Sustainabilty Rationale

Alberni Towers

Sustainable Design Strategy

Rezoning Application

Prepared by Recollective Consulting
2018-06-27

The Alberni Towers project will be designed and constructed to meet the **Low Emissions Green Buildings** requirements of the **City of Vancouver Green Buildings Policy for Rezoning**. Documentation for each of the sustainability criteria is provided as identified in the **Green Buildings Policy for Rezoning - Process and Requirements (Amended April 28, 2017)**.

B.1 – LEED:
The Alberni Towers consists of two residential towers; therefore, LEED Gold **is not** required for the project.

B.2 – Energy Performance Limits:
The proposed design employs the following energy conservation measures to meet the performance limits of the rezoning policy.

- High performance building envelope throughout.
- LED lighting in the common areas of the project.
- Heating and cooling with low power fan coil units and highly effective heat recovery ventilators.
- The central plant is an air source heat pump with backup condensing boilers.
- Low flow fixtures to reduce domestic hot water demand.

The preliminary Zero Emissions Building Plan (ZEBP) Energy Checklist is provided in Appendix 1. This was completed by the project energy modeller and shows that the project meets the performance limits for energy use, heat loss, and greenhouse gas emissions, together with key inputs.
Also, a preliminary energy model report including modeling parameters is provided in Appendix 2.

B.6.2 – Embodied Emissions
Athena Impact Estimator version 5.2 was used to calculate the preliminary embodied emissions for the project. The Life Cycle Assessment (LCA) boundary accounts for cradle-to-grave impacts. The LCA includes systems identified in the Green Building Policy for Rezoning – Process and Requirements. A building lifetime of 60 years is assumed. The following table shows the LCA inputs:

Location	Vancouver, BC
Building Type	Multi-Unit Residential
Building Life Expectancy	60 years
Area take-offs	As per 2018-06-11 Review Set
Structural System	Concrete
Envelope System	Curtain wall, window wall
Window-to-Wall Ratio	50%
Windows	Triple glazing (with some double glazing doors), Aluminum frame

The following table shows the preliminary LCA results:

Summary Measure	**Unit**	**Total Effects Cradle to Grave**	**Total Effect per m²**
Global warming potential	**kg CO2 eq**	6.33E+06	**151.32**
Stratospheric ozone depletion	kg CFC-11 eq	8.66E-02	0.000002
Acidification of land and water	kg SO2 eq	3.99E+04	0.95
Eutrophication	kg N eq	2.20E+03	0.05
Tropospheric ozone formation	kg O3 eq	5.84E+05	13.97
Depletion of non-renewable energy resources	MJ	6.16E+07	1474.37

[Total Area: 41,810.7 m²]

Appendix 3 includes embodied emissions calculation for each building and assembly group.

B.10 – Integrated Rainwater Management and Green Infrastructure
The rainwater management system for this site has been designed in accordance with the City Wide Integrated Rainwater Management Plan criteria. Additional references include the Metro Vancouver Stormwater Source Control Design Guidelines and the Land Development Guidelines for the Protection of Aquatic Habitat which was developed jointly by the Department of Fisheries and Oceans Canada and the British Columbia Ministry of Environment, Lands and Parks (M.O.E.). Planting will feature native and adaptive species to minimize maintenance and pest management. Plant selection and efficient irrigation strategies are expected to reduce watering demand.

Integrated Rainwater Management Plan (IRMP) is included in Appendix 4. The source controls adopted for this development consist of a number of measures to be implemented onsite as well as offsite. Following source controls are shown on the IRMP drawing (Appendix 5) and Integrated Rainwater Management Concept Plan:

- Absorbent Landscaping
- Tree Well Structures
- Water Quality and Treatment Structures
- Detention Tank

