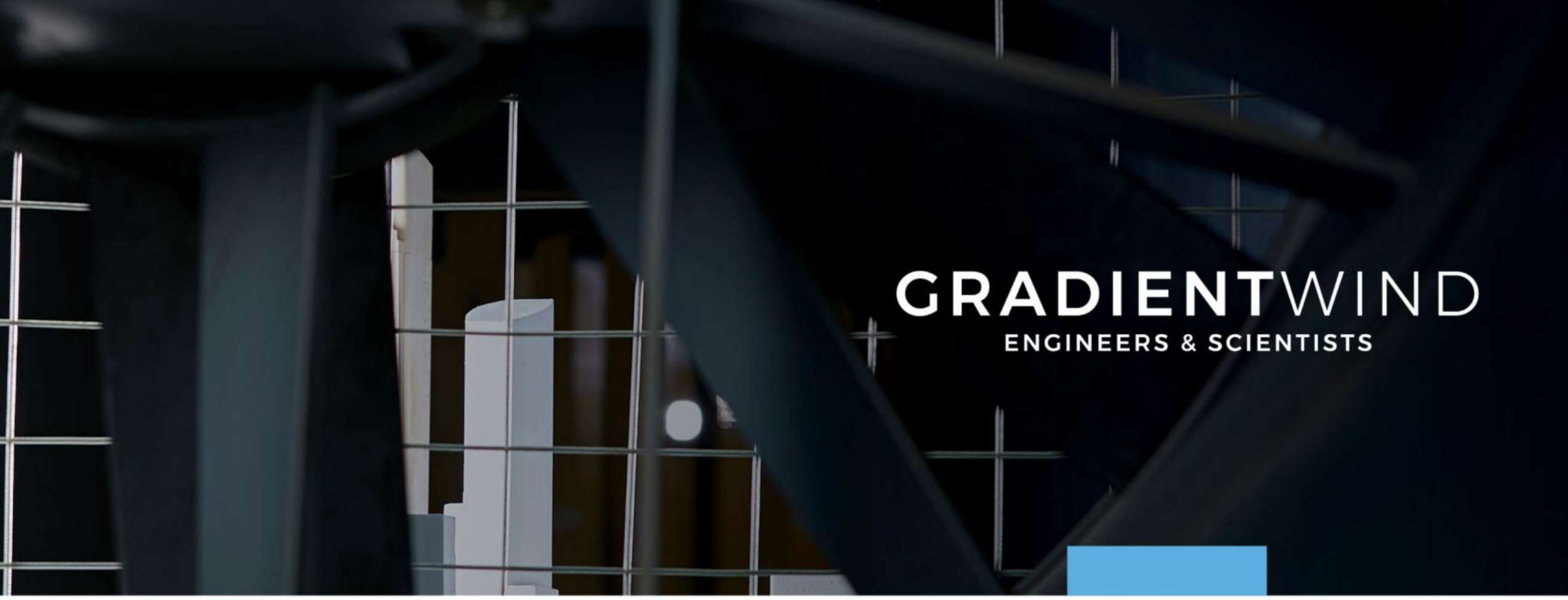
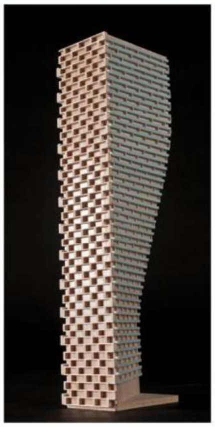


PEDESTRIAN LEVEL WIND STUDY

3 Selkirk Street
Ottawa, Ontario

Report: 20-077-PLW-2025



February 2, 2026

PREPARED FOR
Riverain Developments Inc.
109 Atlantic Avenue, Suite 302B
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PREPARED BY
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EXECUTIVE SUMMARY

This report describes a pedestrian level wind (PLW) study undertaken to satisfy Site Plan Approval application submission requirements for Phase 2 of the proposed residential development located at 3 Selkirk Street in Ottawa, Ontario (hereinafter referred to as “subject site” or “proposed development”). Our mandate within this study is to investigate pedestrian wind conditions within and surrounding the subject site, and to identify areas where wind conditions may interfere with certain pedestrian activities so that mitigation measures may be considered, where required.

The study involves simulation of wind speeds for selected wind directions in a three-dimensional (3D) computer model using the computational fluid dynamics (CFD) technique, combined with meteorological data integration, to assess pedestrian wind comfort and safety within and surrounding the subject site according to City of Ottawa wind comfort and safety criteria. The results and recommendations derived from these considerations are detailed in the main body of the report (Section 5), illustrated in Figures 3A-9, and summarized as follows:

1) All grade-level areas within and surrounding the subject site are predicted to experience conditions that are considered acceptable for the intended pedestrian uses throughout the year. Specifically, conditions over surrounding sidewalks, pathways, transit stops, neighbouring surface parking lots, City owned parkland and parkland dedication area, proposed streets, and in the vicinity of building access points, are considered acceptable.

2) During the typical use period (May to October, inclusive), conditions over the proposed common amenity terrace serving Phases 1 and 2 at Level 3 are predicted to be suitable for a mix of sitting and standing.

    a. Mitigation measures comprising shade structures over potential sitting areas, a solid 1.5-m-tall fence along the perimeter of the pool area, and a 1.8-m-tall windscreen extending along the northeast and northwest perimeters of the amenity terrace were included in the model in coordination with the landscape architect.

b. Under the proposed programming of the terrace, standing areas extend mostly over the central portion of the pool and over the open lawn and active recreation areas, where designated seating is not programmed, while seating areas are programmed where conditions are mostly calm and suitable for sitting during the typical use period. The noted conditions may be considered satisfactory.

