must be reached. A prorated number of points will not be awarded for partial compliance.

Developers have the discretion to choose which optional credits to incorporate into their designs. Higher REAP ratings may help developers to be more attractive to prospective buyers by differentiating their product in the marketplace.

The REAP Performance Levels are:

Gold	45 points
Gold Plus	61 points
Platinum	76 points
Platinum Plus	101 points

## UBC REAP 3.10 CHECKLIST SUMMARY

<b>MANDATORY CREDITS</b>	Max
Sustainable Sites (SS M)	M
Water Efficiency (WE M)	M
Energy & Atmosphere (EA M)	M
Indoor Environmental Quality (IEQ M)	M
Construction (CON M)	M
Innovation and Design Process (ID M)	M

<b>OPTIONAL CREDITS</b>	Max
Sustainable Sites (SS)	10
Water Efficiency (WE)	18
Energy & Atmosphere (EA)	52
Materials & Resources (MR)	18
Indoor Environmental Quality (IEQ)	8
Construction (CON)	4
Innovation and Design Process (ID)	24
<b>TOTAL</b>	<b>134</b>

<b>REAP RATING:</b>	
Gold	45 – 60 points
Gold Plus	61 – 75 points
Platinum	76 – 100 points
Platinum Plus	101 – 134 points

## UBC REAP 3.10 CHECKLIST

Performance Category: Sustainable Sites (SS)			
The intention of the Sustainable Sites category is to reduce the negative impacts of development, maintain the natural landscape, vegetation and environmental attributes of the site and provide new landscaping that enhances the microclimate.			
<b>SS MANDATORY</b>	<u>Points</u>	<u>Mandatory / Optional</u>	<u>Submission</u>
<b>SS M1 – StormWater Management</b>		M	BP
<p><u>Require all new construction projects detain the 10-year, 24-hour storm volume and discharge at the 2-year, 40-hour pre-development rate on site or at a designated centralized facility using low-impact development and green infrastructure strategies. Develop a plan that integrates the on-site storm water management system with the neighbourhood wide storm water management principles and strategies, including controlling of rate and/or quantity of run-off as required.</u></p>			
<b>SS M2 – Adapted and Ecologically Sound Planting</b>		M	BP
<p>Demonstrate that landscape design has minimized the need for pesticides and irrigation through the selection of adaptive and drought-tolerant plants and consideration of the principles of Integrated Pest Management and xeriscaping.</p>			
<b>SS M3 – Bicycle Parking</b>		M	BP
<p>Provide <u>covered bicycle storage facilities including 1.5 parking spaces per dwelling unit or individual parking garages for Class I use, and one 16-stall bike rack per 35 dwelling units</u> 0.5 bicycle parking spaces per dwelling unit for Class II use in accordance with <u>The UBC Development Handbook</u>. Provide short term and long term covered storage facilities for securing bicycles in accordance with the <u>UBC Development Handbook</u>.</p>			
<b>SS M4 – Contribution to Community Car Sharing</b>		M	OP
<p>Contribute to the development of a community car-sharing network by funding the equivalent of one community vehicle per 100 residential units.</p>			

	<u>Points</u>	<u>Mandatory / Optional</u>	<u>Submission</u>	
<b><u>SS M5 Electric Vehicle Charging- Resident</u></b>	<u>2</u>	<u>M</u>	<u>BP</u>	
<u>Provide a minimum of one energized level 2 outlet per residential unit for non-rental developments or provide energized outlets for 50% of resident parking stalls for rental developments. Level 2 charging capacity that provides a minimum of 40A service and a minimum performance level of 12 kWh per stall, over an eight (8) hour period must be provided. Load sharing (up to four-way) and load management systems may be utilized. Exceptions may be granted in cases where utility mandated transformer upgrades are required.</u>				
<b><u>SS-M5-M6 – Light Pollution Reduction</u></b>		M	BP	
Do not exceed <u>the current</u> Illuminating Engineering Society of <del>North America</del> (IESNA) illuminance requirements as stated in <u>the Recommended Practice Manual: Lighting for Exterior Environments</u> .				
<b><u>SS M6M7 –Recycling Collection</u></b>		M	BP	OP
Provide for collection of domestic paper, plastic, glass and metal recyclables by contracting with a waste management company for the service. Recycling storage space shall be designed in accordance with Metro Vancouver's <i>Technical Specifications for Recycling Amenities</i> .				
<b><u>SS M8M7 – Compost Collection</u></b>		M	BP	OP
Provide a space in the building for the collection compost and provide for the compost collection through a contract with UBC Waste Management or another waste management service provider. Design the space in the building in accordance with Metro Vancouver's <i>Technical Specifications for Recycling Amenities</i> .				
<b>SS 1 – RECYCLING AND COMPOSTING</b>				
<b>SS 1.1 – In-Suite Recycling and Compost Separation</b>	2	O	BP	
Provide a space <i>and</i> system for simplified separation and collection of recycling and compostables in each suite or unit.				

	<u>Points</u>	<u>Mandatory / Optional</u>	<u>Submission</u>	
<b>SS 2 – ALTERNATIVE TRANSPORTATION</b>				
<b>SS 2.1 – Additional Bicycle Facilities</b>	<b>2</b>	<b>0</b>	<b>BP</b>	
In addition to the requirements for bicycle parking in the UBC Development Handbook, provide an additional 0.25 Class I bicycle parking per bedroom and an in-building bicycle repair station complete with a 120V electrical outlet.				
<b>SS 2.2 – Electric Vehicle Charging – Visitor</b>	<b>2</b>	<b>0</b>		
Provide one dedicated parking spot per 100 residential units for visitors of residents/owners, fully equipped with Level 2 charging station.				
<b>SS 2.3– Electric Vehicle Charging <u>Stations</u> - Resident</b>	<b><u>42</u></b>	<b>0</b>	<b>BP</b>	
<del>Install</del> <u>Install necessary conduit and transformer capacity to accommodate</u> Level 2 charging stations for the following percentage of owners'/residents' parking.				
<input type="checkbox"/> <del>10</del> 5% of owners'/residents' parking – <u>21</u> Points				
<input type="checkbox"/> <del>20</del> 10% of owners'/residents' parking – <u>21</u> Points				

Performance Category: Water Efficiency (WE)			
The intention of the Water Efficiency category is to encourage strategies that reduce the amount of potable water used for landscape irrigation and building operations.			
<b>WE MANDATORY</b>	<u>Points</u>	<u>Mandatory / Optional</u>	<u>Submission</u>
<b>WE M1-- Efficient Irrigation Technology</b>		M	BP
Design and install a water-efficient irrigation system that includes an automated controller, rain or soil sensors and pressure regulator and for non-grass areas use a micro- or drip-feed irrigation system <b>or</b> install a temporary irrigation system.			
<b>WE M2-- Low Flush Toilets</b>		M	BP
Specify and install high efficiency 4.8 L per flush (1.28 gal) single flush toilets or 3.4/6 L per flush (0.9gal/1.6gal) dual flush toilets for all water closets.			
<b>WE M23 - Low-Flow Faucet Aerators</b>		M	BP
Specify and install low-flow faucets with aerators in all bathroom sinks (max. 3.8 L per minute) and in all kitchen sinks (max. 6.8 L per minute).			
<b>WE M34 - Low-Flow Showerheads</b>		M	BP
Specify and install water-saving showerheads with a maximum flow rate of 8.5 L per minute in each shower.			
<b>WE M45 - Energy Star Clothes Washers and Dishwashers</b>		M	OP
Specify and install Energy Star-labelled <del>dishwashers and clothes washers</del> in each unit, or specify and offer only Energy Star models if these appliances are optional.			
<b>WE 1 - WATER EFFICIENT LANDSCAPING</b>			
<b>WE 1.1 - Reduce Potable Water Use</b>	3	O	BP
Reduce potable water use for site irrigation needs by 50% from the calculated mid-summer baseline.			
<b>WE 1.2 - Eliminate Potable Water Use</b>	3	O	BP
Eliminate potable water use for site irrigation needs.			
<b>WE 2 - WATER USE REDUCTION</b>			
<b>WE 2.1 - Low-Flow Showerheads</b>	2	O	BP
Specify and install water-saving showerheads (maximum of 5.7 L per minute) in each shower			

	<u>Points</u>	<u>Mandatory / Optional</u>	<u>Submission</u>	
<b>WE 2.2 – Water Efficient Dishwashers</b>	1	0		OP
Specify and install water-efficient dishwashers that use ≤ 11 L (2.91 gal) per normal wash cycle or if dishwashers are available only as an option, specify and offer only models complying with this credit.				
<b>WE 2.3 – Most Efficient Clothes Washers</b>	2	0		OP
Specify and install Energy Star clothes washers listed as “Most Efficient” <u>(for the year in which the Building Permit is received)for current year</u> , or if washers are available only as an option, specify and offer only models complying to this standard.				
<b>WE 2.4 - Water Use Reduction Package</b>	2	0		OP
Additional credit for achieving credits: WE 1.1, WE 2.1, WE 2.2 and WE 2.3.				
<b>WE 3 – WATER METERING</b>				
<b>WE 3.1 – Domestic Hot Water Metering</b>	3	0	BP	
In units with central hot water, provide individual domestic hot water metering.				
<b>WE 3.2 – Domestic Cold Water Metering</b>	2	0	BP	
Provide individual cold water meters for all units.				

Performance Category: Energy & Atmosphere (EA)			
The intention of the Energy and Atmosphere category is to reduce depletion of non-renewable energy resources and to reduce environmental impacts of energy use, particularly emissions of local, regional and global air pollutants.			
EA MANDATORY	<b>Points</b>	<b>Mandatory / Optional</b>	<b>Submission</b>
		M	BP
<p><b>EA M1 – Minimum Roof Insulation</b></p> <p>Design the roof assembly with a minimum insulation value of R-40 h·ft<sup>2</sup>·°F/Btu (7.04 °K·m<sup>2</sup>/W) for buildings with attic space and R-28 h·ft<sup>2</sup>·°F/Btu (4.93 °K·m<sup>2</sup>/W) for cathedral ceilings/flat roofs.</p>			
<p><b>EA M2 – Minimum Exterior Wall Insulation</b></p> <p>Design the exterior insulated wall area with a minimum thermal resistance of <i>effective (overall)</i> R-15.6 h·ft<sup>2</sup>·°F/Btu (2.75 °K·m<sup>2</sup>/W) for above grade non-glazed wall areas, and R-7.5 h·ft<sup>2</sup>·°F/Btu (1.32 °K·m<sup>2</sup>/W) "continuous insulation" for below grade walls.</p>			
<p><b>EA M3 – Minimum Floor Insulation</b></p> <p>Design floors above non-heated parkade areas with a minimum insulation value of R-30 h·ft<sup>2</sup>·°F/Btu (5.28 °K·m<sup>2</sup>/W) for framed floors and R-15.6 h·ft<sup>2</sup>·°F/Btu (2.75 °K·m<sup>2</sup>/W) for slab floors.</p>			
<p><b>EA M4 – Energy Efficient Windows</b></p> <p>Specify and install Energy Star-rated windows or windows with a maximum overall U-value of 0.35 Btu/hr-ft<sup>2</sup>·°F (2.0 W/m<sup>2</sup>·°K for non-metal framed windows <i>or</i> a maximum overall U-value of 0.45 Btu/hr-ft<sup>2</sup>·°F (2.55 W/m<sup>2</sup>·°K) for metal framed windows.</p>			
<p><b>EA M5– Minimum Boiler Efficiency</b></p> <p>Specify and install boilers with a minimum thermal efficiency of 84% /AFUE of minimum 90% <i>or heat using District Energy</i></p>			
<p><b>EA M6 – Domestic Hot Water</b></p> <p>Specify and install gas DHW boilers with a minimum efficiency of 84% (mid-efficiency boiler)<i>or heat domestic hot water using District Energy.</i></p>			
<p><b>EA M7 – Energy Star Dishwashers and Refrigerators</b></p> <p>Specify and install Energy Star-labelled dishwashers and refrigerators in each unit.</p>			OP

	<u>Points</u>	<u>Mandatory / Optional</u>	<u>Submission</u>	
<b>EA M8 – Programmable Thermostats</b>		M	BP	
Specify and install programmable thermostats for at least the largest heating zone in each unit.				
<b>EA M9 –Common Area Lighting</b>		M	BP	
Specify and install only non-incandescent lighting, such as fluorescent, compact fluorescent or LED in common areas.				
<b>EA M10 –Parkade and Corridor Lighting Controls</b>		M	BP	
Specify and install parkade and corridor lighting controls to automatically reduce the overall lighting level by at least 30% in a lighting zone when the zone is unoccupied.				
<b>EA <u>M11</u> –Energy Modeling Workshop</b>	<u>2</u>	<u>M</u>	BP	
Model the energy performance of the building and hold a workshop with the design team, a representative from <del>Campus sustainability</del> <u>Sustainability and Engineering, Campus &amp; Community Planning</u> and contractor to evaluate the results and optimize the design of the building.				
<b><u>EA M12 –Commissioning</u></b>	<u>4</u>	<u>M</u>	<u>BP</u>	<u>OP</u>
<u>Contract a third party Commissioning Authority to develop and implement a commissioning plan for all major building energy systems and verify they are installed, calibrated and perform according to design intent.</u>				

	<u>Points</u>	<u>Mandatory / Optional</u>	<u>Submission</u>	
<b>EA – ENERGY EFFICIENCY TARGETS</b>				
<b><u>Building Envelop Airtightness Testing</u></b>	<u>2</u>	<u>M</u>	<u>BP</u>	<u>OP</u>
<u>An airtightness test meeting ASTM E779 or USACE Version 3 standard, as required by the Energy Step Code. This credit is mandatory.</u>				
<b><u>Energy Step Code Step 2</u></b>	<u>6</u>	<u>M</u>	<u>BP</u>	<u>OP</u>
<u>130 kWh/m2-yr (TEUI) and 45 kWh/ m2-yr (TEDI). This credit is mandatory.</u>				
<b><u>Energy Step Code Step 3</u></b>	<u>8</u>	<u>O</u>	<u>BP</u>	<u>OP</u>
<u>120 kWh/m2-yr (TEUI) and 30 kWh/ m2-yr (TEDI). This credit is optional.</u>				
<b><u>Energy Step Code Step 4</u></b>	<u>15</u>	<u>O</u>	<u>BP</u>	<u>OP</u>
<u>100 kWh/m2-yr (TEUI) and 15 kWh/ m2-yr (TEDI). This credit is optional.</u>				
<b><u>Passive House Energy Performance</u></b>	<u>5</u>	<u>O</u>	<u>BP</u>	<u>OP</u>
<u>Design and construct the building to conform to the Passive House Planning Package, version 9 or newer, meeting the requirements of Section 10.2.3.3 (3) of the Energy Step Code Regulation. This credit is optional.</u>				
<b><u>EA Gold Mandatory</u></b>	<u>6</u>	<u>M</u>	<u>BP</u>	<u>OP</u>
<u>Design the building to meet a maximum EUI of 160 kwh/m2/yr, demonstrated using the UBC Energy Modeling Guidelines. This credit is mandatory and required for achievement of REAP Gold.</u>				
<b><u>EA Gold Plus</u></b>	<u>8</u>		<u>BP</u>	<u>OP</u>
<u>Design the building to meet a maximum EUI of 140 kwh/m2/yr, demonstrated using the UBC Energy Modeling Guidelines. This credit is mandatory and required for achievement of REAP Gold Plus.</u>				
<b><u>EA Platinum</u></b>	<u>10</u>		<u>BP</u>	<u>OP</u>
<u>Design the building to meet a maximum EUI of 120 kwh/m2/yr, demonstrated using the UBC Energy Modeling Guidelines. This credit is mandatory and required for achievement of REAP Platinum.</u>				
<b><u>EA Platinum Plus</u></b>	<u>10</u>		<u>BP</u>	<u>OP</u>
<u>Design the building to meet a maximum EUI of 105 kwh/m2/yr, demonstrated using the UBC Energy Modeling Guidelines. This credit is mandatory and required for achievement of REAP Platinum Plus.</u>				

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	<u>Points</u>	<u>Mandatory / Optional</u>	<u>Submission</u>	
<b>EA Credit 1.1: Thermal Energy Sub-Metering</b>	1	O	BP	
Provide separate metering in individual units for measuring thermal energy consumption used for space heating.				
<b>EA 2 – RENEWABLE ENERGY</b>				
<b>EA 2.1 – Future Renewable Electricity</b>	1	O	BP	
Pre-wire buildings and provide installation space for future use of photovoltaic technologies or other renewable electricity generation.				
<b>EA 2.2 – Renewable Electricity Utilization</b>	3	O	BP	
Utilize photovoltaic technologies or other renewable electricity generation for a portion of the building's electrical supply.				
<b>EA 2.3 –Low-Carbon District Energy Utilization</b>	5	O	BP	
Connect to the District Energy System for the building's thermal energy supply in preparation of transition to renewable energy in the future.				
<del><b>EA 3 – COMMISSIONING</b></del>				
<del><b>EA 3.1 – Commissioning</b></del>	4	O	BP	OP
<del>Contract a third party Commissioning Authority to develop and implement a commissioning plan for all major building energy systems and verify they are installed, calibrated and perform according to design intent.</del>				
<del><b>EA 4 – AIRTIGHTNESS</b></del>				
<del><b>EA 4.1 – Building Envelope Airtightness</b></del>	0		BP	OP
<del>The building envelope shall be constructed so that the air change rate is not greater than 3.5ACH50 when measured in accordance with CAN/CGSB 149.15 M86 (Determination of the airtightness of Building envelopes by the Fan Depressurization Method.)</del>				

<b>Performance Category: Materials &amp; Resources (MR)</b>			
The intention of the Materials and Resources category is to encourage design strategies that reduce and reuse material resources, reduce construction waste, and to select building materials that are environmentally preferable.			
<b>MR 1 – RECYCLED CONTENT AND REUSED MATERIALS</b>	<u>Points</u>	<u>Mandatory / Optional</u>	<u>Submission</u>
<b>MR 1.1 – Reused Building Materials</b>	2	0	OP
Use salvaged, refurbished, or reused materials for at least 5% of the total cost of building materials.			
<b>MR 1.2 – Reused Building Materials</b>	2	0	OP
Use salvaged, refurbished, or reused materials for at least 10% of the total cost of building materials.			
<b>MR 1.3 – Recycled Content Materials</b>	1 or 2	0	OP
Specify and use building materials with the following recycled content levels:			
<ol style="list-style-type: none"> <li>1. Common area carpet with minimum 25% recycled content</li> <li>2. Drywall with minimum 15% recycled content</li> <li>3. Batt insulation with minimum 40% recycled content</li> <li>4. Doors contain minimum 15% recycled material</li> <li>5. Concrete with minimum 20% fly ash content, excluding suspended slabs</li> <li>6. Concrete with minimum 40% fly ash content, excluding suspended slabs</li> <li>7. Cabinetry with minimum 20% recycled content</li> <li>8. MDF products with minimum 50% recycled content</li> </ol>			
<input type="checkbox"/> Minimum four recycled content items on list above 1 point			
<input type="checkbox"/> All eight recycled content items on list above 2 points			
<b>MR 2 – REGIONAL MATERIALS</b>			
<b>MR 2.1 – Regionally Manufactured Building Materials</b>	1	0	OP
Use a minimum of 20% (by value) of building materials and products that are assembled or manufactured within a radius of 800 km (500 miles).			

	<u>Points</u>	<u>Mandatory / Optional</u>	<u>Submission</u>	
<b>MR 2.2 – Regionally Sourced Building Materials</b> Of the materials from Credit MR 2.1, use a minimum of 50% (by value) of building materials and products that are extracted, harvested or recovered (as well as assembled or manufactured) within a radius of 800 km (500 miles).	1	0		OP
<b>MR 3 – CERTIFIED AND NON-ENDANGERED FOREST PRODUCTS</b> <b>MR 3.1 – Dimensional Lumber and Plywood</b>  Demonstrate that a minimum of 50% of the total value of dimensional lumber and plywood is certified in accordance with either: CSA Z809 – 2 Points Or Forest Stewardship Council (FSC) – 3 Points	2 or 3	0		OP
<b>MR 3.2 –Hardwood Floors</b>  Specify and install hardwood or bamboo flooring that is certified in accordance with the Forest Stewardship Council or CSA Z809. If floors are offered only as an option, specify and offer only bamboo or renewable products with third-party certification. CSA Z809 – 2 Points Or Forest Stewardship Council (FSC) – 3 Points	2 or 3	0		OP
<b>MR4 BUILDING PRODUCT – INGREDIENTS</b> <b>MR 4.1 – Transparency of Ingredients</b>	2	0		OP
Install ten different building products from three different manufacturers that <del>evaluate and disclose</del> demonstrate the chemical inventory of the product to <del>an</del> accuracy of 0.1% for each product. For each product selected provide either: <ul style="list-style-type: none"> <li>• Health Product Declaration (HPD)</li> <li>• Manufacturers Inventory of all ingredients by CAS number, or</li> <li>• Declare Label (Living Building Institute)</li> </ul>				

	<u>Points</u>	<u>Mandatory / Optional</u>	<u>Submission</u>	
<b>MR 4.2 – Optimization of Ingredients</b>	2	0		OP
Demonstrate that a minimum of 10% (by value) of building materials are optimized for ingredient content by demonstrating optimization in one of the following ways: <ul style="list-style-type: none"> <li>• GreenScreen v1.2 benchmark 4 minimum</li> <li>• Red List free</li> <li>• Free of ingredients listed on REACH Authorization and Candidate List</li> </ul>				

**Performance Category: Indoor Environmental Quality (IEQ)**

The intention of the Indoor Environmental Quality category is to achieve enhanced indoor environmental quality through the thoughtful selection and application of materials and effective ventilation strategies.

IEQ MANDATORY	<u>Points</u>	<u>Mandatory / Optional</u>	<u>Submission</u>	
<p><b>IEQ M1 – Adhesives and Sealants</b></p> <p>Specify and use adhesives, sealants and sealant primers that <del>do not exceed the VOC limits of the Canadian Environmental Choice/are EcoLogo program certified or</del> do not exceed the VOC limits <del>specified in the State of California's</del> South Coast Air <u>Quality</u> Management District (SCAQMD) Rule #1168 <u>on the interior of the building.</u></p>		M		OP
<p><b>IEQ M2 – Paints and Coatings</b></p> <p>Specify and use paints and coatings that carry an EcoLogo label or those rated at a minimum GPI-1 by the Master Painter's Institute on the interior of the building.</p>		M		OP
<p><b>IEQ M3 – Carpet</b></p> <p>Specify and install carpet and carpet cushion that carry the following certifications: Carpet and Rug Institute Green Label Plus <del>or the Ecologo.</del></p>		M		OP
<p><b>IEQ M4 – Ventilation Effectiveness</b></p> <p>Prepare and implement an effective air management strategy that meets the requirements of the current versions of CAN/CSA F326 or ASHRAE-62.1 or 62.2 as applicable to the building configuration.</p>		M	BP	
<p><b>IEQ 1 – LOW-EMITTING MATERIALS</b></p> <p><b>IEQ 1.1 – Low VOC Paints and Coatings</b></p> <p>Specify and use paints and coatings rated at a minimum GPS-2 by the Master Painter's Institute on the interior of the building.</p>	2	O		OP
<p><b>IEQ 1.2 –Low-Emitting Composite Wood Products</b></p> <p>Specify and install interior composite wood products, such as flooring, doors, trim, etc., that <u>are low emitting or</u> have no added urea formaldehyde. Cabinetry is excluded from this credit.</p>	2	O		OP

	<u>Points</u>	<u>Mandatory / Optional</u>	<u>Submission</u>	
<p><b>IEQ 1.3 –Low-Emitting Insulation</b></p> <p>Specify and install formaldehyde-free insulation on the interior of the building.</p>	2	0		OP
<p><b>IEQ 1.4 –Low-Emitting Cabinetry</b></p> <p>Specify and install interior cabinetry (doors, boxes, counters and laminating adhesives) that <u>are low emitting or</u> contain no added urea formaldehyde.</p>	2	0		OP

Performance Category: Construction (CON)			
The construction process can impose significant and lasting impact on the ecology of both the site and beyond. The Construction credits acknowledge and reward contractors who have followed best practices.			
CON MANDATORY	Points	Mandatory / Optional	Submission
<b>M1 – Staging and Construction</b>		M	OP
Prepare and implement a Staging and Construction Plan, including alternate detour information and signage for pedestrians and cyclists.			
<b>M2 – Vegetation Safeguards and Land-Clearing Debris</b>		M	OP
Prepare a site plan showing the sizes and locations of vegetation to be removed, retained and salvaged, including plants located on adjacent public rights-of-way (see reference guide) <b>and</b> develop a plan to effectively handle debris from land clearing and divert it from landfill disposal.			
<b>M3 – Truck Management Plan</b>		M	OP
Prepare and implement a comprehensive truck management plan for the project that conforms to the <i>UBC Strategic Transportation Plan</i> and the <i>Neighbourhood Plan Development Guidelines</i> .			
<b>M4 – Wheel Wash</b>		M	OP
Provide a wheel wash for vehicles leaving the site <i>or</i> a street cleaning program and catch basin protection.			
<b>M5 – Erosion and Sedimentation Control</b>		M	OP
Prepare and implement a Sediment and Erosion Control Plan that conforms to <a href="#">the City of Vancouver Bulletin 2002-003-EV dated March 1, 2017–Best Management Practices Guide for Stormwater: Appendix H– Construction Site Erosion and Sediment Control Guide (GVS&amp;DD, October 1999)</a> .			
<b>M6 – Waste Management Plan</b>		M	OP
Prepare and implement a Waste Management Plan that diverts 75% (by weight) of construction and demolition waste from landfill.			

