1780 Broadway | Mixed Use Development

Rezoning Application

April 2019

SUSTAINABLE DESIGN STRATEGY

addressing City of Vancouver's
Rezoning Policy for Sustainable Large Developments
& Green Buildings Policy for Rezonings

Completed by

INTEGRAL GROUP
DEEP GREEN ENGINEERING

Completed for

Westbank

Crombie REIT

Perkins + Will

Integral Group | Suite 180 - 200 Granville Street, Vancouver, BC V6C 1S4
+1.604.687.1800 | Integralgroup.com

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A. PROJECT OVERVIEW

As a project dedicated to the ideas of transit-oriented design and intelligent sustainability, the 1780 Broadway project represents a well-rounded response to both the surrounding neighborhood and the current definitions of sustainability with the City of Vancouver. The site benefits from a strong and diverse neighborhood with good connections to a variety of amenity greenspaces. From the perspective of the every-day commuter, the project offers unapparelled connectivity to both the existing Millennium and Expo SkyTrain lines allow for easily commutes to downtown Vancouver, Burnaby, New Westminster, and Surrey with further connectivity to the Canada line and UBC space with through the 99 Bus line. The project will further supplement the resident's access to the surrounding City by means of the East 10th Street bicycle network.

As an architectural response to the surrounding area, the project acknowledges the community's needs for more public plaza space both at the ground level and on the top of the podium for residents. The proposed programming for both these spaces responds to the needs of each user group with community focused seating and meeting spaces on the ground level plaza space and family focused play spaces and community building opportunities in the amenity spaces shared between he residential towers. Landscaping is proposed through the site to soften the project and aid in the programming of each space with community gardens and green house space combining with accessible edible planting to connect residents around the ideas of food resiliency and ecology.

From an energy perspective, the design team is committed to a resilient building envelope and form which will help lessen the project's total energy demand passively by responding to the surrounding area and site conditions. To maintain the building's energy efficiency, the mechanical systems proposed for the project will comprise of a variety of technologies selected to maximize efficiency through the year as the demand for heating and cooling energies change.

From a compliance perspective, this project is required to satisfy both the requirements of the Sustainable Larger Developments Policy (applicable September 1, 2018) and the Zero-Emissions Green Building Policy for Rezonings (applicable May 1, 2017). The project response to the applicable Sustainable Larger Developments Policy requirements are outlined below. The project's response to the Zero-Emission Green Building Policy for Rezonings is outlined under **Section J- ZERO- EMISSION GREEN BUILDING REZONING POLICY REPORT.**

B. SUSTAINABLE SITE DESIGN

B.1 Policy Intent

The site design should provide a level of sustainability in line with the City's Greenest City 2020 Action Plan targets of improving access to nature and planting trees. This section contributes to two Greenest City targets – to ensure that every person lives within a five-minute walk to a natural space by 2020, and to plant 150,000 additional trees between 2010 and 2020 to achieve the current Urban Forestry Strategy goal of increasing the city-wide canopy cover to 22% by 2050. The intent of improving access to nature in the city is to improve the health and wellbeing of the community, to provide habitat, to enhance ecosystem function and services, to create public open spaces for people to gather and socialize, and to create opportunities for people to directly experience nature in the city. Additionally, the site design must also contribute to the Urban Forest Strategy, Biodiversity Strategy and Rain City Strategy objectives.

Under the September 1st, 2018 revision of the Sustainable Larger Developments Policy, sites of different typology (A, B, C) has been given prescriptive requirements for tree coverage and vegetation. Type A requires 20-25%, type B require 15-20%, and Type C requires 10-15%. All sites require a vegetative cover of 30% of total site and 40% for private property parcel. Finally, continuous soils at grade is required for 10% of the private property parcel. These guides are provided to ensure developments contribute to the Greenest City targets.

B.2 Strategy

1. Existing Conditions

Currently, the site has very little vegetation and has a very low occupant density for the site area. Most of the site is asphalt and concrete and with some vegetation around the boundary of the site. The site does not currently offer much to the neighbourhood related to the current policy requirements. Below is a figure showing the top down view of the current site with the approximate site boundary. The existing site is currently dominated by a large format retail store, two smaller retail outlets, and a parking lot. A small number of young street trees are currently located along Commercial Drive, with larger trees along East 10th Ave. and smaller trees along the edges of the existing parking lot.

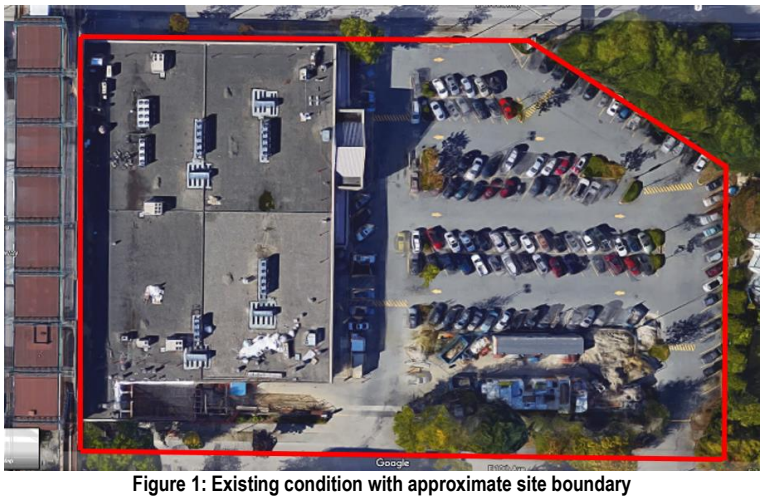

Figure 1: Existing condition with approximate site boundary

Fortunately, the project site is well-situated to local green spaces and parks. The project is located within a five-minute walk to WC Shelley Park to the northwest, a ten-minute walk to McSpadden Park to the north, Clark Park to the South, and a 10-minute walk to John Hendry Park. Building occupants will benefit from the adjacency to these existing green space amenities, which will be supplemented by the proposed addition of high-quality outdoor amenity space for the use of building occupants.

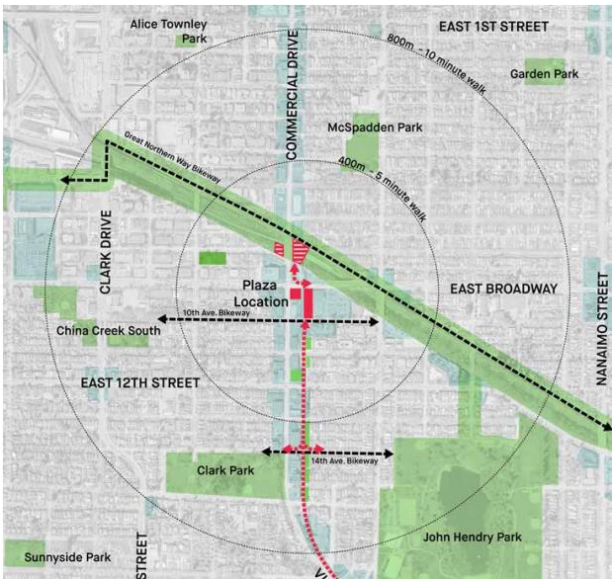

Figure 2: Local parks proximity

2. Proposed Conditions

Based on the proposed makeup of the project, the team agrees the proposed project is likely most in line with the Site Type C as defined in the Sustainable Large Developments Rezoning Policy. As a result of this the project has an obligation to provide 10-15% of the site area in Tree Canopy Coverage as well as 30% total Vegetative Cover for the site. Based on the proposed site area of 9,819 sq.m the prescriptive requirements of the policy require 981 sq.m - 1,472 sq.m of tree canopy and 2,945 sq.m. of vegetated cover. As discussed below, the project has far exceeded these requirements in its proposed design.

In addition to the sheer volume of green space, the heart of the landscape strategy is an intent to maximize both occupant and community usability of the site. Given the site's close proximity to both a major transit hub and the established pedestrian activity along Commercial drive, the design team set out to improve the sites pedestrian permeability and community interface specifically through the use of a public plaza. What the space allows for is the creation of a new space in the area which connects the exiting public spaces in the area to create a more integrated public open space network in line with the Access to Nature Plan issued by the City of Vancouver. At the podium level of the building, additional contiguous vegetation and open space has been proposed for the occupants further improving the resident's immediate access to green space. The project is located on a previously developed infill site, avoiding sensitive habitats and taking advantage of existing infrastructure and surrounding amenities.

Figure 3: Proposed condition; overview of appendix B

As currently proposed, the project will seek to replace and increase the overall number of trees for the site. As part of the established Arborists report for the site, there are 20 existing trees on the site (excluding those in the cut). What the survey

found was that none of these trees would have warranted retention and as such can be replaced as part of the projects proposed tree planting strategy. For additional information on the project's existing tree makeup see **Appendix A**-**Arborist Report**.

In addition to its proximity to nearby green space amenities, the development will provide occupants and visitors with increased access to nature via the inclusion of open-air amenities and added green space on several levels of the building. The development will add new native tree species to help increase the city's overall forest cover and provide natural habitat for local flora and fauna, as well as shaded summer spaces for occupants and residents. The project is currently proposing 1,574 sq.m of tree canopy area at the street level and an additional 2,456 sq.m of tree canopy area throughout the buildings open spaces. These two areas combine for a total of 4,030 sq.m. of total tree canopy (37% of the total site area) far exceeding the policy requirements for the project.

Shading from trees also provide a means of solar shading and a reduction of the heat island effect on lower levels of the building. To align with the project's strategy for Sustainable Food Systems, fruit-bearing tree species will be integrated into the landscaping plan to help enhance the edible landscape food asset. Indigenous species will likely be favoured to provide local habitat. For further detail please refer to **Appendix B-Landscape and Urban Agriculture Plan** and **Appendix C-Landscape Calculations.**

Significantly vegetated areas will be included on most accessible areas on the main podium outdoor areas, open balconies and roof areas throughout each tower. In total, the development will provide ~4,800 sq.m of open balcony space, ~7,700 sq.m of accessible roof area, and ~1900 sq.m of publicly accessible thoroughfare. For further detail on the public plaza, please refer to **Appendix D- Public Plaza Plan**.

Along the edge of the site, large deciduous street trees will be planted, in keeping with the existing context and spaced according to City of Vancouver design guidelines. Overall, site plantings will provide building occupants and visitors with a more enjoyable site experience, natural shading from the sun, and a connection with nature. Floral components will also be added wherever possible to attract and support pollinator and bird species.

The landscape and architectural design of the building will consider the practices outlined in the Bird Friendly Design Guidelines including the following:

- Green the urban landscape by planting native trees and shrubs for birds
- Incorporate a mix of habitat types including: deciduous/mixed forest and shrubland,
- Increase vertical vegetation structure by planting and maintaining native trees and shrubs
- Select a diversity of native and non-invasive plants. (f) Control invasive plants without disturbing birds
- Reduce light pollution
- Incorporate snags and downed wood
- Provide water for birds to drink and bathe

Landscaping will utilize a selection of vegetation to be native and adaptive, supporting less intensive landscape maintenance. The development's green space will be designed to reduce the heat island effect, minimize erosion and aide in surface water management. Further description of the green space importance will be included in the ground and rainwater management section.

C. SUSTAINABLE FOOD SYSTEMS

C.1 Policy Intent

The City will require applicants to demonstrate the overall increase of food system assets. Food assets are defined as resources, facilities, services or spaces that are available to residents of the city (either at the citywide or neighbourhood scale) and which are used to support the city's food system. This will contribute to the Greenest City target of supporting Local Food: to increase city and neighbourhood food assets by a minimum of 50% over 2010 levels by 2020. The intent of creating a sustainable food system is to improve the resilience of Vancouver's food system in accordance with the vision, principles and goals defined in the Vancouver Food Strategy (2013).

C.2 Strategy

The Commercial & Broadway redevelopment are exploring four primary sustainable food strategies throughout the development to satisfy the need for sustainable food systems.

1. Community Gardens

On Level 2 and Roof Levels of Tower B and C, opportunities for urban agriculture are currently proposed. Gardening spaces within a greenhouse (Level 2) and outdoor planters (Roof Level) will be provided to occupants. These locations should support ~1.6 sq.m of gardening space for 30% of residential units of each building. Garden plots will be designed and constructed to satisfy the accessibility and growing conditions outlined in the Rezoning Policy for Sustainable Large Developments including localized organics composting, tool storage spaces, hose bibs, and work benches for gardeners to use. For further detail please refer to **Appendix B-Landscape and Urban Agriculture Plan**.

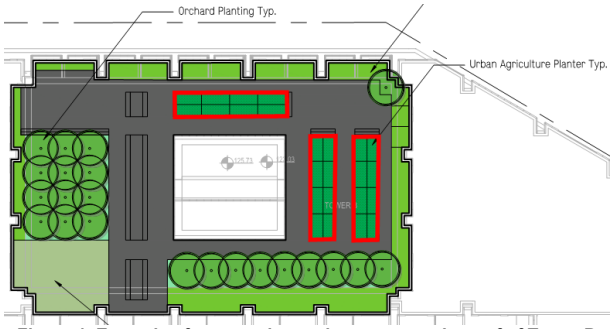

Figure 4: Example of community graden space on the roof of Tower B

2. Edible Landscaping

A second strategy to address the need to provide local food to city residents is the introduction of edible landscaping through orchards. The proposed edible landscape will blend in with the currently proposed tree vegetation. The edible landscape will provide occupants with a source of on-site grown food. The total edible landscape area, denoted as orchard planting, will be ~442 sq.m and be located on Level 2 and all Roof Levels. In the figure below shows an example of the edible landscape region located on the Roof of Tower C. Signage and other education programs will be developed to help inform residents of the available amenity. The requirements for the edible landscape set out in the Sustainable Large Developments policy will be met. For further detail please refer to **Appendix B-Landscape and Urban Agriculture Plan**.

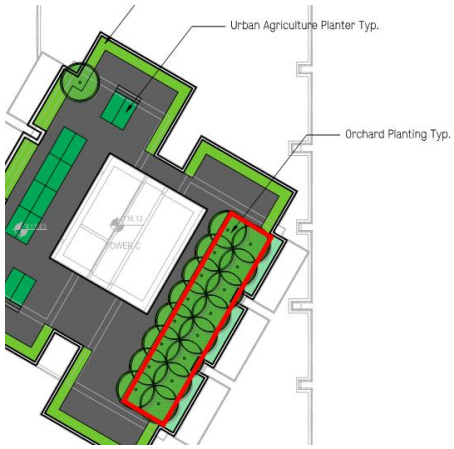

Figure 5: Example of an Edible Landscape (Orchard) on the roof of Tower C

3. Community Kitchen

The third sustainable food strategy 1780 East Broadway will include is a space for a non-commercial community kitchen. Approximately 162 sq.m of space has been identified on the Level 2 amenity area and will be laid out to celebrate food, cooking and hosting of dining events. This will allow the residents to accommodate larger groups of people in the preparation of home cooked and locally sourced meals. Kitchen design will satisfy the requirements of the Sustainable Large Developments Policy including the following:

i) Sufficient space to accommodate a minimum of 12 people in a teaching environment.
ii) Appropriate equipment (cold / freezer storage; dry storage; dishwasher and sink configuration, stove/oven and ventilation, sink configuration) for the intended use.
iii) Adjacent multi-purpose space or room for eating and congregating.
iv) Incorporation of enhanced accessibility features to accommodate wheelchairs, mobility devices and teaching and demonstration screens/aids.
v) Co-locating near complementary amenities such as picnic benches, BBQ areas, and / or community gardens.

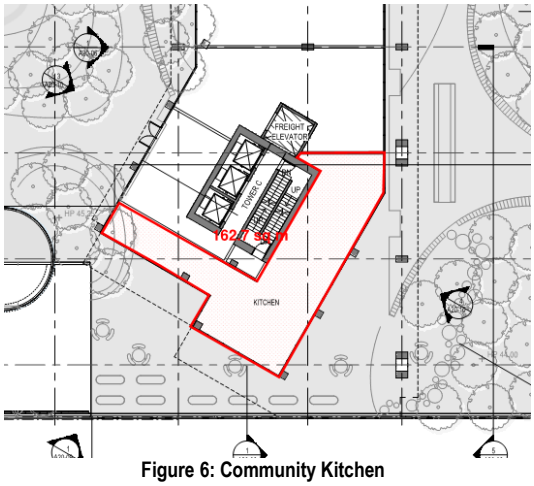

Figure 6: Community Kitchen

4. On-Site Organics Management

The fourth sustainable food strategy implemented by the redevelopment of this site is the inclusion of 'on-site organics management', as part of the larger Zero Waste planning strategy. The project is proposing the inclusion of an in-vessel bio-digester on site to help manage on-site organic waste. The on-site in-vessel system will be accessible to all building occupants as intended by the policy guidelines for on-site organics management. The systems are clean, emit low odour, and help to reduce truck trips to transport heavy saturated food waste. These systems are also capable of producing nutrient-rich water that can be used in irrigation, helping to lower total site water use. The location of the bio-digester in a more visible common area would not only reduce the amount of organic waste from building occupants but would provide an opportunity for residents and visitors to learn about sustainable waste management solutions. Furthermore, with the mixed-use nature and size of the building, multiple organic management locations may be needed to meet the demand of the building occupants.

Additional composting spaces will be provided in proximity to the gardening spaces to manage clippings and gardening activities.

Figure 7: Sample Organics Digestion Equipment

D. GREEN MOBILITY

D.1 Policy Intent

The City requires a Green Mobility Plan outlining measures and strategies to prioritize more sustainable travel to and from the site. This will include the prioritization of walking, cycling, and public transit over automobile use, and support for low-carbon vehicles, such as electric vehicles. These strategies contribute to the Transportation 2040 and Greenest City targets of 1) increasing walking, cycling and public transit to form a minimum of 50% of all trips by 2020 and 66% of all trips by 2040; and 2) reducing motor-vehicle kilometres traveled per resident by 20% from 2007 levels. It will also contribute to the Greenest City target on Climate Leadership to reduce community-based greenhouse gas emissions by 33% from 2007 levels. The intent of encouraging sustainable transportation is:

- To reduce reliance on travel that consumes excessive energy and contributes to GHG emissions and poor air quality;
- To support a thriving economy, to improve the health of residence and the vibrancy of the city, and to enhance the natural environment; and
- To meet mobility needs while minimizing environmental impacts and providing long-term health benefits.

The policy requires a transportation demand management plan meeting the transportation demand bulletin for new developments in Vancouver. Additionally, if applicable, charging outlets must be provided for 10% of commercial structure parking.

D.2 Strategy

Within steps of the Commercial & Broadway site are the Commercial Skytrain Station and Bus Routes 99, 9, and 20, which will encourage visitors and building occupants to make use of alternative transportation opportunities, reducing dependence on single occupancy vehicles. Combined with secured storage for bicycles and electric vehicle charging, including level 3 DC fast chargers, the proposed development affords a distinct advantage for carless commuters.

The project also recognizes and plans to celebrate cyclists using the 10th Avenue dedicated cycling lane. This will include a variety of cyclist-oriented amenities to help establish and improve the sites use as a transit hub accessed by commuters and cyclists alike.

1. Vehicle Provisions – Electric Vehicle Charging

To comply with the electric vehicle requirements from the City of Vancouver, this development proposes to supply 10% of the proposed commercial parking and 100% of the proposed residential parking with electric vehicle charging infrastructure. In this instance this will include providing Class 2 EV charging for the proposed parking spaces. In the context of the 368 residential spaces and 249 commercial spaces, this is equal to 25 spaces for commercial and 368 for residential spaces with level 2 EV charging infrastructure.

In addition to the requirements and to support electric vehicle driving visitors to the site, the design team is reviewing the inclusion of one or two level 3 electric vehicle chargers. These “fast chargers” are capable of completely charging the average electric vehicle in less than 15 minutes. These fast chargers can service more vehicles due to its accelerated charging time, thereby providing not only greater range to potential users, but also the capacity to service more users in aggregate. The development is exploring the ideal location of these chargers and is considering their inclusion into retail parking spaces where the greatest access to visitors can be provided.

2. Access to Transportation

The Commercial & Broadway Street site is in close proximity to both transit and cycle route networks, making it easily accessible from many locations around the city. The site is located along the Broadway Corridor at Commercial Drive and at the nexus of the Expo and Millennium Skytrain Lines. This location provides optimal connectivity for bicycle transportation options, as it is located on the east-west 10th Avenue bike route and near the north-south Woodland Drive and Lakewood Drive routes.

Overall, the development will achieve the following scores on Walkscore:

- Pedestrian Access: 94/100 – ‘Daily errands do not require a car’

- Transit Access: 94/100 – 'World-class public transportation'
- Bicycle Access: 100/100 – 'Flat as a pancake, excellent bike lanes'

3. Transportation Demand Management Strategy

Following a study of the site and the development of a formal Transportation Demand Management Strategy, the design team will be capable of detailing the exact Transportation Demand Management Strategies proposed for the project. In the initial conversations with the design team, the following measures have been identified as opportunities for reducing Single Occupancy Vehicle Use (SOV) across the site. Below are some of the strategies with full details of the strategy found in **Appendix E-Transportation Demand Management Plan.**

- Increased Bicycle Storage- The project will meet the current City of Vancouver By-law requirements for Bicycle storage by providing 80 bicycle spaces for commercial (where 18 is required) and 1335 bicycle spaces for residential (where 1335 is required).
- Community Bicycle Share Programs- The project has allocated space for the City of Vancouver's own Mobi bike share program and is considering an additional private bike share program for the residents of the building focused around electric bicycles. Mobi locations located directly adjacent to the E10th bicycle lane.

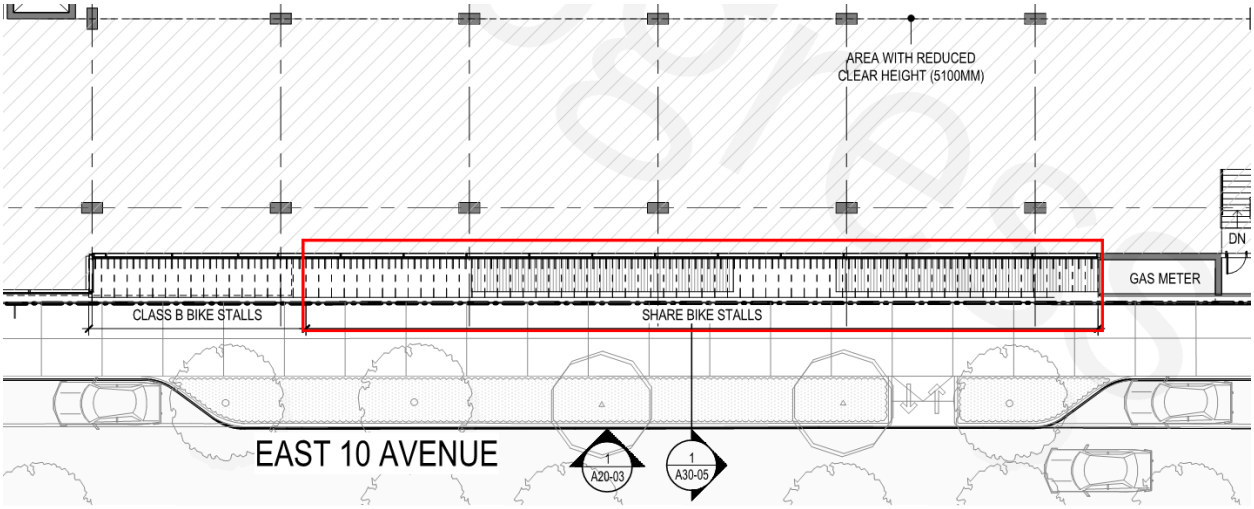

Figure 8: Proposed Bicycle Share Locations

- Cyclist Oriented Amenities- The ownership and design team are committed to exploring and implementing the types of measures meant to welcome and encourage cyclists to and from the site. Of the ideas under consideration, the following represents the types ideas circulated by the team thus far.
  - Secure bicycle storage with potential to have repair stations
  - Cycling oriented retail tenants (cycling cafés)
  - Private electric bike shares for residents.

E. POTABLE WATER MANAGEMENT

E.1 Policy Intent

The intent of the policy is to contribute to the Greenest City goals of reducing potable water use by 33% from 2006 levels and meeting stringent water quality standards. As the city is adopting an integrated water management approach to properly management all water the City is as one system. The conservation and increased efficient use of potable water is intended to help mitigate the effects of increase water demand associated with a rapidly expanding city. This will also contribute to providing increased resiliency of the potable water sources serving Vancouver, in response to climate change.

The policy states that a minimum of 20% indoor and 50% outdoor potable water use must be achieved to contribute to the City's Greenest City goals.

E.2 Strategy

To satisfy the applicable water use reduction targets, the project will use a combination of high efficiency irrigation design and Water Sense plumbing fixtures with a demonstrated reduction in potable water use relative to the baseline water fixture package outlined in the Sustainable Large Sites Rezoning policy. Outdoor water use reductions will be achieved through proven high efficiency irrigation systems like drip irrigation and moisture sensing irrigation controllers. While Indoor water use savings can be demonstrated through careful fixture selection discussed below.

The team is also currently investigating a rainwater re-use system to push towards 100% reduction in outdoor potable water use. The rainwater re-use system can provide the site's irrigation demand and offset potable water uses within the building. This system will also connect with the project's Integrated Rainwater Management Plan (IRMP) to help manage rainwater runoff while also supporting a reduced demand for potable water.

E.3 Design Performance

Following the baseline flow and flush rates provided in table 1 of the administrative bulletin, an indoor water fixture package was developed should meet the required 20% reduction of indoor potable water use. It was observed that the recommended water balance calculator (LEED v4 indoor water use calculator) contained locked baseline values that varied from the City of Vancouver's prescribed baselines provided in table 1 of the administrative bulletin. A replica of the LEED v4 water balance calculator was used in this study, which allowed different baselines to be used. Additionally, the occupancy counts were based on LEED recommended occupancy counts for each space type.