B.3-9 and B.11 – Commitment Letter from the Owner

Sustainabilty Rationale

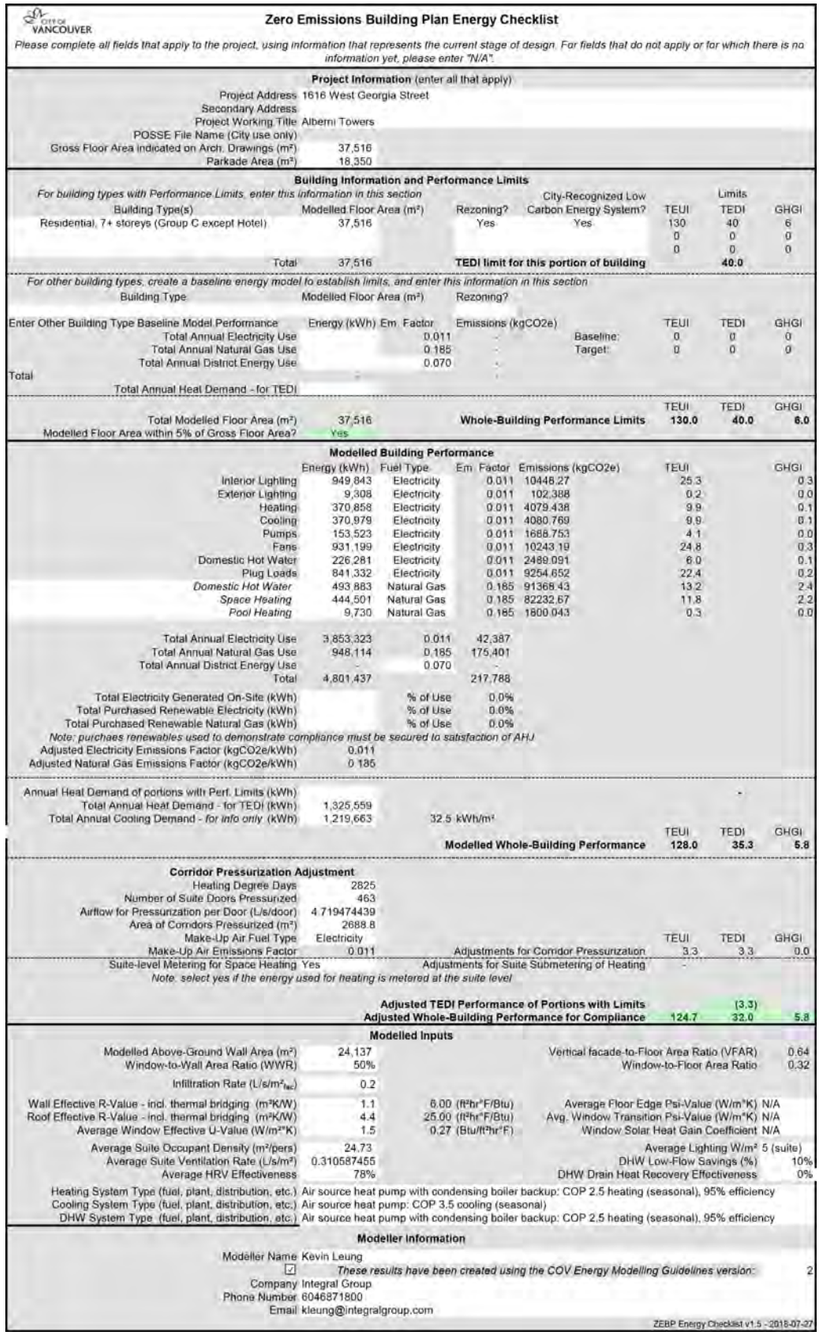
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The Owner has provided a commitment letter for the following sustainability requirements. The letter is included in Appendix 6.

- **B.3 Airtightness Testing:** Whole-building airtightness for each building will be tested and reported, and both buildings will be designed and constructed to meet an air-leakage target of 2.0 L/s*m2 @75 Pa. Airtightness of suites will be designed, tested and reported to comply with a target of 1.2 L/s*m2 @50 Pa.
- **B.4 Enhanced Commissioning:** Advanced commissioning of mechanical and electrical systems will be conducted to ensure the energy savings will remain with the project over time. An enhanced commissioning process for all building energy systems will be completed in accordance with ASHRAE Guideline 0-2005 and 1.1-2007.
- **B.5 Energy System Sub-Metering:** A separate master metering for each energy utility and each building will be provided as well as sub-metering of all major energy end-uses and major space uses within each building. Also, an Energy Star Portfolio Manager account will be setup for each building.
- **B6.1 Refrigerant Emissions:** Refrigerants emission for both buildings will be calculated and reported. The HVAC&R system will be designed to minimize CO2e emissions.
- **B.7 Verified Direct Ventilation:** The ventilation system will be designed to provide fresh outdoor air directly to all occupiable spaces in the quantities defined by code. Heat Recovery Ventilators (HRVs) will be included in the HVAC design.
- **B.8 Low-Emitting Materials:** The project will aim to maximize the quality of the indoor environment for building occupants by using low emitting interior materials by meeting the content requirements of Green Seal, Green Label, Green Label Plus, FloorScore and SCAQMD Rules.
- **B.9 Indoor Air Quality Testing:** The project will employ air quality management strategies through construction. This will be coordinated through an Indoor Air Quality (IAQ) management plan and executed by the construction team. The plan will include IAQ testing for formaldehyde, particulates, ozone, total volatile organic compounds, and carbon monoxide prior to occupancy. Results will be reported to the City of Vancouver.
- **B.11 Resilient Drinking Water Access:** A potable water fountain will be provided for each tower. These water fountains will be easily accessible to all building occupants.

Appendices

- **Appendix 1 - (ZEBP) Energy Checklist**
- **Appendix 2 – Energy Model Inputs**
- **Appendix 3 – Preliminary Embodied Emissions Calculations**
- **Appendix 4 – IRMP**
- **Appendix 5 – IRMP Drawing**
- **Appendix 6 – Commitment Letter from Owner**



CITY OF VANCOUVER

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	1616 West Georgia Street
Secondary Address	
Project Working Title	Alberni Towers
POSSE File Name (City use only)	
Gross Floor Area indicated on Arch. Drawings (m²)	37,516
Parkade Area (m²)	18,350

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)	37,516	Yes	Yes	130	40	6
				0	0	0
				0	0	0
Total	37,516	**TEDI limit for this portion of building**			**40.0**	

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?
Enter Other Building Type Baseline Model Performance		

	Energy (kWh)	Em. Factor	Emissions (kgCO2e)		TEUI	TEDI	GHGI
Total Annual Electricity Use		0.011	-	Baseline:	0	0	0
Total Annual Natural Gas Use		0.185	-	Target:	0	0	0
Total Annual District Energy Use		0.070	-				
Total	-		-				
Total Annual Heat Demand - for TEDI							

