WESBROOK PLACE
A case study in sustainable neighbourhood design

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University of British Columbia

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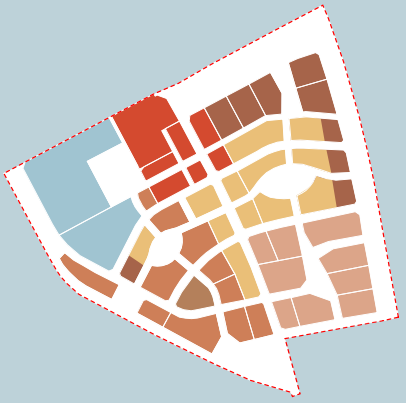

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ABSTRACT

Wesbrook Place, a new development at the University of British Columbia in Vancouver, Canada is notable for bringing a residential neighborhood to a commuter campus and concurrently committing to developing a sustainable, community. This report looks at Wesbrook Place nine years after construction began and six years after the first residents moved in relative to its goals to establish a vibrant, compact, complete and walkable community which limits impacts on local streams and the adjacent forest. By August, 2014, the neighbourhood was 25% built. It performs very well relative to measures of population diversity, land use mix, density, walkability, access to parks and services and to good transit services. A buffer of forest was preserved around the perimeter of the neighbourhood, however few mature trees were saved on site. Several important indicators could not evaluated due to a lack of data, such as building energy performance, transportation mode share by residents, stormwater runoff quantity and quality, residents' satisfaction with quality of life.

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CONTENTS

TABLES AND FIGURES

TABLES

FIGURES

INTRODUCTION

Figure 1.1 Wesbrook Village, source discoverwesbrook.com

Complete communities are walkable, mixed use, transit-oriented communities where people can: find an appropriate place to live at all stages of their lives, earn a living, access the services they need, and enjoy social, cultural, educational and recreational pursuits. A diverse mix of housing types is fundamental to creating complete communities. This includes a mix of housing types and tenures that respond to an aging population, changing family and household characteristics and the full range of household incomes and needs across the region. Access to a wide range of services and amenities close to home, and a strong sense of regional and community identity and connection are also important to promote health and well-being.

Metro Vancouver RGS 2011 page 45

In North America, universities are among the top employers in many cities, and they control large and permanent areas of land and inventories of buildings[1]. For example, the largest in Vancouver, Canada, the University of British Columbia, employs 14,000 people and has an estimated daytime population of 64,000[2]. The next-largest, Simon Fraser University employs 6100 people and has a population of ~42,000 (includes part-time staff and students)[3]. These two campuses represent 4.5% of the total regional population (including students) and 1.8% of all jobs in a region of 2.3 million (excluding students)[4].

Due to their size and relative autonomy, they are like small cities within a metropolitan area, and like any city, they have a significant environmental footprint. Many universities across North America are adopting policies to reduce their environmental footprint, especially regarding the use and pollution of energy and water and impacts on urban ecosystems[5]. UBC estimates that its total (offset) greenhouse gas emissions in 2013 were 53,000 tons of CO2e[6]. Some universities, particularly commuter campuses such as UBC, are developing mixed use neighbourhoods that blur the boundaries between "town and gown" while

concurrently making the campus a more complete and sustainable community. The purposes of such developments are often threefold:

> 1) to raise revenue to support the university enterprise
>
> 2) to attract permanent residents to campus thus reduce total numbers and length of commute trips, and
>
> 3) bring urban services, such as food, personal care, medical services, and night life to campus, thus adding more completeness and vitality[7].

The University of British Columbia (UBC) is the oldest public research university located in the Greater Vancouver region, dating back to 1908. UBC is located on a peninsula at the western extremity of Vancouver, about twelve kilometers from downtown Vancouver. It is further spatially separated from nearby urban areas by a major regional park, Pacific Spirit Regional Park. At its inception, a residential community was envisioned adjacent the university on "endowment" lands set aside for that purpose. One low-density single family development was constructed on these lands between the 1920's and the 1950's. The next developments, collectively called University Town (UTown), were initiated in 2000 and are situated in four locations around the periphery of the main campus. Wesbrook Place is the fifth and most recent of the UTown developments, located on the south edge of campus.

UBC Properties Trust (UBC PT) oversees the development of all building projects on campus, including Wesbrook Place. The mission is "to assist UBC, through optimization of land assets, to achieve the academic and community goals of its Place and Promise mandate"[8]. Residential and commercial properties within the UBC endowments lands are never sold outright, but leased as pre-paid 99-year leases. The net revenue generated from issuing these 99-year leases are invested in two endowments which support the university's academic mission to be a globally significant university[9].

University Town developments aim to enhance the quality of life at UBC by providing places for faculty, staff and students to live, work, study and play. Their design is also intended to strengthen the University's identity and add to the campus vitality. UTown assists UBC to meet some of its sustainability goals:

> Socially: to move from commuter campus to complete community, with places to live, work, learn and recreate.
>
> Environmentally: to locate housing [within walking distance of] work and study, while honoring the magnificent peninsula setting and hydrology of the landscape.
>
> Financially: generate a perpetual financial endowment to support the mission of the university, estimated to be $2 billion over twenty years[10].

In 2011, the permanent residential population of the UBC peninsula was 12,777 (Statistics Canada 2011), including University Town and the older University Endowment Lands (UEL), but excluding students who temporarily reside in residence halls. Presently Wesbrook Place, estimated to be at about 3200 people, represents about 25% of this population. At build-out Wesbrook Place is estimated to reach 12,500 people and will represent over 50% of the UBC peninsula population, projected to be 24,000 by 2021 [11]. Between 2006 and 2011, the population of the UBC peninsula increased by 18%, primarily due to the ongoing development of Wesbrook Place. The population exhibits diversity. In 2011, 74.3% of the people living at UBC were of working ages, between 15 and 64. 16.8% were children and the remaining 8.9% were seniors over 65. From 2006 to 2011, the number of families grew 20% to a total of 3,365. Only 36.5% of the population report English as their mother tongue, while 44.7% report a non-official language as their mother tongue. 33% of the population speak Mandarin, Cantonese or unspecified Chinese at home, and an additional 11.5% report speaking Korean or Farsi at home.

The University Neighbourhood Association (UNA) was established in 2002 to support the growth of UTown (See figure 1.2). The UNA provides a range of municipal-like services for residents of the five UTown neighbourhoods, giving them the same

services as other Metro Vancouver municipalities. These services include managing recreation programs, hosting community events and providing landscape and waste management. The UNA is incorporated under British Columbia's Societies Act and is governed by an eight-member elected Board. As of 2014, the UNA had 3,000 members and represented about 9,000 residents in the five UTown neighbourhoods.

Case Study of Wesbrook Place

This post-occupancy case study evaluates Wesbrook Place against its own goals and targets related to land use planning, urban form, transportation and environmental sustainability. It also compares the pre-development site to post development on matters of land use/cover, impervious surfaces and tree canopy cover. We additionally employed some common indicators of sustainable development, derived from literature, to evaluate aspects of the development such as network density, completeness, connectivity, quality of habitat. Categories of evaluation include:

- Urban design/ complete community: land use mix, density, building massing, housing diversity, parks and amenities
- Building energy and water use: green building standards employed (i.e. REAP, LEED); energy and water conservation
- Transportation & circulation: networks; walkability, cycle-ability; parking (vehicle

Figure 1.2 Neighbourhood Map of UBC

and bicycle)

• Forest and habitat: conserving and restoring forest cover and riparian areas; tree planting (canopy replacement); replacing habitat; native vegetation

• Rainwater management: pervious, impervious areas; best management practices employed; rainwater runoff quantities and quality

This project team gathered and analyzed existing information, including plans, technical reports and permit drawings from UBC Campus and Community Planning and UBC Properties Trust. We additionally conducted field documentation and interviewed key UBC staff. We created maps and map-based analyses to evaluate the development against a set of sustainable neighbourhood development metrics. Indicators were initially derived from literature and then applied as described below. The community plan set very few targets, therefore metrics were selected from the literature to best evaluate the stated goals or strategies found in the planning documents. For example to evaluate "a walkable neighbourhood," we measured how many dwellings are within a five and ten minute walk of the neighbourhood centre, the community centre, parks and transit stops. Some important information was not available (see below in the sections), which then further narrowed the list of metrics. To conclude this evaluative report, we provide a score-card, which summarizes the evaluation of the development against a list of indicators of sustainable development. Finally, we list outstanding research questions at the conclusion.

END NOTES

1. Perry and Wiewel, 2005
2. http://news.ubc.ca/media-resources/ubc-facts-and-figures/accessed December 5, 2014
3. www.sfu.ca/irp/fingertip-statistics.html accessed December 5, 2014
4. Census Canada 2011, Metro Vancouver, December 2011
5. White 2014
6. This represents a 26% reduction per full time equivalent student since 2007 UBC's goal is be carbon neutral by 2050. (http://sustain.ubc.ca/campus-initiatives/climate-energy/ghg-inventory accessed November 30, 2014).
7. UBC 2012
8. http://www.ubcproperties.com/about accessed August 21, 2014
9. http://www.ubcproperties.com/about accessed August 21, 2014.
10. http://www.ubcproperties.com/commitment accessed November 30, 2014
11. Metro Vancouver RGP 2011

URBAN DESIGN: A COMPLETE COMMUNITY

Figure 2.1 Norman MacKenzie Square

OVERVIEW

Wesbrook Place has been coined "village in the woods" due to its location adjacent a large, forested regional park, Pacific Spirit Regional Park (PSRP) and its partial enclosure by a forest buffer. The development sits astride Wesbrook Mall, one of two roadways that extend through the university north-to-south. A mixed use village centre area was located at the northern edge of the neighbourhood near to 16th Avenue, an east-west arterial road which forms the border between the academic campus and the neighbourhood. This village centre includes a full service grocery store and pharmacy and a range of personal and commercial services. Adjacent to the village centre are a high school, a community centre and a future elementary school. The site is subdivided into residential blocks by a fine network of vehicular and "green" pedestrian streets. Situated along the green street network are five existing and one proposed parks. All housing in the development is attached, including townhouses and apartments. Buildings range in height from three stories to 22 stories with the tallest buildings located adjacent to Pacific Spirit Regional Park,

"Create a mixed-use neighbourhood with a distinct "urban village in the woods" character that combines various types and tenures of residential use, a village commercial centre, a community centre and school facilities."

Wesbrook Place was intentionally designed to be a compact, complete and walkable neighbourhood. Specific objectives include:

- a high density, mixed use neighbourhood adjacent a major university
- pedestrian and bicycle friendly on-street and off-street circulation
- excellent transit services within walking distance of dwellings
- a network of green corridors to interconnect parks, green spaces and Pacific Spirit Regional Park
- a commitment to providing affordable faculty and staff housing
- a goal that 50% of households have a resident affiliated with UBC
- no net change policy for off-site hydrology and water quality
- preservation of the forest fringe adjacent to Pacific Spirit Park and mature trees on site

(WPNP 2011)

where the tall trees help to diminish the impact of towers. Through the University Neighbourhood Association (UNA), the neighbourhood offers many social, education and recreational services for residents of. All these factors contribute to creating a relatively complete and vibrant neighbourhood.

Figure 2.2 Illustrative plan from WPNP
Source: WPNP, 2011. Plan drawn by Perry and Associates, Landscape Architecture and Site Planning.

Figure 2.3 Land Use Plan

COMPACTNESS: FORM AND DENSITY

Compact forms of neighbourhood development are a region-wide goal because they are known to support provision of transit services, enable more walkable and well served neighbourhoods, and reduce GHG emissions[1]. Compactness of development, or densities that support a transit service were taken to be a minimum density of 50 persons per gross hectare and target of 150 persons per hectare[2]. As of August 2014, 25% (1,568 units) of the total projected dwelling units were constructed and occupied. An additional 12%, or 739 units were under construction leaving over 3,900 still to be completed.

As of August 2014, the gross residential density was 35.2 dwelling units per gross hectare (total site area) and the net density was 141.3 units per developed residential hectare. At build-out the gross density is projected to be 140.4 units per gross hectare while the net residential density is projected to be 300 units per residential hectare. The gross population density in August 2014 was estimated to be 70 persons per hectare already exceeding the minimum indicator of compactness. The projected population density will be 281 persons per hectare, which will exceed the target indicator of compactness mentioned above and will exceed the density of Vancouver's West End at 217 persons per hectare[3].

The UBC Land Use Plan specified a maximum average floor space ratio (FSR) of 2.5 net for neighbourhood housing with no individual site to have a floor space ratio greater than 3.5. (The average density can be achieved through variable allocation across neighbourhood housing areas.) The gross building area (GBA) for Wesbrook Place at build-out will be ~556,000 m2 (5,985,000 ft2) which yields an average density for Wesbrook Place of 2.68 FSR. In August 2014, individual site FSRs varied from a low of .48 to a high of 3.5 including projects under construction.

Table 2.1 Summary site statistics at October 2014

	Build-out	2014	
Total site area (ha)	44.5	44.5	
Mixed use area (ha)	3.2	3	
Residential area (ha)	17.6	8.1	
School area (ha)	4.5	3	
Community centre (ha)	1	1	
UNOS area (ha)	10.4	n/a	
Conservation lands area (ha)[3]	4.6	4.6	
Streets area (ha)	unknown	unknown	
Dwellings	6250	1568	25% complete
Gross density (d/h)	140.4	35.2	
Net density[2] (d/h)	300.5	141.3	
Estimated population	12,500	3,136	estimate
Gross population density(p/h)[1]	281	70	
Commercial area (m2)	10,000	9000	

Notes:
1. 2 people per unit (UBC figure)
2. Net density calc. includes mixed use area, on-lot conservation easements, excludes streets, parks, school
3. Total open space per WPNP minus UNOS

Table 2.2 Floor Space Ratios

Buildings	Saleable Site Area	GBS (FSR)	FSR
Completed	870,263	1,631,205	1.87
Approved or under construction	217,969	693.487	3.18
Approved	807,614	2,516,254	3.12
Future	336,588	1,133,681	3.37
Total	2,232,434	5,281,833	2.37

Figure 2.4 Isometric view of Wesbrook 2011

Source: University Neighborhoods Association

BUILT FORM

1. Take advantage of view and outlook potential
2. Minimize overshadowing,
3. Relate building form to existing natural conditions

(WPNP 2011)

Currently, the completed buildings on site range from 3 to 22 storeys, with about half being 3 to 4 storeys (See figure 2.5). The buildings in the Village Centre are 5 to 7 storeys and those along the Wesbrook Mall range from 4 to 7 stories. The buildings forming the core area of the first phase of development around Smith Park are the lowest, typically 3 to 4 stories while residential

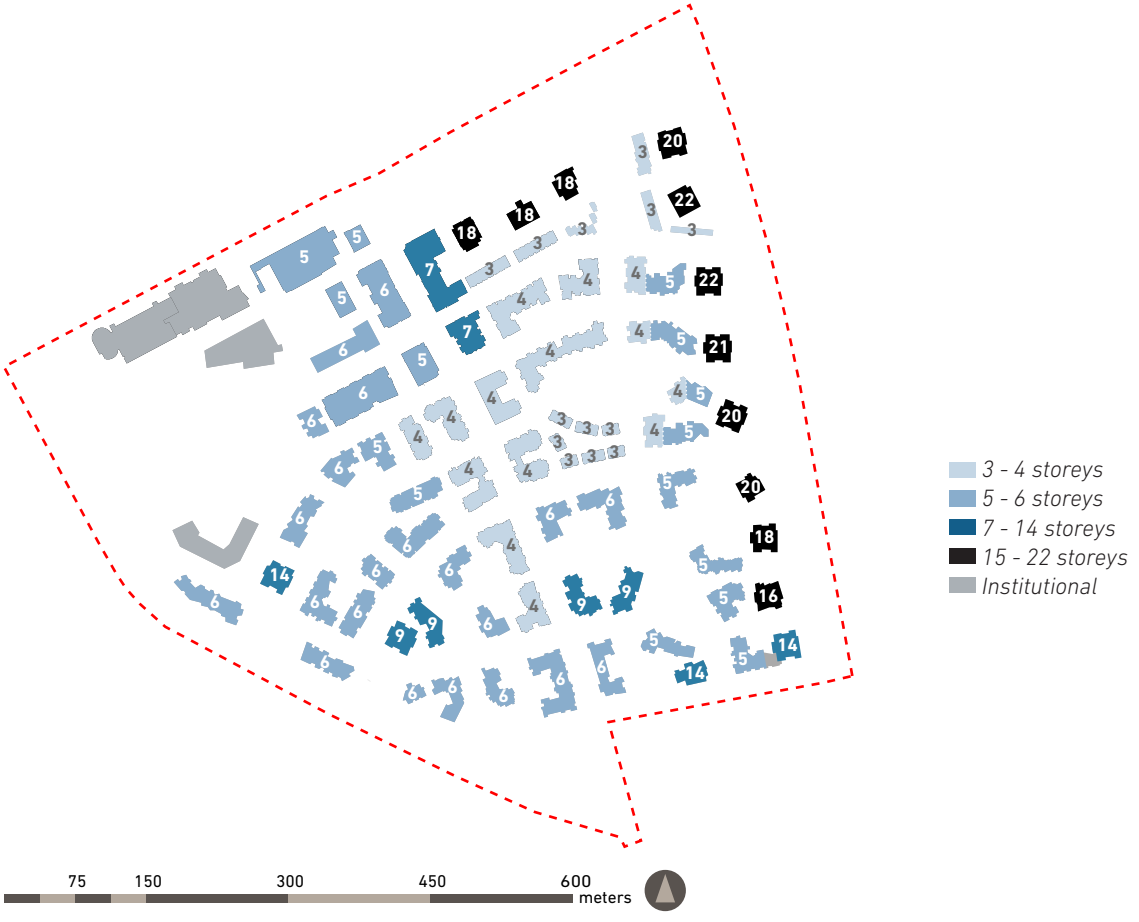


Figure 2.5 Building Heights

towers ranging in height from 14 to 22 stories will align the edge of PSRP and the forest buffer along 16th avenue. The majority of buildings completed in Phase 2, west of Wesbrook Mall and Phase 3 in the southeast corner of the site are planned to be 5 to 6 storey residential.