Design Case							Baseline Case						
Space	Flush Fixture	Daily Uses	Flow Rate (Lpf)	Duration	Occupant Users	Sewage Generation (L)	Space	Flush Fixture	Daily Uses	Flow Rate (Lpf)	Duration	Occupant Users	Sewage Generation (L)
Res	Full Flush						Res	Full Flush					
	M	2	4.8	1	850	8160		M	5	4.8	1	850	20400
	F	2	4.8	1	850	8160		F	5	4.8	1	850	20400
	Half Flush						Staff	Urinal					
	M	3	3	1	850	7650		M	2	1.9	1	170	646
	F	3	3	1	850	7650		Full Flush					
Staff	Full Flush							M	1	4.8	1	170	816
	M	1	6	1	170	1020		F	3	4.8	1	170	2448
	F	1	6	1	170	1020	Transient	Urinal					
	Half Flush							M	0.4	1.9	1	331.5	251.94
	M	0	3	1	170	0		Full Flush					
	F	2	3	1	170	1020		M	0.1	4.8	1	331.5	159.12
	Urinal							F	0.5	4.8	1	331.5	795.6
	M	2	0.5	1	170	170		Occupant Use Check				9851.5	
Transient	Full Flush												
	M	0.1	6	1	331.5	198.9							
	F	0.1	6	1	331.5	198.9							
	Half Flush												
	M	0	3	1	331.5	0							
	F	0.4	3	1	331.5	397.8							
	Urinal												
	M	0.4	0.5	1	331.5	66.3							
	Occupant Use Check				9851.5								
	Total Annual Flush Fixture Sewage					**12564275**		**Total Annual Flush Fixture Sewage**					**16171165**
	Potable Water Offset (annual)					**0**							
	Actual Potable Water use					**12564275**							
Space	Flow Fixtures	Daily Uses	Flow Rate (Lpm)	Duration	Occupant Users	Sewage Generation (L)	Space	Flow Fixtures	Daily Uses	Flow Rate (Lpm)	Duration	Occupant Users	Sewage Generation (L)
Res	Lavatories	5	1.5	15	1700	3188	Res	Lavatories	5	5.7	15	1700	12113
Staff	Lavatories	3	1.5	15	340	383	Staff	Lavatories	3	1.9	15	340	485
Transient	Lavatories	0.5	1.5	15	663	124	Transient	Lavatories	0.5	1.9	15	663	157
Res	Kitchen Sinks	4	5.7	60	1700	38760	Res	Kitchen Sinks	4	6.3	60	1700	42840
Staff	Kitchen Sinks	1	5.7	60	340	1938	Staff	Kitchen Sinks	1	8.3	60	340	2822
Transient	Kitchen Sinks	0	5.7	60	663	0	Transient	Kitchen Sinks	0	8.3	60	663	0
Res	Showers	1	6	480	1700	81600	Res	Showers	1	7.6	480	1700	103360
Staff	Showers	1	5.7	480	340	15504	Staff	Showers	1	7.6	480	340	20672
Transient	Showers	0	5.7	480	663	0	Transient	Showers	0	7.6	480	663	0
	Occupant Use Check				19031.5			Occupant Use Check				19031.5	
	Total Annual Flow Fixture Sewage					**49582040.6**		**Total Annual Flow Fixture Sewage**					**63818053.1**
	Combined Design Annual Sewage					**62146315.6**		**Combined Baseline Annual Sewage**					**79989218.1**
								Percentage Indoor Water Savings					**22.31**

Figure 9: Indoor Potable Water Balance

Using the combined annual flush and flow sewage generation volumes, the annual percent reduction was calculated to be **22%** relative to the established baselines in the Sustainable Large Sites Rezoning Policy. These savings were assumed based on the following combination of plumbing fixtures.

Water Closets- 4.8/ 3 LPF (Residential), 6/ 3 LPF (Commercial)

Urinals- 0.5 LPF (Commercial)

Lavatories- 1.5 LPM (Residential), 1.5 LPM (Commercial)

Kitchen Faucets- 5.7 LPM (Residential), 5.7 LPM (Commercial)

Showers- 6 LPM (Residential), 5.7 LPM (Commercial)

The target reductions in outdoor potable water use to meet the 50% reduction, as calculated by the policy, is using ~260 m3/month less than the baseline. The reductions in outdoor water use are based on the formula set out by the policy and provided below.

Outdoor Potable Water Use Baseline (m3/month) = 120mm x Site's Total Proposed Landscaped Area (4348.9 m2)

Outdoor Potable Water Use Baseline (m3/month) = 521.8

Proposed Outdoor Potable Water Use < 539.2 x 50% or 260.9 (m3/month)

F. RAIN AND GROUND WATER MANAGEMENT

F.1 Policy Intent

The City will require a Rainwater Management Plan that recognizes rainwater as a resource to enhance the community and environment. This will contribute to our Clean Water Greenest City target – to reduce per-capita residential water consumption by 20% by 2020. It also supports several other Greenest City goals. The intent is to reduce stormwater discharge, reduce the generation of runoff, treat surface runoff to reduce contaminants, and where possible, conserve potable water use.

F.2 Strategy

To satisfy the exact requirements of the Rezoning Policy for Sustainable Large Developments the project will focus on a combined effort to increase the amount of vegetation on site while also investigating reusing rainwater within building for non-potable water uses. These solutions aim to go above and beyond both the requirements for reducing the volume of stormwater runoff while also providing opportunities for settling rainwater to remove sediments and further treating the water through mechanical filtration prior to exiting the site.

Ground water management has been reviewed and the civil consultant expects the project will not impact the existing water table. A detailed hydrological study will be prepared by the civil consultant to confirm that no impact will be observed in the water table due to the proposed development. Further information can be found in **Appendix F- Integrated Rainwater Management Plan.**

The predevelopment conditions of the site are that of a highly urbanized site that has no site permeability. All rain water hitting the site is currently directed into a storm sewer. To respond and improve upon the existing site condition, the Commercial and Broadway project will aim to vegetate an area equivalent to ~44% of its site and allow for more opportunities to infiltrate water and improve site stormwater runoff volumes. This will be further supported through a rainwater capture and reuse strategy.

The overall stormwater quantity strategy for the site is to ensure the following three requirements are met to satisfy both the City of Vancouver Green Buildings Policy for Rezoning and Rezoning Policy for Sustainable Large Sites.

1. Quantity Management- The post-development runoff rate and volume equals the pre-development rate and volume for the 2-year 24-hour duration storm. Return the first 24mm of rainwater per day into natural pathways such as infiltration.
2. Quality Management- Ensure that 90% of the average runoff volume is treated to remove 85% of TSS, primarily achieved through a landscape-based treatment system, with mechanical filtration support. Treat the water quality of the next 24mm up to 48mm of rainwater per day to remove pollutants such as hydrocarbons, heavy metals, sediments from erosion, excess nutrients.
3. Stormwater Management- Convey safely rainwater from storm events over 48mm per day to minimize damage to buildings or property

F.3 Design Performance

1. Quantity

To meet the requirements of City of Vancouver's Rezoning Policy for Sustainable Large Developments, the run-off volume for a 2-year 15-minute storm event from a City of Vancouver IDF curve was used for the predevelopment runoff volume

and the CoV 2100 curve used for the post development. Considering the development was previously a parking surface with a runoff coefficient of 0.95, the proposed landscaping aids in the improvement of stormwater peak flow with a reduce runoff coefficient of 0.75. Beyond the use of vegetation, the project will also utilize rainwater retention and reuse to manage peak stormwater flows, mainly from the large hardscapes on the plaza level. Higher detail calculations are available in the attached Stormwater Management Plan in **Appendix F.**

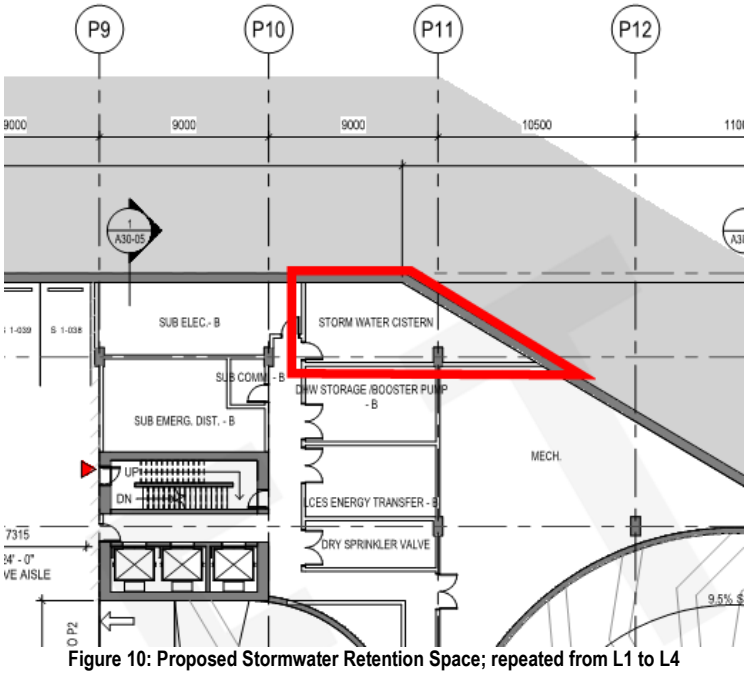

Figure 10: Proposed Stormwater Retention Space; repeated from L1 to L4

Using the City of Vancouver IDF curve for a 2-year 15-minute stormwater event, the project civil consultant has confirmed the minimum amount of water retention for the project to be as follows:

Volume= Site Area (9700 sq.m)*24mm= 233 cu.m

Considering the project's planned inclusion of vegetation for retaining rainwater the final retention volume target for the project is as follows:

Volume= (Site Area (9700 sq.m)- landscaped areas (3,510 sq.m))*24mm= 149 cu.m

2. Quality

To meet the 85% total suspended solids (TSS) removal efficiency, we propose that 'Stormceptors' will be installed at all storm water connection points to the city system. Appropriate sizing of this pre-manufactured product will be achieved with the supplier's sizing information and reviewed by a qualified professional within the design team and the City of Vancouver Engineering as part of the design to support the Site Service Agreement. Where detailed studies are performed, and results in the need of a much higher performing stormwater quality management device to achieve the required TSS removal efficiency, a Jellyfish or Stormceptor brand quality management system will be used.

Using the project site area, we have determined the required treatment rate which the building's stormwater treatment system will be selected to accommodate. It is as follows:

Treatment Flow Rate= (Site Area (9700 sq.m) *48mm)/24hours= 5.39 L/s

For additional information please see the completed Integrated Rainwater Management Plan detailed under **Appendix F**.

G. ZERO WASTE PLANNING

G.1 Policy Intent

The City requires a Zero Waste Design and Operations Plan that considers deconstruction, infrastructure design, and post-construction operations, to meet or exceed the City's Greenest City 2020 goals with respect to waste reduction, increased opportunities for material re-use and recycling, and GHG emissions reductions. The intention is for this to contribute to the Greenest City target on Zero Waste: to reduce solid waste going to the landfill or incinerator by 50% from 2008 levels.

The ultimate objective is to facilitate the reorientation of peoples' habits and practices toward the City's zero waste target. Therefore, the key objectives of a project's Zero Waste Design and Operations Plan are to foster ongoing waste reduction and increased diversion of products and materials form the waste stream through re-use, composting and recycling. The Plan should also aim to reduce operations-related environmental emissions, notably GHG emissions, through strategies such as reduced service-vehicle trips.

G.2 Strategy

The project has ensured that there is sufficient space in the development to allow for adequate sorting and diverting of materials from land fill or incinerator. The project will support the regional and Greenest City target of achieving a minimum of 70% waste diversion on site. As 1780 East Broadway is a mixed-use building containing residential, office, commercial retail, and grocery retail, the following zero waste requirements from the administrative bulletin will be acknowledged in the project's proposed waste strategy:

Multifamily complexes

Must provide:	
Each residential unit	1. Space for organics bin under the sink. 2. Space for recycling bins under the sink (Recycle BC program requires separation of paper, containers, glass).
Common areas (e.g. lobby and corridors)	3. Recycling and organics containers always placed with garbage containers (twinning).
Re-use, Recycling and Organics storage space in building	4. A sufficient number of carts/containers to meet the needs of the entire building.* **see City of Vancouver -Garbage and Recycling Storage Facility Design Supplement.* 5. Signage to instruct occupants on the appropriate use of the organics and recycling containers. 6. Create a program for managing reuse, recycling and removal of bulky items. 7. Programs to ensure items banned from disposable as garbage are not put in garbage http://www.metrovancouver.org/services/solid-waste/bylaws-regulations/banned-materials/Pages/default.aspx 8. Designed to ensure all waste collection day activities occur on-site (as opposed to placing bins onto City property for collection)
Exterior areas (e.g. public sidewalks, pathways and	9. Infrastructure and maintenance plan to maintain a litter-free environment.

Figure 11: Multifamily Zero Waste requirements as per the City of Vancouver's Sustainable Large Developments administraive bulletin

Office and retail buildings

Must provide:	
Each retail/office unit	1. Design to accommodate recycling bin(s) in each working space. 2. Provide a common area space that can accommodate recycling and organics carts.
Common/public areas (e.g. lobby and corridors)	3. Recycling containers always placed with garbage containers (twinning). 4. Provision of organics containers with garbage and recycling containers where appropriate (eg. In eating/kitchen areas)
Re-use, Recycling and Organics storage space in building	5. A sufficient number of recycling and organics carts/containers to meet the needs of the entire building.* **see City of Vancouver -Garbage and Recycling Storage Facility Design Supplement.* 6. Signage to instruct occupants on the appropriate use of the organics and recycling containers. 7. Programs to ensure items banned from disposable as garbage are not put in garbage http://www.metrovancouver.org/services/solid-waste/bylaws-regulations/banned-materials/Pages/default.aspx 8. Designed to ensure all waste collection day activities occur on-site (as opposed to placing bins onto City property for collection)
Exterior areas (e.g. public sidewalks pathways and landscaping)	9. Infrastructure and maintenance plan to maintain a litter-free environment.

Figure 12: Office and Retail Zero Waste requirements as per the City of Vancouver's Sustainable Large Developments administrative bulletin

Food Services

Must provide:	
Work spaces	1. Design to accommodate convenient source segregation of organics, greases and recyclables in food handling and preparation work spaces. 2. Allocate space for organics and recycling containers in all other work spaces.
Customer/public spaces for food consumption	3. Convenient customer/public source segregation of organics, beverage containers and other recyclables in clearly marked disposal containers (twinning) which follow Metro Vancouver's suggested colour schemes for material streams: http://www.metrovancouver.org/services/solid-waste/recycling-signage-campaigns/recycling-signage-colours/Pages/default.aspx .
Organics and recycling storage space in building/complex	4. A sufficient number of carts/containers to meet the needs of the entire building (including organics, grease and recycling).* **see City of Vancouver -Garbage and Recycling Storage Facility Design Supplement.* 5. Signage to instruct occupants on the appropriate use of the organics and recycling containers. 6. Programs to ensure items banned from disposable as garbage are not put in garbage http://www.metrovancouver.org/services/solid-waste/bylaws-regulations/banned-materials/Pages/default.aspx 7. Designed to ensure all waste collection day activities occur on-site (as opposed to placing bins onto City property for collection
Exterior areas (e.g. public sidewalks, pathways and landscaping)	8. Infrastructure and maintenance plan to maintain a litter-free environment.

Figure 13: Food Services Zero Waste requirements as per the City of Vancouver's Sustainable Large Developments administrative bulletin

Additionally, the project will commit to the following as stated in **Appendix G-Zero Waste Management Plan**.

1. Vision Statement

This project will introduce a transparent and innovative means of collecting and managing waste in a mixed-use residential development, this will be done in hopes of re-orienting attitudes around waste management and support the building occupants and operators in becoming leaders in the City of Vancouver.

2. Description of Project Initiatives and Diversion Objectives

The project will target the ongoing diversion rate of 70% by introducing four-stream waste collection: Reuse, Recycling, Organics, and Residual Waste.

As can be noted from the drawing in **Appendix H-Waste Management Spaces**, approximately 562 sq.m (134 sq.m on L2 and 142 sq.m on L1, 118 sq.m on P2, and 168 sq.m on P3) is being provided allowing for extra space for organics management systems, and other waste management initiatives. This extra area provided for zero waste initiatives can also be used for residual waste storage.

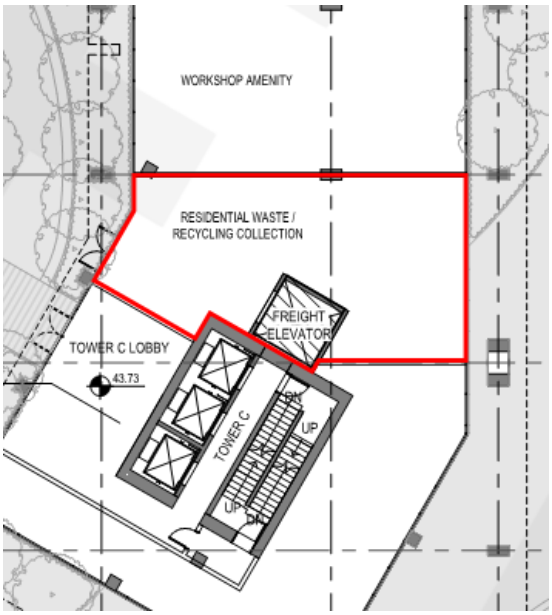

Figure 14: Proposed Residential Waste and Recycling Center; L2 Location

3. Site/Development Infrastructure Design

In addition to the already prescribed Zero Waste actions above, further initiatives will be implemented

Sufficient space will be allocated in each residential unit and larger collection and sorting spaces on the Ground and 1st levels. Reuse will be promoted between residents by offering areas to deposit gently used reusable materials (e.g. books, toys). Residents will be able to make use of other peoples used and unwanted items, reducing the total amount of waste generated in the building.

The project also proposes to include a Recycling Lounge into the development's design to promote the effective separation and collection of recyclables. As per the waste calculations above, the Lounge will be designed to ensure that it is large enough to sustain clean and simple organization of different materials. The space on L1 has been proposed as the most accessible and forthcoming location for such a waste collection and sorting space.

To more directly respond to the Sustainable Large Sites Rezoning conditions the project team is committed to implementing the following:

i) Engage a single hauler for all waste streams generated on site in order to reduce pick up vehicle trips. 1780 East Broadway can reduce collection frequency by choosing a provider that has multiple options for how to collect materials.
ii) Reduce GHG emissions related to collection. A compactor will be recommended where appropriate. Other types of collection containers could also be explored to further reduce collection frequency (space dependent).
iii) Provide a service or billing model that offers occupants incentives to reduce, re-use or recycle rather than to dispose waste. 1780 East Broadway will work with a service provider that will provide feedback on contamination, services that could be reduced to decrease costs. Provide a budge alternative if more materials were recycled.
iv) Ensure that any residual waste is disposed in facilities operated by the City of Vancouver or Metro Vancouver. This will be a requirement of the waste vendor serving the site.
v) Space (in the recycling room) and collection programs for recycling of three or more provincial product stewardship programs (e.g. electronics, batteries, soft plastics, foam packaging). 1780 East Broadway will be ready to implement these services for all residential recycling areas.
vi) As an innovation, as it is not specified in the policy for office and retail, space (in the recycling room) and collection programs for recycling of three or more provincial product stewardship programs (e.g. electronics, batteries, soft plastics, foam packaging will be ready for implementation in all office and retail recycling areas.
vii) Allocate space in the recycling storage area or in another common area for an interoffice materials exchange, bulletin board, and zero waste information kiosk. 1780 East Broadway will promote information exchange in office and retail areas by providing a public board to allow people to post information relating materials available for exchange.

4. Operations

The Recycling Lounge will be designed to facilitate proper waste sorting and reduce the risk of contamination. It will be easily accessible to all residents by its location on the ground level or first floor and will be designed in such a way that it is well-lit, organized, and welcoming in nature. Clear signage will be used in waste management spaces provided in individual tenant spaces will be posted to help occupants sort waste appropriately. Programs to encourage waste that will be considered include building by building competitions, as well as waste collection design that encourages thoughtful disposal (e.g. appropriately sized waste containers).

Building managers will be trained to ensure that waste management procedures are followed once building management has been confirmed. A waste management plan will be created to ensure building management is aware of all waste management facilities and their requirements and provide tips and tools for encouraging tenants to dispose of waste adequately.

To more directly respond to the Sustainable Large Sites Rezoning conditions the project team is committed to implementing the following:

i) Employ a "Greencierge" or Zero Waste support staff to assist residents and business owners to adopt the most sustainable practices as possible. 1780 East Broadway will have a dedicated person to monitor the collection areas

and ensure contamination is kept to a minimum. This person could also be involved with moving containers on collection days.

ii) Establish a building-level zero waste/sustainability team among occupants to engender a community culture around zero waste. 1780 East Broadway will establish a "green team" in the building to report on diversion efforts and update strata on changes in the waste/recycling industry that can positively benefit the strata.

iii) Conduct an annual waste audit and share the results with occupants to assess additional opportunities for diversion. This will be primarily implemented in the commercial areas.

5. Value Added

1780 East Broadway will aim to develop innovative waste diversion techniques on top of what has been committed above. Additionally, methods for waste diversion being explore accountability. As this project will have a mixed use of residential, commercial retail, grocery retail, and office, building management will ensure each occupant type uses the appropriate waste areas and appropriate diversion techniques available. For example, ensuring organics are diverted to the appropriate bin.

H. AFFORDABLE HOUSING

H.1 Policy Intent

For large developments accommodating housing, the City of Vancouver requires an Affordable Housing Plan that considers a range of unit types and tenures and demonstrates how the project will meet or exceed the requirements of the City's Affordable Housing in New Neighbourhoods policy. Providing affordable housing is a key focus for rezoning with Sustainable Large Developments. Applicants are required to meet with City staff and the pre-application stage to discuss the appropriate mix of incomes, household types and tenures. As the formal letter of enquiry was submitted before June 20, 2018, the project may proceed under the previous Rezoning policy, Rezoning Policy for Sustainable Large Developments amended December 16, 2014. In the previous policy, the Affordable Housing in New Neighbourhoods policy (the 20% policy) was applicable where 20% of residential space is to be set as affordable non-market rental.

The intent is to contribute to meeting the affordable housing objectives and targets of the Housing Vancouver Strategy (2018-2027), in particular to achieve the target of 12,000 new units of social, supportive and co-op housing through the delivery mechanisms outlined in the Affordable Housing Delivery and Financial Strategy (2018-2027).To meet the intent of the policy, 1780 East Broadway will create options for more housing affordability, types and choices, including housing for individuals and families that fall under the Housing Income Limits published by BC Housing, and purpose-built rental housing for moderate income households.

H.2 Strategy

As set out by the policy, 20% of residential floor area must be set aside as affordable housing. Given the total residential floor area is 47,438 sq.m, the required affordable housing by floor area is therefore 9,487 sq.m. 1780 East Broadway is currently providing ~12,000 sq.m of affordable housing. In terms of units, the total unit count is 653, 20% of units would therefore be 131 units. 1780 East Broadway is currently providing 148 units of affordable housing which will be spread evenly across the available unit types. In this figure below, the division of affordable housing can be seen in yellow.

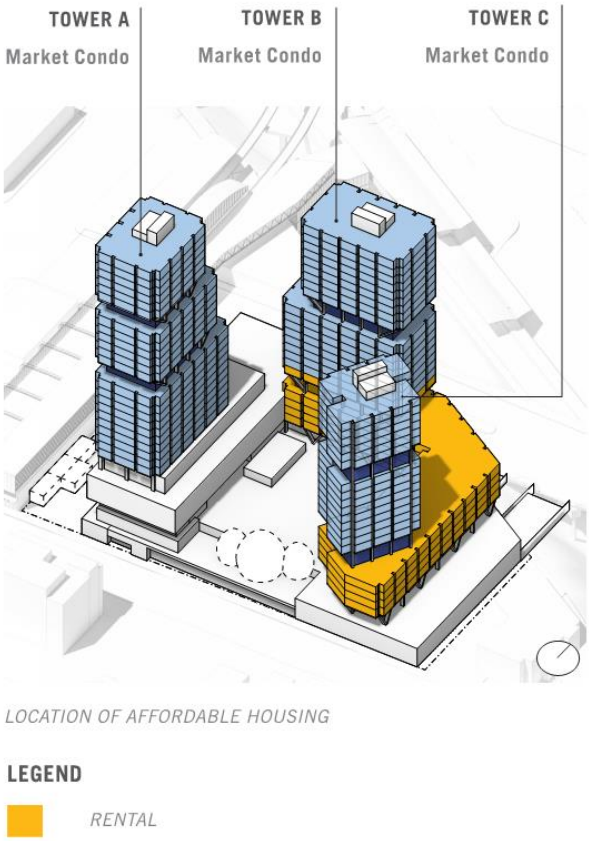

Figure 15: Location of Affordable Housing

East Broadway is still exploring the affordable housing requirement with the City of Vancouver and so the above is subject to change.

I. RESILIENCE

I.1 Policy Intent

Designing with building resilience aligns with the objectives of the Climate Change Adaption Strategy. With increased risk of significant shocks and stresses such as earthquakes, extreme weather, extreme temperatures, and sea level rise, building resilience and disaster preparedness is key to preparing for the future.

The City of Vancouver is undertaking two initiatives related to resilience; 1) a broader resilience strategy, with forthcoming policies related to Vancouver specific shocks and stresses, and 2) the climate change adaption strategy update, adopted by council in 2012, the adaption strategy is being updated with new climate projections and actions. Further, the project must identify building and design strategies that eliminate, reduce, and mitigate adverse impacts including those due to changing climate conditions.

I.2 Strategy

1780 East Broadway intends to meet the demand for improved resilience in building design and providing strategies that mitigate risk and reduce the impact related to shocks and stresses specific to Vancouver. 1780 East Broadway will demonstrate the resilience of the design through the recommended resilience worksheet provided in the Sustainable Large Developments administrative bulletin. The building resilience worksheet is provided in **Appendix I- Resiliency Checklist.**

1780 East Broadway will also provide resilient, self-closing potable water sources that will operate on City pressure. As the Sustainable Large Developments policy states at least 1 resilient water source is needed and the newly applicable Green Buildings rezoning policy states 1 source per every 75 occupants, 1780 East Broadway will provide sufficient resilient

sources to meet the more stringent policy. Based on preliminary occupant calculations, shown below, twenty-eight (28) resilient potable water sources will be provided. As the residential towers are located above the grocery retail (Safeway), the resilient water sources will be located mainly throughout the L2 amenity deck, with some available at the plaza area. The resilient water sources will compliment previous sections of this policy where accessible water sources are needed for various sustainable food assets.