3) The foregoing statements and conclusions apply to common weather systems, during which no dangerous wind conditions, as defined in Section 4.4, are expected anywhere over the subject site. During extreme weather events, (for example, thunderstorms, tornadoes, and downbursts), pedestrian safety is the main concern. However, these events are generally short-lived and infrequent and there is often sufficient warning for pedestrians to take appropriate cover.

TABLE OF CONTENTS

1. INTRODUCTION

Gradient Wind Engineering Inc. (Gradient Wind) was retained by Riverain Developments Inc.to undertake a pedestrian level wind (PLW) study to satisfy Site Plan Control (SPC) application submission requirements for Phase 2 of the proposed mixed-use residential development located at 3 Selkirk Street in Ottawa, Ontario (hereinafter referred to as "subject site" or "proposed development"). The overall development at the site comprises three phases and is known as "Riverain"; Phase 1 is beginning occupancy and Phase 3 is currently under construction. A PLW study was conducted in February 2021[1] for a previous submission including all phases of this development, followed by subsequent addendum letters in August 2021[2] and June 2023[3] addressing Phases 1 and 3, respectively. Our mandate within the current study is to investigate pedestrian wind conditions within and surrounding the subject site for the revised architectural massing design for Phase 2, and to identify areas where wind conditions may interfere with certain pedestrian activities so that mitigation measures may be considered, where required.

Our work is based on industry standard computer simulations using the computational fluid dynamics (CFD) technique and data analysis procedures, City of Ottawa wind comfort and safety criteria, architectural drawings prepared by RLA Architecture in December 2025, surrounding street layouts and existing and approved future building massing information obtained from the City of Ottawa, as well as recent satellite imagery.

2. TERMS OF REFERENCE

The subject site is located on an irregular parcel of land at 3 Selkirk Street in Ottawa. The overall development site is bounded by Montreal Road to the north, Montgomery Street to the east, Selkirk Street to the south, and North River Road to the west. The subject site corresponds to Phase 2 of the phased development consisting of Phase 1 (complete) to the north and Phase 3 (under construction) to the east. Phase 1 consists of a 3-storey podium and a 22-storey tower (Tower A). Phase 2 features a 2-storey podium and a 32-storey tower (Tower B), with a 2-storey parking structure that connects Phases 1

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[1] Gradient Wind Engineering Inc., *'3 Selkirk Street & 2 Montreal Road – Pedestrian Level Wind Study'*, [Feb 4, 2021]
[2] Gradient Wind Engineering Inc., *'3 Selkirk Street & 2 Montreal Road – Pedestrian Level Wind Study, Addendum'*, [Aug 12, 2021]
[3] Gradient Wind Engineering Inc., *'2 Montreal Road, 280 Montgomery Street, 300 Montgomery Street, and 3 Selkirk Street – Pedestrian Level Wind Study Addendum'*, [Jun 14, 2023]

and 2 and features a shared outdoor amenity terrace on its roof. Phase 3 consists of a 2-storey podium and a 28-storey tower (Tower C).

Above one level of underground parking, the ground floor comprises amenity space to the south, parking space to the north, and building services in the remainder of the level. An outdoor amenity space is located to the north of the subject site. A residential entrance is situated to the southeast along a main interior road which connects Selkirk Street to Montgomery Street and provides access to the parking structure between Towers A and B, and to the underground parking serving the proposed development. Level 2 comprises storage space, and a parking structure to the east. Level 3 is reserved for residential space, with amenity space to the north. The building steps back at this level from the east, allowing for a private terrace space to the east as well as the noted common outdoor amenity space to the north, atop of the parking structure, which includes a pool, an open lawn, and an active recreation area. Levels 4-32 are reserved for residential use, and the building is topped by an MPH. The building also steps back from the north and west at Level 7, providing space for private terraces.

The near-field surroundings (defined as an area within 200 metres (m) of the subject site) include Phase 1 and low-rise commercial and residential buildings to the north, low- and mid-rise commercial and residential buildings to the east and southeast, with Phase 3 located to the east, high-rise buildings to the immediate south, and Riverain Park to the southwest. The Rideau River runs from north to south at approximately 45 m to the west.

The far-field surroundings (defined as an area beyond the near-field but within a 2-kilometre (km) radius of the subject site) are characterized by primarily suburban wind exposures from all directions, with sparse mid- and high-rise developments, and the high-rise massing from the Ottawa downtown core to the west. Notably, a development at 112 Montreal Road has been approved to the northeast of the subject site, consisting of 37-, 28-, 16-, and 8-storey towers.

Site plans for the proposed and existing massing scenarios are illustrated in Figures 1A and 1B, while Figures 2A-2H illustrate the computational models used to conduct the study. The existing massing scenario includes the existing massing and any developments approved by the City of Ottawa.

3. OBJECTIVES

The principal objectives of this study are to (i) determine pedestrian level wind conditions at key areas within and surrounding the development site; (ii) identify areas where wind conditions may interfere with the intended uses of outdoor spaces; and (iii) recommend suitable mitigation measures, where required.