	<u>Points</u>	<u>Mandatory / Optional</u>	<u>Submission</u>	
<b>CON 1 – CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT PLAN</b>				
<b>CON 1.1 – Indoor Air Quality Management Plan</b>	2	0		OP
Prepare and implement an Indoor Air Quality (IAQ) Management Plan for the construction and pre-occupancy phases of the building.				
<b>CON 1.2 – Flushout / IAQ Test</b>	2	0		OP
After construction ends and prior to occupancy conduct a minimum two-week continuous building flushout with new filtration media at 100% outside air or conduct a Baseline Indoor Air Quality Test.				

Performance Category: Innovation and Design Process (ID)				
The intent of the Innovation and Design Process category is to provide incentive and credit for general design and other innovative practices that improve the overall sustainability and environmental performance of the project.				
<p><b>ID MANDATORY</b></p> <p><b>ID M1 –Goal Setting Workshop</b></p> <p>Hold a green building workshop or Design Charrette including the developer, design consultants and contractor to review and develop the strategies for achieving the development’s goals and priorities relevant to the <i>Residential Environmental Assessment Program</i>.</p> <p><b>ID M2 – Educate the Homeowner</b></p> <p>Develop a homeowner’s manual that promotes sustainable behavior and describes all of the sustainable features of the project instructing the homeowner on their proper use. This manual should be included in record drawings or some form that will be accessible beyond the first generation of owner/resident.</p> <p><b>ID 1 – INNOVATION IN MATERIALS</b></p> <p><b>ID 1.1 – Life-Cycle Assessment</b></p> <p>Perform a Life-Cycle Assessment of the project’s structure and enclosure and demonstrate a minimum of 5% improvement from a reasonable baseline building for three environmental categories.</p> <p><b>ID 2 –INTEGRATIVE AND UNIVERSAL DESIGN</b></p> <p><b>ID 2.1 – Green Building Specialist</b></p> <p>Engage an expert in green buildings and sustainable construction practices to provide advice on effective green building strategies to the design team.</p> <p><b>ID 2.2 – Design for Safety and Accessibility</b></p> <p>Demonstrate that at least 25% of the units in the building have been designed to meet the intent of SAFERhome standards which address issues of accessibility, children’s safety, seniors and aging in place.</p> <p><b>ID 2.3 – Design for Security and Crime Prevention</b></p> <p>Demonstrate that the design has been reviewed by an accredited Crime Prevention Through Environmental Design (CPTED) practitioner</p>	<u>Points</u>	<u>Mandatory / Optional</u>	<u>Submission</u>	
		M	BP	
		M		OP
		4	O	OP
		1	O	BP
		1	O	BP
	2	O	BP	

ID 3 – MARKET TRANSFORMATION	<u>Points</u>	<u>Mandatory / Optional</u>	<u>Submission</u>	
<p><b>ID 3.1 – Educate the Sales Staff</b></p> <p>Develop marketing materials based on the environmental performance of the project and ensure that the sales staff is knowledgeable about the green building features.</p>	1	0		OP
<p><b>ID 4 – ACADEMIC LINKS</b></p> <p><b>ID 4.1 – Enhance Research or Further Student Development</b></p> <p>Collaborate with UBC students and/or faculty on a research project or other opportunities to enhance the academic mission of the University and integrate it with the community. The research project should be concurrent with, and applicable to, the current project.</p>	5	0	BP	OP
<p><b>ID 4.2 – Energy Data Sharing</b></p> <p>Incorporate a data sharing agreement into the sales contracts or strata constitution that allows building aggregate energy data to be collected for use by the UBC <del>Campus Sustainability</del><u>Sustainability and Engineering, Campus &amp; Community Planning</u>.</p>	4	0	BP	OP
<p><b>ID 5 – INNOVATIVE DESIGN</b></p> <p><b>ID 5.1 – Innovative Design Strategy or Exemplary Achievement</b></p> <p>Demonstrate exceptional performance above the requirements set by one of the existing credits or the implementation of an innovative design strategy not specifically addressed by any of the existing credits.</p>	2	0		OP
<p><b>ID 5.2 – Innovative Design Strategy or Exemplary Achievement</b></p> <p>Demonstrate exceptional performance above the requirements set by one of the existing credits or the implementation of an innovative design strategy not specifically addressed by any of the existing credits.</p>	2	0		OP
<p><b>ID 5.3 – Innovative Design Strategy or Exemplary Achievement</b></p> <p>Demonstrate exceptional performance above the requirements set by one of the existing credits or the</p>	2	0		OP

implementation of an innovative design strategy not specifically addressed by any of the existing credits.

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## Sustainable Sites (SS)

## SS MANDATORY

SS Credit M1: Stormwater Management

Mandatory

## Requirement

Require all new construction projects detain the 10-year, 24-hour storm volume and discharge at the 2-year, 40-hour pre-development rate on site or at a designated centralized facility using low-impact development and green infrastructure strategies.

Develop a plan that integrates the on-site storm water management system with the neighbourhood wide storm water management principles and strategies, including controlling of rate and/or quantity of run-off as required using green infrastructure wherever possible.

## Intent

To provide safe conveyance of stormwater to protect people and property, minimize the need for stormwater infrastructure, and maintain the ecological integrity and health of landscapes and river systems.

## Rationale

Development can significantly decrease the rate of natural water infiltration. Incorporating on-site stormwater management design features mitigates water flow into the storm sewer system, and promotes the health of nearby ecosystems and estuaries.

## Definitions

- *Detention facility:* is a storage facility that is normally dry but is designed to hold surface water temporarily after a runoff event slowing runoff eg. natural swales, surface depressions, tanks, infiltration basins.
- *Retention facility:* collects stormwater and allows the water to soak into the soil. This infiltration process helps recharge groundwater.
- *Infiltration:* Water movement from land surfaces into the soil and water table.
- *Permeability:* Ability of a substance (i.e. soil) to transmit fluids through porous spaces.

## Strategies

- Where available hook into the neighbourhood system to achieve the requirements.
- Design a storm water detention system to handle storm events and reduce loading on storm sewers.
- Provide a subsurface infiltration trench below permeable paving to enhance water infiltration into soils.
- Optimize infiltration and plant health with a soil layer that is high in organic content.
- Consider green roofs, which both delay and reduce the runoff peak flows that occur with conventional roof systems.

## Resources

- Stormwater management at UBC in general:
- <https://www.scribd.com/document/164100175/Wesbrook-Village-Michael-Smith-Park>  
Site: <http://sustain.ubc.ca/campus-initiatives/water/stormwater-management>
- *Stormwater Planning: A Guidebook for British Columbia:* Prepared by the BC Ministry of Environment.  
Site: [https://www2.gov.bc.ca/assets/gov/environment/waste-management/sewage/stormwater\\_planning\\_guidebook\\_for\\_bc.pdf](https://www2.gov.bc.ca/assets/gov/environment/waste-management/sewage/stormwater_planning_guidebook_for_bc.pdf) Site: <http://www.env.gov.bc.ca/epd/mun-waste/waste-liquid/stormwater/index.htm> [https://www2.gov.bc.ca/assets/gov/environment/waste-management/sewage/stormwater\\_planning\\_guidebook\\_for\\_bc.pdf](https://www2.gov.bc.ca/assets/gov/environment/waste-management/sewage/stormwater_planning_guidebook_for_bc.pdf)

- *LEED Canada Reference Guide for Design and Construction 2009*: Information and resources provided for Sustainable Sites Credits 6.1 and 6.2.

**Documentation: *Submit at the Building Permit phase***

- Letter signed by Civil Engineer or responsible party declaring requirements will be met.
- Copy of the Stormwater Management Plan.

## SS MANDATORY

### SS Credit M2: Adapted and Ecologically Sound Planting

Mandatory

#### Requirement

Demonstrate that landscape design has minimized the need for pesticides and irrigation through the selection of adaptive and drought-tolerant plants and consideration of the principles of Integrated Pest Management and xeriscaping.

#### Intent

To promote low maintenance, resource-efficient landscapes that do not require use of pesticides.

#### Rationale

Landscaping can place considerable demands on water resources and require high levels of maintenance. Ecologically sound landscaping is drought tolerant, low maintenance, and provides habitat for wildlife.

#### Definitions

- *Xeriscaping*: Landscaping that conserves water and requires minimal maintenance by using a variety of indigenous and drought-tolerant plants in combination with highly efficient irrigation methods.
- ~~Integrated Pest Management~~: A process of planning and managing ecosystems to prevent organisms from becoming pests.

#### Strategies

- Use native drought-tolerant species (such as *sala*) for groundcover and consider limiting non-drought-tolerant grasses to 50% of landscaped area. to meet the Canadian Landscape Standard.
- Provide adequate volumes of high quality soil for all landscaped areas.
- Install efficient, low volume irrigation systems that deliver water directly to the root zone.
- Use 50 mm of mulching to reduce water lost to evaporation and runoff by 75-90% as compared to unmulched planting areas.
- ~~Implement Integrated Pest Management strategies in order to reduce~~ costs and liabilities associated with pesticide use.
- Consider access to sunlight/shade and over slab and off slab environments to create well adapted and aesthetically pleasing landscapes.

#### Resources

- *Native Plant Society of British Columbia*: The NPSB provides listings of retail and wholesale nurseries and seed suppliers in the province.  
Site: <http://www.npsbc.ca/>
- *Integrated Pest Management Program, BC Ministry of Environment*: The provincial Environmental Protection Division provides information and support for Integrated Pest Management.  
Site: <https://www2.gov.bc.ca/gov/content/industry/agriculture-seafood/animals-and-crops/plant-health/integrated-pest-managementmanagement><http://www.env.gov.bc.ca/epd/ipmp/>
- *Evergreen Native Plant Database*: The non-profit's database provides information about native tree, shrub, wildflower, grasses and vine species across Canada.  
Site: <http://nativeplants.evergreen.ca/>
- ~~Canadian Landscape Standard (CLS)~~: The Canadian Landscape Standard is a detailed set of guidelines on landscape construction projects across Canada published by the Canadian Nursery Landscape Association and the Canadian Society of Landscape Architects.  
Site: <http://www.csla-aapc.ca/standard>

#### Documentation: **Submit at the Building Permit phase**

- ~~Letter signed by Landscape Architect declaring that the requirements will be met including a statement of principles to be applied to site design.~~

## SS MANDATORY

### SS Credit M3: Bicycle Parking

Mandatory

#### Requirement

Provide covered bicycle storage facilities including short-term and 1.5 parking spaces per dwelling unit or individual parking garages for Class I use, and 0.5 bicycle parking spaces long-term covered storage facilities for securing bicycles use, and one 16-stall bike rack per 35 dwelling units for Class II use in accordance with The UBC Development Handbook, in accordance with the UBC Development Handbook.

#### Intent

To encourage bicycle use, which contributes to reducing land development impacts and pollution associated with private automobile use.

#### Rationale

Bicycling is a healthy and sustainable alternative to the car for short commuter distances. Providing accessible and secure bicycle facilities promotes the use of bicycles as an alternative mobility option.

#### Definitions

- *UBC Class I Bicycle Parking:* Intended for long-term use of residents or employees, and may consist of attended facilities under surveillance, insider/indoor bicycle lockers, or restricted access parking.
- *UBC Class II Bicycle Parking:* Intended for short-term use of patrons/residents or visitors, and may consist of bicycle racks located with natural surveillance in an accessible outsidedoor/outdoor location.

#### Strategies

- Consider constructing storage rooms with solid walls. Motion-activated, tamper-proof security lighting is ideal.
- Provide adequate indoor space for proper storage: ideally, rooms should provide at least 1.8 m of headroom and stalls should be at least 1.8 m long for horizontal bicycles, 0.9 m wide if placed vertically.
- Provide bicycle racks with two points of contact, to allow convenient locking for a variety of sizes and styles.

#### Resources

- *The UBC Development Handbook:* The Handbook describes the development approval process for UBC neighbourhoods. See section 7.46 'Parking Requirements for Bicycles'.  
Site: <https://planning.ubc.ca/sites/planning.ubc.ca/files/documents/planning-services/development/UBC%20Development%20Handbook%20-%20April%202018.pdf>  
<http://planning.ubc.ca/sites/planning.ubc.ca/files/documents/UBC%20Development%20Handbook.pdf>  
Site: <http://planning.ubc.ca/sites/planning.ubc.ca/files/documents/UBC%20Development%20Handbook.pdf>
- *Transportation Demand Management Encyclopaedia:* The City of Victoria BC's TDM Encyclopaedia is a comprehensive source of information about innovative management solutions to transport issues, including bicycle parking and storage facilities.  
Site: <http://www.vtpi.org/tdm/tdm85.htm>

- *Bicycle Friendly Berkeley Coalition (BFBC)*: BFBC provides comprehensive resources for addressing issues related to cycling, including detailed guidelines with criteria for determining good quality short-term bicycle parking facilities.

Site: <https://bikeeastbay.org> <http://www.bfbc.org/>

**Documentation: *Submit at the Building Permit phase***

- Letter signed by Architect declaring requirements will be met.
- Number and location of bicycle storage facilities.

## SS MANDATORY

### SS Credit M4: Contribution to Community Car Sharing

Mandatory

#### Requirement

Contribute to the development of a community car-sharing network by funding the equivalent of one community vehicle per 100 residential units.

#### Intent

To reduce environmental impacts associated with private automobile use.

#### Rationale

Car sharing makes public transportation a viable option by providing a cost-effective alternative for special trips. The World Car-Share Online Inventory reports that in 2006, there are more than 1,000 cities in the world with active car-sharing networks.

#### Definitions

- *Community car-sharing network*: An organization that provides access to shared automobiles for its members as an alternative to private ownership.

#### Strategies

- Consult with UBC Properties Trust to make arrangements for the required contribution.
- Provide information to homebuyers on the community car-sharing program

#### Resources

- *Victoria Transport Policy Institute (VTPI)*: The VTPI is an excellent resource for information on a variety of sustainable mobility resources.  
Site: <http://www.vtpi.org/>
- *Wikipedia*: See the Wikipedia online encyclopaedia entry on Car Sharing for a comprehensive overview of car sharing networks worldwide.  
Site: <http://en.wikipedia.org/wiki/Carsharing>
- *Modo, the Car Co-op* is a Vancouver-based not-for-profit co-operative venture incorporated to foster car sharing as an alternative to the privately owned automobiles.  
Site: <http://www.modo.coop/>
- *CarSharing.net* is a non-profit educational and promotional site, supporting the car sharing industry in North America.  
Site: <http://www.carsharing.net/index.html><http://www.carsharing.net>

#### Documentation: *Submit at the Occupancy Permit phase*

- Letter signed by Developer declaring that the requirements have been met.
- Number of residential units and documentation confirming the amount contributed to car-sharing network.

## SS Mandatory – ALTERNATIVE TRANSPORTATION

### SS Credit M5: Electric Vehicle Charging- Resident

2 Points

#### Requirement

Provide a minimum of one energized level 2 outlet per residential unit for non-rental developments or provide energized outlets for 50% of resident parking stalls for rental developments. Level 2 charging capacity that provides a minimum of 40A service and a minimum performance level of 12 kWh per stall, over an eight (8) hour period must be provided. Load sharing (up to four-way) and load management systems may be utilized. Exceptions may be granted in cases where utility mandated transformer upgrades are required. This credit is mandatory.

#### Intent

To reduce the number of greenhouse gas emitting vehicles and encourage the use of alternative fuel vehicles and to provide charging access for residents for electric vehicles, which are becoming more widely available and gaining in popularity.

#### Rationale

Alternative fuel vehicles can reduce greenhouse gas emissions from vehicle operation by approximately 28% as compared to conventional petroleum-powered vehicles. Four-way load shared Level 2 charging with load management provides sufficient charging capacity for overnight charging of electric vehicles and is a cost-effective way to provide charging electrical service while maintaining reasonable building-level electricity demand.

#### Definitions

- Electric Vehicle: A vehicle that uses electrically charged batteries to provide all or partial energy to power an engine, while requiring connection to a power outlet for charging.
- Level 2 Charging: A level 2 electric vehicle charging level as defined by SAE International's J1772 standard.
- Load sharing: Control of the current drawn by multiple electric vehicles on a single circuit, to ensure the capacity of the circuit is not exceeded, and that maximum charging is achieved at each EVSE based on the available capacity.
- Load management: Control of the current drawn by the electric vehicle charging system, at the main switchboard of the building.

#### Strategies

- Utilize load sharing and load management to provide cost-effective charging capacity and manage building level electricity demand.
- Contact the UBC Sustainability and Engineering Green Building Manager regarding questions related to utility mandated transformer upgrades.

#### Resources

- AES Engineering costing analysis prepared for the City of Richmond (2017).  
Site: <http://udi.bc.ca/wp-content/uploads/2017/06/Final-Report-r004-EV-Requirements-20170404.pdf>
- Canadian Electric Vehicle Infrastructure Deployment Guidelines (2014).  
Site: [https://www.bchydro.com/content/dam/BCHydro/customer-portal/documents/corporate/environment-sustainability/electric-vehicles/DC14-071%20Canadian%20EV%20Infrastructure%20Deployment%20Guidelines%202014\\_web.pdf](https://www.bchydro.com/content/dam/BCHydro/customer-portal/documents/corporate/environment-sustainability/electric-vehicles/DC14-071%20Canadian%20EV%20Infrastructure%20Deployment%20Guidelines%202014_web.pdf)

#### Documentation: Submit at the Building Permit phase

- Letter signed by Electrical Engineer declaring that the requirements will be met.
- Plans showing electrical service to stalls and documentation of load sharing and load management systems.

## SS MANDATORY

### SS Credit ~~M6M5~~: Light Pollution Reduction

Mandatory

#### Requirement

Do not exceed the current Illuminating Engineering Society of North America (IESNA) illuminance requirements as stated in ~~the Recommended Practice Manual: Lighting for Exterior Environments~~.

#### Intent

To eliminate light trespass from the building site, improve night sky access, and reduce development impacts on nocturnal environments and wildlife.

#### Rationale

Light pollution and light trespass compromise astronomical research, cause adverse human health effects, disrupt ecosystems, and needlessly consume excess energy.

#### Definitions

- *Light Trespass*: Unwanted or nuisance light emanating from a neighbouring property.
- *Light Pollution*: Waste light from buildings sites that interferes with astronomical research, produces glare, and adversely affects the environment.
- *Illuminance*: Amount of light falling on a surface, measured in units of footcandles (fc) or lux (lx).

#### Strategies

- Use full cut-off luminaires to direct light downward where it is needed, e.g. on pedestrian pathways, sidewalks and landscaped areas. Do not provide additional illumination for roadways.
- Design for an illuminance uniformity ratio of 4:1 for pathway lighting.
- Minimize outdoor lighting levels (e.g. limit exterior lighting on decks, balconies). Carefully match outdoor lighting levels with the application and use no more than absolutely necessary.
- Keep lighting poles low and closely spaced. For more uniform area lighting, such as parking lots, use a larger number of lower, pole-mounted luminaires instead of fewer, taller fixtures.
- Avoid reflective surfaces beneath downlit signs. Whenever possible, design the surfaces beneath downlit signs to be light absorptive rather than reflective.

#### Resources

- ~~Illuminating Engineering Society of North America~~: IESNA is the recognized technical authority on illumination. The society publishes a variety of technical documents on illumination, as well as other lighting-related publications that encourage good lighting design.  
Site: <https://www.ies.org/> <http://www.iesna.org/index.cfm>
- *International Dark-Sky Association*: IDA provides extensive resources, guidelines and recommendations for minimizing light pollution.  
Site: <http://www.darksky.org/>
- ~~Print Media: LEED v4 for Building Design and Construction-Canada for New Construction and Major Renovations 2009~~: Information and resources for Sustainable Sites Credit 8, 'Light Pollution Reduction'.

#### Documentation: *Submit at the Building Permit phase*

- Letter signed by Electrical Engineer declaring that the requirements will be met, including a description of the lighting strategy employed to achieve the credit.
- Cut sheet from the lighting manufacturer indicating that the fixture's design and illuminance meet requirements.

## SS MANDATORY

### SS Credit M7M6: Recycling Collection

Mandatory

#### Requirement

Provide for collection of domestic paper, plastic, glass and metal recyclables by contracting with a waste management company for the service. Recycling storage space shall be designed in accordance with Metro Vancouver's Technical Specifications for Recycling Amenities.

#### Intent

To facilitate recycling and reduce the amount of waste sent to landfills.

#### Rationale

Recycling diverts valuable materials from the waste stream and allows them to be reclaimed for use as feedstock for new products, or to be reused as reconditioned or remanufactured products. Recyclable materials should include, at minimum, containers made from glass, metal or plastics labeled 1, 2, 4 or 5, as well as recyclable papers and cardboard.

#### Strategies

- Garbage removal contractors can often be contracted to remove recyclables as well. Phone around to compare costs and services.
- Consult with recycling contractors about the number, type and size of recycling bins that will be needed, as the bins may need to be purchased from them.
- Early contact with a recycling contractor could aid in coordinating in-suite collection systems with the collection system for the whole building (see SS Credit 1.1).

#### Resources

- *Metro Vancouver: Metro Vancouver's Technical Specifications for Recycling Amenities* -offers space specifications for recycling storage in new developments.  
Site: <http://www.metrovancouver.org/services/solid-waste/SolidWastePublications/TechnicalSpecsStorageSpaceAccessRecyclingMulti-FamilyCommercialDevelopments.pdf><http://www.metrovancouver.org/services/solidwaste/planning/Engagement/Pages/MFC.aspx>
- *UBC Waste Management, Department of Plant Operations*: The UBC Waste Management Office orchestrates campus recycling and composting activities and provides education and information on waste reduction to the campus community.  
Site: <http://buildingoperations.ubc.ca/business-units/municipal/waste-management/>  
<http://www.recycle.ubc.ca/>
- *Recycling Council of British Columbia*: RCBC provides information on waste reduction, recycling, disposal and pollution prevention throughout the province.  
Site: <http://www.rcbc.bc.ca/>

#### Documentation: **Submit at the Building Permit phase**

- Location and size of recycling storage area in the building. This area will serve as space for both materials recycling and organics.

#### Documentation: **Submit at the Occupancy Permit phase**

- Letter signed by the Developer or Building Owner declaring that the requirements have been met, including a description of the waste management contract in place.

## SS MANDATORY

### SS Credit M&M7: Compost Collection

Mandatory

#### Requirement

Provide a space in the building for the collection compost and provide for the compost collection through a contract with UBC Waste Management or another waste management service provider. Design space in the building in accordance with Metro Vancouver's *Technical Specifications for Recycling Amenities*.

#### Intent

To facilitate composting to reduce the amount of organic waste that is disposed of in landfills.

#### Rationale

Composting organic waste reduces the volume of materials sent to municipal landfills, which helps to reduce demand for landfill infrastructure and to reclaim organic material for use as mulch and fertilizer. ~~Metro Vancouver is also considering a 2015 ban on organics from the waste stream. This credit prepares new buildings for this potential reality.~~

#### Definitions

- *Compost*: Organic waste from food or plant sources that has been naturally decomposed.

#### Strategies

- Contact the UBC Waste Management Office or a private hauler in the lower mainland and surrounding areas who will transport compostables from UBC neighbourhoods to the facilities.
- To streamline waste management, consider contracting with haulers that will handle and remove compost and recycling in addition to regular garbage pickup.

#### Resources

- *Composting Council of Canada*: The Council is a national non-profit which serves as the central resource and network for the composting industry in Canada.  
Site: <http://www.compost.org/>
- *City of Vancouver*: The City of Vancouver maintains a source list of commercial organic waste haulers.  
Site: <http://vancouver.ca/green-vancouver/food-scraps-haulers.aspx>
- *Metro Vancouver*: Metro Vancouver's *Technical Specifications for Recycling Amenities*—offers space specifications for recycling storage in new developments.  
Site: <http://www.metrovancouver.org/services/solid-waste/SolidWastePublications/TechnicalSpecsStorageSpaceAccessRecyclingMulti-FamilyCommercialDevelopments.pdf>  
~~<http://www.metrovancouver.org/services/solidwaste/planning/Engagement/Pages/MFC.aspx>~~

#### Documentation: *Submit at the Building Permit phase*

- Location and size of recycling organics storage area in the building. This area will serve as space for both materials recycling and organics.

#### Documentation: *Submit at the Occupancy Permit phase*

- Letter signed by the Developer or Building Owner declaring that the requirements have been met, including a description of the waste management contract in place.

## SS 1 – RECYCLING AND COMPOSTING

### SS Credit 1.1: In-Suite Recycling and Compost Separation

2 points

#### Requirement

Provide a space *and* system for simplified separation and collection of recycling and compostables in each suite or unit.

#### Intent

To facilitate recycling and composting in order to reduce the amount of waste sent to landfills.