			TEUI	TEDI	GHGI
Total Modelled Floor Area (m²)	37,516	**Whole-Building Performance Limits**	**130.0**	**40.0**	**6.0**
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	949,843	Electricity	0.011	10448.27	25.3	0.3
Exterior Lighting	9,308	Electricity	0.011	102.388	0.2	0.0
Heating	370,858	Electricity	0.011	4079.438	9.9	0.1
Cooling	370,979	Electricity	0.011	4080.769	9.9	0.1
Pumps	153,523	Electricity	0.011	1688.753	4.1	0.0
Fans	931,199	Electricity	0.011	10243.19	24.8	0.3
Domestic Hot Water	226,281	Electricity	0.011	2489.091	6.0	0.1
Plug Loads	841,332	Electricity	0.011	9254.652	22.4	0.2
Domestic Hot Water	493,883	Natural Gas	0.185	91368.43	13.2	2.4
Space Heating	444,501	Natural Gas	0.185	82232.67	11.8	2.2
Pool Heating	9,730	Natural Gas	0.185	1800.043	0.3	0.0
Total Annual Electricity Use	3,853,323	0.011	42,387			
Total Annual Natural Gas Use	948,114	0.185	175,401			
Total Annual District Energy Use	-	0.070				
Total	4,801,437		217,788			
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)					-	
Total Annual Heat Demand - for TEDI (kWh)	1,325,559					
Total Annual Cooling Demand - *for info only* (kWh)	1,219,663	32.5 kWh/m²				

	TEUI	TEDI	GHGI
Modelled Whole-Building Performance	**128.0**	**35.3**	**5.8**

Corridor Pressurization Adjustment

			TEUI	TEDI	GHGI
Heating Degree Days	2825				
Number of Suite Doors Pressurized	463				
Airflow for Pressurization per Door (L/s/door)	4.719474439				
Area of Corridors Pressurized (m²)	2688.8				
Make-Up Air Fuel Type	Electricity				
Make-Up Air Emissions Factor	0.011	Adjustments for Corridor Pressurization	3.3	3.3	0.0
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			**(3.3)**
Adjusted Whole-Building Performance for Compliance	**124.7**	**32.0**	**5.8**

Modelled Inputs

Modelled Above-Ground Wall Area (m²)	24,137		Vertical facade-to-Floor Area Ratio (VFAR)	0.64
Window-to-Wall Area Ratio (WWR)	50%		Window-to-Floor Area Ratio	0.32
Infiltration Rate (L/s/m²$_{fac}$)	0.2			
Wall Effective R-Value - incl. thermal bridging (m²K/W)	1.1	6.00 (ft²hr°F/Btu)	Average Floor Edge Psi-Value (W/m°K)	N/A
Roof Effective R-Value - incl. thermal bridging (m²K/W)	4.4	25.00 (ft²hr°F/Btu)	Avg. Window Transition Psi-Value (W/m°K)	N/A
Average Window Effective U-Value (W/m²°K)	1.5	0.27 (Btu/ft²hr°F)	Window Solar Heat Gain Coefficient	N/A
Average Suite Occupant Density (m²/pers)	24.73		Average Lighting W/m²	5 (suite)
Average Suite Ventilation Rate (L/s/m²)	0.310587455		DHW Low-Flow Savings (%)	10%
Average HRV Effectiveness	78%		DHW Drain Heat Recovery Effectiveness	0%
Heating System Type (fuel, plant, distribution, etc.)	Air source heat pump with condensing boiler backup: COP 2.5 heating (seasonal), 95% efficiency			
Cooling System Type (fuel, plant, distribution, etc.)	Air source heat pump: COP 3.5 cooling (seasonal)			
DHW System Type (fuel, plant, distribution, etc.)	Air source heat pump with condensing boiler backup: COP 2.5 heating (seasonal), 95% efficiency			

Modeller Information

Modeller Name	Kevin Leung
☑	*These results have been created using the COV Energy Modelling Guidelines version:* 2
Company	Integral Group
Phone Number	6046871800
Email	kleung@integralgroup.com

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

Sustainabilty Rationale

Alberni Towers - 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 3.64
Building Area	Above grade gross area: 403,824 ft²
Hours of Operation	Based on *ENERGY MODELLING GUIDELINES section 2.1 Schedules*
Envelope Performance	
Overall Roof U-value (BTU/h·ft²·°F)	U-0.040 (R-25)
Overall Wall U-value (BTU/h·ft²·°F)	U-0.166 (R-6) (includes all thermal bridges per CoV's *ENERGY MODELLING GUIDELINES*)
Overall Floor/Soffit U-value (BTU/h·ft²·°F)	U-0.100 (R-10)
Percentage Glazing	50%
Overall Glass U-value including frame (BTU/h·ft²·°F), and Solar Heat Gain Coefficient (SHGC)	U-0.27 (triple glazing, overall including fixed, operable and sliding doors) SHGC-0.35 Pool Dome Glazing U-0.69 SHGC-0.39
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
Internal Loads	
Occupancy	Residential: People = no. bedrooms + 1 (based on ASHRAE 62.1-2001 Table 2) All other space type occupancy densities as per NECB 2011
Lighting Power Density (LPD) (W/ft²)	Space by Space Method / NECB 2011 Lighting Power Density [W/ft²]: Corridor/Transition: 0.78 Lounge/Recreation: 0.87 Electrical/Mechanical: 1.24 Residential Suite: 0.46 Lobby: 0.90 Lobby for elevator: 0.64 Parking Garage: 0.13 Stairway: 0.69 Restroom: 0.98 Locker Room: 0.91 Pool: 0.88 Gym: 0.91 Storage: 0.63
Exterior lighting	2.5 kW (preliminary exterior lighting allowance)
Plug-Loads	Residential: 0.464 W/ft² (all electric in-suite appliances) (Based on *ENERGY MODELLING GUIDELINES section 2.2.1 Residential Suites*) All other space type occupancy densities as per NECB 2011

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.