COMMERCIAL SERVICES

4. Pedestrian-oriented "village centre" to serve UTown residents
5. Provide shops and services for daily needs
6. Provide a full service grocery store
7. Enable a significant social component

(WPNP 2011)

The village centre is one of two residential areas on the UBC peninsula, which have commercial services, including the only full service grocery store, thus this commercial village was intended to serve all of University Town. Currently, 5 out of the 6 mixed-use buildings are built. The total area of commercial space is limited to 10,000 square meters of ground floor retail plus some additional second floor office. Save-On-Foods, the grocery store, is 3,124 m2 and includes a full range of groceries, a pharmacy, a café and deli. Other retail units in the village are intentionally small and typically range from 52 m2 to 428m2, with an average size of 93 m2. Currently the range of services includes: the grocery store, the pharmacy, a liquor store, a bank, a dentist, seven food services including a large craft beer restaurant, and eight other services such as running store, bike store, yoga studio, optometrist. Missing at present are a daycare, medical services and an elementary school.

The village centre provides a significant social component for the community. Two outdoor plazas support the Village Centre and several eating establishments have outdoor seating. The community centre is scheduled to open in June, 2015 and includes recreation facilities, meeting spaces, a teen centre and a daycare (see next page).

The village centre is located on Wesbrook Mall at the north end of the neighbourhood and at edge of the rest of campus. It is accessible by bicycle and car for the majority of UTown residents, being as close as 1/2 km and as far as 2.7 km from the other residential neighbourhoods and student housing. For most residents of Wesbrook Place, the Village Centre is very walkable. Figure 2.8, shows the walking distance from the Village Centre to residential buildings along streets and paths. 100% of existing dwellings are within a five minute walk of the Village Centre and all current and future developments are within a ten minute walk. The high school is within a two minute walk of the Village Centre and the community centre.

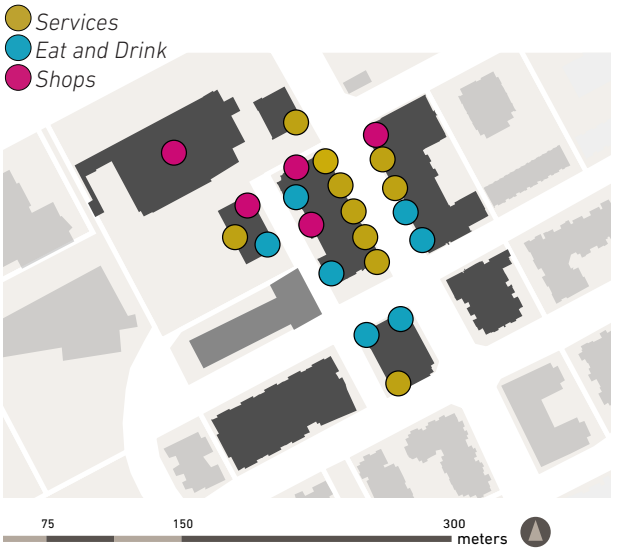


Figure 2.6 Village Centre Services by Type

Table 2.3 Checklist of services (Farr 2008)

	Wesbrook Place	
Pedestrian destination	8 August 2014	Summer 2015
Bank	✓	✓
Child care facility		✓
Community/civic centre		✓
Convenience store		
Dental office	✓	✓
Hair care/personal care		✓
Hardware store		
Recreation facility		✓
Laundry/dry cleaner		
Library		
Liquor store	✓	✓
Live-work housing		
Medical office	✓	✓
Park	✓	✓
Pharmacy	✓	✓
Place of worship		
Police/fire station		
Post office		
Restaurant	✓	✓
School, elementary		
School, secondary	✓	✓
Senior care facility	✓	✓
Share car	✓	✓
Shops, miscellaneous	✓	✓
Supermarket	✓	✓
Take-out food	✓	✓
Third place	✓	✓
Transit stop	✓	✓
28	16 (57%)	19 (68%)

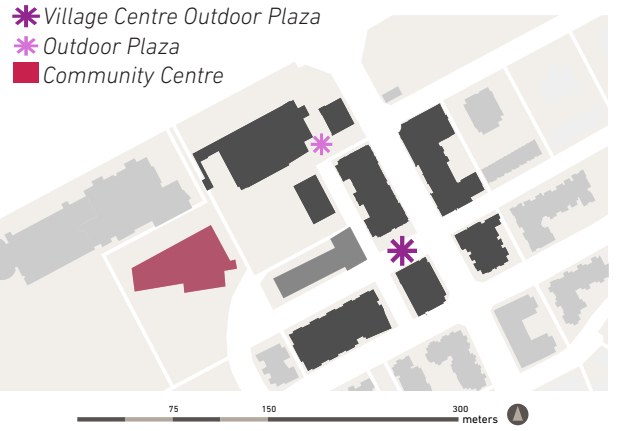


Figure 2.7 Wesbrook Commercial Centre Plaza

Figure 2.8 Walking distances from the Village Centre to residences

HOUSING DIVERSITY AND AFFORDABILITY

8. Provide a diverse range of housing types, tenures, market, non-market, unit sizes, and densities
9. At least 50% of housing will be non-market for staff, faculty, co-operative, social or other special housing needs
10. 20% of dwellings will be rental housing
11. 50% of households will include one or more members who work or study at UBC

(WPNP 2011)

The exact demographic profile of Wesbrook Place is unknown, thus it is necessary to assume it is similar to the entirety of the UBC peninsula with 74% being between 15 and 64, 17% being children and the remaining 9% being seniors over 65[4]. In 2011, the number of families on the peninsula was 3,365[5], representing 56% of households[6].

Currently 20% of dwellings are apartments in towers, 11% are apartments in mid-rise buildings, 64% are apartments in low-rise buildings (six stories or less), and 4% are townhouses. As of August, 2014, 22% of dwellings were purpose-built rental units. Another 94 rental units were under construction and scheduled to be occupied in 2015, which will raise the percentage to 28%, thereby exceeding the target set out in the Plan. To date, 153 rental apartments in three four storey buildings are specifically targeted to UBC faculty and staff and are rented at below-market rates. The 94 unit building mentioned above will also be targeted faculty and staff rental housing, bringing the total to 247 or 16% of all dwellings. There are 180 apartments, 11% of dwellings, in a purpose-built seniors housing complex situated within the village centre (see below).

As of December, 2014 a total of 79 units were on the market costing an average of $848.54 per square foot[7]. Data on rentals in Wesbrook was limited at the time of this study but prices range from $650 for a basement apartment to $1200 for a top storey apartment,[8][9]. The housing market

Table 2.4 Tenure Types of completed and future developments as of May 15, 2014

Market Strata			
Completed Lots	12	Completed Units	1,218
Market Rental			
Completed Lots	3	Completed Units	197
Future Lots	2	Future Units	156
Non Market Rental (faculty & staff)			
Completed Lots	2	Completed Units	153
Future Lots	6	Future Units	694
Approved or under construction - Market Strata			
Future Lots	3	Future Units	645
Approved- Restricted Ownership			
Future Lots	1	Future Units	36
Undesignated			
Future Lots	10	Future Units	3,126

Information provided by UBC Properties Trust

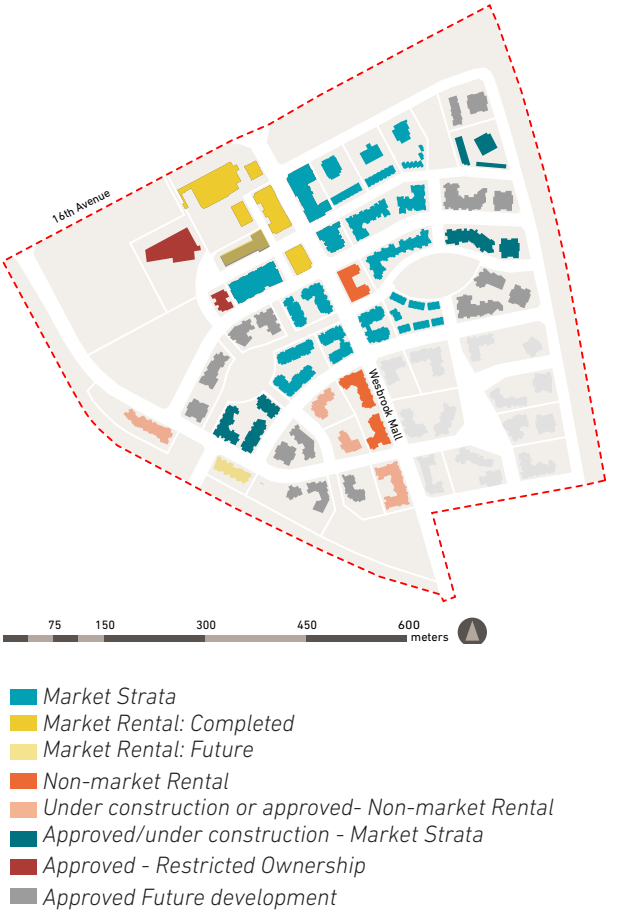


Figure 2.9 Tenure Diagram

in Wesbrook compared to Point Grey, a community found on the other side of Pacific Spirit Regional Park, is similar as condos are an average of $683.99 per square foot and houses are quite big in Point Grey and average $1,609.04 per square foot[10].

AGING IN WESTBROOK

12. Provide the ability for "aging-in-place" within the community
13. Community facilities will enable access for elderly people and people with movement or sensory difficulties
14. The neighbourhood will be designed to allow equal access to all people and buildings should be visitable by persons with disabilities

(WPNP 2011)

The percentage of seniors residing on the UBC peninsula, at 9.5% of the population, is lower than the Metro Vancouver average of 13.5%. Nonetheless, University Town and Wesbrook Place have and will attract downsizing seniors to the private housing stock. "Tapestry" is an independent retirement residence developed in the village centre of Wesbrook Place. It is the first purpose-built seniors residence at UBC and provides both independent living and a range of assisted living services. Tapestry is composed of two seven-storey buildings, connected by a bridge. The ground level of both buildings is commercial space. Of 180 total dwellings, 134 units are one and two bedroom rental apartments, while the remaining 46 units are one and two bedroom for purchase condominium homes[11]. Residents of Tapestry are within a 120 meter walk of the grocery store, a 220 meter walk of the community centre, and a 240 meter walk of the nearest park, Khorana Park.

PARKS AND RECREATION

15. Provide a variety of public and private recreation experiences, including parks, plazas, children's play spaces, a playing field, a ball diamond, tennis courts
16. Provide play spaces for children within 400 m of residences
17. Provide 1.2 ha of open space per 1000 population
18. .83 ha of UNOS per 1000 population

(WPNP 2011)

Usable Neighbourhood Open Space (UNOS) is defined in the UBC Land Use Plan (2012) as "open space for residential use including local parks, play grounds and tennis courts." At Wesbrook Place, UNOS additionally includes the green streets, public plazas, playing fields, and a buffer along PSRP (See Figure 2.12). At Wesbrook Place, streets, green streets and parks were developed in advance of residential development so that when residents moved in, the public realm was also complete and ready for occupation. In the summer of 2014, approximately 95% of roads and

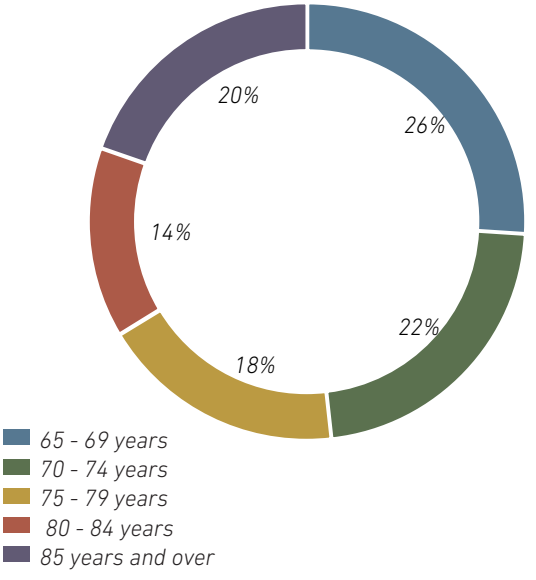


Figure 2.10 Population of Seniors by five-year age groups for Electoral Area
Source: 2011Census

80% green spaces were completed. The six parks range in size from 1 to 2.5 hectares and accommodate both active and passive recreation. Four parks include children's play areas. Brockhouse Park and Playing Field is affiliated with the high school and includes a multi-use all season field with lighting. Nobel Park has a baseball diamond, and tennis courts will be developed adjacent the new community centre. Pedestrian and bicycle only green streets interconnect all of the park spaces, and can be used as passive green space. The "green edge" found along 16th Avenue and adjacent to Pacific Spirit Regional Park, connects the neighbourhood green spaces to PSRP. As of August, 2014, approximately 12 hectares of parks

Figure 2.11 Playground in Smith Park

Figure 2.12 Open Space Diagram

Figure 2.13 Walking distances from the parks to residences

Figure 2.14 Walking distances from the playgrounds to residences

Table 2.5 Usable Neighborhood Open Space: Parks, Green Streets, and Greenway

Usable Neighborhood Open Space: Parks, Green Streets, and Greenway	Area (hectares)
Khorana Park	1.00
Smith Park	1.15
Brockhouse Park and Playing Field	2.53
Mundell Park	0.96
Nobel Park	1.14
Unnamed Park (incomplete)	1.12
Norman MacKenzie Square	0.06
Other (green streets)	2.44
Green Edge and Tree Retention Area	4.77
Total	**15.17**

Source: WPNP 2011

and open spaces were complete putting the ratio of green space to residents at 3.8 hectares per 1000 people. This far exceeds the target of 1.2 ha/1000 specified by the plan, however this ratio will go down as more housing is completed.

All existing dwellings (100%) are within a 400 m walk of UNOS, a park and a playground.

COMMUNITY CENTRE AND SCHOOLS

19. Provide a secondary school site, including land for playing fields
20. Reserve an elementary school site close to the secondary school
21. Provide daycare consistent with 2009 UBC Childcare Expansion Plan
22. The community centre will be located contiguous with the village commercial centre adjacent to the school and playing field.

(WPNP 2011)

University Hill Secondary School, moved from an older building near the UBC campus to Wesbrook Place and opened in January 2013. This is the smallest high school operated by the Vancouver School Board (and proud of it), and includes grades 8 to 12. The school is located adjacent

to the Village Centre. This school serves all high school students who live in University Town, in student housing on campus and in the University Endowment Lands. It fronts onto large all-weather playing fields in Brockhouse Park. 69% of existing dwellings are within a 400m walk of the high school.

Currently elementary school students attend a nearby school, Norma Rose Point School, located 1.4 kilometers north of the Village Centre. This is a comfortable bike ride, but a long walk for children, thus many are likely driven to school. There is an elementary school site on reserve south of the secondary school for future expansion (See Figure 2.3).

A 2000 m2 community centre located adjacent the village centre and the high school is scheduled to open June 2015. The community centre activity is intended to help animate the village core and contribute to the safety and security of the area throughout the day and evening. Proximity to the school provides opportunities to share resources. For example, the playing fields are jointly managed by the High School (Vancouver School Board) and the University Neighbourhood Association. Facilities in the Community Centre will include a gymnasium and fitness centre, meeting rooms and multi-purpose rooms for classes, programs and events, a teen centre and games room, a coffee shop, multiple places for informal drop-in and casual use (i.e. open lounge areas), a dance studio, and a daycare centre with an outdoor play area. The daycare centre will accommodate 49 children. All residents of University Town are eligible to be members of the Community Centre and use its facilities. Presently residents have access to other community centres located elsewhere on campus. (See Figure 2.17). 90% of existing dwellings are within a 400 m walk of the community centre, while 10% are within 800 meters.