4. METHODOLOGY

The approach followed to quantify pedestrian wind conditions over the site is based on CFD simulations of wind speeds across the subject site within a virtual environment, meteorological analysis of the Ottawa area wind climate, and synthesis of computational data with City of Ottawa wind comfort and safety criteria[4]. The following sections describe the analysis procedures, including a discussion of the noted pedestrian wind criteria.

4.1 Computer-Based Context Modelling

A computer based PLW study was performed to determine the influence of the wind environment on pedestrian comfort over the proposed development site. Pedestrian comfort predictions, based on the mechanical effects of wind, were determined by combining measured wind speed data from CFD simulations with statistical weather data obtained from Ottawa Macdonald-Cartier International Airport. The general concept and approach to CFD modelling is to represent building and topographic details in the immediate vicinity of the subject site on the surrounding model, and to create suitable atmospheric wind profiles at the model boundary. The wind profiles are designed to have similar mean and turbulent wind properties consistent with actual site exposures.

An industry standard practice is to omit trees, vegetation, and other existing and planned landscape elements from the model due to the difficulty of providing accurate seasonal representation of vegetation. The omission of trees and other landscaping elements produces slightly stronger wind speeds.

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[4] City of Ottawa Terms of References: Wind Analysis
https://documents.ottawa.ca/sites/documents/files/wind_analysis_tor_en.pdf

4.2 Wind Speed Measurements

The PLW analysis was performed by simulating wind flows and gathering velocity data over a CFD model of the site for 16 wind directions. The CFD simulation model was centered on the proposed development, complete with surrounding massing within a radius of 480 m. The process was performed for two context massing scenarios, as noted in Section 2.

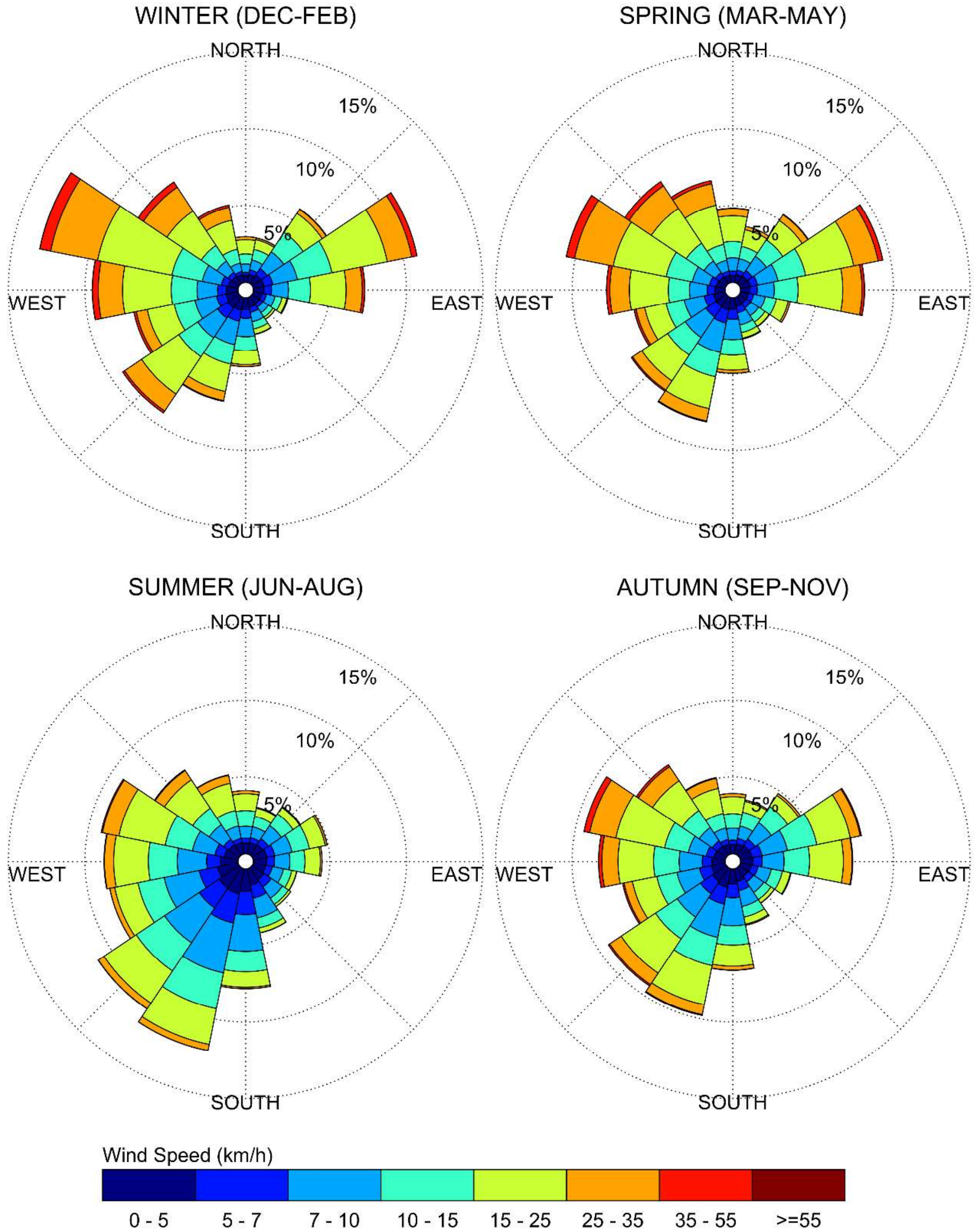
Mean and peak wind speed data obtained over the subject site for each wind direction were interpolated to 36 wind directions at 10° intervals, representing the full compass azimuth. Measured wind speeds approximately 1.5 m above local grade and the common amenity terrace serving the proposed development were referenced to the wind speed at gradient height to generate mean and peak velocity ratios, which were used to calculate full-scale values. Gradient height represents the theoretical depth of the boundary layer of the earth's atmosphere, above which the mean wind speed remains constant. Further details of the wind flow simulation technique are presented in Appendix A.