#### Rationale

Decisions to relegate many materials to the waste stream occur at the household level. By making it easier to recycle or compost materials than to throw them away, thoughtful design can help to make waste diversion standard household practice. In-suite containers provide a visual reminder to residents to participate in waste diversion, and facilitate the transporting of materials to the main collection area.

#### Definitions

- *Compostables*: Organic waste from food or plant sources that can be naturally decomposed. May include cooked food and meats, depending on the composting method used on the site or at the collection facility.

#### Strategies

- Complete built-in, under-counter compost/recycling bins are available. Review examples of in-suite separation systems in the *Southeast False Creek Solid Waste Management Plan*.
- Select a location in the suite that is accessible and easy to keep clean.
- Provide container labels that list compostable and recyclable items.
- Coordinate labelling of in-suite separation containers with containers in the main collection area to simplify transfer.

#### Resources

- *UBC Waste Management, Department of Plant Operations*: The UBC Waste Management Office orchestrates campus recycling and composting activities and provides education and information on waste reduction to the campus community.

Site: <http://buildingoperations.ubc.ca/business-units/municipal/waste-management/>  
<http://www.buildingoperations.ubc.ca/municipal/waste-management/>

#### Documentation: *Submit at the Building Permit phase*

- Letter signed by Architect declaring that the requirements will be met.
- Description of the system implemented.

## SS 2 – ALTERNATIVE TRANSPORTATION

### SS Credit 2.1: Additional Cycling Amenities

2 points

#### Requirement

In addition to the requirements for bicycle parking in the UBC Development Handbook, provide an additional 0.25 Class I bicycle parking per bedroom and an in-building bicycle repair station complete with a 120V electrical outlet.

#### Intent

To encourage bicycle use, reduce land development impacts and reduce pollution associated with private automobile use.

#### Rationale

Bicycling is a healthy and sustainable alternative to the car for short commuter distances. Providing accessible and secure bicycle facilities promotes the use of bicycles as an alternative mobility option. Additionally, end of trip facilities help to promote continued bicycle use for residents, including a 120V electrical outlet for electric bicycle charging.

#### Definitions

- *UBC Class I Bicycle Parking:* Intended for long-term use of residents or employees, and may consist of attended facilities ~~under surveillance~~, inside indoor bicycle lockers, or restricted access parking.
- *UBC Class II Bicycle Parking:* Intended for short-term use of ~~patrons residents~~ or visitors, and may consist of bicycle racks located with natural surveillance in an accessible ~~outside outdoor~~ location.
- *Bicycle Repair Station:* A station to include tools for repair and a tire pump.

#### Example

Type of Unit	Number of Units	SS Credit M3	SS Credit 2.1 (add)	Total Bicycle Parking
Studio	8	8 x 1.5 = 12	8 x 1 x 0.25 = 2	14
1 Bedroom	25	25 x 1.5 = 37.5	25 x 1 x 0.25 = 6.25	44
2 Bedroom	42	42 x 1.5 = 63	42 x 2 x 0.25 = 21	84
3 Bedroom	32	32 x 1.5 = 48	32 x 3 x 0.25 = 24	72
<b>TOTALS</b>	<b>107</b>	<b>161</b>	<b>53</b>	<b>214</b>

#### Resources

- *HUB:* HUB is a Metro Vancouver charitable organization that promotes cycling in the Lower Mainland.  
Site: <https://bikehub.ca/>
- *Commercial "Packaged" Repair Stations:*  
Site: <http://www.urbanracks.com/repair.html>  
Site: <http://www.dero.com/products/fixit/>

#### Documentation: *Submit at the Building Permit phase*

- Letter signed by Architect declaring that the requirements will be met, including:
  - Number and location of bicycle parking facilities.
  - Description of the bicycle repair station.

## SS 2 – ALTERNATIVE TRANSPORTATION

### SS Credit 2.2: Electric Vehicle Charging - Visitor

2 points

#### Requirement

Provide one dedicated parking spot per 100 residential units for visitors of residents/owners, fully equipped with Level 2 charging station.

#### Intent

To reduce the number of greenhouse gas emitting vehicles and encourage the use of alternative fuel vehicles.

#### Rationale

Alternative fuel vehicles can reduce greenhouse gas emissions from vehicle operation by approximately 28% as compared to conventional petroleum-powered vehicles.

#### Definitions

- *Plug-in Electric Vehicle:* A vehicle that uses electrically charged batteries to provide all or partial energy to power an engine, while requiring connection to a power outlet for charging.
- *Level 2 Charging Station:* A complete charging station comprised of the necessary wiring, circuitry, and outlets for a 220V, 40A connection.

#### Strategies

- In underground visitor parking, designate space(s) for electric vehicle charging.

#### Resources

- *LiveSmart BC:* LiveSmart BC has developed a Toolkit that includes guidelines for developers or other parties interested in installing electric vehicle charging stations in MURBS.

Site: <http://www.livesmartbc.ca/incentives/transportation/EV-toolkit.html>

#### Documentation: *Submit at the Building Permit phase*

- Letter signed by Architect declaring that the requirements will be met.
- Plan showing location of parking spots equipped with charging stations for electric vehicles.

## SS 2 – ALTERNATIVE TRANSPORTATION

SS Credit 2.3: Electric Vehicle Charging Stations- Resident

24points

### Requirement

Install necessary conduit and transformer capacity to accommodate Level 2 charging stations for the following percentage of owners'/residents' parking.

~~10~~5% of owners'/residents' parking (12 Points)

~~20~~10% of owners'/residents' parking (12 Points)

### Intent

To reduce the number of greenhouse gas emitting vehicles and encourage the use of alternative fuel vehicles.

Providing Level 2 charging stations will provide immediate opportunity for residents to access charging for

### Rationale

Alternative fuel vehicles can reduce greenhouse gas emissions from vehicle operation by approximately 28% as compared to conventional petroleum-powered vehicles. Access to Level 2 charging stations will provide sufficient charging capacity for overnight charging of electric vehicles.

### Definitions

- Plug-in Electric Vehicle: A vehicle that uses electrically charged batteries to provide all or partial energy to power an engine, while requiring connection to a power outlet for charging.
- Level 2 Charging: ~~A complete charging station, comprised of the necessary wiring, circuitry, and outlets for a 220V, 40A connection~~ A level 2 electric vehicle charging level as defined by SAE International's J1772 standard.

### Strategies

Charging stations that accommodate load-sharing are required. Charging stations with advanced metering systems can facilitate tracking of energy use and management of energy use costs by building owners. A dedicated BC Hydro meter for the EV charging system will also allow building owners to track energy use and costs.

### Resources

- Plug In BC: Plug In BC have compiled resources for parties interested in installing electric vehicle charging stations in MURBS in BC.

Site: <http://pluginbc.ca/charging-stations/charging-at-home/>

### Documentation: *Submit at the Building Permit phase*

- Letter signed by the Electrical Engineer declaring that the requirements will be met.
- Plan showing location of charging stations.
- Cut sheet from manufacturer of charging stations that will be installed.

## ~~SS 2—ALTERNATIVE TRANSPORTATION~~

### ~~SS Credit 2.3: Electric Vehicle Charging—Resident 4 points~~

#### ~~Requirement~~

~~Install necessary conduit and transformer capacity to accommodate Level 2 charging stations for the following percentage of owners'/residents' parking.~~

~~10% of owners'/residents' parking——(2 Points)~~

~~20% of owners'/residents' parking——(2 Points)~~

#### ~~Intent~~

~~To reduce the number of greenhouse gas emitting vehicles and encourage the use of alternative fuel vehicles.~~

#### ~~Rationale~~

~~Alternative fuel vehicles can reduce greenhouse gas emissions from vehicle operation by approximately 28% as compared to conventional petroleum powered vehicles.~~

#### ~~Definitions~~

~~*Plug in Electric Vehicle:* A vehicle that uses electrically charged batteries to provide all or partial energy to power an engine, while requiring connection to a power outlet for charging.~~

~~*Level 2 Charging Station:* A complete charging station, comprised of the necessary wiring, circuitry, and outlets for a 220V, 40A connection.~~

#### ~~Strategies~~

~~Install conduit, transformer capacity and necessary space in the electrical room to accommodate Level 2 Charging for the following percentage of owners'/residents' parking.~~

~~10% of owners'/residents' parking—2 Points~~

~~20% of owners'/residents' parking—2 Points~~

~~*LiveSmart BC:* LiveSmart BC has developed a Toolkit that includes guidelines for developers or other parties interested in installing electric vehicle charging stations in MURBS.~~

~~*Site:* [http://www.livesmartbc.ca/incentives/transportation/EV\\_toolkit.html](http://www.livesmartbc.ca/incentives/transportation/EV_toolkit.html)~~

#### ~~Documentation: *Submit at the Building Permit phase*~~

~~Letter signed by Architect declaring that the requirements will be met.~~

~~Plan showing location of space designated for electric vehicle charging ready stalls.~~

## Water Efficiency (WE)

### WE MANDATORY

#### WE Credit M1: Efficient Irrigation Technology

Mandatory

#### Requirement

Design and install a water-efficient irrigation system that includes an automated controller, rain or soil sensors and pressure regulator and for non-grass areas use a micro- or drip-feed irrigation system *or* install a temporary irrigation system.

#### Intent

To reduce the use of potable water for landscape irrigation.

#### Rationale

While water seems plentiful in BC's Lower Mainland, the issues of supply and quality are becoming increasingly important. Landscaping that uses water more efficiently assists in reducing impacts on water infrastructure. Efficient irrigation systems can reduce water consumption by 50-70% in planted areas, and overall per capita water consumption by 20-25%.

#### Definitions

- *Potable water*: Water that meets drinking water quality standards and is approved for human consumption by the authority having jurisdiction.

#### Strategies

- Use subsurface drip irrigation for trees to eliminate moisture losses due to evaporation.
- Specify a variety of drought tolerant plants in landscaping.
- Mulch planting beds to 50 mm depth to reduce loss of water by evaporation.
- Place plant communities with similar water regimes in common zones and match irrigation equipment and regimens with plant community requirements.

#### Resources

- *Waterbucket.ca*: The Waterbucket.ca website is the vehicle for communicating a water sustainability action plan for British Columbia, and includes a range of resources promoting water efficient planning and irrigation technologies.  
Site: [www.waterbucket.ca](http://www.waterbucket.ca)
- *Irrigation Industry Association of British Columbia*: The IIABC fosters and promotes information exchange on a range of issues related to irrigation in BC.  
Site: <http://www.irrigationbc.com/>
- *Print Media*: BC Trickle Irrigation Manual. BC Ministry of Agriculture and Food. April 1999 Edition.
- *Print Media*: *LEED Canada-NC Version 1.0*: Information and resources for Water Efficiency Credit 1, 'Water Efficient Landscaping'.

#### Documentation: *Submit at the Building Permit phase*

- Letter signed by Landscape Architect indicating the requirements will be met, including a description of the irrigation system.

## **WE MANDATORY**

### WE Credit M2: Low-Flush Toilets Mandatory

#### **Requirement**

Specify and install high efficiency 4.8 L per flush (1.28 gal) single flush toilets or 3.4/6 L per flush (0.9gal/1.6gal) dual flush toilets for all water closets.

#### **Intent**

To reduce potable water use associated with toilet flushing.

#### **Rationale**

Toilets that use less water reduce sewage treatment costs and help to defer the costs of building additional infrastructure.

#### **Definitions**

*High efficiency toilets:* High efficiency toilets use 4.8 L of water per flush or lower

*Dual flush toilets:* Dual flush toilets include two flush options, one for lighter needs (approximately 3.4 L or less) and another for heavier needs (approx. 6 L or less).

#### **Strategies**

Consult with suppliers and builders to identify models that perform well. CSA and Warnock Hersey labels ensure the toilet model has passed performance and maintenance tests.

Consider pressure assisted and vacuum assisted models as they generally improve the flushing performance of low flush toilets.

Ensure water pressure at the toilet will be adequate for the specified toilet type: pressure assisted tanks require higher water pressure than gravity fed tank toilets.

Ensure the flush mechanism is properly adjusted and commissioned to deliver the appropriate amount of water per flush.

Slope drain lines adequately to ensure there is no sludging.

- *Advanced Buildings Technologies and Practices:* Advanced Buildings provides an overview of technologies and practices that improve the energy and resource efficiency of commercial and multi-unit residential buildings.

Site: [http://www.advancedbuildings.org/low\\_flow\\_toilet.html](http://www.advancedbuildings.org/low_flow_toilet.html)

*Metro Vancouver Residential Water Conservation:* Metro Vancouver's Water Conservation program provides guidance to residential, commercial and industrial water users on water conservation.

Site: <http://www.metrovancouver.org/services/water/conservation/Pages/residential.aspx>

#### **Documentation: Submit at the Building Permit phase**

Letter signed by Mechanical Engineer declaring that the requirements will be met, including identification of specific fixtures used and flow rate.

- Cut sheet from the manufacturer indicating flow rate.

## WE MANDATORY

WE Credit M2M3: Low-Flow Faucet Aerators

Mandatory

### Requirement

Specify and install low-flow faucets with aerators in all bathroom sinks (max. 3.8 L per minute) *and* in all kitchen sinks (max. 6.8 L per minute).

### Intent

To reduce potable water use associated with faucet use.

### Rationale

According to the GVRD, approximately 14% of water used in residential buildings is from bathroom and kitchen faucets. Faucets that use less water reduce demand, which helps to reduce treatment costs and defer future costs of building additional infrastructure.

### Definitions

- *Low-flow faucet*: A faucet that is designed to use less water than conventional faucets.
- *Aerator*: Aerators restrict water flow at the outlet without reducing water pressure by mixing air into the water stream.
- *Potable water*: Water that meets drinking water quality standards and is approved for human consumption by the authority having jurisdiction.

### Strategies

- Consult with local suppliers to identify appropriate low-flow faucets with the required performance ratings for all bathroom and kitchen sinks.

### Resources

- ~~*Metro Vancouver Residential Water Conservation: Metro Vancouver's Water Conservation program provides guidance to residential, commercial and industrial water users on water conservation.*~~  
~~*Site: <http://www.metrovancouver.org/services/water/conservation/Pages/default.aspx>*~~
- ~~*BC Hydro: Through the Power Smart at Home program, BC Hydro provides resources on a wide range of energy saving strategies, including installing aerators.*~~  
~~*Site:*~~

### Documentation: *Submit at the Building Permit phase*

- Letter signed by Mechanical Engineer or responsible party declaring that the requirements will be met, including identification of specific fixtures used and flow rate.
- Cut sheet from the faucet manufacturer indicating flow rate.

## WE MANDATORY

WE Credit M3M4: Low-Flow Showerheads

Mandatory

### Requirement

Specify and install water-saving showerheads with a maximum flow rate of 8.5 L per minute in each shower.

### Intent

To reduce energy use associated with hot water heating for showers.

### Rationale

According to Natural Resources Canada, domestic hot water heating accounts for approximately 26% of residential energy demand in BC. Low-flow showerheads use less than 9 L of water per minute, a 50% reduction in water use as compared to conventional showerheads.

### Definitions

- *Low-flow showerheads*: Low-flow showerheads use 8-9L of water or less per minute, approximately half the water of a traditional showerhead, while maintaining the same water pressure.

### Strategies

- Consult with suppliers and builders to identify features or specific models of water-saving showerhead that meet the performance criteria.
- Not all low-flow showerheads perform equally well. Select manufacturers and models that have performed well in residential applications in the past.

### Resources

- *BC Hydro*: With its *Power Smart at Home* program, BC Hydro provides resources on a wide range of energy saving strategies, including installing low-flow showerheads.

Site: <https://www.bchydro.com/powersmart/residential/savings-and-rebates/do-it-yourself-and-save/install-water-saving-showerheads-aerators.html>[http://www.bchydro.com/powersmart/residential/guides\\_tips/green-your-home/water\\_guide/low\\_flow\\_shower.html](http://www.bchydro.com/powersmart/residential/guides_tips/green-your-home/water_guide/low_flow_shower.html)

~~*Metro Vancouver Residential Water Conservation*: Metro Vancouver's Water Conservation program provides guidance to residential, commercial and industrial water users on water conservation.~~

Site: ~~<http://www.metrovancouver.org/services/water/conservation/Pages/residential.aspx>~~

### Documentation: *Submit at the Building Permit phase*

- Letter signed by Mechanical Engineer or responsible party declaring that the requirements will be met, including identification of specific faucets used and flow rate.
- Cut sheet from the manufacturer indicating flow rate.

## WE MANDATORY

WE Credit M4M5: Energy Star ~~Dishwashers and~~ Clothes washers

Mandatory

### Requirement

Specify and install Energy Star-labelled ~~dishwashers and~~ clothes washers in each unit or specify and offer only Energy Star models if these appliances are optional.

### Intent

To reduce water and use associated with the use of ~~dishwashers and~~ clothes washers.

### Rationale

Appliance use represents one of the largest single end-uses in residential buildings. Energy Star qualified ~~dishwashers and~~ clothes washers reduce residential water and energy demand, operating costs, and environmental impacts.

### Definitions

- *Energy Star*: The Energy Star symbol designates appliances that are among the most efficient in the marketplace. Requirements vary from one category to another, but typically an Energy Star model must be at least 20 percent more efficient than a conventional model.

### Strategies

- Refer to NRCAN's Energy Star appliance directory to identify qualifying ~~dishwasher and refrigerator clothes washer~~ makes and models or,
- Refer to NRCAN's current Energy Star key product criteria to identify non-Energy Star-labelled clothes washer models of equivalent energy efficiency.

### Resources

- *Energy Star*: Natural Resources Canada and the Office of Energy Efficiency provide information on the program. The Energy Star appliance directory includes a comprehensive listing of the most energy efficient appliances in the market. See links below ~~to~~ Energy Star qualified model lists for ~~dishwashers and~~ clothes washers.

Site: <http://oee.nrcan.gc.ca/residential/10759>

~~Dishwashers: <http://oee.nrcan.gc.ca/pml-imp/index.cfm?action=app.search-recherche&appliance=DISHWASHERS>~~

- *Clothes Washers:*  
<http://oee.nrcan.gc.ca/pml-imp/index.cfm?action=app.search-recherche&appliance=CLOTHESWASHERS>
- *Clothes Washers key product criteria:*  
[https://www.energystar.gov/products/appliances/clothes\\_washers/key\\_product\\_criteria](https://www.energystar.gov/products/appliances/clothes_washers/key_product_criteria)

### Documentation: *Submit at the Occupancy Permit phase*

- Letter signed by Architect or responsible party declaring that the requirements will be met.
- Cut sheet from the manufacturer of the Energy Star labelled or equivalent ~~appliances clothes washers~~ that will be installed.
- Supporting documentation to prove that any non-Energy Star-labelled clothes washers installed meet the Energy Star key product criteria.

## WE 1 – WATER EFFICIENT LANDSCAPING

### WE Credit 1.1: Reduce Potable Water Use

3 points

#### Requirement

Reduce potable water use for site irrigation needs by 50% from the calculated midsummer baseline consumption.

### WE Credit 1.2: Eliminate Potable Water Use

3 points

#### Requirement

Eliminate potable water use for site irrigation needs.

#### Intent

To reduce or eliminate the use of potable water for landscape irrigation.

#### Rationale

While water seems plentiful in BC's Lower Mainland, the issue of water supply and water quality is becoming increasingly critical. Capturing rainwater and designing landscapes to use water more efficiently assists in reducing demand and the impact on existing infrastructure.

#### Definitions

- *Potable water:* Water that meets drinking water quality standards and is approved for human consumption by the authority having jurisdiction.
- *Rainwater cisterns:* Cisterns are water collectors commonly used in homes in locations with less access to public water systems like on the BC Gulf Islands, where water scarcity is a frequent issue.

#### Strategies

- Provide collection systems to collect rainwater run-off from roofs, to be used in a landscape irrigation system with cisterns and pumps.
- Use captured rainwater to feed any on-site water features.

#### Resources

- *Advanced Buildings Technologies and Practices:* Advanced Buildings provides an overview of cisterns and rainwater harvesting systems.  
Site: <http://www.advancedbuildings.org/cisterns.html>
- *Waterbucket.ca:* The Waterbucket.ca website includes a range of resources promoting water efficient planning and irrigation technologies.  
Site: [www.waterbucket.ca](http://www.waterbucket.ca)
- *Irrigation Industry Association of British Columbia:* The IIABC fosters and promotes information exchange on a range of issues related to irrigation in BC. See "Standards for Landscape Irrigation Systems."  
Site: <http://www.irrigationbc.com/page/standards>

#### Documentation: *Submit at the Building Permit phase*

- Letter signed by Landscape Architect declaring that the requirements will be met, including a description of system and calculations to verify the claim of 50% or more reduction in potable water for irrigation.

## WE 2 – WATER USE REDUCTION

### WE Credit 2.1: Low-Flow Showerheads

2 points

#### Requirement

Specify and install low-flow showerheads (max. 5.7 L per minute) in each unit.

#### Intent

To reduce water and energy use associated with residential showers.

#### Rationale

According to Natural Resources Canada, domestic hot water heating accounts for approximately 26% of residential energy demand in BC.

#### Definitions

- *Low-flow showerheads:* Low-flow showerheads use 5-9L of water or less per minute, approximately half the water of a traditional showerhead, while maintaining the same water pressure.

#### Strategies

- Consult with suppliers and builders to identify features or specific models of water-saving showerhead that meet the performance criteria.
- Not all low-flow showerheads perform equally well. Select manufacturers and models that have performed well in residential applications in the past.

#### Resources

- *BC Hydro:* With its *Power Smart at Home* program, BC Hydro provides resources on a wide range of energy saving strategies, including installing low-flow showerheads.

Site: <https://www.bchydro.com/powersmart/residential/savings-and-rebates/do-it-yourself-and-save/install-water-saving-showerheads-aerators.html><http://www.bchydro.com/powersmart/residential/guides-tips/green-your-home/water-guide/low-flow-shower.html>

- ~~*Metro Vancouver Residential Water Conservation:* Metro Vancouver's Water Conservation program provides guidance to residential, commercial and industrial water users on water conservation.~~

Site: <http://www.metrovancouver.org/services/water/conservation/Pages/residential.aspx>

#### Documentation: *Submit at the Building Permit phase*

- Letter signed by Mechanical Engineer or responsible party declaring that the requirements will be met, including identification of specific showerheads used and flow rate.
- Cut sheet from the manufacturer indicating flow rate.

## WE 2 – WATER USE REDUCTION

### WE Credit 2.2: Water Efficient Dishwashers

1 point

#### Requirement

Specify and install water-efficient dishwashers that use  $\leq 11$  L (2.91 gal) per normal wash cycle or if dishwashers are available only as an option, specify and offer only models complying to this standard.

#### Intent

To reduce potable water use associated with dishwashers.

#### Rationale

According to the GVRD, approximately 2% of water used in residential buildings is used in dishwashers. 80% of the energy required to operate a dishwasher is used to heat water, so dishwashers that use the least water are also the most energy efficient. Dishwashers that use 15L or less represent approximately the top 50% of Energy Star rated dishwashers on the market.

#### Definitions

- *Water efficient dishwasher:* dishwashers that use less water (and energy) than conventional dishwashers.
- *Potable water:* water that meets drinking water quality standards and is approved for human consumption by the authority having jurisdiction.

#### Strategies

- Use Natural Resource Canada's on-line EnerGuide appliance directory to identify models that meet the performance requirement.
- Specify water efficient dishwashers in all tender documents, and consult with local suppliers and installers on which models work best.

#### Resources

- *Energy Star:* Natural Resources Canada and the Office of Energy Efficiency provide a searchable database of dishwashers.

Site: <http://oee.nrcan.gc.ca/pml-imp/index.cfm?action=app.search-recherche&appliance=DISHWASHERS>

- *Energy Star:* Natural Resources Canada and the Office of Energy Efficiency provide information on the program. The Energy Star appliance directory includes a comprehensive listing of the most energy efficient appliances in the market.

Site:

<http://oee.nrcan.gc.ca/residential/10759><http://oee.nrcan.gc.ca/energystar/english/consumers/index.cfm?attr=0>

#### Documentation: *Submit at the Occupancy Permit phase*

- Letter signed by Architect or responsible party declaring that the requirements have been met.
- Cut sheet from the manufacturer of the dishwasher indicating water use per cycle.

## WE 2 – WATER USE REDUCTION

### WE Credit 2.3: Most Efficient Clothes Washers

2 points

#### Requirement

Specify and install Energy Star clothes washers listed as “Most Efficient” (for the year in which the Building Permit is received) or if washers are available only as an option, specify and offer only models complying to this standard

#### Intent

To reduce potable water use associated with clothes washers.

#### Rationale

According to the GVRD, approximately 23% of water used in residential buildings is used in clothes washers. Clothes washers that use less water reduce demand, which helps to reduce water treatment costs and future costs of supplying additional infrastructure.

#### Definitions

- *Most Efficient clothes washers:* clothes washers that use less water (and energy) than conventional clothes washers and have been rated as Most Efficient by Energy Star.
- *Potable water:* water that meets drinking water quality standards and is approved for human consumption by the authority having jurisdiction.

#### Strategies

- Use Natural Resource Canada’s on-line EnerGuide appliance directory to identify models that meet the performance requirement.
- Consider front-loading clothes washers, which generally use much less water, soap, and energy than top-loading units.

