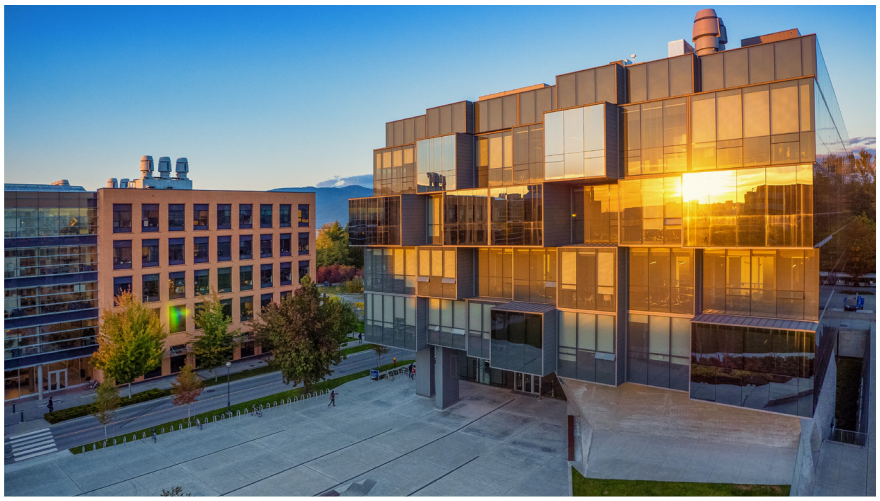
The University of British Columbia

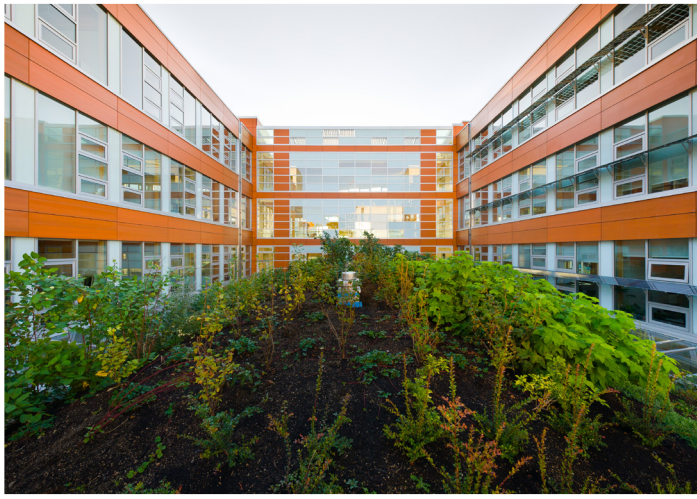
UBC LEED Implementation Guide

FOR BUILDING DESIGN + CONSTRUCTION V4

AUGUST 2016





VISION

By 2035, UBC Vancouver is envisioned to be a campus that embodies regenerative sustainability; this will be reflected in teaching, learning, research, partnerships, operations, infrastructure and the UBC community.

As part of the commitment to this vision, UBC Campus and Community Planning is encouraging high performance and high quality built infrastructure, that aligns with established regulatory green building requirements and encourages accountability through exemplary LEED ratings.

LEED v4

This guide provides specific direction for the UBC Vancouver Campus to implement the LEED Building Design + Construction v4 Rating Systems. It has been developed to support all UBC policy and in particular, is aligned with the UBC Vancouver Campus Plan, the Technical Guidelines and the Climate Action Plan.

LEED 2009

The UBC LEED Implementation Guide for LEED Canada 2009 will continue to guide projects registered under applicable rating systems until LEED 2009 projects on campus are complete and certified.

ACKNOWLEDGEMENTS

UBC's Campus and Community Planning (Sustainability and Engineering) developed this guide with support from CityPeople Consulting and the following UBC departments: Energy and Water and Campus and Community Planning - Planning and Design.

UBC is a member of the **Canada Green Building Council** and is proud to demonstrate support of the CaGBC's mission; to lead and accelerate the transformation to high-performing green buildings.

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UBC Centre for Brain Health - pursuing LEED Gold

INTRODUCTION

UBC aspires to demonstrate leading green building design and is committed to accountability in building performance.

This effort is aligned with various important campus-wide policies to support long-term sustainable development across campus and within the academic program. These important guiding documents include:

- 20-Year Sustainability Strategy for the University of British Columbia Vancouver Campus (2014);
- Place and Promise: the UBC Plan (August 2012);
- The UBC Vancouver Campus Plan (September 2014);
- UBC Climate Action Plan (2010-2015);
- Climate Action Plan 2020 (in development latest draft June 2016);
- Sustainability Academic Strategy (October 2009);
- The UBC Transportation Plan (2014);
- UBC Vancouver Campus Zero Waste Action Plan (October 2014);
- UBC Water Action Plan (in development);
- UBC Integrated Stormwater Management Plan (December 2013).

This UBC LEED v4 Implementation Guide (the Guide) aims to align the LEED Building Design + Construction (LEED BD+C) v4 rating systems and UBC campus policy to facilitate a high performance built environment on campus. In addition, it supports the provincial requirement for all publicly funded new construction and major renovation projects to achieve LEED Gold certification.

The objective of this Guide is to provide direction and clarification for the application of the BD+C v4 Rating Systems for the UBC Vancouver Campus new building projects. This guide identifies UBC performance priorities within the LEED rating system to facilitate a streamlined and coordinated LEED process, supporting exemplary project certification ratings.

This Guide was informed by a series of workshops with campus stakeholders, a study of past performance of LEED projects at UBC, an analysis of UBC policy and programs within the context of LEED requirements, and engagement with users of previous iterations of the Guide. The study identified the credits within the BD+C v4 rating systems that most clearly align with UBC policy and sustainable design priorities, in addition to building performance thresholds that are either consistently being met, surpassed or can be expected to be reasonably attained.

It is the intention of UBC to update the contents of this Guide to maintain consistency with campus policy and priorities as they evolve, and as industry best practice and building performance strategies progress. Version identification will be identified by date; month and year of publication.

HOW TO USE THIS GUIDE

All major capital projects (>$2.5 million) over 1,000 square meters in area are required to earn LEED Gold certification. Other third party verified building performance certification programs, such as the Living Building Challenge or Passive House, may be permitted instead, under specific circumstances, agreed to in advance with UBC Sustainability and Engineering.

This Guide is intended to provide project teams with the UBC-specific guidance they require to optimize LEED for the Vancouver campus, and should be used as a companion document to the UBC Vancouver Campus Plan Design Guidelines and UBC Technical Guidelines. Project teams should reference all relevant UBC policy and guidance documents along with this Guide.

This Guide interprets and supplements the LEED BD+C v4 rating systems for projects built on the UBC Vancouver campus. The LEED BD+C v4 Reference Guide remains the core document for guidance on achieving and documenting each prerequisite and credit.

This Guide identifies mandatory credits that must be achieved for UBC projects along with any specific guidance for optional credits. It acts as an application guide where further UBC specific direction is offered and UBC performance priorities are described.

It is imperative to note that direction is only given where applicable to the UBC context; where no direction is given, follow the Reference Guide.

Where a project team feels a mandatory credit cannot be earned due to special circumstances, a request for variance may be submitted for consideration; the variance process is described below.

Further information if required may be obtained by contacting:

UBC Sustainability and Engineering
2260 West Mall
Vancouver, BC Canada V6T 1Z4
Tel: 604 822 1657
Email: penny.martyn@ubc.ca

UBC Earth Sciences Building - LEED Gold

LIST OF RESOURCES

The following lists relevant supporting documents and documents referenced within this Guide that should be referred to for additional guidance:

LEED BD+C v4 Reference Guide:

http://www.usgbc.org/resources/leed-reference-guide-building-design-and-construction

LEED Online:

https://www.usgbc.org/leedonline/

USGBC Addenda Database:

http://www.usgbc.org/leed-interpretations

Alternative Compliance Paths for Canadian LEED Projects:

https://www.cagbc.org/cagbcdocs/leed/LEED%20v4%20Canadian%20ACP%20Language-as%20of%202014-06-24.pdf

LEED v4 Regional Priority Credit Selection Canada:

https://www.cagbc.org/cagbcdocs/leed/LEED%20v4%20Canada%20Regional%20Priority%20Credit%20Selection%202014-08-05-EN.pdf

USGBC Pilot Credit Library and Open Alternative Compliance Paths:

http://www.usgbc.org/pilotcredits/New-Construction/v4

Vancouver Campus Plan:

http://planning.ubc.ca/vancouver/planning/policies-plans/land-use-governance-documents/vancouver-campus-plan

UBC Water Action Plan:

https://sustain.ubc.ca/campus-initiatives/water/water-action-plan

UBC Waste Action Plan:

https://sustain.ubc.ca/campus-initiatives/recycling-waste/what-ubc-doing/waste-action-plan

UBC Climate Action Plan:

https://sustain.ubc.ca/campus-initiatives/climate-energy/climate-action-plan-2020

UBC Technical Guidelines: Guidelines by Specification Division:

http://www.technicalguidelines.ubc.ca/

UBC Technical Guidelines- Sustainability

http://www.technicalguidelines.ubc.ca/technical/sustainability.html

DEFINITIONS

Table 2: Definitions

Term	Definition
Basis of Design (BOD):	The information necessary to accomplish the owner's project requirements, including system descriptions, indoor environmental quality criteria, design assumptions, and references to applicable codes, standards, regulations, and guidelines. The BOD should be developed based on the Design Brief and submitted prior to Development Permit.
Campus + Community Planning (C+CP):	The UBC Campus and Community Planning office comprises several specialized departments including Planning and Design, Development Services, Sustainability and Engineering, Community Development and Public Engagement.
Canadian Alternative Compliance Paths (ACPs):	Developed by the Canada Green Building Council (CaGBC), Alternative Compliance Paths (ACPs) provide equivalent means of meeting credit and prerequisite requirements, such as by referencing standards more familiar or appropriate for Canada, where they exist. A Canadian ACP document is available online at: www.cagbc.org/cagbcdocs/leed/LEED%20v4%20Canadian%20ACP%20Language-as%20of%202014-06-24.pdf Canadian ACPs are incorporated into the USGBC Credit Library where applicable.
Credit Interpretation Request (CIR):	The Project Credit Interpretation Request (CIR) process is designed to allow project teams to obtain technical guidance on how LEED requirements including Minimum Program Requirements (MPR), Prerequisites, and Credits pertain to their projects specifically. Credit interpretations are not published in the online interpretation database, and may not be precedent setting. Project teams may submit a CIR to the USGBC at their discretion with a copy submitted to S&E.
LEED Addenda	Addenda incorporate changes and improvements to LEED rating systems and reference guides to help clarify, correct, interpret or provide alternative language. Addenda are subject to USGBC committee review and are published as frequently as quarterly. Addenda and Interpretations are published in a searchable, online database: www.usgbc.org/leed-interpretations

Term	Definition
LEED Credit Library:	The requirements of each LEED credit are included in an online searchable database, including credit language, supplemental resources, interpretations and discussions from the LEED user forum. http://www.usgbc.org/credits
LEED Interpretation (LI):	An official answer to a formal technical inquiry made to the USGBC about implementing LEED on a project. Interpretations help project teams understand how their projects can meet LEED requirements and provide clarity on existing options. LEED Interpretations are precedent setting and all projects are required to adhere to interpretations published before the registration date. Interpretations are published with Addenda in an online searchable database: www.usgbc.org/leed-interpretations Project teams may submit an interpretation to the USGBC at their discretion with a copy submitted to S&E.
LEED Pilot Credit Library:	An online, searchable database that introduces new credits and alternative compliance paths to existing credits, that may be applied to registered projects. The process allows projects to test more innovative credits that have not yet completed the drafting and balloting process. http://www.usgbc.org/pilotcredits/all/all
Mandatory:	Describes credits that are directly aligned with UBC policy, priority and building performance requirements, or with the Vancouver Campus Plan. All credits identified as mandatory, must be earned by all UBC projects.
Optional:	Describes credits that may be pursued at the discretion of each project team.
Owner's Project Requirements (OPR):	A written document that details the ideas, concepts, and criteria determined by the owner to be important to the success of the project.
Reference Guide:	The requirements of the rating system are contained with the Reference Guide. The LEED Reference Guide for Green Building Design + Construction v4 contains the rating system requirements for New Construction and Major Renovations (NC) and LEED Core & Shell (CS), Healthcare, Retail, Schools, Data Centres, Warehouses and Distribution Centres, Hospitality.
S&E	Sustainability and Engineering. Department of UBC Campus and Community Planning.

LEED AT UBC

For the purposes of this Guide, credits were prioritized and identified as mandatory or optional for achievement at UBC. UBC expects all credits identified as mandatory to be achieved; projects may earn an exemption if credit requirements cannot be reasonably met (see Exemptions and Requests for Variance below). Achieving all mandatory credits required by UBC yields a total of 61 points. Refer to Table 1: Summary of UBC LEED Credit Compliance, for the list of mandatory and optional credits.