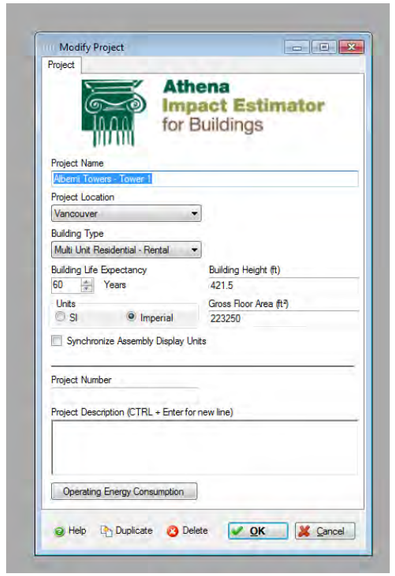
	Proposed Design Model Characteristics
Process Loads	Swimming pool as per *Swimming Pools and the ENERGY STAR Score in the United States and Canada* Miscellaneous: 30 kW (preliminary process load allowance) Elevators: 6 x 3 kW
Domestic Hot Water Consumption	Residential: 0.025 gpm/person with 10% reduction (low flow fixture) (as per Based on *ENERGY MODELLING GUIDELINES section 2.2.1 Residential Suites*) All other space type service water heating demand as per NECB 2011
Mechanical Systems	
Indoor Design Temperature for Conditioned Areas	Based on *ENERGY MODELLING GUIDELINES 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: ≈0.30 W/cfm (average) • ERV fan power: ≈28 W • Bathroom fan power: 13.6 W • Ventilation fans on continuously, bathroom fans on 2 hours/day Lobby/Amenity/Gym Heating and cooling by fan coil unit and ventilation by heat recovery ventilators (HRV) • Fan coil unit: ≈0.30 W/cfm (average) • ERV fan power: ≈32 W (per 300 cfm) • Ventilation fans on continuously Pool: Rooftop air handling unit with hydronic heating and chilled water cooling and dehumidification (60% RH max). Exhaust runaround coil heat recovery. • AHU fan power: ≈1.33 W/cfm • 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: ≈0.30 W/cfm • Ventilation fans on continuously Parkade: Parkade fan • Fan power: ≈0.20 W/cfm • Fan hours of operation: 4 hours/day
Minimum Ventilation Rates	Living areas: 0.35 air changes per hour but not less than 15 cfm per person Gym: 20 cfm/person at 30 people/1000 ft² Pool: 0.50 cfm/ft² Corridor pressurization: 10 cfm/door (kept at 60°F) (Outdoor air is calculated by ASHRAE 62-2001)
Heat Recovery	Dwelling Units – in-suite ERV Sensible effectiveness: ≈78% Latent effectiveness: ≈35% Amenity/Gym HRV Sensible effectiveness: ≈55% Pool runaround heat recovery Sensible effectiveness: ≈40%
Central Plant	
Heating Type & Hot Water Loop	Air source heat pump (Aermec NRP: simultaneous heating and cooling) with condensing boiler backup (switch at 36°F outdoor air temperature, i.e. approximately 30% heat load from boiler, 70% from ASHP) • Efficiency: ≈2.5 seasonal COP (heat pump), 95% thermal efficiency (boiler) • Design supply: 120°F • Design loop DT: 20°F
Cooling Type & Chilled Water Loop	Air source heat pump (Aermec NRP: simultaneous heating and cooling) • Efficiency: ≈3.5 seasonal COP • Design supply: 44°F • Design loop DT: 10°F
Domestic Water Heater and Efficiency	Air source heat pump with condensing boiler backup (switch at 36°F outdoor air temperature, i.e. approximately 45% heat load from boiler, 55% from ASHP) • Efficiency: ≈2.5 seasonal COP (heat pump), 95% thermal efficiency (boiler)

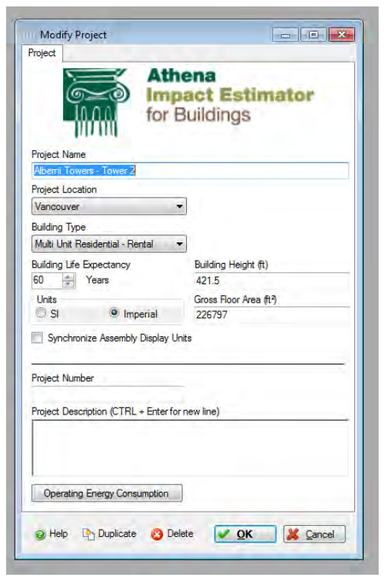
Sustainabilty Rationale

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Appendix 3 – Preliminary Embodied Emissions Calculations

Snapshot of Athena Impact Estimator software used for the LCA.





LCA Measure Table By Assembly Groups (Cradle to Grave) - Tower 1

LCA Measures	Unit	Foundations	Envelope	Columns and Beams	Roofs	Floors	Total
Global Warming Potential	kg CO2 eq	2.07E+04	1.63E+06	1.58E+05	7.52E+03	1.31E+06	**3.13E+06**
Acidification Potential	kg SO2 eq	1.11E+02	1.22E+04	7.13E+02	4.75E+01	6.67E+03	**1.97E+04**
HH Particulate	kg PM2.5 eq	1.36E+01	8.90E+03	3.94E+02	4.52E+01	1.63E+03	**1.10E+04**
Eutrophication Potential	kg N eq	1.07E+01	4.39E+02	4.47E+01	3.29E+00	5.88E+02	**1.09E+03**
Ozone Depletion Potential	kg CFC-11 eq	2.02E-04	3.14E-02	5.88E-04	4.57E-05	1.05E-02	**4.27E-02**
Smog Potential	kg O3 eq	2.43E+03	1.37E+05	1.21E+04	9.23E+02	1.36E+05	**2.89E+05**
Total Primary Energy	MJ	1.96E+05	1.77E+07	1.95E+06	1.24E+05	1.36E+07	**3.36E+07**
Non-Renewable Energy	MJ	1.83E+05	1.54E+07	1.90E+06	1.21E+05	1.29E+07	**3.05E+07**
Fossil Fuel Consumption	MJ	1.69E+05	1.50E+07	1.48E+06	1.12E+05	1.11E+07	**2.79E+07**