Space Type	*Room Type*	*Quantity*	*Occupant Count*
Residential	Studio	95	190
	1 Bedroom	235	470
	2 Bedroom	252	756
	3 Bedroom	71	284
	Total	653	
	Total Residential Occupants		1700
Space Type	*Space Name*	*Area (SF)*	*Staff FTE Count*
General Office	Office	49,042	197
Retail, general	Plaza CRU's	3,486	7
Grocery store	Safeway	49,381	90
Educational, daycare	DayCare	12,271	20
Health club/aerobics ro	Fitness Center	9,635	9
Restaurant	Restaurant	7,374	17
	Total Commercial Occupants		340
Total Building Occupants			2040
Potable Water Access Points			**27.20**

Figure 16: Resilient potable water sources calculation as per the Green Buildings Rezoning Policy

J. ZERO- EMISSION GREEN BUILDING REZONING POLICY REPORT

As a part of the Rezoning Application package, the following Sustainable Design Strategy has been developed to provide confirmation the project design submitted is on target to meet the requirements as dictated by the Green Buildings Policy for Rezonings 2016, option B. Low Emissions Green Building, effective May 1, 2017. This section will address each component of the Green Buildings Policy for Rezonings, regardless of some sections being previously described, to ensure compliance of this policy is met.

The following narrative includes preliminary strategies explored by the design team, with the aim to achieve the various requirements of the Low Emissions Green Building pathway, along with all required supporting evidence at this stage, as listed:

Item B.2: Brief summary of strategies and measures to achieve performance limits for energy use, heat loss, and greenhouse gas emissions, including;

Preliminary Zero Emissions Building Plan (ZEBP) Energy Checklist, completed by the project energy modeller, showing that the project meets the performance limits for energy use (TEUI), heat loss (TEDI), and greenhouse gas emissions (GHGI), together with key inputs;

2-4 page summary of detailed energy model inputs for detailed and/or 3rd party review.

Item B.6.2: Preliminary embodied emissions calculations, and a description of specific measures that will be explored during design to reduce embodied emissions;

Item B.10: The site IRMP, describing the chosen strategies and green and grey infrastructure measures included in the landscape and building design. The IRMP describes;

How these measures contribute to the city-wide IRMP targets for water volume reduction and quality treatment, and

Include preliminary site and volume calculations to compare site performance to the City-wide targets;

Landscape/Architectural Site Plans highlighting the green and grey infrastructure measures described in the site IRMP as also provided.

A commitment by the owner to meet the requirements of the Green Buildings Policy for Rezonings with documentation to be submitted at a later project phase, including:

B.3: design, build, and test to meet an airtightness target of 2.0 L/s/m² @ 75 Pa;

B.4: complete an enhanced commissioning process;

B.5: design and build to include building metering and sub-metering of energy, and to enter into agreement on energy reporting, including assistance for building future owners;

B.6.1: complete refrigerant emissions calculations;

B.7: design and build a direct ventilation system;

B.8: design and build with low-emitting materials;

B.9: test indoor air quality prior to occupancy;

B.11: design and build a resilient potable water access point.

J.1 LEED Gold - Building Design + Construction

As the project is over 50% residential, LEED registration, design and certification are not required.

J.2 Performance Limits

At this stage, the project is still in concept design where the building shape/massing and suite layout are subject to City approval and other changes. Additionally, the mechanical, electrical and envelope design are not fully defined, but instead, under exploration.

A preliminary energy model has not yet been conducted to confirm the final performance of the building in its proposed configuration. The project will incorporate a Low Carbon Energy System (LCES) and given the mixed-use nature of the building, the blended Whole-Building Performance Limits, as stated in Table 1, are the following: **TEUI 154.3 kWh/m2; TEDI 55.5 kWh/m2; GHGI 8.3 kgCO2/m2**. The design team and project owner confirm the project will be designed in compliance with these limits. The modelled Whole-Building Performance is within compliance with the following: **TEUI 151.4 kWh/m2; TEDI 41.7 kWh/m2; GHGI 3.8 kgCO2/m2**.

Efficiency Indicator	Whole Building Performance Limits	Whole Building Performance Results
TEUI (kWh/m2)	154.3	151.4
TEDI (kWh/m2)	55.5	41.7
GHGI (kgCO2/m2)	8.3	3.8

To achieve the performance targets outlined above, the project team is considering the following;

- 50% Window to Wall Ratio
- LED Lighting in suites and common spaces
- Water efficient plumbing fixtures
- Energy Recovery Ventilator, electrically sourced heating and cooling equipment including Air-Sourced Heat Pumps (ASHP), high efficiency chillers, and geo-exchange
- Condensing boilers or solar thermal for back-ups

The Zero Emission Building Plan Checklist and Input Summary Tables are provided under **Appendix J- Zero Emissions Building Plan Checklist** and **Appendix K- Input Summary Table** respectively.

J.3 Airtightness Testing

Whole-building and suite airtightness testing and reporting is required for this residential building. The project owner has committed to meet this requirement – please see **Appendix L – Owner Letter of Commitment**.

J.4 Enhanced Commissioning

An enhanced commissioning process is required for all building energy systems. The project owner has committed to meet this requirement – please see **Appendix L – Owner Letter of Commitment**.

J.5 Energy System Sub-Metering + Reporting

Separate master metering for each energy utility, along with sub-metering of all major energy end-uses and major space uses is required. The building owner must enter an agreement with the City of Vancouver to share utility data for minimum three (3) years and provide assistance for building future owners. The project owner has committed to meet this requirement – please see **Appendix L– Owner Letter of Commitment**.

J.6 Refrigerant Emissions + Embodied Emissions

Preliminary embodied emissions calculations for all major building materials have been conducted based on the building's rezoning concept design. Various floor, wall and roof areas have been confirmed through the preliminary energy model. As current designs do not include detailed structural information, various comparable mixed-use developments in Vancouver were referenced. From these reference buildings, applicable details related to column quantity, span, load and typical wall assemblies have been applied to the various floor, wall, and roof lengths and areas for this building. As more detailed information is available specific to this project, the life cycle assessment model will be refined and updated.

The building includes towers of various heights with the tallest at ~100 m. Furthermore, the building includes four levels of parkade. Other major concept design assumptions include:

Concept Design Assumptions	Parkade	Above Grade
Floor Area	38,560 m2	66,393 m2
Building Footprint	9640 m2	7373 m2
Columns & Beams	Type: Concrete Height (m): 3.5-4.9	Type: Concrete Height (m): 2.7-5.4
Foundations	Concrete Footings, Slab on Grade	n/a
Interior Walls	Elevator Cores: Cast in place concrete Interior Walls: Concrete Block	Elevator Cores: Cast in place concrete Residential: Steel Stud, Mineral Wool Batt, Gypsum Commercial: Concrete Block
Exterior Walls	1587.2 m total wall length Concrete 35 MPa,	12,050.9 m total wall length Concrete 35 MPa, Curtain Wall, Fiberglass Batt (Commercial L1: Cast in Place, XPS)
Floors	Concrete 35 MPa	Concrete 35 MPa, Insulation above unconditioned space
Roof	n/a	12,829 m2 total roof area throughout project Concrete Slab, Extruded Polystyrene Insulation, Concrete Tile
Glazing	n/a	50% WWR Residential: Curtain Wall Commercial: Aluminum Frame, Double Glazing

The Athena Impact Estimator for Buildings software was utilized, which is in compliance with EN 15978. A 60-year building life expectancy was modeled. The following outputs represent the overall embodied emissions associated with these assumed structural and enclosure components:

Embodied Emissions at Concept Design		
	Unit	**Total**
Global Warming Potential	kg CO2 eq	4.05 E+07
Global Warming Potential Intensity	kgCO2eq/m²	385.8
Global Warning Potential Annualized Intensity (60-year building life expectancy)	kgCO2eq/m²/year	6.4

It has been determined based on the Concept Design of 1780 East Broadway, the total lifecycle embodied emissions Global Warming Potential intensity is 4.05 E+07 kgCO2eq/m² and annualized intensity is 6.4 kgCO2eq/m²/year, considering a 60-year building life.

During design development, the same exercise will be conducted should the building heating and cooling system selections have a capacity of equipment containing refrigerants 35 kW or greater. Once mechanical systems have been selected, emissions from refrigerants will been calculated using the following formula: kgCO2e/m2 = [GWPr*Rc*(0.02*L+0.1+)] / (L*A). Outputs representing the overall refrigerant emissions associated with the building's mechanical components will be provided to the City of Vancouver.

Upon Building Permit Application, the project team will provide embodied emissions calculations representing the building permit stage design and a description of what measures, if any, were taken to reduce embodied emissions.

J.7 Verified Direct Ventilation

The building's ventilation system will provide outdoor air directly to all occupiable spaces, in the quantities defined by code. The project owner has committed to meet this requirement – please see **Appendix L – Owner Letter of Commitment**.

J.8 Low Emitting Materials

All interior finishes will be selected to minimize volatile organic compounds and added urea formaldehyde to improve the indoor environmental quality. The project owner has committed to meet this requirement – please see **Appendix L– Owner Letter of Commitment**.

J.9 Indoor Air Quality Testing

Prior to occupancy, testing for formaldehyde, particulates, ozone, total volatile organic compounds and carbon monoxide will be conducted. The results will be compared to City targets and will be reported for occupancy permit. The project owner has committed to meet this requirement – please see **Appendix L– Owner Letter of Commitment**.

J.10 Integrated Rainwater Management + Green Infrastructure

In consultation with the City of Vancouver's Best Management Practice Toolkit, the project site Integrated Rainwater Management Plan includes green and grey infrastructure measures considered appropriate for the building type, design, project location and surrounding area. Landscape/Architectural Site Plans highlighting the green and grey infrastructure measures described in the site IRMP has been included with this Rezoning Application Package – please see **Appendix F - Integrated Rainwater Management Plan**.

J.11 Resilient Drinking Water Access

The building's design will provide access to potable water which utilizes City operated system pressure (not electrically aided). Points of water access will be provided for every 75 occupants; according to current project data, this would equate to twenty-eight (28) points of resilient water access. This has been discussed previously in the section on Resilience.

The project owner has committed to meet this requirement – please see **Appendix L– Owner Letter of Commitment**.

Summary

The above noted strategies support a holistic approach to addressing the requirements of the City of Vancouver's Green Buildings Policy for Rezonings. Implementing these strategies through design and construction will produce a sustainable and resilient building capable of delivering optimum building performance, while also improving indoor environmental quality for occupants.

Appendix A-Arborist Report

ARBORTECH CONSULTING a division of: ACL GROUP

TREE MANAGEMENT REPORT:
FOR DEVELOPMENT APPLICATION PURPOSES

Report Date: **April 26, 2017** **Rev 0:** ACL File: **17130**

ACL Bus Lic: **16 742556** (Inter-Municipal West) City File: _____

Client: Attn.: **Ariele Peterson**
Westbank Projects Corp
501 – 1067 West Cordova Street
Vancouver, BC V6C 1C7

Prepared By: **Nick McMahon**
Senior Arborist and Project Manager
ISA Certified Arborist #PN-7136A
Tree Risk Assessment Qualified (TRAQ)

Site Address: **1780 East Broadway, Vancouver**

Project: **Proposed Re-Development**

Figure 1. Aerial Photo of the Subject Site.

1. BACKGROUND

The subject site is comprised of an existing commercial property currently occupied with an operating grocery store and related loading bay and surface parking stalls. The proposed development includes the demolition of the existing buildings and the construction of a new mixed use development, including residential units, office space and commercial space and the related hardscape such as driveways, underground parkade structure and he related civil servicing.

Arbortech Consulting has undertaken an arboricultural assessment of the existing trees located at or within influencing distance of this proposed development. Our site investigation was performed on March 15, 2017.

Land development generally increases the density and site coverage which may directly conflict with and require the removal of existing trees, and the related construction work may cause changes to the growing site that

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indirectly impact trees such as; new exposure to environmental stresses (primarily sun and wind), changes to soil hydrology (water availability to trees), changes in surface drainage (promoting drought or flood) and other factors.

Pursuant to municipal bylaws or policies, our role is to act as project arborist to assist the developer with implementing retention of viable and suitable trees within the project where it is possible and practical, and ensuring the long term success by providing guidance and direction through the design and construction process. We take a comprehensive approach coordinated on a team basis with the client, the project design professionals and the municipality. This study presents tree condition findings, retention priority rankings, tree retention potential of the site, and the proposed tree preservation strategy for municipal submission purposes.

2. APPROACH AND METHODOLOGY

Tree preservation requires careful technical consideration. Our tree retention planning process consists of a qualitative review of existing trees that identifies and promotes a thorough understanding of tree retention opportunities. Our procedures are based on standardized tree assessment metrics, allowing us to prioritize which trees are best suited and/or provide the best value for consideration of retention, with a logical supporting rationale. Our intent is to provide sound data for the client to make informed decisions, and to facilitate prudent selection and implementation of adequate protection measures so that selected retained trees will be a valuable asset upon the completion of the project. Our assessment and findings are in accordance with arboricultural best management practices, regional considerations, and regulatory requirements. The procedures we follow are summarized as follows:

- Project Preparation:
  Review the client supplied information, including; the survey (topography and tree locations) and the concept design, to determine the general land use changes and possible site influences on existing trees.
- Field Work:
  Complete a site visit to inspect and collect pertinent tree data and review the site conditions.
- Assessment:
  Compile the tree data, including; size, species, age class, current health condition, structural condition (including overt major defects), size and form, contribution in the landscape, species and stand level tolerance to site disturbance, as well as other factors to assign a retention priority ranking based on arborist determined viability and value ratings of each tree or group of trees.
- Preliminary Assessment:
  Prepare and provide a preliminary draft ***Tree Inventory*** and a ***Tree Assessment Drawing*** for the existing tree resource that reports; the assessment results, the general limitations and/or opportunities for tree preservation, the retention priority rankings, and the optimal protection setbacks for candidate retention trees (generally only for trees of priority 1 and 2 ranking, but may also include other trees). This data is issued in cad format for use by the client, the design team and/or the municipality in planning, preparing or revising the project design to accommodate tree preservation.
- Supporting Consultations:
  Review the proposed project design to identify expected construction conflicts with candidate retention trees. If the design team reports challenges in meeting the optimal tree protection setbacks, the project arborist will meet with the design team to explore; design alternatives, the use of low impact construction methods and materials, and/or opportunities for municipal concessions, in an effort to mitigate tree retention impacts. If we deem that proposed encroachments are tolerable and within acceptable thresholds for tree impacts, and if provisions for proactive and compensatory enhancement treatments are implemented, then encroachments into the optimal tree protection setbacks will be supported. This is the common standard.
- Final Report:
  Finalize the ***Tree Inventory*** and a ***Tree Management Drawing*** referencing the final project design for inclusion in this report.
- Municipal Review:
  After submission, the municipality may seek clarifications about the findings in our report and/or exercise their discretion to require design revisions to retain and protect certain trees. Coordination with inter-departmental reviews may benefit from further consultations or meeting attendance by the project arborist, and this process may precipitate the need for revisions to our documents.

Tree protection compliance is a subsequent phase of our work that the municipality may require proof of contract that we are retained to provide on-going assistance during detailed design, site preparation and construction.

3. TREE CONDITION ASSESSMENT

For full details of the tree data, please refer to the enclosed Tree Inventory (see Appendix B), and for tree locations please reference the enclosed Tree Assessment Drawing (see Appendix C).

Our assessment of the existing trees includes the size data to determine the trunk diameter, height and spread as measured by the arborist (this supersedes surveyor data), the vigour and vitality, age class, growing site constraints and other tree or site factors. The condition of trees is determined from our thorough visual tree assessment (VTA) methods and protocols to review their health and their structure as independent factors. Note that a healthy appearing tree may have significant structural defects.

This is not a tree failure risk assessment, however the structural form and presence/absence of defects were factors in our assessment. The structural integrity of trees can be estimated by visual assessment, however additional review and/or detailed testing may be required to confirm the severity of defects.

Assessment of Tagged Trees:

For full details of the tree data, please refer to the enclosed ***Tree Inventory*** (see Appendix B), and for tree locations please reference the enclosed ***Tree Assessment Drawing*** (see Appendix C).

Tree Assessment Summary:

The trees are rated for general overall condition into the categories as follows:

Table 1. Tree Condition Results

Condition Rating:	Quantities:	Definition:
HIGH RISK	0	A tree deemed through TRAQ methods to pose high or extreme risk to the site or surrounding lands and that must be removed to abate those risks.
VERY POOR	13	A tree with significant health or structural impairment(s) that are deemed to be untreatable with practical and effective arbor culturally sound methods.
FAIR	7	A tree with minor health or structural issues that can generally be treated or mitigated successfully.
GOOD	0	A tree in good health and with no overt structural defects observed and no impediments in its root zone.
SPECIMEN	0	An open grown tree of mature age class having representative and typical form of the species, is in good health, and has no apparent significant defects.
TOTAL	**20**	

4. TREE RETENTION POTENTIAL

Tree retention ***viability*** considers the pre-existing health and structural condition as well as general species characteristics such as; failure patterns, tolerance to growing site changes, root invasiveness, and hardiness in our region (adaptability to climate and weather, susceptibility to pest and disease, and other factors).

Tree retention ***value*** considers attributes such as; amenity, function, location, contribution, dominance and aesthetics. The municipality may have additional considerations that could influence the value rating. If so, these factors should be brought to the attention of the applicant.

The priority ranking for consideration of retention in this development is determined from the viability and value ratings as per the matrix below.

Matrix 1. Priority Ranking

RETENTION VIABILITY:	RETENTION VALUE: Low	Medium	High
Unsuitable	**NIL**	**NIL**	**2**
Marginal	**2**	**2**	**1**
Suitable	**2**	**1**	**1**

Note: Trees of specimen quality should receive special consideration for retention where possible.

5. TREE RETENTION DESIGN

Refer to the Tree Inventory (see Appendix B) and the Tree Management Drawing (see Appendix D)

After consideration of the tree assessment and retention priority rankings in review of the project design, the existing trees are proposed to be treated as follows:

Table 2. Tree Retention by Priority Rankings

Priority Ranking:	Total:	Remove:	Retain:	Retention Tree Tag #'s:
1	0	0	0	
2	1	0	0	
Nil	19	19	0	
TOTAL	**20**	**20**	**0**	

Remove 19 Trees:

Trees proposed to be removed are deemed to be unsuitable for retention due to their condition and viability, and/or are not able to be accommodated within the project design.

Remove 7 Trees Due to Construction Conflict:

Tree #s: 970, 975, 976, 981, 988, 993, and 995

- These trees are in direct conflict with the underground parking structure and cannot be accommodated in the current design.

Remove 13 Trees Due to Condition:

Tree #s 971, 972, 973, 974, 987, 989, 990, 991, 992, 994, 996, 997 and 998

- These trees are in very poor pre-existing condition and are also in direct conflict with the underground parking structure and cannot be accommodated in the current design.

Shared Tree Approvals:

Trees proposed to be removed that are shared ownership will require the approval from the respective neighbouring property owner before the municipality can approve its removal.

These trees include tag #: **981.**

6. OFF-SITE TREES

Private Off-Site Trees:

Remove – Refer 1 Tree: Certain trees are in direct conflict with the proposed development and will require approval from the respective owners before approval can be obtained from the municipality.

Tree # 999

- Seek approval from the neighbouring owner to remove this tree due to excessive and destabilizing root loss will result from excavation for the new underground parking structure.
- If approval cannot be obtained, then further coordination with this office will be necessary for protection measures that would be required to be implemented and maintained within the subject site for the duration of construction and may have design implications.

Municipal Trees:

Protect: 12 off-site city owned trees as detailed herein and on the attached appendices.

Trees S001, S002, S003, S005, S006 and S007

- Significant defects were observed in tree #s **S003 and S005.** Refer condition findings to Parks department for assessment in context to city risk assessment protocols and consideration for treatment at their sole discretion.

Untagged Trees (Closed Lane Envelope)

- The project arborist must be on-site during the excavation for the underground parking structure to undertake root pruning and direct low impact methods. *See Tree Management Drawing for additional information and approximate location references.*

Remove – Refer 11 Trees: Certain trees are in direct conflict with the proposed development and will require Parks department approval for removal.

Tree #s 977, 978, 979, 980, 982, 983, 984, 985, 986

- Seek Parks department approval to remove 9 trees located in-board of the existing sidewalk in the city owned road frontage due to excessive root loss that will result from excavation for the underground parking structure.
- If approval cannot be obtained, then further coordination with this office will be necessary for protection measures that would be required to be implemented and maintained within the subject site for the duration of construction and may have design implications.

Trees S004 and S008

- Seek Parks department approval to remove 2 trees located on the planted boulevard in the city owned road frontage due to conflict with proposed new driveway crossings and excessive root loss that will result from preparation for driveway installation.
- If approval cannot be obtained, then further coordination with this office will be necessary for protection measures that would be required to be implemented and maintained within the subject site for the duration of construction and may have design implications.

7. TREE REPLACEMENT

Tree replacement requirements will be confirmed by the municipality in relation to their policies. The municipality generally requires two replacement trees for each bylaw tree to be removed (2:1 quota), up to a maximum quantity for the lot size or the available space for planting. The replacement trees must meet city requirements for minimum size at planting (i.e. 6 cm calliper for deciduous species and 3.5 m height for coniferous species) and other criteria. Replacement tree design details will be specified by others.

8. CERTIFICATION

The findings herein are the opinion of the consultant and deemed to be true and correct to the best the assessor's ability.

Certified By:

Nick McMahon,
Senior Project Arborist

Qualifications:

- ISA Certified Arborist #PN-7136A
- Qualified Tree Risk Assessor (TRAQ)
- Certified Tree Risk Assessor #1763

Enclosures;

Appendix A:	Tree Photos
Appendix B:	Tree Inventory
Appendix C:	Tree Protection Specifications
Appendix D:	Tree Assessment Drawing
Appendix E:	Tree Management Drawing
Appendix F:	Letter of Undertaking

Assumptions and Limiting Conditions:

This report was prepared for and on the behalf of the client as addressed herein. Upon receipt of payment of our account in full, this report will become the property of the client. This report is intended for the exclusive use of our client, but in its entirety. Arbortech Consulting shall not accept any liability derived from partial, unintended, unauthorized or improper use of this report.

This report is restricted only to the subject trees as detailed herein, and no other trees were inspected or assessed.

The inner tissue of the trunk, limbs and roots, as well as the majority of the root systems of trees are hidden within the tree and below ground. Trees have adaptive growth strategies that can effectively mask defects. Our assessment is limited by relying on the outward signs and non-destructive testing to identify the severity of defects that may be indicators of structural deficiencies. We use our training, experience and judgement in this regard, however not all defects can be diagnosed. It may not be feasible to identify certain defects, or to measure the severity, without causing mortal injury to the tree. Further, we must acknowledge that extreme weather and environmental influences are unpredictable, and that any tree has risk of failure in such events. Arbortech Consulting does not guarantee or warrant that a tree is free of defect or that it will not fail.

The ownership of trees is determined from the location of the trunk where it merges from the ground in relation to the property line, and requires the advice from a duly qualified professional surveyor. Third party information provided to the consultant may have been relied upon in the formation of the opinion of the consultant in the preparation of this report, and that information is assumed to be true and correct. Arbortech has not verified that information, and does not warrant it as correct.

The use of maps, sketches, photographs and diagrams are intended only as a reference for the readers' use in understanding the contents and findings of this report, and are not intended as a representation of fact.

Approvals from a municipality and/or regulatory agency may be required prior to carrying out any treatments recommended in this report. The client is responsible to make application for, pay related fees and costs, and meet all requirements and conditions for the issuance of such permits, approvals or authorizations.

