

UBC Okanagan Campus, located in Kelowna, British Columbia, has experienced a rapid development since the transition from Okanagan University College. Since 2005, campus floor space has nearly tripled, and since 2009, student enrollment has more than doubled. The Campus is 105 hectares, and has a student population of 8,400. The current floor area of campus is 83,000 m<sup>2</sup> of academic program area and 50,000 m<sup>2</sup> residential area, accommodating 1,680 student beds. The existing buildings on campus are categorized based on phases of development and split between academic and residences (see to Figure 1), and are referred to as:

- Academic Legacy Buildings (old academic)—6 buildings, built between 1992 and 2001
- 2. New Academic Buildings—5 buildings, built 2008 and onwards
- 3. Residences—18 buildings, built between 1992 and 2010

The existing building stock and infrastructure has presented a number of performance and operational challenges, and is one of the drivers for developing a *Whole Systems Infrastructure Plan*.

In collaboration with the UBCO team, the following assumptions related to campus student growth were developed for the purposes of this Plan:

- 7% per year for 2015-2020
- 5% per year for 2020-2025
- 2% per year for 2025-2030
- At 2030: double capacity

These projection have been used to inform the technical performance modeling and analysis in this planning effort.

A summary of the key campus infrastructure systems reviewed as part of the *Whole Systems Infrastructure Plan* is described in more detail under each section for energy, carbon, water, ecological landscape and biodiversity, and stormwater (Part 2).

This section outlines further the context for this study with regards to the existing infrastructure, ecological and landscape setting in which UBCO is located, UBCO's Campus Plan and Sustainability commitments, and regional climate change implications.

# 3.1 UBCO EXISTING CAMPUS INFRASTRUCTURE OVERVIEW

The current campus infrastructure systems reviewed as part of the Whole Systems Infrastructure Plan consist of:

• District Energy System used for heating and cooling by academic buildings

#### LEGEND



#### FIGURE 1 (FACING PAGE): CAMPUS PLAN OF EXISTING BUILDINGS

- · Central Heating Plant used for heating of legacy academic buildings
- Natural gas distribution system
- Power distribution system
- Potable water distribution system
- Sewage water conveyance system

The infrastructure systems have been assessed to understand current operational challenges and feasible opportunities for upgrades to achieve UBCO's long-term sustainability goals. Each system is described in more detail in Part 2 Sections 4-7.

# 3.2 ECOLOGICAL CONTEXT

The UBC Okanagan Campus, located in Kelowna, British Columbia, is characterized by an intimate campus setting in the Okanagan Very Dry Hot Ponderosa Pine biogeoclimatic zone, which is the driest forested zone in BC, with hot, dry conditions in summer and cool conditions with little snow in winter. Mean annual precipitation (Kelowna Airport) is 298 mm; of which 102 mm (34%) falls as snow. Average July temperature is 19.5°C and average December temperature is -2.6°C. A detailed summary of the existing ecology and biodiversity context is presented as part of the introduction to the Ecological Landscape and Biodiversity Section.

# 3.3 UBC'S SUSTAINABILITY POLICY CONTEXT

UBC has already taken many steps towards institutionalizing sustainability best practices on campus through its investment in Campus Sustainability teams for both its Vancouver and Okanagan campuses, and has a number of guiding policies that have informed the University's efforts to optimize its performance with regards to greenhouse gas emissions (GHG), energy, waste, and water conservation, and green building development.

Of significance and relevance for the *Whole Systems Infrastructure Plan* are a number of UBC's guiding documents including:

- 1. Place and Promise: The UBC Plan (updated 2012)
- 2. UBC Sustainability Plan: 20-Year Sustainability Strategy (2014)
- 3. UBC Point Grey Climate Action Plan 2010-2015

#### Place and Promise: The UBC Plan

Evident within UBC's strategic plan, *Place and Promise: The UBC Plan*<sup>1</sup>, is UBC's strong commitment to sustainability as it identifies sustainability as one of nine commitments supported by a number of goals and actions.

<sup>1</sup> University of British Columbia. *Place and Promise: The UBC Plan.* http://strategicplan.ubc.ca/the-plan/sustainability/

#### TABLE 1: UNIVERSITY OF BRITISH COLUMBIA SUSTAINABILITY GOALS

COMMITMENT		GOALS		
Select excerpts from Place and Promise: The UBC Plan				
Sustainability 1		Ensure UBC's economic sustainability by aligning resources with the University vision and deploying them in a sustainable and effective manner.		
The University explores and exemplifies all aspects of economic, environmental and social sustainability.	2	Make UBC a living laboratory in environmental sustainability by combining its sustainability leadership in teaching, research and operations.		
	3	Foster social sustainability through teaching, research and community engagement that promote vibrant human interaction and community cohesion.		