Table 1: Summary of UBC LEED Credit Compliance

Credit / Prerequisite	Title	UBC Credit Compliance	Points Required	Points Available
INTEGRATIVE PROCESS			**Required**	**Available**
Credit	Integrative Process	Mandatory	1	1
LOCATION + TRANSPORTATION			**Required**	**Available**
Credit	LEED for Neighbourhood Development Location	Optional	0	16
Credit	*Sensitive Land Protection	Mandatory	1	1
Credit	High Priority Site	Optional	0	2
Credit	Surrounding Density and Diverse Uses	Mandatory	5	5
Credit	Access to Quality Transit	Mandatory	1	5
Credit	Bicycle Facilities	Mandatory	1	1
Credit	Reduced Parking Footprint	Not Available	0	1
Credit	Green Vehicles	Optional	0	1
SUSTAINABLE SITES			**Required**	**Available**
Prerequisite	Construction Activity Pollution Prevention	Prerequisite		
Credit	Site Assessment	Mandatory	1	1
Credit	Site Development – Protect or Restore Habitat	Mandatory	2	2
Credit	Open Space	Optional	0	1
Credit	Rainwater Management	Mandatory	2	3
Credit	Heat Island Reduction	Optional	0	2
Credit	Light Pollution Reduction	Mandatory	1	1
WATER EFFICIENCY			**Required**	**Available**
Prerequisite	Outdoor Water Use Reduction	Prerequisite		
Prerequisite	Indoor Water Use Reduction	Prerequisite		
Prerequisite	Building-level Water Metering	Prerequisite		
Credit	Outdoor Water Use Reduction	Mandatory	1	2

Credit / Prerequisite	Title	UBC Credit Compliance	Points Required	Points Available
WATER EFFICIENCY (continued)			**Required**	**Available**
Credit	Indoor Water Use Reduction	Mandatory	3	6
Credit	Cooling Tower Water Use	Mandatory	2	2
Credit	Water Metering	Optional	0	1
ENERGY + ATMOSPHERE			**Required**	**Available**
Prerequisite	Fundamental Commissioning and Verification	Prerequisite		
Prerequisite	*Minimum Energy Performance	Prerequisite		
Prerequisite	Building-level Energy Metering	Prerequisite		
Prerequisite	Fundamental Refrigerant Management	Prerequisite		
Credit	Enhanced Commissioning	Mandatory	4	6
Credit	*Optimize Energy Performance	Mandatory	10	18
Credit	Advanced Energy Metering	Mandatory	1	1
Credit	Demand Response	Mandatory	1	2
Credit	Renewable Energy Production	Mandatory	1	3
Credit	Enhanced Refrigerant Management	Mandatory	1	1
Credit	Green Power and Carbon Offsets	Optional	0	2
MATERIALS + RESOURCES			**Required**	**Available**
Prerequisite	Storage and Collection of Recyclables	Prerequisite		
Prerequisite	Construction and Demolition Waste Management Planning	Prerequisite		
Credit	Building Lifecycle Impact Reduction	Mandatory	3	5
Credit	Building Product Disclosure and Optimization – Environmental Product Declaration	Optional	0	2
Credit	Building Product Disclosure and Optimization – Sourcing of Raw Materials	Mandatory	1	2
Credit	Building Product Disclosure and Optimization – Material Ingredients	Optional	0	2
Credit	Construction and Demolition Waste Management	Mandatory	2	2

Credit / Prerequisite	Title	UBC Credit Compliance	Points Required	Points Available
INDOOR ENVIRONMENT QUALITY			**Required**	**Available**
Prerequisite	Minimum Indoor Air Quality Performance	Prerequisite		
Prerequisite	Environmental Tobacco Smoke Control	Prerequisite		
Credit	Enhanced Indoor Air Quality Strategies	Mandatory	1	2
Credit	Low-emitting Materials	Mandatory	3	3
Credit	Construction Indoor Air Quality Management Plan	Mandatory	1	1
Credit	Indoor Air Quality Assessment	Mandatory	1	2
Credit	Thermal Comfort	Mandatory	1	1
Credit	Interior Lighting	Optional	0	1
Credit	Daylighting	Optional	0	1
Credit	Quality Views	Optional	0	1
Credit	Acoustic Performance	Optional	0	1
INNOVATION			**Required**	**Available**
Credit	Innovation	Mandatory	5	5
Credit	LEED Accredited Professional	Mandatory	1	1
REGIONAL PRIORITY			**Required**	**Available**
	BD+C New Construction Canada Pacific Maritime + Urban Population (4 of 6)	Mandatory	4	4
Credit	SS Rainwater Management – 2 points	Optional		1
Credit	WE Outdoor Water Use Reduction – 2 points	Optional		1
Credit	WE Indoor Water Use Reduction – 4 points	Optional		1
Credit	EA Enhanced Commissioning – 5 points	Optional		1
Credit	Optimize Energy Performance – 10 points	Mandatory		1
Credit	Building Life Cycle Impact Reduction – 3 points	Mandatory		1
		TOTAL	**61**	**110**

Certified: 40-49 points Silver: 50-59 points Gold: 60-79 points Platinum: 80+ points

*** Canadian ACP Available, refer to the CaGBC Canadian ACP Document at:**
www.cagbc.org/cagbcdocs/leed/LEED%20v4%20Canadian%20ACP%20Language-as%20of%202014-06-24.pdf

LEED Campus Guidance and Group Approach

The USGBC LEED Campus Guidance for Projects on a Shared Site (April 2014) document provides direction for projects where individual or group certification will be pursued for multiple buildings on a shared site. UBC has elected not to establish a single Master Site for the campus, as such each project is required to prepare documentation demonstrating site specific compliance. There may be future circumstances where a Master Site or Group Approach is appropriate (such as where multiple buildings are pursuing certification on a sub-site within the larger campus); in such cases project teams are encouraged to liaise with Campus and Community Planning, Green Building Manager on a coordinated program.

Exemptions and Requests for Variance

UBC expects all credits identified as Mandatory to be achieved. Project teams may be granted an exemption if it can be demonstrated that credit requirements cannot reasonably be met. To earn an exemption, a Request for Variance must be made to Campus and Community Planning, Sustainability and Engineering, Green Building Manager as early as possible. The Request for Variance form is included in Appendix A.

Registration

Projects at UBC must be registered with the USGBC and submit a preliminary LEED checklist Campus and Community Planning, Green Building Manager, prior to Development Permit application. The UBC Green Building Manager must be included as a member of the project team on LEED Online at the time of registration.

Certification

UBC requires project teams to pursue the Design and Construction Split Review Option for all LEED v4 projects on campus. This split review option entails a design-stage review of applicable prerequisites and credits immediately following completion of construction documents, and then upon project completion, final documentation is submitted for the Construction review.

Adopting the split review option allows project teams to document all design related credits during the construction administration period, prior to design teams dissolving. It also permits clarification of issues while the design team is still actively working with the larger project team, thus greatly simplifying the certification process. For details on the certification process refer to USGBC Guide to Certification: http://www.usgbc.org/cert-guide/commercial, and the BD+C v4 Reference Guide.

UBC Student Union Building - pursuing LEED Platinum

REQUIREMENTS + GUIDANCE

INTEGRATIVE PROCESS

IP Credit: Integrative Process

MANDATORY	
1 Required	1 Available

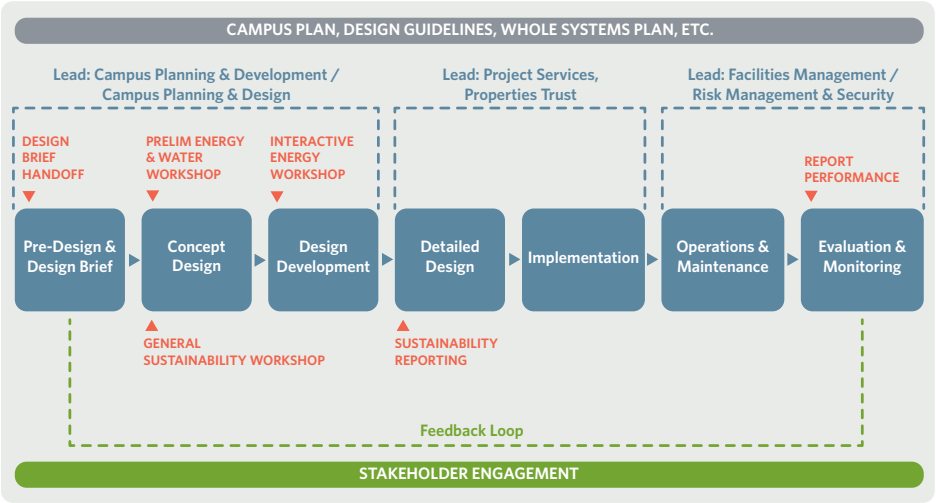
Requirements
All projects must comply as per LEED BD+C v4.

Guidance
Projects teams should reference Appendix B: UBC Sustainability Process for Major Capital projects for alignment with the credit requirements. UBC considers an integrative process vital to a holistic, systems-based approach to sustainable design and construction. Early analysis of interrelationships among systems can support efficient, simplified and cost-effective strategies for high performance outcomes. Figure 1 below shows an overview of how the UBC Sustainability Process aligns with the project milestones and the requirements of the Integrative Process credit.

Resources
UBC Sustainability Process for Major Capital Projects (Appendix B)

http://www.technicalguidelines.ubc.ca/files/UBC_Sustainability_Process-Dec2014.pdf

Figure 1: Overview of the UBC Sustainability Process



LOCATION + TRANSPORTATION

LT Credit: LEED for Neighbourhood Development Location

NOT AVAILABLE	
0 Required	16 Available

Guidance
Currently there are no sites certified under the LEED ND rating system on UBC's Vancouver Campus. Should this condition change, the Guide will be updated to reflect this credit and project teams may apply the available points toward their score.

LT Credit: Sensitive Land Protection

MANDATORY	
1 Required	1 Available

Requirements
All projects must comply as per LEED BD+C v4.

Guidance
Projects must assess current site conditions and ecological status of the site at the time of design. It is imperative that an assessment of species and ecosystems at risk, floodplains and water bodies are considered for each development project on the campus; site assessments should be conducted early in the process and align with and inform the steps required by the Integrative Process credit and UBC Sustainability Process for Major Capital Projects.

Resources
BC Conservation Data Centre: http://www.env.gov.bc.ca/cdc/

UBC Sustainability Process for Major Capital Projects: http://www.technicalguidelines.ubc.ca/files/Sustainability/UBC_Sustainability_Process-Dec2014.pdf

LT Credit: High Priority Site

OPTIONAL	
0 Required	2 Available

Requirements
Projects teams working with sites that might comply with the credit are encouraged to pursue it through any available option.

Guidance

***Option 1 — Historic District*:** Project teams are encouraged to review Section 7.2 Heritage Conservation of the Vancouver Campus Plan and associated Heritage Conservation Theme tables and maps to determine if the project site may eligible to pursue compliance with this credit.

***Option 2 — Priority Designation*:** Not applicable.

***Option 3 — Brownfield Remediation*:** There are no contaminated sites identified on the Vancouver campus currently. However, project teams are advised to consult with UBC Risk Management Services if future conditions indicate contamination may have occurred.

Resources

UBC Risk Management Services - Environmental Services:
http://www.riskmanagement.ubc.ca/about-us/contact-us

LT Credit: Surrounding Density and Diverse Use

MANDATORY	
5 Required	**5 Available**

Requirements

All projects must comply with both Option 1 and 2 of LEED BD+C v4 to earn 5 points.

Guidance

***Option 1 — Surrounding Density (2-3 points)*:** To confirm compliance with Option 1, locate the project on the UBC Surrounding Density Map provided in Appendix C. Campus development density has been calculated using the Combined Density methodology, and mapped for use by all future projects. The majority of project sites will be located in zones with surrounding density of greater than 8,035 sq.m/ha buildable land to earn 3 points.

Projects should mark the location of the project site on the UBC Development Density Map in Appendix C, and upload it as part the project documentation to LEED Online. Refer to the sample Credit Form included in Appendix C for suggested language and direction.

***Option 2 — Diverse Uses (1-2 points)*:** To confirm compliance with Option 2, locate the project site on the UBC Diverse Uses Map provided in Appendix C. The Diverse Uses Map provides only general use types to account for the wide range and variability of campus amenities over time. Project teams are encouraged to consult online campus maps, Google maps and to review amenities on the ground to confirm applicable amenities at the time of certification. If the analysis indicates a lack of amenities within the required distance, contact C+CP Sustainability and Engineering to determine if future planned amenities may be able to contribute.

Resources

UBC Development Density Map, Appendix C

UBC Diverse Uses Map, Appendix C

Sample Credit Form, Appendix C

LT Credit: Access to Quality Transit

MANDATORY	
1 Required	5 Available

Requirements
All projects must comply as per LEED BD+C v4 for at least one point.

Guidance
A transit analysis has been completed for the UBC Vancouver Campus. To confirm compliance, refer to the UBC Transit Maps in Appendix D to locate the project site within 400m walking distance of a bus stop.

Current daily transit service on campus is:

UBC Bus loop: 1184 weekday trips; 491 weekend trips.

C18 Shuttle: 36 weekday; 31 weekend trips.

C20 Shuttle: 43 weekday; 27 weekend trips.

Transit service is provided for the convenience of estimation only. Daily transit service should be confirmed for each project at the time of documentation.

Resources
UBC Transit Maps, Appendix D

TransLink Transit Schedules:
http://tripplanning.translink.ca/hiwire?.a=iScheduleLookup

LT Credit: Bicycle Facilities

MANDATORY	
1 Required	1 Available

Requirements
All projects must comply as per LEED BD+C v4.

Guidance
A Bicycle Network map for the Vancouver Campus is included in Appendix D. All roads on the Vancouver campus have a speed limit of 30km/hr, allowing them to be considered as part of the Bicycle Network as defined by the LEED BD+C LEED v4 Reference Guide. All other infrastructure that may be considered as part of the Network is identified on the map in Appendix E.

Projects must also comply with credit requirements by providing bicycle storage and shower rooms within their project boundary, ensuring that the Campus Plan Design Guidelines (End-of-Trip-Facilities 2.5.6) have been met.