RECOLLECTIVE

LCA Measure Table By Assembly Groups (Cradle to Grave) - Tower 2

LCA Measures	Unit	Foundations	Envelope	Columns and Beams	Roofs	Floors	Total
Global Warming Potential	kg CO2 eq	2.22E+04	1.68E+06	1.58E+05	7.52E+03	1.33E+06	**3.20E+06**
Acidification Potential	kg SO2 eq	1.19E+02	1.25E+04	7.13E+02	4.75E+01	6.78E+03	**2.02E+04**
HH Particulate	kg PM2.5 eq	1.46E+01	9.17E+03	3.94E+02	4.52E+01	1.65E+03	**1.13E+04**
Eutrophication Potential	kg N eq	1.15E+01	4.52E+02	4.47E+01	3.29E+00	5.98E+02	**1.11E+03**
Ozone Depletion Potential	kg CFC-11 eq	2.17E-04	3.23E-02	5.88E-04	4.57E-05	1.07E-02	**4.38E-02**
Smog Potential	kg O3 eq	2.61E+03	1.41E+05	1.21E+04	9.23E+02	1.38E+05	**2.95E+05**
Total Primary Energy	MJ	2.11E+05	1.83E+07	1.95E+06	1.24E+05	1.38E+07	**3.43E+07**
Non-Renewable Energy	MJ	1.96E+05	1.59E+07	1.90E+06	1.21E+05	1.31E+07	**3.12E+07**
Fossil Fuel Consumption	MJ	1.81E+05	1.54E+07	1.48E+06	1.12E+05	1.13E+07	**2.85E+07**

LCA Measure by Impact Category - Tower 1

Summary Measure	Unit	Total Effects Cradle to Grave A to D
Global warming potential	kg CO2 eq	3.13E+06
Stratospheric ozone depletion	kg CFC-11 eq	4.27E-02
Acidification of land and water	kg SO2 eq	1.97E+04
Eutrophication	kg N eq	1.09E+03
Tropospheric ozone formation	kg O3 eq	2.89E+05
Depletion of non-renewable energy resources	MJ	3.05E+07

LCA Measure by Impact Category - Tower 2

Summary Measure	Unit	Total Effects Cradle to Grave A to D
Global warming potential	kg CO2 eq	3.20E+06
Stratospheric ozone depletion	kg CFC-11 eq	4.38E-02
Acidification of land and water	kg SO2 eq	2.02E+04
Eutrophication	kg N eq	1.11E+03
Tropospheric ozone formation	kg O3 eq	2.95E+05
Depletion of non-renewable energy resources	MJ	3.12E+07

Sustainabilty Rationale

Vector engineering services ltd.

1.0 INTRODUCTION

Vector engineering Services Ltd has been retained to provide civil engineering and Integrated Rainwater Management Plan design on behalf of Alberni Street Developments for the property located at 1625 West Georgia Street, in Vancouver, BC. The subject site is located along the South side of West Georgia Street, west of Cardero Street (see aerial photo in Appendix 1).

As a condition of development, the City of Vancouver has requested an Integrated Rainwater Management Plan for the site. In response to this requirement, Vector Engineering Services Ltd. was retained to provide analysis of the site drainage and establish an Integrated Rainwater management strategy for the proposed new development. The hydrologic calculations and storm modeling of the site are summarized in this report and are hereby submitted to the City for review.

2.0 EXISTING CONDITIONS

The subject site is approximately 0.39 hectares in area, covered by parking area and buildings with minimal landscaping. The current ground cover condition at the site is 95% impervious. The site currently slopes in a north to north-west direction.

3.0 PROPOSED DEVELOPMENT

The development plan calls for construction of two residential tower over a common underground parkade that covers the entire site area. With the proposed development of the site, the total overall impervious site coverage will decrease to 70%. The impervious areas will consist of building roofs, pedestrian rest areas, parkade ramp and hard landscaped areas. The remainder of the site will consist of a variety of landscaped areas, above the parkade roof slab. (See Appendix 2).

4.0 STORM WATER MANAGEMENT OBJECTIVES AND BMPS

To improve the quality rainwater runoff and improve health of natural water bodies, the City of Vancouver has adopted a City Wide Integrated Rainwater Management Plan and a Rezoning Policy for Sustainable Large Developments. This plan requires all new developments requiring rezoning to incorporate rainwater management measures to control post development runoff rates and to improve the quality of rainwater runoff using Best Management Practices.

The rainwater management system for this site has been designed in accordance with the City Wide Integrated Rainwater Management Plan criteria and the Rezoning Policy for Sustainable Large Developments requirements.

As per City of Vancouver Rainwater Management Bulletin dated July 2018 we have considered to reduce stormwater discharge volume, reduce the flow rate of peak runoff and treat surface runoff to reduce contaminants.