Figure 2.15 Walking Distance from University Hill Secondary School

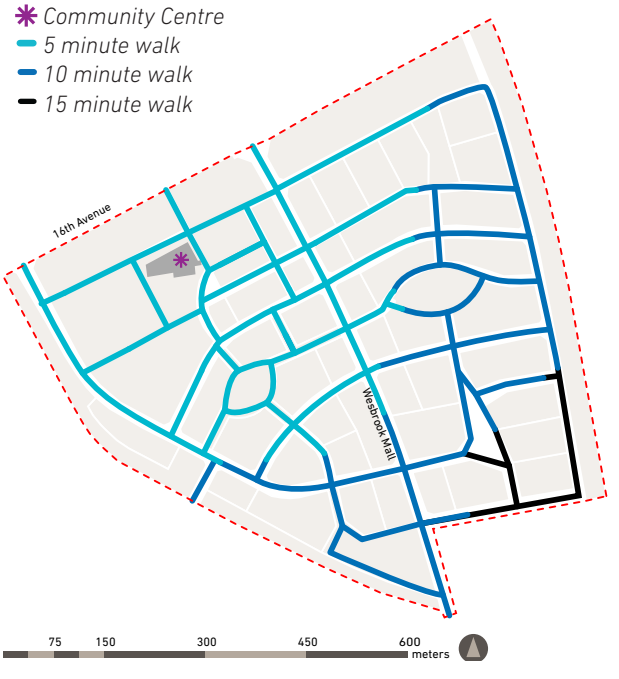


Figure 2.16 Walking Distance from Community Centre

TOWN AND GOWN: LINKS BETWEEN ACADEMIC AND RESIDENTIAL

23. A learning community- integrate academic functions into urban fabric
24. Public awareness of research initiatives

(WPNP 2011)

"We live and breathe in UBC. We've been to their libraries, we've swam in their pools, and we've taken over their computers to play computer games. We probably know the campus better than any first-year student. Most of us live here and it's probably more home than neighbor."[12]

Residents of UTown who do not attend school or work on campus have opportunity to mix with students, academics and researchers. The intention for University Town is to integrate academic and research activities with the residential community (Westbrook Place Neighborhood Plan, 2011). Institution-related offices and opportunities for learning in conjunction with the school and other public realm spaces are permitted and encouraged. The Community Services Card program provides access for residents to social and cultural facilities across campus (libraries, museums, galleries). UBC cultural services include the Museum of Anthropology, The Beatty Biodiversity Museum, the Morris and Helen Belkin Art Gallery, the Chan Centre for Performing Arts, the UBC Botanical Garden, Nitobe Garden. Numerous athletic events and public lectures occur throughout the year.

Community and Recreational Services
1 Beaty Biodiversity Museum
2 Doug Mitchell Thunderbird Sports Centre
3 Chan centre for the performing arts
4 Museum of Anthropology
5 Nitobe Memorial Garden
6 Osborne Centre
7 Outdoor Basketball Court
8 Rashpal Dhillon Track and Field Oval
9 Spencer Field
10 Student Recreation Centre
11 The Old Barn Community Centre
12 UBC Koerner Library
13 UBC Botanical Garden
14 UBC Aquatic Centre
15 UBC Skate Park
16 Wesbrook Community Centre

Childcare and Educational Services
17 Norma Rose Point School
18 UBC Childcare
19 University Hill Elementary School
20 University Hill Secondary School

Figure 2.17 Community and Recreational Centres and Schools located at UBC

END NOTES

1. Metro Vancouver 2011
2. Kellett et al 2009
3. West End Community Plan, November 2013, City of Vancouver
4. Statistics Canada 2011
5. Statistics Canada 2011
6. Metro Vancouver Bulletin: Population and dwellings 2011
7. www.realtor.ca, 2014
8. AMSRentline, 2014
9. Craigslist Rental Listings, 2014
10. www.realtor.ca, 2014
11. bccondos.net/tapestry-at-wesbrook-village
12. (http://go.vsb.bc.ca/schools/uhill/Pages/Neighbourhood.aspx) From the University Hill Secondary School web site.

TRANSPORTATION AND CIRCULATION

EMPHASIZING ALTERNATIVE MODES OF TRANSPORTATION

Figure 3.1 Green Street

OVERVIEW

Wesbrook Place features a fine-grained transportation network that is accommodating of several modes of transportation. With five different classifications of street, the neighbourhood grid is highly complex, yet is managed in a hierarchical way. This complexity promotes walkability and cycling by reducing block length for pedestrians and cyclists, as well as by providing several vehicle-free routes to the village centre, Pacific Spirit Regional Park, UBC, and green space within the community. The neighbourhood is well-served by public transit, connecting it to the Vancouver metropolitan area and reinforcing its close relationship to the university via a campus-wide mini bus network. In addition, Wesbrook is partnered with three private car sharing companies, and promotes the use of electric vehicles, thus encouraging residents to have the smallest impact possible when the use of personal vehicles is required.

The following analysis is broken down into five parts. The first will be a hollistic look at the logic and overarching structure of the grid. A discussion on how the network accomodates each of four modes of transportation supported within the neighbourhood (walking, cycling, public transit, and personal vehicles) will follow. Each of these sections begin with relevant transportation goals summarized from Wesbrook Place Neighbourhood Plan and will be used to guide the discussion.

STREET GRID

1. Reduce automobile travel
2. Create a multi-modal transportation system
3. Establish a hierarchical road network that integrates with the road network on campus
4. Create a redundant circulation network
5. Support UBC transportation programs

Section 2.5

The street grid emerged from participants' input during the community workshops held in 2004. The final design seen today can be attributed to the community's strong desire to create an organic, village-like atmosphere in contrast to the typical, rigid city grid[1]. As demonstrated in Figure 3.3, Wesbrook Mall serves as the spine of the neighbourhood, integrating it with the eastern edge of UBC at W 16th Avenue, and serving as the primary organizing element within the neighbourhood itself. In addition to Wesbrook Mall, there are several points of access into or out of the neighbourhood, some of which are tailored to specific modes of transportation, that provide direct connections to all of the various landmarks adjacent to the neighbourhood. Overall, the grid constitutes a redundant circulation network that supports various means of transportation and encourages the use of alternative transportation methods within its locality.

Wesbrook's circulation network features four classifications of roads: Collector, Local, Greenway, and Green Street (see Figure 2.3). Wesbrook Mall and Ross Drive are the two collector roads. The former, serving as the main thoroughfare to the neighbourhood, supports the principal access point, Village Centre, and majority of the commercial venues, while the latter provides another means of access to W 16th Ave and separates Wesbrook and the UBC Farm. Both of these roads support bus services which will be discussed later on in this chapter.

Local roads make up the remaining roadways that permit automobile traffic. They support on-street parking as well as parking garage entrances. Sidewalks are a feature on both sides and they are lined with street trees on at least one side.

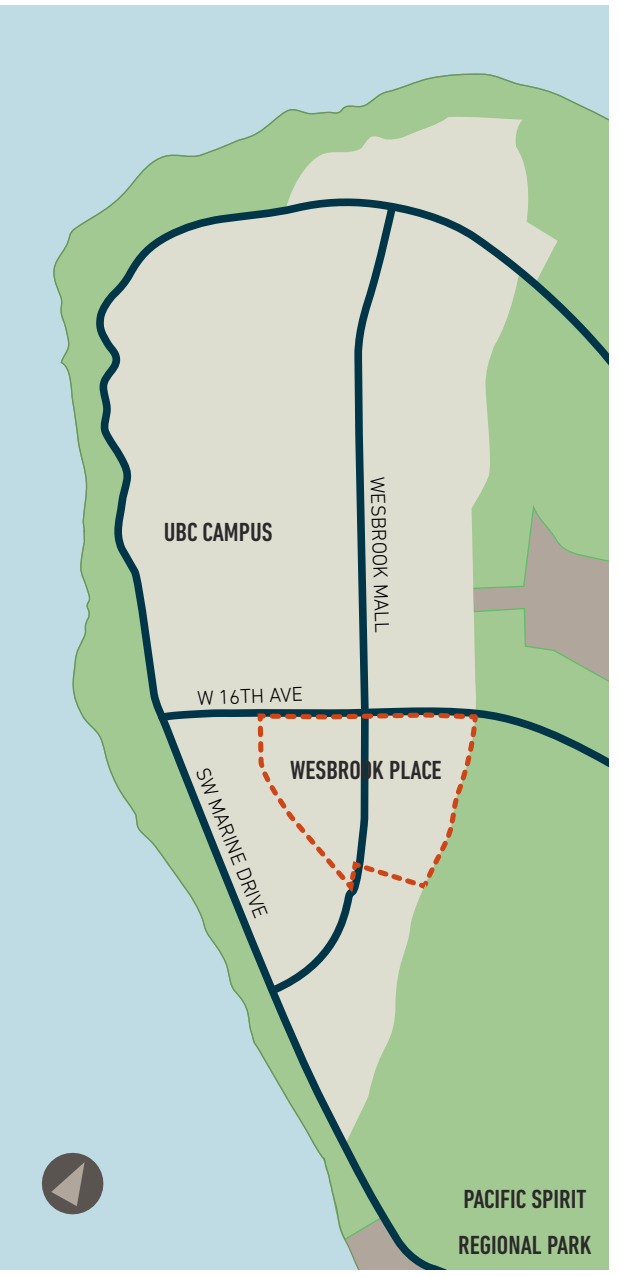


Figure 3.2 Major thoroughfares

The Greenway is designed to accommodate all non-motorized forms of transportation and serves the organizational role of connecting Wesbrook Place to UBC's pedestrian Main Mall to the northwest, the UBC Farm to the southwest, and Pacific Spirit Regional Park to the east. In do

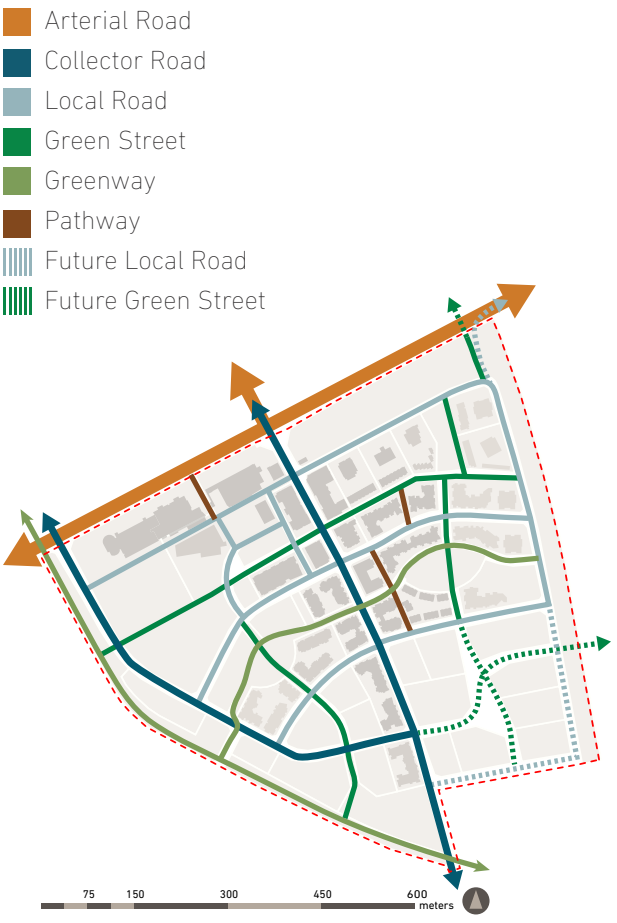


Figure 3.3 Neighbourhood road hierarchy

ing so, it also provides a vehicle-free network between many of the open spaces and parks found within Wesbrook itself and even contributes an additional 2.45 hectares of open space. Typically, Greenways feature a path that is 2 to 3 meters wide and lined with vegetation on either side.

Like the Greenway, Green Streets are meant to support predominantly non-motorized means of transportation; however, they are designed to provide a greater diversity of program. That they serve as building frontage streets is the most significant distinction. Because of this, they are wider than Greenways to accommodate emergency vehices and moving vans. The design of Green Streets varies widely throughout the neighbourhood. Spanning 13 to 17 meters in total, the streets generally support two paths separated by plants and water features, the smaller of which serves as an access point for the units that face it.

PEDESTRIAN CIRCULATION

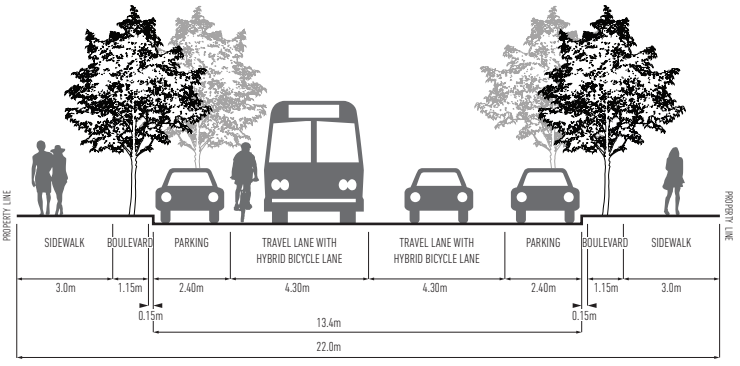
6. Encourage walking by providing a continuous network of pedestrian facilities, and safety measures
7. Ensure that road design considers the following performance criteria — safety, ecology, community building, aesthetics and long term investment in high quality materials.
8. Incorporate traffic calming features

Section 2.5

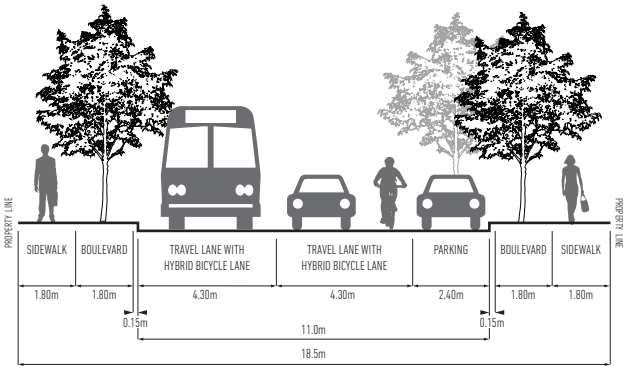
The pedestrian circulation network is fine-grained, redundant, and well connected to all of the development's landmarks, as illustrated by Figure 3.6 and Table 3.1. Dead-end paths and cul-de-sacs are absent; instead, pedestrian travel within Wesbrook is prioritized through the provision of Greenways and Green Streets. These pedestrian-oriented streets, dispersed throughout the development, provide a variety of access routes to any destination.

The effectiveness of the network can be evidenced through measuring the distances people must walk from their building to a given destination. Because the Wesbrook Place Neighborhood Plan only specifies target distances from residencies to open space and bus stops, the North American standard of a five-minute walking distance, roughly 400 m, will be used as the metric of evaluation. The following maps illustrate which buildings lie within the 5 minute radius of several different landmarks. As well, a radius of 400 m as the crow flies has been included to indicate the absolute distance away from the landmark.

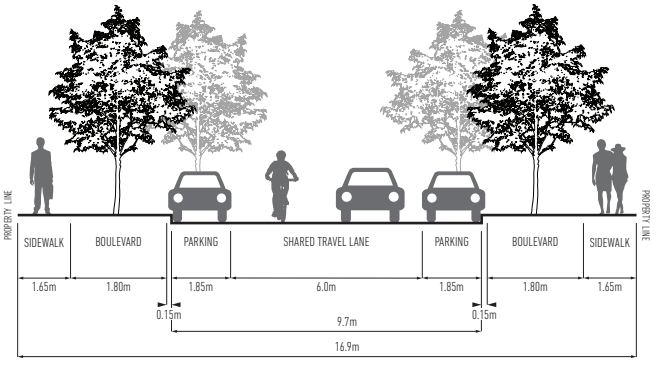
The first landmark to be examined is the plaza in front of the community grocery store, Save-on-Foods (Figure 3.7). The neighborhood Plan refers to the plaza as a "significant social component for the community," and that it should "provide a hub for community interaction." Based on the estimated 6,250 total units at buildout, only 34%, or 2,096 units, are within a five minute walk of the plaza. And while the unit distribution of the southeastern portion of the neighbourhood is still unresolved, it is likely that anywhere from 96%



NEIGHBORHOOD CENTRE COLLECTOR WITH TRANSIT

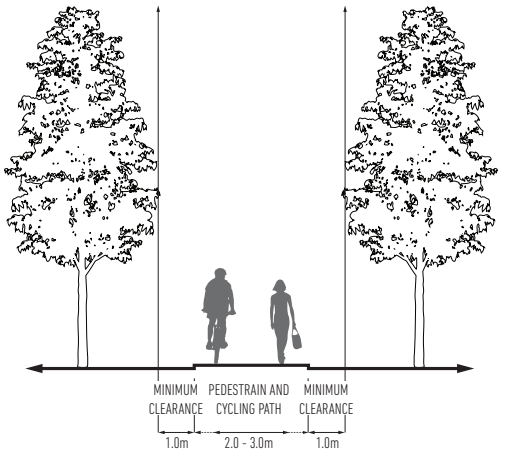


TYPICAL NEIGHBORHOOD COLLECTOR WITH TRANSIT

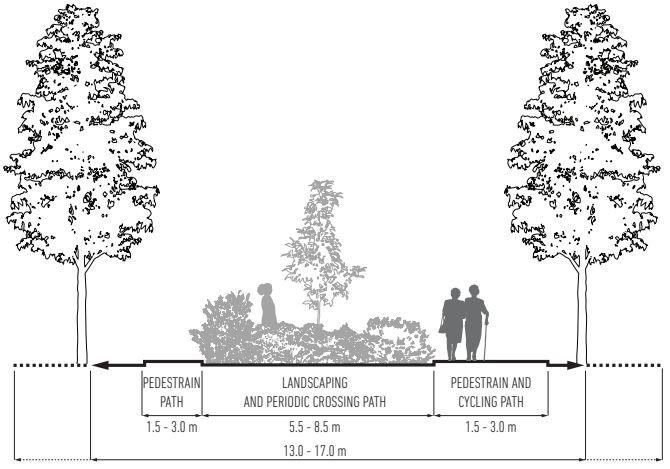


LOCAL STREET

Figure 3.4 Vehicular Street Sections based on drawings from the Wesbrook Place Neighbourhood Plan



GREENWAY



GREEN STREET

Figure 3.5 Non-vehicular Street Sections

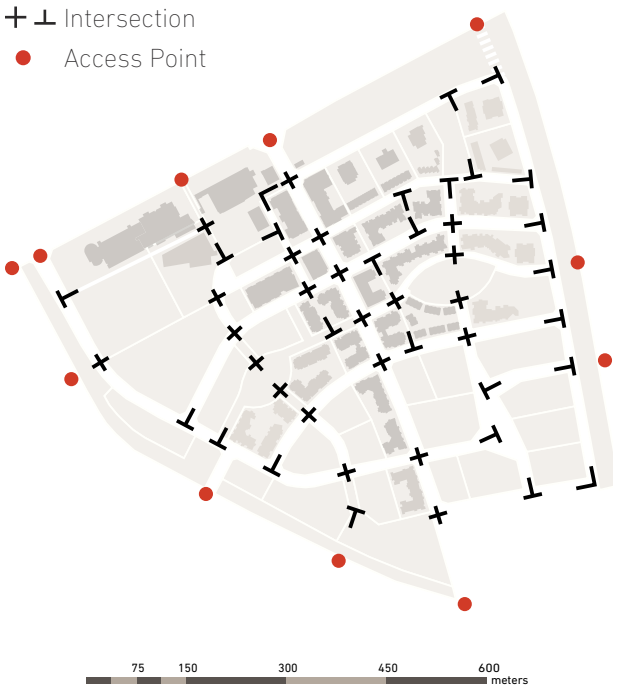


Figure 3.6 Intersection form and density

Table 3.1 — Pedestrian Connectedness

Linear Meters	11,870
Number of Blocks	37
Average Block Length (m)	71
Number of Access Points	11
Number of Intersections	50

to 100% of units will be within a 10 minute walk from the plaza. However, due to its adjacency to both the village's only grocery store and primary entrance, it likely sees more traffic than it would were it at the geographical centre of the development and removed from its "urban" context. This condition was not coincidental, as the commercial core was thoughtfully sited at the entrance for this very reason.