#### Resources

- ~~Energy Star:~~ Natural Resources Canada and the Office of Energy Efficiency provide information on the program. The Energy Star appliance directory includes a comprehensive listing of the Most Efficient appliances in the market. ~~The 2017 list includes ls are separated into small washers (2.5 cu.ft. and smaller) and large washers (more than 2.5 cu.ft.) only, as seen in the links below.~~

- ~~Large Washer~~ EnergyStar Most Efficient Washers: <https://www.energystar.gov/most-efficient/me-certified-clothes-washers/> Small Washer: [http://www.energystar.gov/index.cfm?c=most\\_efficient.me\\_clothes\\_washers\\_sm](http://www.energystar.gov/index.cfm?c=most_efficient.me_clothes_washers_sm)

#### Documentation: *Submit at the Occupancy Permit phase*

- Letter signed by Architect or responsible party declaring that the requirements have been met.
- Cut sheet from the manufacturer of the clothes washer indicating Energy Star rating and water use per cycle.

## WE 2 – WATER USE REDUCTION

### WE Credit 2.4: Water Use Reduction Package

2 points

#### Requirement

Additional credit for achieving credits: WE 1.1, WE 2.2, WE 2.2 and WE 2.3.

#### Intent

To reduce potable water use associated with irrigation, showers, dishwashers and clothes washers.

#### Rationale

Approximately 53% of water used in residential buildings is used for toilet flushing, dishwashers and clothes washers combined. Fixtures and appliances that use less water reduce demand, which helps to reduce water treatment costs and future costs of supplying additional infrastructure.

#### Definitions

- *Potable water*: water that meets drinking water quality standards and is approved for human consumption by the authority having jurisdiction.

#### Strategies

- Specify the fixtures and appliances required for WE 2.1, WE 2.2 and WE 2.3.

#### Documentation: Submit at the Occupancy Permit phase

- Letter signed by Mechanical Engineer declaring that the credits requirements have been achieved.

## WE 3 – WATER METERING

### WE Credit 3.1 Domestic Hot Water Metering

3 points

#### Requirement

In units with central hot water, provide individual domestic hot water metering.

#### Intent

To encourage energy and water conservation by providing effective feedback to residents on hot water use.

#### Rationale

If suites are not individually metered, homeowners will not have clear idea of the amount of heated water they are using. Metering enables occupants to better understand their hot water usage patterns and to see the effectiveness of water saving strategies.

#### Strategies

- Consult with local suppliers to determine types of water meters commonly used in multi-unit residential applications.
- Consult with plumbing professionals for advice on locating the meters for easy access by meter readers or service personnel, which will depend on the type of meter that is selected.
- Consider installing meters with remote reading capability to reduce future operating costs, and facilitate the integration of future electronic billing systems.

#### Resources

- *Alliance for Water Efficiency*: The Alliance for Water Efficiency includes a resource study, "National Multifamily Submetering and Allocation Billing Program Study" which investigates submetering water utilities in various U.S. cities.

Site: <http://www.allianceforwaterefficiency.org/submetering.aspx>

- *National Environmental Services Centre*: NESC is located at West Virginia University and provides comprehensive information on water issues.

Site: [http://www.nesc.wvu.edu/futurewater/water\\_efficiency/resources.cfm](http://www.nesc.wvu.edu/futurewater/water_efficiency/resources.cfm)

#### Documentation: *Submit at the Building Permit phase*

- Letter signed by Mechanical Engineer declaring that requirements will be met
- Location and description of the metering system.

## WE 3 – WATER METERING

### WE 3.2: Cold Water Metering

2 points

#### Requirement

Provide individual cold water meters for all units.

#### Intent

To encourage water conservation by providing effective feedback to residents on water use.

#### Rationale

If suites are not individually metered, homeowners will not have clear idea of the amount of water they are using. Metering enables occupants to better understand their water usage patterns and to see the effectiveness of water saving strategies. Over 50% of Canadian municipalities are metered.

#### Strategies

- Consult with local suppliers to determine types of water meters commonly used in multi-unit residential applications.
- Consult with plumbing professionals for advice on locating the meters for easy access by meter readers or service personnel, which will depend on the type of meter that is selected.
- Consider installing meters with remote reading capability to reduce future operating costs, and facilitate the integration of future electronic billing systems.

#### Resources

- *Alliance for Water Efficiency*: The Alliance for Water Efficiency includes a resource study, "National Multifamily Submetering and Allocation Billing Program Study" which investigates submetering water utilities in various U.S. cities.  
Site: <http://www.allianceforwaterefficiency.org/submetering.aspx>
- *National Environmental Services Centre*: NESC is located at West Virginia University and provides comprehensive information on water issues.  
Site: [http://www.nesc.wvu.edu/futurewater/water\\_efficiency/resources.cfm](http://www.nesc.wvu.edu/futurewater/water_efficiency/resources.cfm)

#### Documentation: *Submit at the Building Permit phase*

- Letter signed by Mechanical Engineer declaring that requirements will be met.
- Location and description of the metering system.

## Energy & Atmosphere (EA)

### EA MANDATORY

#### EA Credit M1: Minimum Roof Insulation

Mandatory

#### Requirement

Design the roof assembly with a minimum insulation value of R-40 h-ft<sup>2</sup>·°F/Btu (7.04 °K-m<sup>2</sup>/W); for buildings with attic space and R-28 h-ft<sup>2</sup>·°F/Btu (4.93 °K-m<sup>2</sup>/W) for cathedral ceilings/flat roofs.

#### Intent

To control unwanted heat losses and gains by installing roof assemblies with improved thermal performance.

#### Rationale

Roof assemblies with higher R-values reduce unwanted energy gains and losses, promoting energy conservation and more comfortable indoor environments. Insulating with loose-fill fiberglass and cellulose or fiberglass batt insulation is relatively inexpensive; combined with a quality air barrier it reduces energy losses and minimizes condensation.

#### Definitions

- *R-value*: A measure of how well a material resists the passage of heat. The higher the R-value, the more effective the material is at keeping indoor environments warm in winter and cool in summer.
- *Air Barrier*: Air barriers prevent the passage of air through envelope assemblies. Airtight roof decks or roofing membrane serve as air barriers in roof assemblies.

#### Strategies

- Consult with a building envelope specialist to determine a combination of individual components that will deliver the required R-value. Consider installing full insulation thickness (using raised heel trusses), and wind barrier at eaves.
- Ensure the integrity of the air barrier by accommodating penetrations in the ceiling such as plumbing vent stacks, pot lights, partition walls, and electrical fixtures.

#### Resources

- ~~Manitoba R-2000 Home Program~~: The R2000 program provides details illustrating best practice strategies for high performance building envelope design. ~~The “Technical corner: Attics and Roofs” page provides basic information on insulation and air barriers. -~~  
Site: <https://www.nrcan.gc.ca/node/5089/http://www.r2000manitoba.com/technical.shtml>
- *Passive House*: Provides standards for extremely well insulated buildings for high performance buildings.  
Site : <http://www.passivehouse.ca/design-fundamentals>  
<http://www.passivhaustagung.de/PassiveHouseE/Passive-house-insulation.html>

#### Documentation: *Submit at the Building Permit phase*

- Letter signed by Architect declaring that the requirements will be met.
- Description and overall R-value of the roof assembly used.

## EA MANDATORY

### EA Credit M2: Minimum Exterior Wall Requirements

Mandatory

#### Requirement

Design the exterior insulated wall area with a minimum thermal resistance of **effective (overall)** R-15.6 h-ft<sup>2</sup>·°F/Btu (2.75 °K-m<sup>2</sup>/W) for above grade non-glazed wall areas, and R-7.5 h-ft<sup>2</sup>·°F/Btu (1.32 °K-m<sup>2</sup>/W) “continuous insulation” for below grade walls.

#### Intent

To control unwanted heat losses and gains by installing wall assemblies with improved thermal performance.

#### Rationale

Wall assemblies with higher R-values reduce unwanted heat gains and losses, promoting energy conservation and more comfortable indoor environments.

#### Definitions

- *Building envelope*: The assembly of exterior partitions of a building that enclose conditioned spaces, through which thermal energy may be transferred to or from the exterior unconditioned spaces.
- *R-value (nominal)*: R-value is the measure of thermal resistance, or how well a material resists the passage of heat. In construction terms.
- *Effective R-value*: Effective R-value is a measure of overall wall performance, accounting for the full wall assembly.

#### Strategies

- Consult with a building envelope specialist to determine a combination of individual components that will deliver the required effective R-value. Components and strategies may include optimizing depth and spacing of studs in the wall cavity for maximum thermal performance.
- Design wall assemblies that reduce unnecessary thermal bridging through framing or wall detailing.

#### Resources

- *Homeowner Protection Office*: The HPO is a provincial Crown corporation that was formed as a response to widespread problems with condominium construction in the coastal BC climate. The office provides information and support to residential consumers, as well as technical information on high quality envelope construction and a range of educational opportunities for builders.

Site: <https://www.bchousing.org/licensing-consumer-services> <http://www.hpo.bc.ca/>

- *American Society of Heating Refrigerating and Air Conditioning Engineers*: ASHRAE develops energy standards for worldwide use, including the 90.1-2010 standard, which specifies similar R-values for insulated walls. The standard is available through ASHRAE's website.

Site: <https://www.ashrae.org/>

#### Documentation: *Submit at the Building Permit phase*

- Letter signed by Architect declaring that the requirements will be met.
- Description and overall R-value of the wall/roof-assembly used.

## EA MANDATORY

### EA Credit M3: Minimum Floor Insulation

Mandatory

#### Requirement

Design floors above non-heated parkade areas with a minimum insulation value of R-30 h-ft<sup>2</sup>·°F/Btu (5.28 °K-m<sup>2</sup>/W) for framed floors and R-15.6 h-ft<sup>2</sup>·°F/Btu (2.75 °K-m<sup>2</sup>/W) for slab floors.

#### Intent

To control unwanted heat losses by installing floor assemblies with improved thermal performance above non-heated parkades.

#### Rationale

A lot of heat can be lost through the floors when livable space is built over an unheated parkade and is not adequately insulated. Floor assemblies with higher R-values reduce unwanted heat loss, promoting energy conservation and more comfortable indoor environments.

#### Definitions

- *R-value*: A measure of how well a material resists the passage of heat. The higher the R-value, the more effective the material is at keeping indoor environments warm in winter and cool in summer.

#### Strategies

- Consult with a building envelope specialist to determine a combination of individual floor components and strategies that will deliver the required R-value.
- Ensure that appropriate measures are taken to prevent air leakage between the headers and the foundation wall.
- Pay careful attention to ensure that all penetrations in the wall are properly sealed and insulated.
- Ensure that the vapor barrier is installed at the most appropriate point in the wall assembly relative to the dew point.

#### Resources

- *American Society of Heating Refrigerating and Air Conditioning Engineers*: ASHRAE develops energy standards for worldwide use, including the 90.1-2010 standard, which specifies similar R-values for floor insulation. The standard is available through ASHRAE's website.

Site: <https://www.ashrae.org/>

#### Documentation: *Submit at the Building Permit phase*

- Letter signed by Architect declaring that the requirements will be met.
- Description and overall R-value of the ~~floor~~ ~~roof~~ assembly used.

## EA MANDATORY

### EA Credit M4: Energy Efficient Windows

Mandatory

#### Requirement

Specify and install Energy Star-rated windows *or* windows with a maximum overall U-value of 0.35 Btu/hr-ft<sup>2</sup>-°F (2.0 W/m<sup>2</sup>-°K) for vinyl frames or 0.45 Btu/hr-ft<sup>2</sup>-°F (2.55 W/m<sup>2</sup>-°K) or less for aluminum frames.

#### Intent

To minimize uncontrolled heat loss and heat gain through the building's windows.

#### Rationale

Windows with higher thermal performance reduce uncontrolled heat loss and heat gain, which helps to reduce energy consumption and make indoor environments more comfortable. Energy Star qualified windows are distinguished from other windows by their superior insulating performance.

#### Definitions

- *U-value:* A measure of heat flow through any combination of materials, air layers and air spaces. Lower U-values indicate products that insulate better and slow the transfer of heat into and out of buildings.
- *Energy Star:* The Energy Star symbol designates products that are among the most energy efficient in the marketplace. Energy Star windows are qualified for their energy efficiency for each of four zones in Canada with specified U-values.

#### Strategies

- Use Natural Resource Canada's on-line Energy Star for windows program to identify models that qualify for use in the lower mainland.
- Check the BC Hydro Power Smart at Home Windows Rebate Program for availability of financial incentives to install Energy Star windows in new residential construction.

#### Resources

- *Office of Energy Efficiency (OEE):* Natural Resources Canada and the Office of Energy Efficiency provide comprehensive information on the Energy Star program for windows including qualifying criteria and lists of models, manufacturers and suppliers.  
Site: <http://www.nrcan.gc.ca/energy/products/categories/fenestration/13739>
- *BC Hydro Power Smart:* With its Power Smart at Home Windows Rebate Program, BC Hydro offers rebates for Energy Star labelled windows installed in single-family homes and multi-unit residential developments.  
Site: <https://www.bchydro.com/powersmart.html> <http://www.bchydro.com/>
- *American Society of Heating Refrigerating and Air Conditioning Engineers:* ASHRAE develops energy standards for worldwide use, including the 90.1-2010 standard, which is available through ASHRAE's website.  
Site: <https://www.ashrae.org/>

#### Documentation: *Submit at the Building Permit phase*

- Letter signed by Architect declaring that the requirements will be met.
- Shop drawing from manufacturer showing glazing system U-value or that windows are Energy Star-rated.

## EA MANDATORY

### EA Credit M5: Minimum Boiler Efficiency

Mandatory

#### Requirement

Specify and install hot water boilers with a minimum thermal efficiency of 84%/ AFUE of minimum 90% ~~or heat using District Energy.~~

#### Intent

To reduce energy use associated with space heating. The boilers installed should be designed to supply 100% of the building's thermal energy needs in a fashion that is District Energy Ready (see EA Credit M11).

#### Rational

According to Natural Resources Canada, space conditioning accounts for approximately 52% of residential energy demand in BC. Newer furnaces are available with combustion efficiencies ranging from 80% up to 97%, promoting energy conservation and reduced operating costs.

#### Definitions

- *Thermal Efficiency:* Thermal Efficiency is the most widely used measure of a commercial boiler and make-up air efficiency. It is based on the ratio of the amount of heat produced by the heating appliance, to the amount of fuel supplied to the appliance.
- *Annual Fuel Utilization Efficiency (AFUE):* AFUE is the most widely used measure of a furnace's heating efficiency. It is based on the ratio of the amount of heat actually delivered to your home, to the amount of fuel supplied to the furnace.

#### Strategies

- If residential sized appliances (boilers or furnaces) are used, specify and install units with minimum an AFUE of 90%
- Ensure that the heating appliance is properly sized for the application, as over-sizing (>25% over peak demand) is a major cause of short cycling and inefficiency.
- Ensure that chimney and flue vents are properly sized using locally approved vent pipe materials.

#### Resources

- *American Society of Heating, Refrigerating and Air-Conditioning Engineers:* In addition to developing and maintaining industry standards for HVAC&R systems (heating, ventilation, air conditioning and refrigeration) ASHRAE provides a wide range of educational materials for researchers and practitioners.

Site: [www.ashrae.org](http://www.ashrae.org)

#### Documentation: *Submit at the Building Permit phase*

- Letter signed by Mechanical Engineer declaring that the requirements will be met.
- Manufacturer's spec sheet showing minimum efficiency of installed equipment.

## EA MANDATORY

### EA Credit M6: Domestic Hot Water

Mandatory

#### Requirement

Specify and install gas DHW boilers with a minimum efficiency of 84% (mid-efficiency boiler) ~~or heat domestic hot water using District Energy.~~

#### Intent

To reduce energy use associated with domestic hot water heating.

#### Rationale

According to Natural Resources Canada, domestic hot water heating accounts for approximately 26% of residential energy demand in BC. DHW boilers that operate with higher efficiency promote energy conservation and reduced operating costs.

#### Definitions

- *Energy Factor*: The energy factor (EF) indicates a water heater's overall energy efficiency based on the amount of hot water produced per unit of fuel consumed over a typical day.
- *First Hour Rating (FHR)*: The first hour rating is the amount of hot water in US gallons the heater can supply per hour (starting with a tank full of hot water)

#### Strategies

- Ensure that minimum efficiency or energy factor requirement is met.
- Ensure proper sizing for DHW units in gallons per occupant, and only consider domestic hot water heaters with a first hour rating that matches peak hour demand.
- To reduce venting-related energy losses with gas-fired boilers, consider installing sealed-combustion units.
- For gas-fired DHW boilers, only consider units with electronic ignition and power draft systems.

#### Resources

- *American Council for an Energy-Efficient Economy (ACE3)*: ACE3 offers a number of water heating efficiency measures.

Site: <http://www.aceee.org/consumer/water-heating>

#### Documentation: *Submit at the Building Permit phase*

- Letter signed by Mechanical Engineer declaring that the requirements will be met.
- Manufacturer's spec sheet showing minimum efficiency of installed equipment.

## EA MANDATORY

### EA Credit M7: Energy Star Dishwashers and Refrigerators

Mandatory

#### Requirement

Specify and install Energy Star-labelled dishwashers *and* refrigerators in each unit.

#### Intent

To reduce energy consumption associated with the use of dishwashers and refrigerators.

#### Rationale

Appliance use represents one of the largest single end-uses in residential buildings. Energy Star qualified refrigerators reduce residential energy demand, operating costs, and environmental impacts.

#### Definitions

- *Energy Star*: The Energy Star symbol designates appliances that are among the most energy efficient in the marketplace. Requirements vary from one category to another, but typically an Energy Star model must be from 10 to 50 percent more efficient than a conventional model.

#### Strategies

- Refer to NRCAN's Energy Star appliance directory to identify qualifying dishwasher and refrigerator makes and models or,
- Refer to NRCAN's current Energy Star key product criteria to identify non-Energy Star-labelled appliances of equivalent energy efficiency.

#### Resources

- *Energy Star*: Natural Resources Canada and the Office of Energy Efficiency provide information on the program. The Energy Star appliance directory includes a comprehensive listing of the most energy efficient appliances in the market.  
Site: <http://www.nrcan.gc.ca/energy/products/energystar/12519>
- Refrigerators: <http://oee.nrcan.gc.ca/pml-lmp/index.cfm?action=app.search-recherche&appliance=REFRIGERATORS>
- Refrigerator key product criteria:  
[https://www.energystar.gov/products/appliances/refrigerators/key\\_product\\_criteria](https://www.energystar.gov/products/appliances/refrigerators/key_product_criteria)
- Dishwashers:  
<http://oee.nrcan.gc.ca/pml-lmp/index.cfm?action=app.search-recherche&appliance=DISHWASHERS>
- Dishwasher key product criteria:  
[https://www.energystar.gov/products/appliances/dishwashers/key\\_product\\_criteria](https://www.energystar.gov/products/appliances/dishwashers/key_product_criteria)
- *EnerGuide*: Natural Resources Canada and the Office of Energy Efficiency provide information on the program as well as energy and water consumption ratings of major appliances. See "Appliance Model Listings".  
Site: <http://oee.nrcan.gc.ca/energuide/home.cfm>

#### Documentation: *Submit at the Occupancy Permit phase*

- Letter signed by Architect or responsible party declaring that the requirements have been met.
- Cut sheet from the manufacturer of the Energy Star labelled or equivalent appliances that will be installed.
- Supporting documentation to prove that any non-Energy Star-labelled appliances installed meet the Energy Star key product criteria.
- ~~Cut sheet from the manufacturer indicating appliances are Energy Star labelled.~~

## EA MANDATORY

### EA Credit M8: Programmable Thermostats

Mandatory

#### Requirement

Specify and install programmable thermostats for at least the largest heating zone in each unit.

#### Intent

To reduce energy consumption associated with space heating.

#### Rationale

Programmable thermostats maintain a desired comfort level when a home is occupied, then enter an economizing mode at night and when the home is unoccupied. As peak heating or cooling only occurs when the home is occupied, programmable thermostats save energy and heating costs.

#### Definitions

- *Programmable thermostat:* A thermostat that senses room temperature and controls the HVAC system according to a pre-programmed schedule set by the homeowner. Some models are capable of accommodating different settings for every day of the week.

#### Strategies

- Programmable thermostats must have at least two different programming periods and at least four possible temperature settings to qualify.
- Consult with suppliers to identify models that are easy to use, and provide the homeowner with an operation manual.

#### Resources

- *BC Hydro:* With its *Power Smart at Home* program, BC Hydro provides resources on a wide range of energy saving strategies, including installing programmable thermostats.

~~Site: [http://www.bchydro.com/powersmart/residential/guides\\_tips/green\\_your\\_home/heating\\_guide/manage\\_thermostat.html](http://www.bchydro.com/powersmart/residential/guides_tips/green_your_home/heating_guide/manage_thermostat.html)~~ <https://www.bchydro.com/powersmart/residential/savings-and-rebates.html>

#### Documentation: *Submit at the Building Permit phase*

- Letter signed by Electrical engineer or responsible party declaring that the requirements will be met.
- Cut sheet from the manufacturer of the thermostat supplied and description of thermostat locations.

## EA MANDATORY

### EA Credit M9: Common Area Lighting

Mandatory

#### Requirement

Specify and install only non-incandescent lighting, such as fluorescent, compact fluorescent or LED, in common areas.

#### Intent

To reduce energy use associated with lighting in common areas.

#### Rationale

Approximately 95% of the energy used by incandescent bulbs produces heat rather than light. Compared with incandescent lighting, fluorescent and LED lighting produce significantly more light per watt of energy consumed. Non-incandescent bulbs also last a lot longer than incandescents: fluorescent bulbs last approximately 10 times longer, and LEDs approximately 25 times longer.

#### Definitions

- *Fluorescent and compact fluorescent lighting:* Fluorescent lighting produces light by fluorescing phosphors instead of heating a filament. Compact fluorescent lamps can be installed in most standard incandescent fixtures.
- *Light Emitting Diode (LED) lighting:* A display and lighting technology that produces visible light when an electrical current is applied to a semiconductor diode.

#### Strategies

- Specify safety signage that uses LED lighting.
- Look for LED fixtures that replace more common compact fluorescent fixtures, feature and exterior lights.
- Check with a local lighting supplier to determine the appropriate fixture and bulb type for common areas.
- Where compact fluorescent bulbs will be used, ensure that fixtures are either specially designed for or are compatible with compact fluorescent bulbs.

#### Resources

- *BC Hydro:* With its *Power Smart at Home* program, BC Hydro provides resources on a wide range of energy saving strategies and incentives.

Site: <https://www.bchydro.com/powersmart/residential/savings-and-rebates.html>  
[http://www.bchydro.com/powersmart/residential/guides-tips/green-your-home/lighting\\_guide/energy\\_efficient\\_lighting.html](http://www.bchydro.com/powersmart/residential/guides-tips/green-your-home/lighting_guide/energy_efficient_lighting.html)

#### Documentation: *Submit at the Building Permit phase*

- Letter signed by the Electrical Engineer declaring that the requirements will be met including a description of the common area lighting.

## EA MANDATORY

### EA Credit M10: Parkade and Corridor Lighting Controls

Mandatory

#### Requirement

Specify and install parkade and corridor lighting controls to automatically reduce the overall lighting level by at least 30% in a lighting zone when the zone is unoccupied.

#### Intent

To reduce energy use associated with lighting in parking areas and corridors.

#### Rationale

Occupancy sensors and dimming controls can reduce demand for lighting energy by 30 to 60% (depending on usage) over spaces that are continuously lit, due to the intermittent occupancy.

#### Definitions

- *Parkade Lighting*: Lighting designed to illuminate the underground parking areas and drives.
- *Corridor Lighting*: Lighting that illuminates the corridors of the building.
- *Occupancy Sensors*: Electrical sensors that detect occupancy and control lighting according to pre-set commands. The three types of occupancy sensors are passive infrared (PIR), ultrasonic, and hybrid or dual-technology sensors. The most common combination of sensor types is PIR and ultrasonic sensors.
- *Dimming Controls*: Electrical controllers that allow lighting output to vary depending on control sequences.

#### Strategies

- Install occupancy sensors to each lighting zone that turn off the zone when no occupancy is detected.
- Install dimming controls to lower all lamps to 70% or lower when the zone is unoccupied.
- Take caution to ensure that all lighting fixtures, ballasts, or lamps are suited for dimming, as some may not include these features.
- Consult with suppliers to determine the most appropriate type of occupancy sensor for a given parkade configuration, as well as the best location(s) for installation.
- Effectively coordinate lighting design to ensure safety is not compromised.

#### Resources

- *BC Hydro*: With its *Power Smart* program, BC Hydro provides resources on a wide range of energy saving strategies and incentives for lighting systems.

Site: <https://www.bchydro.com/powersmart/business/technologies-equipment/lighting-systems.html> <http://www.bchydro.com/powersmart/business/power-smart-tips/lighting-systems.html>

- *Lighting Controls Association*: The Lighting Controls Association published a two-part series on the lighting standards in ASHRAE 90.1-2010.