APPENDIX A

TREE PHOTOS

Tree # 970

Tree #s 971 & 972

Tree #s 973 & 974

Tree # 987

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TREE PHOTOS

Tree # 988

Tree #s 989 & 990

Tree # 999

Tree S001

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TREE PHOTOS

Tree S002

Trees S003, 977, 978, 979, 980

Tree # 980

Tree S005

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TREE PHOTOS

Tree S006

Tree S008

Untagged Trees Within Closed Lane

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Integral Group | Suite 180 - 200 Granville Street, Vancouver, BC V6C 1S4
+1.604.687.1800 | Integralgroup.com

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APPENDIX B: TREE INVENTORY

Notes:

Tag # denotes the serial numbered aluminum tag affixed to the tree as referenced in report and on drawing
Dbh denotes the diameter of the trunk measured in cm, at 1.4 m above grade or to arboricultural standards (below scaffunion or trunk area method for single stem equivalent of multi trunk trees)
Tol denotes the species tolerance to changes in its growing environment; **T** denotes Tolerant, **I** denotes Intolerant
Ht denotes the height of the tree in metres as measured or estimated by the assessor.
Spr denotes the spread fo the bracnhes and foliage (dripline) in metres as measured or estimated by the assessor.
Loc denotes the ownership of trees based on the survey and project plans provided;
On denotes on-site, **Off** denotes private Neighbour Tree, **City** denotes Street Tree, **Park** denotes tree in existing/proposed Park, **ESA** denotes tree in existing/proposed ESA
Age denotes the age class of the tree relative to its noraml urban lifespan; **Y** denotes Young, **M** denotes Mature, **O** denotes Over-Mature (Senescent)
Class denotes the structural class of a tree growing in a forest stand environment;
UNDER = understory tree, usually forming a component of the secondary canopy. Only viable within stand retention areas.
SUPP = suppressed tree has negligible trunk taper and very very low LCR (<30%). Usually not viable. Targets for treatment (removal) along new forest edges.
COD = codominant has limited trunk taper and moderate LCR (30 to 50%). Requires stand scale retention to be consdidered viable, and edge windfirming will be required
DOM = dominant tree has anchoring attributes to the primary canopy, good trunk taper, significant LCR (>50%) and robust root system. Viable for retention, usually only in stand/grove conditions
Cond denotes health and structural condition using Visual Tree Assessment (VTA) procedures; **HR** denotes High Risk (TRAQ), **VP** denotes Very Poor, **F** denotes Fair, **G** denotes Good, **S** denotes Specimen
Viab denotes the viability for retention considering its condition, tolerance and other factors; **U** denotes Unsuitable, **M** denotes Marginal, **S** denotes Suitable
Value denotes contribution, location and purpose in the landscape and other factors; **L** denotes Low, **M** denotes Medium, **H** denotes High
Priority denotes our numerical rating for the retention consideration to be referenced in the planning and design process. See report for further context.
Action denotes proposed retention or removal in context to the current project design. See report and drawing for further details and for tree protection measures

Tag #	Dbh	Tree Type	Tol	Ht	Spr	Loc	Age	Class	Cond	Viab	Value	Priority	Description, Main Defects (if any), and Construction Impact/Mitigation	Action
970	34	Pin oak	T	11	6	ON	M	OPEN	F	M	M	2	• Roots are growing on the surface in the soft landscape, restricted by and in direct contact with existing curb and hardscape. • Historically pruned via heading cuts on the southwest side for building clearance. • Excessive root and crown loss will result from excavation for the new underground parking structure, and this tree is proposed to be removed.	Remove
971	11	English hawthorne	T	5	4	ON	Y	OPEN	VP	U	L	NIL	• Fully dead. • Lean to the northwest.	Remove
972	13	Green ash	T	8	3	ON	Y	OPEN	VP	U	L	NIL	• Roots restricted by hardscape. • Bow to the south.	Remove
973	13	linden		8	4	ON	Y	OPEN	VP	U	L	NIL	• Historically topped at 4.0m above grade. • Replacement leaders attach at the historic topping site and have developed a weak crown structure. • Root crown obscured by historic placement of excess fill.	Remove
974	15	linden		8	4	ON	Y	OPEN	VP	U	L	NIL	• Historic placement of excess fill (mulch) obscures root crown. • Bow to the northeast.	Remove
975	14	Green ash		9	4	ON	Y	OPEN	F	U	L	NIL	• Historic placement of excess fill obscures the root crown. • Divergent co-dominant leaders narrowly attach at 2.2m above grade with a bark inclusion.	Remove
976	15	Green ash		11	4	ON	Y	OPEN	F	U	L	NIL	• Historic placement of excess fill obscures the root crown. • Divergent co-dominant leaders narrowly attach at 2.2m above grade with a bark inclusion. • Narrowly bifurcated at 5.0m above grade.	Remove

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Tag #	Dbh	Tree Type	Tol	Ht	Spr	Loc	Age Class	Cond	Viab	Value	Priority Description, Main Defects (if any), and Construction Impact/Mitigation	Action
977	38	Green ash	18	7	CITY	M OPEN	VP	N/A	N/A	N/A	• Narrowly bifurcated at 0.5m above grade with a long bark inclusion extending upwards to 1.5m with reaction wood and seeping water. • Crown gap in upper crown.	Remove - Refer
978	36	Pacific dogwood	18	6	CITY	M OPEN	F	N/A	N/A	N/A	• Historic placement of excess fill obscures root crown. • Two co-dominant leaders narrowly attach at 3.5m above grade with a bark inclusion. • Crown suppressed on the east and west sides due to proximity and suppression from adjacent trees.	Remove - Refer
979	32	Pacific dogwood	15	6	CITY	M OPEN	F	N/A	N/A	N/A	• Multiple stems narrowly attach at base with a bark inclusion extending below grade. • Embedded in the crown of adjacent trees, resulting in an asymmetrical crown biased to the west.	Remove - Refer
980	49	Douglas-fir	19	5	CITY	M OPEN	F	N/A	N/A	N/A	• Asymmetrical crown suppressed on the northeast side. • Growing on a mound with very large surface roots.	Remove - Refer
981	36	Douglas-fir	19	6	ON	M OPEN	F	U	M	NIL	• **Shared tree.** • Asymmetrical crown merged with adjacent tree and suppressed on the southwest side. • Suitable for retention with adjacent tree.	Remove
982	21	Pacific dogwood	15	5	CITY	M OPEN	F	N/A	N/A	N/A	• Two co-dominant stems narrowly attach at base with a bark inclusion extending below grade. • Roots from adjacent tree girdling the stem at root crown. • Embedded in the crown of adjacent tree, resulting in a suppressed, asymmetrical crown biased to the east.	Remove - Refer
983	18	Pacific dogwood	10	4	CITY	M OPEN	F	N/A	N/A	N/A	• Multiple leaders narrowly attach at 10m and entwined in the crown.	Remove - Refer
984	20	Pacific dogwood	10	4	CITY	M OPEN	F	N/A	N/A	N/A	• Narrowly bifurcated at base with bark inclusion and forming ribs.	Remove - Refer
985	23	Pacific dogwood	11	4	CITY	Y OPEN	F	N/A	N/A	N/A	• Two stems narrowly attach at base with a bark inclusion and well limb-tied in the crown. • Historic placement of excess fill over the root zone obscures root crown.	Remove - Refer
986	18	Pacific dogwood	9	4	CITY	Y OPEN	F	N/A	N/A	N/A	• Stem damaged at 1.0m above grade on the northwest side. • Narrowly bifurcated at 0.5m with a bark inclusion.	Remove - Refer
987	19	Douglas-fir	10	3	ON	Y OPEN	VP	U	L	NIL	• Girdling roots over root crown. • Root growth restricted by existing hardscape. • Object embedded in the stem at base.	Remove
988	25	linden	14	5	ON	M OPEN	F	U	M	NIL	• Stem historically damaged on the east side - likely due to vehicle contact. • Historic placement of excess fill obscures the root crown. • Lean to the north.	Remove
989	26	Western redcedar	6	1	ON	M OPEN	VP	U	L	NIL	• Root zone restricted by existing curb 2.0m to the northwest. • Open column of decay on the east side of the stem extending from the historic topping site at 2.0m to base.	Remove
990	30	Western redcedar	6	1	ON	M OPEN	VP	U	L	NIL	• Historically shear pruned into a topiary. • Historically shear pruned into a topiary - to excess, exposing the crown interior and resulting in crown loss on the west side.	Remove

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Tag #	Dbh	Tree Type	Tol	Ht	Spr	Loc	Age Class	Cond	Viab	Value	Priority Description, Main Defects (if any), and Construction Impact/Mitigation	Action
991	36	Western redcedar	6	1	ON	M OPEN	VP	U	L	NIL	• Historic aggressive shear pruning into a topiary. • Stem damaged on the west side at base with missing bark.	Remove
992	37	Western redcedar	6	2	ON	M OPEN	VP	U	L	NIL	• Historically shear pruned into a topiary to mitigate aerial conflict with parking lot. • Multiple co-dominant leaders embedded in the crown and well limb-tied.	Remove
993	15	Green ash	10	5	ON	M OPEN	F	U	L	NIL	• Sweep to the north corrected at 2.0m above grade. • High crown and poorly tapered stem.	Remove
994	11	Green ash	10	3	ON	Y OPEN	VP	U	L	NIL	• Dieback (10%) on the south side.	Remove
995	13	Green ash	10	4	ON	Y OPEN	F	U	L	NIL	• Narrowly bifurcated at 2.0m above grade. • Dieback in the low crown on the north side.	Remove
996	10	Green ash	10	3	ON	Y OPEN	VP	U	L	NIL	• Poorly tapered stem with high crown. • Poorly tapered stem with excessive epicormic growth.	Remove
997	11	Green ash	6	4	ON	Y OPEN	VP	U	L	NIL	• Sun scalded stem between 4 and 8.0m above grade. • Historically topped at 3.0m above grade, resulting in decayed pruning wounds and the development of a weakly structured crown.	Remove
998	28	Flowering cherry	15	6	ON	M OPEN	VP	U	L	NIL	• Multiple co-dominant scaffold branches narrowly attach at 2.0m above grade with a bark inclusion. • Historically pruned via heading cuts over the parking lot, resulting in decayed pruning wounds.	Remove
999	57	Horsechestnut	20	7	OFF	M OPEN	G	N/A	N/A	N/A	• Multiple co-dominant scaffold branches narrowly at and above 2.0m with bark inclusion and seeping water.	Remove - Refer
5001	15	Mountain ash	5	3	CITY	M OPEN	F	N/A	N/A	N/A	• Growing in cut-out planter in the sidewalk.	PROTECT
5002	est. 13	Norway maple	10	4	CITY	M OPEN	F	N/A	N/A	N/A	• Dense moss growth obscures branches throughout the crown • Access restricted due to current construction activity. • Protection measures not in place and encroachments observed within the root zone (i.e. storage, trailers etc.)	PROTECT
5003	30	Green ash	14	9	CITY	M OPEN	VP	N/A	N/A	N/A	• Severe bow to the southeast over the road. • Stem damaged and missing bark (50% circumference) at 4.0m above grade due to historic vehicle contact. • Historic removal of co-dominant scaffold branch - 1.8m above grade on the south east side has resulted in a large, decayed wound.	PROTECT - Refer
5004	8	Horsechestnut	4	2	CITY	Y OPEN	VP	N/A	N/A	N/A	• Embedded in the crown of adjacent tree, resulting in a bow and asymmetrical crown biased to the south. • Large injury to the stem on the east side (50% circumference). • Historically pruned via heading cuts over the road. • Seek Parks department approval to remove this tree due to direct conflict with the new commercial and office driveway entrance	Remove - Refer
5005	30	Horsechestnut	10	4	CITY	M OPEN	VP	N/A	N/A	N/A	• Large, open decayed cavity on the northwest side of the stem from 0.8- 1.2m above grade - probed to a depth of 16cm.	PROTECT - Refer

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Tag #	Dbh	Tree Type	Tol	Ht	Spr	Loc	Age Class	Cond	Viab	Value	Priority	Description, Main Defects (if any), and Construction Impact/Mitigation	Action
5006	60	Horsechestnut		16	8	CITY	M OPEN	VP	N/A	N/A	N/A	• Historically topped between 4 and 6.0m above grade, resulting in large, decayed pruning wounds. • Longitudinal in-turned seam from 3.5m above grade to an open cavity at 2.0m - seeping water. • Longitudinal shear plane crack on scaffold branch on the north side over the sidewalk.	PROTECT
5007	10	Red maple		9	2	CITY	Y OPEN	VP	N/A	N/A	N/A	• Longitudinal crack on the stem from 0.3-1.0m above grade on the southwest side. • High, narrow crown.	PROTECT
5008	55	Horsechestnut		14	6	CITY	M OPEN	F	N/A	N/A	N/A	• Historically topped at a height of 6.0m above grade, resulting in large, decayed pruning wounds. • Historic placement of excess fill obscures the root crown. • Sounding suggests significant internal defect above 2.5m. • Seek Parks department approval to remove this tree due to direct conflict with the proposed new residential and loading bay entrance.	Remove - Refer

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APPENDIX C

TREE PROTECTION SPECIFICATIONS

1. **CONTACT INFORMATION:**
   All tree protection questions, clarifications and coordination, should be directed to:
   ARBORTECH CONSULTING *OFFICE:* ***604 275 3484*** *EMAIL:* ***trees@aclgroup.ca***
   A project arborist will be assigned by our office to schedule a pre-construction meeting, and coordination of supervision protocols will be established.
2. **TREE PROTECTION ZONES (TPZ):**
   Tree protection setbacks are defined on our drawings and documents relative to the centre of the tree trunk where it emerges from the ground and/or the actual extent and spread of the crown or roots of the tree. The ***TPZ*** is comprised of three main components:
   CPZ – CROWN PROTECTION ZONE SETBACKS:
   Specified by the project arborist to be at a minimum of the dripline extents of the crown (furthest reaching branches and foliage) plus 1.0 m. Restrictions on any aerial encroachment within a CPZ are required in order to protect from tree damage. This includes interim needs during site preparation or construction (machinery, cranes, trucks, vehicles, etc.), design elements (new structures, etc), and the working space required to build or maintain them. Pruning may be possible to accommodate certain encroachments but some encroachments may not be feasible within tolerances for impacts – consult with project arborist to confirm.
   RPZ – ROOT PROTECTION ZONE SETBACKS:
   A specified setback denoting the closest limits of soil/root disturbance determined by the project arborist based on; tree species, size, age class, condition, soil type and depth, drainage, topography, wind exposure and changes thereof, constrained root conditions, and acceptable thresholds specific to those factors. RPZ alignments that are smaller than the CPZ may be supported conditional to; the locations of the design features being sufficiently set back to allow for building space and grade transition, the aerial encroachment of that design feature within the CPZ being of tolerable impacts, and/or implementation of special remedial measures or enhancement treatments.
   WSS – WORKING SPACE SETBACKS:
   A setback zone to the specified offset from the ***RPZ*** (see tree management drawing) where all proposed site changes or construction work is to be supervised by the project arborist. Demolition of existing structures or hard landscape features will require low impact methods, and any excavations within this zone will require on-site direction and root pruning services of the project arborist.
   The design professionals should consider the above, as well as the rest of this document in preparing the project designs.
3. **TREE PROTECTION ZONE RESTRICTIONS:**
   Trees that are specified to be retained must be protected from damage during all phases of development related work on the site. Any access or construction related work within the TPZ (CPZ, RPZ and/or WSS) requires advance approval, guidance and on-site direction or supervision by the project arborist. General restrictions in the ***TPZ*** are as follows:
   - No soil disturbance of any scope or to any depth for cuts or fills, including but not limited to; trenching, stripping of over-burden, bulk excavation, fill placement, site preparation, grade transitions, topsoil placement, etc.,
   - No passage or operation of machinery, trucks, vehicles or equipment (including small track machines, skid steers, lifts, etc), except as approved and directed by the project arborist, and subject to special measures.
   - No storage of soil, spoil, gravel, construction materials, waste materials, etc.,
   - No waste or washing of concrete, stucco, drywall, paint, or other potentially harmful materials,
   - No placement of temporary structures or services,
   - No affixing lights, signs, cables or any other device to retained trees,
   - No pruning or cutting of retained trees, except as approved and directed by the project arborist, and performed by a qualified tree service firm employing ISA Certified Arborists and working to ANSI A300 and ANSI Z133 Standards.
   - No landscape finishing, such as but not limited to; installing retaining walls, digging planting holes, placing growing medium, installing irrigation or conduit, etc., except as approved and directed by the project arborist.
4. **TENDERING, IFC DRAWINGS AND CONSTRUCTION MANAGEMENT:**
   Tendering of the project, issuance of the IFC drawings and documents (architectural, civil, landscape, mechanical, geo-technical, etc.) as well as planning of the construction (demolition, site clearing, excavation, shoring, access/egress, crane operations, etc.) should be coordinated with the tree protection specifications herein and the measures outlined as specified on the ***Tree Management Drawing*** prepared by this office. Any conflicts with the TPZ's identified by the project team or the contractor will require additional detailed review by the project arborist in advance of proceeding.
5. **BARRIERS – TREE PROTECTION FENCES:**
   Barriers should be erected at the CPZ setback where possible, but must be installed no closer to the RPZ specified alignments as a minimum tree protection measure. Signs stating "TREE PROTECTION ZONE - NO ENTRY" must be placed on the tree protection fence at a suitable frequency at the direction of the project arborist. The contractor, sub-contractors and trades should be made aware of the restrictions therein (see above). The barriers must be maintained at those alignments in good condition, and may not be removed for any reason (including landscaping), unless prior approval from the project arborist is obtained.
6. **SURVEYING:**
   Tree locations are derived from the project survey, and any discrepancies should be coordinated with their office directly and reported to the project arborist.
   Tree barriers aligned with or within close proximity to a property line, a design feature, a restrictive covenant line, and/or an environmentally sensitive or protected area may require a survey in advance to enable accurate barrier installation.

APPENDIX C

TREE PROTECTION SPECIFICATIONS

7. TREE PRUNING, TREATMENTS, ENHANCEMENTS AND SPECIAL MEASURES:

The developer and their contractors are responsible to ensure completion of enhancement or remedial tree treatments, and proactive tree protection measures for retained trees as specified by the project arborist, including but not limited to;

- Pruning for risk mitigation, crown restoration, form, building or overhead clearance, and/or sight lines.
- Pre-treatments such as root mapping, vertical aeration, advance root pruning and other treatments.
- Installation of soil amender (i.e. mulch) within the ***RPZ*** to mitigate soil desiccation and to improve soil fertility.
- Supplemental watering to compensate for soil hydrology changes.
- Low impact removal for stumps located within a ***CPZ*** (i.e. stump grinding or cutting with project arborist supervision).
- Windfirming of new forest edges created by clearing of the development lands, including: re-assessment, tree removals, pruning, modification to wildlife tree, or other treatments as specified by the project arborist.

See the tree management drawing for further details.

8. DEMOLITION OR PRE-CONSTRUCTION OPERATIONS:

If tree removal permits are issued at this stage, please review next item also. Note that some municipalities will not approve tree removal at the demolition phase. Tree barriers may need to be installed prior to demolition and/or the municipality may require on-site direction and supervision by the project arborist during the process of demolishing existing structures and hardscapes. In some cases tree protection barriers must be realigned, and restoration of the zone undertaken, after demolition is complete. A letter of undertaking (***LOU***) confirming supervision may be required by, or may be on file with, the municipality. The demolition contractor will need to coordinate with the project arborist accordingly.

9. TREE REMOVAL/CLEARING OPERATIONS:

A copy of the tree permit must be provided to the project arborist to check for congruency with our tree management drawing. Note that neighbour approvals, additional municipal permits and/or authorizations from regulatory bodies may be required and are the responsibility of the developer or their assigned representative. Certain trees requiring removal may not be shown or referenced on the drawing or documents prepared by this office (i.e. undersize or non-bylaw trees or untagged trees assessed in groups). There are often removal trees (identified or unidentified on our drawings) that require felling, extraction and stump removal from TPZ's using low impact methods. Only the trees shown for retention within a tree protection zone as specified on our tree management drawing shall be retained (unless otherwise directed by the developer). The contractor and/or the land clearing subcontractor should verify the tree removal and clearing scope based on their own site investigation. The developer/owner and their contractor should also coordinate with the project arborist in advance to identify retained trees, identify low impact removal trees, review the work plan, and to ensure contractor compliance with the tree protection measures specified.

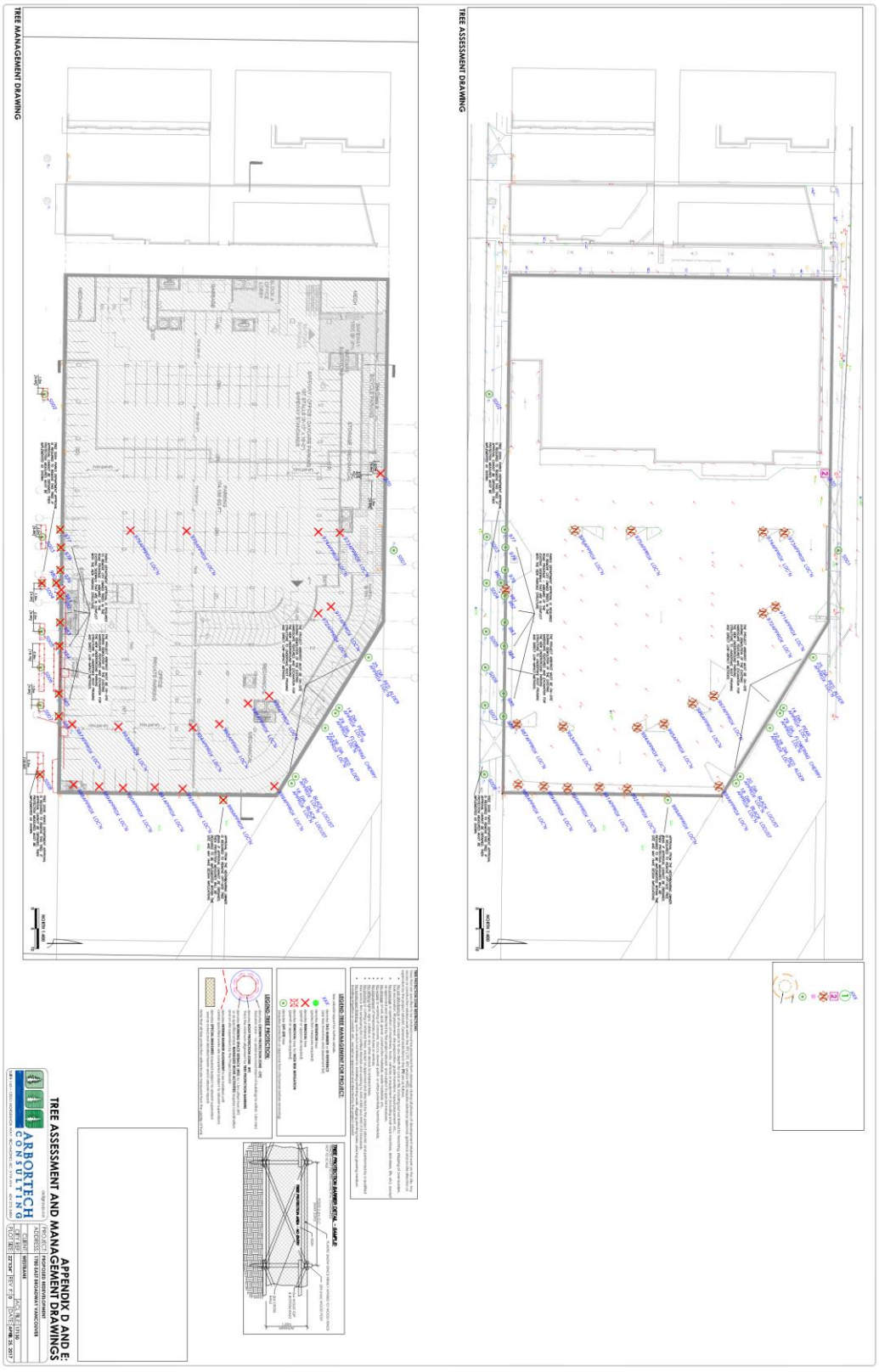
10. CONSTRUCTION OPERATIONS:

A letter of undertaking (***LOU***) for arborist supervision may be on file with the municipality. The contractor (project manager/site superintendent) and the developer are encouraged to proactively meet with the project arborist in advance of commencing work on the project to; establish communication and procedural protocols, review responsibilities for tree protection measures at specific milestones of the project, and identify and resolve any anticipated tree protection related challenges. Pursuant to the Tree Protection Zone Restrictions noted above, the trunks, branches, foliage and roots of retained trees, as well as the soil within the TPZ, must not be damaged by construction activities. Careful attention to excavation, access/egress, servicing, and machinery equipment and crane operation in proximity to the height and size of the TPZ's is recommended. Note that pruning to reduce the height of retained trees (topping or heading) CANNOT be accommodated. It is recognized that certain unpredictable construction conflicts with a TPZ may arise that could interfere with the protection of the selected trees, however any proposed encroachment into a TPZ and/or changes to the tree retention scheme are subject to approval in advance by the project arborist and the municipality. Special measures required for tree protection compliance related to construction work in the ***CPZ*** or within an ***RPZ*** may be feasible to accommodate managed encroachments into a ***TPZ***, such as but not limited to:

- Root mapping by the project arborist.
- Installing armour or suspended structures over the soil within the ***RPZ*** to accommodate temporary worker or equipment passage within a ***TPZ***. Several types of armouring may be available. Implementation is at the discretion of the project arborist and may be conditional to municipal approvals.
- Low impact trenching using air-vac or hydro-vac, with arborist supervision, to accommodate underground services or utilities. This option is restricted as to viability by; proximity, scope, depth, shoring needs, tree species, site/soil conditions and other factors.

11. LANDSCAPING OPERATIONS:

Removal of the tree barriers requires advance coordination and approval by the project arborist. The operation of equipment of any size or type, the placement of growing medium, all grading and sub-base preparation for hard landscape features. (i.e. sidewalks and patios), site preparation for retaining walls and footings, excavation for fences, signs and other landscape features, digging of planting holes for new plants and trees, the digging of trenches for irrigation, drainage and lighting infrastructure, and the placement of turf and other surface finishing, all have a high potential for causing damage to trees, roots or soil. Advance coordination between the landscape contractor and our office prior to landscape operations commencing is required to avoid tree protection non-compliance and bylaw issues.