Resources
UBC Bicycle Network Maps, Appendix E

UBC Cycling Maps:
http://planning.ubc.ca/vancouver/transportation-planning/transportation-maps/cycling-maps

UBC Bicycle parking and end-of trip-facilities requirements: Campus Plan Part 3

Map of campus: http://maps.ubc.ca/PROD/index.php

City of Vancouver major bike route connection:
http://vancouver.ca/files/cov/map-cycling-vancouver.pdf

LT Credit - Reduced Parking Footprint

NOT AVAILABLE	
0 Required	1 Available

Guidance
Project teams are advised that the Vancouver campus is reducing parking capacity and anticipates an increase in transit ridership. As such, no new carpool parking will be added, making this credit as currently defined unavailable to projects.

LT Credit - Green Vehicles

OPTIONAL	
0 Required	1 Available

Requirements
Projects are encouraged to pursue compliance with credit requirements if appropriate within the context of the project.

Guidance
The UBC Vancouver campus is actively limiting new parking infrastructure however electric vehicle charging stations are encouraged and may be available to select projects. All green vehicle parking spaces and charging stations are designated and managed by UBC Parking. Where green vehicle parking currently exists, spaces are provided at the same cost as regular vehicles and electric charging is offered at no cost. Project teams are encouraged to liaise with UBC Parking to explore options and opportunities for green vehicles where relevant and appropriate.

Resources
UBC Transportation Plan (October 2014):
http://planning.ubc.ca/sites/planning.ubc.ca/files/documents/transportation/plans/UBC-Transportation-Plan-2014_Oct.pdf

UBC electric vehicle charging locations: http://www.plugshare.com/?location=14211

Bicycle storage facilities outside UBC CIRS
Photo Credit: Martin Tessler

Green roof at the
UBC Centre for Interactive Research on Sustainability - LEED Platinum

SUSTAINABLE SITES

SS Credit: Site Assessment

MANDATORY	
1 Required	1 Available

Requirements
All projects must comply as per LEED BD+C v4.

Guidance
Projects must complete a site specific assessment to account for unique local conditions and changing ecological status. Project teams are encouraged to consider the requirements of this credit early and to align the assessment and research with the Integrative Process credit, as well as reference the UBC Sustainability Process for Major Capital Projects.

Resources
USGBC LEED v4 Site Assessment Worksheet:
http://www.usgbc.org/resources/site-assessment-worksheet

BC Conservation Data Centre:
http://www.env.gov.bc.ca/cdc/

UBC Sustainability Process for Major Capital Projects:
http://www.technicalguidelines.ubc.ca/files/Sustainability/UBC_Sustainability_Process-Dec2014.pdf

SS Credit:
Site Development - Protect or Restore Habitat

MANDATORY	
2 Required	2 Available

Requirements
All projects must comply as per LEED BD+C v4, Option 1: On-site Restoration to earn two points.

Guidance
Projects are encouraged to carefully consider soil condition requirements of the areas to be restored and vegetated, as well as consider aligning with rainwater management strategies.

While it is the requirement for all projects to comply by Option 1, where project teams determine it is not possible due to land use constraints or other limiting circumstances beyond design solutions, teams are encouraged to consider habitat offset purchase

to comply by financial support, to earn one point. Only Canadian land trusts are acceptable to UBC, and projects are encouraged to consider local options such as the Nature Trust of British Columbia.

Resources
www.naturetrust.bc.ca

SS Credit: Open Space

OPTIONAL	
0 Required	**1 Available**

Guidance
Projects are encouraged to pursue compliance with the credit requirements and to satisfy them within the project site area. If necessary, projects may claim eligible open space beyond the LEED Project Site Area, as per the credit guidance in the Reference Guide. Project teams are encouraged to identify desirable open space and liaise with the C+CP Green Building Manager to confirm it is available to be claimed, and has not been allocated to other LEED projects on campus.

Resources
Vancouver Campus Plan: http://www.campusplan.ubc.ca/

Refer to Part 2 Campus Plan, Map 2-3 Open Space Network.

SS Credit: Rainwater Management

MANDATORY	
2 Required	**3 Available**

Requirements
All projects must comply as per LEED BD+C v4, Option 1: Percentile of Rainfall Events, Path 1, 95th Percentile to earn a minimum of two points.

Guidance
UBC requires that each new building on campus consider and manage rainwater within the project site to contribute to campus-wide stormwater management. As per the UBC Integrated Stormwater Management Plan (Draft), the campus aims to keep runoff and overland flow from impacting sensitive adjacent sites, while managing challenging conditions for infiltration across much of the campus where clay soils occur. Refer to Appendix F, UBC Rainwater Infiltration Map, for areas where infiltration is allowed on campus.

Projects are encouraged to evaluate integrated strategies that consider the use of rainwater to offset both indoor and outdoor potable water needs, in addition to green infrastructure and low impact development (LID) strategies. Refer to the UBC Integrated Stormwater Management Plan (Draft) April 2014 for details on the campus-wide management strategies, and ensure proposed strategies are considered as part the Integrative Process and Site Assessment credits.

Access the USGBC LEED v4 Rainfall Events Calculator to document management

strategies and demonstrate compliance. The following table provides rainfall data calculated from historical records for UBC Vancouver Campus. This data is made available for guidance and planning purposes; historical records should be accessed for the relevant 30-year period.

Table 2:

PERCENTILE	RAINFALL EVENT (MM 24H STORM)
100th	72.7
98th	46.7
95th	37.4
90th	29
85th	24

Resources
Appendix F: Rainwater Infilitration Map:
http://www.usgbc.org/resources/rainfall-events-calculator

UBC Vancouver Campus Plan:
http://planning.ubc.ca/vancouver/planning/policies-plans/land-use-governance-documents/vancouver-campus-plan

UBC Integrated Stormwater Management Plan (Draft), April 2014:
http://planning.ubc.ca/sites/planning.ubc.ca/files/documents/projects-consultations/consultations/UBC%20Draft%20ISMPv4_April%202014.pdf

SS Credit: Light Pollution Reduction

MANDATORY	
1 Required	1 Available

Requirements
All projects must comply as per LEED BD+C v4 by applying either BUG rating method or Calculation method for one point.

Guidance
To determine the Uplighting and Light Trespass requirements for the project, teams should locate the project site on the UBC Light Zone Map (Appendix G), prepared to reflect the Model Lighting Ordinance, Lighting Zones across campus. In addition, refer to the Illuminance Hierarchy table and site plan in the Vancouver Campus Plan where required exterior lighting levels for each area of campus are described.

Resources
Appendix G: UBC Light Zone Map
http://planning.ubc.ca/sites/planning.ubc.ca/files/documents/planning-services/policies-plans/VCPUpdate2014_Part3.pdf

Refer to Part 3 Campus Plan, Map 3-13 Lighting – Building Exterior Areas.

International Dark Sky Association Model Lighting Ordinance:
http://darksky.org/our-work/public-policy/mlo/

UBC Centre for Interactive Research on Sustainability - LEED Platinum

WATER EFFICIENCY

WE Prerequisite: Outdoor Water Use Reduction

PREREQUISITE

Requirements
All projects must comply as per the requirements of LEED BD+C v4, Option 2 Reduced Irrigation.

Guidance
As per the UBC Technical Guidelines, automatic irrigation is required in all landscaped areas and drip irrigation is prohibited. Project teams are encouraged to consider high performance and efficient spray head systems, drought tolerant landscaping and include smart irrigation controls including rain sensors. Drip irrigation may be acceptable in some circumstances; teams may wish to propose it where appropriate and discuss with the relevant UBC project managers. All equipment should be consistent with UBC preferred systems.

Resources
UBC Technical Guidelines:
http://www.technicalguidelines.ubc.ca/technical/divisional_specs.html

UBC Water Action Plan:
https://sustain.ubc.ca/campus-initiatives/water/water-action-plan

WE Prerequisite: Indoor Water Use Reduction

PREREQUISITE

Requirements
All projects must comply as per the requirements of LEED BD+C v4.

Guidance
Potable water use reduction is a priority for UBC. While project teams are encouraged to consider strategies beyond fixture efficiency to reduce indoor water use, the following table summarizes minimum efficiencies for all UBC projects.

Table 3: Maximum Fixture Flush/Flow Rates for UBC

Fixture Type	Flow Rate
Toilets	4.8 LPF
Urinals	1.9 LPF
Lavatory faucets	1.9 LPF
Kitchen faucets	5.7 LPM
Shower heads	5.7 LPM

Project teams are advised to select high-efficiency toilets with a Maximum Performance (MaP) rating of at least 1000g of waste per flush for the best performance results.

In addition to fixtures and fittings, LEED BD+C v4 includes minimum performance standards for some appliances and process water loads as per Table 2 and Table 3 in the prerequisite. Project teams are encouraged to review and identify further opportunities for water use reduction by selecting efficient appliances as per ENERGYSTAR or equivalent standard, and by by working with the building users early in the design process to identify unique process water demands. A water assessment is also required as part of the Integrated Process credit to assess early on in the design process, specific loads from kitchens, laboratories, laundry, cooling towers, and other equipment demand volumes and reduction opportunities, as applicable.

Refer to the Integrated Process credit and the UBC Sustainability Process for Major Capital Projects for related guidance.

Resources
Maximum Performance (MaP) website:
http://www.map-testing.com/

UBC Technical Guidelines:
http://www.technicalguidelines.ubc.ca/technical/divisional_specs.html

US EPA Water Sense:
https://www3.epa.gov/watersense/

UBC Sustainability Process for Major Capital Projects:
http://www.technicalguidelines.ubc.ca/files/Sustainability/UBC_Sustainability_Process-Dec2014.pdf

WE Prerequisite: Building Level Water Metering

PREREQUISITE

Requirements
All projects must comply as per the requirements of LEED BD+C v4.

Guidance
Building level water metering, data collection and reporting is strongly supported and aligned with UBC goals and performance targets.

Project teams should refer to the Vancouver Campus Plan Design Guidelines and the UBC Monitoring Based Commissioning Requirements, which require projects to include potable water metering to track water consumption for building and exterior landscape within the project scope.

Resources
UBC Monitoring Based Commissioning:
http://www.technicalguidelines.ubc.ca/technical/divisional_specs.html#Div01

UBC Vancouver Campus Plan – Design Guidelines:
http://planning.ubc.ca/sites/planning.ubc.ca/files/documents/planning-services/policies-plans/VCPUpdate2014_Part3.pdf

WE Credit: Outdoor Water Use Reduction

MANDATORY	
1 Required	**2 Available**

Requirements
All projects must comply as per the requirements of LEED BD+C v4, Option 2 Reduced Irrigation (50%) to earn at least one point.

Guidance
Potable water use reduction is a priority for UBC, however, as per the UBC Technical Guidelines, automatic irrigation is required in all landscaped areas and drip irrigation is prohibited. Project teams are encouraged to consider high performance and efficient spray head systems, drought tolerant landscaping, and smart irrigation controls and rain sensors to demonstrate additional savings. Drip irrigation may be acceptable in some circumstances; teams may wish to propose it where appropriate and discuss with the relevant UBC project managers.

Resources
UBC Technical Guidelines:
http://www.technicalguidelines.ubc.ca/technical/divisional_specs.html

UBC Water Action Plan:
https://sustain.ubc.ca/campus-initiatives/water/water-action-plan

WE Credit: Indoor Water Use Reduction

MANDATORY	
3 Required	**6 Available**

Requirements
All projects must comply as per the requirements of LEED BD+C v4 for a water use reduction of at least 35% and 3 points.

Guidance
Potable water use reduction is a priority for UBC. While project teams are

encouraged to consider strategies beyond fixture efficiency to reduce indoor water use, the following table summarizes maximum efficiencies for all UBC projects. Although not preferred, waterless urinals will be considered in lower occupancy program areas.

Table 4: Maximum Fixture Flush/Flow Rates for UBC

Fixture Type	Flow Rate
Toilets	4.8 LPF
Urinals	1.9 LPF
Lavatory faucets	1.9 LPF
Kitchen faucets	5.7 LPM
Shower heads	5.7 LPM

Project teams are advised to select high-efficiency toilets with a Maximum Performance (MaP) rating of at least 1,000g of waste per flush for the best performance results.Projects are urged to consider captured rainwater, recycled wastewater/greywater or other non-potable sources and strategies to meet the requirements, and exceed 35% savings.

In addition to fixtures and fittings and non-potable sources, project teams are encouraged to review and identify further opportunities for water use reduction through selecting efficient appliances as per ENERGYSTAR or equivalent standard, and to identify building typologies or building spaces with specific process water loads. These loads are required to be identified as part of the Integrated Process credit to assess early on, specific loads from kitchens, laboratories, laundry, cooling tower, and other equipment demand volumes and reduction opportunities, as applicable.

Refer to the Integrated Process credit and the UBC Green Building Process for Major Capital Projects for related guidance.

Resources

Maximum Performance (MaP) website:
http://www.map-testing.com/

UBC Technical Guidelines:
http://www.technicalguidelines.ubc.ca/technical/divisional_specs.html

UBC Water Action Plan:
https://sustain.ubc.ca/campus-initiatives/water/water-action-plan

UBC Sustainability Process for Major Capital Projects:
http://www.technicalguidelines.ubc.ca/files/Sustainability/UBC_Sustainability_Process-Dec2014.pdf

WE Credit: Cooling Tower Water Use

MANDATORY	
2 Required	2 Available

Requirements
All projects must comply as per the requirements of LEED BD+C v4.

Guidance
Water in cooling towers is chemically treated to control bacterial growth. Local water is very soft and does not require calcium, calcium carbonate or other minerals be controlled with treatment, and as such cooling tower blowdown rate (wasted water) is minimal. Buildings which do not include a cooling tower may use Pilot ACP "No Cooling Tower".

Resources
UBC Water Action Plan:
https://sustain.ubc.ca/campus-initiatives/water/water-action-plan

LEED Pilot credit library, open ACP for No Cooling Tower Metric
http://www.usgbc.org/node/5586086?return=/pilotcredits/all/v4

WE Credit: Water Metering

OPTIONAL	
0 Required	1 Available

Requirements
All projects are encouraged to comply as per the requirements of LEED BD+C v4.