Part 1: <http://lightingcontrolsassociation.org/ashrae-releases-90-1-2010-part-1-design-scope-administrative-requirements/>

Part 2: <http://lightingcontrolsassociation.org/ashrae-releases-90-1-2010-part-2-lighting-controls/>

#### Documentation: *Submit at the Building Permit phase*

- Letter signed by the Electrical Engineer declaring that the requirements will be met.
- Identification of controlled and un-controlled parkade lighting wattage.

## EA MANDATORY

### EA Credit M11: Energy Modeling Workshop

2 points

#### Requirement

Model the energy performance of the building and hold a workshop with the design team, a representative from ~~Campus Sustainability~~Sustainability and Engineering, Campus & Community Planning and the contractor to evaluate the results and optimize the design of the project.

#### Intent

To reduce energy use associated with overall building operation and use.

#### Rationale

According to Natural Resources Canada, space conditioning and domestic hot water heating combined account for approximately 78% of residential energy demand in BC. Designing buildings to optimize energy usage promotes conservation and reduces operating costs.

#### Strategies

- Use commercial building energy analysis software or similar to model the building's design for code compliance and EUI.
- Consider applying to BC Hydro Power Smart New Construction for potential rebates associated with energy modeling.
- Use a building a simulation that is able to measure the impact of various design scenarios on capital and operating costs and provide rapid feedback to the design team and workshop participants.
- Consider creating bundles that combine various energy performance options in order identify and analyse the implication of various combinations for the final proposed design.

#### Resources

- *Natural Resources Canada Office of Energy Efficiency (OEE)*: The OEE offers assistance for the design and construction of new buildings that are more energy efficient than standard buildings built in Canada.  
Site: <http://www.nrcan.gc.ca/energy/efficiency/buildings/eenb/model/4055>  
Energy modeling software: <http://www.nrcan.gc.ca/energy/software-tools/7417>

#### Documentation: *Submit at the Building Permit phase*

- Minutes and results of the energy modeling workshop.

## **EA MANDATORY**

### **EA Credit M12: Commissioning**

**4 points**

#### **Requirement**

Contract a third party Commissioning Authority to develop and implement a commissioning plan for all major building energy systems and verify they are installed, calibrated and perform according to design intent.

#### **Intent**

To ensure that best practices in design are combined with best practices in construction.

#### **Rationale**

As a new homeowner takes occupancy of a building, they want to ensure that the green building in which they have invested their money has been constructed as designed. The Commissioning Authority, hired as a third party directly by the developer, helps to offer an unbiased quality control step in this development process. Additionally, commissioning has been found to significantly increase energy efficiency of the building.

#### **Definitions**

- Commissioning Authority: Professional hired by the developer to report that the construction and construction decisions meet the intent of the original design.
- Building Energy Systems: Any building system, including mechanical, electrical and controls, that impact the energy consumption of the building.

#### **Strategies**

- Engage a Commissioning Authority early in the project to develop a Commissioning Plan and ensure the commissioning requirements are properly covered.
- Mechanical and/or electrical Commissioning Agents will oversee their respective work and schedule. The Commissioning Authority will oversee the Commissioning Agents.
- Have the Authority review design drawings at each milestone (e.g. 30%, 50%, issued for construction), prior to the developer's approval.
- Employ the Authority to do multiple site reviews to catch any potential errors or oversights before correcting the mistake is costly.
- Have the Authority produce a final commissioning report prior to occupancy confirming that the Building's Energy Systems are installed and operating according to design.

#### **Resources**

- Natural Resources Canada: Commissioning for New Buildings: Information and resources for building commissioning, including energy system commissioning.  
Site: <http://www.nrcan.gc.ca/energy/efficiency/buildings/20679>
- Canada Standards Agency: CSA Standard Z320 is a national standard for building commissioning.  
Site: <http://shop.csa.ca/en/canada/building-systems/z320-11-r2016/inv/27032582011>
- LEED v 4 Building Design + Construction: New Construction: Information and resources for Fundamental Commissioning and Verification.  
Site: <https://www.usgbc.org/node/2612328?return=/credits/new-construction/v4>

#### **Documentation: Submit at the Building Permit phase**

- Commissioning Plan

#### **Documentation: Submit at the Occupancy Permit phase**

- Final commissioning report, detailing the final approvals and the project commissioning process.

**EA MANDATORY**

**EA – ENERGY EFFICIENCY TARGETS**

**Requirement**

Design and construct the building to meet BC Energy Step Code (ESC). The building design must meet mandatory or optional ESC Step targets, below, and meet the requirements of Section 10.2.3 of the BC Energy Step Code Regulation. The Energy Step Code includes energy targets and an air tightness testing requirement. REAP credits and points schedule are found below.

Building Envelop Airtightness Testing – An airtightness test meeting ASTM E779 or USACE Version 3 standard, as required by the Energy Step Code. This credit is mandatory. **2 points**

Energy Step Code Step 2 – 130 kWh/m<sup>2</sup>-yr (TEUI) and 45 kWh/ m<sup>2</sup>-yr (TEDI). This credit is mandatory. **6 points**

Energy Step Code Step 3 – 120 kWh/m<sup>2</sup>-yr (TEUI) and 30 kWh/ m<sup>2</sup>-yr (TEDI). This credit is optional. **8 points**

Energy Step Code Step 4 – 100 kWh/m<sup>2</sup>-yr (TEUI) and 15 kWh/ m<sup>2</sup>-yr (TEDI). This credit is optional. **15 points**

Passive House Energy Performance - Design and construct the building to conform to the Passive House Planning Package, version 9 or newer, meeting the requirements of Section 10.2.3.3 (3) of the Energy Step Code Regulation. This credit is optional.

**5 points**

**EA Credit M12 Points Table**

<u>Testing Requirement</u>	<u>Total Points</u>	<u>Mandatory/Optional</u>
<u>Airtightness Test</u>	<u>2</u>	<u>Mandatory</u>
<u>Energy Step Code Target</u>	<u>Total Points</u>	<u>Mandatory/Optional</u>
<u>Energy Step Code – Step 2</u>	<u>6</u>	<u>Mandatory</u>
<u>Energy Step Code – Step 3</u>	<u>14</u>	<u>Optional</u>
<u>Energy Step Code – Step 4</u>	<u>29</u>	<u>Optional</u>
<u>Passive House Energy Performance</u>	<u>34</u>	<u>Optional</u>

**Intent**

To reduce building total energy usage and thermal demand by ensuring that the designed energy performance meets a high standard.

**Rationale**

For construction at UBC, we are aiming for high performance energy performance, in order to fulfill the objectives of the UTown@UBC Community Energy & Emissions Plan. Traditionally, energy codes and standards have used energy costs as a proxy for energy performance. To improve building performance outcomes, energy use intensity targets were introduced into REAP Version 3.0. The Province of BC has introduced energy use intensity targets in the Energy Step Code, and this update aligns REAP Version 3.1 with Energy Step Code Targets.

## Definitions

- Total Energy Use Intensity (TEUI): The modelled amount of total energy used by a building, per unit of area, per year, expressed in kWh/(m<sup>2</sup>·year). It is determined as defined by the BC Energy Step Code Regulation
- Thermal Energy Demand Intensity (TEDI): Thermal energy demand intensity is the amount of annual heating energy needed to maintain a stable interior temperature, taking into account heat loss through the envelope and passive gains. It is calculated per unit of area of conditioned space per year, and expressed in kWh/(m<sup>2</sup>·year). It is determined as defined by the BC Energy Step Code Regulation.
- Airtightness Testing: Airtightness testing uses fans to pressurize a building and quantify air leakage rates under controlled conditions. Testing must meet the requirements of the BC Energy Step Code.
- Passive House: Passive House is an internationally recognized building standard that is a rigorous voluntary energy-based standard, resulting in buildings that consume up to 90 percent less heating and cooling energy than conventional buildings.
- Pro-rated EUI target for mixed use buildings (residential with commercial/retail): To obtain a prorated target for your development, apply to the UBC Sustainability and Engineering Green Building Manager.

## Strategies

Many strategies can be employed in order to meet Energy Step Code targets. Below are a few strategies that may be considered during design and construction as cost effective approaches to improve building energy performance.

- Improve airtightness, consider achieving Passive House level of airtightness (0.173 l/s-m<sup>2</sup>).
- Install LED lighting and occupancy sensors throughout the building.
- Improve envelope performance, consider utilizing pre-manufactured panelized wall systems.
- Utilize heat-recovery ventilation (HRV).

## Resources

- BC Energy Step Code Resources: The BC Energy Step Code website has resources for designers and builders on their website: <https://energystepcode.ca/>
- BC Energy Step Code Regulation: [http://www.bclaws.ca/civix/document/id/mo/mo/2017\\_m158](http://www.bclaws.ca/civix/document/id/mo/mo/2017_m158)
- City of Vancouver Energy Modelling Guidelines: <http://vancouver.ca/files/cov/energy-modelling-guidelines-v1.0.pdf>
- BC Housing Illustrated Guide to Achieving Airtight Buildings: <https://www.bchousing.org/research-centre/library/residential-design-construction/achieving-airtight-buildings>
- Passive House Canada Developer's Guide : <http://www.passivehousecanada.com/downloads/PHC-developers-guide.pdf>

## Documentation: Submit at the Building Permit phase

- Preliminary energy modeling report and UBC Energy Modeling Checklist.

## Documentation: Submit at the Occupancy Permit phase

- A letter signed by the Architect or Engineer declaring that the building design meets the requirements of Energy Step Code and that Energy Step Code targets have been met
- Final energy modeling report and UBC Energy Modeling Checklist
- Air tightness test results
- For the Passive House Energy Performance Credit, provide energy model documentation as required by Section 10.2.3.3 (3) of the Energy Step Code Regulation.

## EA TARGETS – BUILDING ENERGY EFFICIENCY

### EA GOLD

6 points

#### Requirement

Design the building to meet a maximum energy use intensity (EUI) of 160 kWh/m<sup>2</sup>/yr, demonstrated using the UBC Energy Modeling Guidelines. This credit is mandatory and required for achievement of REAP Gold.

#### Intent

To reduce building energy usage by ensuring that the designed energy performance meets a high standard.

#### Rationale

Traditionally, energy codes and standards have used energy/utility costs as a proxy for energy performance. This system is designed for a wide variety of building types that are located in various climates. For construction at UBC, we are aiming for high performance energy performance, in order to fulfill the objectives of the UTown@UBC Community Energy & Emissions Plan. In an effort to affect the building performance more specifically, energy use intensity targets have been introduced into REAP.

#### Definitions

- **Energy Use Intensity (EUI):** Energy use intensity is the measure of the buildings annual energy use per unit of floor area. For the purposes of REAP, this is considered the modeled energy performance, normalized for weather, and reported in kWh/m<sup>2</sup>/year

#### Strategies

In general, passive design strategies should be considered first, as they are often the best combination of performance and cost.

- Reduce the amount of exterior glazing, keeping the ratio of glazing to 40-50% of the wall area.
- Install double pane windows with argon fill and warm edge spacers.
- Install passive heat recovery on the wastewater system.
- Perform air leakage tests and reduce the leakage rate to less than 0.4 cfm/m<sup>2</sup> of building enclosure area.

#### Resources

- **City of Vancouver:** The City of Vancouver published a Passive Design Toolkit.

Site:

- [http://vancouver.ca/home\\_property\\_development/energy\\_and\\_water\\_efficient\\_building\\_design.aspx](http://vancouver.ca/home_property_development/energy_and_water_efficient_building_design.aspx)

- **UBC Energy Modeling Guidelines:** UBC developed an Energy Modeling Guideline document that includes best practice procedures for energy modelers.

#### Documentation: *Submit at the relevant Permit phase*

- **Development Permit:** Preliminary energy use that is targeted for the development. This performance level is required for the development to be certified REAP Gold.
- **Building Permit:** Preliminary Energy Modeling Checklist.
- **Occupancy Permit:** Final Energy Modeling Checklist, summary output from the energy model, and a letter signed by the Architect or Engineer declaring that the requirements have been met.

## EA TARGETS — BUILDING ENERGY EFFICIENCY

### EA GOLD PLUS Energy Step Code Step 3

8 points

#### Requirement

Design the building to meet a maximum energy use intensity (EUI) of 140 kWh/m<sup>2</sup>/yr, demonstrated using the UBC Energy Modeling Guidelines BC Energy Step Code Step 3 (120 kWh/m<sup>2</sup>-yr (TEUI) and 30 kWh/m<sup>2</sup>-yr (TEDI)). The building design must meet the requirements of Section 10.2.3 of the BC Energy Step Code Regulation. This credit is required for achievement of REAP Gold PLUS, but may also be used toward achieving a lower certification.

#### Intent

To reduce building total energy usage and thermal demand by ensuring that the designed energy performance meets a high standard.

#### Rationale

Traditionally, energy codes and standards have used energy/utility costs as a proxy for energy performance. This system is designed for a wide variety of building types that are located in various climates. For construction at UBC, we are aiming for high performance energy performance, in order to fulfill the objectives of the UTown@UBC Community Energy & Emissions Plan. Traditionally, energy codes and standards have used energy/utility costs as a proxy for energy performance. In an effort to affect To improve the building performance more specifically outcomes, energy use intensity targets have been were introduced into REAP Version 3.0. The Province of BC has introduced energy use intensity targets in the Energy Step Code, and this update aligns REAP Version 3.1 with Energy Step Code Targets.

#### Definitions

- Total Energy Use Intensity (TEUI): The modelled amount of total energy used by a building, per unit of area, over the course of a year, expressed in kWh/(m<sup>2</sup>-year). Energy use intensity is the measure of the buildings annual energy use per unit of floor area. For the purposes of REAP, this is considered the modeled energy performance, normalized for weather, and reported in kWh/m<sup>2</sup>/year. It is determined as defined by the BC Energy Step Code Regulation
- Thermal Energy Demand Intensity (TEDI): Thermal energy demand intensity is the amount of annual heating energy needed to maintain a stable interior temperature, taking into account heat loss through the envelope and passive gains. It is calculated per unit of area of the conditioned space over the course of a year, and expressed in kWh/(m<sup>2</sup>-year). It is determined as defined by the BC Energy Step Code Regulation.

#### Strategies

Many strategies can be employed in order to meet this target. Below are a few strategies that may be considered during design and construction in addition to those mentioned for REAP Gold Energy Step Code Step 2 energy performance.

- Ensure that thermal breaks in the envelope are minimized or eliminated (e.g. balconies, windows, etc.) Improve envelope and window thermal performance.
- Install hot and cold water metering in each suite.
- Consider LED lighting with dimming controls throughout the building.
- Achieve Passive House level of airtightness (0.173 l/s m<sup>2</sup>). Perform air leakage tests and reduce the leakage rate to less than 0.30 cfm/m<sup>2</sup> of building enclosure area.

#### Resources

- ~~Canada Mortgage and Housing Corporation: The CMHC's website includes a number of resources for reducing energy in multi-unit residential buildings.~~

~~Site: <http://www.cmhc-schl.gc.ca/en/inpr/bude/himu/waensati/index.cfm>~~

~~— BC Energy Step Code Resources:~~

~~— BC Energy Step Code Regulation: [http://www.bclaws.ca/civix/document/id/mo/mo/2017\\_m158](http://www.bclaws.ca/civix/document/id/mo/mo/2017_m158)~~

~~— BC Housing: BC Housing has Energy Step Code seminars, workshops and webinars covering best practices, up-to-date research and building code information for the construction and design of homes in B.C.~~

~~Site: <https://www.bchousing.org/research-centre/building-smart>~~

- ~~UBC Energy Modeling Guidelines: UBC developed an Energy Modeling Guideline document that includes best practice procedures for energy modelers.~~

**Documentation: *Submit at the relevant Permit phase***

- ~~**Building Permit:** Preliminary Energy Modeling Report and UBC Energy Modeling Checklist.~~
- ~~**Occupancy Permit:** Final Energy Modeling Report and UBC Energy Modeling Checklist, summary output from the energy model, and a letter signed by the Architect or Engineer declaring that the requirements have been met the building design meets the requirements of Energy Step Code Section 10.2.3 and that Energy Step Code Step 3 targets have been met~~
- ~~\_\_\_\_\_~~

## EA TARGETS — BUILDING ENERGY EFFICIENCY

### EA PLATINUM

10 points

#### Requirement

Design the building to meet a maximum energy use intensity (EUI) of 120 kWh/m<sup>2</sup>/yr, demonstrated using the UBC Energy Modeling Guidelines. This credit is required for achievement of REAP Platinum, but may also be used toward achieving a lower certification.

#### Intent

To reduce building energy usage by ensuring that the designed energy performance meets a high standard.

#### Rationale

Traditionally, energy codes and standards have used energy/utility costs as a proxy for energy performance. This system is designed for a wide variety of building types that are located in various climates. For construction at UBC, we are aiming for high performance energy performance, in order to fulfill the objectives of the UTown@UBC Community Energy & Emissions Plan. In an effort to affect the building performance more specifically, energy use intensity targets have been introduced into REAP.

#### Definitions

- **Energy Use Intensity (EUI):** Energy use intensity is the measure of the buildings annual energy use per unit of floor area. For the purposes of REAP, this is considered the modeled energy performance, normalized for weather, and reported in kWh/m<sup>2</sup>/year

#### Strategies

Many strategies can be employed in order to meet this target. Below are a few strategies that may be considered during design and construction in addition to those mentioned for lower energy performance credits.

- Install high performance triple pane windows with thermally non-conductive frames.
- Perform air leakage tests and reduce the leakage rate to less than 0.25 cfm/m<sup>2</sup> of building enclosure area.

#### Resources

- **Canada Mortgage and Housing Corporation:** The CMHC's website includes a number of resources for reducing energy in multi-unit residential buildings.
- **Site:** <http://www.cmhc-schl.gc.ca/en/inpr/budo/himu/waensati/index.cfm>
- **UBC Energy Modeling Guidelines:** UBC developed an Energy Modeling Guideline document that includes best practice procedures for energy modelers.

#### Documentation: *Submit at the relevant Permit phase*

- **Building Permit:** Preliminary Energy Modeling Checklist.
- **Occupancy Permit:** Final Energy Modeling Checklist, summary output from the energy model, and a letter signed by the Architect or Engineer declaring that the requirements have been met.

## EA TARGETS — BUILDING ENERGY EFFICIENCY

### EA PLATINUM PLUS

10 points

#### Requirement

Design the building to meet a maximum energy use intensity (EUI) of 105 kWh/m<sup>2</sup>/yr, demonstrated using the UBC Energy Modeling Guidelines. Achieve Passive House certification for the building, as defined in the Energy Step Code (refer to Section 10.2.3.3 (3)). The building design must also meet the requirements of Section 10.2.3 of the BC Energy Step Code Regulation. This credit is required for achievement of REAP Platinum Plus, but may also be used toward achieving a lower certification.

#### Intent

To reduce building energy usage by ensuring that the designed energy performance meets a high standard.

#### Rationale

Traditionally, energy codes and standards have used energy/utility costs as a proxy for energy performance. This system is designed for a wide variety of building types that are located in various climates. For construction at UBC, we are aiming for high performance energy performance, in order to fulfill the objectives of the UTown@UBC Community Energy & Emissions Plan. In an effort to affect the building performance more specifically, energy use intensity targets have been introduced into REAP.

#### Definitions

- Energy Use Intensity (EUI) Passive House: Passive House is an internationally recognized building standard that is a rigorous voluntary energy based standard, resulting in buildings that consume up to 90 percent less heating and cooling energy than conventional buildings. Energy use intensity is the measure of the buildings annual energy use per unit of floor area. For the purposes of REAP, this is considered the modeled energy performance, normalized for weather, and reported in kWh/m<sup>2</sup>/year

#### Strategies

Many strategies can be employed in order to meet this target. Below are a few strategies that may be considered during design and construction in addition to those mentioned for lower energy performance credits.

- Install high performance triple pane windows with thermally non-conductive frames.
- Perform air leakage tests and reduce the leakage rate to less than 0.2 cfm/m<sup>2</sup> of building enclosure area.
- Install heat recovery on the ventilation system, whether central or decentralized.

#### Resources

- Canada Mortgage and Housing Corporation: The CMHC's website includes a number of resources for reducing energy in multi-unit residential buildings.
- Site: <http://www.cmhc-schl.gc.ca/en/inpr/bude/himu/waensati/index.cfm>
  - UBC Energy Modeling Guidelines: UBC developed an Energy Modeling Guideline document that includes best practice procedures for energy modelers.

#### Documentation: *Submit at the relevant Permit phase*

- Building Permit: Preliminary Energy Modeling Checklist.
- Occupancy Permit: Final Energy Modeling Checklist, summary output from the energy model, and a letter signed by the Architect or Engineer declaring that the requirements have been met.

## EA 1 – ENERGY METERING

### EA Credit 1.1: Thermal Energy Sub-Metering

1 point

#### Requirement

Provide separate metering in individual units for measuring thermal energy consumption used for space heating.

#### Intent

To encourage efficient use of thermal energy for space heating, by providing effective feedback to residents.

#### Rationale

Individual metering will give homeowners a clear idea of the amount of thermal energy they are using throughout the year. Sub-metering offers an important means to educate users on the energy and cost implications of different activities and use patterns.

#### Definitions

#### Strategies

- Install thermal energy (BTU) meters to measure space heating in individual units.
- Consider ultrasonic meters, which are smaller and have improved performance over standard displacement meters. The "first in Canada" installation of ultrasonic meters in a vertical subdivision was at Polygon's Quilchena Park development in Vancouver.

#### Resources

- ~~*Advanced Buildings Technologies and Practices provides an overview of technologies and practices that improve the energy and resource efficiency of commercial and multi-unit residential buildings. The 'Load Management' section contains information on utility sub-metering.*~~

~~*Site: [http://www.sustainablebuilding.com/Advanced%20Buildings/Utility%20Sub-metering\\_files/main\\_t\\_load\\_utility\\_sub\\_metering.htm](http://www.sustainablebuilding.com/Advanced%20Buildings/Utility%20Sub-metering_files/main_t_load_utility_sub_metering.htm)*~~

#### Documentation: *Submit at the Building Permit phase*

- Letter signed by Mechanical Engineer declaring that the requirements will be met.

## EA 2 – RENEWABLE ENERGY SYSTEMS

### EA Credit 2.1: Future Renewable Electricity

1 point

#### Requirement

Pre-wire buildings and provide installation space for future use of photovoltaic technologies or other renewable electricity generation.

#### Intent

To encourage and recognize increasing levels of self-supply with renewable technologies, to reduce environmental impacts associated with fossil fuel energy use.

#### Rationale

Renewable energy systems can help to transform buildings from energy consumers to energy producers. As the technology and economics of renewable systems continues to improve, forward thinking developers are increasingly considering future adoption as a key part of building design.

#### Strategies

- Analyze the approximate exposed surface areas that could be used for future photovoltaic arrays in order to calculate their potential energy contribution.
- Consider roughing in conduit and pipe chases for potential PV collection areas during building construction in order to reduce future installation costs and disruption to the building.
- Consider discussing with BC Hydro the trade-offs between installing a net metering system as compared to amount of battery storage capacity required to operate the system.
- Consider using Natural Resource Canada's RETScreen renewable energy evaluation tool in order to assess the feasibility of PV installations in any region of Canada.
- Consider the use of fuel cells and provide a location and electrical connection suitable for an installation.

#### Resources

- *Solar Energy Society of Canada, Inc. (SESCI):* SESCO is a volunteer based, non-profit solar organisation, and carries breaking Canadian solar news, workshops and conferences.

Site: <http://sesci.org/> <http://www.sesci.ca/>

- *BC Hydro:* Contact BC Hydro for information on setting up a net metering interconnection agreement.

Site: <https://www.bchydro.com/work-with-us/selling-clean-energy/net-metering.html> [http://www.bchydro.com/energy-in-bc/acquiring-power/current\\_offerings/net\\_metering.html](http://www.bchydro.com/energy-in-bc/acquiring-power/current_offerings/net_metering.html)

- *RETScreen:* The RETScreen International Clean Energy Decision Support Centre assists public and private decision makers to effectively analyze and implement renewable energy projects.

Site: <http://www.retscreen.net/>

#### Documentation: *Submit at the Building Permit phase*

- Letter signed by Electrical Engineer declaring that the requirements will be met.
- Drawings showing wiring schematics.

## EA 2 – RENEWABLE ENERGY SYSTEMS

### EA Credit 2.2: Renewable Electrical Utilization

3 points

#### Requirement

Utilize renewable electricity for a portion of the building's electric supply.

#### Intent

To encourage and recognize increasing levels of onsite renewable technologies to reduce environmental impacts associated with fossil fuel energy use

#### Rationale

Renewable energy systems can help to transform buildings from energy consumers to energy producers.

#### Strategies

- Specify the use of PV-powered lighting where applicable such exterior landscapes and pathway lighting.
- Consider solar access when designing roofs, walls, windows and external shading devices intended for solar collection. A system that is well integrated building design generally offers the best economics and aesthetics.

#### Resources

- *The Canadian Solar Industries Association's (CanSIA)*: CanSIA's mission is to develop a strong, efficient, and professional Canadian solar industry, and offers current technical and product information.  
Site: <http://www.cansia.ca/>
- *Solar Energy Society of Canada, Inc. (SESCI)*: SESCO is a volunteer based, non-profit solar organisation, and carries breaking Canadian solar news, workshops and conferences.  
Site: <http://sesci.org/> <http://www.sesci.ca/>
- *RETScreen*: The RETScreen International Clean Energy Decision Support Centre assists public and private decision to effectively analyze and implement renewable energy projects.  
Site: <http://www.retscreen.net/>

#### Documentation: *Submit at the Building Permit phase*

- Letter signed by Electrical Engineer declaring that the requirements will be met.
- Specification sheet for technologies being installed.