TREE MANAGEMENT DRAWING
TREE ASSESSMENT DRAWING
APPENDIX D AND E:
TREE ASSESSMENT AND MANAGEMENT DRAWINGS
ARBORTECH
CONSULTING

LETTER OF ASSURANCE – LETTER OF UNDERTAKING

FOR FIELD SERVICES BY PROJECT ARBORIST DURING CONSTRUCTION

April 26, 2017 ACL File: 17130

Attn.: **staff – City of Vancouver**

Project: Proposed Re-Development

Site Address: 1780 East Broadway, Vancouver

Ref Documents: Tree Management Report and Appendices (A-F)

Pursuant to municipal requirements, the owner has retained Arbortech Consulting as **Project Arborist**. The owner and/or contractor takes responsibility to ensure our attendance prior to and during construction to; review the scope of work, determine possible tree impacts, and provide on-site direction for low impact methods and materials so that tree and tree root protection can be achieved to municipal and project arborist satisfaction. In addition to the restrictions on access within the Root Protection Zones (RPZ), on site Project Arborist attendance is required when the following construction related events occur within the Crown Protection Zone (CPZ) or within the Working Space Setback (WSS) of a retained or protected tree as identified on the Tree Management Report and Drawing prepared by this office:

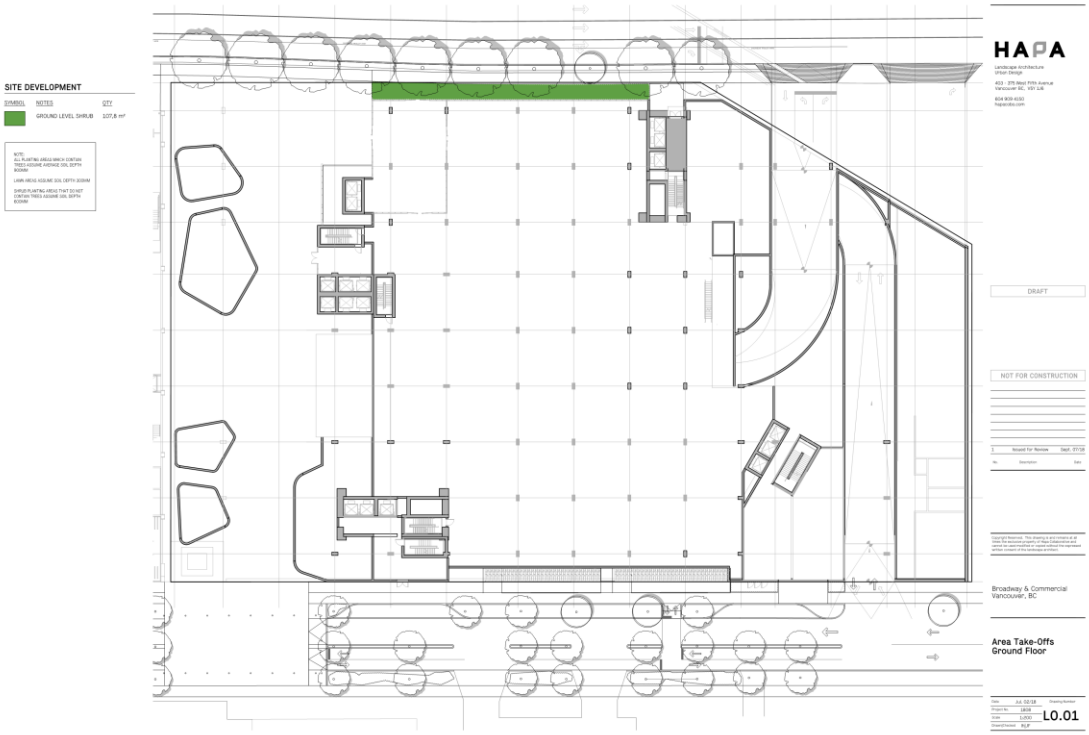
1. **Any grade changes or soil disturbance of any scope**
2. **Sub-base preparation for driveway or site access**
3. **Demolition of any existing buildings and hard landscapes**
4. **Any tree pruning, removal or stump removals**
5. **Site preparation and civil works**
6. **Trenching or excavation for installation of any underground services or utilities**
7. **Excavation or striping for new building foundation or for preparation of hardscape installations**
8. **Installation of site fill and related retaining walls and fences**
9. **Any landscape installation and finishing**

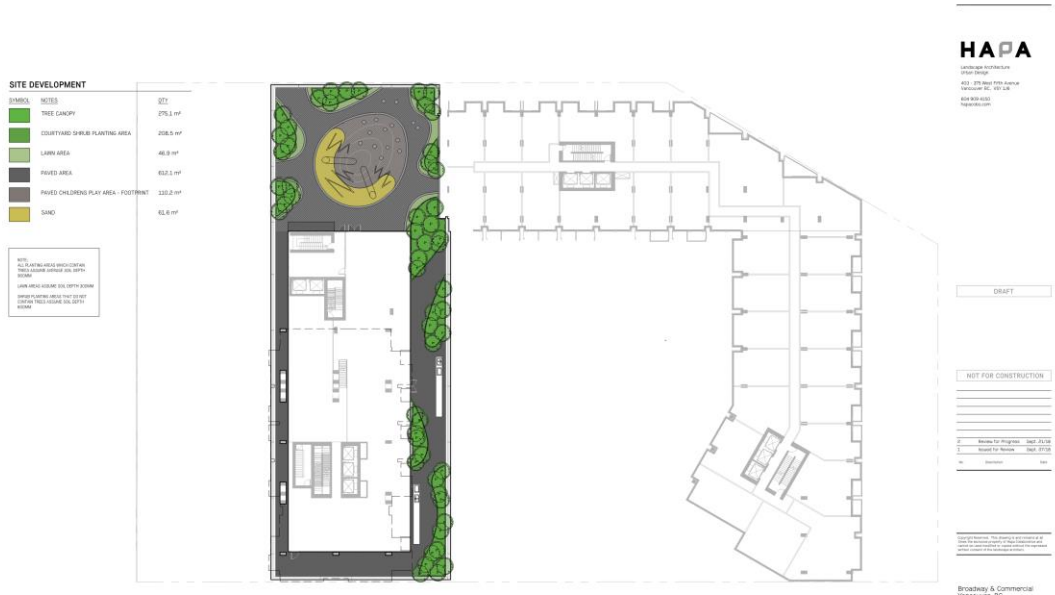
Site review reports are required to be issued after each site visit to the city, the owner, and the general contractor, and a final sign-off report is required after completion of construction and landscaping. By signing below, the contractor and owner(s) agree that they;

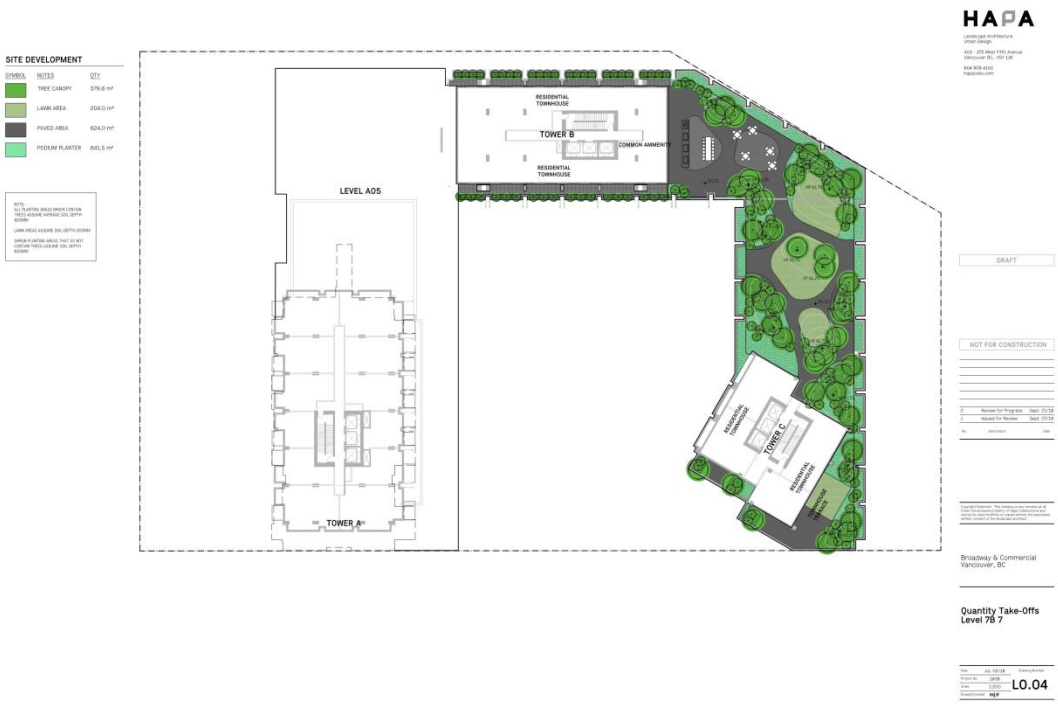
- Have retained Arbortech Consulting on an hourly charge-out basis accordingly,
- Have read and understand the standard Arbortech Consulting ***Tree Protection Specifications*** (see attached or reference documents),
- Will provide Arbortech Consulting with all relevant design drawings and report any design changes that may require work within the driplines of retained trees and/or influence tree protection zones,
- Will ensure that Arbortech Consulting is contacted with a minimum of **3 business days advance notice** to arrange attendance by the project arborist at required times, and
- Will comply with project arborist directed and supervised work in conformance with arboricultural standards and best management practices, and using low impact materials and methods as directed.
- If non-compliance or unsupervised encroachments occur, the owner agrees to our hourly rates for Arbortech Consulting to undertake investigation and remedial treatment services as we deem to be necessary.

Submitted by:	Signed by:	Signed by:
Nick McMahon **Project Arborist** Contact for Scheduling: Phone: **604 275 3484** Email: **trees@aclgroup.ca**	_____ **General Contractor** _____ Print Name Phone: _____ Email: _____	_____ **Owner(s) or Owner Agent** _____ Print Name(s) Phone: _____ Email: _____

Appendix B-Landscape and Urban Agriculture Plan




SITE DEVELOPMENT
SYMBOL
NOTES
QTY
TREE CANOPY
COURTYARD SHRUB PLANTING AREA
LAWN AREA
PAVED AREA
PAVED CHILDRENS PLAY AREA - FOOTPRINT
SAND
HAPA
DRAFT
NOT FOR CONSTRUCTION
Broadway & Commercial
Vancouver, BC
Quantity Take-Offs
Level 5A
L0.03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SYMBOL
NOTES
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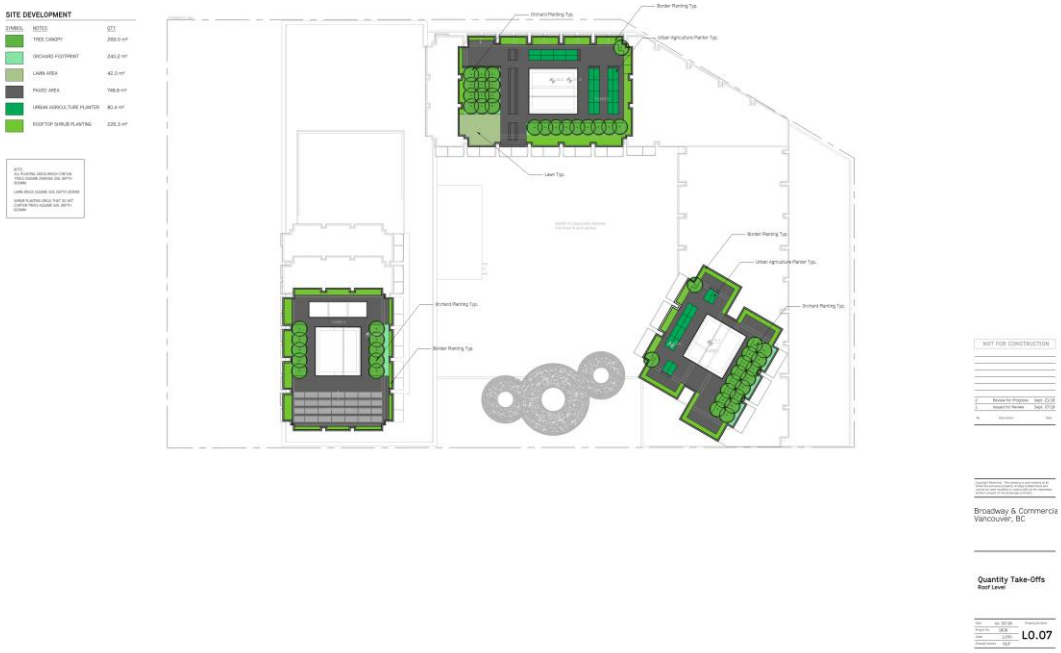
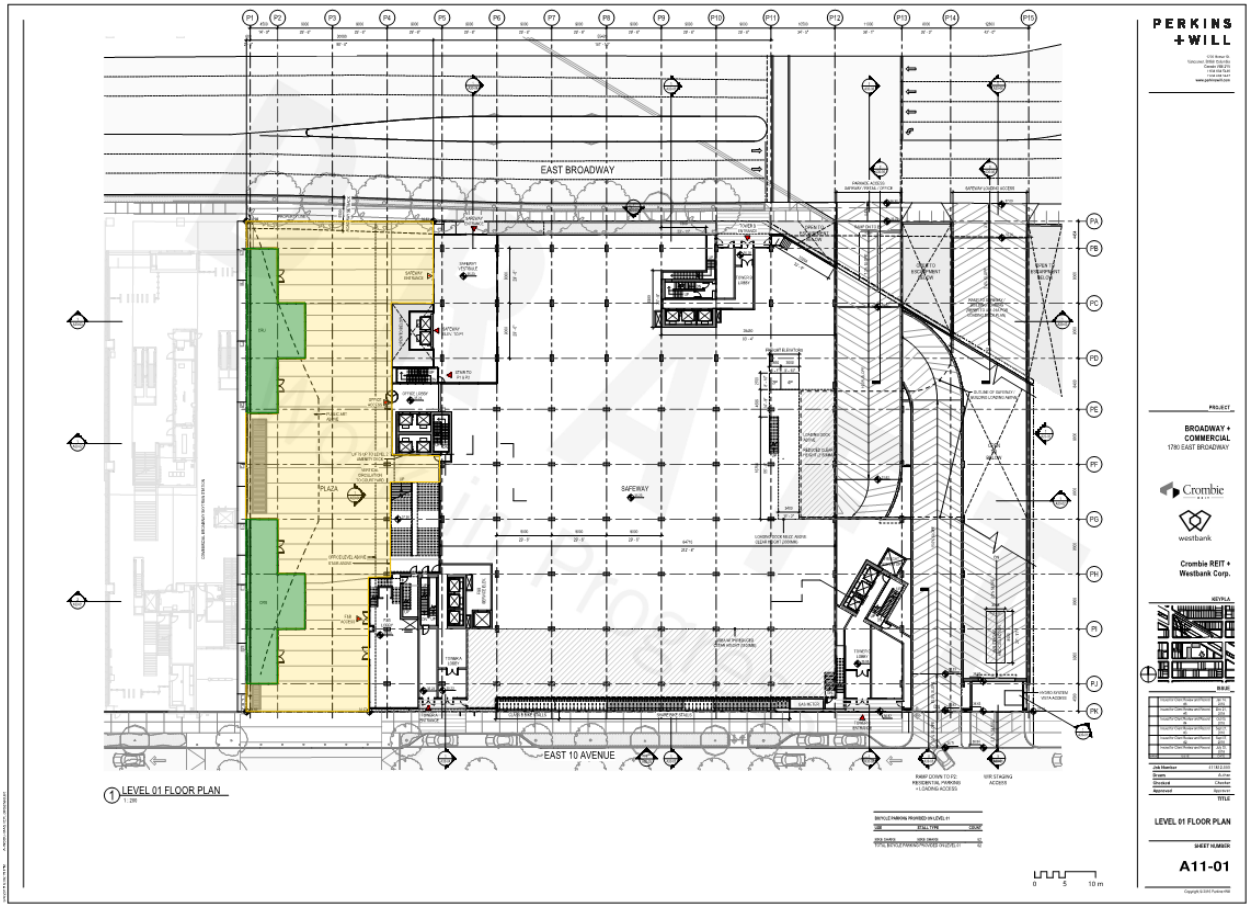
TREE CANOPY
LAWN AREA
PAVED AREA
PODIUM PLANTER
RESIDENTIAL TOWNHOUSE
TOWER B
COMMON AMMENITY
LEVEL A05
TOWER A
TOWER C
HAPA
DRAFT
NOT FOR CONSTRUCTION
Broadway & Commercial
Vancouver, BC
Quantity Take-Offs
Level 7B 7
L0.04


SITE DEVELOPMENT
SYMBOL
NOTES
QTY
TREE CANOPY
ORCHARD FOOTPRINT
LAWN AREA
PAVED AREA
URBAN AGRICULTURE PLANTER
ROOFTOP SHRUB PLANTING
Orchard Planting Typ.
Border Planting Typ.
Urban Agriculture Planter Typ.
Lawn Typ.
HAPA
NOT FOR CONSTRUCTION
Broadway & Commercia
Vancouver, BC
Quantity Take-Offs
Roof Level
L0.07

Appendix C-Landscape Calculations

	Tree Canopy Area (m sq)	Street Tree Canopy	Planter with trees (900mm depth)	Urban Agriculture Planter	Planter with shrubs (600mm depth)	Planter with Lawn (300mm)	Vegetative cover (m2)
L1		1574			107.8		107.8
L2	1333		202		1119	391.5	1712.5
L5A	275.1				208.5	46.9	255.4
L7B +7C	579.2				641.5	204	845.5
L16A, 18B + 18C (roof)	269		240.2	80.4	226.3	42	588.9
L24A							0
Balconies Lush (2.1m sq)							
Tower A (92)					193.2		193.2
Tower B (101)					212.1		212.1
Tower C (60)					126		126
Balconies Neat / Orderly (1.2m sq)							
Tower A (92)					138		138
Tower B (83)					124.5		124.5
Tower C (30)					45		45
Total Area (m sq)	**2456.3**	**1574**	442.2	80.4	3141.9	684.4	**4348.9**
Tree Canopy Calculations targeting "10-15% of Total Site"							
Percent of Total Parcel Area (m2) 9819	25%	Not included					
Percent of Parcel + Public Area (m2) 10861	37%	Included					
Vegetation Cover Calculations targeting "40% of Private Propery"							
Percent of Parcel Area (m2) 9819							44%
Percent of Parcel Area no plaza (m2) 7827							56%
Soil Volume (m3)			397.98		1885.14	205.32	**2488.44** Total

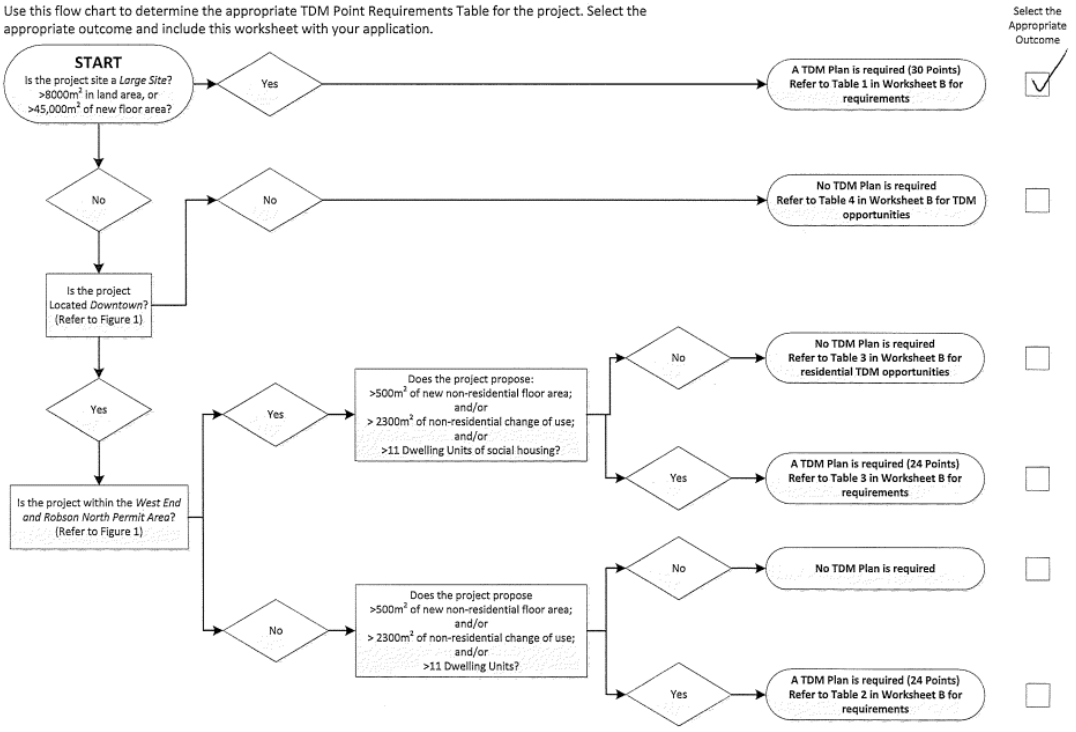
Appendix D-Public Plaza Plan



Appendix E-Transportation Demand Management Plan

WORKSHEET A: TDM Requirements Flow Chart

Use this flow chart to determine the appropriate TDM Point Requirements Table for the project. Select the appropriate outcome and include this worksheet with your application.



Administrative Bulletin: Transportation Demand Management for New Development in Vancouver
Schedule A - TDM Plan Summary Worksheets

WORKSHEET B: TDM Point Requirements

Refer to Worksheet A to determine the appropriate Table for the project.

Table 1 - TDM Point Targets for Large Sites

The following requirements apply to large sites with >8000m^2 in land area, or >45,000m^2 of new development floor area.

Select the appropriate target for each development land use. Minimum targets for each land use must be met individually; however TDM measures available to multiple land uses may count towards the requirements of all those land uses.

Note that for large sites, at least eight (8) of the required points must come from shared vehicles.

Development	Required Points
Residential	
Residential - Social housing	☑ Fewer than 12 dwelling units, no TDM requirement ☐ For 12 dwelling units or more, a minimum of 18 points.
Residential - Strata	☐ Fewer than 12 dwelling units, no TDM requirement ☐ For 12 to 24 dwelling units, a minimum of one (1) point per dwelling unit; ☑ For 25 or more dwelling units, a minimum of 30 points;
Residential - Rental	☐ Fewer than 12 dwelling units, no TDM requirement ☐ For 12 to 24 dwelling units, a minimum of one (1) point per dwelling unit; ☑ For 25 or more dwelling units, a minimum of 30 points;
Commercial	
Commercial - Office	☐ Less than 500 m^2, no TDM requirement ☐ For 500 to 1,000 m^2 a minimum of 0.024 points per m^2; ☑ For greater than 1,000 m^2 a minimum of 30 points;
Commercial - Retail/Service	☐ Less than 500 m^2, no TDM requirement ☐ For 500 to 1,000 m^2 a minimum of 0.024 points per m^2; ☑ For greater than 1,000 m^2 a minimum of 30 points;
Other	
All other land uses	☐ Up to 30 points, to be determined on a case-by-case basis by the Director of Planning in consultation with the General Manager of Engineering Services.
Change of Use	
Change of use, all land uses	☐ For 2,300 m^2 or more, 30 points, to be determined by the Director of Planning in consultation with the General Manager of Engineering Services.

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Schedule A - TDM Plan Summary Worksheets 3

WORKSHEET C: Transit Accessibility Parking Reductions

A project may be eligible for minimum parking reduction based on high levels of Transit Accessibility. Refer to the table below to determine the parking requirement reduction available to each land use in the proposed development.

Transit accessibility parking reductions are in addition to parking reductions achieved through the provision of TDM measures.

Accessibility Levels

☑ **Level A** Within:
- 100 m walking distance of any one (1) existing FTN route, including B-Line stops only, or
- 200 m walking distance of any intersection of two (2) existing FTN routes, including B-Line stops only, or
- 400 m walking distance of a SkyTrain station

☐ **Level B** Within:
- 101 m to 200 m walking distance of any one (1) existing FTN route, including B-Line stops only, or
- 201 m to 400 m walking distance of any intersection of two (2) existing FTN routes, including B-Line stops only, or
- 401 m to 800 m walking distance of a SkyTrain station

☐ **Level C** Greater than:
- 200 m walking distance of any one (1) existing FTN route, including B-Line stops only, or
- 400 m walking distance of any intersection of two (2) existing FTN routes, including B-Line stops only, or
- 800 m walking distance of a SkyTrain station

FTN is the Frequent Transit Network, as defined by TransLink.

Table 5 - Parking Requirement Reduction by Land Use and Transit Accessibility

Land Use	Transit Accessibility		
	Level A	Level B	Level C
Residential - Social Housing Residential - Rental (except social housing)	20%	10%	0%
Residential - Strata Commercial - Office Commercial - Retail / Service Other	10%	5%	0%

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Schedule A - TDM Plan Summary Worksheets 7

4241-52
Broadway + Commercial
TDM Measures

Code	Description	Details	Maximum Points Achieved				Notes
			Residential Strata	Residential Rental	Commercial Office	Commercial Retail	
ACT-02	Improved Access to Class A Bicycle Parking	An entry for bicycles fully separated from the vehicle ramp for bicycle parking located underground.	2	2	2	2	
ACT-03	Enhanced Class B Bike Parking	Provide enhanced visitor Class B bicycle parking, consisting of well-lit, secure, indoor facilities, excellent access design with respect to : lighting, finishes, grades, convenience. Project requires 36 Class B for Residential and 18 for Commercial	2	2	2	2	
ACT-05	Bike Maintenance Facilities	Include bicycle maintenance facilities in a designated, secure area within the building with proper drainage, where sufficient workspace with bicycle maintenance tools and supplies are readily available on a permanent basis and offered in good condition to encourage bicycling.	2	2	2	2	
ACT-07	Public Bike Share Space	Provide space for Public Bike Share (PBS). It is assumed this would still applies based on what was shown on previous scheme.	8	8	8	8	
ACT-09	Walking Improvements	Provide large sacle improved and enhanced pedstrian facilities off-site. The project is providing a public plaza with pedestrian linkage to the SkyTrain station from the site.	6	6	6	6	
COM-02	Carshare Vehicles and Spaces	Provide publicly accessible two-way car share vehicle(s) and space(s) on-site for at least 3 years, up to the following ratios: • Residential - Strata: A minimum of one (1) car share vehicle and space for every 50 Dwelling Units (9 required for 8 points); • Residential - Rental: A minimum of one (1) car share vehicle and space for every 25 Dwelling Units (10 required for 16 points); • Commercial - Office: Up to one (1) car share vehicle and space for each 4,600 square metres of gross floor area (2 required for 8 points). • Commercial - Retail: Up to one (1) car share vehicle and space for each 4,600 square metres of gross floor area (2 required for 3 points).	4	8	8	3	Assume 5 car-share spaces and vehicles are provided. TDM points can be adjusted based on number of car-share vehicles provided.
SUP-03	Multi-modal Wayfinding Signage	Provide multi-modal wayfinding signage - probably at the plaza	Not Available	2	2	2	
PKG-02	Parking Supply	Provide off-street parivate vehicular parking in an amount no greater than the minimum parking requirement.	2	2	2	2	
OTH-01	Innovative Strategies (Points awarded subject to City's discretion)	Unbundling Parking (i.e. the sales of parking stalls is separated from the sales of the unit. Similarly, the rent for the parking space is sepearated from the base rent for the rental units)	1	1	To be confirmed	Not Used	
OTH-01	Innovative Strategies (Points awarded subject to City's discretion)	Provide 10% of Class A bicycle parking spaces to be sized for non-standard bikes (i.e. cargo, recumbent, trailers, etc.)	1	1	1	1	
OTH-01	Innovative Strategies (Points awarded subject to City's discretion)	Offer on-site bike repair services to residents on a semi-annual basis for 10 years	Not Used	1	1	Not Applicable	
OTH-01	Innovative Strategies (Points awarded subject to City's discretion - City confirmed up to 2 points will be awarded for Day Care)	Provision of On-site Day Care Facility	2	2	2	2	
		Total	**30**	**37**	**36**	**30**	

Appendix F-Integrated Rainwater Management Plan

Binnie File No. 16-0858

RAINWATER MANAGEMENT PLAN PRELIMINARY DESIGN

Westbank Corp.