### 20-Year Sustainability Strategy

Building upon its high level strategic commitments to sustainability, in 2014 UBC published its *20-Year Sustainability Strategy*<sup>2</sup> which recognizes that sustainability requires continuous improvement and it is more than just doing less harm but rather it is about how the University can have a lasting positive impact on both ecological and social systems. The 20-Year Plan proposes that by 2035 "...regenerative sustainability is embedded across the University throughout teaching, learning, research, operations and infrastructure, and the UBC Community." In support of this vision, UBC established the following five strategic goals which also form strong underpinnings for the objectives and goals established for the *Whole Systems Infrastructure Plan*:

- 1. A sustainability lens is applied to operational decision-making at UBC.
- 2. The integration of campus-scale energy, water, waste, and food systems is linked to improved quality of life for students, staff, faculty and campus community and to enhanced ecological integrity.
- 3. UBC continuously and iteratively improves sustainability practices through meaningful community and stakeholder engagement, collaboration and scenario analysis, directed at reaching solutions.
- 4. The built environment demonstrates regenerative design and operation throughout the UBC community.
- 5. Effective strategic partnerships are in place, leading to the development and application of real world solutions to sustainability challenges; UBC is a key contributor to dozens of such processes locally and around the world.

## UBC Point Grey Climate Action Plan

UBC's *Climate Action Plan* (2010-2015) sets an important directive addressing climate change for the entire institution:



<sup>2</sup> UBC. 2014. 20-Year Sustainability Strategy for the University of British Columbia Vancouver Campus. http://sustain.ubc.ca/our-commitment/strategic-plans-policies-reports/sustainability-plans

Confronting the challenge of climate change, the University of British Columbia will advance solutions on campus that eliminate emissions, will accelerate efforts to respond to the impacts of climate change, and will partner locally and globally to demonstrate leadership and accountability to future generations.<sup>3</sup>

Embedded within this *plan* is an important framework that establishes UBC's commitment to mitigating GHG emissions and establishes targets for reducing emissions as compared to 2007 levels:

- » 33 per cent by 2015
- **»** 67 per cent by 2020
- **»** 100 percent by 2050

Although these GHG emissions targets are for the UBC Point Grey Campus, UBC has a strong desire to identify similarly ambitious sustainability and GHG emissions reduction targets for the UBC Okanagan Campus.

UBC is currently updating its *Climate Action Plan* for 2015-2020, and is interested in developing a similar plan for its Okanagan Campus. Milestone recommendations from the *Whole Systems Infrastructure Plan* will inform the development of the UBCO *Climate Action Plan*.

#### Other Sustainability Initiatives

Additional sustainability-oriented plans that are proposed or under development for UBCO include the development of a Water Action Plan and Transportation Demand Pan.

In addition to these policies, UBC Point Grey and Okanagan Campuses have rolled out various staff, faculty and student engagement programs to promote a culture of conservation, and to benchmark and monitor performance in various areas related to water, waste, and energy. For example, the University's Sustainability Initiative and its Ambassador Program provide ongoing education programs related to its sustainability initiatives on both campuses. UBCO developed The Power of You program, a comprehensive strategy developed to engage staff and faculty in voluntary behaviour changes intended to reduce energy consumption in nine academic buildings on campus. Such engagement programs are an important part of the University's toolkit for optimizing and deepening its sustainability performance.

<sup>3</sup> UBC. 2010. *Climate Action Plan* 2010-2015. http://sustain.ubc.ca/campus-initiatives/climate-energy/climate-action-plan

# 3.4 UBCO CAMPUS PLAN

Established as a campus of the University of British Columbia in 2005, UBC Okanagan has experienced a 95% increase in floor area and an 81% increase in student enrolment since 2007. In 2005, UBCO developed a Campus Plan to guide the physical and landscape planning of the campus, and it was updated in 2009. In 2015, UBCO updated its Campus Plan to "...guide the physical evolution of the University's Okanagan Camps over the next 20 years"<sup>4</sup> and established the following vision statement for the future direction and development of the Campus:

The University of British Columbia's Okanagan Campus aspires to be the centre for learning and innovation that produces global citizens through transformative personal growth and collaboration. Its people, places and activities are linked by a shared commitment to fostering community, and supporting social and ecological well-being. Deeply connected to the landscape, the campus is an accessible, intimate, and welcoming environment—a catalyst for positive change.

-Adopted by UBC of Board of Governors, September 2015

The following core planning principles<sup>5</sup> were established for the Campus Plan:

- 1. A Welcoming and Connected Campus: Through design, programming and partnerships, strengthen physical and social connections on campus and to the surrounding community to create lasting and impactful relationships between people and places and nurture shared learning and innovation.
- 2. Celebrating Place: Strengthen the intimacy and legibility of campus spaces and places, while celebrating the surrounding Okanagan landscape, to achieve a distinguished and compact campus within an indigenous landscape setting.
- **3. Campus Vitality:** Leverage campus growth to create a vibrant community, meeting the needs of all users and enabling students, staff, faculty and the broader community to connect, learn and linger.
- 4. Whole Systems Infrastructure: Manage campus growth through a whole systems (environment, economic and social sustainability) lens to achieve net-positive impact on the well-being of the campus community and ecology



<sup>4</sup> University of British Columbia. 2015. The University of British Columbia Okanagan Campus Plan. June 2015.