Guidance
Projects with significant water process loads such as laboratories or other high water load uses are encouraged to comply and consider a metering strategy early. Refer to the Integrated Process credit and include considerations as part of the water analysis. The credit requires two submeters. The following sub systems are recommended for metering: irrigation and process water.

Resources
UBC Monitoring Based Commissioning:
http://www.technicalguidelines.ubc.ca/technical/divisional_specs.html#Div01

UBC Vancouver Campus Plan – Design Guidelines:
http://planning.ubc.ca/sites/planning.ubc.ca/files/documents/planning-services/policies-plans/VCPUpdate2014_Part3.pdf

UBC Student Union Building - Pursuing LEED Platinum

ENERGY AND ATMOSPHERE

EA Prerequisite:
Fundamental Commissioning and Verification

PREREQUISITE

Requirements
Refer to EA credit – Enhanced Commissioning.

EA Prerequisite: Minimum Energy Performance

PREREQUISITE

Requirements
Refer to EA credit – Optimize Energy Performance.

EA Prerequisite: Building Level Energy Metering

PREREQUISITE

Requirements
Refer to EA credit Advanced Energy Metering.

EA Prerequisite:
Fundamental Refrigerant Management

PREREQUISITE

Requirements
Refer to EA Credit – Enhanced Refrigerant Management.

EA Credit: Enhanced Commissioning

MANDATORY	
4 Required	**6 Available**

Requirements
All projects must comply as per the requirements of LEED BD+C v4, Option 1, Path 2, for a minimum of four points. Envelope Commissioning is encouraged but not required.

Guidance
A Commissioning Authority must be engaged before the completion of Design Development, and project teams are urged to consider the requirements of Fundamental Commissioning and Verification within the mandatory requirements of the Enhanced Commissioning credit. Teams are encouraged to develop a strong Basis of Design (BOD) document in response the Owners Project Requirements (OPR). Submit the BOD and OPR prior to Development Permit application, and the Commissioning and Measurement and Verification Plan prior to Building Permit application. Project teams should refer to the UBC Technical Guidelines Section 019100 Commissioning for the details on implementing commissioning on campus.

Resources
UBC Technical Guidelines Division 1 General Conditions, Section 01 91 00 Commissioning:
http://www.technicalguidelines.ubc.ca/technical/divisional_specs.html#Div01

UBC Technical Guidelines Division 1 General Conditions, Section 019200 Monitoring Based Commissioning:
http://www.technicalguidelines.ubc.ca/technical/divisional_specs.html#Div01

UBC Sustainability Process for Major Capital Projects:
http://www.technicalguidelines.ubc.ca/files/Sustainability/UBC_Sustainability_Process-Dec2014.pdf

EA Credit: Optimize Energy Performance

MANDATORY	
10 Required	**18 Available**

Requirements
Projects are required to comply with the credit for Optimize Energy Performance by applying Option 1, Whole Building Simulation. Teams may choose to use either ASHRAE 90.1 – 2010 or NECB 11 (as per Canadian ACPs) as the reference energy code. A minimum savings of 25% for 10 points are mandatory.

Alternative Energy Performance Metric Requirements
The USGBC has available an Alternate Energy Performance Metric through the Pilot Credit Library. This option allows projects to demonstrate compliance by applying a metric other than energy cost, including Source Energy and Greenhouse Gas Emissions, which align closely with UBC's Climate Action Plan (CAP).

Project teams are required to consider the Alternative Energy Performance Metric path and evaluate to the most beneficial approach when the initial energy modeling is undertaken at Schematic Design. Options must be presented to the UBC project management team and the Green Building manager to assess the most advantageous evaluation method or modeling scenario.

As per the Pilot Credit, if the Alternative Performance Metric is pursued, it applies to the Minimum Energy Performance prerequisite, Optimize Energy Performance and On-site Renewable Energy credits; teams are required to register their pursuit of the Pilot Credit with the USGBC.

Should the Alternative Performance Metric Pilot Credit become unavailable, use Option 1, Whole Building Simulation comparing energy cost.

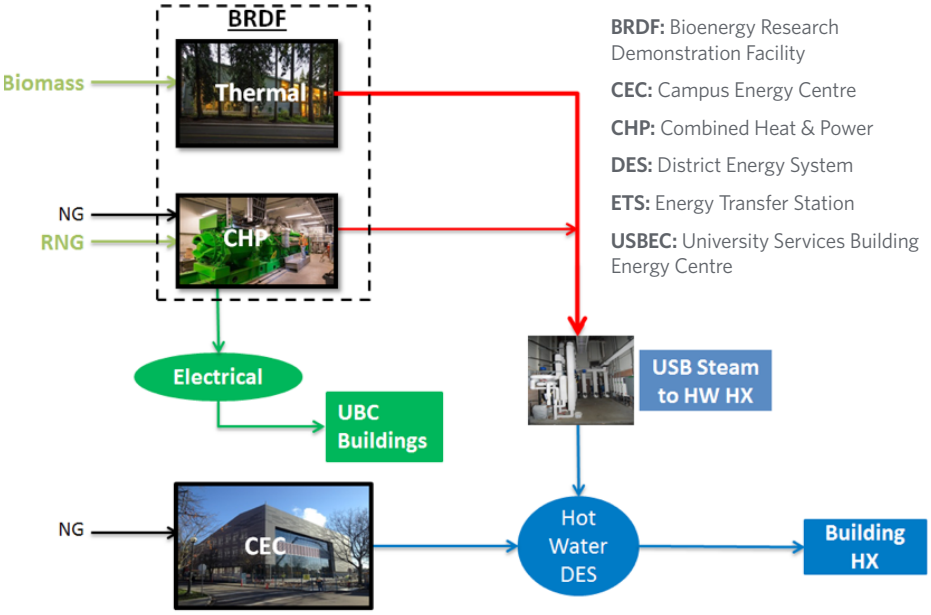
Guidance

New buildings must connect to the district energy system, to reduce life cycle costs and greenhouse gas emissions (GHG) by way of the renewable thermal energy from the Bioenergy Research and Demonstration Facility (BRDF). Some buildings may be located too far from a district energy line and should be heated either by the efficient use of electricity or target Passive House requirements.

There are three main district energy sources at UBC:

1. The Campus Energy Centre (CEC): Three 15 MW high-efficiency hot water boilers fuelled by natural gas. These serve as the primary energy source to the district energy system.
2. The BRDF's biomass boiler: A base loaded 6 MW thermal energy boiler which runs on wood waste and produces renewable thermal energy.
3. The BRDF's cogeneration unit: A 2 MWe combined heat and power engine is fuelled by a mix of natural gas and renewable natural gas (RNG). 2.4 MW of thermal energy is recovered from the engine which is also base loaded.

Figure 2: UBC Energy Generation Services for the Academic DES



It is recommended that projects that connect to the Academic District Energy System, use Path 2: Full accounting of DES upstream and downstream equipment, to take full advantage of the UBC Academic District Energy System efficiencies and renewable energy contribution. DES system efficiencies, utility costs and calculated contributions from the CEC, Bioenergy Research Demonstration Facility the (BRDF) and the CHP operation electrical and thermal energy production to be applied to projects are provided as reference in Appendix H.

If the Alternative Energy Performance Metric is pursued, project teams are advised to carefully review the Pilot Credit Library for additional documentation requirements.

Resources
Refer to Appendix H, UBC District Energy System and Utility Data
UBC Climate Action Plan:
https://sustain.ubc.ca/campus-initiatives/climate-energy/climate-action-plan-2020

UBC Sustainability Process for Major Capital Projects:
http://www.technicalguidelines.ubc.ca/files/Sustainability/UBC_Sustainability_Process-Dec2014.pdf

Alternative Compliance Paths for Canadian LEED Projects (link):
http://www.cagbc.org/cagbcdocs/leed/LEED%20v4%20Canadian%20ACP%20Language-as%20of%202014-06-24.pdf

LEED Pilot credit library, open ACP for Alternative Energy Performance Metric:
http://www.usgbc.org/node/7489409?return=/pilotcredits/all/all

EA Credit: Advanced Energy Metering

MANDATORY	
1 Required	**1 Available**

Requirements
All projects must comply as per the requirements LEED BD+C v4 Reference Guide.

Guidance
Project teams should reference the UBC Monitoring Based Commissioning Document to inform and align the metering strategy. During the design process, project teams are urged to engage UBC Building Operations or Student Housing and Hospitality Services in developing a monitoring strategy and operational data reporting protocol so as to maximize opportunities for operator feedback.

Resources
UBC Technical Guidelines Division 1 General Conditions, Section 019200 Monitoring Based Commissioning:
http://www.technicalguidelines.ubc.ca/technical/divisional_specs.html#Div01

UBC Technical Guidelines:
http://www.technicalguidelines.ubc.ca/

UBC Building Operations:
http://www.buildingoperations.ubc.ca/

EA Credit: Demand Response

MANDATORY	
1 Required	**2 Available**

Requirements
All projects must comply as per the requirements of LEED BD+Cv4, Case 2 – Demand Response Program Not Available, for 1 point.

Guidance
UBC encourages design teams to consider the requirements of this credit early in design to support future opportunities to align with a fully automated demand response program. Teams are urged to coordinate their approach with UBC project management and the Green Building Manager.

UBC is not currently under a demand response contract with BC Hydro or Fortis BC, but is preparing for future demand response obligations due to a limited peak demand infrastructure capacity and a growing campus. Demand Response (DR) integrated into building controls shall be semi-automate where participation in a DR event will need to be decided and initiated by a person on a case-by-case basis. All DR measures shall be tied to one initiation line of code and fully automated thereafter. The DR system programming must be tested to effectively reduce demand as required by the LEED credit and commissioned as part of the Commissioning Authority's scope of work. UBC is a major research university any demand response programming to curtail demand must not adversely impact research and curtailment must not be targeted for critical research equipment.

Resources
UBC Technical Guidelines:
http://www.technicalguidelines.ubc.ca/

EA Credit: Renewable Energy Production

MANDATORY	
1 (or 2) Required	**3 Available**

Requirements
Projects connected to the Academic District Energy System (for thermal energy) are required to provide a minimum 5% on-site renewable energy to earn at least 2 points. Projects not connected to the Academic District Energy System (for thermal energy) must provide at least 1% on-site renewable energy to earn at least 1 point.

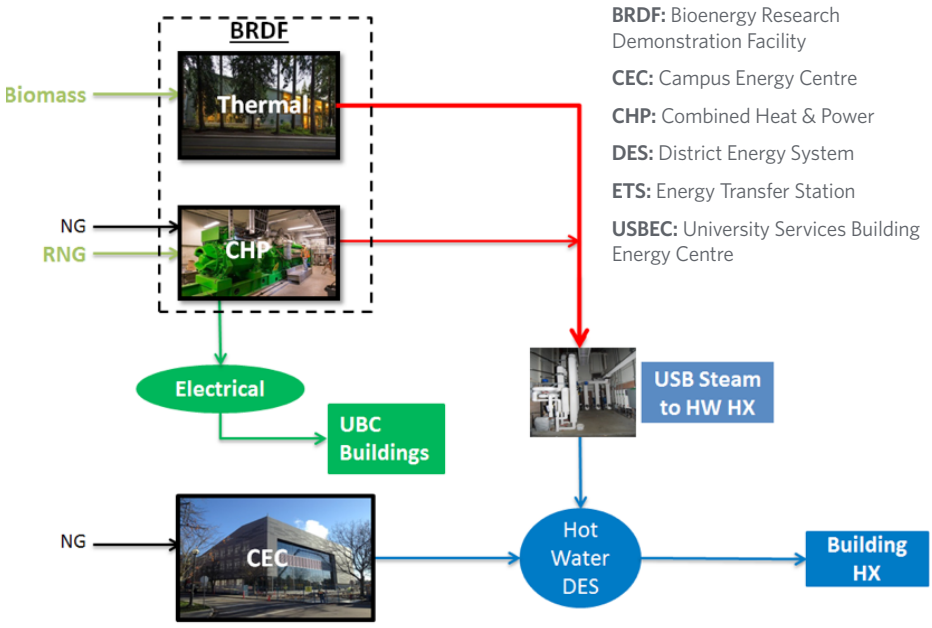
Alternative Energy Performance Metric Requirements
If the Alternate Energy Performance Metric is applied to comply with the Minimum and Optimize Energy Performance prerequisite and credit, the same metric is required to be used for Renewable Energy Production.

Guidance
There are three main district energy sources at UBC:

- The Campus Energy Centre (CEC) - consists of three 15 MW high-efficiency hot water boilers fueled by natural gas. These serve as the primary energy source to the district energy system.
- The BRDF's biomass boiler – a base loaded 6 MW thermal energy boiler which runs on wood waste and produces renewable thermal energy.
- The BRDF's cogeneration unit – a 2 MWe combined heat and power engine is fueled by a mix of natural gas and renewable natural gas (RNG). 2.4 MW of thermal energy is recovered from the engine which is also base loaded.

The BRDF system use biomass to generate renewable thermal heat for the DES, accounting for approximately 25% of the overall DES thermal heat generation on campus. Projects connected to the Academic District Energy System can account for the portion of thermal heat that is generated from the BRDF as renewable energy source.

Figure 3: UBC Energy Generation Services for the Academic DES



It is recommended that projects that connect to the Academic District Energy System apply Path 2: Full accounting of DES upstream and downstream equipment, to take full advantage of the DES system efficiencies and renewable energy portion.

Data for the UBC Academic District Energy System efficiencies, utility costs and calculated contribution from BRDF thermal energy production are provided in Appendix H. The Appendix also includes a copy of he required letter from the owner of the DES to be submitted as part of the credit documentation.