City of Vancouver

Commercial + Broadway
1780 East Broadway

September 26, 2018
Revised: March 25, 2019

Reviewed by:
Russell Warren, P.Eng, LEED Green Associate
Senior Project Manager, Associate

Prepared by:
Donal Casey, P.Eng
Design Engineer

R.F. BINNIE & ASSOCIATES LTD.
300 - 4940 Canada Way,
Burnaby, BC V5G 4K6
Main: 604-420-1721

OQM CERTIFIED

BINNIE

TABLE OF CONTENTS

APPENDICES

1 INTRODUCTION

Westbank is proposing a multi-family residential/commercial development at 1780 East Broadway southeast of the Commercial Street intersection in Vancouver, BC. The subject property is currently zoned C-3A commercial and is proposed to be rezoned to accommodate a 24-storey mixed use building. The proposed development includes removal of the existing commercial building and construction of up to 24 storeys of residential units plus office space, ground floor retail space, and below grade parking.

The City of Vancouver's *Rezoning Policy for Sustainable Large Developments* requires that a Rainwater Management Plan (RWMP) be prepared and submitted for this development. R.F. Binnie & Associates Ltd., who has been retained by the Developer as the civil engineering consultant on this project, has prepared the following preliminary RWMP in line with these requirements and the City of Vancouver's *Citywide Integrated Rainwater Management Plan*.

2 EXISTING CONDITIONS

The project site is approximately 0.97 hectares and is bounded by East Broadway to the north, East 10th Avenue to the south, the Commercial - Broadway SkyTrain station and Expo Line to the west, and multi-family mid-rise buildings to the east. A Safeway building is located at the west side of the property and the remainder almost entirely consists of paved surface parking. The site is essentially flat and the surface area is almost entirely impervious.

The site is currently serviced by the City's municipal combined sewer main on East 10th Avenue. There is also an existing storm main along East Broadway.

3 PROPOSED DEVELOPMENT

The proposed high density mixed-use development consists of several buildings up to 24-storey with multiple levels of underground parking. A new storm service connection will be required to service the proposed development, subject to approval by the City of Vancouver. Given the existing site usage, the proposed development reduces the impervious site coverage by incorporating landscaped areas within and around the perimeter of the site. Refer to **Appendix C** for a conceptual landscaping plan.

An on-site rainwater management system shall be implemented as outlined in Section 5, to control runoff quantity and water quality.

4 RAINWATER MANAGEMENT DESIGN CRITERIA

The design criteria referenced to propose a rain water management strategy for the proposed site are from two sources:

- The City of Vancouver's Sustainable Large Development Rezoning Policy
- The City of Vancouver's Citywide Integrated Rainwater Management Plan (IRMP)

The City's rainwater management targets include capturing or reusing the rainfall from frequent rain showers, treating additional runoff from large storms, and providing runoff routes during extreme storm events. Quantity and quality control targets are outlined in the following sections.

4.1 Quantity Control

City of Vancouver requirements for Sustainable Large Developments:

- Post-development runoff rate and volume = pre-development runoff rate and volume, for the 2-year 24-hour duration storm.

City of Vancouver Citywide IRMP:

- Capture a minimum of 50% of the 6-month/24-hour post-development volume from effective impervious areas, other than collector/arterial roads in all land uses and either infiltrate to ground, evapotranspiration, or reuse the captured rainfall.
    - Equivalent to capturing the first 24mm per day.
- For developments defined as 'large scale developments', reduce post-development runoff rate and volume to at or below the pre-development runoff rate and volume for the 2-year/24-hour duration storm.

4.2 Quality Control

City of Vancouver requirements for Sustainable Large Developments:

- Treat 90% of the average run-off volume.
- The practices used to treat runoff must be capable of 85% TSS removal.

City of Vancouver Citywide IRMP:

- Treat 90% of the volume of runoff from effective impervious areas, other than roof in low density residential land uses, to the water quality standards – yellow or green – for piped drainage set out in Monitoring and Adaptive Management Framework for Stormwater, Metro Vancouver, 2014.
    - Equivalent to treating an additional 24mm of rainfall per day (48mm total).

5 RAINWATER MANAGEMENT PLAN

Control of runoff quantity and water quality will be achieved through the implementation of rainwater management features selected based on Best Management Practices (BMPs) outlined in the City's IWMP. Preliminary drainage analysis and proposed strategies considered suitable for this project are addressed in the following sections.

The existing site soils limit the infiltration potential of the site and the extents of the proposed building and underground parkade limits the opportunity to capture and infiltrate rainwater on-site. Nonetheless, the proposed rainwater management plan has been designed to meet the City's rainwater management criteria through a series of rainwater management strategies. Design of the rainwater management features will be coordinated with the landscape architect and mechanical engineer.

5.1 Rainwater Management Features

The rainwater management features that are to be considered for this site have been selected with Best Management Practices (BMPs) in mind. While limitations of the subject property render some BMPs impractical or impossible, an effort will be made to maximize the application of BMPs. Table 5-1 summarizes which BMPs are to be considered in the proposed redevelopment, and which are omitted.

Table 5-1 - Best Management Practices Selection

BMP	Proposed for Project?	Comment
Absorbent Landscaping	✓	Planters and soft landscaped surface finishes provide aesthetic means of rainwater source control. A minimum of 450mm of topsoil overlain by sod and other absorbent landscaping materials will comprise the finished soft surface areas around the building. The absorbent landscaping material acts as a natural filter for the rainwater prior to infiltrating into the ground.
Rain Gardens	x	The extents of the underground parkade does not allow for native soil beneath the landscaped surfaces. Rain gardens could regularly flood as they may not have adequate capacity to absorb concentrated flows from a large drainage area.
Infiltration Swales	x	The extents of the underground parkade does not allow adequate area for infiltration via drainage swales.
Pervious Pavers	x	The extents of the underground parkade make this application unsuitable for permeable pavers.
Green Roof	✓	A green roof provides an aesthetic means of rainwater source control. Extensive/intensive green roof areas have been incorporated in to the site design.
Rainwater Harvesting	✓	Rainwater Harvesting can be difficult for some developments but with extensive landscape areas requiring irrigation there is potential for significant rainwater harvesting on this project. Rainwater re-use in commercial washroom facilities may also

5 RAINWATER MANAGEMENT PLAN

Control of runoff quantity and water quality will be achieved through the implementation of rainwater management features selected based on Best Management Practices (BMPs) outlined in the City's IWMP. Preliminary drainage analysis and proposed strategies considered suitable for this project are addressed in the following sections.

The existing site soils limit the infiltration potential of the site and the extents of the proposed building and underground parkade limits the opportunity to capture and infiltrate rainwater on-site. Nonetheless, the proposed rainwater management plan has been designed to meet the City's rainwater management criteria through a series of rainwater management strategies. Design of the rainwater management features will be coordinated with the landscape architect and mechanical engineer.

5.1 Rainwater Management Features

The rainwater management features that are to be considered for this site have been selected with Best Management Practices (BMPs) in mind. While limitations of the subject property render some BMPs impractical or impossible, an effort will be made to maximize the application of BMPs. Table 5-1 summarizes which BMPs are to be considered in the proposed redevelopment, and which are omitted.

Table 5-1 - Best Management Practices Selection

BMP	Proposed for Project?	Comment
Absorbent Landscaping	✓	Planters and soft landscaped surface finishes provide aesthetic means of rainwater source control. A minimum of 450mm of topsoil overlain by sod and other absorbent landscaping materials will comprise the finished soft surface areas around the building. The absorbent landscaping material acts as a natural filter for the rainwater prior to infiltrating into the ground.
Rain Gardens	×	The extents of the underground parkade does not allow for native soil beneath the landscaped surfaces. Rain gardens could regularly flood as they may not have adequate capacity to absorb concentrated flows from a large drainage area.
Infiltration Swales	×	The extents of the underground parkade does not allow adequate area for infiltration via drainage swales.
Pervious Pavers	×	The extents of the underground parkade make this application unsuitable for permeable pavers.
Green Roof	✓	A green roof provides an aesthetic means of rainwater source control. Extensive/intensive green roof areas have been incorporated in to the site design.
Rainwater Harvesting	✓	Rainwater Harvesting can be difficult for some developments but with extensive landscape areas requiring irrigation there is potential for significant rainwater harvesting on this project. Rainwater re-use in commercial washroom facilities may also

BMP	Proposed for Project?	Comment
		be possible but will need to be further reviewed with the project team during the design process.
Storage/Detention Tank	✓	Storage tanks can be contained within the parkade and may be necessary in order to achieve the City of Vancouver's Water Reduction Criteria.
Water Quality Treatment System	✓	A water quality treatment system is proposed for treatment of 90% of rainfall.
Catch Basins and Oil Water Separators	✓	For areas that do not have the ability to treat rainwater with vegetation and soils, this BMP will enable the reduction of pollutants present in hard-surface runoff.

5.2 Quantity Control

Rainfall data used in the hydrologic analysis was derived from the Metro Vancouver Regional IDF Curves (2009), Zone 4. The existing site conditions were analysed and a runoff coefficient of 0.95 was determined. The conceptual landscaping site plan was analysed and a post-development runoff coefficient of 0.74 was determined to be representative of the properties future condition. Copies of the runoff coefficient calculations can be found in **Appendix A**.

Using the runoff coefficients determined above, the pre-development runoff flow for the 1:2-year storm was determined to be 74 L/s. Similarly, the post-development 1:2-year storm was calculated to produce a peak runoff flow of 59 L/s. This results in a reduction in the 1:2-year peak runoff flow by approximately 20%. Peak flow detention strategies for extreme rainfall events are not required as the post-development runoff is less than the pre-development runoff, as per the City's design criteria.

The pervious areas of the proposed development is approximately 36% of the site area and provides rainfall capture of approximately 84m³. The remaining impervious areas of the proposed development provide a target on-site capture volume of 149m³ based on capturing 24mm of rainfall over a 24 hour period from effective impervious areas. Refer to capture volume calculations provided in **Appendix B**.

The substantial landscape areas proposed as part of this development also require extensive irrigation systems. A rainwater harvesting and reuse system is also proposed to both increase the rainwater capture from the site and to reduce the potable water consumption required by the development. Based on the landscaped areas of the site, rainwater volumes of up to 700m³ could be used during summer months for irrigation.

It is expected that a detention tank will also be incorporated into the building structure to supplement any remaining target storage volume. A detention tank design shall incorporate an allowable release rate that, in the absence of infiltration facilities, is representative of typical groundwater recharge and waterway base flows. A low release rate of 1.0L/s/ha is proposed for this project.

5.3 Quality Control

Water quality is important when discharging into natural waterways as the quality of the runoff directly impacts the overall health of the receiving streams or lakes. Absorbent landscaping material acts as a natural filter for rainwater landing on pervious surface areas and surface BMPs. The use of catch basins with sumps and trapping hoods on proposed impervious surfaces will provide an initial opportunity to treat rainwater runoff.

A water quality treatment system shall be installed immediately before the service connection to the municipal sewer main. The system shall be designed to treat 90% of the average runoff volume (equivalent to 48mm rainfall from effective impervious areas) and shall be capable of removing 85% by mass of the inflow Total Suspended Solids (TSS). Building sewers and collected site runoff shall be directed through the treatment system.

5.4 Off-site Rainwater Management Features

Additional rainwater management features may be considered as part of the off-site road and landscaping improvements. Stormwater runoff originating from the City rights-of-way is typically directed to catch basins which convey water directly to the sewer mains for removal. Part of this project will be to enhance the stormwater management efforts within the City property to improve the quality of the stormwater runoff and to reduce the amount of water that needs to be conveyed within the pipes.

East Broadway is an arterial road and will consist predominantly of impervious surface to meet the City's street standards and is not considered suitable for significant BMP application. East 10th Avenue is expected to include landscaped boulevards and there may be opportunity to implement infiltration-based BMPs. The landscaping will provide opportunity to treat and infiltrate rainwater which falls in the landscaped areas as well as runoff from the sidewalks. BMPs that are to be considered for off-site use include absorbent landscaping, rain gardens, infiltration swales and rock pits.

6 GROUNDWATER MANAGEMENT PLAN

In accordance with the City's Large Site Rezoning Rainwater Management Requirements, a Hydrogeological Study is required to confirm existing site hydrogeology and confirm that the proposed development will not adversely impact the yearly high water table. A detailed Hydrogeological Study will be prepared to confirm the above requirement but, based on the existing site conditions, impacts to the existing water table from the proposed development are not expected.

7 CONCLUSION

Westbank is proposing a multi-family residential/commercial development at 1780 East Broadway southeast of the Commercial Street intersection in Vancouver, BC. The proposed development will reduce the effective impervious area when compared to the existing site conditions.

The City of Vancouver requires redevelopments to control runoff quantity and water quality of rainwater prior to being discharged into the municipal storm sewer in order to protect downstream infrastructure and waterways. The City's rainwater management targets include capturing or reusing the rainfall from frequent rain showers, treating additional runoff from large storms, and providing runoff routes during extreme storm events.

Rainwater management features will be implemented to achieve the City's rainwater management criteria. This report proposes BMP's for consideration in detailed project design.

We trust you find the above information suitable for your needs. Should you have any questions or comments on the information contained, please do not hesitate to contact the undersigned.

Reviewed by:

Russell Warren, P.Eng, LEED Associate
Senior Project Manager

Prepared by:

Donal Casey, P.Eng
Design Engineer

APPENDIX A

RUNOFF COEFFICIENT CALCULATIONS

R.F. Binnie & Associates Ltd.
205 – 4946 Canada Way
Burnaby, BC V5G 4K6
Tel: 604-420-1721 Fax: 604-420-4743

Calculations

Project Name:	**Commercial + Broadway**	**Project #:**	**16-0858**
Description:	**Runoff Coefficient Calculations (1:2-year)**	**Date:**	**25-Mar-19**

2 – YEAR PRE-DEVELOPMENT

Area Type	Runoff Coefficient, R	Area, A (Hectares)	SAF	Rainfall Intensity, I (mm)	Flow, Q_2 (m^3/s)
Impervious Area	0.95	0.970	1.0	29.0	0.074
Pervious Area	0.30	0.000	1.0	29.0	0.000
TOTAL		**0.970**			**0.074**

Average Runoff Coefficient = 0.95 (Pre–Development Condition)

NOTES:
1. Rain fall Intensities taken from: Rainfall IDF Data – Metro Vancouver Regional IDF Curve (Zone 4)
2. Time of Concentration Tc = 10 minutes (COV sewer design manual)

2– YEAR POST DEVELOPMENT

Area Type	Runoff Coefficient, R	Area, A (Hectares)	SAF	Rainfall Intensity, I (mm)	Flow, Q_2 (m^3/s)
Impervious Area	0.95	0.619	1.0	29.0	0.047
Pervious Area	0.40	0.351	1.0	29.0	0.011
TOTAL		**0.970**			**0.059**

Average Runoff Coefficient = 0.75 (Post–Development Condition)

NOTES:
1. Rain fall Intensities taken from: Rainfall IDF Data – Metro Vancouver Regional IDF Curve (Zone 4)
2. Time of Concentration Tc = 10 minutes (COV sewer design manual)
3. Flows based on Rational Formula Q = RAIN x Soil Adjustment Factor
4. N = 0.00278 for flow in cubic meters per second.
5. Post-development areas are approximated from conceptual landscape design.

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APPENDIX B

RAINWATER MANAGEMENT CALCULATIONS

BINNIE

R.F. Binnie & Associates Ltd.
205 – 4946 Canada Way
Burnaby, BC V5G 4K6
Tel: 604-420-1721 Fax: 604-420-4743

Calculations

Project Name:	**Commercial + Broadway**	**Project #:**	**16-0858**
Description:	**Rainwater Management Features - Sizing**	**Date:**	**25-Mar-19**

REQUIREMENT FROM CITYWIDE INTEGRATED RAINWATER MANAGEMENT PLAN:

1.) Water Volume Reduction (Capture):

Capture a minimum of 50% of the 6-month/24-hour post development volume from effective impervious areas, other than collector/arterial in all land uses and either infiltrate to ground, evapotranspirate, or reuse the captured rainfall.

- 50% of the 6 month/24-hour event is equivalent to 24mm

VOLUME REDUCTION - REQUIRED CAPTURE VOLUME:

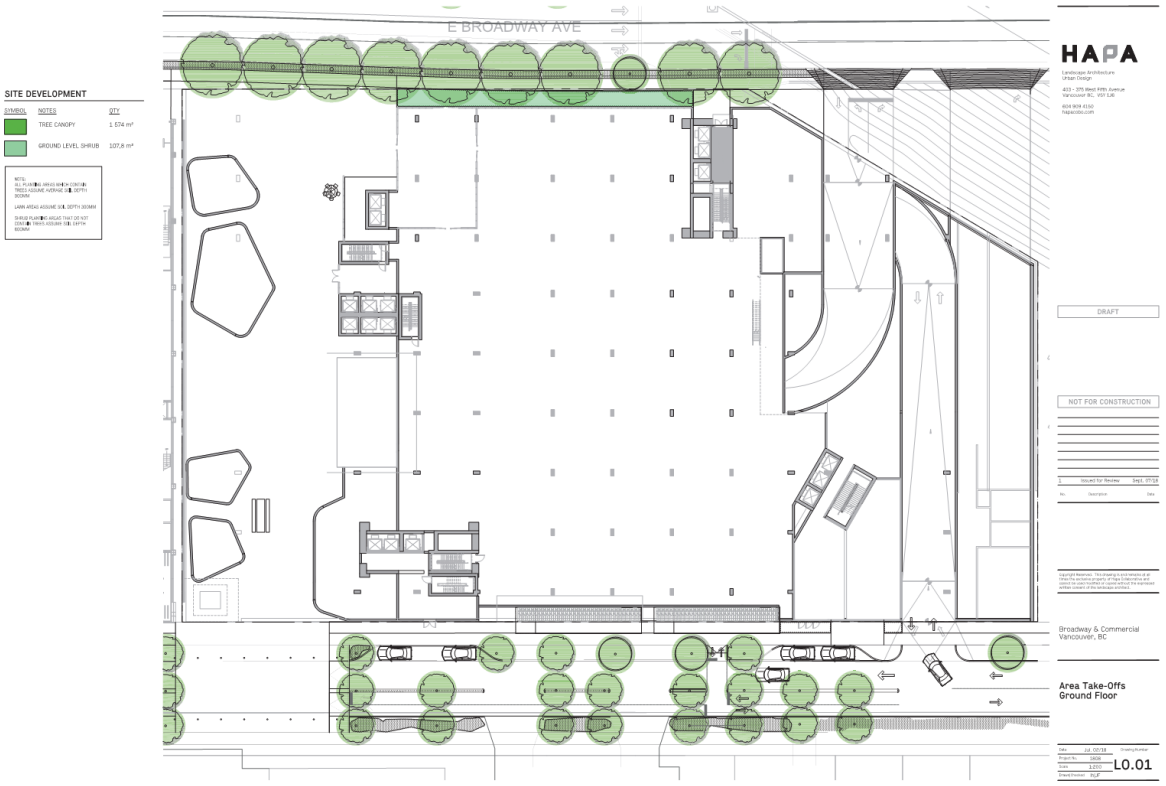
Pervious Area =	3,510 m^2	
Impervious Area =	6,190 m^2	
Impervious Area directed to Landscaping =	0 m^2	
Total Site Area =	9,700 m^2	
Effective Impervious Area =	**6,190 m^2**	
50% of 6-month/24 hour rainfall =	24 mm	
Pervious Area Runoff:		
Rainfall Volume (pervious area only) =	84 m^3	
Absorbent landscaping depth =	450 mm	*(3)*
Porosity =	30 %	
Retention capacity =	474 m^3	
Runoff volume to source control =	0 m^3	
Effective Impervious Area Runoff:		
Rainfall Volume (effective impervious area only) =	149 m^3	
Target Capture Volume (24hrs) =	**149 m^3**	

NOTES:
(1) Post-development areas are approximated from conceptual landscape design.
(2) Assume all pervious areas consist of absorbent landscaping material.

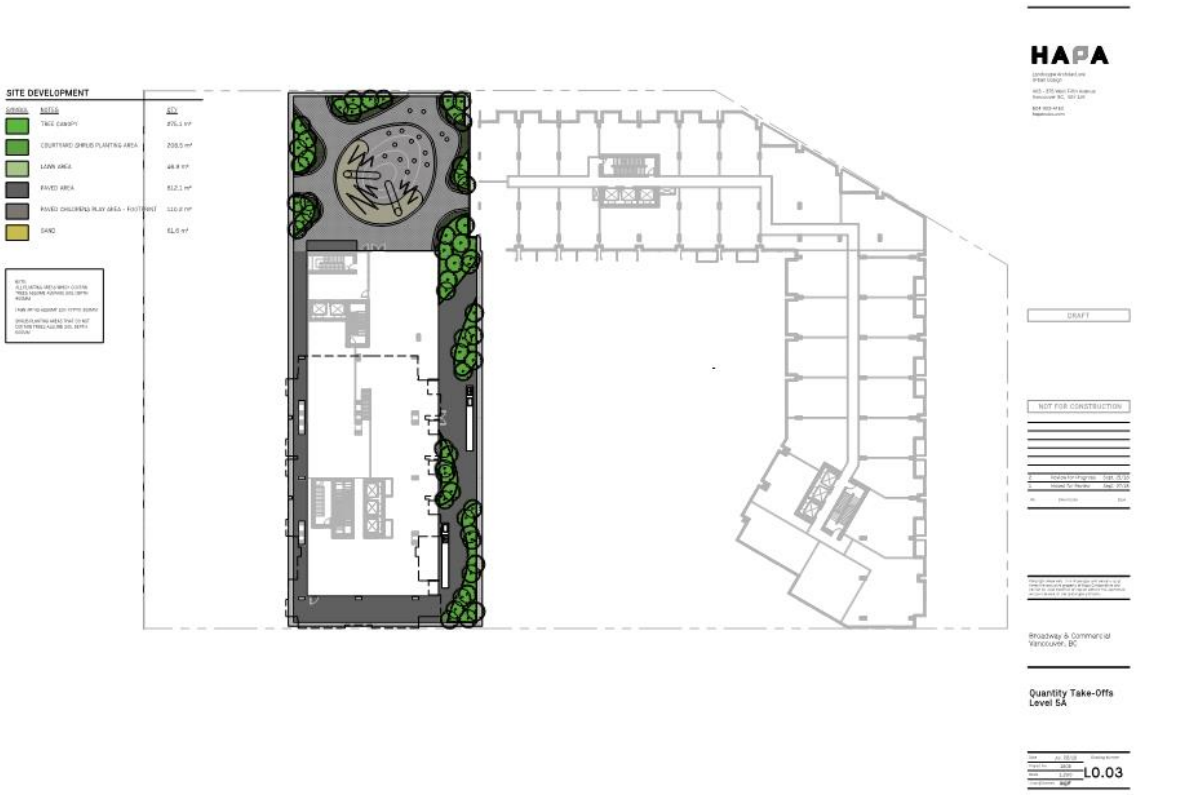
Page 1 of 1

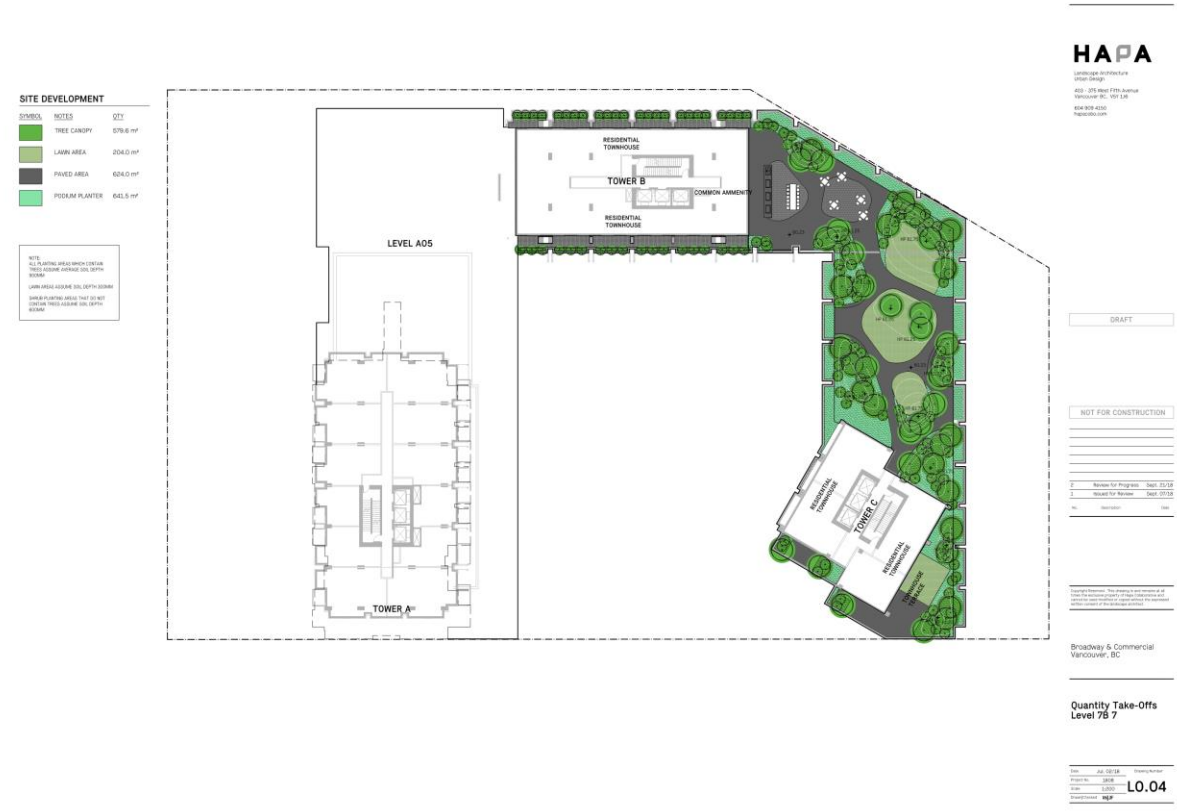
APPENDIX C

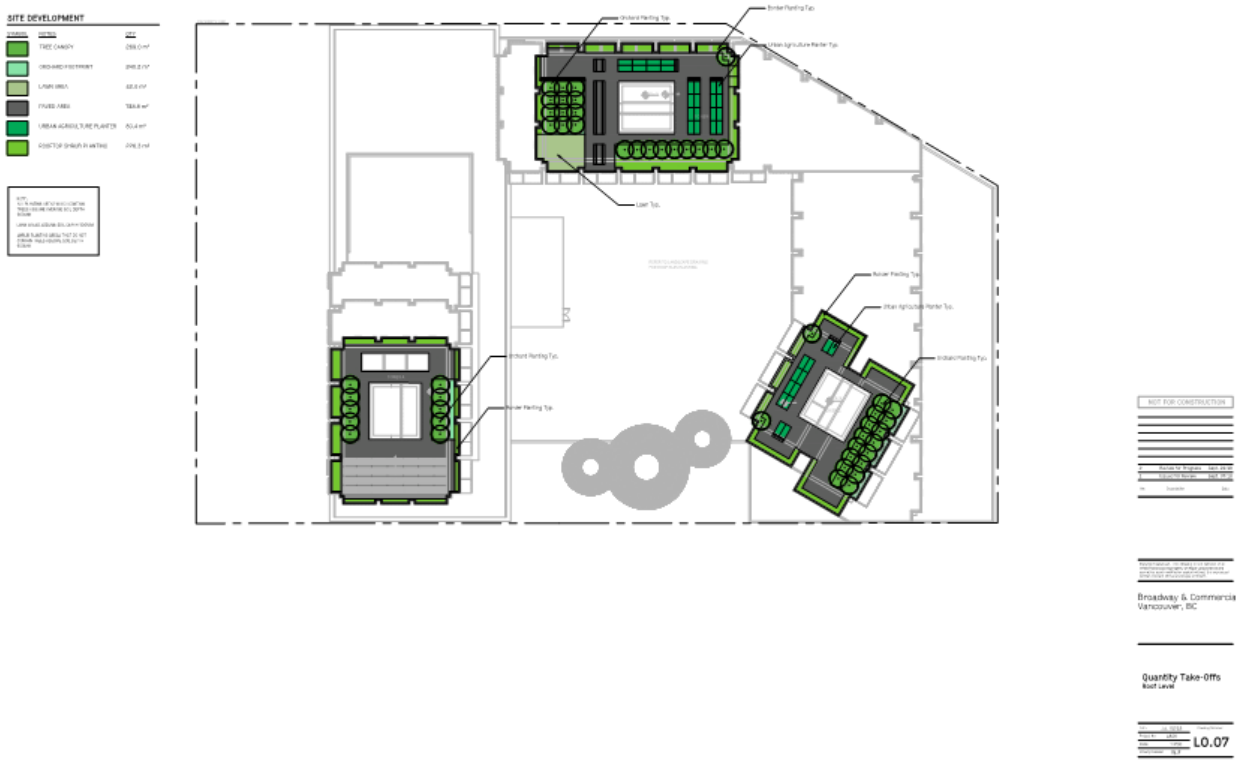
LANDSCAPE PLANS


E BROADWAY AVE
SITE DEVELOPMENT
SYMBOL NOTES QTY
TREE CANOPY 1 674 m²
GROUND LEVEL SHRUB 107.8 m²
HAPA
DRAFT
NOT FOR CONSTRUCTION
Broadway & Commercial
Vancouver, BC
Area Take-Offs
Ground Floor
L0.01