4.3 Historical Wind Speed and Direction Data

A statistical model for winds in Ottawa was developed from approximately 40 years of hourly meteorological wind data recorded at Ottawa Macdonald-Cartier International Airport and obtained from Environment and Climate Change Canada. Wind speed and direction data were analyzed during the appropriate hours of pedestrian usage (that is, between 06:00 and 23:00) and divided into four distinct seasons, as stipulated in the wind criteria. Specifically, the spring season is defined as March through May, the summer season is defined as June through August, the autumn season is defined as September through November, and the winter season is defined as December through February, inclusive.

The statistical model of the Ottawa area wind climate, which indicates the directional character of local winds on a seasonal basis, is illustrated on the following page. The plots illustrate seasonal distribution of measured wind speeds and directions in kilometers per hour (km/h). Probabilities of occurrence of different wind speeds are represented as stacked polar bars in sixteen azimuth divisions. The radial direction represents the percentage of time for various wind speed ranges per wind direction during the measurement period. The prominent wind speeds and directions can be identified by the longer length of the bars. For Ottawa, the most common winds occur for westerly wind directions, followed by those from the east, while the most common wind speeds are below 36 km/h. The directional prominence and relative magnitude of wind speed changes somewhat from season to season.

SEASONAL DISTRIBUTION OF WIND
OTTAWA MACDONALD-CARTIER INTERNATIONAL AIRPORT



Notes:

1. Radial distances indicate percentage of time of wind events.
2. Wind speeds are mean hourly in km/h, measured at 10 m above the ground.

4.4 Pedestrian Wind Comfort and Safety Criteria – City of Ottawa

Pedestrian wind comfort and safety criteria are based on the mechanical effects of wind without consideration of other meteorological conditions (that is, temperature and relative humidity). The comfort criteria assume that pedestrians are appropriately dressed for a specified outdoor activity during any given season. Five pedestrian comfort classes based on 20% non-exceedance mean wind speed ranges are used to assess pedestrian comfort: (1) Sitting; (2) Standing; (3) Strolling; (4) Walking; and (5) Uncomfortable. The gust speeds, and equivalent mean speeds, are selected based on the Beaufort scale, which describes the effects of forces produced by varying wind speed levels on objects. Wind conditions suitable for sitting are represented by the colour blue, standing by green, strolling by yellow, and walking by orange; uncomfortable conditions are represented by the colour magenta. Specifically, the comfort classes, associated wind speed ranges, and limiting criteria are summarized as follows:

PEDESTRIAN WIND COMFORT CLASS DEFINITIONS

Wind Comfort Class	Mean Speed (km/h)	Description
SITTING	≤ 10	Mean wind speeds no greater than 10 km/h occurring at least 80% of the time. The equivalent gust wind speed is approximately 16 km/h.
STANDING	≤ 14	Mean wind speeds no greater than 14 km/h occurring at least 80% of the time. The equivalent gust wind speed is approximately 22 km/h.
STROLLING	≤ 17	Mean wind speeds no greater than 17 km/h occurring at least 80% of the time. The equivalent gust wind speed is approximately 27 km/h.
WALKING	≤ 20	Mean wind speeds no greater than 20 km/h occurring at least 80% of the time. The equivalent gust wind speed is approximately 32 km/h.
UNCOMFORTABLE	> 20	Uncomfortable conditions are characterized by predicted values that fall below the 80% target for walking. Brisk walking and exercise, such as jogging, would be acceptable for moderate excesses of this criterion.

Regarding wind safety, the pedestrian safety wind speed criterion is based on the approximate threshold that would cause a vulnerable member of the population to fall. A 0.1% exceedance gust wind speed of 90 km/h is classified as dangerous. From calculations of stability, it can be shown that gust wind speeds of 90 km/h would be the approximate threshold wind speed that would cause an average elderly person in good health to fall. Notably, pedestrians tend to be more sensitive to wind gusts than to steady winds for lower wind speed ranges. For strong winds approaching dangerous levels, this effect is less important because the mean wind can also create problems for pedestrians.

Experience and research on people's perception of mechanical wind effects has shown that if the wind speed levels are exceeded for more than 20% of the time, the activity level would be judged to be uncomfortable by most people. For instance, if a mean wind speed of 10 km/h (equivalent gust wind speed of approximately 16 km/h) were exceeded for more than 20% of the time most pedestrians would judge that location to be too windy for sitting. Similarly, if mean wind speed of 20 km/h (equivalent gust wind speed of approximately 32 km/h) at a location were exceeded for more than 20% of the time, walking or less vigorous activities would be considered uncomfortable. As these criteria are based on subjective reactions of a population to wind forces, their application is partly based on experience and judgment.

Once the pedestrian wind speed predictions have been established throughout the subject site, the assessment of pedestrian comfort involves determining the suitability of the predicted wind conditions for discrete regions within and surrounding the subject site. This step involves comparing the predicted comfort classes to the target comfort classes, which are dictated by the location type for each region (that is, a sidewalk, building entrance, amenity space, or other). An overview of common pedestrian location types and their typical windiest target comfort classes are summarized on the following page. Depending on the programming of a space, the desired comfort class may differ from this table.