## EA 2 – RENEWABLE ENERGY SYSTEMS

### EA Credit 2.3: Low Carbon District Energy Utilization

5 points

#### Requirement

~~Utilize low carbon, renewable energy through connection~~ Connect to the District Energy System for the building's thermal energy supply in preparation of transition to renewable energy in the future.  
~~(or be District Energy compatible).~~

#### Intent

To encourage and recognize increasing levels of community scale (District Energy) renewable technologies supply to reduce environmental impacts associated with fossil fuel energy use.

#### Rationale

Use of renewable energy as opposed to fossil fuel-based energy reduces GHG emissions and pollution of air and water. By 2024, the Neighbourhood District Energy System (NDES) plans to implement waste heat recovery from TRIUMP and/or the Wesbrook Place portion of the NDES as a renewable energy source.

#### Strategies

- Connect to a district energy system that utilizes renewable energy for its energy generation.

#### Resources

- *BC Climate Action Toolkit*: The BC Climate Action Toolkit includes resources and training on district energy systems.  
Site: <http://www.toolkit.bc.ca/tool/district-energy-systems>
- *RETScreen*: The RETScreen International Clean Energy Decision Support Centre assists public and private decision to effectively analyze and implement renewable energy projects.  
Site: <http://www.retscreen.net/>

#### Documentation: *Submit at the Building Permit phase*

- Letter signed by the Developer declaring requirements will be met.

## EA 3—COMMISSIONING

### EA Credit 3.1Mx: Commissioning

4 points

#### Requirement

Contract a third party Commissioning Authority to develop and implement a commissioning plan for all major building energy systems and verify they are installed, calibrated and perform according to design intent.

#### Intent

To ensure that best practices in design are combined with best practices in construction.

#### Rationale

As a new homeowner takes occupancy of a building, they want to ensure that the green building in which they have invested their money has been constructed as designed. The Commissioning Authority, hired as a third party directly by the developer, helps to offer an unbiased quality control step in this development process. Additionally, commissioning has been found to significantly increase energy efficiency of the building.

#### Definitions

- *Commissioning Authority:* Professional hired by the developer to report that the construction and construction decisions meet the intent of the original design.
- *Building Energy Systems:* Any building system, including mechanical, electrical and controls, that impact the energy consumption of the building.

#### Strategies

- Engage a Commissioning Authority early in the project to develop a Commissioning Plan and ensure the commissioning requirements are properly covered.
- Mechanical and/or electrical Commissioning Agents will oversee their respective work and schedule. The Commissioning Authority will oversee the Commissioning Agents.
- Have the Authority review design drawings at each milestone (e.g. 30%, 50%, issued for construction), prior to the developer's approval.
- Employ the Authority to do multiple site reviews to catch any potential errors or oversights before correcting the mistake is costly.
- Have the Authority produce a final commissioning report prior to occupancy confirming that the Building's Energy Systems are installed and operating according to design.
- 

#### Resources

*Natural Resources Canada: Commissioning for New Buildings: Information and resources for building commissioning, including energy system commissioning.*

*Site:* <http://www.nrcan.gc.ca/energy/efficiency/buildings/20679>

- *Canada Standards Agency: CSA Standard Z320 is a national standard for building commissioning.*

*Site:* <http://shop.csa.ca/en/canada/building-systems/z320-11-r2016/inv1/27032582011www.csa.ca>

— *Print Media: LEED v4 Building Design + Construction: New Construction Canada for New Construction and Major Renovations 2009: Information and resources for Fundamental Commissioning and Verification* EA Credit 3.

*Site:* <https://www.usgbc.org/node/2612328?return=/credits/new-construction/v4>

- **Documentation:**

- ~~Submit at Building Permit phase~~
- Commissioning Plan
- ~~Submit at the Occupancy Permit phase~~
- Final commissioning report, detailing the final approvals and the project commissioning process.

## EA 4 Mandatory — AIRTIGHTNESS

### EA Credit 4.1Mx: Building Envelope Airtightness Testing

2 points

#### Requirement

The building envelope shall be constructed so that the air change rate is not greater than 3.5 ACH50 when measured in accordance with CAN/CGSB 149.15 M86 (Determination of the Airtightness of Building Envelopes by the Fan Depressurization Method) A blower door airtightness test that is compliant with the BC Energy Step Code regulation will be completed. The airtightness test will be completed in accordance with ASTM E 779, "Standard Test Method for Determining Air Leakage Rate by Fan Pressurization", or USACE Version 3, "Air Leakage Test Protocol for Building Envelopes".

#### Intent

To encourage increased airtightness to save energy and to enhance building envelope durability.

#### Rationale

Historically 25%—40% of the heat loss from a typical building occurs because of air leakage, this percentage can undermine other energy efficiency strategies if not controlled. In addition, excessive air leakage across a building assembly can cause moisture to condense inside assemblies resulting in a reduced durability and the possibility of mould development.

Air barrier systems control air flow from conditioned to unconditioned spaces and must be installed in a continuous manner over the entire building enclosure to avoid any gaps.

No exterior assembly can be totally airtight, a small amount of leakage will always occur, this credit specifies a maximum allowable air infiltration.

#### Definitions

*An air barrier is any element that reduces the movement of air through a building enclosure.*

*The air barrier system is a combination of interconnected materials, flexible sealed joints and components of the building envelope that provide the airtightness of the building enclosure.*

Air Leakage Rate: A measure of the rate that air leaks through the building envelope per unit area of the building envelope, as recorded in L/(s·m<sup>2</sup>) at a 75 Pa pressure differential.

Air Changes per Hour at a 50 Pa Pressure Differential (ACH50): The number of times the full volume of air in the building exchanges in an hour when a building is at a specified pressure, different than the outdoor air pressure, as measured by a "blower door test". This measures the airtightness of the building (or how much air leaks through the building envelope).

#### Strategies

- Specify air barrier system to be continuous throughout the building paying attention to sealing transition between the walls and roof as well as the foundation and walls.
- Provide flexible seal at all moving joints.
- Design air barrier to withstand pressures that will be present in the building.
- 

#### Resources

- BC Energy Step Code Resources: <https://www2.gov.bc.ca/gov/content/industry/construction-industry/building-codes-standards/energy-efficiency/energy-step-code/resources>
- BC Energy Step Code Regulation:
- Information on R-2000 program requiring airtightness:  
Site: <http://oee.nrcan.gc.ca/residential/builders-renovators-trades/4350>

■ ~~Information about building air barrier systems.  
Site: <http://www.wbdg.org/resources/>~~

■ ~~Documentation:~~

~~*Submit at the Building Permit phase*~~

■ ~~Letter signed by the Developer stating that the requirements will be met.~~

■ ~~*Submit at Occupancy Permit phase*~~

■ ~~Provide documentation showing test results.~~

## EA 5—ENERGY MODELING

### EA Credit 5.1: Energy Modeling Workshop

2 points

#### Requirement

Model the energy performance of the building and hold a workshop with the design team, a representative from Campus Sustainability and the contractor to evaluate the results and optimize the design of the project.

#### Intent

To reduce energy use associated with overall building operation and use.

#### Rationale

According to Natural Resources Canada, space conditioning and domestic hot water heating combined account for approximately 78% of residential energy demand in BC. Designing buildings to optimize energy usage promotes conservation and reduces operating costs.

#### Strategies

- Use commercial building energy analysis software or similar to model the building's design for code compliance and EUI.
- Consider applying to BC Hydro Power Smart New Construction for potential rebates associated with energy modeling.
- Use a building simulation that is able to measure the impact of various design scenarios on capital and operating costs and provide rapid feedback to the design team and workshop participants.
- Consider creating bundles that combine various energy performance options in order to identify and analyse the implication of various combinations for the final proposed design.

#### Resources

- *Natural Resources Canada Office of Energy Efficiency (OEE):* The OEE offers assistance for the design and construction of new buildings that are more energy efficient than standard buildings built in Canada.

*Site:*

*Energy modeling software:*

#### Documentation: *Submit at the Building Permit phase*

- Minutes and results of the energy modeling workshop.

## Materials & Resources (MR)

### MR 1 – RECYCLED CONTENT AND REUSED MATERIALS

#### MR Credit 1.1: Reused Building Materials

2 points

##### Requirement

Use salvaged, refurbished, or reused materials for at least 5% of the total cost of building materials.

#### MR Credit 1.2: Reused Building Materials

2 points

##### Requirement

Use salvaged, refurbished, or reused materials for at least 10% of the total cost of building materials.

### Intent

To reduce the environmental impacts associated with manufacturing new building materials by reusing salvaged building materials.

### Rationale

Reuse of salvaged materials reduces demolition waste and avoids the environmental impact of extracting raw materials to manufacture new building materials.

### Strategies

- Establish communication between building stakeholders to identify opportunities to incorporate reused materials into the building design.
- Identify local sources for salvaged and refurbished materials and other materials available for reuse.
- Consider salvage materials such as beams and posts, flooring, paneling, doors and frames, cabinetry and furniture, brick, and decorative items.

### Resources

- *Building Materials Reuse Association*: BMRA is a non-profit organization that facilitates building deconstruction and reuse/recycling of recovered building materials.  
Site: <http://www.bmra.org/>
- *Print Media: LEED Canada for New Construction and Major Renovations 2009*: Information and resources for Materials and Resources Credit 3.

### Documentation: *Submit at the Occupancy Permit phase*

- Letter signed by Architect declaring that the requirements have been met.
- Total value of construction materials and total value of re-used building materials.

## MR 1 – RECYCLED CONTENT AND REUSED MATERIALS

### MR Credit 1.3: Recycled Content Materials

1 or 2 points

#### Requirement

Specify and use building materials with recycled content levels :

1. Common area carpet with minimum 25% recycled content
2. Drywall with minimum 15% recycled content
3. Batt insulation with minimum 40% recycled content
4. Doors contain minimum 15% recycled material
5. Concrete with minimum 20% fly ash content, excluding suspended slabs
6. Concrete with minimum 40% fly ash content, excluding suspended slabs
7. Cabinetry with minimum 20% recycled content
8. MDF products with minimum 50% recycled content

- Four out of eight recycled content items on list above - 1 point
- All eight recycled content items on list above - 2 Points

#### Intent

To reduce the environmental impacts associated with manufacturing new building materials by using products with recycled content.

#### Rationale

Use of materials with recycled content reduces the environmental impacts associated with extracting raw materials for use in the manufacture of new building materials.

#### Definitions

*Recycled content:* includes pre-consumer recycled content and post-consumer recycled content.

#### Strategies

- Begin to consider incorporating recycled content materials into the project in the early stages of design.
- Identify local sources for materials with recycled content, and support regionally produced recycled content products to reduce costs of transportation.
- Evaluate recycled content materials for durability and performance in order to ensure that recycled content materials perform well in terms of strength, maintenance, and lifetime.

#### Resources

- *Print Media: LEED Canada for New Construction and Major Renovations 2009:* Information and resources for Material & Resources Credit 4.

#### Documentation: *Submit at the Occupancy Permit phase*

- Letter signed by Architect declaring that the requirements have been met.
- Manufacturer's cut sheet for each material selected indicating recycled content.

## MR 2 – REGIONAL MATERIALS

### MR Credit 2.1: Regionally Manufactured Building Materials

1 point

#### Requirement

Use a minimum of 20% (by value) of building materials and products that are assembled or manufactured within a radius of 800 km (500 miles).

#### Intent

To foster sustainable regional economic development by increasing demand for building materials that are manufactured locally, and to reduce the environmental impacts associated with transporting materials over long distances.

#### Rationale

Motor vehicles are major energy consumers and sources of air, noise and water pollution. Transportation represents approximately 27% of total North American energy consumption and 70% of total petroleum consumption. Using materials that are extracted and processed locally reduce their embodied energy.

#### Definitions

- *Regionally Manufactured Building Materials:* Building materials and products that are assembled or manufactured within a radius of 800 km (500 miles). Building materials and products does not include electrical components, mechanical components, plumbing items, appliances or equipment.
- *Embodied Energy:* Embodied energy is the energy used in all of the processes associated with the construction of a building, from the extraction of raw materials, to product delivery. Embodied energy is a significant component of a building's lifecycle impact.

#### Strategies

- Establish a project goal for locally sourced materials and identify materials and suppliers that can achieve this goal.
- During construction, ensure that the specified local materials are installed and quantify the total percentage of regional materials installed.
- Set up a reporting and documentation system with sub-contractors and materials suppliers to collect and track required information.

#### Resources

- *Print Media: LEED Canada for New Construction and Major Renovations 2009:* Information and resources for Material & Resources Credit 5.

#### Documentation: *Submit at the Occupancy Permit phase*

- Letter signed by Architect declaring that the requirements have been met.
- Total value of building materials and total value of regionally manufactured materials.

## MR 2 – REGIONAL MATERIALS

### MR Credit 2.2: Regionally Sourced Building Materials

1 point

#### Requirements

Of the materials from Credit MR 2.1, use a minimum of 50% (by value) of building materials and products that are extracted, harvested or recovered (as well as assembled or manufactured) within a radius of 800 km (500 miles).

#### Intent

To foster sustainable regional economic development by increasing demand for building materials that are extracted and manufactured locally, and to reduce the environmental impacts associated with transporting materials over long distances.

#### Rationale

Motor vehicles are major energy consumers and sources of air, noise and water pollution. Transportation represents approximately 27% of total North American energy consumption and 70% of total petroleum consumption. Using materials that are extracted and processed locally reduce their embodied energy.

#### Definitions

- *Regionally Sourced Building Materials:* Building materials and products that are extracted, harvested, recovered, assembled or manufactured within a radius of 800 km (500 miles). Building materials and products does not include electrical components, mechanical components, plumbing items, appliances or equipment.
- *Embodied Energy:* Embodied energy is the energy used in all of the processes associated with the construction of a building, from the extraction of raw materials, to product delivery. Embodied energy is a significant component of a building's lifecycle impact.

#### Strategies

- Establish a project goal for locally sourced materials and identify materials and material suppliers that can achieve this goal.
- During construction, ensure that the specified local materials are installed and quantify the total percentage of local materials installed.
- Set up a reporting and documentation system with sub-contractors and materials suppliers to collect and track required information.

#### Resources

- *Print Media: LEED Canada for New Construction and Major Renovations 2009:* Information and resources for Material & Resources Credit 5.

#### Documentation: *Submit at the Occupancy Permit phase*

- Letter signed by Architect declaring that the requirements have been met.
- Total value of regionally manufactured materials and total value of those materials that are also regionally extracted, harvested, or recovered.

## MR 3 – CERTIFIED AND NON-ENDANGERED FOREST PRODUCTS

### MR Credit 3.1: Dimensional Lumber and Plywood

2 or 3 points

#### Requirement

Demonstrate that a minimum of 50% of the total value of dimensional lumber and plywood is certified in accordance with either:

- |                                     |          |
|-------------------------------------|----------|
| CSA Z809                            | 2 points |
| Or Forest Stewardship Council (FSC) | 3 points |

#### Intent

To support environmentally responsible, socially beneficial, and financially viable forest stewardship.

#### Rationale

Environmental impacts associated with much of conventional forest practices include soil erosion, stream sedimentation, habitat destruction, water and air pollution and waste generation. Wood certification is an important measure for demonstrating that sustainable forestry practices have been employed.

#### Definitions

- *Sustainable Forestry*: Forest management intended to meet long-term forest product needs while maintaining forest biodiversity.
- *Chain of Custody Certification*: A document used to verify compliance with FSC guidelines that tracks the movement of wood products from the forest to a vendor.
- *Independent Certifier*: An accredited third-party certifier that conducts independent audits on forest management and the chain of custody.

#### Strategies

- Research the availability of wood products that are available from FSC or CSA-certified sources.
- Develop a list of local vendors, suppliers and manufacturers that are FSC or CSA certified and establish product availability as early as possible.

#### Resources

- *Forest Stewardship Council (FSC)*: Certified products bear the FSC logo indicating that the FSC has verified that the wood has been harvested from forests that it deems as sustainably managed.  
Site: <https://ca.fsc.org/en-ca> <http://www.fsccanada.org/>
- *CSA Sustainable Forest Management Standards*: CSA SFM Z809 standards require forest companies to set in place a comprehensive management system.  
Site:  
[http://shop.csa.ca/en/canada/invt/27017442008?utm\\_source=bing&utm\\_medium=cpc&utm\\_term=CSA%20Z809&utm\\_content=Sustainable+Forest+Management&utm\\_campaign=ENV+General](http://shop.csa.ca/en/canada/invt/27017442008?utm_source=bing&utm_medium=cpc&utm_term=CSA%20Z809&utm_content=Sustainable+Forest+Management&utm_campaign=ENV+General)
- *Print Media: LEED Canada for New Construction and Major Renovations 2009*: Information and resources for Material & Resources Credit 7.

#### Documentation: *Submit at the Occupancy Permit phase*

- Letter signed by Architect declaring that the requirements have been met.
- Total value of lumber and plywood
- Total value of certified lumber and plywood used in the project and for FSC provide CoC documentation for each product.

## MR 3 – CERTIFIED AND NON-ENDANGERED FOREST PRODUCTS

### MR Credit 3.2: Hardwood or Bamboo Flooring

2 or 3 points

#### Requirement

Specify and install hardwood or bamboo flooring that is certified in accordance with either:

- |                                     |          |
|-------------------------------------|----------|
| CSA Z809                            | 2 points |
| Or Forest Stewardship Council (FSC) | 3 points |

#### Intent

To support environmentally responsible, socially beneficial, and financially viable forest stewardship as well as the use of rapidly renewable flooring materials.

#### Rationale

Using products made from rapidly renewable materials like bamboo or from certified hardwood encourages sustainable forest management practices.

#### Definitions

- *Sustainable Forestry*: Forest management intended to meet long-term forest product needs while maintaining forest biodiversity.
- *Chain of Custody Certification*: A document used to verify compliance with FSC guidelines that tracks the movement of wood products from the forest to a vendor.
- *Independent Certifier*: An accredited third-party certifier that conducts independent audits on forest management and the chain of custody.

#### Strategies

- Research the availability of bamboo flooring or hardwood flooring that is available from FSC or CSA-certified sources.
- Explore engineered hardwood flooring
- Contact vendors as early as possible to establish product availability.

#### Resources

- *Forest Stewardship Council (FSC)*: Certified products bear the FSC logo indicating that the FSC has verified that the wood has been harvested from forests that it deems as sustainably managed.  
Site: <https://ca.fsc.org/en-ca> <http://www.fsccanada.org/>
- *CSA Sustainable Forest Management Standards*: CSA SFM Z809 standards require forest companies to set in place a comprehensive management system.  
Site: [http://shop.csa.ca/en/canada/invt/27017442008?utm\\_source=bing&utm\\_medium=cpc&utm\\_term=CSA%20Z809&utm\\_content=Sustainable+Forest+Management&utm\\_campaign=ENV+General](http://shop.csa.ca/en/canada/invt/27017442008?utm_source=bing&utm_medium=cpc&utm_term=CSA%20Z809&utm_content=Sustainable+Forest+Management&utm_campaign=ENV+General)

*Print Media*: *LEED Canada for New Construction and Major Renovations 2009*: Information and resources for Material & Resources Credits 6 & 7.

#### Documentation: *Submit at the Occupancy Permit phase*

- Letter signed by Architect declaring that the requirements have been met.
- Manufacturer's cut sheet for each material selected indicating certification standard and for FSC provide CoC documentation for each product.

## MR 4 – BUILDING PRODUCTS INGREDIENTS

### MR Credit 4.1: Transparency of Ingredients

2 points

#### Requirement

Install ten different building products from three different manufacturers that evaluate and disclose ~~demonstrate~~ the chemical inventory of the product to an~~and~~ accuracy of 0.1%. For each product selected provide either:

- Health Product Declaration (HPD)
- Manufacturers Inventory of all ingredients by CAS number, or
- Declare Label (Living Building Institute)

#### Intent

To encourage transparency in the market place by requesting ingredients for building products. By encouraging early adopters the intent is to start moving towards building products that contain less potentially harmful chemicals

#### Rationale

Many building products contain ingredients that are detrimental to human health, some are regulated, but many are not. The intent is that by providing transparency of ingredients manufacturers will be encouraged to optimize their products and more avoid more hazardous chemicals.

#### Definitions

Health Product Declaration (HPD): is a building product “nutrition label” which reports health-related information. The EPD can be developed using an open standard which is available manufacturers for disclosure of product contents, emissions and health information. The standard is available at [www.hpd-collaborative.org](http://www.hpd-collaborative.org), [www.ppdcollaborative.org](http://www.ppdcollaborative.org)

#### Strategies

Contact manufacturers as early as possible to ask for documentation.

#### Resources

- [Perkins + Will Precautionary List: Includes suggestions for alternate products arranged by MasterFormat section.](http://www.transparency.perkinswill.com)  
Site: [www.transparency.perkinswill.com](http://www.transparency.perkinswill.com)
- [The Pharos Project: Building product library providing in depth information about product ingredients:](http://www.pharosproject.net)  
Site: [www.pharosproject.net](http://www.pharosproject.net)
- [Avoiding Toxic Chemicals in Commercial Building Projects: A Handbook of Common Hazards and How to Keep Them Out.](http://www.buildinggreen.com)  
Site: [www.buildinggreen.com](http://www.buildinggreen.com)

~~Suggestions for alternate products arranged by MasterFormat section.~~

~~Site: [Perkins + Will Precautionary List](http://www.transparency.perkinswill.com) [www.transparency.perkinswill.com](http://www.transparency.perkinswill.com)~~

~~Information about healthy building materials including HPD's.~~

~~Site: [Healthy Building Network](http://www.healthybuilding.net) [www.healthybuilding.net](http://www.healthybuilding.net)~~

~~Building product library providing in depth information about product ingredients:~~

~~Site: [The Pharos Project](http://www.pharosproject.net) [www.pharosproject.net](http://www.pharosproject.net)~~

~~Article: [Avoiding Toxic Chemicals in Commercial Building Projects: A Handbook of Common Hazards and How to Keep Them Out.](http://www.buildinggreen.com) [www.buildinggreen.com](http://www.buildinggreen.com)~~

#### Documentation: *Submit at the Occupancy Permit phase*

- Letter signed by Architect declaring that the requirements have been met, including a list of the chosen products.
- Documentation for each product.

## MR 4 – BUILDING PRODUCTS INGREDIENTS

### MR Credit 4.2: Optimization of Ingredients

2 points

#### Requirement

Demonstrate that a minimum of 10% (by value) of building materials are optimized for ingredient content by demonstrating optimization in one of the following ways:

- GreenScreen v1.2 benchmark 4 minimum
- Red List free
- Free of ingredients listed on REACH Authorization or Candidate List

#### Intent

Encourage the selection of building products that minimize the use or generation of harmful substances.

#### Rationale

#### Definitions

- *GreenScreen* is from the not profit Clean Production Action which divides chemicals into four benchmarks, the most hazardous being Benchmark 1.
- *Red List*: a list of chemicals developed by the Living Building Institute to be avoided in building products for use in Living Building Certification.
- *REACH Authorization*: used in legislation developed by the European Union in a broad mandate to evaluate all chemicals and impose restrictions based on their hazard profile.

#### Resources

~~*Red List, Living Building Challenge, the Red List provides a list of materials and chemicals that are detrimental to human health.*~~

- ~~*Site: <http://living-future.org/living-building-challenge/certification/documentation-requirements>*~~
- ~~*Red List, Living Building Challenge: the Red List provides a list of materials and chemicals that are detrimental to human health.*~~  
~~*Site: <https://living-future.org/declare/declare-about/red-list/>*~~
- *GreenScreen* provides list of hazardous materials.  
*Site: <https://www.greenscreenchemicals.org/http://www.cleanproduction.org/Green.Greenscreen.php>*
- *REACH authorization list.*  
*Site: <https://echa.europa.eu/authorisation-list>*  
*REACH candidate list*  
*Site: <https://echa.europa.eu/candidate-list-table><http://echa.europa.eu/web/guest/addressing-chemicals-of-concern/authorisation/recommendation-for-inclusion-in-the-authorisation-list/authorisation-list>*

#### Documentation: *Submit at the Occupancy Permit phase*

- Letter signed by Architect declaring that the requirements have been met.
- Documentation of optimized ingredient content for each product chosen.
- Total value of building materials and the total value of building materials optimized for ingredient content.

## Indoor Environmental Quality (IEQ)

### IEQ MANDATORY

IEQ Credit M1: Adhesives and Sealants

Mandatory

#### Requirement

Specify and use adhesives, sealants and sealant primers that ~~do not exceed the VOC limits of the Canadian Environmental Choice/are~~ EcoLogo ~~program certified~~ or do not exceed the VOC limits ~~specified~~ in the ~~State of California's~~ South Coast Air Quality Management District (SCAQMD) Rule #1168 ~~on the interior of the building.~~

#### Intent

To reduce the quantity of indoor air contaminants that are odorous or potentially irritating or harmful to the comfort and health of installers and occupants.