If the Alternative Energy Performance Metric is pursued, project teams are advised to carefully review the Pilot Credit Library (insert link) for additional documentation requirements.

Resources

Refer to Appendix H, UBC District Energy System and Utility Data

UBC Climate Action Plan:
https://sustain.ubc.ca/campus-initiatives/climate-energy/climate-action-plan-2020

UBC Sustainability Process for Major Capital Projects:
http://www.technicalguidelines.ubc.ca/files/Sustainability/UBC_Sustainability_Process-Dec2014.pdf

Alternative Compliance Paths for Canadian LEED Projects

LEED Pilot credit library, open ACP for Alternative Energy Performance Metric:
http://www.usgbc.org/node/7489409?return=/pilotcredits/all/all

EA Credit: Enhanced Refrigerant Management

MANDATORY	
1 Required	1 Available

Requirements
All projects must comply as per the requirements of the LEED BD+C v4 Reference Guide.

Guidance
Projects may comply by Option 1 or Option 2.

Resources
N/A

EA Credit: Green Power and Carbon Offsets

OPTIONAL	
0 Required	2 Available

Requirements
All projects are encouraged to comply as per the requirements of LEED BD+C v4.

Guidance
At the time of publication, a LEED Interpretation submitted by the BC Climate Action Secretariat was under consideration to confirm if provincial carbon offsets (Offsetters) may be considered equivalent to Green-E certification. If the outcome is positive, it may allow projects to comply the carbon offset credit requirement. This credit will remain Optional until the LEED Interpretation is complete. Green power and Renewable Energy Credits are not recommended for project credit achievement.

Resources
N/A


UBC Bio Energy Research Demonstration Facility

UBC Robert Lee Alumni Centre

MATERIALS AND RESOURCES

MR Prerequisite:
Storage and Collection of Recyclables

PREREQUISITE

Requirements
All projects must comply as per the requirements of the LEED BD+C v4 Reference Guide.

Guidance
Waste diversion and collection systems are well established on the Vancouver Campus for all operational waste. Refer to the UBC Technical Guidelines, Recycling Infrastructure Guidelines for UBC Buildings for guidance on required waste and recycling collection containers and storage locations. Campus collection strategies are in place for mercury containing lamps, batteries and electronic waste through UBC Risk Management. Refer to the UBC Risk Management for details.

Resources
Battery recycling:
http://riskmanagement.ubc.ca/environment/recycling-programs/battery-recycling

Electronic waste:
http://www.buildingoperations.ubc.ca/sustainability/zero-waste/e-waste/

Mercury Containing Lamps:
http://www.buildingoperations.ubc.ca/sustainability/zero-waste/recycling-programs/

Recycling Infrastructure Guidelines for UBC Buildings

http://www.technicalguidelines.ubc.ca/technical/sustainability.html#issues

UBC Technical Guidelines:
http://www.technicalguidelines.ubc.ca/

MR Prerequisite:
Construction and Demolition Management Planning

PREQUISITE

Requirements
All projects must comply as per the requirements of the LEED BD+C v4 Reference Guide.

Guidance
Refer to Division 1 of the UBC Technical Guidelines 01 74 19 Construction Waste Management Plan for detailed guidance on developing a compliant plan to guide the project. Project teams are advised to ensure the management plan includes a robust and regular ongoing reporting protocol during construction to support the most successful process and highest diversion rates. UBC provides tools and tracking forms for construction waste at the Technical Guidelines link below.

Resources
UBC Vancouver Campus Zero Waste Action Plan:
https://sustain.ubc.ca/campus-initiatives/recycling-waste/what-ubc-doing/waste-action-plan

UBC Technical Guidelines: Construction and Demolition Waste:
http://www.technicalguidelines.ubc.ca/technical/sustainability.html

Technical Guidelines 01 74 19 Construction Waste Management and Disposal.

MR Credit: Building Life Cycle Impact Reduction

MANDATORY	
0 Required	**0 Available**

Requirements
All projects must comply as per the requirements of the LEED BD+C v4 Reference Guide, by applying Option 4 Whole-Building Life-Cycle Assessment to earn three points.

Qualifying major renovations may comply by applying Option 1 – Historic Building Reuse to earn five points. Project teams are advised to confirm eligibility of historic designation with USGBC in advance, by checking for future direction published through LEED Interpretations or submitting a project specific Credit Interpretation.

Guidance
Project teams are encouraged to identify a specialist (within the existing project team or special consultant) to facilitate the LCA analysis early in the design process, and link this effort to the Integrative Process credit, and align it with the UBC Sustainability Process for Major Capital Projects.

Project teams are also encouraged to consider the use of wood as a substantial contribution to the building construction to take advantage of the low carbon benefits and support the local, responsible timber industry.

Resources
UBC Sustainability Process for Major Capital Projects:
http://www.technicalguidelines.ubc.ca/files/Sustainability/UBC_Sustainability_Process-Dec2014.pdf

MR Credit: Building Product Disclosure and Optimization (BPDO) – Environmental Product Declarations

OPTIONAL	
0 Required	2 Available

Requirements
All projects are encouraged to comply with the credit requirements by demonstrating compliance with either environmental product declaration and/or multi-attribute optimization.

Guidance
Project teams should carefully consider material attributes early in the design process, and are encouraged to contact manufacturers and suppliers to request information and verification documentation for both attributes required by Option 1 and Option 2 where it is not already available, to help advocate for transparent and verified material attribute reporting. Project teams should include considerations for materials qualities within individual specification sections.

Resources
USGBC BPDO Calculator:
http://www.usgbc.org/resources/bpdo-calculator

International Standard Organization:
www.iso.org

International EPD System:

http://www.environdec.com/en/EPD-Search/

ASTM Environmental Product Declarations:

http://www.astm.org/CERTIFICATION/EpdAndPCRs.html

UL Environment EPD System:

http://productguide.ulenvironment.com/SearchResults.aspx?CertificationID=15

NSF Environmental Product Declarations:

http://info.nsf.org/Certified/Sustain/Listings.asp?ProdCat=EPD&

MR Credit:
Building Product Disclosure and Optimization (BPDO) – Sourcing of Raw Materials

MANDATORY	
1 Required	2 Available

Requirements
All projects must comply as per the requirements of the LEED BD+C v4 Reference Guide by applying Option 2 Leadership Extraction Practices, to earn 1 point. Teams are encouraged to pursue raw material source and extraction reporting for an additional 1 point.

Guidance
UBC has prioritized the following material qualities as part of the Technical Guidelines for Sustainability:

- Reused or salvaged materials or equipment
- Materials that are certified as having an optimized life cycle impact by a third party
- Materials with recycled and recyclable content
- Materials that are appropriately and responsibly sourced
- Bio based materials
- Wood

Project teams should carefully consider material attributes early in the design process, and are encouraged to contact manufacturers and suppliers to request information and verification documentation for both attributes required by Option 1 and Option 2 where it is not already available, to help advocate for transparent and verified material attribute reporting.

Project teams should include considerations for materials qualities within individual specification sections.

Resources
FSC Canada:
www.fsccanada.org
http://findfsc.com/

Sustainable Agriculture Network:
www.sanstandards.org

The Rainforest Alliance:
www.rainforest-alliance.org

UBC Technical Guidelines:
http://www.technicalguidelines.ubc.ca/

USGBC BPDO Calculator:
http://www.usgbc.org/resources/bpdo-calculator

MR Credit: Building Product Disclosure and Optimization (BPDO) – Material Ingredients

OPTIONAL	
0 Required	**2 Available**

Requirements
All projects are encouraged to comply as per the requirements of the LEED BD+C v4 Reference Guide by applying any combination of Options.

Guidance
Supporting and advocating for healthy building materials and transparency is a high priority for UBC. Project teams are encouraged to contact suppliers and manufacturers of products to request required documentation where it is not already available, to help advocate for verified material ingredient and attribute reporting. Project teams should include considerations for materials qualities within individual specification sections.

Resources
UBC Technical guidelines:
http://www.technicalguidelines.ubc.ca/

USGBC BPDO Calculator:
http://www.usgbc.org/resources/bpdo-calculator

International Standards Organization:
www.iso.org

Cradle to Cradle Product Innovation Institute:
http://www.c2ccertified.org/

HPD Collaborative:
http://hpdcollaborative.org/

American Institute of Architects Practicing Architecture - Materials:
http://www.aia.org/practicing/materials/index.htm

Declare Product Database:
http://www.aia.org/practicing/materials/index.htm

Pharos:
https://www.pharosproject.net/

MR Credit:
Construction and Demolition Waste Management

MANDATORY	
2 Required	**2 Available**

Requirements
All projects must comply as per the requirements of the LEED BD+C v4 Reference Guide, Option 1, Path 2, Divert 75% and Four Material Streams to earn 2 points. While the credit will be earned by demonstrating 75% of waste has been diverted, UBC has set a more ambitious goal and requires at least 90% of waste is diverted.

As an alternative, projects are encouraged to pursue compliance via Option 2, Reduction of Total Waste Material for 2 points, in lieu of Option 1, Path 2.

Guidance
Refer to the UBC Technical Guidelines for Sustainability for direction on preparing a Construction Waste Management Plan. Project teams are advised to ensure the management plan includes a robust and regular ongoing reporting protocol during construction to support the most successful process and highest diversion rates. UBC provides tools and tracking forms for construction waste at the Technical Guidelines link below.

Resources
UBC Technical Guidelines: Construction and Demolition Waste:
http://www.technicalguidelines.ubc.ca/technical/sustainability.html

INDOOR ENVIRONMENTAL QUALITY

EQ Prerequisite: Environmental Tobacco Smoke Control

PREREQUISITE

Requirements
All projects must comply as per the requirements of LEED BD+C v4.

Guidance
Project teams are advised that UBC Policy prohibits smoking 8 meters from any doorway or building air intake, such as an openable window or air vent. Signage indicating that smoking is not allowed within 8 meters must be funded and installed as part of the project scope and budget.

Resources
http://riskmanagement.ubc.ca/health-safety/smoking

http://www.universitycounsel.ubc.ca/files/2012/07/policy15.pdf

EQ Credit: Enhanced Indoor Air Quality Strategies

MANDATORY	
1 Required	2 Available

Requirements
All projects must comply as per the requirements of LEED BD+C v4, by complying with Enhanced IAQ strategies to earn 1 point. Complying with additional enhanced IAQ strategies for an additional point is encouraged but not required.

Guidance
As per the UBC Technical Guidelines, Institutional Grade Entry Mats are required in all entries to reduce cleaning, and to provide sufficient non-slip flooring at entrances. Mat wells of any kind are not allowed.

Resources
UBC Technical Giuidelins Section 09 00 10:
http://www.technicalguidelines.ubc.ca/technical/divisional_specs.html#Div09

EQ Credit: Low Emitting Materials

MANDATORY	
3 Required	3 Available

Requirements
All projects must comply as per the requirements of LEED BD+C v4 to earn 3 points by applying either Option 1 or Option 2.

Guidance
Material health and transparency is a high priority for UBC and project teams are urged to consider the lowest emitting materials available, and to advocate to manufacturers and suppliers where more information is required or better performing materials are needed. Project teams should include considerations for low emitting materials within individual specification sections.

Resources
South Coast Air Quality Management District: http://www.aqmd.gov/

EQ Credit: Construction Indoor Air Quality Management Plan

MANDATORY	
1 Required	2 Available

Requirements
All projects must comply as per the requirements of LEED BD+C v4 to earn at least one point.

Guidance
N/A

Resources
Sheet Metal and Air-Conditioning National Contractors Association: www.smacna.org

EQ Credit: Indoor Air Quality Assessment

MANDATORY	
1 Required	2 Available

Requirements
All projects must comply as per the requirements of LEED BD+C v4 by applying Option 1 – Flush-out, to earn at least one point. Path 1 or Path 2 are both acceptable. Project

teams are encouraged, but not required, to pursue Option 2 – Air Testing to earn two points.

Guidance
Project teams pursuing Path 1 or Path 2, are advised to consider the construction schedule carefully. Teams must provide time contingency to ensure an adequate period is available to flush the building post construction and in advance of occupancy.

Project teams are advised to liaise with the mechanical engineer early to determine the required flush-out period based on equipment and average outdoor temperature at the time of flushing.

Option 2 Air testing (1 point)

Project teams pursuing Option 2 are advised to create the best conditions under which to conduct IAQ testing. The building should be cleaned and allowed to air before the IAQ testing takes place. Any cleaning products used before testing should be low in VOCs such as EcoLogo or Green Seal certified products. Project teams are urged to contact their IAQ testing professional for additional advice on building condition in advance of testing, as well as to discuss scheduling and timing.

Scheduling should allow time for lab results to confirm the air quality has met the requirements, in case re-testing is necessary. Re-testing must be done in advance of occupancy.

Resources
Sheet Metal and Air Conditioning Contractor's National Association:
www.smacna.org

EQ Credit: Thermal Comfort

MANDATORY	
1 Required	**1 Available**

Requirements
All projects must comply as per the requirements of LEED BD+C v4 by applying either ASHRAE Standard 55-2010 or ISO and CEN Standards to earn one point.

Guidance
N/A

Resources
UBC Technical Guidelines Section 20 00 30 Indoor Thermal Comfort:
http://www.technicalguidelines.ubc.ca/technical/divisional_specs.html#Div20

EQ Credit: Interior Lighting

OPTIONAL	
0 Required	**1 Available**

Requirements

All projects are encouraged to comply as per the requirements of LEED BD+C v4 by applying either Option 1: Lighting Control and/or Option 2: Lighting Quality.