TARGET PEDESTRIAN WIND COMFORT CLASSES FOR VARIOUS LOCATION TYPES

Location Types	Target Comfort Classes
Primary Building Entrance	Standing
Secondary Building Access Point	Walking
Public Sidewalk / Bicycle Path	Walking
Outdoor Amenity Space	Sitting / Standing
Café / Patio / Bench / Garden	Sitting / Standing
Transit Stop (Without Shelter)	Standing
Transit Stop (With Shelter)	Walking
Public Park / Plaza	Sitting / Standing
Garage / Service Entrance	Walking
Parking Lot	Walking
Vehicular Drop-Off Zone	Walking

5. RESULTS AND DISCUSSION

The following discussion of the predicted pedestrian wind conditions for the subject site is accompanied by Figures 3A-6B, which illustrate wind conditions at grade level for the proposed and existing massing scenarios, and by Figures 8A-D, which illustrate wind conditions over the common amenity terrace serving the proposed development at Level 3. Conditions are presented as continuous contours of wind comfort throughout the subject site and correspond to the comfort classes presented in Section 4.4.

Wind comfort conditions are also reported for the typical use period, which is defined as May to October, inclusive. Figures 7A-B and 9 illustrate winds comfort conditions at grade level and over the noted common amenity terrace, respectively, during this period, consistent with the comfort classes illustrated in Section 4.4.

The details of these conditions are summarized in the following pages for each area of interest.

5.1 Wind Comfort Conditions – Grade Level

Sidewalks along Selkirk Street: Following the introduction of the proposed development, wind comfort conditions over the nearby public sidewalks along Selkirk Street are predicted to be suitable for a mix of standing and strolling during the summer and autumn, becoming suitable for walking, or better, during the spring and winter.

Wind comfort conditions over the nearby public sidewalks along Selkirk Street under the existing massing are predicted to be suitable for a mix of standing and strolling during the spring and autumn, and a mix of sitting and standing during the summer and autumn. While the introduction of the proposed development produces slightly windier conditions in comparison to existing conditions over the sidewalks along Selkirk Street, wind conditions with the proposed development are nevertheless considered acceptable.

Sidewalks along North River Road, Montreal Road, and the Rideau River Eastern Pathway: Prior to and following the introduction of the proposed development, conditions over the nearby public sidewalks along North River Road, Montreal Road, and over the Rideau River Eastern Pathway are predicted to be suitable for standing, or better, throughout the year, with the exception of an area near the intersection of Montreal Road and Montgomery Street, where conditions are predicted to be suitable for strolling, or better, throughout the year. The noted conditions are considered acceptable.

Transit Stops along North River Road and Montreal Road: Wind conditions over the nearby transit stops along North River Road and Montreal Road are predicted to be suitable for standing, or better, throughout the year, which is considered acceptable.

Sidewalks along Montgomery Street: Prior to and following the introduction of the proposed development, wind conditions over the nearby public sidewalks along Montgomery Street are predicted to be suitable for strolling, or better, throughout the year. The noted conditions are considered acceptable.

Walkways along the Interior Road Connecting Montgomery Street to Selkirk Road: Following the introduction of the proposed development, wind conditions over the walkways along the interior road connecting Montgomery Street to Selkirk Road are predicted to be suitable for strolling, or better, throughout the year, with the exception of an area to the southwest of Phase 3, where conditions are predicted to be suitable for walking during the spring and winter.

Conditions over the noted walkways under the existing massing are predicted to be suitable for strolling, or better, throughout the year. While the introduction of the proposed development produces slightly windier conditions in comparison to existing conditions over the noted walkways, wind conditions with the proposed development are nevertheless considered acceptable.

City Owned Parkland and Parkland Dedication Area: Prior to and following the introduction of the proposed development, wind conditions during the typical use period over the City owned parkland near the intersection of North River Road and Montreal Road, and over the parkland dedication area serving Phase 3 to the east, are predicted to be suitable for a mix of sitting and standing.

Building Access Points: Wind conditions in the vicinity of the building access points serving the proposed development are predicted to be suitable for standing, or better, throughout the year. The noted conditions are considered acceptable.

5.2 Wind Comfort Conditions – Common Amenity Terrace at Level 3

In coordination between the wind consultant and the building and landscape architects, mitigation measures were included within the shared Level 3 common amenity terrace serving Phases 1 and 2. Specifically, shade structures over potential sitting areas, a solid 1.5-m-tall fence along the perimeter of the pool area, and a 1.8-m-tall windscreen extending along the northeast and southwest perimeters of the amenity terrace were included in the model.

During the typical use period, wind comfort conditions within the common amenity terrace at Level 3 are predicted to be suitable for a mix of sitting and standing, with standing areas extending mostly over the central portion of the pool, the open lawn and active recreation areas, where designated seating is not programmed. Where conditions are predicted to be suitable for standing, they are also predicted to be suitable for sitting for at least 75% of the typical use period, with the exception of an isolated area over the green roof beside the pool area and an area over the active recreation area.

Given the programming of the terrace, and the targeted placement of mitigation elements combined with the targeted placement of seating areas where conditions are mostly calm and predicted to be suitable for sitting, the wind conditions within the Level 3 amenity terrace may be considered acceptable.