#### Rationale

Volatile organic compounds (VOCs) emitted from adhesives, sealants and paints based on polymers, solvents or plasticizers can compromise human health and the earth's atmosphere. VOCs contribute to both smog and poor indoor air quality.

#### Definitions

- *Volatile Organic Compounds (VOC)*: carbon-containing compounds that evaporate readily at room temperature.

#### Strategies

- Specify low-VOC adhesives, sealants, and sealant primers in construction documents, and ensure VOC limits are clearly stated in each section where these materials are addressed.
- Schedule field monitoring to ensure that only materials meeting the criteria are used.
- Review manufacturer's cut sheets for all adhesives, sealants and sealant primers to ensure they meet the criteria.

#### Resources

- ~~Environmental Choice Program/Ecologo~~: The EcoLogo is a registered trademark of Environment Canada and ~~is part of the Environmental Choice Program.~~ EcoLogo designates products that have met specific environmental performance criteria.

~~Site:~~ <https://services.ul.com/service/ecologo-certification/> ~~Site:~~ <http://www.ecologo.org/en/index.asp>

- ~~California~~ South Coast Air Quality Management District (SCAQMD): The District's Rule #1168 contains VOC limits for ~~adhesives, primers and sealers~~ in architectural applications.

~~Site:~~ <http://www.aqmd.gov/rules/rulesreg.html>

#### Documentation: *Submit at the Occupancy Permit phase*

- Letter signed by Architect declaring that the requirements have been met.
- Manufacturer's cut sheet indicating VOC content of all adhesives, sealants and sealant primers used in the project.

## IEQ MANDATORY

### IEQ Credit M2: Paints and Coatings

Mandatory

#### Requirement

Specify and use paints and coatings that carry an EcoLogo label or are rated at a minimum GPS-1 by the Master Painter's Institute on the interior of the building.

#### Intent

To reduce the quantity of indoor air contaminants that are odorous or potentially irritating or harmful to the comfort and health of installers and occupants.

#### Rationale

Paints and coatings contain organic and inorganic compounds or materials that may adversely impact human health and the atmosphere by releasing solvents or other toxic materials at various stages of the product life cycle.

#### Definitions

- *Low-Emitting Materials*: Materials containing compounds that do not evaporate at room temperature.
- *Volatile Organic Compounds (VOC)*: Carbon-containing compounds that evaporate readily at room temperature.

#### Strategies

- Specify low VOC paints and coatings in construction documents, and ensure specifications are clearly stated in each section where these materials are addressed.
- Schedule field monitoring to ensure that only paints and coatings meeting the criteria are used.

#### Resources

- *Master Painter's Institute*: The Institute provides information on the practical and technical aspects of paints and coatings and their professional application. The 'Specify Green' section contains the MPI "[Green Performance Rating Standard](#)" rating system for identifying low-emitting paints.  
Site: <http://www.paintinfo.com/>
- *Environmental Choice Program/Ecologo*: The EcoLogo is a registered trademark of Environment Canada and is part of the Environmental Choice Program. EcoLogo designates products that have met specific environmental performance criteria.  
Site: <https://services.ul.com/service/ecologo-certification/> - <http://www.ecologo.org/en/index.asp>

#### Documentation: *Submit at the Occupancy Permit phase*

- Letter signed by Architect declaring that the requirements have been met.
  - Manufacturer's cut sheet indicating VOC content of all paints and coatings used on the interior of the building.

## IEQ MANDATORY

### IEQ Credit M3: Carpet

Mandatory

#### Requirement

Specify and install carpet and carpet cushion that carry the following certifications: Carpet and Rug Institute Green Label Plus ~~or Ecologo certification.~~

#### Intent

To reduce the quantity of indoor air contaminants that are odorous or potentially irritating or harmful to the comfort and health of installers and occupants.

#### Rationale

Carpets are sources of volatile organic compounds (VOCs), dust, and fibre release.

#### Definitions

- *Volatile Organic Compounds (VOC)*: carbon-containing compounds that evaporate readily at room temperature.

#### Strategies

- Specify low-VOC carpets in construction documents.
- Ensure that VOC limits are clearly stated in each specification section where carpets are addressed.
- Tack in-suite carpets instead of gluing. Carpet in public/common areas should be adhered using low-VOC adhesives.

#### Resources

- *Carpet and Rug Institute Green Label Indoor Air Quality Test Program*: The program designates products that have been tested by an independent laboratory and have met criteria for very low emissions. The program covers: carpet, cushion and adhesives.

Site: <http://www.carpet-rug.com/>

~~*Environmental Choice Program/Ecologo*: The EcoLogo label is a registered trademark of Environment Canada and is part of the Environmental Choice Program. EcoLogo designates products that have met specific environmental performance criteria.~~

~~Site: <https://services.ul.com/service/ecologo-certification/> <http://www.ecologo.org/en/certifiedgreenproducts/>~~

#### Documentation: *Submit at the Occupancy Permit phase*

- Letter signed by Architect declaring that the requirements have been met.
- Certification documentation for products selected.

## IEQ MANDATORY

### IEQ Credit M4: Ventilation Effectiveness

Mandatory

#### Requirement

Prepare and implement an effective air management strategy that meets the requirements of the current versions of CAN/CSA F326 or ASHRAE-62.1 or 62.2 as applicable to the building configuration.

#### Intent

To remove indoor air contaminants such as moisture and odours from kitchens and bathrooms, and to ensure adequate levels of outdoor airflow.

#### Rationale

New construction techniques and materials have led to buildings that are more tightly built, making adequate ventilation all the more critical. Inadequate ventilation can lead to high humidity levels, and can cause combustion gases from unsealed heating equipment to be released into the building.

#### Strategies

- Consult ASHRAE 62.1, 62.1 or and CSA F326 for detailed design strategies that support ventilation system planning to promote healthy indoor air quality levels. The systems clearly define adequate levels of air changes per hour.
- Proper equipment sizing including air handlers, coils, ducting, and fans are key elements in the overall system design, and should supply the outdoor airflow requirements for each zone in the building.
- During the design phase, pay particular attention to system and equipment components that curb indoor air contaminants at their source such as HEPA filters.
- During the design phase, ensure that system components such as ducts, plenums, and coils are readily accessible for regular cleaning and maintenance.
- Avoid locating outdoor-air intakes near point sources of contaminants such as vehicle emissions, cooling tower drift, or flue vents.
- Ensure that indoor air contaminated by building functions such as copiers, chemical storage, or combustion processes is exhausted locally, and is not allowed to mix with indoor return air.

#### Resources

- *Canadian Standards Agency (CSA)*: The CSA standard details ventilation standards for buildings and can be found on their website.  
Site: <http://www.csagroup.org> <http://www.csa.ca/cm/ca/en/home>
- *American Society of Heating Refrigerating and Air Conditioning Engineers*: ASHRAE develops ventilation standards for worldwide use, including the ASHRAE 62 standard, which specifies ventilation standards for multi-unit residential buildings. The standard is available through ASHRAE's website.  
Site: <https://www.ashrae.org/>

#### Documentation: *Submit at the Building Permit phase*

- Letter signed by Mechanical Engineer declaring that the requirements will be met.
- Description of ventilation system and fresh air management strategies employed.

## IEQ 1 – LOW-EMITTING MATERIALS

### IEQ Credit 1.1: Low VOC Paints and Coatings

2 points

#### Requirement

Specify and use paints and coatings rated a minimum GPS-2 by the Master Painter's Institute on the interior of the building.

#### Intent

To reduce the quantity of indoor air contaminants that are odorous or potentially irritating or harmful to the comfort and health of installers and occupants.

#### Rationale

Paints and coatings contain organic and inorganic compounds or materials that may adversely impact human health and the atmosphere by releasing solvents or other toxic materials at various stages of the product life cycle.

#### Definitions

- *Low-Emitting Materials*: Materials containing compounds that do not evaporate at room temperature.
- *Volatile Organic Compounds (VOC)*: Carbon-containing compounds that evaporate readily at room temperature

#### Strategies

- Specify GPS-2 architectural and special purpose coatings that meet a minimum VOC limit of 50 g/L paints in construction documents. Ensure specifications are clearly stated in each section where paints are addressed.
- Schedule field monitoring to ensure that only paints and coatings meeting the criteria are used.
- If there is no alternative, and a small quantity of a coating that exceeds the GPS-2 VOC limit is used, use a VOC budget to demonstrate that the overall average of VOC in all coating products meets the 50 g/L limit.

#### Resources

- *Master Painter's Institute*: The Institute provides information on the practical and technical aspects of paints and coatings and their professional application. The 'Specify Green' section contains the MPI "Green Performance Rating Standard" system for identifying low-emitting paints. ~~he 'Specify Green' section contains the MPI rating system for identifying low-emitting paints.~~

Site: <http://www.paintinfo.com/>

#### Documentation: *Submit at the Occupancy* – *Permit phase*

- Letter signed by Architect declaring that the requirements have been met.
- Manufacturer's cut sheet indicating VOC content of all paints and coatings used on the interior of the building.
- Calculations of VOC budget showing that the total average of VOC in all coating products based in litres applied meets the GPS-2 VOC limit of 50 g/L.

## IEQ 1 – LOW-EMITTING MATERIALS

### IEQ Credit 1.2: Low-Emitting Composite Wood Products

2 points

#### Requirements

Specify and install interior composite wood products, such as flooring, doors, trim, etc., that are low emitting or have no added urea formaldehyde. Cabinetry is excluded ~~from~~ this credit.

#### Intent

To reduce the quantity of indoor air contaminants that are odorous or potentially irritating or harmful to the comfort and health of installers and occupants.

#### Rationale

Urea formaldehyde is a volatile organic compound (VOC) that a product can off-gas over its lifetime. The International Agency for Research on Cancer (IARC) considers formaldehyde a human carcinogen, a key factor in the material's implications for human health over the long-term. VOC's have short-term health implications as well, such as eye, nose and throat irritation, and headaches and nausea.

#### Definitions

- *Volatile Organic Compounds (VOC)*: Carbon-containing compounds that evaporate readily at room temperature.

#### Strategies

- Contact local suppliers early to determine availability of interior composite wood products that are urea-formaldehyde free.
- Ultra-low-emitting or no added formaldehyde resins are acceptable (as defined by the California Air Resources Board, Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products regulation).

#### Resources

- *Composite Panel Association and Composite Wood Council*: Provides comprehensive information on composite panel and wood.  
Site: <http://www.pbmdf.com/>
- *International Agency for Research on Cancer (IARC)*: The objective of the IARC is to promote international collaboration in cancer research.  
Site: <http://www.iarc.fr/>
- *Print Media: LEED Canada for New Construction and Major Renovations 2009*: Information and resources for Indoor Environment Quality Credit 4.4.

#### Documentation: *Submit at the Occupancy Permit phase*

- Letter signed by Architect declaring that the requirements have been met.
- Manufacturer's cut sheet indicating each interior composite wood product contains no added urea formaldehyde.

## IEQ 1 – LOW-EMITTING MATERIALS

### IEQ Credit 1.3: Low-emitting Insulation

2 points

#### Requirements

Specify and install formaldehyde free insulation on the interior of the building.

#### Intent

To reduce the quantity of indoor air contaminants that are odorous or potentially irritating or harmful to the comfort and health of installers and occupants.

#### Rationale

Formaldehyde is a volatile organic compound (VOC) that a product can off-gas over its lifetime. The International Agency for Research on Cancer (IARC) considers formaldehyde a human carcinogen, a key factor in the material's implications for human health over the long-term. VOC's have short-term health implications as well, such as eye, nose and throat irritation, and headaches and nausea.

#### Definitions

- *Volatile Organic Compounds (VOC)*: Carbon-containing compounds that evaporate readily at room temperature.
- *Interior of building*: Inside of the air barrier where the acoustic and thermal insulation is installed.

#### Strategies

- Contact local suppliers early to determine availability of insulations and drywall that are formaldehyde free.

#### Resources

- *International Agency for Research on Cancer (IARC)*: The objective of the IARC is to promote international collaboration in cancer research.  
Site: <http://www.iarc.fr/>

#### Documentation: *Submit at the Occupancy Permit phase*

- Letter signed by Architect declaring that the requirements have been met.
- Manufacturer's cut sheet indicating each product selected is urea-formaldehyde free.

## IEQ 1 – LOW-EMITTING MATERIALS

### IEQ Credit 1.4: Low-Emitting Cabinetry

2 points

#### Requirement

Specify and install interior cabinetry (doors, boxes, counters and laminating adhesives) that are low emitting or contain no added urea formaldehyde.

#### Intent

To reduce the quantity of indoor air contaminants that are odorous or potentially irritating or harmful to the comfort and health of installers and occupants.

#### Rationale

Urea formaldehyde is a volatile organic compound (VOC) that a product can off-gas over its lifetime. The International Agency for Research on Cancer (IARC) considers formaldehyde a human carcinogen, a key factor in the material's implications for human health over the long-term. VOC's have short-term health implications as well, such as eye, nose and throat irritation, and headaches and nausea.

#### Definitions

- *Volatile Organic Compounds (VOC)*: Carbon-containing compounds that evaporate readily at room temperature.
- *Carcinogen*: A substance that is an agent in directly causing cancer.

#### Strategies

- Contact local suppliers early to determine availability of cabinetry that is urea-formaldehyde free.
- Consider using low-VOC finishes for all cabinetry sealants, finishing materials, and millwork.
- Ultra-low-emitting or no added formaldehyde resins are acceptable (as defined by the California Air Resources Board, Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products regulation).

#### Resources

- *Composite Panel Association and Composite Wood Council*: Provides comprehensive information on composite panel and wood.  
Site: <http://www.pbmdf.com/>
- *International Agency for Research on Cancer (IARC)*: The objective of the IARC is to promote international collaboration in cancer research.  
Site: <http://www.iarc.fr/>

#### Documentation: *Submit at the Occupancy Permit phase*

- Letter signed by Architect declaring that the requirements have been met.
- Manufacturer's cut sheet indicating each product selected contains no added urea formaldehyde.

## Construction (CON)

### CON MANDATORY

#### CON Credit M1: Staging and Construction

Mandatory

#### Requirements

Prepare and implement a Staging and Construction Plan, including alternate detour information and signage for pedestrians and cyclists.

#### Intent

To protect the ecology and natural features of the site such as topography, watercourses, flora and fauna from damage during the construction process.

#### Rationale

The construction process can be highly damaging to natural systems on the site. Although these effects cannot be completely avoided, protecting adjacent areas and vegetation from construction activity and debris can help to minimize the overall impact.

#### Definitions

- *Staging and Construction Plan*: A plan that establishes where and how construction materials and equipment will be temporarily stored on or near the construction site.

#### Strategies

- Identify staging and equipment storage areas in designated areas that are away from trees and vegetation, and that will cause minimal compaction of soils to be landscaped.
- Establish clearly marked construction and disturbance boundaries; delineate lay-down, recycling and disposal areas; and use areas to be paved as staging areas.
- Reduce the development footprint as much as possible, including building(s), access roads and parking.
- Limit site disturbance by using protective fencing.
- Designate washout area for concrete trucks in a non-disruptive area.
- Do not nail signs, utility boxes or fencing to trees.

#### Resources

- *UBC Strategic Transportation Plan*: The Strategic Transportation Plan describes UBC's policies for managing all automobile traffic on campus, including requirements and strategies for managing truck traffic during construction.

[Site: https://planning.ubc.ca/sites/planning.ubc.ca/files/documents/transportation/plans/UBC-Transportation-Plan-2014\\_Oct.pdf](https://planning.ubc.ca/sites/planning.ubc.ca/files/documents/transportation/plans/UBC-Transportation-Plan-2014_Oct.pdf) [Site: http://transportation.ubc.ca/transportation-planning/files/2010/08/STP2005\\_14\\_July05\\_Approved.pdf](http://transportation.ubc.ca/transportation-planning/files/2010/08/STP2005_14_July05_Approved.pdf)

#### Documentation: *Submit at the Occupancy Permit phase*

- Letter signed by Developer declaring that the requirements have been met.
- Copy of staging and construction plan.

## CON MANDATORY

### CON Credit M2: Vegetation Safeguards and Land-Clearing Debris

Mandatory

#### Requirements

Prepare a site plan showing the sizes and locations of vegetation to be removed, retained and salvaged, including plants located on adjacent public rights-of-way **and** develop a plan to effectively handle debris from land clearing and divert it from landfill disposal.

#### Intent

To protect the ecology and natural features of the site such as topography, watercourses, flora and fauna from damage during the construction process.

#### Rationale

The construction process can be highly damaging to natural systems on the site. Although these effects cannot be completely avoided, protecting adjacent areas and vegetation from construction activity and debris can help to minimize the overall impact.

#### Strategies

- Carefully survey the site prior to building and map existing site vegetation. Where possible, retain all significant trees and natural features and preserve natural slopes and the existing direction of water flow across the site.
- Prepare a site plan showing the sizes and locations of vegetation to be removed, retained and salvaged, including plants located on adjacent public rights-of-way.
- Protect the root zones of saved trees. Protection of existing significant trees should be substantial, visible and extend to at least the full perimeter of the tree canopy (the "drip line").
- Remove and stockpile topsoil, and where suitable, strip groundcover and shrubs for reuse after construction.
- Develop a plan to effectively handle debris from land clearing and divert from landfill disposal.
- Eliminate the use of pesticides in the preparation of the site to the greatest extent possible.

#### Resources

- *UBC Strategic Transportation Plan*: The Strategic Transportation Plan describes UBC's policies for managing all automobile traffic on campus, including requirements and strategies for managing truck traffic during construction.  
Site: [https://planning.ubc.ca/sites/planning.ubc.ca/files/documents/transportation/plans/UBC-Transportation-Plan-2014\\_Oct.pdf](https://planning.ubc.ca/sites/planning.ubc.ca/files/documents/transportation/plans/UBC-Transportation-Plan-2014_Oct.pdf)[http://transportation.ubc.ca/transportation\\_planning/files/2010/08/STP2005\\_14\\_July05\\_Approved.pdf](http://transportation.ubc.ca/transportation_planning/files/2010/08/STP2005_14_July05_Approved.pdf)

#### Documentation: *Submit at the Occupancy Permit phase*

- Letter signed by Developer declaring that the requirements have been met.
- Copy of vegetation site plan.
- Copy of debris and land clearing management plan.

## CON MANDATORY

### CON Credit M3: Truck Management Plan

Mandatory

#### Requirement

Prepare and implement a comprehensive truck management plan for the project that conforms to the *UBC Strategic Transportation Plan* and the *Neighbourhood Plan Development Guidelines*.

#### Intent

To manage truck traffic through residential neighbourhoods and control the frequency with which designated routes are used to reach the project site.

#### Rationale

Heavy truck traffic contributes to noise and air pollution in residential neighbourhoods. Truck traffic routing is necessary to minimize impacts on neighbourhoods surrounding the development site.

#### Definitions

- *Truck Management Plan*: A plan that identifies how truck traffic will be managed to disperse and minimize adverse impacts during project construction.

#### Strategies

- Contact UBC Properties Trust to develop a truck management plan for construction projects.
- Minimize truck trips by using pup or transfer trailers and by reusing materials on site where possible.
- Disperse truck traffic among the designated truck routes that connect to UBC.

#### Resources

- *UBC Strategic Transportation Plan*: The Strategic Transportation Plan describes UBC's policies for managing all automobile traffic on campus, including requirements and strategies for managing truck traffic during construction.  
Site: [https://planning.ubc.ca/sites/planning.ubc.ca/files/documents/transportation/plans/UBC-Transportation-Plan-2014\\_Oct.pdf](https://planning.ubc.ca/sites/planning.ubc.ca/files/documents/transportation/plans/UBC-Transportation-Plan-2014_Oct.pdf) [http://transportation.ubc.ca/transportation-planning/files/2010/08/STP2005\\_14\\_July05\\_Approved.pdf](http://transportation.ubc.ca/transportation-planning/files/2010/08/STP2005_14_July05_Approved.pdf)
- *UBC Neighbourhood Plans*: Each UBC neighbourhood has its own development plan. Where specified, truck management plan requirements must be adhered to during construction.  
Site: [http://www.planning.ubc.ca/vancouver\\_home/plans\\_and\\_policies/land\\_use\\_planning/ubc\\_neighbourhood\\_plans.php](http://www.planning.ubc.ca/vancouver_home/plans_and_policies/land_use_planning/ubc_neighbourhood_plans.php)

#### Documentation: *Submit at the Occupancy Permit phase*

- Letter signed by Developer declaring that the requirements have been met.
- Copy of truck management plan.

## CON MANDATORY

CON Credit M4: Wheel Wash

Mandatory

### Requirement

Provide a wheel wash for vehicles leaving the site *or* a street cleaning program and catch basin protection.

### Intent

To reduce the amount of soil and other solids leaving the site during excavation and entering into the storm water system.

### Rationale

Construction vehicles can transport significant amounts of water contaminants off the site, including sediments, concrete, lubricants, fuels, solvents, fertilisers and pesticides. If allowed to enter storm drains, these contaminants may pollute water systems with silt, change the chemical balance, or remove dissolved oxygen.

### Definitions

- *Wheel Wash*: A temporary or permanent installation that uses an immersion bath or water spray to remove mud, soil, rock, debris and other materials from the tires and undercarriages of vehicles.
- *Street Cleaning Program*: Cleaning programs establish schedules for sweeping based on the rate of debris accumulation and the anticipated frequency of rain events.
- *Catch Basin Protection*: Stormwater systems can be protected from sediment and pollutant loads with filtering materials installed in the catch basin system. A catch basin is an inlet from the street to the storm drain system that typically includes a grate and a sump to capture sediment.

### Strategies

- Consult with UBC Properties Trust to determine whether truck traffic will be heavy enough to require a wheel wash.
- For street cleaning, identify and focus on priority areas where debris will most likely accumulate and produce the highest contaminant loads. Determine sweeping frequency based on the rate of debris accumulation and the frequency of rain events.
- Protect catch basins with filtering products that will prevent pollutants from entering storm drains.

### Resources

- *Best Management Practices Guide for Stormwater*: This BMP guide, developed by Metro Vancouver, provides comprehensive information on stormwater management practices including wheel wash, street cleaning and catch basin protection.

*Site Part 1*: <http://www.metrovancouver.org/services/liquid-waste/LiquidWastePublications/BMPVol2a.pdf>

*Part 2*: <http://www.metrovancouver.org/services/liquid-waste/LiquidWastePublications/BMPVol2b.pdf>

*Part 3*: <http://www.metrovancouver.org/services/liquid-waste/LiquidWastePublications/BMPVol2c.pdf>

<http://www.metrovancouver.org/services/wastewater/sources/Pages/StormwaterManagement.aspx>

### Documentation: *Submit at the Occupancy Permit phase*

- Letter signed by Developer declaring that the requirements have been met.

**CON MANDATORY****CON Credit M5: Erosion and Sedimentation Control****Mandatory****Requirement**

Prepare and implement a Sediment and Erosion Control Plan that conforms to [the City of Vancouver Bulletin 2002-003-EV dated March 1, 2017-Best Management Practices Guide for Stormwater: Appendix H—Construction Site Erosion and Sediment Control Guide \(GVS&DD, October 1999\)](#).

**Intent**

To control on-site erosion to reduce negative impacts on water and air quality.

**Rationale**

Prevent loss of soil during construction by stormwater runoff and/or wind erosion by taking measures to protect topsoil by stockpiling for reuse. Prevent sedimentation of storm sewer or receiving streams and/or air pollution with dust and particulate matter.

**Definitions**

- *Soil erosion*: The removal and loss of soil by the action of water, ice, gravity or wind.
- *Sedimentation*: The settling out of soil particles transported by water.
- ~~*Sediment and Erosion Control Plan*~~: A plan that encompasses all applicable stabilisation strategies required to limit sediment and erosion during construction, including:
  - A statement of erosion control and stormwater control objectives;
  - A comparison of post-development stormwater runoff conditions with predevelopment conditions;
  - A description of all temporary and permanent erosion control and stormwater control measures implemented on the project site; and
  - A description of the type and frequency of maintenance activities required for erosion control

**Strategies**

- Consult UBC and the Metro Vancouver for recommended measures to mitigate erosion and promote sedimentation control.