<sup>5</sup> University of British Columbia. 2015. The University of British Columbia Okanagan Campus Plan. June 2015



The Campus Plan supports the overall approach to developing a whole systems approach to infrastructure planning in order to optimize and deepen the long-term performance goals of the campus. This *Whole Systems Infrastructure Plan* is, therefore, regarded as a companion roadmap and plan for realizing the long-term sustainability goals for the University and Okanagan Campus.

# 3.5 REGIONAL CLIMATE CHANGE CONTEXT

It is widely recognized and scientifically supported that climate change is occurring and that communities across the globe are experiencing changes in temperature, precipitation and as such increased severity of storm events in some regions. The International Panel on Climate Change latest report concluded the following:

Human influence on the climate system is clear, and recent anthropogenic emissions of greenhouse gases are the highest in history. Recent climate changes have had widespread impacts on human and natural systems.

And,

Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over the decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, and sea level has risen.<sup>6</sup>

British Columbia is anticipated to experience greater warming and changes in precipitation regime than the global average, and depending on the different IPCC Emissions scenarios BC could see warming of 2 to 3°C or 3 to 5°C by the year 2080.<sup>7</sup> Understanding potential changes in the Okanagan climate is an important component of planning future infrastructure requirements for the UBCO Campus. UBCO is located in a semi-arid climate and currently experiences hot, dry summers and cold, dry winters.

The Pacific Climate Impacts Consortium (PICS) is a regional climate service centre at the University of Victoria that conducts quantitative studies on the impacts of climate change and climate variability in the Pacific and Yukon region.<sup>8</sup> PICS has developed a number of tools to help communicate the potential predicted regional impacts of climate change that are based on 15 Global Climate Model (GCM) and SRES emissions scenario combinations provided by the Intergovernmental Panel on Climate Change (IPCC). Using the Pacific Climate

<sup>6</sup> International Panel on Climate Change. 2014. Climate Change 2014 Synthesis Report Summary for Policymakers http://www.ipcc.ch/pdf/assessment-report/ar5/syr/AR5\_SYR\_FINAL\_SPM.pdf

<sup>7</sup> Province of British Columbia, Ministry Home Research Branch. Climate Change. www.for.gov.bc.ca/ hre/topics/climate.htm June 2015.

<sup>8</sup> Pacific Climate Impacts Consortium. http://www.pacificclimate.org/about-pcic

Impacts Consortium's Plan2Adapt Tool, the following table summarizes the predicted changes in the Central Okanagan region for 2020 and 2050<sup>9</sup>:

ORANAGAN IN 2020 AND 2030					
CLIMATE VARIABLE	SEASON	2020	2050		
Mean Temperature	Annual	+1.0°C	+1.9°C		
Precipitation %	Annual	+5.0%	-2% to +7.0%		
	Summer	-5.0%	-11% to +10%		
	Winter	+3.0%	-2.0% to +10%		
Snowfall %	Summer	+7 %	-18% to +0%		
	Winter	-33%	-58% to 1%		
Growing Degree Days (degree days)	Annual	+178 degree days	+ 85 to -283 degree days		
Heating Degree Days	Annual	-364 degree days	-517 to -201 degree days		
Frost Free Days	Annual	+ 14 days	+7 to +21 days		

# TABLE 2:SUMMARY OF CLIMATE CHANGE IMPACTS FOR CENTRAL<br/>OKANAGAN IN 2020 AND 2050\*

\*Note: See Appendix C for additional information on Climate Change impact and assumptions from PICS. \*Note: Data presented is for 2020s (i.e., up to 2030).

Based on the above data, the following trends are observed for the Okanagan region:

- Increased annual temperature.
- Increased annual precipitation. Although there is an increase, it may be anticipated that rainfall events are shorter and more intense.
- Decreased snowfall and snow pack leading to an overall decline in groundwater recharge and glacier fed water systems.

While recognizing these trends, greater attention and consideration should be given to:

- Water Stewardship: It will be important to consider how water conservation and reuse measures, along with programs to support water conservation-based behaviour can be implemented to prepare the campus for future potential water shortages. Although UBCO may be a moderate consumer of water in the broader region, this longterm imperative for the region will need to be monitored by UBCO and factored into UBCO's strategic planning and decision making processes, and how it positions itself a regional leader in this area.
- Wildfire Management: The region will remain susceptible to forest fires as summers are predicted to be warmer and dryer. The University

<sup>9</sup> Pacific Climate Impacts Consortium Plan2Adapt Tool http://www.pacificclimate.org/analysis-tools/ plan2adapt [April 2015]

will continue to remain diligent at managing its campus landscape and surrounding forest ecosystems carefully to help prevent spread of wildfires. A direct opportunity for the University will be to explore how a water reuse system will support the long-term fire management and suppression strategy for the campus.

• Operational Costs and GHG Emissions: With an increase in temperature, UBCO can expect an increase in the number of cooling days. As UBCO moves towards its long-term carbon neutrality goals, it will be important to consider the energy costs associated with an increase in cooling days, greenhouse gas implications and the possible opportunities for alternative fuel sources. Linked to this, UBCO can expect to see an increase in carbon tax and carbon offset costs over the next 15 years. Implementation of near and long-term energy conservation measures will assist in reducing these operational costs.