5.3 Wind Safety

Within the context of typical weather patterns, which exclude anomalous localized storm events such as tornadoes and downbursts, no pedestrian areas within or surrounding the subject site are expected to experience conditions that could be considered dangerous, as defined in Section 4.4.

5.4 Applicability of Results

Pedestrian wind comfort and safety have been quantified for the specific configuration of existing and foreseeable construction around the subject site. Future changes (that is, construction or demolition) of these surroundings may cause changes to the wind effects in two ways, namely: (i) changes beyond the immediate vicinity of the subject site would alter the wind profile approaching the subject site; and (ii) development in proximity to the subject site would cause changes to local flow patterns.

6. CONCLUSIONS AND RECOMMENDATIONS

A complete summary of the predicted wind conditions is provided in Section 5 and illustrated in Figures 3A-9. Based on computer simulations using the CFD technique, meteorological data analysis of the Ottawa wind climate, City of Ottawa wind comfort and safety criteria, and experience with numerous similar developments, the study concludes the following:

1) All grade-level areas within and surrounding the subject site are predicted to experience conditions that are considered acceptable for the intended pedestrian uses throughout the year. Specifically, conditions over surrounding sidewalks, pathways, transit stops, neighbouring surface parking lots, City owned parkland and parkland dedication area, proposed streets, and in the vicinity of building access points, are considered acceptable.

2) During the typical use period (May to October, inclusive), conditions over the proposed common amenity terrace serving Phases 1 and 2 at Level 3 are predicted to be suitable for a mix of sitting and standing.

a. Mitigation measures comprising shade structures over potential sitting areas, a solid 1.5-m-tall fence along the perimeter of the pool area, and a 1.8-m-tall windscreen extending along the northeast and northwest perimeters of the amenity terrace were included in the model in coordination with the landscape architect.

b. Under the proposed programming of the terrace , standing areas extend mostly over the central portion of the pool and over the open lawn and active recreation areas, where designated seating is not programmed, while seating areas are programmed where conditions are mostly calm and suitable for sitting during the typical use period. The noted conditions may be considered acceptable.

3) The foregoing statements and conclusions apply to common weather systems, during which no dangerous wind conditions, as defined in Section 4.4, are expected anywhere over the subject site. During extreme weather events, (for example, thunderstorms, tornadoes, and downbursts), pedestrian safety is the main concern. However, these events are generally short-lived and infrequent and there is often sufficient warning for pedestrians to take appropriate cover.

Sincerely,

Gradient Wind Engineering Inc.

LICENSED PROFESSIONAL ENGINEER
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February 02, 2026
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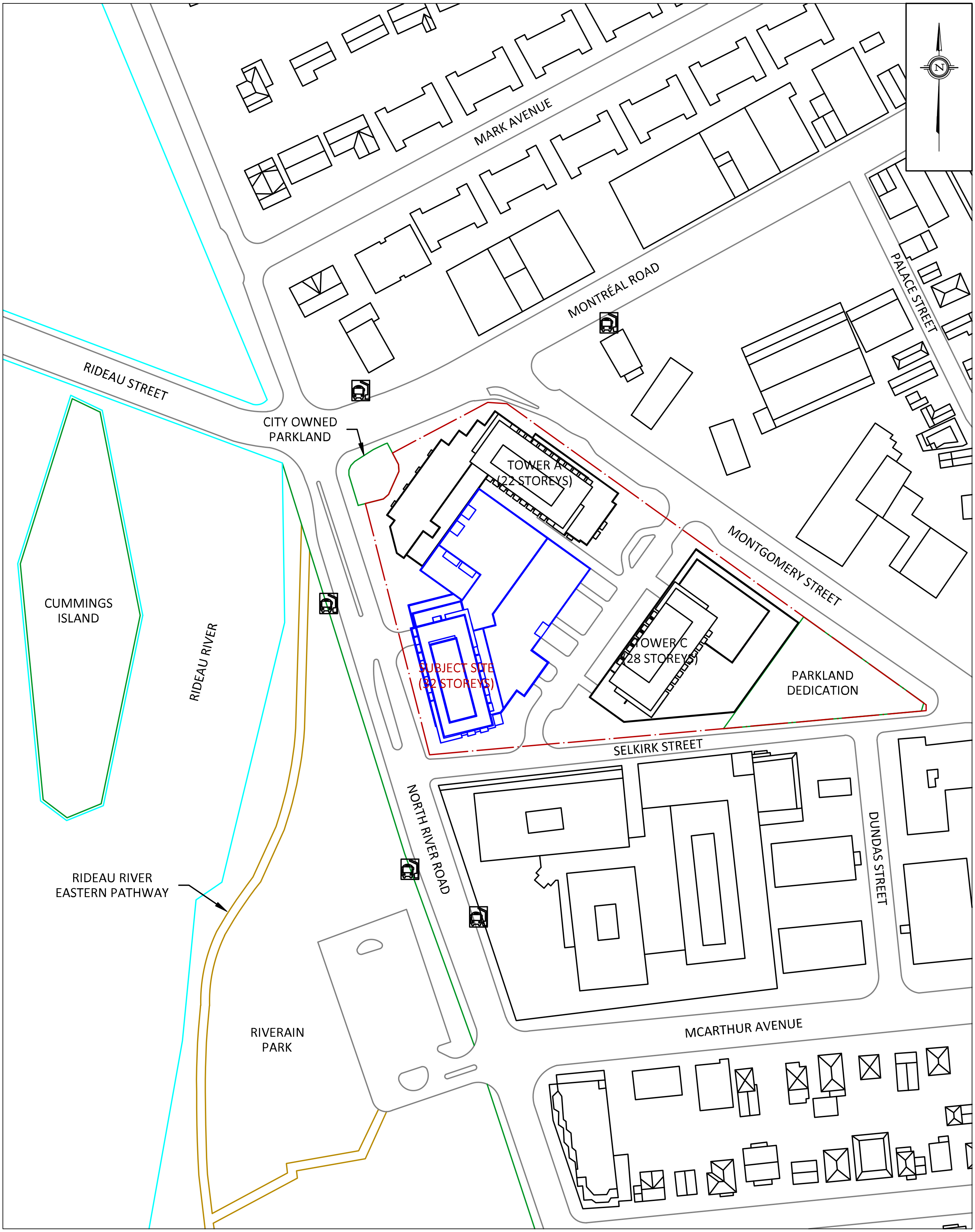