**Resources**

- *BC Ministry of Environment*: The Ministry provides a wide range of publications that support ecologically sensitive site development, including “*Stormwater Planning: A Guidebook for British Columbia, Chapter 7: Site Design Solutions for Achieving Performance Targets*”

Site: ~~[https://www2.gov.bc.ca/assets/gov/environment/waste-management/sewage/stormwater\\_planning\\_guidebook\\_for\\_bc.pdf](https://www2.gov.bc.ca/assets/gov/environment/waste-management/sewage/stormwater_planning_guidebook_for_bc.pdf)~~ <http://www.env.gov.bc.ca/epd/mun-waste/waste-liquid/stormwater/>

- ~~*City of Vancouver Bulletin 2002-003-EV. Erosion and Sediment Control Large Lot Development (1,000M2 or More). Revised March 1, 2017.*~~

Site: <https://bulletins.vancouver.ca/2002/2002-003.pdf>

~~*Best Management Practices Guide for Stormwater: Appendix H—Construction Site Erosion and Sediment Control Guide: Greater Vancouver Sewerage and Drainage District, October 1999.*~~

~~*Part 1:*~~ [http://www.metrovancouver.org/services/liquid\\_waste/LiquidWastePublications/BMPVol2a.pdf](http://www.metrovancouver.org/services/liquid_waste/LiquidWastePublications/BMPVol2a.pdf)

~~*Part 2:*~~ [http://www.metrovancouver.org/services/liquid\\_waste/LiquidWastePublications/BMPVol2b.pdf](http://www.metrovancouver.org/services/liquid_waste/LiquidWastePublications/BMPVol2b.pdf)

~~*Part 3:*~~ [http://www.metrovancouver.org/services/liquid\\_waste/LiquidWastePublications/BMPVol2c.pdf](http://www.metrovancouver.org/services/liquid_waste/LiquidWastePublications/BMPVol2c.pdf)

Site: <http://www.metrovancouver.org/services/wastewater/sources/Pages/StormwaterManagement.aspx>

**Documentation: *Submit at the -Occupancy Permit phase***

- Letter signed by the Civil Engineer or responsible party declaring that the requirements have been met
- Copy of the Erosion and Sedimentation Control Plan.

## CON MANDATORY

### CON Credit M6: Waste Management Plan

Mandatory

#### Requirement

Prepare and implement a Waste Management Plan that diverts 75% (by weight) of construction and demolition waste from landfill.

#### Intent

To divert construction and demolition from landfill disposal, to redirect recyclable material back to the manufacturing process, and to reclaim reusable construction materials for future use.

#### Rationale

Although actual waste reduction quantities and techniques will vary by site (based on materials used, local recycling markets and other conditions), builders can manage wastes safely and effectively while diverting the maximum possible amount of construction waste from disposal.

#### Definitions

- *Waste Management Plan*: A document prepared in advance of construction that details how construction waste will be managed throughout the project. Plans include specific instructions to crews and subcontractors on material separation and handling procedures.

#### Strategies

- Consider on-site separation and recycling of cardboard, metals, brick, concrete, plastic, clean wood, glass, gypsum wallboard, carpet, and insulation.
- Designate a specific area on the construction site for recycling, and track recycling efforts throughout the construction process.
- Identify construction haulers and recyclers to handle the designated material.

#### Resources

- *Metro Vancouver's Demolition ~~Permit, Land Clearing and Waste Management Toolkits~~: Provides a walk-through of demolition permit requirements for reuse and recycling of materials.*  
Site: <http://vancouver.ca/home-property-development/green-demolition-practices.aspx>
- *Print Media: LEED Canada for New Construction and Major Renovations 2009*: Information and resources for Materials & Resource Credit 2.

#### Documentation: *Submit at the Occupancy Permit phase*

- Letter signed by Contractor declaring that the requirements have been met.
- Copy of construction Waste Management Plan and hauling summary demonstrating 75% diversion.

## CON 1 – CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT PLAN

### CON Credit 1.1: Indoor Air Quality Management Plan

2 points

#### Requirement

Prepare and implement an Indoor Air Quality (IAQ) Management Plan for the construction and pre-occupancy phases of the building.

#### Intent

To prevent indoor air contamination resulting from the construction process that is odorous or potentially irritating or harmful to the comfort and health of installers and occupants.

#### Rationale

Building construction inherently includes activities that can contaminate buildings and subsequently impact indoor air quality well after the building is occupied. Construction management strategies and procedures can be instituted during construction that can reduce levels of indoor air contamination.

#### Definitions

- *Indoor Air Quality Management Plan*: A document specific to a building project that outlines measures to minimize contamination in the building during construction.
- *Absorptive Construction Materials*: Porous construction and finishing materials that can collect air pollutants and later release them into occupied spaces.

#### Strategies

- Protect the ventilation system ducting during construction, control pollutant sources, and interrupt pathways for contamination.
- Protect stored on-site or installed absorptive construction materials from moisture damage, and sequence installation to avoid contamination of absorptive materials such as carpets.
- Require a cessation of indoor smoking site policy as soon as drywall is delivered.
- Clean interiors, building cavities, ventilation systems and components, and replace filtration media prior to occupancy.

#### Resources

- *Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guideline for Occupied Buildings under Construction 2<sup>nd</sup> Edition 2007*: Provides an overview of air pollutants associated with construction and a range of control measures.  
Site: [www.smacna.org](http://www.smacna.org)
- *Print Media: LEED Canada for New Construction and Major Renovations 2009*: Information and resources for Indoor Environment Quality Credit 3.1.

#### Documentation: *Submit at the Occupancy Permit phase*

- Letter signed by Contractor declaring that the requirements have been met.
- Copy of Indoor Air Quality Management Plan.

## CON 1 – CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT PLAN

### CON Credit 1.2: Flushout / IAQ Test

2 points

#### Requirement

After construction ends an prior to occupancy conduct a minimum two-week continuous building flushout with new filtration media at 100% outside air *or* conduct a Baseline Indoor Air Quality Test.

#### Intent

To reduce the concentration of indoor air contaminants produced during construction prior to occupancy.

#### Rationale

Building construction inherently includes activities that produce air contaminants, which can subsequently impact indoor air quality into occupancy. Flushout procedures undertaken before occupancy expel contaminants that may have accumulated in the building during construction.

#### Definitions

- *Flushout*: Sustained ventilation of the building after the end of construction and prior to occupancy with new filtration media and outdoor air.
- *Baseline IAQ test*: An indoor air quality testing procedure that randomly selects sampling points to measure the maximum concentration levels for the following contaminants:
  - *Formaldehyde*: 27 ppb
  - *Particulates*: 50 mg per cubic meter
  - *TVOC*: 500 mg per cubic meter
  - *4-PCH*: 6.5 mg per cubic meter

#### Strategies

- Decide on a flushout plan or an IAQ testing prior to construction start.
- Develop the construction schedule to accommodate flushout or IAQ testing prior to occupancy.
- Include flushout or IAQ testing requirements in tender documents.
- Prior to IAQ testing reduce indoor air contaminant in order to achieve baseline. Retest non-compliant areas.

#### Resources

- *EPA*: Protocols for environmental requirements for air quality.  
Site: <https://www.epa.gov/indoorairplus> <http://www.epa.gov/indoorairplus/index.html>
- *Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guideline for Occupied Buildings under Construction, 1995*: Provides an overview of air pollutants associated with construction and a range of control measures.  
Site: [www.smacna.org](http://www.smacna.org)
- *Print Media: LEED Canada for New Construction and Major Renovations 2009*: Information and resources for Indoor Environment Quality Credit 3.2.

#### Documentation: *Submit at the Occupancy Permit phase*

- Letter signed by Contractor declaring that the requirements have been met, including:
  - Copy of specifications showing requirement for flushout or results of IAQ testing.

## Innovation and Design Process (ID)

### ID MANDATORY

ID Credit M1: Goal-Setting Workshop

Mandatory

#### Requirement

Hold a green building workshop or Design Charrette including the developer, design consultants and contractor to review and develop the strategies for achieving the development's goals and priorities relevant to the Residential Environmental Assessment Program.

#### Intent

To create, through consensus, a set of comprehensive environmental design goals and strategies for a project and enhance communication and interaction throughout the design process.

#### Rationale

Goal-setting workshops promote a collaborative vision of specific goals and priorities in the early planning stages of the project. Early consensus on environmental goals amongst key consultants and trades acts as a strong driver in achieving green building goals over the duration of the project.

#### Definitions

- *Integrated Design Process (IDP)*: IDP involves the full design team and key stakeholders from the beginning of a building project. The group works together in a comprehensive, team-based approach with the goal of producing a successful integration of environmental systems and strategies.
- *Design Charrette*: An intensely focused workshop in which participants with a wide range of backgrounds and expertise are brought together to collaborate on a design problem.
- *Consensus*: The outcome of collaborative problem-solving where the solution is generally accepted rather than considered a grudging compromise, and that agreement is deep-rooted enough that it can stand for some time without need to revisit the issue.

#### Strategies

- Establish the key deliverables of the goal-setting workshop.
- Define performance goals at the outset and refer to them throughout the project.
- Examine functional requirements.
- Examine site development issues.
- Commence teamwork in the early stages of the project.

#### Resources

- *U.S. National Renewable Energy Laboratory (NREL)*: The NREL offers a comprehensive "Handbook for Planning and Conducting Charrettes for High-Performance Projects" as well as ~~powerpoint~~[PowerPoint](#) presentation templates and sample charrette reports.

#### Documentation: *Submit at the Building Permit phase*

- Copy of the minutes or report from the Goal Setting Workshop clearly outlining the REAP related priorities and goals.

## ID MANDATORY

ID Credit M2: Educate the Homeowner

Mandatory

### Requirement

Develop a homeowner's manual that promotes sustainable behaviour and describes all of the sustainable features of the project instructing the homeowner on their proper use. This manual should be incorporated into record drawings or some form that will be accessible beyond the first generation of owner/resident.

### Intent

To promote awareness and ensure proper operation and maintenance of various systems in the suite and building.

### Rationale

Proper operation and maintenance is required for optimal performance of energy and water efficient technologies. A manual that explains all of the features included in a home provides building occupants with access to the information they need to ensure the technologies perform as intended.

### Strategies

- Ensure all of the green features of the home are well documented and described in the homeowner's manual. Provide resources for additional information where possible.
- Proper lifetime operation and maintenance ensures installed features will meet design goals. Provide written operational instructions for all appliances and equipment, maintenance schedules, maintenance instructions, manuals, warranties, and product descriptions.
- Promote sustainable behaviour by providing information on how to minimize energy and resource use throughout the home.

### Resources

- ~~NAHB Model Green Home Building Guidelines; National Association of Homebuilders: In the 'Operation, Maintenance and Homeowner Education' section, the Guidelines highlight information to include in a homeowner's manual. This also constitutes material the sales staff should have mastery of.~~

~~Site: <http://www.nahbgreen.org/Guidelines/nahbguidelines.aspx>~~

### Documentation: *Submit at the Occupancy Permit phase*

- Letter signed by Developer certifying the requirements have been met.
- Copy of homeowner's manual highlighting sustainable features of the project.

## ID 1 – INNOVATION IN MATERIALS

### ID Credit 1.1: Life-Cycle Assessment

4 points

#### Requirement

Perform a Life-Cycle Assessment of the project's structure and enclosure and demonstrate a minimum of 5% improvement from a reasonable baseline building for three Environmental Categories.

#### Intent

To introduce a more holistic assessment of building environmental performance.

#### Rationale

Life cycle assessment (LCA) is a tool that can inform the design and construction team on how to build a more sustainable building. By performing a LCA during the design phase of the building, the team can look at the costs and benefits of using different materials in the building.

#### Definitions

*Life-Cycle Assessment (LCA):* is a technique to assess environmental impacts associated with all the stages of a product's life from-cradle-to-grave (i.e., from raw material extraction through materials processing, manufacture, distribution, use, repair and maintenance, and disposal or recycling).

*Environmental Categories:* global warming potential in CO<sub>2</sub>e, depletion of stratospheric ozone, acidification of land and water sources in kg SO<sub>2</sub>, eutrophication in kg, formation of tropospheric ozone in kg and depletion on non-renewable energy resources in MJ

#### Strategies

- Consult with local LCA firms, who can provide the most up-to-date tools and resources on LCA integration into a project.
- Include LCA in the project's major consulting contracts. As the LCA inputs are based on the materials, some price economy may be gained by using the consultant's in-house expertise.
- Incorporate LCA into the contract with the Green Building Specialist. Many green building specialist also have expertise in LCA.
- Train staff on the use of LCA software, such as [Athena's Impact Estimator](#).
- Look for academic links with LCA, which may help in gaining credit for ID Credit 4.1.

#### Resources

- *LCA Alliance @ UBC:* UBC has developed an alliance of graduate students doing work in Life-Cycle Assessment. Their website offers resources and contacts for more information.

Site: <https://lcaalliance.wordpress.com/> <http://lcaalliance.com/>

- *Wikipedia:* Life-cycle assessment information.

Site: [http://en.wikipedia.org/wiki/Life\\_cycle\\_assessment](http://en.wikipedia.org/wiki/Life_cycle_assessment)

#### Documentation: *Submit at the Occupancy Permit phase*

- Life-cycle assessment report, showing the results of the life-cycle assessment and confirmation that the credit criteria have been met.

## ID 2 – INTEGRATIVE AND UNIVERSAL DESIGN

### ID Credit 2.1: Green Building Specialist

1 point

#### Requirement

Engage an expert in green buildings and sustainable construction practices to provide advice on effective green building strategies to the design team.

#### Intent

To support, encourage, and streamline the process of implementing green strategies into building projects.

#### Rationale

The green building specialist can guide the design process and maintain a focus on environmental goals throughout the project. An experienced specialist familiar with the local construction industry can greatly reduce the effort required to achieve the goals associated with sustainable building practices.

#### Definitions

- *Green Building Specialist: An expert with LEED AP BD+C certification or equivalent accreditation and experience in green buildings.*
- *LEED AP BD+C:* A Leadership in Energy and Environmental Design Accredited Professional is an individual who has been accredited in the LEED rating system and is capable of providing a framework for assessing building performance and meeting sustainability goals.
  - *Integrated Design Process (IDP):* IDP involves the full design team and key stakeholders from the beginning of a building project. The group works together in a comprehensive, team-based approach with the goal of producing a successful integration of environmental systems and strategies.

#### Strategies

- Utilize an Integrated Design Process to maximize the benefits for the whole project.
- Bring the green building specialist 'on board' early on in the project. From the project's outset, work with the green building specialist to:
  - Establish a reference against which alternative strategies can be evaluated;
  - Set green design goals that are both challenging and reasonably attainable;
  - Promote whole-building design strategies and raise awareness of green building benefits.

#### Resources

- *Better Bricks:* Provides further insight into the rationale for, and steps for achieving a meaningful integrated design process.  
Site: <https://betterbricks.com/build-a-case><http://www.betterbricks.com/default.aspx?pid=energyeffectivedesign>
- *Print Media: LEED Canada for New Construction and Major Renovations 2009:* Information and resources for Innovation in Design Credit 2.

#### Documentation: *Submit at the Building Permit phase*

- Letter signed by Developer identifying an expert in green buildings and construction practices has been engaged for the project.
- Explanation of expert's combination of experience and education that demonstrate ability to provide advice.

## ID 2 – INTEGRATIVE AND UNIVERSAL DESIGN

### ID Credit 2.2: Design for Safety and Accessibility

1 point

#### Requirement

Demonstrate that at least 25% of the units in the building have been designed to meet the intent of SAFERhome standards which address issues of accessibility, children's safety, seniors and aging in place.

#### Intent

To design units with consideration of occupants with special accessibility and safety issues.

#### Rationale

Statistics Canada reports that 90% of accidents occur in the home. The SAFERhome Standards Society provides a Canadian certification program that simultaneously addresses issues of sustainability and universal design, promoting the health and safety of building occupants and the larger community.

#### Definitions

- **SAFER:** The acronym for the five tenets of the SAFERhome housing credo: Sustainable, Automated, Friendly, Environmental and Recycling.

#### Strategies

- Consult with the SAFERhome Society early on to ensure the 19-point criteria required for the certification program will be met in the building design, including:
  - Wider doors and hallways to improve circulation and accessibility.
  - More accessible placement of electrical outlets and plumbing features.
  - Wider stairways with narrower nosings to reduce tripping and falling hazards.

#### Resources

- *SAFERhome Standards Society:* The non-profit society promotes the adoption and use of housing standards and practices that are safe, healthy and sustainable for occupants and members of the community.

Site: <https://saferhomestandards.com/> Site: <http://www.saferhomesociety.com/> <https://saferhomestandards.com/>

#### Documentation: *Submit at the Building Permit phase*

- Letter signed by Architect declaring that the requirements have been met including an explanation of how the criteria have been addressed in the design.

## ID 2 – INTEGRATIVE AND UNIVERSAL DESIGN

### ID Credit 2.3: Design for Security and Crime Prevention

2 points

#### Requirement

Demonstrate that the design has been reviewed by an accredited Crime Prevention Through Environmental Design (CPTED) practitioner.

#### Intent

To alter or enhance the built environment through design that reduces opportunities for crime and nuisance activity.

#### Rationale

Careful environmental design can discourage and prevent crime, improving quality of life for homeowners and the larger community.

#### Definitions

Design informed by environmental criminology is based on a number of concepts, including:

- *Access control:* Controlling the access to a building or portion of a building, such as underground parking.
  - *Defensibility:* Markers that discourage opportunities for crime such as fencing, locks on doors and bars on windows.
  - *Surveillance:* Surveillance can be "natural" where residents observe the public areas of their neighbourhood, and "formal" where a person such as a security guard is employed to watch an area.
- *Target hardening:* Hardening or increasing security of a potential target, including surveillance, lighting, locks and fencing.
- *Territoriality:* Claiming an area as one's own and exerting influence over the area through maintenance of physical markers.

#### Strategies

- Undertake a review of the design by a certified CPTED practitioner and implement the recommendations to create a safer and more secure building for the occupants and visitors.

#### Resources

- *Crime Prevention Through Environmental Design Vancouver:* CPTED Vancouver is a non-profit organization which works to increase awareness and provide education and services for design approaches based on environmental criminology.

Site: <http://www.designcentreforcpted.org/Pages/Principles.html>

#### Documentation: *Submit at the Building Permit phase*

- Letter signed by Architect declaring that the requirements have been met.

## ID 3 – MARKET TRANSFORMATION

### ID Credit 3.1: Educate the Sales Staff

1 point

#### Requirement

Develop marketing materials based on the environmental performance of the project and ensure the sales staff is knowledgeable about the green building features.

#### Intent

To transform the residential housing market by highlighting the wide range of benefits associated with green building features, as compared to conventional construction.

#### Rationale

Well-designed marketing materials and knowledgeable staff ensure that the benefits of green building ownership are effectively communicated in a competitive housing market. Consumer demand for green building can be increased if more consumers are made aware of the long-term benefits of owning and occupying green homes.

#### Strategies

- Contract with a housing marketing firm that has a sound understanding of green building principles and effective leverage points within the current housing market.
- Conduct on-site training sessions with sales staff to ensure working knowledge of green building features and systems specific to the building. Use sample products and energy bills as teaching aids.
- Walk-throughs and model suites can be invaluable educational tools for buyers and for sales staff. For example, model suites with display cutaways and wall sections can help to demonstrate energy-efficient construction practices.

#### Resources

- ~~*Selling Green Homes: Alameda County's New Home Construction Green Building Guidelines are designed for the residential building industry. See "Chapter 5: Selling Green Homes" for advice on educating sales staff and market differentiation for green homes.*~~  
~~*Site: <http://www.stopwaste.org/home/index.asp?page=487>*~~
- ~~*NAHB Model Green Home Building Guidelines; National Association of Homebuilders: In the 'Operation, Maintenance and Homeowner Education' section, the Guidelines highlight information to include in a homeowner's manual. This also constitutes material the sales staff should have mastery of.*~~  
~~*Site: <http://www.nahbgreen.org/Guidelines/nahbguidelines.aspx>*~~
- *The Insider's Guide to Marketing Green Buildings:* This 2005 guide written by Jerry Yudelson provides comprehensive strategies, data, tools and techniques for marketing green buildings.  
*Site: <https://www.buildinggreen.com/newsbrief/insiders-guide-marketing-green-buildings>*

#### Documentation: *Submit at the Occupancy Permit phase*

- Letter signed by Developer declaring that the requirements have been met.
- Copy of marketing material highlighting sustainable features of the project.

## ID 4 – ACADEMIC LINKS

### ID Credit 4.1: Enhance Research or Further Student Development

5 points

#### Requirement

Collaborate with UBC students and/or faculty on a research project or other opportunities that are applicable to the current building project, and will enhance the academic mission of the University and integrate it with the community.

#### Intent

To promote relationships amongst the development and academic communities and research on residential development projects, to aid UBC in achieving its goal of providing leadership in demonstrating the means to a sustainable community on campus.

#### Rationale

Residential development at UBC constitutes a unique and mutually beneficial opportunity to conduct research, to expand knowledge about green building practice and performance, and to build skills amongst developers, students, faculty, and the community.

#### Strategies

- Contact the SEEDS Program coordinator to discuss potential research projects that involve students, faculty and university staff. The SEEDS website contains a wide array of projects that have already been completed.
- Consult with project architects and other professionals involved in the building project to identify potential research subjects or issues of interest to the building industry.

#### Resources

- *SEEDS Program*: SEEDS (Social, Ecological, Economic Development Studies) projects bring together students, faculty and staff in projects that address sustainability issues. SEEDS projects aid the Sustainability Office in achieving its goal of developing an environmentally responsible campus that is socially and economically viable.  
Site: <http://sustain.ubc.ca/courses-teaching/seeds/seeds-library>

#### Documentation: ~~:- Submit at the relevant Permit phase~~

##### ~~▪ Submit at the Building Permit phase:~~

- Letter signed by Developer declaring that the requirements will be met.

##### ~~▪ Submit at the Building Occupancy Permit phase~~

- Copy of research project or description of project opportunity.

## ID 4 – ACADEMIC LINKS

### ID Credit 4.2: Energy Data Sharing

4 points

#### Requirement

Incorporate a data sharing agreement into the sales contracts or strata constitution that allows building aggregate energy data to be collected for use by UBC ~~Campus Sustainability~~Sustainability and Engineering, Campus & Community Planning.

#### Intent

To better understand actual building energy performance and aid the future development of student/academic research and UBC policy.

#### Rationale

While modeled energy performance for multi-unit residential buildings has become increasingly more common, actual building performance is much more difficult to obtain. This data, particularly within a defined community, is very valuable for researching best practice, understanding modeled vs. actual performance, and tracking performance trends over time.

#### Strategies

- Contact the Manager, Green Buildings in the UBC ~~Campus Sustainability~~Sustainability and Engineering, Campus & Community Planning to coordinate this effort.
- Coordinate with utility providers to work out an agreement to allow data access to the UBC ~~Campus Sustainability~~Sustainability and Engineering, Campus & Community Planning.
- Install a single meter on the electric, water, natural gas, and any other utility and allow for the possibility of access to that data to the UBC ~~Campus Sustainability~~Sustainability and Engineering, Campus & Community Planning.
- Write language into the contracts for sales/leases or into the Strata constitution that makes this agreement available.
- Set up an innovative way to provide data back to the building occupants for potential Innovation and Design points.

#### Documentation: Submit at the Building Permit phase

- Letter signed by Developer declaring that the requirements will be met, and highlighted copies of the sales, lease, and/or Strata documents that detail this agreement.
  - For purpose-build rental apartment buildings: a letter from an authorized representative of building owner's property management company stating that utility energy consumption data (e.g., FortisBC, BC Hydro and/or Corix) will be provided to UBC Sustainability + Engineering upon request.

#### Documentation: Submit at the Occupancy Permit phase

- For strata owned buildings: a letter signed by the developer declaring that UBC Sustainability + Engineering can obtain utility energy consumption data upon request, an explanation of the mechanism for data sharing (e.g., via a strata bylaw), and a copy of strata bylaw

Letter signed by Developer declaring that the requirements will be met

Highlighted copies of the sales, lease, and/or Strata documents that detail this agreement.

## ID 5 – INNOVATIVE DESIGN

ID Credits 5.1 – 5.3: Innovative Design Strategy or Exemplary Achievement

2 – 6 points

### Requirement

Demonstrate exceptional performance above the requirements set by one of the existing credits *or* the implementation of an innovative design strategy not specifically addressed by any of the existing credits.

### Intent

To provide design teams and projects the opportunity to be awarded points for exceptional performance achieving the next performance threshold above the requirements set by the UBC Residential Environmental Assessment Program criteria and/or innovative performance not specifically addressed by the program.

### Rationale

Although the performance measures covered in the UBC Residential Environmental Assessment Program address a wide range of issues, it is important to continually foster innovation and provide opportunities for developers, designers and contractors to explore other possible advances.

### Definitions

- *Integrated Design Process (IDP)*: IDP involves the full design team and key stakeholders from the beginning of a building project. The group works together in a comprehensive, team-based approach with the goal of producing a successful integration of environmental systems and strategies.
- *Design Charrette*: An intensely focused workshop in which participants with a wide range of backgrounds and expertise are brought together to collaborate on a design problem.

### Strategies

- Conduct research to identify applicable global best practices for building design, construction, commissioning, and post-occupancy evaluation.
- Consult with the design team and a green building specialist to determine where it is possible to substantially exceed a performance credit.
- Use the goal setting workshop to establish support for individual team members to take new initiatives and propose ideas for innovative strategies throughout the project, where achievable.
- Consider using the Integrated Design Process and design charrettes to identify high performance sustainable design measures that are not covered within the REAP assessment system.

### Resources

- *Better Bricks*: Provides further insight into the rationale for, and steps for achieving a meaningful integrated design process.  
Site: <https://betterbricks.com/build-a-case><http://www.betterbricks.com/default.aspx?pid=energyeffectivedesign>
- *Print Media: LEED Canada for New Construction and Major Renovations 2009*: Information and resources for Innovation in Design Credit 1.

### Documentation: *Submit at the Occupancy Permit phase*

- Submit a description of the exceptional performance or the innovative design strategy. The submission should include: a description of the requirement, the intent, a rationale, strategies used and documentation that will be submitted to support the credit achievement.