SITE DEVELOPMENT
SYMBOL NOTES QTY
TREE CANOPY 1 333 m²
URBAN AGRICULTURE - ORCHARD FOOTPRINT 202.0 m²
COURTYARD SHRUB PLANTING AREA 1 119 m²
LAWN AREA 391.5 m²
PAVED AREA 1 738 m²
WOOD DECK AREA 158.7 m²
WATER FEATURE 151.3 m²
BRIDGE PAVING 94.4 m²
HAPA
HARDSCAPE TBD TYP.
HARDSCAPE TBD TYP.
WATER FEATURE
SLOPED LAWN
MIN. SOIL DEPTH 300
DRAFT
NOT FOR CONSTRUCTION
Broadway & Commercial
Vancouver, BC
Quantity Take-Offs
Level 2
L0.02


SITE DEVELOPMENT
SYMBOL
NOTES
QTY
TREE CANOPY
COURTYARD OMPUS PLANTING AREA
LAWN AREA
PAVED AREA
PAVED CHILDREN'S PLAY AREA - FOOTPRINT
SAND
HAPA
DRAFT
NOT FOR CONSTRUCTION
Broadway & Commercial
Vancouver, BC
Quantity Take-Offs
Level 5A
L0.03


SITE DEVELOPMENT
SYMBOL
NOTES
QTY
TREE CANOPY
579.6 m²
LAWN AREA
204.0 m²
PAVED AREA
624.0 m²
PODIUM PLANTER
641.5 m²
RESIDENTIAL TOWNHOUSE
TOWER B
COMMON AMMENITY
LEVEL A05
TOWER A
TOWER C
HAPA
DRAFT
NOT FOR CONSTRUCTION
Broadway & Commercial
Vancouver, BC
Quantity Take-Offs
Level 7B 7
L0.04


SITE DEVELOPMENT
HAPA
NOT FOR CONSTRUCTION
Broadway & Commercial
Vancouver, BC
Quantity Take-Offs
Roof Level
L0.07

Appendix G-Zero Waste Management Plan

Kevin Welsh
Integral Group
Via Email

December 20, 2018

Kevin,

Target Zero Waste Consulting has reviewed the architectural drawings for the Crombie REIT and Westbank joint development located at 1780 East Broadway in Vancouver. The purpose of this document is to provide the framework for the collection of waste, recycling and organics for the residents and tenants of this development.

This document identifies the types, sizes and number of containers proposed for the collection of waste, recyclables and organics to meet the needs of the development based on the information provided.

Included in this document is information relating to the movement of containers on collection days. The collection of the different material types has been designed to minimize the time service providers have to be on site.

Should you have any questions regarding the contents of this document, please contact me at any time.

Regards,

Jeff Levitt
President
Target Zero Waste Consulting Inc.

1780 East Broadway – waste and recycling services outline

This proposed development is comprised of residential towers (market and rental) along with office, commercial, amenity and daycare areas. The market and rental residential sections will have separate waste and recycling collection areas. Non-residential tenants will share a space that is not accessible by the residents.

Residential collection – 428 market

- Residential waste for the market units will be collected in a low-profile compactor that will be serviced direct from the collection area located on level P3. The compactor will reduce the frequency of collection and will not require a staging area.
- Cardboard and mixed paper will be commingled and collected in a lidded split roll-off container. The other section of the split roll-off is for the collection of mixed containers and glass. The roll-off option was chosen to reduce space required in both the collection and staging areas and reduce the number of vehicle trips.
- The roll-off container has been sized to allow for pick up direct from the collection area. As with the waste compactor, no staging area is required.
- To reduce space and the number of vehicle trips, residential organics will collected in front-load containers. On collection day the organics will be moved to the street-level staging area using the dedicated freight elevator.
- The staging area is located on the property and at no time will the containers be stored on City of Vancouver property. Information on the temporary staging area is detailed on the architectural drawings provided by Perkins + Will.

Residential waste & recycling area (428 units)

Category:	Container type:	Size	Quantity:
Waste	Compactor	8-cubic yard	One
Mixed containers & glass	Roll-off	4,587 litre	One*
Cardboard & all paper products	Roll-off	3,058 litre	One*
Compostables	Front-load container	2-cubic yard	Two

*The roll-off is one container split into two sections

Container quantity calculations

Residential waste & recycling area (428 units)

Category:	No. of units:	Generation rate (l/unit/week):	Total volume generated (L/week):	Container capacity:	Estimated collection frequency:
Waste	428	53	22,684	8 cu. yard	Two times per week
Mixed containers & glass combined	428	20.6	8,817	3,058 L	Four times per week
Cardboard & all paper products	428	42.5	18,190	4,587 L	Four times per week
Compostables	428	14	5,992	2 cu. yard	Two times per week

Residential collection – 194 rental

- Residential waste for the rental units will be collected in a low-profile compactor that will be serviced direct from the collection area located on level P3. The compactor will reduce the frequency of collection and will not require a staging area.
- Cardboard and mixed paper will be commingled and collected in a lidded split roll-off container. The other section of the split roll-off is for the collection of mixed containers and glass. The roll-off option was chosen to reduce space required in both the collection and staging areas and reduce the number of vehicle trips.
- The roll-off container has been sized to allow for pick up direct from the collection area. As with the waste compactor, no staging area is required.
- To reduce space and the number of vehicle trips, residential organics will collected in front-load containers. On collection day the organics will be moved to the street-level staging area using the dedicated freight elevator.
- The staging area is located on the property and at no time will the containers be stored on City of Vancouver property. Information on the temporary staging area is detailed on the architectural drawings provided by Perkins + Will.

Residential waste & recycling area (194 units)

Category:	**Container type:**	**Size**	**Quantity:**
Waste	Compactor	8-cubic yard	One
Mixed containers & glass	Roll-off	4,587 litre	One*
Cardboard & all paper products	Roll-off	3,058 litre	One*
Compostables	Front-load container	2-cubic yard	One

*The roll-off is one container split into two sections

Container quantity calculations

Residential waste & recycling area (194 units)

Category:	No. of units:	Generation rate (l/unit/week):	Total volume generated (L/week):	Container capacity:	Estimated collection frequency:
Waste	194	53	10,282	8 cu. yard	Once per week
Mixed containers & glass combined	194	20.6	3,996	3,058 L	Two times per week
Cardboard & all paper products	194	42.5	8,245	4,587 L	Two times per week
Compostables	194	14	2,716	2 cu. yard	Two times per week

Office, commercial, amenity and daycare collection – 7,912 square metres

- The non-residential tenants will share a designated collection area. Waste will be collected in a low-profile compactor and will be serviced direct from the collection area located on level P2. The compactor will reduce the frequency of collection and will not require a staging area.
- Cardboard and mixed paper will be commingled and collected in a lidded split roll-off container. The other section of the split roll-off is for the collection of mixed containers and glass. The roll-off option was chosen to reduce space required in the collection areas and limit the number of vehicle trips required to collect multiple totes for collecting paper and mixed containers.
- The roll-off container has been sized to allow for pick up direct from the collection area. As with the waste compactor, no staging area is required.
- To reduce space and the number of vehicle trips, residential organics will collected in front-load containers. On collection day the organics will be moved to the street-level staging area using the dedicated freight elevator.
- The staging area is located on the property and at no time will the containers be stored on City of Vancouver property. Information on the temporary staging area is detailed on the architectural drawings provided by Perkins + Will.

Non-residential waste & recycling area (7,912 square metres)

Category:	**Container type:**	**Size**	**Quantity:**
Waste	Compactor	8-cubic yard	One
Mixed containers & glass	Roll-off	6,116 litre	One*
Cardboard & all paper products	Roll-off	1,529 litre	One*
Compostables	Front-load container	2-cubic yard	One
Used cooking oil	Drum	170 litre	One

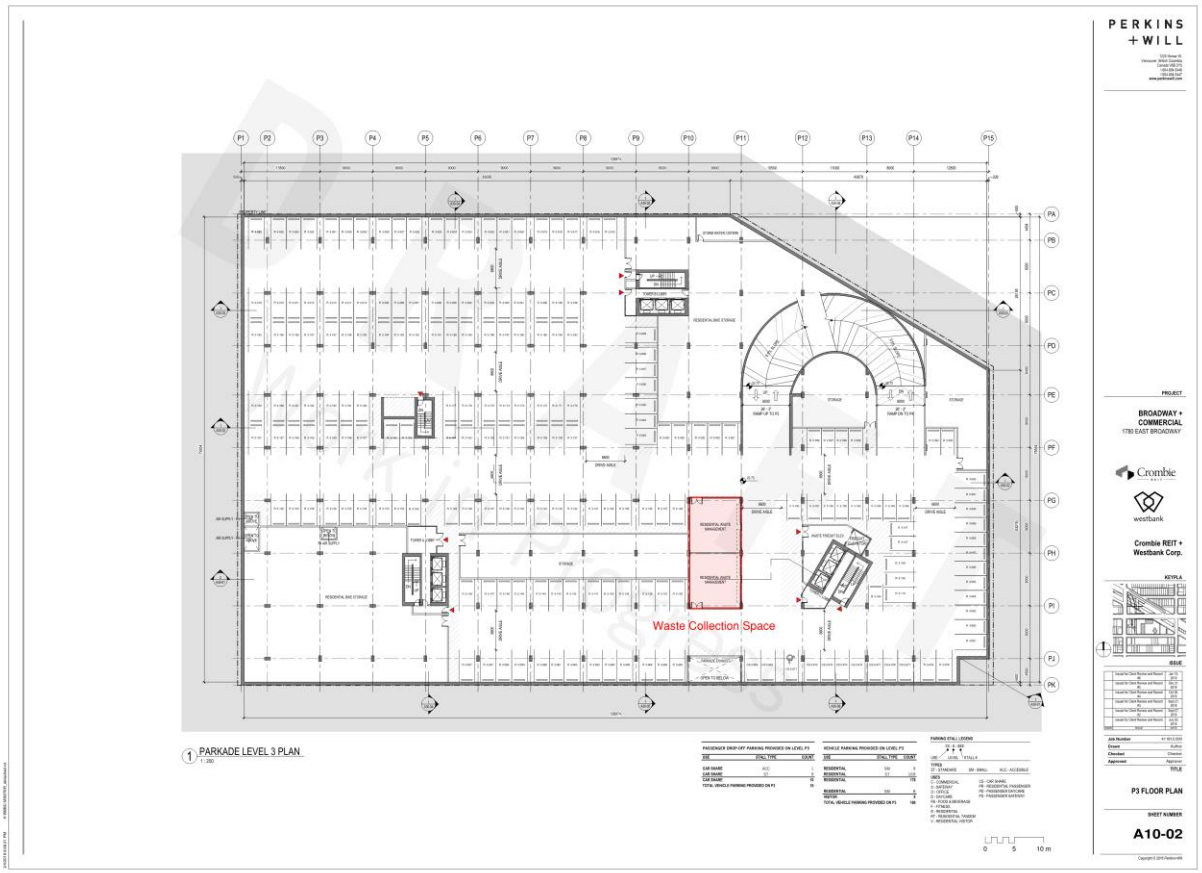
*The roll-off is one container split into two sections

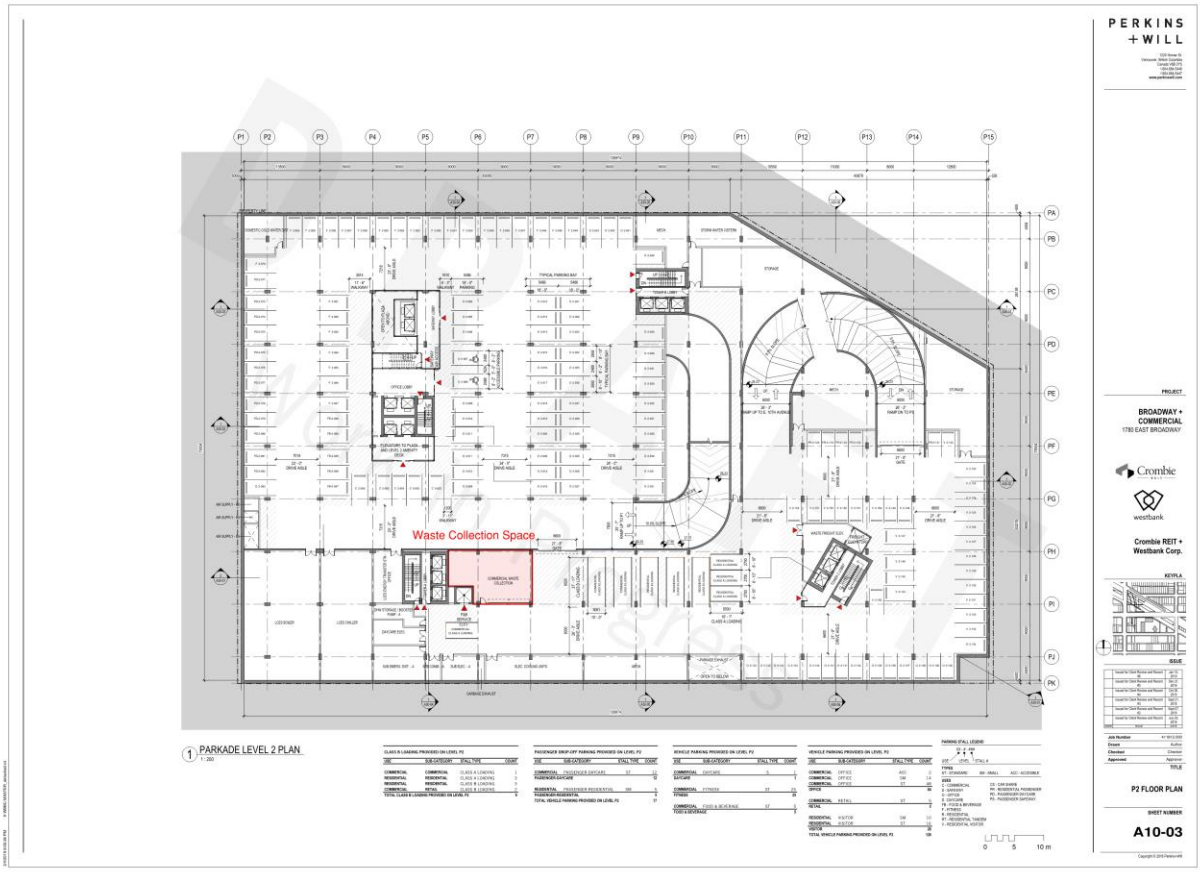
Container quantity calculations

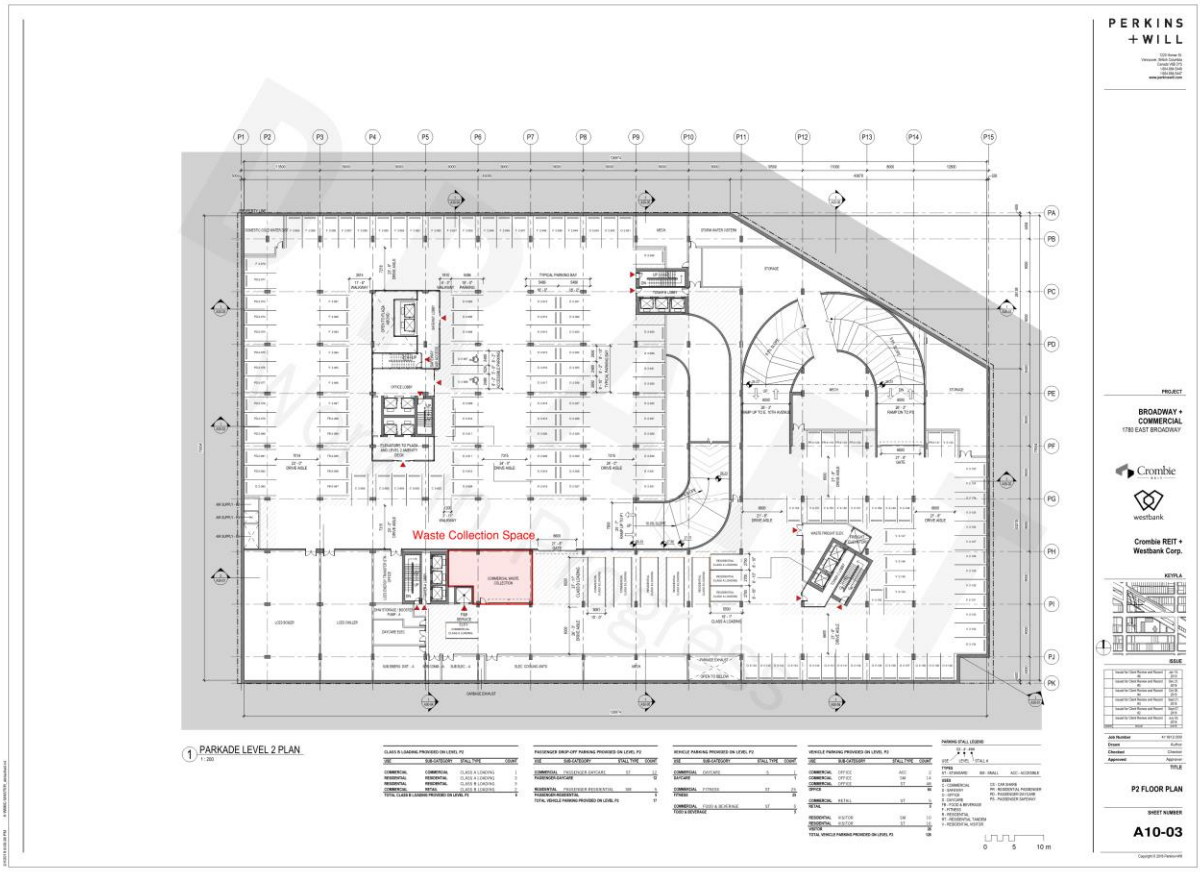
Non-residential waste & recycling area (7,912 square metres)

Category:	Area $m^{2:}$	Total volume generated (L/week):	Container capacity:	No. of containers collected per week:
Waste	7192	9,272	8 cu. yard	Once per week
Mixed containers & glass combined	7192	5519	4,587 L	Three times per week
Cardboard & all paper products	7192	14,811	3,058 L	Once per week
Compostables	7192	4,018	2 cu. yard	Three times per week
Used cooking oil	849	297	170 L	Three times per week

Appendix H-Waste Management Spaces




PERKINS + WILL
Waste Collection Space
1 PARKADE LEVEL 2 PLAN
1 : 200
PROJECT
BROADWAY + COMMERCIAL
1780 EAST BROADWAY
Crombie REIT + Westbank Corp.
KEYPLAN
ISSUE
P2 FLOOR PLAN
SHEET NUMBER
A10-03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PROJECT
BROADWAY + COMMERCIAL
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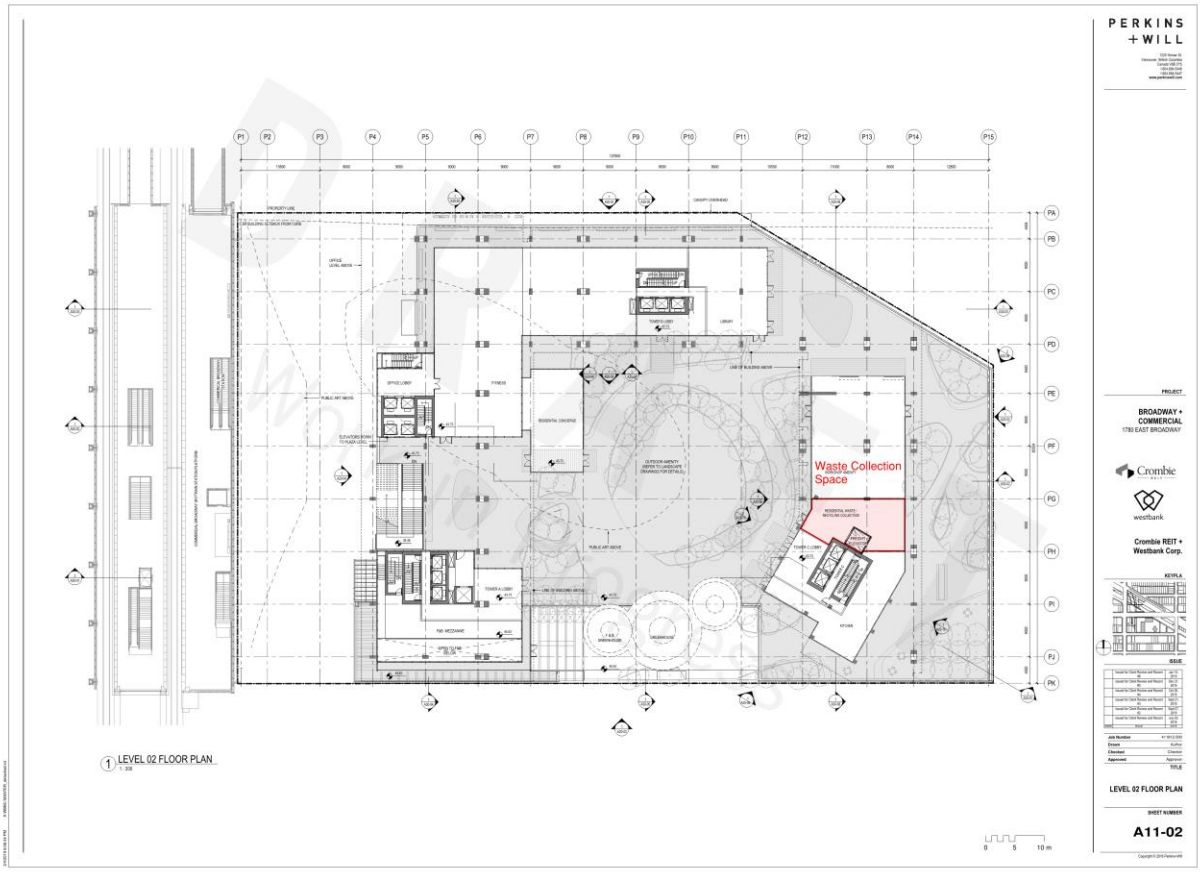
Crombie REIT + Westbank Corp.
KEYPLAN
ISSUE
P2 FLOOR PLAN
SHEET NUMBER
A10-03


Waste Collection Space
1 LEVEL 02 FLOOR PLAN
PERKINS + WILL
BROADWAY + COMMERCIAL
1780 EAST BROADWAY
Crombie REIT + Westbank Corp.
LEVEL 02 FLOOR PLAN
A11-02

Appendix I-Resilient Building Checklist

City of Vancouver- Resilience Worksheet

Project responses are provided in *red.*

Planning	
What is the estimated full useful project life? 60 years	
Have you considered the risks and hazards to your project and occupants both today and throughout the useful project life? Please list them:	
Identify below any local risk or hazard studies that you have completed or are referencing. Example: Floodplain mapping (http://guidelines.vancouver.ca/F014.pdf), seismic assessment, hazardous materials list.	
Have hazard mitigation and risk management efforts been included in the project? Have impacts and risks to inhabitants been considered and mitigated? Describe how:	Y/N
Have projected climate conditions for the useful project life been consulted? Please consult Vancouver specific climate projections attached to this worksheet. Please indicate projection year used: 2050s, 2080s, 2100, other_____	☐
Describe any strategies or design features that support rapid recovery after a hazard event:	
Describe how your project fosters community connections and interaction (including trusted spaces for people to congregate, communication mechanisms, etc):	

Have you set targets for recoverability / re-occupancy of the project in the event of structural damage? Has this been incorporated into design? Describe below: *It's not contemplated as part of a "Normal Importance" building as defined by the Vancouver Building Bylaw, the BC Building Code, nor the National Building Code of Canada. The project does not meet the typical definition of a High Importance such as a hospital, Institutional, police, emergency facilities or community centre it is not typical of a private building. As the design progresses a discussion will be had with the clients and a strategy considered in buildings aside from post-disaster facilities.*	Y/**N**
Describe how the project has been designed to ensure accessibility of spaces for people with mobility challenges and for an aging population:	

Essential Safety

Will there be emergency plans in place for buildings?	**Y**/N
Can drinking water be supplied without power?	**Y**/N
Will toilets and sinks work without power? Amenity level fixtures will continue to work and tanked toilets will have capacity for 1 flush	**Y**/N
Describe the back-up power capacity: what is it, which systems will it power and for how long? If fuel is needed, is there a contract in place to obtain it following a disaster? Note that renewable energy systems avoid the anticipated difficulty of accessing and transporting fuel post event. *On-site generators will be provided to support minimum life safety systems. The generator will use a stored reserve of (natural gas/ diesel fuel). The systems considered to be minimum life safety include the following:* - *One elevator per building* - *Corridor lighting (reduced emergency capacity)* - *Emergency Communications and security systems* - *Etc.* *The project will be designed to maintain 2 days of minimum life safety function in the event of a power outage.*	
Will the project include hook-ups for temporary generators and boilers? *The project will contain an emergency hookup for the temporary boilers to help condition the building in the event of an emergency.* *On-site electrical generators will have capacity to meet minimum life safety conditions.*	**Y**/N

Has solar energy been considered to provide some back-up power capacity? If yes, what is system size? _____kW	Y/N
Are there safe, accessible locations for occupants to gather in the event of an earthquake, flood, or other event causing structural damage to the project? *Not on the site. Gathering places would be pre-designated areas of refuge such as Schools, Community Centres, Hospitals, etc. Not on an isolated private site, nor a specific part of the site. Based on this there is not intention to produce such a space.*	Y/**N**
Is there space for 72 hours of emergency supplies in the facility? Describe: *Each suite will include ample closet storage and pantry space for storing emergency provisions According to the Canadian Red Cross' preparedness guide a 4 person -72 hour Emergency ration of supplies, should take up as much space as 1.3 cubic feet which could be fit in any number of the proposed storage spaces.*	Y/N

Climate Resilience

HEAT – review climate projections for temperature, cooling degree days and summer extremes.