Guidance
N/A

Resources
USGBC Interior Lighting Calculator:
http://www.usgbc.org/resources/interior-lighting-calculator

INNOVATION

IN Credit: Innovation

MANDATORY	
5 Required	**5 Available**

Requirements
All projects must comply as per the requirements of LEED BD+C v4 to earn the maximum of 5 available Innovation points. Projects are required to document Green Cleaning and an Education Program as two of the five strategies. Specific program elements for Education may be proposed at the discretion of the design team. UBC offers Green Building tours which may contribute to active education strategy.

Guidance
Project teams can consider pursuing the following Pilot Credits which align with UBC priorities and programs:

- Bird Friendly Design
- Design for Enhanced Resilience

Project teams should reference the USGBC Innovation Catalogue to identify other appropriate and available Innovation credits for their projects early in the design process.

Resources
USGBC Innovation Credit Library:
http://www.usgbc.org/credits/new-construction/v4/innovation-catalog

USGBC Pilot Credit Library:
http://www.usgbc.org/pilotcredits

UBC green Cleaning Program:
http://www.buildingoperations.ubc.ca/wp-content/uploads/2011/06/Green-Cleaning-Program1.pdf

REGIONAL PRIORITY

RP Credit: Regional Priority

MANDATORY	
4 Required	4 Available

Requirements
All projects must comply as per the requirements of LEED BD+C v4 to earn the maximum of 4 available Regional Priority points from the 6 options for Regional Priority Credits.

Guidance
Regional Priority Credits for Canada are identified in the LEED v4 Regional Priority Credit Selection Canada document available through the CaGBC website. Applicable credits for UBC are thost listed for Zone 6A Pacific Maritime + Urban Population.

Based on UBC's mandatory requirements of the base credits, all projects can expect to earn the following:

- Regional Priority - SS Rainwater Management (2 points base credit)
- Regional Priority - EA Optimize Energy Performance – (10 points base credit)
- Regional Priority - MR Building Life-Cycle Impact Reduction – (3 points base credit)

At least one additional Regional Priority credit must be earned from the remaining options:

- Regional Priority - WE Outdoor Water Use Reduction (2 points base credit)
- Regional Priority - WE Indoor Water Use Reduction (4 points base credit)
- Regional Priority - EA Enhanced Commissioning (5 points base credit)

Resources
LEED v4 Regional Priority Credit Selection – Canada:
https://www.cagbc.org/cagbcdocs/leed/LEED%20v4%20Canada%20Regional%20Priority%20Credit%20Selection%202014-08-05-EN.pdf

APPENDIX A

UBC LEED Implementation Guide Variance Request Form

APPENDIX B

UBC Sustainability Process for Major Capital Projects

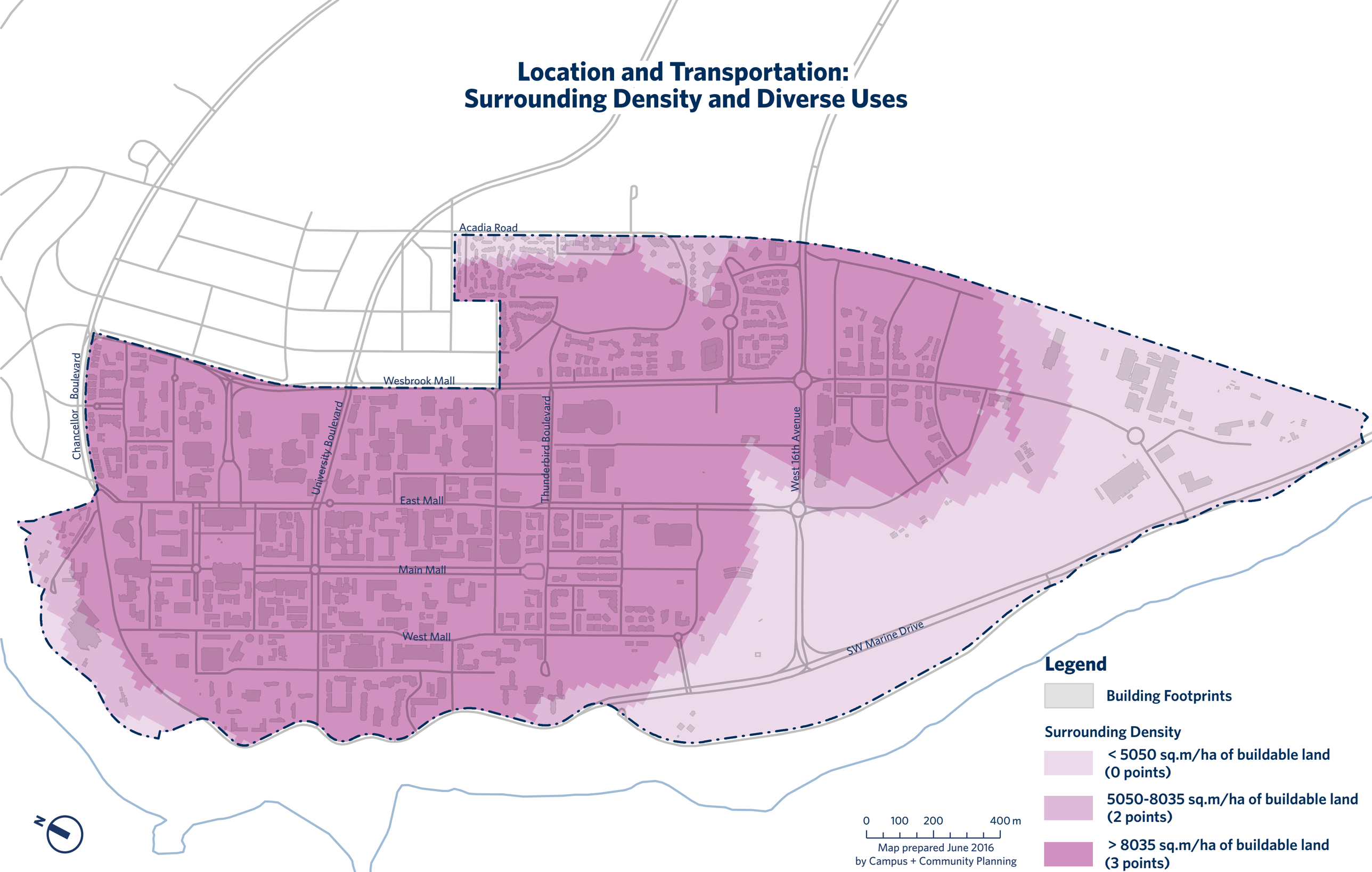
UBC SUSTAINABILTY PROCESS- Major Capital Projects

Phase	Step	Responsibility	Description	Prerequisites	Outcomes	Participants
Pre-Design	**Step 1: Design Brief Development**	C&CP	Staff develop a set of social, economic and environmental sustainability goals with stakeholders, reflecting the particular challenges and opportunities for the project.			UBC stakeholders
	Board 1					
Schematic Design	**Step 2: Design Brief Handoff**	C&CP	Meeting to present and discuss sustainability goals, fielding questions and challenges from the Architect.	• Architect selected	• Communication of goals and aspirations	Architect, UBC stakeholders Project Manager
	Step 3A: Preliminary Energy and Water Workshop	Design Team	Based on preliminary energy analysis and water budget, coordinate a team meeting to brainstorm / assess potential strategies to achieve project goals. Consider: site conditions, massing and orientation, renewable energy potential, basic envelope attributes, lighting levels, thermal comfort ranges, process load needs, operational parameters.	• **Schedule early enough in schematic design to inform massing decisions** • Team's Initial information analysis complete • Preliminary energy analysis and identification of dominant energy loads complete • Indoor, outdoor and process water budget complete	• Encourage thinking "out of the box" • Passive design and synergies considered and regenerative design possibilities identified • Submit meeting minutes	Design Team, UBC stakeholders Project Manager
	AUDP Pre-application					
	Step 3B: General Sustainability Workshop (technical)	Design Team	Facilitated team meeting to investigate integrated strategies that meet sustainability goals and which explore synergies among systems and components.	• **Schedule with AUDP pre-application meeting during schematic design** • Submit workshop agenda for approval	• Agreement on specific targets for each Design Brief goal. • Conceptual building envelope design • Submit meeting minutes and LEED checklist	Design Team, UBC stakeholders Project Manager
	Development Permit Process: AUDP, DRC, public open house					
	Board 2					
	DP					
Design Development	**Step 3C: Interactive Energy Workshop**	Design Team	Review potential energy savings strategies to inform and refine energy and envelope design relative to life cycle costs.	• **Schedule at the end of design development** • Energy model complete • Consensus on energy conservation measures	• Life cycle cost consideration of energy conservation measures • Submit energy model report	Design Team, UBC stakeholders Project Manager
Construction Documents	**Step 4: Sustainability Reporting**	Design Team	Submit Sustainability Report which summarizes the cross cutting strategies used to achieve performance and process targets for each design brief goal	• **Schedule before BP**	**Submit prior to occupancy:** • Sustainability Report • Final energy model • M&V and Cx Plan • Final LEED scorecard	Design Team
	Board 3					
	BP					
Construction/ Occupancy	**Step 5: Report Performance**	Design Team C&CP	Report broad sustainability outcomes from the project for inclusion in the Board 4 Report	• 1 year of performance records available • LEED documentation submitted to UBC	• Feedback to inform future projects	UBC stakeholders
	Board 4					

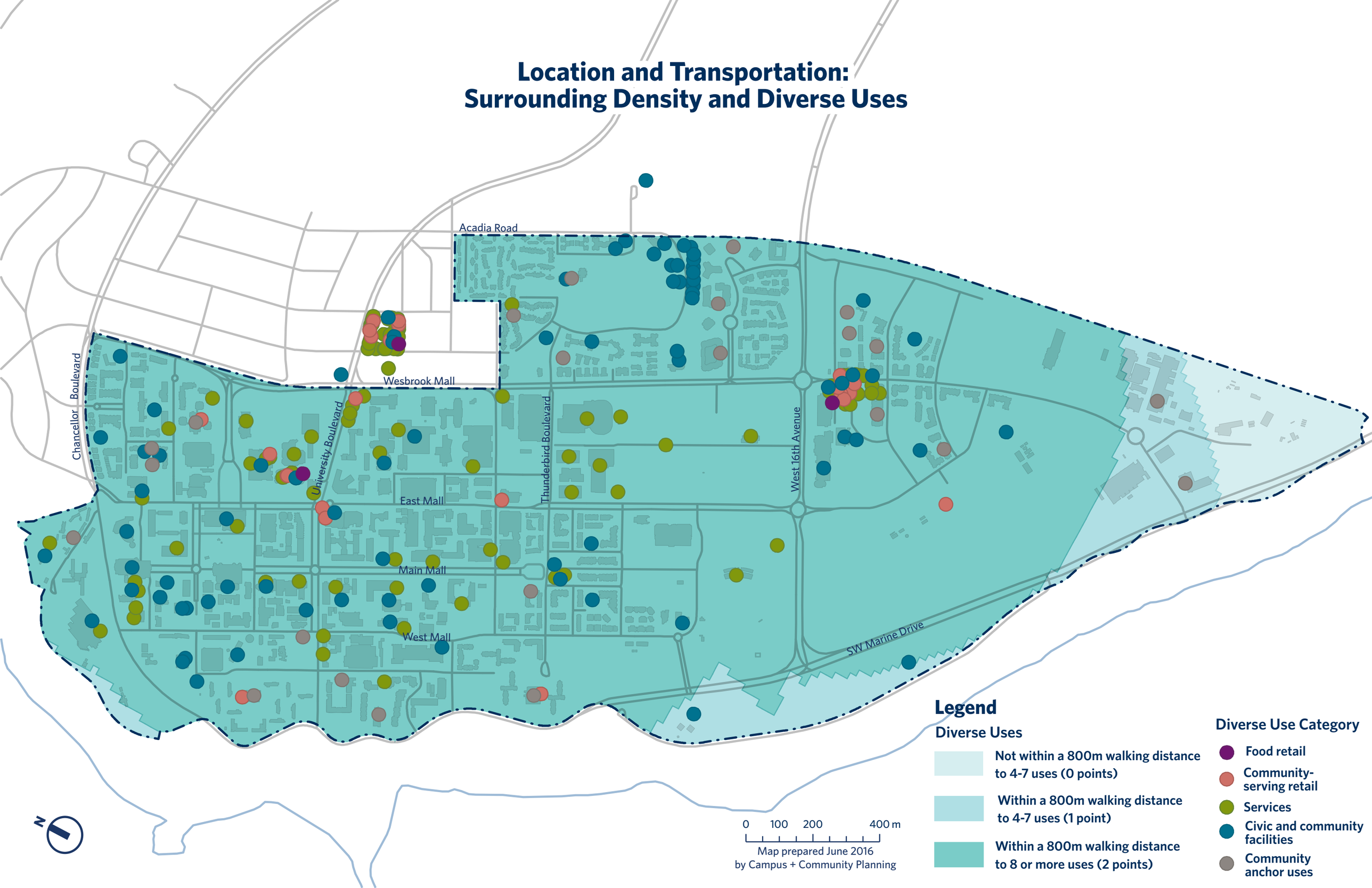
APPENDIX C

UBC Surrounding Density and Diverse Uses Maps

Location and Transportation:
Surrounding Density and Diverse Uses



Location and Transportation:
Surrounding Density and Diverse Uses



LT Credit Surrounding Density And Diverse Uses

Rating Systems

Building Design and Construction

- (●) New Construction
- ( ) Core and Shell
- ( ) Schools - New Construction
- ( ) Retail - New Construction
- ( ) Data Centers - New Construction
- ( ) Hospitality - New Construction
- ( ) Healthcare

Interior Design and Construction

- ( ) Commercial Interiors
- ( ) Retail - Commercial Interiors
- ( ) Hospitality - Commercial Interiors

- ( ) The project is using IP units.
- (●) The project is using SI units.