The second landmark, the new community centre is of interest because it, too, is meant to "animate the village core," as well as "contribute to the safety and security of the area" (Figure 2.8). Set to open in 2015, the community centre is located about 100 meters southeast of the plaza. Because it is closer to denser residential buildings than the plaza, 37%, or 2,337, residential units are within its 5 minute vicinity. This shift does, however, put more space between the centre and the neighbourhood's southeast corner, where an estimated 200 to 700 units may lie beyond the 10 minute threshold. Further, it is not located on Wesbrook Mall and is surrounded by a playing field and parking lot from the west to northeast. Despite these drawbacks in siting, the services the community centre intends to provide will likely be the determining factor in its success.

Open space is another landmark of importance designated within the Plan (Figure 2.9). It declares that every residential unit should be within 250 meters of Greenways, which connect to nearly all of the village's parks and fields. Every building lies generously within the 250 meter distance, indicating that the strategy of equally dispersing green space throughout the development highly effective in acheiving this goal.

—

In addition to connectivity, aesthetics was another strategy used to promote walking. Developing the aesthetics of the pedestrian network at all scales provides interest and encourages people to walk for enjoyment instead of mere necessity. The meandering nature of the grid is intended to reduce monotony, while the variety of vegetation and building materials seeks to contribute to the interest of the walk. Furthermore, various water features and benches enhance the pedestrain experince by providing places of pause and things to look at.

Attention to pedestrian safety is the final strategy employed to encourage walking within Wesbrook. Vegetated bulbouts and boulevards separate pedestrians from vehicular traffic, while elevated crosswalks made with pavers that visually contrast the street facilitate their safe crossing (Figure 2.10); some crosswalks have the added feature of flashing lights. Finally, lighting fixtures installed along all streets and paths in Wesbrook are intended to provide safety and security while also "creating a sense of place and character." Certainly, these features make paths more welcoming in winter when the sun sets realtively early than they otherwise would be.

Figure 3.7 5- and 10-minute walking distances to village plaza

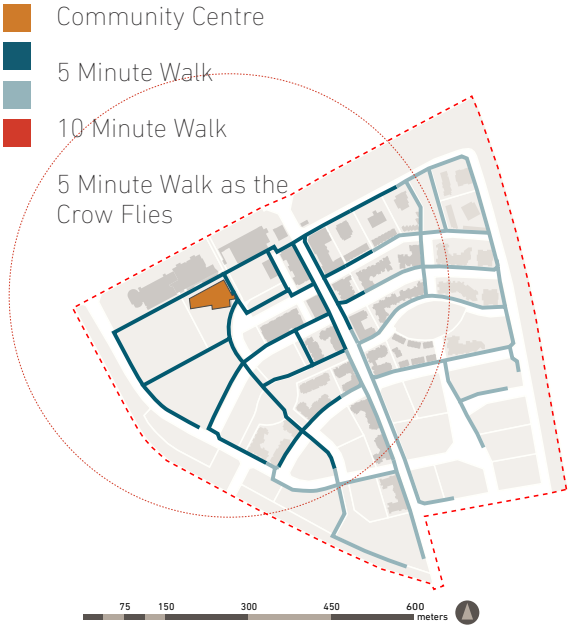


Figure 3.8 5- and 10-minute walking distances to community centre

BICYCLE CIRCULATION

9. Encourage cycling by providing a continuous network of cycling facilities

Section 2.5

Within Wesbrook, bicyclists are permitted on all paths and roadways, and thus have the same degree of acessibility as pedestrains (Figure 3.4), but there is no space designated solely for their use. The Neighbourhood Plan describes a paving scheme for the Green Streets that was never realized, in which the centre of the path is reserved for cyclists and distinguished from the rest via contrasting pavers (Figure 3.5 shows the implemented scheme on a 2.5 meter wide pathway). As a result, they must share the same space. Similarly on roads, cyclists are not provided with bike lanes, but instead "sharrows," which merely serve as a reminder to drivers to share the road.

In contrast to lacking accommodations in circulation, bicycle parking is well provided for in the form of both class one long-term, secure parking for residents and class two accommodations for visitors, which generally takes the form of a typical, publicly-accessible bikerack. As per the UBC Development Handbook, a minimum of 1.5 class one bicycle parking spots are required per residential unit. Additionally, to accommodate visitors, a minimum of 16 class two parking spots are required for every 35 units. A random sampling of ten residential buildings returned a total of 2,569 bicycle parking spots for 949 units of varying size[2]. Unfortunately, there is no data on how many of those spots are filled, let alone how many people regularly use their bike for transportation purposes.

PUBLIC TRANSIT

> 10. Accommodate full-size transit buses along Wesbrook Mall south of 16th Avenue, and mini-buses on other roads within the neighbourhood
>
> Section 2.5 (WPNP 2011)

The Wesbrook community is served by eight different bus routes. Of these, three have stops within the village, while the other five have stops just beyond the main entrance at Wesbrook Mall and West 16th Avenue (see Table 3.2 on the next page). Initially, as indicated by Figure 3.11, the mini buses were planned to more directly serve the eastern portion of the neighbourhood, but were instead rerouted along Wesbrook Mall. Still, the transit service goal was met.

All of the routes travel north- or westbound to UBC, making public transit a highly viable option to get to the university. In fact two of the routes, the C 18 and C 20, are mini buses that connect Wesbrook to a number of destinations on campus, thus further strengthening the transit ties between the community and campus.

All of the other listed routes are part of Translink's regional transit network, which connects Wesbrook residents to the rest of the city, the Vancouver international Airport, and the suburbs beyond. Heading eastbound or southbound, all of these routes terminate at a Skytrain station for easy access to the metro region. However, despite this convenience and the number of routes that serve the neighborhood, only one of them is an express route, and none of them provide direct access to downtown.

The Neighbourhood Plan establishes the standard 5 minute walking distance as the acceptable range for units to be from a transit stop in order to be considered convenient. Figure 3.11 shows the distribution of residences that are served by each of the three transit stops within Wesbrook. At buildout, anywhere from two thirds to three quarters of all units will be within an acceptable walking distance from from all three routes. The most western stop, found on Ross Drive and supporting the mini bus routes, serves 36% of the community. The other two stops, both on Wesbrook Mall, provide services for all three routes, including both directions for the 41. Currently they each serve approximately 50% of the projected total units, but that is anticipated to grow as the southeastern portion of the community is developed.

Figure 3.9 Elevated crosswalk on Wesbrook Mall

Figure 3.10 The aesthetics of the pedestrain experience

VEHICULAR CIRCULATION

The Neighbourhood Plan acknowledges that the elimination of personal vehicles is, at this time, still impractical and, therefore, seeks to "reduce automobile travel." In addition to the previously mentioned actions taken to promote other modes of transportation, three primary strategies were implemented.

The first strategy attempts to restrict the number of vehicles owned by residents. Two methods of *maximum* allowable parking spaces are provided to developers, and the one resulting in fewer spaces must be used. In either case, no more than two spots per unit are permitted. Nevertheless, numerous units are allegedly associated with three or more cars[3].

Another strategy used is the provision of reserved parking spots for vehicles that run on alternative fuels. While this is not mandatory, developers may receive one REAP[4] point for doing so. The requirements of the point stipulate that for every eighty parking spots, two must be reserved for alternative fuel vehicles and that of those, half must be equipped with electric vehicle charging amenities.

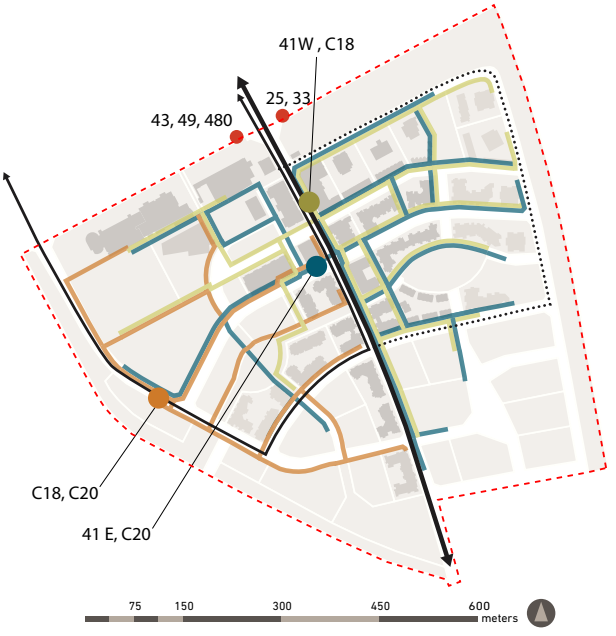


Figure 3.11 5-minute Walking Distance from Bus Stops

Finally, Wesbrook Place has been designed to accommodate car share facilities. The services of three car share companies are available in Wesbrook, ZipCars, Car2Go, and Modo. To make the use of car sharing more enticing, the use of Car2Go is free to community members who have a community card, which is free for all residents. Statistics on percentage of trips made with car share vehicles are unavailable.

FUTURE PLANS

A few modifications to the current circulation network are currently being implemented or are being planned for when finances become available. The most significant is the extension of Binning Road to West 16th Avenue in the form of a single right-turn-only lane and a bike lane. This addition is intended to provide a supplemental route out of the neighbourhood, reducing congestion in the village centre. The bike lane component will feed into the bike lane already present on West 16th Avenue. Accompanying this alteration is the development of a new pedestrian crosswalk across West 16th Avenue, connecting Wesbrook to another university residential neighbourhood, Hampton Place as well as a future elementary school.

UBC Transportation is also hoping to make changes to the crosswalks on Wesbrook Mall. At present, it is reportedly unsafe to cross this street. While studies confirmed that speeding along this thoroughfare was not an issue, it has not yet been decided which actions the University will take to ameliorate the problem, nor has a time frame been established.

Table 3.2 — Bus routes serving Wesbrook Place

Route #	Average Departure Interval (min)		
Has Stop in Wesbrook	M-F	Saturday	Sunday
41	Destination: Joyce Station - via 41st St		
Morning <12	5	15	15
Afternoon 12 - 16:30	8	15	15
Evening 16:30-19:00	5	26	24
Night 19<	20	30	30
C18	Destination: UBC (Counter-clockwise)		
All	30		
C20	UBC (Clockwise)		
All	30		
Has Stop at Wesbrook Mall and W 16th Ave			
49	Destination: Metrotown Station - via 49th St		
Morning <12	11		
Afternoon 12 - 16:30	20		
Evening 16:30-19:00	9		
Night 19<	19		
480	Destination: Bridgeport Station - via 41st St to Granville St		
Morning <12	30		
Afternoon 12 - 16:30	18		
Evening 16:30-19:00	20		
Night 19<	30		
43	Destination: Joyce Station - via 41st St		
Morning <12	13		
Afternoon 12 - 16:30	11		
Evening 16:30-19:00	11		
Night 19<	20		
33	Destination: 29th Ave. Station - via W 11p2.4276th Ave		
Morning <12	15	30	30
Afternoon 12 - 16:30	12	30	30
Evening 16:30-19:00	12	30	30
Night 19<	30	30	30
25	Destination: Nanaimo Station Brentwood Statio - via W King Edward St		
Morning <12	11	12	13
Afternoon 12 - 16:30	9	12	12
Evening 16:30-19:00	9	14	13
Night 19<	22	21	22

CONCLUSION

In general, all ten transportation goals outlined in the South Campus Neighbourhood Plan were met. Several "best practice" actions were taken to promote the non-vehicular modes of transportation, from building a fine-grained, hierarchical, and redundant street grid, to paying heed to pedestrian safety and experience. The street system is logically connected to the greater UBC grid, and numerous routes connect all modes of transportation to destinations adjacent to the community and beyond. In addition, the infrastructure required to support the use of car sharing services and some alternative fuel vehicles was provided for.

While all the goals may have been met, the manner in which some of them were deviates from how they were initially planned. The most serious example of this is the lack of adequate bicycle infrastructure, particularly on Green Streets. Additional alterations are less severe, such as the rerouting of the C 18 and C 20 bus lines, as well as the lack of clarity of the Greenway and Green Street hierarchy.

Finally, not all areas of the neighbourhood are adequately served by the village amenities. In particular, the southeastern portion largely lies beyond acceptable standardized walking distances to many of the community's landmarks, including the community centre, plaza, grocery store, seconday school, and bus stops, though it will be well served by the open space network.

END NOTES

1. Perry, Kim, interview by author, Vancouver, BC, July 7, 2014.
2. Refer to Figure 3.5 in chapter 4, Building Energy and Water Use
3. Falkner, Krista, interview with author, Vancouver, July 11, 2014
4. Residential Environmental Assessment Program, a sustainability assessment tool similar to LEED developed by UBC

BUILDING ENERGY AND WATER USE

GREEN URBAN VILLAGE LIVING

Figure 4.1 Model of Wesbrook Place Neighbourhood housed at the Wesbrook Welcome Centre

OVERVIEW

In order to create a resource-efficient community, it is essential to understand the critical role that infrastructure plays in setting the stage for how buildings can be physically designed and operated. Through this "big picture" approach, the burden of efficient energy use is partially transferred from the buildings' design and construction to the distributing infrastructure network itself. This has the advantage of being more cost effective in terms of amount of money spent to GHGs reduced than if buildings had to bear that burden through better, more expensive construction and the utilization of building-scale alternative energy sources, such as solar panels[1].

In this section, the larger-scale, ongoing energy infrastructure plans will be discussed. As well, methods used to reduce energy and water consumption at the building scale will be examined. Goals relating to these topics come from the following sections of the Wesbrook Place Neighbourhood Plan: Sections 2.2.2 — A Compact and Complete Community; 3.2.1 — Energy Infrastructure; 3.2.2 — Water and Liquid Waste Management; and 3.5.15 — Green Building Rating System.

INFRASTRUCTURE

1. Provide safe, effective and innovative infrastructure systems within reasonable economic parameters

   Wesbrook Place Neighbourhood Plan Section 2.2.2

2. Explore implementing a neighbourhood scale energy distribution system
3. Infrastructure and operations will be designed to be as energy efficient as possible
4. Explore various renewable energy systems

   Wesbrook Place Neighbourhood Plan Section 3.2.1

5. Buildings should be able to be linked into the future district energy system

   Wesbrook Place Neighbourhood Plan Section 3.5.15

The primary strategy for supplying energy to Wesbrook is the use of a modern, clean energy based district energy system. A district energy system works by producing energy in a centralized location and, as in this case, distributing the energy via heated water to all the buildings in the network through pipes. The water is continuously circulated, bringing "waste," cooled water from the buildings back to the plant to be reheated.

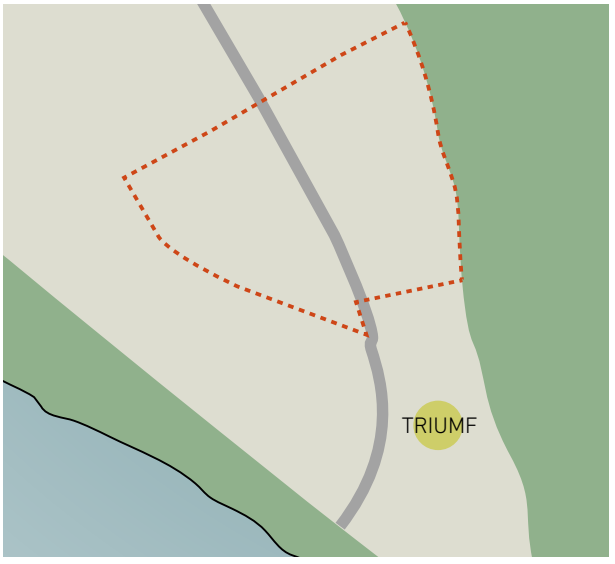


Figure 4.2 Location of TRIUMF in relation to Wesbrook Place

In the case of Wesbrook, the Canadian national particle and nuclear physics laboratory, TRIUMF, will be used as the energy source[2]. The facility is located only about 200 meters south of the neighbourhood, see Figure 4.2. To give a sense of how much heat it is able to contribute to this system, consider that TRIUMF accounts for 25% of the Point Grey Campus's total energy use[3]. With this much excess thermal energy, it is expected that the facility will be able to provide heating through the district energy network to Wesbrook Place, the stadium, East Campus, Acadia, and potentially Musqueam Block F, the last three of which are also residential communities. Additionally, as the system expands, other alternative fuel sources such as biofules, solar thermal, and other science labs of campus can be used to supplement TRIUMF, if necessary. In this way, the energy used to heat Wesbrook can be considered reliable, adaptable, and — all desirable and sustainable qualities for an energy source.