Consider the Urban Heat Island Effect resulting in higher temperatures in urban areas.

Have impacts of heat on the project been considered, including:

- Material change or degradation of structural integrity at accelerated rates
- Health and safety impacts on occupants vulnerable to heat
- Increased failure or reduced efficiency of electrical or mechanical systems
- Need for landscape material hardy to summer drought

Summarize:

The primary climate resilience strategy for the project will be in the design and construction of the high-performance envelope. This will support the project's energy efficiency in the event of either the 2050 climate change model or 2080 climate change model by limiting solar gains and help to retain cooling energy during hot spells. The project's mechanical plant will be modular and expandable to support the system's capacity at higher temperatures and durations. Other considerations include:

- *Durable building finishes which are installed to accommodate the common expansion and contraction of materials as well as the proposed additional movement of the materials during extreme climate events.*
- *Detailed envelop and mechanical design to ensure that the indoor temperature always provides some relief from the heat to vulnerable occupants.*
- *Adaptable mechanical and electrical systems to provide additional capacity when demanded of the building and accommodate the changes in efficiency.*
- *Resilient and well-established plantings to help whether hotter climates and rainwater capture and re-use systems capable of supporting landscaping during periods of drought.*

Describe how the building and its systems will be adapted to efficiently manage future higher average temperatures, higher extreme temperatures, additional annual heatwaves, longer heatwaves and longer periods of drought: *Mechanical systems will be designed to allow for expansion and adaption to the changing climate conditions and technologies available to the project. The base building hydronic based heating and cooling infrastructure will allow for a detailed review and adoption of available technologies during the buildings operation or at the end of the plant equipment's life should more efficient technologies be available at the time.*
Describe all the building and site measures to reduce heat-island effect at the site and in the surrounding areas: *The building will be heavily vegetated with a proposed site coverage of 46% vegetation. As an opportunity to reduce solar heat gains the project will respond well by replacing what is currently dark asphalt with vegetation. For the remainder of the project's hardscapes, light colour lower density materials will be considered where feasible to further reduce the impacts of urban heat island effect.*
PRECIPITATION – Review climate projections for annual rainfall, rainfall extremes and precipitation as snow. Review Vancouver IDF curves – both current and future-proofed.
Have impacts of changing precipitation patterns on the project been considered, including: • Increasing instances of mould • Potential for greater frequency of stormwater management systems being overwhelmed, low areas flooded and sewer back-ups • Impacts to the durability of materials Summarize: *The design team has considered the impacts of changing precipitation patterns for this project. Following the City of Vancouver's requirements, the landscape infiltration and stormwater conveyance system will be designed to accommodate increasing storm event intensity due to climate change. The design team has no comments on the instances of mould or durability of materials at this time.*
Describe main strategies employed to infiltrate, evaporate, detain or reuse rainwater to achieve water volume reductions for system resiliency: *The project site will be designed to meet, and most likely exceed, the rainwater retention requirements, improving the project resiliency. The main strategies of the stormwater management plan include extensive absorbent landscape areas, rainwater reuse in the building, and detention facilities to reduce water volumes and release rates.*
Is there a program in place to keep catch basins clear? **Y**/N
How are areas below grade protected from flooding? Are there mechanical or electrical systems below grade? If so, how are they flood-proofed? *The project includes three levels of below grade parking. On the upper most level of parking several spaces are dedicated to the building mechanical and electrical spaces. These spaces are located within the parkade structure which*

will comprise of a water-tight cast in palace concrete perimeter waterproofed to ensure water remains outside of the building space and away from essential mechanical and electrical spaces. *At the bottom of the parkade, infiltration pits will be provided with the intention to collect any excess water in the parkade and from around the structure. Foundation drainage will collect groundwater from the perimeter of the parkade through the drain tiles to ensure water only enters the building with control and is immediately pumped out to avoid infiltration. Parkade drainage sumps will be provided to collect any water introduced into the parkade either from the parkade entrance or vehicles.*	
Coastal Storms and Sea Level Rise	
Is the project located in a floodplain? Map: http://guidelines.vancouver.ca/F014.pdf If no, the remaining questions can be left blank.	Y/**N**
What flood construction level is the project designed to? _____m or Not Applicable	
If in a flood plain, describe site design strategies for adapting to sea level rise including building access during flood events, elevated site areas, hard and soft barriers, etc.	
If in a flood plain, is the design adaptable – can the flood construction level be raised further in future or can increased protection of critical systems be implemented?	
If in a flood plain, confirm that mechanical and electrical systems are not located below the flood construction level. (Please also ensure all hazardous materials will be stored above the FCL.)	

City of Vancouver Climate Change Projections

Table 1: 2016 climate projections - All projections to year 2050:

Climate Variable	Description of Metric
Precipitation	
5% in winter increase 7% in spring and 12% in fall with 19% decrease in summer	Average seasonal changes
Length of dry spells increase 23% (from 23 to 29 days on avg. per year)	Max length of consecutive days with precipitation less than 1mm
63% more precipitation on extremely wet days	Annual total precipitation that falls on days where precipitation exceeds 99th percentile of precipitation (intensity and frequency)
33% more precipitation on very wet days	As above but 95th percentile
A 1:20 year return precipitation event will increase in intensity by 36%	Max daily precipitation expected to occur on average once in 20 years (intensity only)

Temperature	
2.9°C average increase	Annual average temp increase
Summer days above 25°C more than double from 18-43	Frequency of summer days where maximum temperature is above 25°C
Warmest summer day is 3.9°C warmer	Maximum temperature of the warmest summer days
Coldest winter nights 4.9°C warmer (from -9.4°C to -4.7°C)	Min temp of the coldest day in winter
Very cold days are projected to warm from -16°C to -11°C Very hot days increase in intensity from 32°C to 37 °C	Minimum and maximum daily temp expected to occur on average 1:20 years
Hot summer days that occur only once per year on average are projected to occur 12 times annually	Days above 30°C
Heating and Cooling	
29% fewer HDD	Total of the number of degrees below 18°C that occur daily, summed over each day of the year. Indicator for heating demand.
CDD from 60 to 250 days (25% more than Portland's historic average)	Total of the number of degrees above 18°C that occur daily, summed over each day of the year. Indicator for cooling demand.
Snowpack	
For our watersheds as a whole, April 1 snowpack projected decrease 58%	Lower elevations will no longer have snowfall

Growing Season	
15% increase in length of growing season	Growing season length is the length between the first span of six days above 5°C in spring, and the first span of six days below 5°C in the fall.
72% decrease in number of frosty days	Annual count of days when maximum temperature is below 0°C
44% increase in Growing degree days	Total of the number of degrees above 5°C that occur daily, summed over each day of the year. Indicator for plant growth.

Appendix J- ZEBP Energy Modelling Checklist

Zero Emissions Building Plan Energy Checklist

Please complete all fields that apply to the project, using information that represents the current stage of design. For fields that do not apply or for which there is no information yet, please enter "N/A".

Project Information (enter all that apply)

Project Address	1780 East Broadway
Secondary Address	
Project Working Title	Broadway + Commercial
POSSE File Name (City use only)	
Gross Floor Area indicated on Arch. Drawings (m²)	58,226
Parkade Area (m²)	28,470

Building Information and Performance Limits

For building types with Performance Limits, enter this information in this section

Building Type(s)	Modelled Floor Area (m²)	Rezoning?	City-Recognized Low Carbon Energy System?	Limits TEUI	Limits TEDI	Limits GHGI
Residential, 7+ storeys (Group C except Hotel)	47,672	Yes	Yes	130	40	6
Office	4,216	Yes	Yes	110	27	3
Retail (Group D & E except Office)	323	Yes	Yes	170	21	3
Total	52,211	**TEDI limit for this portion of building**			**38.8**	

For other building types, create a baseline energy model to establish limits, and enter this information in this section

Building Type	Modelled Floor Area (m²)	Rezoning?
Supermarket	6,015	Yes

Enter Other Building Type Baseline Model Performance	Energy (kWh)	Em. Factor	Emissions (kgCO2e)		TEUI	TEDI	GHGI
Total Annual Electricity Use	2,664,555	0.011	29,310	Baseline:	580.186	200.1686	30.25692
Total Annual Natural Gas Use	825,350	0.185	152,690	Target:	377.1209	200.1686	30.25692
Total Annual District Energy Use	-	0.070	-				
Total	3,489,905		182,000				
Total Annual Heat Demand - for TEDI	1,204,044						

			TEUI	TEDI	GHGI
Total Modelled Floor Area (m²)	58,226	**Whole-Building Performance Limits**	**154.3**	**55.5**	**8.3**
Modelled Floor Area within 5% of Gross Floor Area?	Yes				

Modelled Building Performance

	Energy (kWh)	Fuel Type	Em. Factor	Emissions (kgCO2e)	TEUI	GHGI
Interior Lighting	1,399,630	Electricity	0.011	15395.93	24.0	0.3
Exterior Lighting	35,040	Electricity	0.011	385.44	0.6	0.0
Heating	637,014	Electricity	0.011	7007.154	10.9	0.1
Cooling	537,307	Electricity	0.011	5910.377	9.2	0.1
Pumps	353,003	Electricity	0.011	3883.033	6.1	0.1
Fans	1,710,991	Electricity	0.011	18820.9	29.4	0.3
Domestic Hot Water	338,889	Electricity	0.011	3727.779	5.8	0.1
Plug Loads	1,839,815	Electricity	0.011	20237.97	31.6	0.3
Heating	42,935	Natural Gas	0.185	7942.99	0.7	0.1
Refrigeration	1,711,757	Electricity	0.011	18829.33	29.4	0.3
Domestic Hot Water	681,217	Natural Gas	0.185	126025.2	11.7	2.2

Total Annual Electricity Use	8,563,446	0.011	94,198
Total Annual Natural Gas Use	724,152	0.185	133,968
Total Annual District Energy Use	-	0.070	-
Total	9,287,598		228,166
Total Electricity Generated On-Site (kWh)		% of Use	0.0%
Total Purchased Renewable Electricity (kWh)		% of Use	0.0%
Total Purchased Renewable Natural Gas (kWh)		% of Use	0.0%

Note: purchaes renewables used to demonstrate compliance must be secured to satisfaction of AHJ

Adjusted Electricity Emissions Factor (kgCO2e/kWh)	0.011
Adjusted Natural Gas Emissions Factor (kgCO2e/kWh)	0.185

Annual Heat Demand of portions with Perf. Limits (kWh)	1,965,943			**37.7**	
Total Annual Heat Demand - for TEDI (kWh)	2,903,523				
Total Annual Cooling Demand - *for info only* (kWh)	1,807,967	31.1 kWh/m²			
			TEUI	TEDI	GHGI
		Modelled Whole-Building Performance	**159.5**	**49.9**	**3.9**

Corrider Pressurization Adjustment

Heating Degree Days	2825				
Number of Suite Doors Pressurized	708				
Airflow for Pressurization per Door (L/s/door)	9.438948879				
Area of Corridors Pressurized (m²)	3533				
Make-Up Air Fuel Type	Electricity		TEUI	TEDI	GHGI
Make-Up Air Emissions Factor	0.011	Adjustments for Corridor Pressurization	8.2	8.2	0.1
Suite-level Metering for Space Heating	Yes	Adjustments for Suite Submetering of Heating	-		

Note: select yes if the energy used for heating is metered at the suite level

Adjusted TEDI Performance of Portions with Limits		**29.5**	
Adjusted Whole-Building Performance for Compliance	**151.4**	**41.7**	**3.8**

Modelled Inputs				
Modelled Above-Ground Wall Area (m²)	36,234		Vertical facade-to-Floor Area Ratio (VFAR)	0.62
Window-to-Wall Area Ratio (WWR)	50%		Window-to-Floor Area Ratio	0.31
Infiltration Rate ($L/s/m^2_{fac}$)	0.2			
Wall Effective R-Value - incl. thermal bridging (m²K/W)	2.6	15.00 (ft²hr°F/Btu)	Average Floor Edge Psi-Value (W/m°K)	
Roof Effective R-Value - incl. thermal bridging (m²K/W)	3.5	20.01 (ft²hr°F/Btu)	Avg. Window Transition Psi-Value (W/m°K)	
Average Window Effective U-Value (W/m²°K)	2.0	0.35 (Btu/ft²hr°F)	Window Solar Heat Gain Coefficient	0.3
Average Suite Occupant Density (m²/pers)	25.95		Average Lighting W/m²	5
Average Suite Ventilation Rate (L/s/m²)	0.295312828		DHW Low-Flow Savings (%)	10%
Average HRV Effectiveness	78%		DHW Drain Heat Recovery Effectiveness	0%
Heating System Type (fuel, plant, distribution, etc.)	Ground source heat pump, heat recovery chiller, air source heat pump with condensing boiler backup			
Cooling System Type (fuel, plant, distribution, etc.)	Ground source heat pump, heat recovery chiller, air source heat pump			
DHW System Type (fuel, plant, distribution, etc.)	Ground source heat pump, heat recovery chiller, air source heat pump with condensing boiler backup			

Modeller Information		
Modeller Name	Lam Pang	
☑	*These results have been created using the COV Energy Modelling Guidelines version:*	2
Company	Integral Group	
Phone Number	604-687-1800	
Email	lpang@integralgroup.com	

ZEBP Energy Checklist v1.5 - 2018-07-27

Appendix K- Energy Modelling Input Summary Table

1780 East Broadway - LCES Type 2a: Utility-Owned On-Site LCES
City of Vancouver Rezoning Energy Modeling Input Summary Table

	Proposed Design Model Characteristics
General	
Location	Vancouver, BC
Simulation Weather File	Vancouver 2016 CWEC
Climate Zone	ASHRAE Climate Zone 5C
Modeling Software	eQUEST 3.65
Building Area	Total FSR area provided: 58,226 m²
Hours of Operation	Residential: NECB 2015 Schedule G CRU/Safeway: NECB 2015 Schedule C Food Prep/Dining/Daycare: NECB 2015 Schedule B Office: NECB 2015 Schedule A Based on *CoV Energy Modelling Guidelines v2 Section 2.1 Schedules*
Envelope Performance	
Overall Roof U-value (BTU/h·ft²·°F)	U-0.050 (R-20)
Overall Wall U-value (BTU/h·ft²·°F)	U-0.067 (R-15) (includes all thermal bridges per *CoV Energy Modelling Guidelines v2 Section 3*)
Percentage Glazing	50%
Overall Glass U-value including frame (BTU/h·ft²·°F), and Solar Heat Gain Coefficient (SHGC)	U-0.35 (overall including fixed, operable and sliding doors with framing losses) SHGC-0.30
Floor slab above parkade U-value (BTU/h·ft²·°F)	U-0.067 (R-15)
Infiltration	Constant rate of 0.20 L/s·m² of total gross above-ground wall and roof areas As per *CoV Energy Modelling Guidelines v2 Section 2.4 Infiltration*
Internal Loads	
Occupancy	Residential: People = no. bedrooms + 1 CRU/Safeway/Workshop: 322.8 ft²/person Restaurant/Gym/Lobby/Daycare: 107.6 ft²/person Office: 269 ft²/person Kitchen/Library: 215.2 ft²/person (Based on NECB 2015 Table A-8.4.3.2. (2))
Lighting Power Density (LPD) (W/ft²)	

Space by Space Method	Proposed Lighting Power Density [W/ft²]
Corridor/Transition	0.45*
Electrical/Mechanical	0.40
Dining / Leisure	0.70
Food Preparation Area	1.00
Gym	0.41*
Library	0.72
Lobby - Other	0.81*
Lobby for Elevator	0.56*
Workshop	0.65*
Parking Garage	0.12*
Stairway	0.50*
Storage	0.36*
Washroom	0.54*
Retail	1.20
Day Care	0.85

	Proposed Design Model Characteristics
	<table><tr><td>Office</td><td>0.41*</td></tr><tr><td>Supermarket</td><td>1.20</td></tr><tr><td>Residential Suite</td><td>0.46</td></tr></table> *Occupancy sensor LPD reduction included
Lighting Controls	Occupancy sensor: 10% LPD reduction Daylighting sensor: where applicable (Lighting controls as per ASHRAE 90.1-2016 9.4.1)
Plug-Loads	Residential: 0.464 W/ft^2 CRU/Safeway: 0.23 W/ft^2 Rest/ Gym/Lobby/Daycare: 0.09 W/ft^2 Office: 0.70 W/ft^2 (Based on *CoV Energy Modelling Guidelines v2 Section 2.2.1 Residential Suites* and NECB 2015)
Exterior Lighting	8 kW (preliminary estimate)
Process Loads	Elevator: 3 kW each Office IT load allowance: 5 kW per floor (2 floors) High intensity rooms: 40 kW (mechanical/electrical room) and 120 kW (transformer room) Restaurant Kitchen: 2.2384 kW (Electricity) and 16,967.5 BTU/h (Gas) Safeway refrigeration loads: 1,100,000 Btu/h (peak)
Domestic Hot Water Consumption	Residential/Storage: 0.025 gpm/person with 10% reduction (low flow fixture) CRU: 40 W/person Safeway: 85 kW (peak) Daycare: 60 W/person Kitchen: 120 W/person Office/Gym/Workshop/Restaurant: 90 W/person (Based on *CoV Energy Modelling Guidelines v2 Section 2.2.1 Residential Suites* and NECB 2011)
Mechanical Systems	

	Proposed Design Model Characteristics
Indoor Design Temperature for Conditioned Areas	Occupied: 71.6°F (heating), 75.2°F (cooling) Unoccupied: 64.4°F (heating), 95.0°F (cooling) Electrical room: 80.0°F (cooling) Based on *CoV Energy Modelling Guidelines v2 Section 2.1 Schedules*
System Description and Efficiency	Dwelling units: Heating and cooling by fan coil unit and ventilation by in-suite energy recovery ventilator (ERV) • Fan coil unit: ≈0.25 W/cfm (average) • ERV fan power: 40 W • Bathroom fan power: 10 W • Ventilation fans on continuously Small CRU in public open space: Heating and cooling by fan coil unit and ventilation through mechanical louvre (tenant fit-out) • Fan coil unit: ≈0.25 W/cfm (average) • Fans run continuously during occupied hours and cycle on/off to meet the heating/cooling loads during unoccupied hours (OA off) Gym, daycare, and office: Heating and cooling by fan coil unit and ventilation by central energy recovery ventilator (ERV) • Central ERV fan power: ≈1.4 W/cfm • Fan coil unit: 0.25 W/cfm (average) • Fans run continuously during occupied hours and cycle on/off to meet the heating/cooling loads during unoccupied hours (OA off) Restaurant: Heating and cooling by fan coil unit and ventilation by central air handling unit • AHU fan power: ≈1.4 W/cfm • Fan coil unit: 0.25 W/cfm (average) • Separate kitchen exhaust MUA: ≈1.9 W/cfm (includes ecologizer) • Fans run continuously during occupied hours and cycle on/off to meet the heating/cooling loads during unoccupied hours (OA off) Safeway: Air handling unit with zone reheat (no heat recovery) • AHU fan power: ≈1.5 W/cfm • Separate exhaust MUA: ≈1.9 W/cfm (includes ecologizer) • Fans run continuously during occupied hours and cycle on/off to meet the heating/cooling loads during unoccupied hours (OA off) Corridor: Roof-top air handler with hydronic heating coil • Fan power: 1.0 W/cfm • Ventilation fans on continuously Main electrical rooms: Cooling by fan coil unit • Fan power: ≈0.25 W/cfm (average) • Ventilation fans on continuously Parkade: Parkade fan • Fan power: 0.30 W/cfm • Fan hours of operation: 4 hr/day
Minimum Ventilation Rates	Living areas: 0.35 air changes per hour but not less than 15 cfm per person CRU/Safeway: 0.30 cfm/ft^2 Safeway separate exhaust MUA: ≈5,000 cfm Restaurant separate exhaust MUA: ≈7,000 cfm Amenity: 20 cfm/person (50 people/1000 ft^2) Daycare: 15 cfm/person (50 people/1000 ft^2) Office: 20 cfm/person (7 people/1000 ft^2) Corridor pressurization: 20 cfm/door (based on ASHRAE 62-2001)
Heat Recovery	Dwelling units in-suite ERV Sensible effectiveness: 78%

	Proposed Design Model Characteristics
	Latent effectiveness: 35% Central ERV enthalpy wheel Sensible effectiveness: 78% Latent effectiveness: 74%
Central Plant	
Heating Type & Hot Water Loop	Ground source heat pump • Efficiency: 3.60 seasonal COP • Capacity: 2,700 MBH heating • Design supply: 110°F • Design loop DT: 20°F Air source heat pump • Efficiency: 2.42 heating COP at 25°F ambient Condensing boilers • Efficiency: 95%
Cooling Type & Chilled Water Loop	Ground source heat pump • Efficiency: 2.70 seasonal COP • Design supply: 44°F • Design loop DT: 9°F Heat recovery chiller • Efficiency: 4.05 seasonal COP Air source heat pump • Efficiency: 3.37 cooling COP at 85°F ambient
Domestic Water Heater and Efficiency	Heating supplied by LCES central plant
Heat Rejection	Fluid cooler heat rejection
Safeway Refrigeration Loop	Refrigeration waste heat from CO_2 compressors reject to Safeway AHU, Safeway MUA and DHW preheat. Remaining heat provided by LCES central plant

6.1 LCES Type 2a: Utility-Owned On-Site LCES

This type refers to a new utility-owned LCES located on-site within a development. Type 2a LCES must meet the following requirements:

(a) a qualified engineer must provide written verification that the LCES is designed to provide low carbon energy such that the development will meet the City's GHG limits;

(b) there must be evidence that a utility will purchase the LCES and supply long term energy service from the LCES to the development; and

(c) the utility must have demonstrated experience with other similar successful LCES.

Prior to the application for an occupancy permit, the developer must deliver evidence to the City's satisfaction that the LCES was successfully registered with the BCUC, and that the ownership of the LCES was, or will soon be, duly transferred to a utility.

Appendix L- Owner Letter of Commitment

westbank

August 7, 2018

Planning, Urban Design,
+Sustainability Department
City of Vancouver
Email:
planning@vancouver.ca

453 West 12th Avenue
Vancouver, BC
V5Y 1V4

Re: 1780 East Broadway Rezoning Application
Commitment to meet the requirements of the Green Buildings Policy for Rezonings

As a part of the Rezoning Application package for 1780 East Broadway, Westbank Projects Corp. and or its' assignee hereby commits to meet the requirements of the Green Buildings Policy for Rezonings, and commits to providing the required documentation at time of Development Permit Application, Building Permit Application and Occupancy Permit Application. At this concept stage of design, in addition to the measures identified previously in the Sustainable Design Strategy section of the Rezoning Application package, Westbank Projects Corp. and or its' assignee commits to the following requirements:

- B.3: Airtightness Testing: design, build, and test to meet an airtightness target of 2.0 L/s/m^2 @ 75 Pa;
- B.4: Enhanced Commissioning: complete an enhanced commissioning process;
- B.5: Energy System Sub-Metering and Reporting: design and build to include building metering and sub-metering of energy, and to enter into agreement on energy reporting, including assistance for building future owners;
- B.6.1: Refrigerant Emissions and Embodied Emissions: complete refrigerant emissions calculations;
- B.7: Verified Direct Ventilation: design and build a direct ventilation system;
- B.8: Low-Emitting Materials: design and build with low-emitting materials;
- B.9: Indoor Air Quality Testing: test indoor air quality prior to occupancy;
- B.11: Resilient Drinking Water Access: design and build a resilient potable water access point.

The design team and future operations team will coordinate to incorporate the measures required to meet all requirements of the Green Buildings Policy for Rezonings.

Yours truly,
Westbank Projects Corp. and/or its' assignee

Josh Anderson
Project Manager

P: 604.685.8986 | F: 604.893.1708 | westbankcorp.com

5th Floor Gallery, 1067 West Cordova Street, Vancouver, BC V6C 1C7 CANADA