All Projects

Select one or more of the following:

- [✓] **Option 1**. Surrounding density (2-3 points)
- [✓] **Option 2.** Diverse uses (1-2 points)

Option 1. Surrounding Density

Points are calculated as follows:

Combined Density	Separate Densities		Points
Sq M per Hectare of Buildabe Land	Residential Density (DU/hectare)	Nonresidential Density (FAR)	
5,050	17.5	0.5	2
8,035	30	0.8	3

Upload: Vicinity map
Provide a scaled area plan or map showing the project site, the surrounding area, and a 1/4-mi (400-m) radius from the project boundary. Label the buildings that are included in the density calculations.

Select one of the following:

- ( ) The project will document surrounding density with separate residential and nonresidential densities.
- (●) The project will document surrounding density with combined residential and nonresidential densities.

Combined Residential and Nonresidential Densities

Table: Average density within 1/4 mi (400 m)

Complete the table below. Include all buildings and buildable land within 1/4 mi (400 m) of the project boundary. Exclude the project site area and building(s).

Total building area (sq m)	
Total buildable land (ha)	
Sq m per ha of buildable land	

Option 2. Diverse Uses

Table: Diverse uses

Use Label on Map	Name of Use	Use Category	Use Type [1]	Walking Distance (m)	
					+ -
Number of uses within 800-m walking distance [2]				0	
Number of use categories within 800-m walking distance [2]				0	

Notes:
1 No more than two uses in each use type may be counted toward compliance.
2 Must be within walking distance of 3-5 use categories and 4-7 uses for 1 point and 3-5 use categories and 8 or more uses for 2 points.

Upload: Vicinity map
Provide an area plan or map showing the project site, use locations, and walking route to each use. Label each use.

Special Circumstances

Describe the circumstances limiting the project team's ability to provide the submittals required in this form. Be sure to reference what additional documentation has been provided, if any. Non-standard documentation will be considered upon its merits. (Optional)

The UBC Campus + Community Planning Department calculated and mapped development density according to the credit calculation methodology. The UBC Development Density Map showing the location of BUILDING NAME has been uploaded to demonstrate compliance with this credit, in addition to the information provided on this form.

Upload: Special circumstances
Provide any additional documentation that supports the claim to special circumstances. (Optional)

Summary

Name

Date

August 24, 2016

SAVE FORM CHECK FORM **Incomplete.** Please complete the highlighted fields and/or address any omissions in the Special Circumstances section.

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V01
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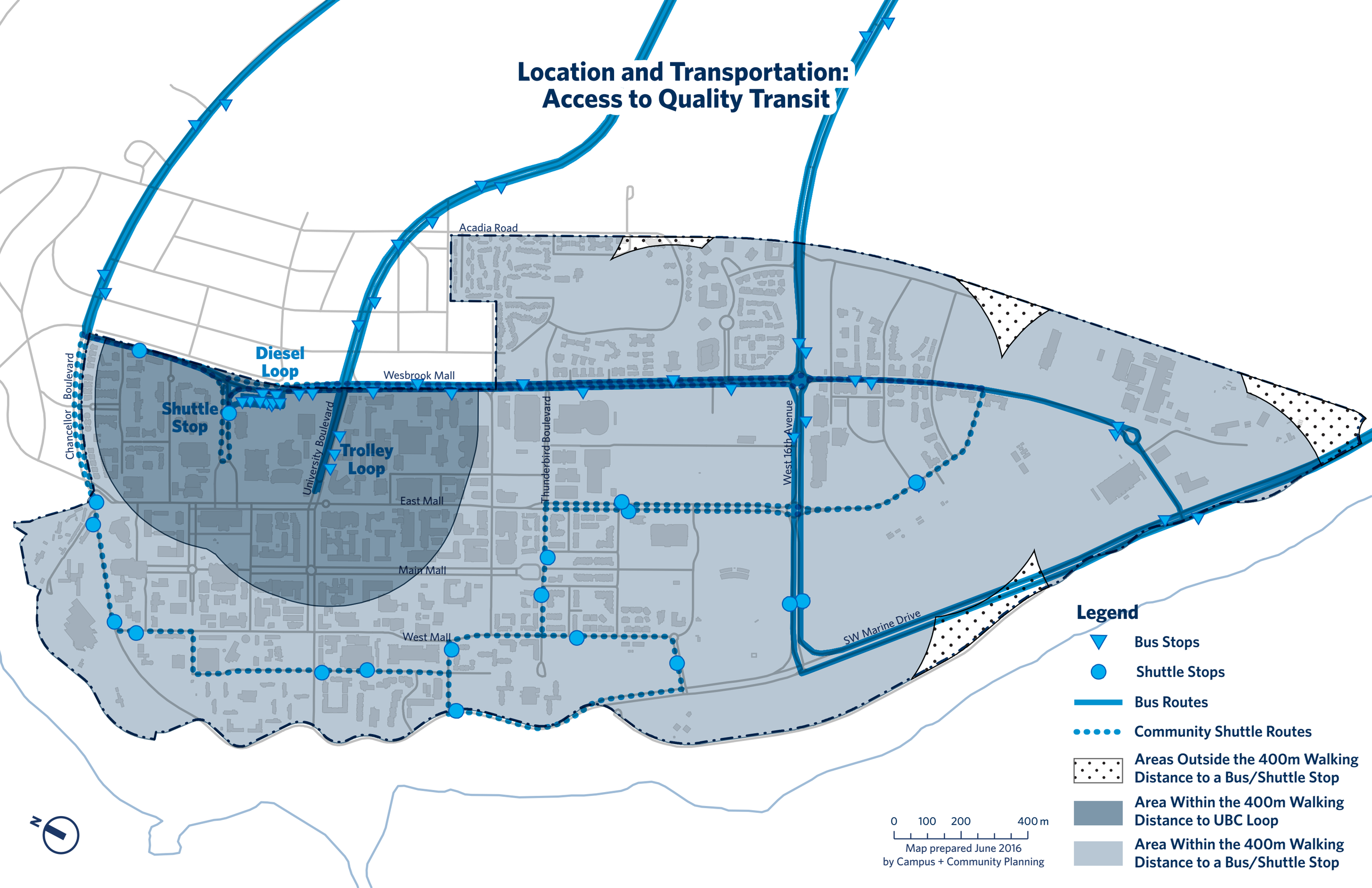
APPENDIX D

UBC Transit Maps

Location and Transportation: Access to Quality Transit



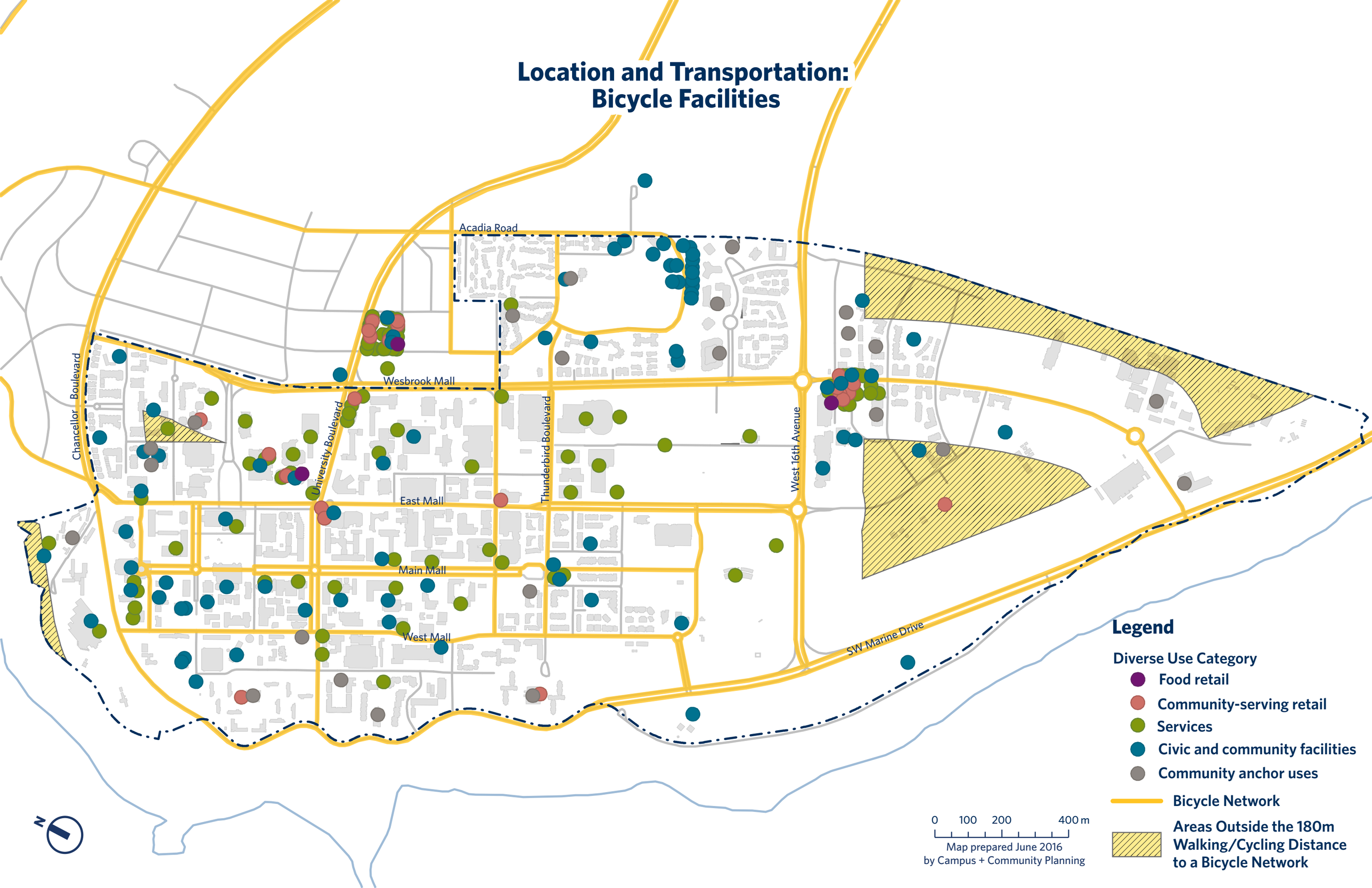
Legend

- Bus Stops
- Shuttle Stops
- Bus Routes
- Community Shuttle Routes
- Areas Outside the 400m Walking Distance to a Bus/Shuttle Stop
- Area Within the 400m Walking Distance to UBC Loop
- Area Within the 400m Walking Distance to a Bus/Shuttle Stop

APPENDIX E

UBC Bicycle Network Map

Location and Transportation: Bicycle Facilities



Legend

Diverse Use Category

- Food retail
- Community-serving retail
- Services
- Civic and community facilities
- Community anchor uses

- Bicycle Network
- Areas Outside the 180m Walking/Cycling Distance to a Bicycle Network

APPENDIX F

UBC Rainwater Infiltration Map

Sustainable Sites:
Rainwater Management

Acadia Road

Wesbrook Mall

Chancellor Boulevard

University Boulevard

Thunderbird Boulevard

West 16th Avenue

East Mall

Main Mall

West Mall

SW Marine Drive

N

Legend

Rainwater Infiltration Area

0 100 200 400 m

Map prepared March 2016
by Campus + Community Planning

APPENDIX G

UBC Light Zone Map

Legend

- LZ3: Moderately high ambient lighting
- LZ2: Moderate ambient lighting
- LZ1: Low ambient lighting
- LZ0: No ambient lighting

0 100 200 400 m

Map prepared June 2016
by Campus + Community Planning

N

APPENDIX H

UBC District Energy System and Utility Data

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UBC DES LEED Submission Documentation

Background

The University of British Columbia has recently converted its heritage steam system to a modern high-efficiency hot water district energy system. This $88 million project was completed in 2016 and replaces the existing steam system with a new hot water boiler plant, 14km of distribution piping, and 131 energy transfer stations throughout the academic core.

New buildings are encouraged to connect to the district energy system where practical to reduce life cycle costs and greenhouse gas emissions (GHG) (by way of the renewable thermal energy from the Bioenergy Research and Demonstration Facility (BRDF)).

There are three main district energy sources at UBC:

- The Campus Energy Centre (CEC) - consists of three 15 MW high-efficiency hot water boilers fueled by natural gas. These serve as the primary energy source to the district energy system.
- The BRDF's biomass boiler – a base loaded 6 MW thermal energy boiler which runs on wood waste and produces renewable thermal energy.
- The BRDF's cogeneration unit – a 2 MW_e combined heat and power engine is fueled by a mix of natural gas and renewable natural gas (RNG). 2.4 MW of thermal energy is recovered from the engine which is also base loaded.

The figure below provides a simplified schematic of UBC's DES and the district energy sources.