The implementation of the project is currently underway, and expected to be completed by 2024. The British Columbia-based company, CORIX, will design, construct, own and operate the district energy system, while UBC and the BC Utilities Commission will provide oversight. Though the infrastructure is currently in place to harness TRIUMF's excess heat, before buildout, it is not financially feasible to do so. In the meantime, two temporary natural gas centres have been built to supply the necessary energy. Once complete, it is anticipated to reduce GHG emissions by 60% over conventional methods.

—

As previously stated in the section overview, building-scale energy production has not served as the predominant strategy for reducing non-renewable energy use. While certain residences such as MBA House, have installed solar thermal heating, and others like The Wesbrook use geothermal technology, in comparison to strategies like district energy, these methods, overall, contribute little to mitigating the neighbourhood's energy demands.

ENERGY AND WATER USE AT THE BUILDING SCALE

Building energy and water conservation is a fundamental and conventional strategy for making the built environment more sustainable. Designing buildings to use less while still adhering to familiar patterns of use is a straightforward way to reduce inhabitants' environmental footprint in a non-intrusive way—this is especially true when aggregated across a neighbourhood-scale of development.

In order to shepherd this move toward using less, UBC developed its own green building evaluation system: Residential Environmental Assessment Program, or REAP[45]. Developed collaboratively by UBC Properties Trust, UBC Architecture professor Dr. Ray Cole and his students, Campus & Community Planning, and Campus Sustainability[6], the evaluation tool is designed to specifically address issues of sustainability as they relate to UBC's residential buildings on and around the Point Grey campus, including the entirety of Wesbrook Place. The program itself is structured similarly to the US Green Building Council's LEED program: REAP addresses various indoor and outdoor aspects of the built project through a point-based system in which certain actions, meeting certain standards, or the use of certain strategies or materials results in the accumulation of points, the total of which indicates the level of certification earned. For the purposes of this chapter, discussion involving REAP will be limited to how it addresses building energy and interior water use, despite the wide range in topics the program includes to direct sustainable design.

The following two sections are a closer look at how REAP specifically addresses energy and interior water use. Versions 2.1 (2009) and 3.0 (anticipated to be adopted before 2015) of the Program will serve as the focus of the examination, despite several buildings having been constructed under previous versions. In order to provide some context for the program's evaluation criteria, corresponding standards from LEED, the British Columbia Building Code (BCBC), and ASHRAE 90.1 2004; 2010, when appropriate. In addition, it should be noted that each of these systems may have had several versions published over the course of Wesbrook's development to date; however, because their role in this case is merely to contextualize the standards set by REAP, only the latest version is represented here.

ENERGY

> 6. Buildings will be designed to be as energy efficient as possible
>
> Wesbrook Place Neighbourhood Plan Section 3.2.1

Through REAP, energy use use is addressed by prescribing performance standards for specified building elements. In this respect REAP and LEED differ. Instead of prescribing specific standards for a limited number of building components, LEED awards credits from its energy section based on a modeled demonstration of a building's ability to operate a certain percentage (from 5 to 50%) below the designated ASHRAE baseline. ASHRAE does, however, specify standards for particular building elements, and these standards have been adopted by BCBC, and will provide the basis for this section's comparison. Both the 2004 and 2010 versions have been included for the purposes of this comparison. The former has been in use for the majority of Wesbrook's development (since 2004), and the latter applies to projects whose building permits were submitted December 20, 2013 or later, thus suggesting future performance for the remainder of residences yet to be built[7].

REAP addresses energy conservation through both active and passive strategies. Table 4.1 shows a breakdown between differences in mandatory and optional credit specifications for both versions of the performance rating program. While most of the mandatory specifications remain constant, there is almost no consistency between the optional credits. Here the difference can be primarily accounted for through REAP 3.0's new mandatory requirement, Energy efficiency targets. This requirement repositions

Table 4.1 Mandatory (grey) and optional (white) energy-related REAP credits

REAP 2.1	REAP 3.0
Roof insulation	Roof insulation
Exterior wall insulation	Exterior wall insulation
Floor Insulation	Floor Insulation
Energy Efficient Windows	Energy Efficient Windows
Furnance/Make-up air efficiency	
Boiler efficiency	Boiler efficiency
Energy Star dishwasher	Energy Star dishwasher
Energy Star refigerator	Energy Star refigerator
Energy Star clothes washer	
In-unit programable thermostat	In-unit programable thermostat
Non-incandescent lighting	Non-incandescent lighting
	District energy compatibility
	Energy use modeling targets by level of REAP certification

REAP 2.1	REAP 3.0
Better roof insulation	
Better wall insulation	
Energy Star Windows	
Better furnace/make-up air efficiency	
Better boiler efficiency	
CFL lighting	
Better floor insulation	
High-performance Energy Star windows	
Heat recovery system	
Geo-exchange Heating	
High boiler efficiency	
Modeled energy use 50% below baseline	
In-unit gas metering	
Solar access study, infrastructure installation, panel installation	Solar infrastructure installation, panel installation
	In-unit thermal energy metering
	Building envelope air-tightness

mandatory

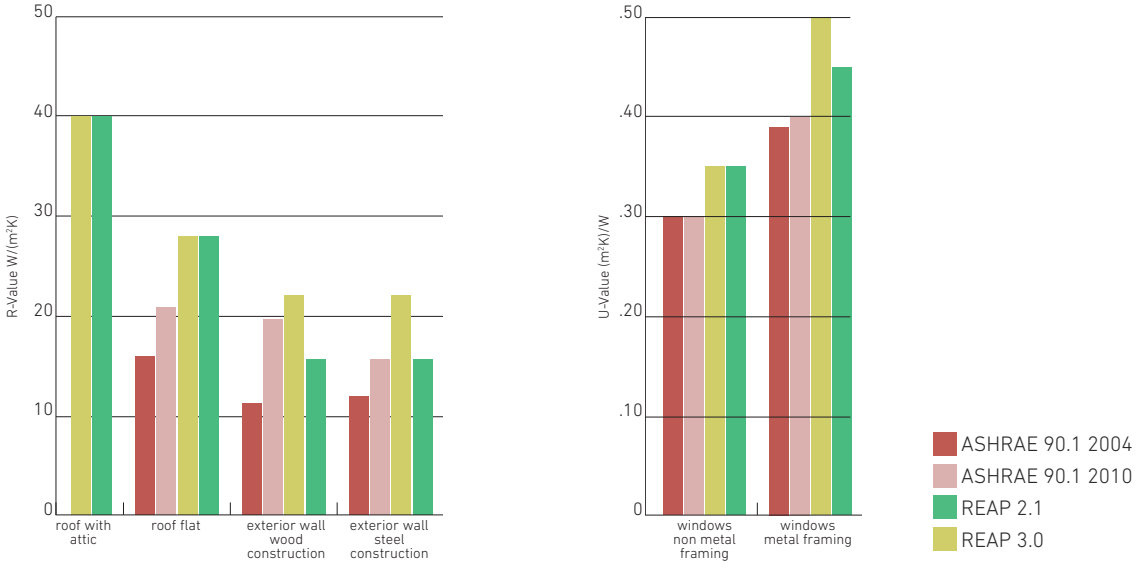


Figure 4.3 Minimum energy standards by evaluation system

REAP to be more similar to LEED, as described above.

Figure 4.3 illustrates the minimum standards for measurable mandatory specifications per REAP, as they pertain to the latest two versions of both ASHRAE and REAP. Though there are additional measurable specifications listed in the preceding table, only those that are also present in ASHRAE standards are depicted, for comparative purposes.

WATER

> 7. Minimize potable water use
> 8. Require the use of water efficient fixtures.
>
> Wesbrook Place Neighbourhood Plan Section 3.2.2

REAP addresses interior water use in a similar way to which it handles energy: a set of mandatory requirements establishes the minimum performance standard, while better performance is incentivised through awarded REAP credits. The following graphs depict the mandatory minimum specifications required by each of several standards systems (Figure 4.4). In the context of REAP, these standards have to be met, but additional measures to reduce interior water use are encouraged through the provision of additional certification credits. A comparison between mandatory and optional credits between the two versions is shown in Table 4.2.

From looking at actual interior water use data collected by UBC Utilities from a set of 10 buildings, a few patterns emerge (Figure 4.5 through Figure 4.7). The graphs depict the average amount of water used per residential unit per building in cubic meters. The graphs are unfortunately misleading in that the annual "quartiles" depicted at the bottom are based on when the utility records data instead of representing 4 equal segments of time. Because of this, it seems as though significantly more water is used during the summer period relative to the others. While it is true that more water is used, it is not quite to the extent that a brief glance conveys. Nevertheless,

lpf - liters per flush; lpm - liters per minute; lpc - liters per cycle

Figure 4.4 Minimum water use standards by evaluation system

Table 4.2 Mandatory (grey) and optional (white) indoor water related REAP credits

REAP 2.1	REAP 3.0
Low flush toilet	Low flush toilet
Faucet aerators	Faucet aerators
Low flow showerhead	Low flow showerhead
duel flush toilet	
Efficient dishwasher	Energy Star dishwasher
Efficient clothes washer	Energy Star clothes washer
Hot and cold water metering for units	Hot and cold water metering for units
	More efficient dishwasher
	More efficient clothes washer

mandatory

the buildings' water use in comparison to one another is honestly represented.

The focus of the first graph is the performance of each of the represented buildings. While there is some variation in performance throughout the year in each building, typically their performance is consistent on an annual scale. There are, of course, exceptions to this such as the usually poor performance by Ultima and Pathway in 2012 and The Wesbrook's relatively excellent performance in the same year. While the cause of these anomalies is unknown they seem to have been isolated incidences to the buildings themselves rather than a result of a condition affecting the whole neighbourhood.

Perhaps the most striking aspect of this data is the variation in consumption from building to building. In some cases it is easy to infer why this might be so. The MBA House, for example, is essentially configured like a traditional student dormitory, having small units (22 to 39 sq. meters) with only a kitchenette, no personal clothes washing facilities, and no balconies, which could otherwise house plants or require washing. In most other cases, the potential reasons for the difference are not so clear. The following two graphs are an investigation into why this might be so.

Figure 4.6 depicts the same graph as the previous figure but color codes the buildings by their level of REAP certification, instead of building name. While not entirely consistent, it appears that typically those buildings having achieved REAP gold or platinum tend to outperform the other residences; again, MBA House is an outliar.

The final graph in this section examines the same data recategorized by building type. In this instance no affect appears to be had by a building's construction on its water use. Given that they be unrelated, this is an expected outcome.

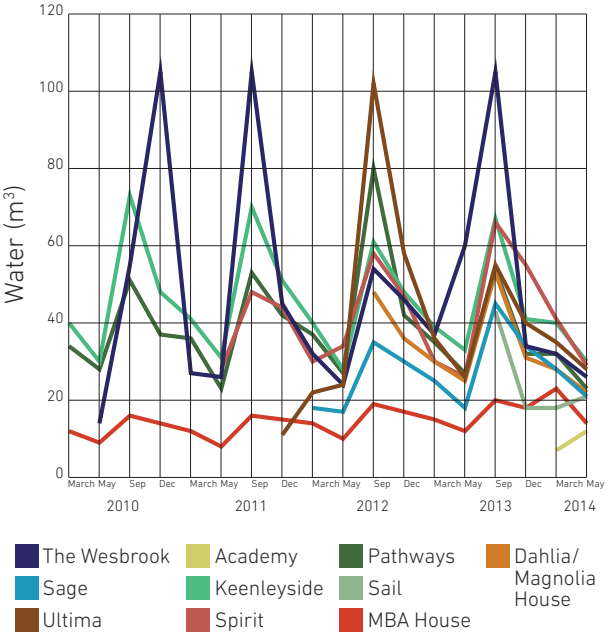


Figure 4.5 Water use by building: Name

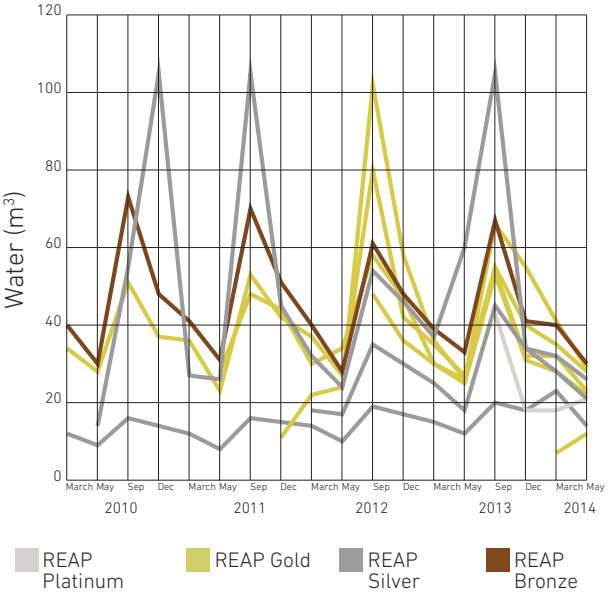


Figure 4.6 Water use by building: REAP certification

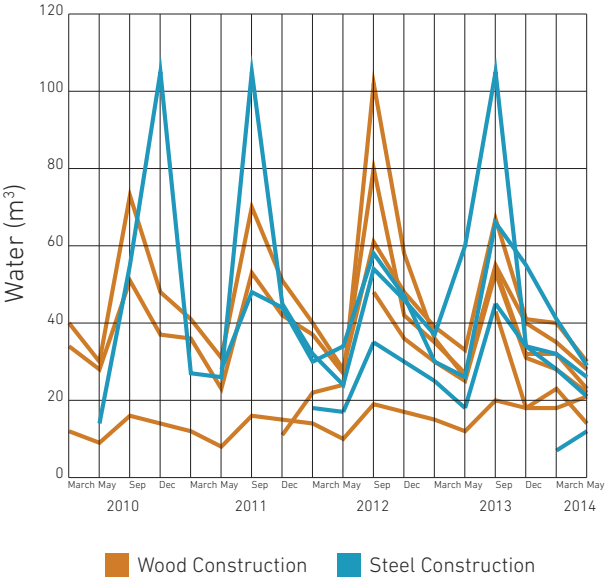


Figure 4.7 Water use by building: Construction type

REAP CERTIFICATION

> 9. Buildings must be designed to meet REAP Gold standards or higher
>
> Wesbrook Place Neighbourhood Plan Section 3.5.15

Despite REAP Gold serving as the minimum achievement standard, not all residencies meet this goal[8]. Currently, only 63% have obtained gold or platinum certification, while 32% earned silver, and 5%, representing one building, received bronze (see Figure 4.6 and Table 4.3 — REAP certification by building). At this point in time, there exist no repercussions for projects that fail to meet this minimum requirement, nor have strategies been planned to enforce this requirement in the future.[9]

CONCLUSION

The University of British Columbia adopted two primary, large-scale strategies to reduce energy and water consumption throughout its jurisdiction, including Wesbrook Place. The first, involving the creation of a district energy system, provides clean energy by recycling waste heat from the national particle and nuclear physics laboratory, TRIUMF. While not yet in operation, the system is expected to be resilient and flexible as the laboratory's heat energy can be practicably supplemented by any number of other renewable resources. In addition to significantly reducing the community's environmental footprint, this tactic has the added benefit of providing energy security, which is especially valuable in an uncertain climate future.

The second strategy utilized was the development of building performance standards tailored to residences on UBC's Point Grey campus in the form of REAP. Covering many topics related to building sustainability, the program seeks to reduce inhabitants' environmental impact in a non-intrusive way. Without sufficient data, it is difficult to understand the impact REAP has had on building energy and water performance.

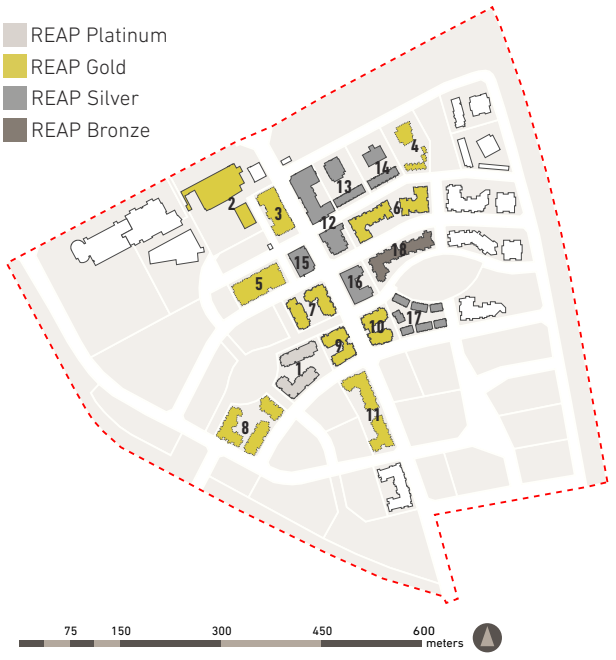


Figure 4.8 REAP certification to date by building

Table 4.3 REAP certification by building

Platinum	
1	Sail
Gold	
2	Granite Terrace
3	The Mews
4	Academy
5	Yu
6	Pathways
7	Pacific
8	Prodigy
9	Ultima
10	Spirit
11	Dahlia/Magnolia House
Silver	
12	Tapestry
13	The Wesbrook
14	Sage
15	MBA House
16	Larkspur House
17	Terrace West Townhones
Bronze	
18	Keenleyside

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HYDROLOGY & STORMWATER
A SUSTAINABLE DRAINAGE STRATEGY

Figure 5.1 Wesbrook Place rainwater collection signage.