GRADIENTWIND
ENGINEERS & SCIENTISTS

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613 836 0934 • GRADIENTWIND.COM

PROJECT	3 SELKIRK STREET, OTTAWA PEDESTRIAN LEVEL WIND STUDY		DESCRIPTION FIGURE 1A: PROPOSED SITE PLAN AND SURROUNDING CONTEXT
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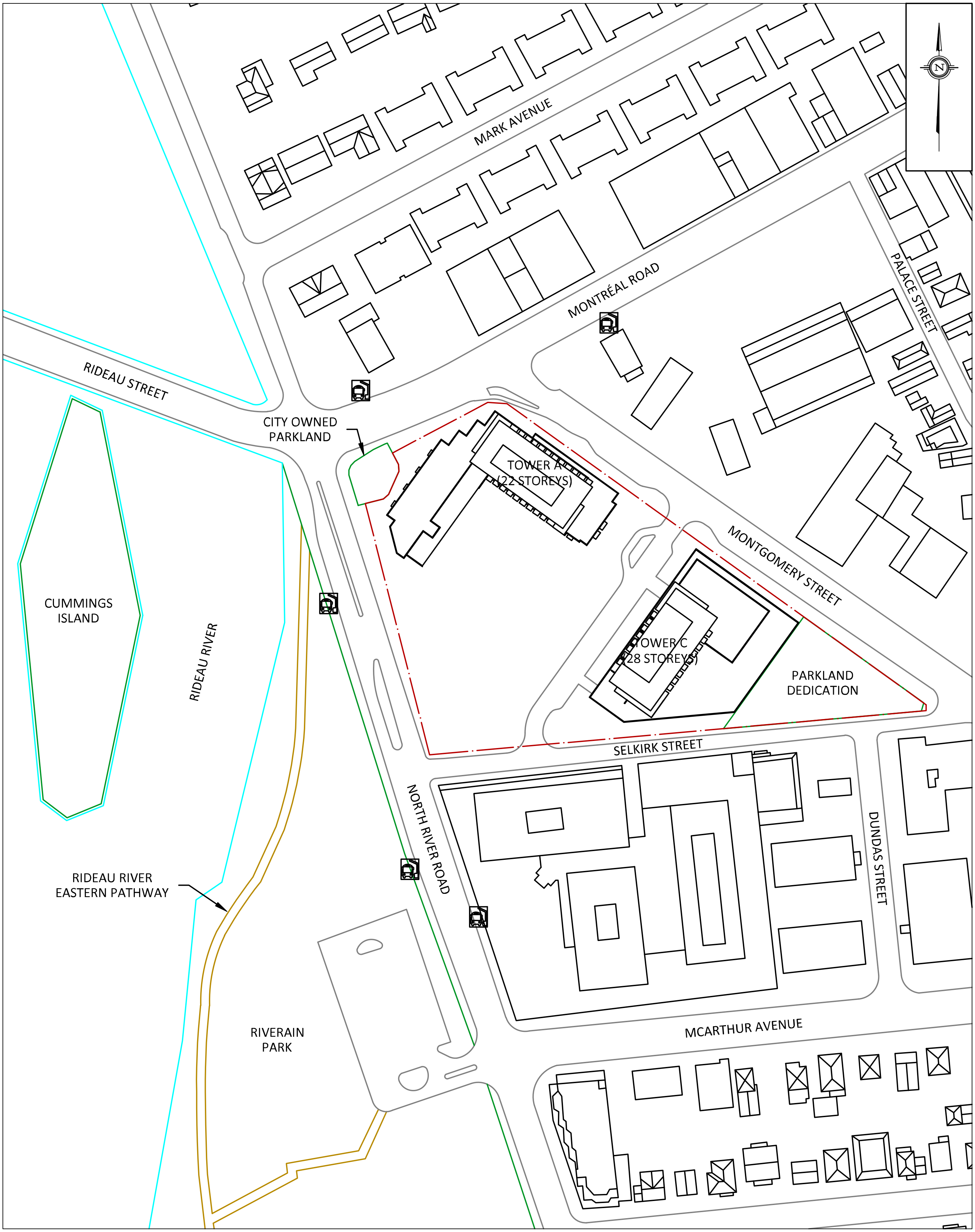
DATE	DECEMBER 12, 2025	DRAWN BY S.K.	



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PROJECT: 3 SELKIRK STREET, OTTAWA PEDESTRIAN LEVEL WIND STUDY		DESCRIPTION: FIGURE 1B: EXISTING SITE PLAN AND SURROUNDING CONTEXT
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DATE: DECEMBER 12, 2025	DRAWN BY: S.K.	