The measures proposed are to be employed to meet the following targets:

- Post-development peak runoff rate = Pre-development peak runoff rate for the five-year 24-hour duration storm.
- Capture and retain 24mm of rainfall in 24 hours from all areas, including rooftops, paved areas and landscape.

The IRMP includes source control that treats 90% of the average runoff volume and the water treatment structure is capable of 80% TSS removal.

Additional references include the Metro Vancouver Stormwater Source Control Design Guidelines and the Land Development Guidelines for the Protection of Aquatic Habitat which was developed jointly by the Department of Fisheries and Oceans Canada and the British Columbia Ministry of Environment, Lands and Parks (M.O.E.).

The source controls adopted for this development consist of several measures to be implemented onsite as well as offsite. The source controls are shown on the attached drawing, Integrated Rainwater Management Concept Plan and are summarized below.

4.1 Tier 1 Priority Green Infrastructure Practices – Rain Water Harvesting for Reuse

The proposed site layout has no available space for in-situ engineered infiltration systems due to underground parkade that covers the entire site area.
Therefore the Tier 1 approach to meet the Rainwater Management objectives has not been considered.

4.2 Tier 2 Priority Green Infrastructure Practices – Retention within Non-Infiltrating Landscape

The primary purpose of the absorbent landscaping is to reduce runoff from impermeable surfaces by intercepting and retaining rainwater. The target is to retain 24 mm of rainfall in 24 hours from all areas.

The post-development site area including rooftops, paved areas and landscaping is approximately 3406 m^2.

24mm of rainfall volume = 3406 m^2 x 24mm = 81.74 m^3.

Sustainabilty Rationale

The post-development site layout will have a total area of landscaping of 1018 m^2 consisting in areas with thicknesses of absorbent soils between 450mm and 900mm over the parkade slab
To capture and retain the rainfall volume of 81.74 m^3 the total soil volume required assuming a capacity of soil absorbency of 20% will be:

Soil volume required = 81.74 m^3 /20% = 408.7 m^3 and therefore an average thickness of 450mm will be required.

The landscaping plan call for absorbent landscaping areas with soil thickness varying from 450mm in shrub landscaped areas to 900mm in treed areas.

The total soil volume provided is 822.6 m^3 which is greater than the minimum soil volume required of 408.7 m^3.

The hard landscaping such as walkways, pedestrian rest areas and other hard landscaping will be graded to drain towards the adjacent soft landscaped areas which will be provided with an overflow catchbasin tied into the site drainage system inside the underground parkade structure.
The roof runoff will be directed into the site drainage system inside the underground parkade structure.
The absorbent landscaping provided will have the capacity of retaining 164.5 m^3 which is greater than 81.74 m^3 required to retain 24 mm of rainfall in 24 hours from all site areas.
However the roof area and underground parkade access ramp will not drain into the absorbent landscaping the soil volume provided will have the capacity of retaining the volume required as per City criteria.

4.3 Tier 3 Priority Green Infrastructure Practices – Detention Storage with Treatment and Slow Release

As outlined previously in Section 4.0 of this report, the criterion used for stormwater analysis is to limit the five-year 24-hour (2100 IDF curve) post-development peak runoff to the five-year 24-hour (2014 IDF Curve) pre-development peak runoff.

Detention tanks collect and store stormwater runoff during a storm event, then release it at controlled rates to the downstream drainage system, thereby attenuating peak discharge rates from the site.

Detention volume required to meet the City of Vancouver peak runoff reduction to the to the five-year 24-hour (2014 IDF Curve) pre-development level = 16.00 m^3.

The total volume retained into the absorbent landscaping will be greater the required detention volume and therefore a rainwater detention tank will not be used for the proposed development.

The proposed development is not anticipated to have an adverse effect on the downstream conveyance and stream channel capacity.

4.4 Water Quality

The on-site stormwater drainage system is designed to separate runoff from the roof and hard and soft landscaped areas from the contaminated first flush runoff on the roadways and parking areas. Water from the parkade podium hard landscaped areas will be routed through the proposed absorbent landscaping.

The average of 450mm growing medium thickness provided is considered to achieve the target of water treatment for these areas.

Primary treatment of stormwater from parking areas and roadways is derived from hooded catch basins and a conventional oil-water separator to retain sediment as well as oil and hydrocarbons leaking from vehicles accessing the subject site.

As the roof area and underground parkade access ramp will not drain into the absorbent landscaping, the rainwater runoff from these areas will be directed through the proposed water treatment unit (Jellyfish) which will provide treatment of stormwater for hydrocarbons, heavy metals and suspended solids that will be installed before the discharge into the City storm sewer system. The stormwater treatment structure is designed to filter stormwater runoff to remove hydrocarbons, heavy metals and suspended solids. A brochure from the jellyfish supplier has been attached for review as Appendix 4.

5.0 Hydrologic Model and Analysis

The following drainage modeling and analysis was used for design of the Stormwater Management System for this project.

5.1 Rainfall Data

The rainfall data used in the hydrologic analysis was based on the five-year return period rainfall, as per the City's Stormwater Management Design Criteria and City of Vancouver Rainwater Management Bulletin dated July 2018.

Sustainabilty Rationale

The City of Vancouver IDF curve (2014), AES rainfall data for pre-development conditions and IDF curve (2100), AES rainfall data for post-development conditions have been modeled and tabulated for storms of 5 year 24-hour duration, was selected for the hydrologic analysis (Appendix 3).

5.2 Existing Runoff

To simulate the two-year stormwater runoff for the existing condition, the relative impervious and pervious areas were analyzed and hydrologic models were computed using the Illudas method from a computer program "HYDSYS for Drainage". For the purpose of establishing a release rate for comparison between pre and post development conditions, soil type C (slow infiltration rates) was input into all drainage models.