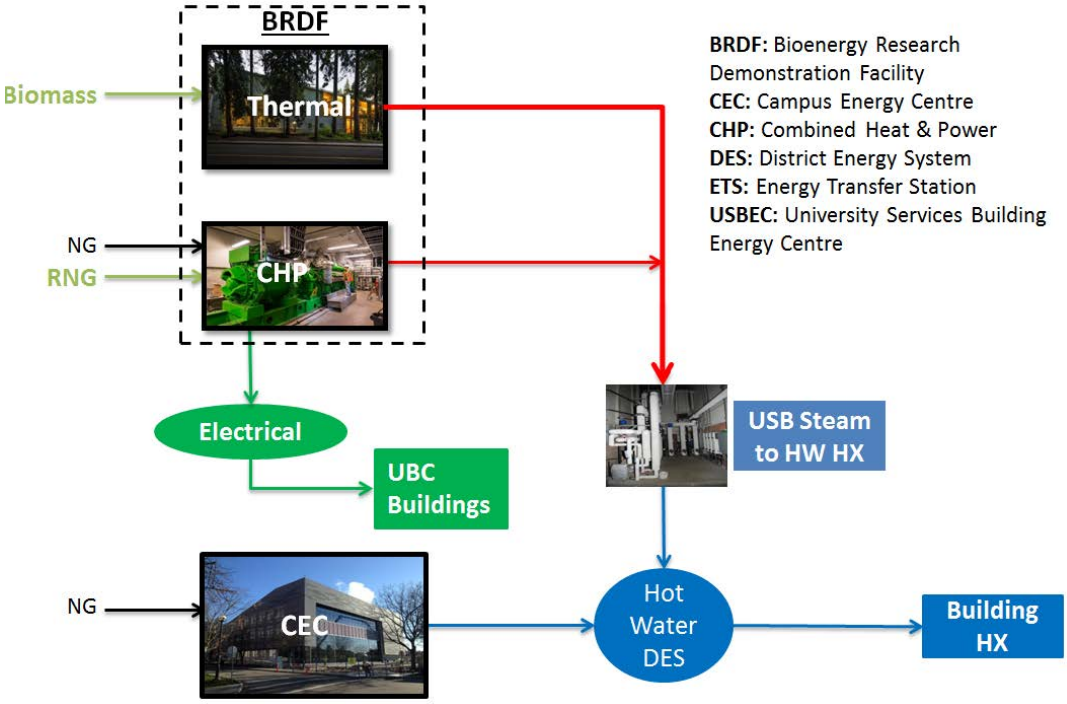

Figure 1 – UBC Thermal & Electrical Generation

Option 1 - Path 1 Building Stand-Alone

Option 1, Path 1 is not a recommended compliance path for UBC projects as it does not allow for DES GHG credits for Optimize Energy Performance, nor does it allow for DES Renewable Energy Production credits from the BRDF. UBC recommends that the Energy Modeller use Option 1, Path 2 for DES connected new construction projects.

If Path 1 must be used, this energy model accounts only for downstream equipment (including building DES heat exchangers), upstream DES equipment is not accounted. Proposed and Baseline are modelled using purchased energy according to the reference guide.

1. **Energy Rates**
   For the purposes of this Path, a flat rate structure has been calculated by UBC on a campus scale for both electricity and thermal energy. UBC's blended rate for BC Hydro electricity should be used as UBC is charged energy and demand on a campus level, not a building by building level. Please refer to the flat virtual energy rates given below.

Option 1 - Path 2 Full DES Performance Accounting

Option 1, Path 2 Full DES Accounting is the recommended compliance path for UBC projects as it allows for projects to take credit for the DES' low carbon intensity and renewable energy production. This energy model scope accounts for both downstream equipment and upstream equipment.

UBC's overall DES efficiency is better than the standalone ASHRAE 90.1-2010 baseline boiler plant in terms of energy efficiency and is much better in terms greenhouse gas emissions due to the biomass component of the BRDF. Option 1 - Path 2 also allows for a significant renewable energy credit to be taken for Renewable Energy Production (see below) that cannot be taken credit for under Option 1 - Path 1.

1. **Energy Rates**
   UBC's DES plant operates under a specific and atypical rate structure[1] that actively takes advantage of an interruptible rate strategy (Rate 22) for load management as required by Fortis BC. For this reason the rate structure used for this path shall be the rate structure as applied to UBC's DES. Refer to the virtual energy rates below.

2. **Proposed building , DES-equivalent plant**

   a. District Energy Thermal Efficiency/Heating Plant Efficiency
   A virtual plant with the same efficiencies as the upstream district energy heating system shall be modelled. The entire upstream district energy system consists of a piping distribution network fed from two units: the BRDF Biomass Boiler and the Campus Energy Centre's gas boilers. CHP is

[1] Pg 364, LEED v4 Reference Guide for Green Building Design and Construction

modelled separately as explained in the next section. Each unit's main and auxiliary energy inputs and outputs are measured and monitored by UBC. The natural gas and electrical consumption of each plant (CEC and BRDF), the biomass consumption of the BRDF Biomass Boiler, and the thermal output of each plant is monitored. The monitored data has been combined with analytical methods that extrapolate the measured data based on heating degree days to determine total annual natural gas consumption, electrical consumption, biomass consumption and thermal output. The values determined from this analysis are summarized below. The summary provides UBC's overall annual average District Energy Thermal Efficiency that should be used in the proposed building model plant, as well as the equivalent tCO2/GWh delivered for thermal energy should the project team pursue this credit based on GHG's instead of cost or energy efficiency. The District Energy Thermal Efficiency includes all operational effects such as standby, equipment cycling, partial load operation, internal pumping, and thermal losses.

b. Pumping Energy and other electrical parasitic loads

All electrical loads, including distribution pumping energy, for the CEC and BRDF are measured and monitored by UBC. These values are updated annually in this Appendix. The total annual electricity consumption for the BRDF and CEC are added and divided by the annual DES thermal output to come up with a kWh per MWh thermal delivered.

This kWh/MWh number represents the parasitic electrical and pumping energy and is to be multiplied by the Proposed Building's thermal load to the DES. **The resulting total kWh's shall be added as an annual auxiliary electrical load in the Proposed Building.**

c. Thermal Distribution Losses

Thermal Distribution Losses are already accounted for in the District Energy Thermal Efficiency given in this Appendix. No adjustments need to be done by the energy modeller.

Because UBC's hot water district energy system was completed in 2016, UBC is still in the process of commissioning and verifying hot water meters. At present, a number of thermal meters at the building level are not correctly reporting and collecting through UBC's ION Meter Database, this means it is not possible to measure thermal distribution losses from UBC's DES at this time.

A detailed engineering analysis was completed of the district energy distribution system to calculate thermal losses. The heat loss formula below was used to calculate total distribution losses throughout the entire UBC district energy piping network:

$$W = \frac{2\pi\,(Tm - Ta)}{3.42\ x\ 12\ (\frac{Ln\left(\frac{Di}{Dp}\right)}{Ki} + \frac{Ln\left(\frac{Dj}{Di}\right)}{Kj})}\ x\ Sf$$

Where W is Watts of heat loss per foot of pipe. A detailed description of the formula and variable definitions can be found on Urecon's website[2].

A calculated distribution heat loss of 14,700 GJ/year was determined through this methodology for UBC's hot water distribution network. This is compared to the total annual thermal energy delivered to the UBC campus to get a percentage distribution loss relative to load. This percentage is found in this Appendix and is updated annually. Because the distribution heat losses are static, the percentage will change annually depending on total thermal energy distributed by the DES annually. **This percentage is already incorporated in the District Energy Thermal Efficiency provided below.**

d. BRDF CHP Fuel Consumption

LEED v4 gives special guidance for cogeneration plants, so processes related to UBC's CHP system have not been included in the DES Proposed Model Inputs. Instead, the fuel attributed to the LEED building by the CHP plant shall be calculated as per pg. 366 – 368 of the LEED v4 reference guide using the inputs to the equations as provided below. Because there are two fuel inputs associated with the BRDF cogen, there will be two CHP_{FUEL} calculated by the energy modeler: one for natural gas, and one for renewable natural gas. The $CHP_{FUEL\ Natural\ Gas}$ and $CHP_{FUEL\ Renewable\ Natural\ Gas}$ shall then be multiplied by the utility rates as given below. The same shall be done for any process added to the baseline building.

[2] http://www.urecon.com/tracing/heat_loss.html

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UBC Renewable Energy/BRDF Submission Documentation

To Whom It May Concern:

The Bioenergy Research Demonstration Facility (BRDF) houses two production units that provide thermal energy to UBC's district energy system:

- The BRDF's biomass boiler – a base loaded 6 MW thermal energy boiler which runs on wood waste and produces renewable thermal energy.
- The BRDF's cogeneration unit – a 2 MW_e combined heat and power engine is fueled by a mix of natural gas and renewable natural gas (RNG). 2.4 MW of thermal energy is recovered from the engine for the district energy system.

The values below reflect the most recent projected figures based on the actual measured values for the renewable energy generated by the BRDF's biomass boiler. These values are updated annually by UBC's Energy and Water Department.

The BRDF produces the equivalent of 7.38% of UBC's annual electricity consumption; however, this portion is not yet eligible for renewable energy credit as it is produced for Fortis Renewable Natural Gas.

For Projects connected to DES:

	Thermal	
Total Thermal Delivered to Campus:	155,478	MWh
Thermal Supplied by BRDF:	39,583	MWh
% Thermal Supplied by BRDF to DES:	25.5%	

UBC hereby confirms that:

- The renewable energy reported is allocated directly to the DES and not directly to any building in particular.
- Within the DES renewable energy allocation, no renewable energy is assigned specifically to the DES central plant building, if any (in a separate LEED application), is also being counted toward the renewable energy contribution of the connected project building.
- That no renewable energy is being double-counted among any connected project buildings in separate LEED applications.
- That UBC, the DES owner and operator, maintains rights to the environmental benefits of the site-generated renewable energy.

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UBC Utility Rates

Utility Rates to be Used for All Credits:

Fiscal Year: **April 1, 2015 - Mar 31, 2016**

The following flat rate structures are to be used when a project is pursuing Option 1, Path 1 AND Path 2 for the Optimize Energy Performance LEED Credit. These rates shall be adjusted to Virtual DES rates as required by LEED v4.

For Buildings Connected to the DES: Option 1, Path 1

Flat DES Rates	Description	Value	Units	Notes
UBC DES	UBC, DES Thermal Hot Water	31.17	$/MWh	Delivered Thermal Energy to Building including all upstream losses and effects.
BC Hydro	BC Hydro Electricity	$ 68.94	$/MWh	Blended UBC rate, with carbon

For Buildings Connected to the DES: Option 1, Path 2

Flat DES Rates	Description	Value	Units	Notes
Biomass	Biomass Input into DES	3.79	$/GJ	Blended commodity rate, with carbon
Natural Gas	Interruptible Gas Input into DES	8.76	$/GJ	Blended commodity rate, with carbon
Renewable Natural Gas	RNG Input into DES	11.88	$/GJ	Blended commodity rate, with carbon
BC Hydro	BC Hydro Electricity	$ 68.94	$/MWh	Blended UBC rate, with carbon

For Buildings NOT Connected to the DES

Utility Energy Rates	Description	Value	Units	Notes
Fortis Rate 25	Non-DES Gas Rate (Non-Interruptible)	$ 10.79	$/GJ	Blended commodty rate, with carbon
	Energy	6.38	$/GJ	Energy delivered with carbon
	Demand	22.58	$/GJ	Demand is equal to 1.25 multiplied by the greater of 1) the highest average daily consumption of any month during the winter period (Nov 1st - March 31) OR 2) one half of the highest average daily consumption of any month during the summer period (April 1 - Oct 31). It is billed monthly.
BCH	BC Hydro Electricity	68.94	$/MWh	Blended UBC rate, with carbon
	Energy	52.89	$/MWh	2017/18 Rate with carbon
	Demand	8.98	$/kW	2017/18 Rate

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UBC DES Monitored Values

BRDF Thermal Boiler

Biomass Input		180,086	GJ
BRDF Thermal Gas Input		1,300	GJ
Biomass Thermal Output		39,583	MWh
Thermal Efficiency		78.6%	
Biomass Cost	$	3.79	$/GJ
Rate 25 NG Cost	$	10.79	$/GJ

BRDF Cogen

Natural Gas Input		116,525	GJ
Renewable Natural Gas Input		57,393	GJ
Cogen Thermal Output/Waste Heat		14,927	MWh
Cogen Electrical Output		15,942	MWh
Thermal Efficiency		31%	
Electrical Efficiency		33%	
Total Cogen Efficiency		64%	
Cogen Gas Cost		8.76	$/GJ
Cogen RNG Cost		11.88	$/GJ

CEC Hot Water Boilers

CEC Gas Input		434,671	GJ
CEC Thermal Ouptut		105,051	MWh
CEC Efficiency		87%	
Rate 22 NG Cost	$	8.76	$/GJ

Parasitic Loads

BRDF Electricity Consumption		2239	MWh
CEC Electricity Consumption		2750	MWh
Electrical Costs	$	68.94	MWh

Thermal Distribution Losses

Distribution System Heat Losses	4,083	MWh
% Distribution Losses from Thermal Outputs	2.6%	

All in Thermal Boiler Efficiency

Total Boiler Energy Input	616,057	GJ
Total Boiler Energy Produced	159,561	MWh
Total Energy Delivered	155,478	MWh
DES Heating Plant Efficiency	93%	
District Energy Thermal Efficiency	91%	

GHG Emission Factors

Biomass GHG EF	2.24	kgCO2/GJ
NG GHG EF	49.75	kgCO2/GJ
RNG GHG EF	0.29	kgCO2/GJ
Electrical GHG EF	10.00	kgCO2/GWh

DES GHG Emissions

GHGs	GHG total	
Biomass Thermal Plant	468	tCO2e
CEC	21,625	tCO2e
Parasitic	50	tCO2e
Total GHGs	22,143	tCO2e
GHG per GWh delivered	142	tCO2e/GWh delivered

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UBC DES Monitored Values

DES Proposed Model Inputs		
District Energy Thermal Efficiency	91%	
Parasitic Electrical & Pumping Energy per Thermal Delivered	32.09	kWh electrical per MWh thermal delivered
Weighted Average Cost per Thermal Energy Delivered	31.17	$/MWh
Weighted Average GHG	142.42	tCO2/GWh delivered

CHP equation inputs from the BRDF Cogen		
X_{heat} =	10%	
Total District Heat Provided =	155,478	MWh (used for calculating $BLDG_{HEAT}$)
CHP_ELEC_{TOTAL}	15,942	MWh
$CHP_{FUEL\ Natural\ Gas}$	116,525	GJ of NG
$CHP_{FUEL\ Renewable\ Natural\ Gas}$	57,393	GJ of RNG