OVERVIEW

Current knowledge and practice related to sustainable rainwater management prioritizes rainwater as a resource, planning for the full spectrum of rainfall events, monitoring performance and employing adaptive management[1]. Metro Vancouver's *Stormwater Source Control Design Guidelines 2012* additionally emphasize managing rainwater at the site level, with a focus on maximizing infiltration and implementing retention and detention as necessary[2]. The scale of "sites" may vary from individual parcels to developments the size of Wesbrook Place. "The general strategy for South Campus drainage is to retain rainfall from small, frequent events, detain rainfall from larger events, and convey runoff from extreme events." (Wesbrook Place Neighbourhood Plan 2011, page 38) This is accomplished with three somewhat independent drainage systems: two surface drainage systems which capture non-road runoff from the east and west sides of Wesbrook Mall and one conventional underground system, which carries road- related runoff and overflow.

Average Annual Precipitation 1,200 mm
July: 39.3 mm
November: 196.1 mm
Site Area 327,900 m^2
Projected Effective Imperviousness 60%
Collectible Rainfall 135 l/cap/day

Senbel, M. (2009). A systems analysis for UBC South Campus, Northeast Sub-Area Neighbourhood. Vancouver: University of British Columbia.

Soil:

- located on a mantle of wave washed lag gravel
- approx. 1-2 meters thick
- covered in gravely sandy soil loam soils with a thick layer of humo-ferrric podzol soil
- even topography
- no major landforms
- 80m above sea level

AECOM. (2013). Hydrogeologic Stormwater Management Strategy- Phase 1. Vancouver.

Aplin & Martin Consultants; Holland Barns Planning Group. (2005). A Sustainable Drainage Strategy for the South Campus Neighbourhood. Vancouver.

The UBC campus drains into four different water catchments, with South Campus constituting one of these drainage catchments. Wesbrook Place, located in the South Campus catchment area, primarily drains to sewers and ditches which outfall to Booming Ground Creek in Pacific Spirit Park. Naturally an ephemeral stream, Booming Ground Creek formerly had seasonal flows and was dry 4-6 months of the year. However, the rainwater runoff from South Campus, provides flows into the creek throughout the year, including the dry months, thus it is no longer ephemeral.[3] The 2005 Sustainable Drainage Strategy for the South Campus Neighbourhood noted that at that time Booming Ground Creek included sensitive habitat values in its lower reaches due to occasional sitings of salmonid fish species, and was experiencing some erosion problems. Thus one objective of the stormwater management for Wesbrook Place was to limit off-site runoff to rates equivalent to two-year rain events. [WPNP 2011]

The site receives an annual precipitation of 1226.5 mm/year, with a low of 39.3mm in July and a high of 196.1 mm in November[4]. The drastic change between dry and wet seasons created several challenges for the rainwater management on the site. The system needed to retain all small rain events on site, detain five-year sized events to a two-year size to help protect Booming Ground Creek and effectively convey larger rain events off site to protect the development. At the same time, the surface drainage system was designed to be a public amenity, thus needed to have water present year-round.

Another challenge is created by the geology of the Point Grey Peninsula. A low permeability till cap sits near the surface. It limits vertical infiltration. A relatively impermeable sand silt layer below that creates a perched aquifer at about 18 meters above sea level, and seepage from the perched aquifer is known to cause cliff erosion.[5] To limit erosion, the UBC Campus and Community Planning has identified an area along the edge of the cliff (red in Figure 5.3) where infiltration of rainwater is discouraged. Wesbrook Place, however, lies outside of this area, therefore infiltration of rain is highly supported in order to manage rainwater on site.

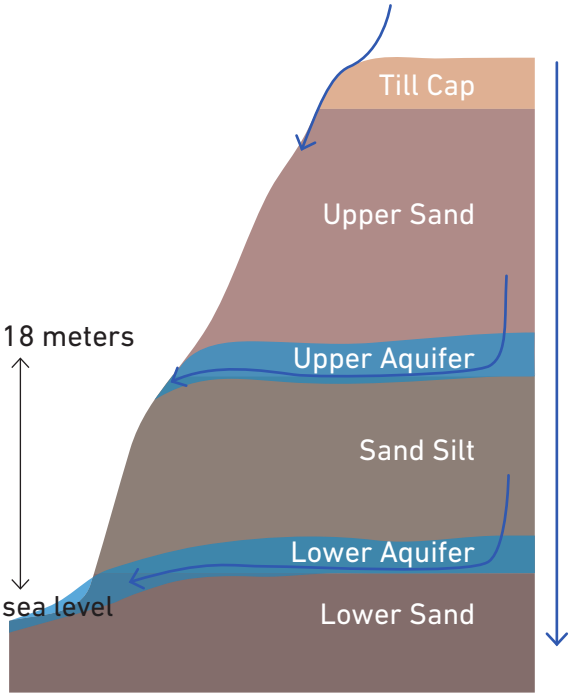

Figure 5.2 Geological composition of the area. Water seeps through the till cap and percolates through the Upper Sand unit until it reaches the Sand Silt unit, where it becomes trapped. This Upper aquifer runs southwestward toward the cliffs overlooking the Fraser River and Point Gray marine shoreline, resulting in a groundwater discharge from the cliff face at around 18m above sea level causing erosion of the cliff.

Figure 5.3 South Campus Catchment. Hatched area indicates where infiltration is prohibited in order to minimize cliff erosion.

Current policy at UBC is to detain 10 year storm events to a 2-year, 24-hour flow rate. This applies to all new development sites on the academic campus. In the case of Wesbrook Place, this requirement is lower, to detain flows up to 5-year storm events to the 2-year flow rate.

The campus uses the YVR storm intensity curve from Environment Canada for modeling (last updated in 2006) of storm events. Modeling for extreme rainfall events is based on the 100 year 24-hour storm event.

RAINWATER MANAGEMENT

Rainwater that falls on the site is collected in two ways: through a system of underground mains or pipes (Figure 5.4) and through an open channel rainwater management system (Figure 5.5).

The subsurface system collects rainwater from roadways, parking and some rooftops. The western half of this system connects to a detention basin under Nobel Park (See figure 5.4), which helps to reduce flow rates of rainwater discharging from the site. A second detention basin handles some of the runoff from the eastern half of the site. In the event of higher storm flows, approximately 20% of the flow is discharged to the Secondary South Campus Outfall and into an unnamed creek to the north of Booming Ground Creek.

The surface system is made up of a series of open channels, which collect rainwater from roofs and landscape areas adjacent to the channel and direct it into rainwater collection ponds. On the east side of Wesbrook Mall, water exits the large pond in Smith Park into a sand filter from which some aquifer recharge may occur. A fixed quantity of water in the pond system is filtered and recirculated to maintain water levels in the water channels. During dry months, the surface system is supplemented with irrigation runoff and well water.

West of Wesbrook Mall, a similar open channel system is used, however the design of the channels and ponds includes rocky edges and some in-water planting. These channels are lined, thus also impervious. Rainwater from the high school playing fields is designed to flow into this system at its headwaters. This system is also recirculated and water is maintained in the system throughout the summer. This system can overflow if necessary into the Nobel Park detention basin.

While the rainwater management system was designed to limit flows to Booming Ground Creek to 2-year, 24-hour rates, flow rates are not being monitored, therefore there is no way to know if the system is functioning as designed. Currently, the University maintains a digital model (constantly updated), which maps out the hydraulic system and simulates rainfall events. Based on these simulations the model estimates where, during large storm events, flooding will occur. These results are then used to guide future improvements.

There are 2-3 areas identified on South Campus where chronic or significant flooding occurs (see Figure 5.6) All three of these areas are off the Wesbrook Place site, but two of them are impacted by runoff from the site. These areas of flooding may be indicators that the stormwater infrastructure on site is not performing according to expectations. The Integrated Stormwater Management Plan, which is currently being developed for UBC, will take into account these shortcomings and will propose alterations such as an additional detention area (see Figure 5.12).

BEST MANAGEMENT PRACTICES

The use of stormwater Best Management Practices helps to achieve the larger goal of retaining all rainfall from small rain events on site. The 2005 Sustainable Drainage Strategy for the South Campus Neighbourhood identified a list of BMPs which could be utilized in the South Campus area, including: narrower roads, green streets, permeable pavements, roof downspout disconnection, tree planting, green roofs, infiltration trenches, infiltration basins, vegetated swales, absorbent landscaping, aquifer recharge, and water harvesting.

Most of the Best Management Practices outlined in the Sustainable Drainage Strategy for South Campus Neighbourhood are present on site. Of those recommended and listed above, only vegetated swales and green roofs have not been employed in the public realm. A vegetated swale was used at the high school. Extensive tree planting and the use of deep absorbent soil layers sitewide will significantly add to rainwater absorp-

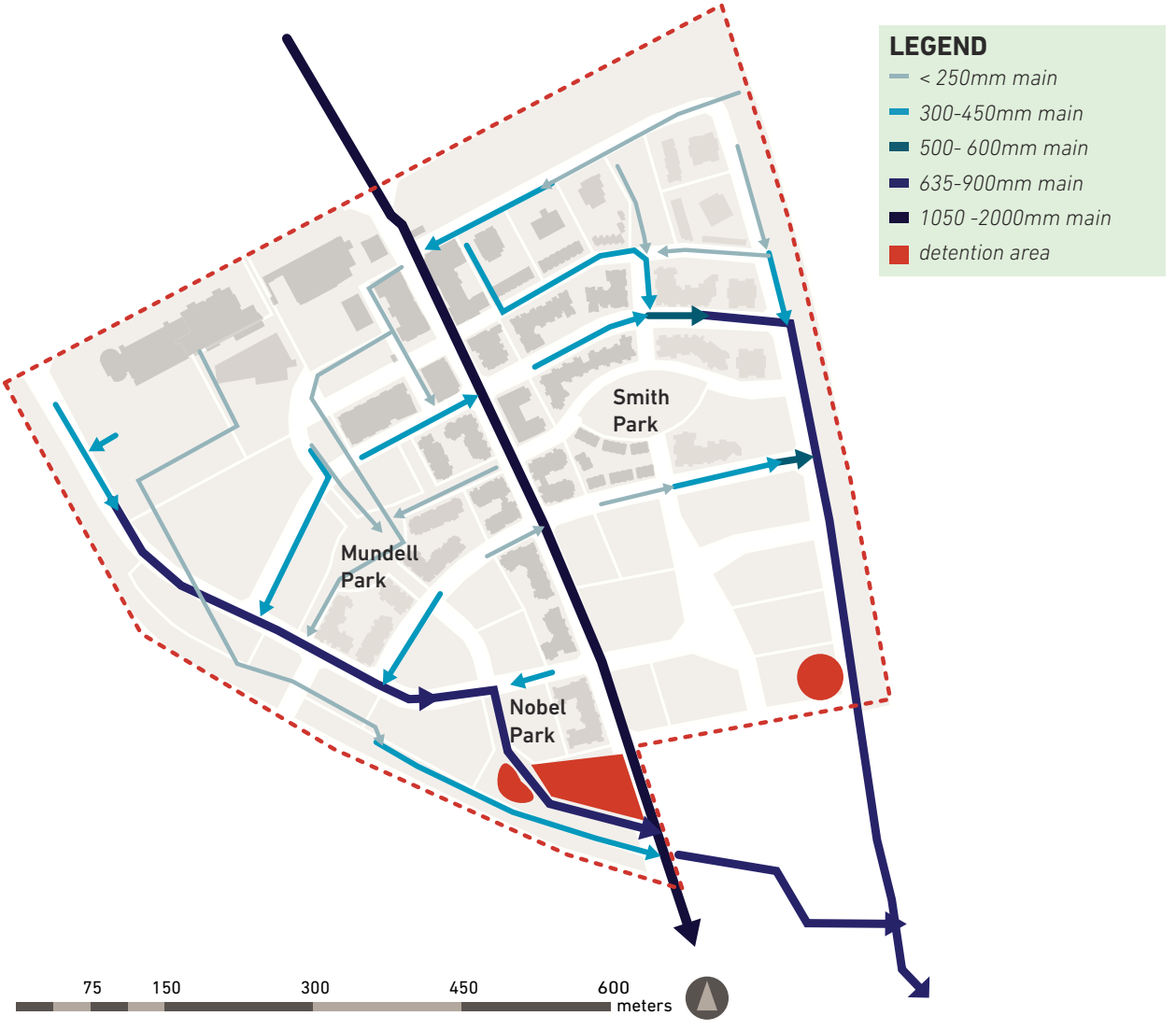

Figure 5.4 Sub-surface drainage system

tion and infiltration. (Figures 5.7- 5.11, illustrate some of these BMPs). However, there are several common BMP's that have not been implemented such as green roofs, rain gardens, water harvesting and on-parcel infiltration.

The most prominent stormwater BMP is the open channel system (Figure 5.5). This system picks up rainwater from nearby building roofs and landscaped areas and channels it into the rainwater collection pond in Smith Park. On its way it passes through a series of aeration stairs. On the east side of Wesbrook Mall, water exits the large pond in Smith Park to a below grade sand filter from which some aquifer recharge may occur. On the west side, a terminal pond is located adjacent Nobel Park. A fixed quantity of water in both pond systems is filtered and re-circulated to maintain water levels in the channels. Any overflow is directed into a detention pond. Unfortunately, other than aeration, the system does little to improve the quality of water, as compared to vegetated swales. Because it is an open channel some additional pollution is collected (i.e. fecal matter from

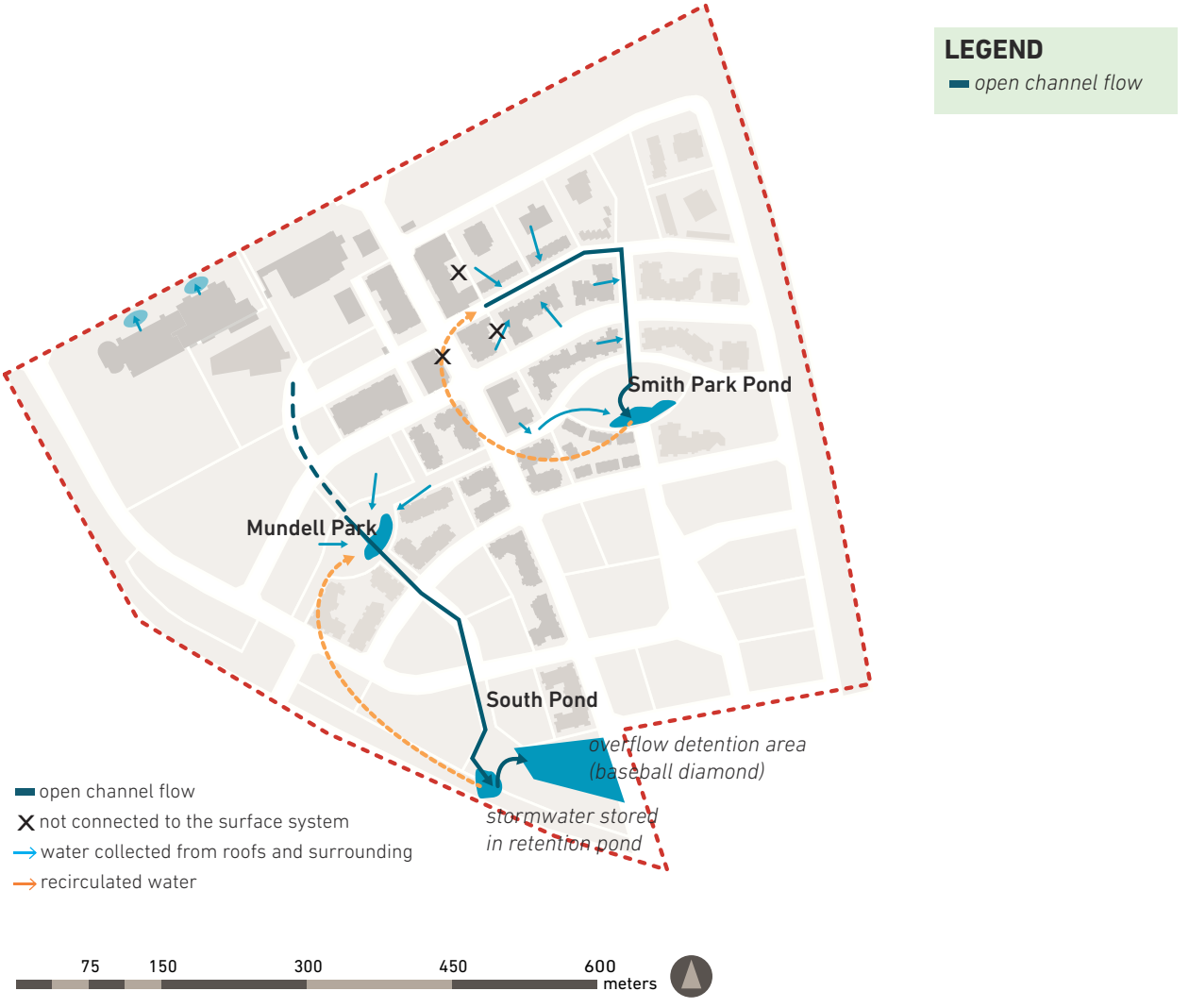

Figure 5.5 Surface drainage system

ducks). The entire system has a hard surface bottom, with very little vegetation to filter the water and no pervious surface to allow for infiltration along the way. To maintain water levels in the dry months, the system adds water and energy to drive a pumping system. The surface drainage system prioritized aesthetics over infiltration and filtration[6]. This promoted the image and quality of the development while concurrently supporting the goal of making rainwater visible on the site. However, by emphasizing aesthetics and a stable water supply year-long, this system does not accurately reflect local rainfall characteristics. Can the residents distinguish between conventional water features fed by potable water and this rainfall-fed system?