In accordance with the City Vancouver Integrated Rainwater management Design Criteria, the pre-development computer model simulations were completed for five year storms with durations of 24 hours for the City of Vancouver IDF curve (2014), AES rainfall data.

Based on the described parameters above, the peak runoff value and volume for the five-year 24 hour rainfall event was calculated to be as follows:

Five year 24 hour existing peak flow and total rain volume

Existing Site $Q_{5yr,\ 24hr\ =}$ 21.1 l/sec
Total rain volume V5yr, 24hr= 330 m^3

Allowable Release Rate

In accordance with the City Vancouver Integrated Rainwater management Design Criteria, allowable release rate = Existing $Q_{5year24hour}$

Max. $Q_{5yr,\ prop}$ = 21 l/sec

A copy of the modeling results for existing pre-development conditions has been attached in Appendix 3.

5.3 Post Development Runoff

The post development stormwater runoff was also analyzed and hydrologic models were computed using the same HYDSYS software. The models were adjusted to reflect the change in total site areas and impervious surface areas between the pre-development and post development conditions. The soil type and overland flow parameters are the same as for the existing condition, however the impervious site coverage has decreased from the assumed 95% to 70%.

Based on the described parameters above, the peak runoff value and volume for the five-year 24 hour rainfall event for the City of Vancouver IDF curve (2100), AES rainfall data was calculated to be as follows:

Five year 24 hour post development peak flow and volume

Proposed Site $Q_{5yr,\ 24hr}$ = 24 l/s
Total rain volume V5yr, 24hr= 300 m^3

After imputing in the model the storage provided the absorbent landscaping the peak runoff rate has decreased to:
Proposed Site $Q_{5yr,\ 24hr}$ = 3.0 l/s which is less than Max. $Q_{5yr,\ prop}$ = 21 l/sec

A copy of the post-development conditions computer modeling results has been attached in Appendix 3.

6.0 Maintenance Guidelines

The absorbent landscaping is a key component of the proposed Stormwater Management Plan for this development. It has been designed as a permanent low-maintenance system requiring regular monitoring and periodic maintenance.

Monitoring and maintenance of individual components of the system will consist of the following measures described below:

Catchbasins and Oil-Water Separators

- Inspect oil-water separator and all catch basins for debris and sediment accumulation.
- Remove grate/lid.
- Remove debris as found.
- Remove accumulated sediment and oil using truck mounted suction pump equipment with storage tank when sediment reaches ½ of the sump depth.
- Sediment shall be disposed offsite at an approved landfill.
- Replace grate/lid.
- All catchbasins to be recharged with clean water after silt/sediment removal.

Sustainabilty Rationale

Landscaping

Monitoring (annually by Landscape Architect):

- Inspect plants for die-back, for growth and for general health.
- Observe extent of yearly dieback.
- Forward growing medium sample to laboratory for testing if general plant health in question.
- Inspect plants for signs of pests or diseases.
- Inspect plants for breakage or wind damage.
- Review lawn maintenance operations.
- Observe plant and planter maintenance, weed and debris removal.
- Observe growing medium settlement.
- Review planter edging, flashing, gravel borders.
- Inspect for standing water, saturation or other indications of poor drainage.
- Review irrigation system function and coverage where applicable.
- Prepare annual report.

Maintenance Operations (by maintenance contractor):

- Perform establishment maintenance operations to BCSLA/BCLNA BC Landscape Standard, latest edition for 55 days from Substantial Performance.
- Perform general maintenance operations to BCSLA/BCLNA BC Landscape Standard, latest edition after 55 days from Substantial Performance.
- Replace dead or dying plant materials regularly.
- Fertilize plant materials per plant requirements.
- Respond to laboratory soil test recommendations if indicated.
- Perform pest/disease management as required.
- Prune dead, diseased or broken branches, prune shrubs and trees for form and to optimize flowering yearly.
- Perform standard lawn maintenance operations regularly.
- Stabilize trees or shrubs where indicated.
- Remove weeds, debris and cultivate growing medium regularly.
- Add soil amendment where soil settlement has occurred yearly.
- Maintain and repair edging, flashing, and gravel borders as required.
- Observe, report and perform drainage improvements where indicated.
- Adjust irrigation system regularly for coverage.
- Repair irrigation system leaks immediately.
- Perform winterization and spring start-up procedures.
- Document maintenance operations regularly.

7.0 CONCLUSION

Peak flow and volume attenuation will be provided with the installation of absorbent landscaping and the runoff from adjacent impervious surfaces such as rooftops and paved being directed through the absorbent landscaping

Stormwater treatment will be provided through the separation of first flush flow. Runoff from of roadway access underground parking areas will be directed to oil separators. Conventional oil/water separators will be installed within the parkade and connected to the sanitary sewer system.

Runoff for the building roof and hard surface landscaped area will be directed through the absorbent landscaping.

The rainwater management system for this site has been designed in accordance with the City Wide Integrated Rainwater Management Plan criteria and the Rezoning Policy for Sustainable Large Developments requirements.

A copy of the proposed Integrated Rainwater Management Plan has been attached in Appendix 2. Copies of the drainage model printout for pre-development and post development conditions have been attached as Appendix 3.

Should you require additional information please contact the undersigned.