Prior to the Wesbrook Place development, the site was approximately 45% developed or landscaped and 55% covered in second growth forest[7]. The total impervious area anticipated once the site is completed will be about 90% of the site. The surface drainage system, and numerous BMPs employed on the site dramatically reduce the total impervious area of the development to a much smaller effective impervious area (EIA). It is beyond the scope of this project to estimate the resulting EIA. See Chapter 6 for information on projected canopy cover.

It is however, important to note, that not all BMP's can be physically seen and some are implemented before any development takes place. Others such as street sweeping are ongoing practices. Due to lack of information, this section only documented the physical BMPs employed in site design.

WATER QUALITY

Developments can have a significant impact on the surrounding water quality, and affect the health of ecosystems downstream. Significant increases in impervious surface areas increase both the volume and rates of runoff. As water passes through a developed site it picks up urban pollutants, which are carried downstream to creeks and rivers. Preserving base flows in Booming Ground Creek was one of the objectives of both the WPNP and of the Sustainable Drainage strategy. However, no explicit strategies were put in place to protect water quality in Booming Ground Creek and limit runoff-related urban pollutants from entering the creek.

The campus does have two programs in place to ensure that the harmful substances are not released into the stormwater system. The Environmental Health and Safety Office monitors all internal campus operations to ensure that waste from the operations is disposed of properly. This includes ensuring that liquid waste is not discharged to the stormwater system unless allowed to by the regulations.

The second program is the Campus and Community Planning Construction Sediment Control program. This program requires that developments on campus minimize the amount of sediments such as soils, sands, gravels deposited on the roads and into the sewers. This is typically done through wheel well washers (to reduce dirt dragged onto street) and installation of filters on storm drain catch basins. [9] Neither of these programs address pollution from urban runoff post development.

Despite numerous documents put out by the University, which highlight the importance of water

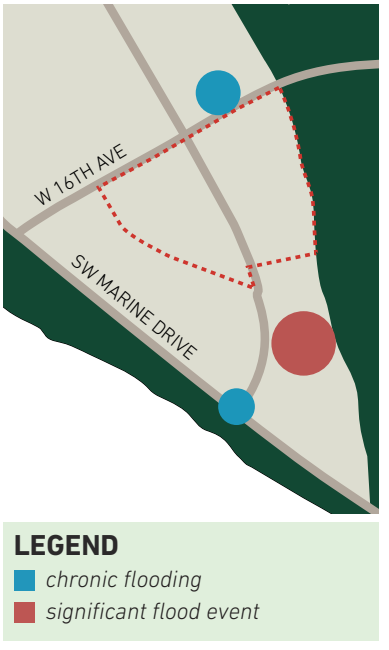

Figure 5.6 Chronic flooding areas

quality testing and the recommendation for water quality efforts to be reviewed every 5 years[11] (to ensure that UBC conforms to government standards), no water quality testing is currently carried out at Wesbrook Place or South Campus. There are however, promises that "a stormwater quality monitoring program will be developed as part of the implementation plan for UBC's ISMP. The program will involve the monitoring of flows for volume as well as for contaminants."[13]

WATER FEATURES ON THE SITE

> Retain rainfall from small, frequent rain events - detain rainfall from larger rain events, convey runoff from extreme events
>
> Aplin & Martin Consultants; Holland Barns Planning Group. (2005). A Sustainable Drainage Strategy for the South Campus Neighbourhood. Vancouver.

Water features are very prominent on the site not only in the surface drainage system discussed above but also on development parcels—in courtyards or at building entrances. This can be attributed partly to a goal in WPNP to create visible stormwater infrastructure. Unfortunately, these stand-alone water features in both the public and private realm are not connected to the rainwater system on site and play no water management functions (see Figure 5.13).

In fact, these stand-alone water features use potable water as the source and must be filtered and pumped. There are no systems in place to measure how much potable water is used by these features, nor how much energy they use. However, considering the number and extent of these features, they do raise questions relative to the WPNP goals to minimize potable water use (Also see Chapter Four, Building Energy and Water Use).

Figure 5.7 Grass swale

Figure 5.8 Open channels

Figure 5.9 On-street parking with permeable paving

Figure 5.10 Surface ponding

Figure 5.11 Detention storage tank

INTEGRATED STORMWATER MANAGEMENT PLAN

As a response to a lack of cohesiveness in storm water management on campus, the UBC Campus and Community Planning Office is in the process of developing an Integrated Storwater Management Plan (ISMP). The plan aims to help effectively and responsibly manage stormwater within the campus boundary by: reducing the rate of water flow through detention facilities, improving water quality using BMP's and eliminate expanding or adding new off-site outfalls.

Part of the ISMP is a 200 year flood detention facilities plan which takes into account all the future development that is expected on the site.

It proposes the addition of a large detention tank (capable of containing 25,000-30,000 m^3 of water which will limit the release rate of runoff to 1.2 m^3/ second) adjacent to Wesbrook Mall and Marine Dr. (see Figure 5.12).

Figure 5.12 Detention areas

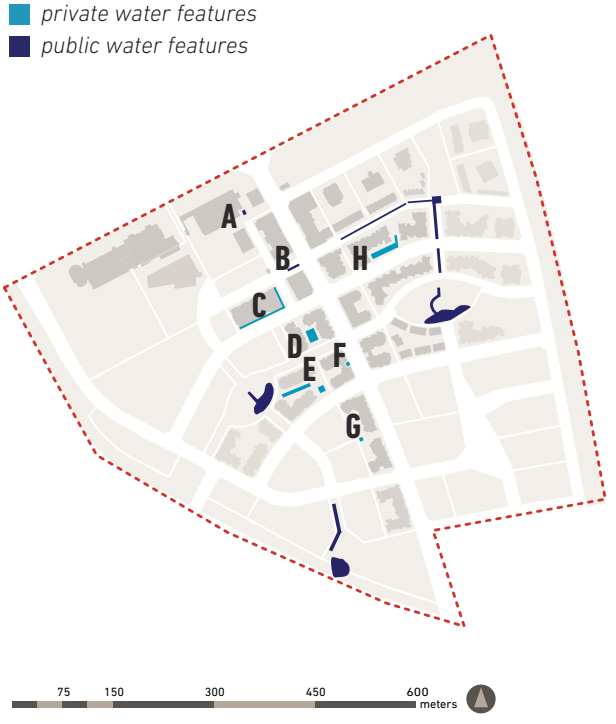

Figure 5.13 Water features (see photos next page)

Figure 5.14 Water features at Wesbrook Place

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FOREST & HABITAT
A VILLAGE IN THE WOODS

Figure 6.1 Wesbrook Place

ECOLOGY

Wesbrook Place, promoted and marketed as the "Village in the Woods", is located adjacent to Pacific Spirit Regional Park (PSRP). This regionally significant habitat refuge is managed by Metro Vancouver for both for habitat functions and passive human uses. The connection with the regional park is a key distinguishing feature of the development and also cause for concern in terms of the development's potential impact on the park and habitat values. The WPNP addressed the objectives of the PSRP Management Plan to "retain the Park's regionally significant features in as natural a state as possible for recreational enjoyment, and educational and scientific benefits"[1] by preserving buffers along the edges of the development and retaining some existing trees on site. Additionally, the plan included an objective to "use native trees and shrubs in landscaping, with an emphasis on providing good bird habitat" (WPNP Section 1.5, p. 5)

An environmental assessment was conducted prior to development (Pottinger Gaherty 2004) and recommended: establish tree retention areas; use native trees and shrubs in landscaping with emphasis on bird habitat; retain wildlife trees on site; provide habitat movement corridors between major habitat patches and PSRP. In order to bring these objectives into fruition, the planning documents for Wesbrook place outlined several ecological and environmental goals.

The following section evaluates the development in 2014 against WPNP goals.

RETAIN EXISTING TREES

Prior to development of Wesbrook Place, the site was partially developed in a mix of academic and operations uses, however the northeast quadrant was forested. Approximately 55% of the site was covered in second growth forest dominated by western red cedar, douglas fir, western hemlock, red alder and bigleaf maple. The concept for the plan included preserving a buffer of existing forest along the east, west and north-east boundaries of the site. Additionally, some stands of mature trees were to be retained within the parks and greenways in the development.

Figure 6.2 illustrates the tree canopy cover and impervious area pre-development and Figure 6.3 shows the site in 2013.

The UBC Campus Community Plan required a 25 meter buffer adjacent to Pacific Spirit Regional Park however, the development has exceeded this buffer requirement by providing a 30meter and in some cases 60 meter buffer between the park and development.

- The green edge of the development that interfaces with the Pacific Spirit Regional Park is comprised of a 15 meter native forest buffer and parallel to that, a 15 meter Usable University Open Space (UNOS).
- The land adjacent to 16th avenue Northeast of Westbrook mall includes a 60 meter buffer (with 30 meter of preserved native forest and 30 meters of UNOS) established in order to preserve the 80-90 year old coniferous trees.
- The edge adjacent to 16th Avenue between Wesbrook and East Mall is not continuous, in order to avoid too much separation of South Campus to main campus. This area includes numerous preserved mature trees.
- There is also a 30-70 meter buffer (varies) on the South west portion of the site (outside the side boundary), between the UBC farm and the development.

Figure 6.2 2003 Forest Cover

Figure 6.3 2013 Forest and tree cover

RETAINED TREES

In addition to the environmental assessment mentioned above, an arborist identified trees within the planned greenspace network with potential to be saved. In the eastern half of the site 13 mature conifers were preserved, predominantly in and around Smith Park (see Figure 6.4). In the western half of the site, 12 mature conifers were saved along 16th Avenue, adjacent to the High School.

Developers of each parcel must additionally compensate UBC for tree removal. They are required to conduct a tree inventory and provide financial

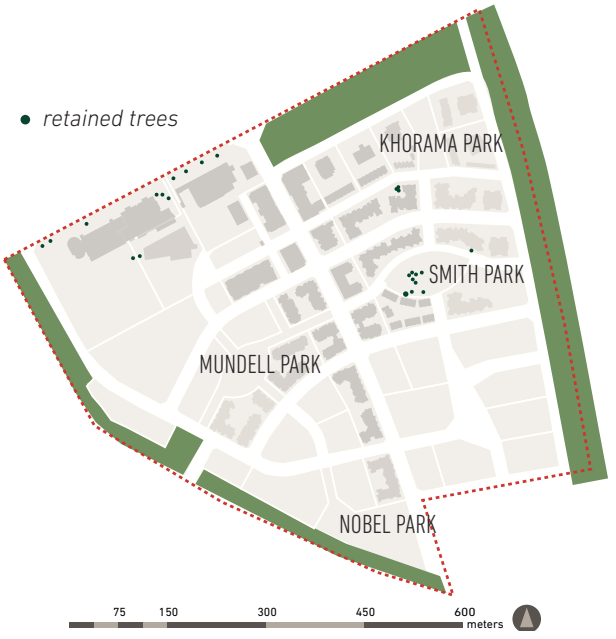

Figure 6.4 Retained trees

Figure 6.5 Various preserved trees on site

compensation to UBC to replace all trees over 15 cm. caliper dbh, which are removed for construction, at a rate of one-for-one on the UBC campus.

HABITAT

While the provision of green buffers is important, in order to establish actual habitat connectivity, these buffers and habitat patches need to provide effective habitat qualities. The metrics for evaluating habitat quality used in this report are: vertical stratification, habitat amenities, presence of water and tree species diversity.

Vertical stratification evaluates the habitat quality of an area based on the presence of ground-cover, shrub and canopy. Unfortunately, most of the areas on site have a low to moderate vertical stratification, see Figure 6.6 and 6.7.

While the preserved forest has a very high vertical stratification, the adjacent UNOS land registers low on the scale, with little or no shrubs and under-canopy vegetation. In some cases this is due to the young age of the planting and will change as the shrubs and vegetation grow, whereas in other cases, vertical stratification has been prevented with highly manicured grass landscaping.

Another way to evaluate habitat value is to look for the presence of snags and large woody debris (stumps and logs). These "amenities" were only present in the preserved native forest on the edges of Pacific Spirit Park. Landscaping throughout the public and private spaces in the development has a more manicured and "clean" quality and debris could not be found anywhere else on the site.

Conserving naturally wet areas is of extreme importance, since they provide habitat and drinking water for birds and invertebrates. Figure 5.5 in Hydrology maps the presence of water features on site. These possess little habitat value. The channels and ponds in the eastern half of the development are concrete edged with concrete bottoms, thus lack vegetative edges. Except ducks, which are present in the ponds, the pond design separates wildlife from the water and provides

no cover. The channels and ponds in the eastern half of the development have rock bottoms, and some in-water vegetation, but still have concrete as opposed to vegetated edges, with similar results.

BIRD HABITAT

The Plan specified "use of native trees and shrubs in landscaping with an emphasis on providing good bird habitat" (WPNP 2011, p. 5) as part of the mitigation for forest loss. Additionally, during public consultations, concerns about the protection of wildlife in the area were raised, including a concern over the presence of an eagle's nest on site. As part of the public process, the nest's location (Figure 6.8) was mapped and considered in the overall plan of the site.

During numerous site visits, several bird species were spotted (thanks to the water features on site). However, there are no studies into the number of birds. No nest boxes were installed though they were recommended in the Plan.

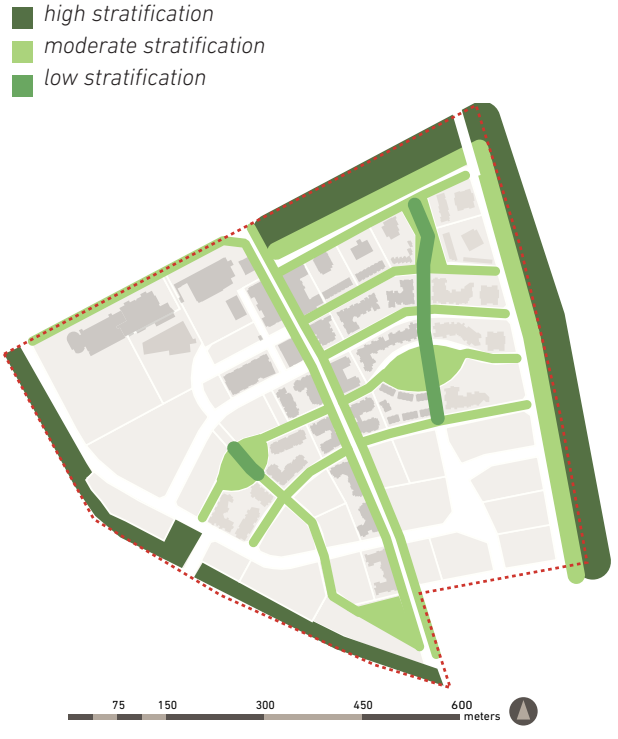

Figure 6.6 Vegetative stratification

Tree species diversity has a strong positive influence on bird population.[3] For the purpose of this study an inventory of all trees planted on site was derived from development permit drawings. According to the analysis, there are 34 different genus present on site. Figure 6.9 illustrates the distribution based on tree counts. There is a fairly even distribution of all species except for *Acer circinatum* which is the dominant species on the site. While the diversity is high, the eveness is skewed.

According to the Vancouver's *Bird-friendly Design Guidelines* the incorporation of a mix of coniferous and deciduous vegetation is important when designing bird friendly landscapes[4]. Analysis of the previously mentioned inventory shows that most trees planted on site were deciduous (79.1%) while fewer than a quarter of trees planted were coniferous (21.9%).

The use of native plants which have persistent fruits or plants is also beneficial to bird habitat. Trees such as Pacific crabapple, which holds its fruit into the winter[5], will therefore provide hospitable conditions for birds on site. There were thirteen *Malus fusca* (Pacific crabapple) planted on site.

The report also stresses the importance of the use of native trees to promote bird habitat.

NATIVE TREE SPECIES

The use of native species was of high priority in the Wesbrook Place Neighbourhood Plan and in the Environmental Assessment. Native plants are better suited for the climate conditions and require less irrigation and pesticides. They also provide habitat and food for native wildlife.

Out of the 1374 trees that were listed in the development permits (residential parcels), 560 or 41% were native, of those 62.7% were vine maples (Acer circinatum). The list of native trees used on the site additionally includes Acer macrophyllum, Amelanchier alnifolia, Cornus nuttalli, Pinus contorta, Pseudotsuga menziesii, Thuja plicata, Tsuga mertensiana. Of the native trees planted, 73.75% (413) are deciduous and 26.25% (147) are

HIGH STRATIFICATION: if they are large enough, patches with high vertical stratification can support populations of interior species

MODERATE STRATIFICATION: moderate habitat value

LOW STRATIFICATION: generally poor habitat for all but edge species

Figure 6.7 Vegetative stratification

coniferous. Excepting red alder, all major canopy species represented in the adjacent forest have been planted on this site.