Reviewed by:

Dan Diaconu, P.Eng.
Project Engineer

Vic Sagorski AScT
Director of Engineering & Development
Associate

CC Alberni Street Developments, Attn: Gary Wong

Sustainabilty Rationale



NO.	DATE	REVISION	BY
0	2018/06/25	ISSUED FOR RE-ZONING APPLICATION	DD
1	2019/03/20	ISSUED FOR DP APPLICATION	DD

Vector engineering services ltd.
3375 NORLAND AVE. BURNABY B.C. V5B 3A9 PH: 604-298-2333 FAX: 604-298-5652

CLIENT: ALBERNI STREET DEVELOPMENTS

INTEGRATED RAINWATER MANAGEMENT PRE-DEVELOPMENT
1616 WEST GEORGIA STREET

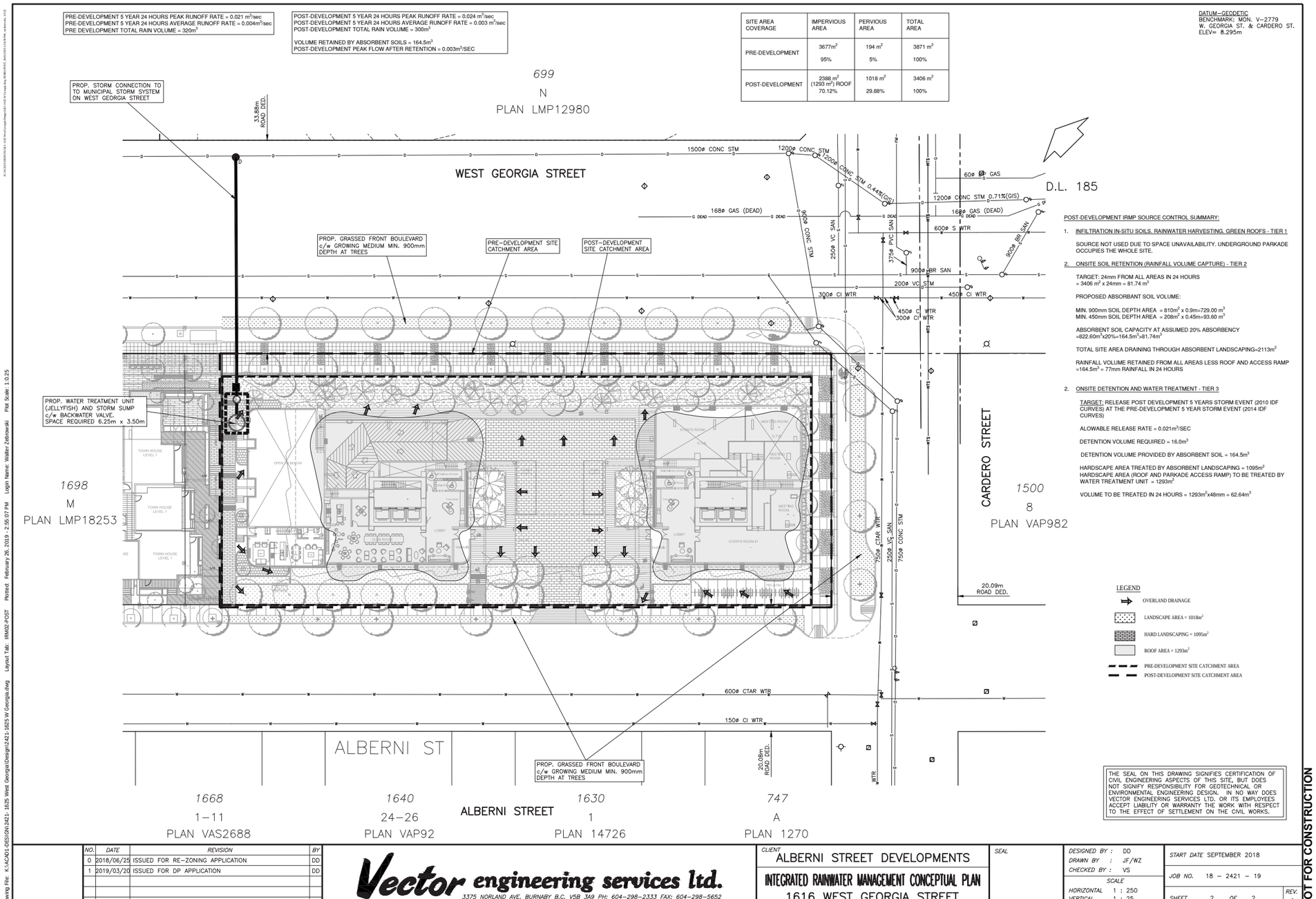
SEAL

DESIGNED BY : DD
DRAWN BY : JF/WZ
CHECKED BY : VS

SCALE
HORIZONTAL 1 : 250
VERTICAL 1 : 25

START DATE SEPTEMBER 2018
JOB NO. 18 - 2421 - 19
SHEET 1 OF 2
REV. 1

Sustainabilty Rationale



Sustainabilty Rationale

June 22, 2018

City of Vancouver
Planning, Urban Design, & Sustainability Department
453 West 12th Avenue
Vancouver, BC V5Y 1V4

To Whom It May Concern:

I, Gary Wong, represent the owner for the Alberni Towers development, which is applying for rezoning. As per the City of Vancouver's Green Buildings Policy for Rezoning, I confirm that Alberni Towers is committing to implement, with documentation to be submitted at a later project phase, the following sustainability requirements:

- B.3: design, build, and test to meet an airtightness target of 2.0 L/s/m @ 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.

If you have any questions, please contact the undersigned.

Yours truly,

Gary Wong
Director

GW/sm