Habitat connectivity is also of concern. The Environmental Assessment recommended habitat corridors to connect major patches. While several "green streets" cross the site East to West, they do not act as effective habitat corridor between PSRP and nearby habitat areas, such as the forested areas around the UBC farm. These green corridors do provide significant tree canopy, which will improve with age, however they are characterized by manicured landscapes with poor stratification below the tree canopy. (See Figure 6.7) Additionally several roads intersect these "green streets" (Binning Rd., Wesbrook Mall and Ross Dr.), thereby fragmenting these green strips and limiting small animal movement.

Figure 6.8 Eagle's nest

CANOPY COVER

Since development of the site began in 2005, almost 1400 trees have been planted on site (See Figure 6.13). Four hundred and twenty of those trees are planted in the public realm, along streets, green streets and in parks. The estimated canopy cover (when all trees on the current site mature) is roughly 17 hectares (160, 900m^2), while the area of the whole site is 44.5 hectares. It is estimated that 38% of the site will have tree cover when the trees mature. It is important to note however, that this number is based on the mature size of the trees planted on site, whereas many trees in an urban setting do not reach their mature size. This estimate includes developments proposed up to August 2014.

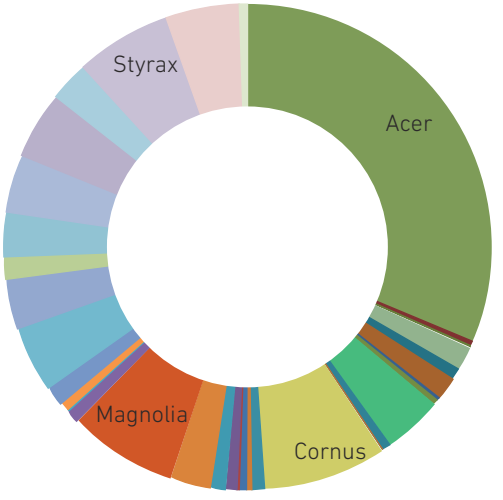

Figure 6.9 Range of trees (based on genus) on site (the largest pie slice represents maples; *Acer circinatum* was proposed in almost all development permits)

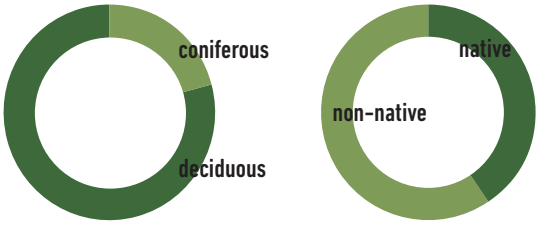

Figure 6.10 Tree canopy mix (287 coniferous, 1087 deciduous) and native vs non-native

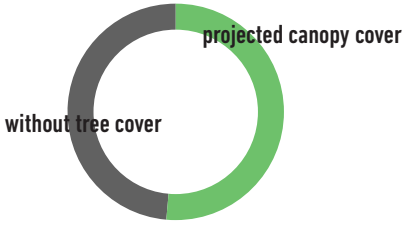

Figure 6.11 Percentage (%) canopy cover projected at tree maturity. This is based on an inventory of all the trees proposed in the pre-development plans that were approved by Properties Trust and the UBC Planning Office. The numbers are based on 60% of the mature size for the tree to account for canopy overlap when trees are planted close together.

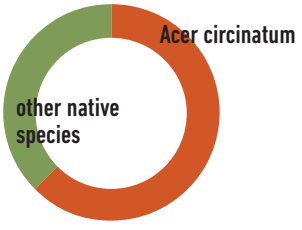

Figure 6.12 Distribution of native trees (351/560)

Figure 6.13 Forest buffers and trees planted in public realm

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2. Er, K. B. (2002). Effects of forest loss and fragmentation with urbanization on bird communities in Vancouver. Vancouver
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4. Ibid.

CONCLUSION

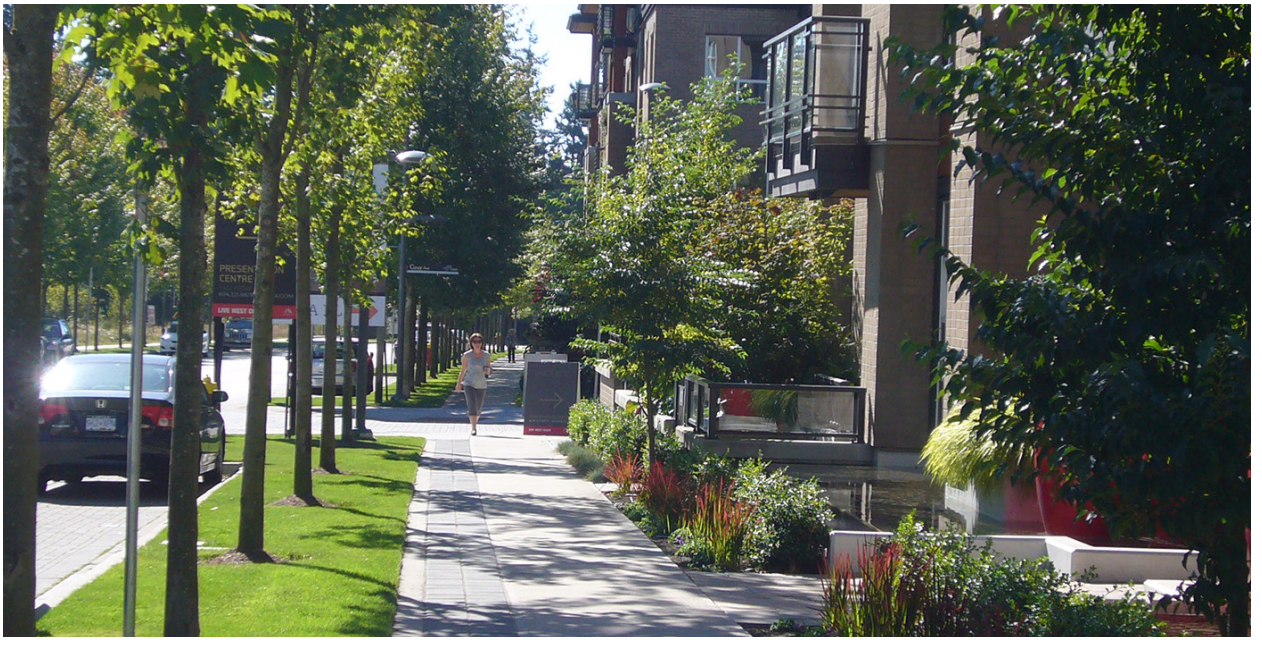

Figure 7.1 Sidewalk along Wesbrook Mall

Based upon the 2011 census, a balanced age demographic lives at UBC, although percentages of seniors are lower than the regional averages and children are slightly higher. The neighbourhood exhibits diversity with over 41% of the population speaking a non-official language at home. Wesbrook Place meets common targets for neighbourhood compactness. The neighbourhood provides a satisfactory range of frequently needed goods and services, but it is missing daycare until summer 2015, an elementary school, medical services and a post office. For the aspirational (actual numbers not known) 50% of households including a person affiliated with UBC, the campus is easily accessed by bicycle and transit, but it is not a walkable distance to campus. Over 14,000 potential jobs are close at hand. Housing is predominantly apartments in multi-family buildings (96%) with only 4% being single-family attached dwellings and no single family detached homes. The neighbourhood currently exceeds its target to supply rental housing, but is not yet meeting its targets for non-market rental housing designated for faculty and staff.

The neighbourhood is exceptionally well served with parks, open spaces natural areas (PSRP) and soon by a full service community centre. At present, high schoolers go to school in their neighbourhood whereas elementary age and pre-school children have to go the campus or further afield. Most dwellings are within a five-minute walk of the village centre, however not all are. With the completion of the last phase of development even fewer will be within a five-minute walk. Everyone is within a five-minute walk of public open spaces and 90% are within a five minute walk of the soon to be completed community centre. No resident surveys have been conducted so there is missing information such as: how many residents are affiliated with UBC; how people travel to work (modes); levels of satisfaction with housing choices and costs; levels of satisfaction with transit service; levels of satisfaction with personal, commercial and recreational and cultural services.

All buildings constructed at Wesbrook Place were supposed to adhere to the REAP Gold standard per the WPNP. Despite REAP Gold serving as the minimum achievement standard, not all residencies meet this goal. Currently, only 63% have obtained gold or platinum certification, while 32% earned silver, and 5%, representing one building, received bronze. Data to evaluate building energy performance was not available. In terms of water useage, those buildings having achieved REAP

gold or platinum tended to outperform the other residences in our sample. MBA House, a student residence, outperforms all other buildings evaluated by a significant measure.

The neighbourhood is very walkable, with a fine-grained, well-connected pedestrian network. The streets are well designed for pedestrians and a secondary "green" pedestrian network provides and off-street pathway system which interconnects parks, the school, the community centre and the village centre. All residents in 2014 were within a five-minute walk of green space, parks and playgrounds. Bicycles are permitted on the off-street paths, although they must share with pedestrians. As well, they have to share the roads with cars and buses. The neighbourhood is very well served by transit, with three bus routes passing through, and an additional five by the edge of neighbourhood. At peak times buses run as frequently as every four minutes and at off-peak times service is typically at least every 20 minutes.

The WPNP required buffer protection, recommended the preservation of existing trees wherever possible, recommended planting native trees and plants which provide bird habitat, and recommended providing habitat corridors for wildlife movement. The required buffers were successfully protected and remain intact, providing high quality habitat along the edges of the development. Of approximately 24 hectares of forest cover on the site pre-development, 8.5 hectares were retained in forest buffers and approximately 25 additional mature trees were protected.

A good diversity of tree species has been planted on the site and 41% of the newly planted trees are natives. Unfortunately of those native trees, almost 63% are vine maple. This is too high a percentage for a single trees species as it puts the urban forest of this development at risk of pests and disease. A small number of trees and shrubs planted on the site are attractive to birds for food. No invasive trees were planted, and for the most part all developments avoided trees that are discouraged in the UBC Vancouver Campus Plan of 2010.

The recommendation to create habitat corridors across the site to connect major habitat areas did not happen. The development creates a significant gap between the surrounding habitat areas. As the vegetation matures this gap will be partially filled at the tree canopy level, however the ground plane will remain a problem. More vertical stratification is definitely needed in the green streets to provide a habitat corridor for species moving east to west.

Wesbrook Place was designed to implement the stormwater management objectives and design guidelines proposed in the WPNP and the 2005 Sustainable Drainage Strategy for the South Campus Neighbourhood, particularly the goals to retain and detain rainfall from small and moderate rain events, to manage flow rates going into Booming Ground Creek and to make rainwater visible. Only one clear target was set, to maintain flow rates to Booming Ground Creek at a 2-year, 24-hour flow rate. No targets were set for water quality or for less tangible goals such educating residents. Because no monitoring is happening, it is impossible to know if the system is performing as designed. Monitoring of both quantity and quality of runoff would provide a far better understanding of actual performance and would enable future adaptive management.

To achieve the goals in the plan, a long list of best management practices were implemented. It was beyond the scope of this study to evaluate the net effect of implementing all of these BMPs on the total effective impervious area of the site. Such a study would be an invaluable contribution to understanding the performance of this rainwater management system.

The following "scorecard" compares Wesbrook Place performance against a range of common indicators of sustainable development.

We conclude this report with a listing of outstanding questions.

THE COMMUNITY

• Are the residents of this community satisfied with housing choices and costs, transit service, personal, commercial, recreational and cultural services?

• How many Wesbrook Place households include one or more people who work or study at UBC?

URBAN DESIGN

• With a limitation of 10,000 m2 of commercial floor area, is it possible for Wesbrook Place to provide as "excellent" range of services?

• What commercial and other services are clearly missing per the residents?

• What cultural and recreation activities are residents travelling off-site for and at what rates and distances?

• How does the cost of housing at Wesbrook Place compare to Vancouver's West side and to Vancouver overall?

• Is any housing at UBC "affordable" for low or middle income families?

BUILDINGS

• Are the buildings energy and water efficient? Are they performing at levels which exceed 50% below the 1997 National Model Energy Code of Canada?

• Do the residents use 30% to 50% less water than the average Canadian?

TRANSPORTATION

• What is the travel behavior of the Wesbrook Place residents? What is the mode split for travel to work?

• How do their total annual vehicle kilometers travelled compare to Vancouver and Metro averages?

HABITAT AND ECOSYSTEM HEALTH

• What impact has the insertion of this development onto the South Campus lands had on wildlife that inhabit the adjacent habitat areas?

• What wildlife species are found on site?

HYDROLOGY AND STORMWATER MANAGEMENT

• Is the stormwater management system performing as designed and meeting the target flow rates into Booming Ground Creek?

• Is the surface rainwater system performing as designed?

• What is the effective impervious area of Wesbrook Place and how does this compare to total impervious area?

• What impact has this development had on the hydrology, water quality, and in-water habitat in Booming Ground Creek?

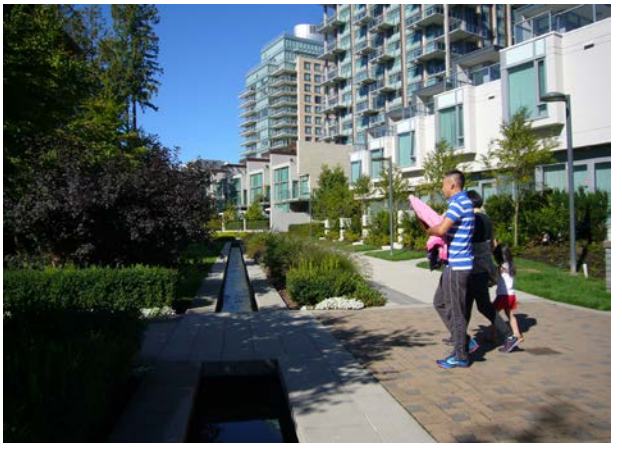

Figure 7.2 A green street

Table 7.1 Wesbrook Scorecard

+ (exceeds)
√ (meets)
- (below)
n/a (unknown)

INDICATOR	WESBROOK PLACE PLANS	REFERENCE METRICS	STATUS AT AUGUST 2014	
URBAN DESIGN				
a compact community	people/hectare not specified; average fsr 2.5, maximum fsr 3.5	minimum 50 p/h, target 150 people/hectare[1]	70 persons/hectare; average fsr 2.68, maximum fsr 3.5	-
employment opportunities	target not specified	1 job per household within 5km, 1:1 ratio[1]	8.9:1 jobs:housing ratio; unknown % work/ study at ubc	+,?
provision of local services	provide schools, community centre, and daycare	>70% of desirable ped. destinations is excellent[2]	57% of desirable ped. destinations (satisfactory)	-
schools and recreation	provide schools, community centre, and daycare	100% of dwellings within 400m of civic amenity[1]	high school exists; community centre & daycare under construction	√, -
parks and green spaces	1.2 ha/1000 population of all open space; .83 ha/1000 population of unos	minimum park size: .067 ha[2]	3.8 ha/1000 pop. for unos; park sizes from 1 to 2.53 ha	+
range of affordable housing	50% non- market for faculty, staff; 20% rental housing	varies by region/ no national target	10% below-market faculty & staff rentals; 22% rental units	-, +
housing diversity	target not specified	varies by region/no national target	96% apartments; 4% townhouses; 11% seniors	n/a
BUILDINGS: ENERGY AND WATER USE				
Building energy	all buildings to be built to REAP gold standard	modeled energy use 50% below baseline (1997 Model National Energy Code of Canada)[1]	63% of buildings meet REAP gold, platinum; 32% met REAP silver; 5% meet REAP bronze	-
Potable water	water efficient fixtures mandatory	reduce potable water use by 30% min. to 50% target (over Canadian average of 329 l/person/ day)[1]	data not available	?
TRANSPORTATION, CIRCULATION				
transportation choice	target not specified	type, frequency of transit not specified	bus transit on 4 to 20 minute intervals	√
transit access	target not specified	90% min. to 100% of people, jobs within 400m of transit stop	100% within 400m	√
pedestrian network	"walkable"	block length 137 to 183 meters[2]	pedestrian network: 40 to 219 meters; average block length 96 meters	+
bicycle network	"bicycle-friendly"	target not specified	no bicycle specific lanes or paths	-
walk to services	"walkable"	90% min. - 100% of dwellings within 400m of local services	100% within walking distance of village centre	-
walk to schools	"walkable"	90% min. - 100% of dwellings within 400m of civic	69% of dwellings within 400m of high school; 0% within 400 m of elementary school	
walk to parks, playgrounds	"walkable" & playgrounds within 400 m of residences	park or green space within 3 minute walk (250 metres) of every dwelling[2]	100% of dwellings within 250 metres of green space; 100% within 400 meters of parks and playgrounds	√
HABITAT AND ECOSYSTEM HEALTH				
Preserve habitat	25 metre buffer adjacent PSRP	100% of existing significant habitat preserved[1]	30 - 60 m buffer preserved; 19% of forest preserved on-site	-
Restore habitat	site-wide target not specified	20% of habitat preserved, restored or enhanced[1]	25 mature confer trees preserved; no habitat area created	-
Use native vegetation	Plant native trees in the public realm	no reference metric	41%native trees planted on residential lands	n/a
HYDROLOGY AND STORMWATER MANAGEMENT				
no net change in hydrology	maintain peak flow rates at 2-year level	100% of existing watershed hydrology protected[1]	data not available	?
area of effective impervious surfaces (EIA)	use bmps to reduce eia below TIA	less that 10% EIA[1]	38% potential canopy cover	?
tree canopy intensity	target not specified	20% min. - 40% target of total area[1]	38% potential canopy cover	√
no net change in water quality	no degradation of water quality	no net change in water quality[1]	data not available	?

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