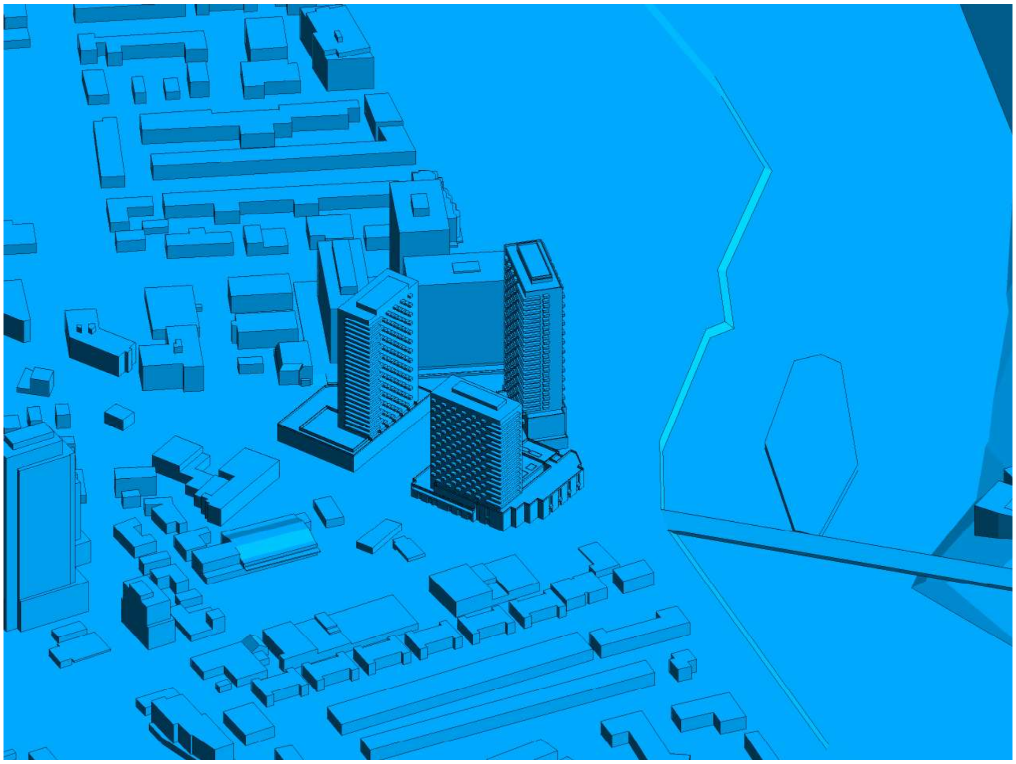


FIGURE 2A: COMPUTATIONAL MODEL, PROPOSED MASSING, NORTH PERSPECTIVE

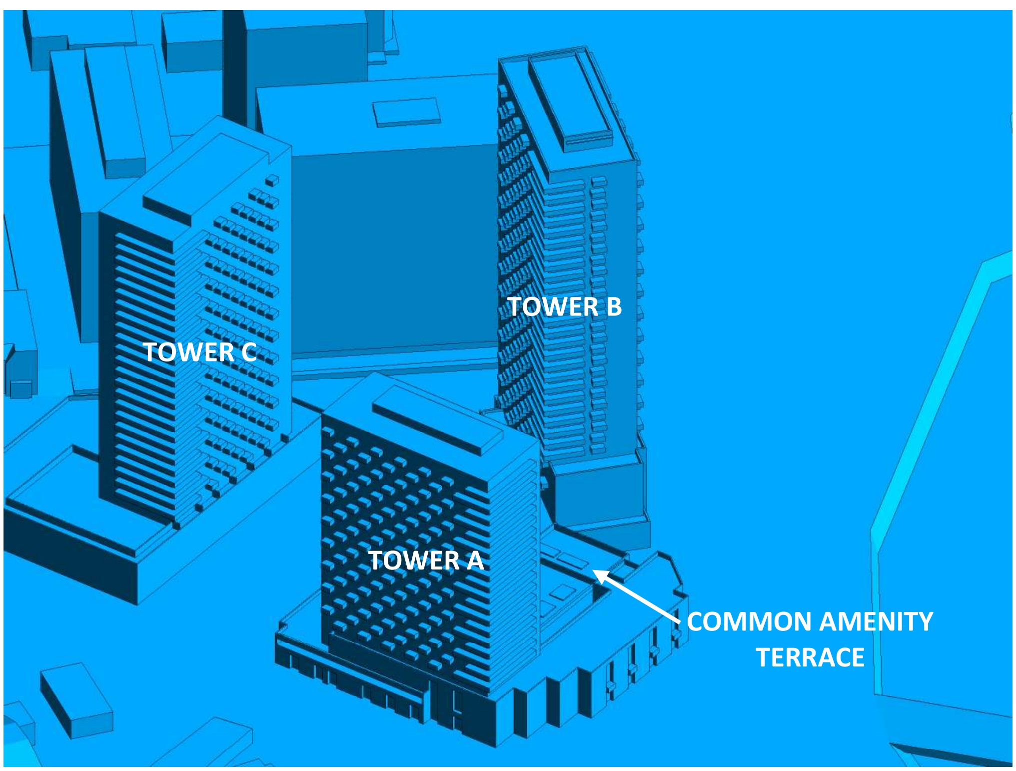


FIGURE 2B: CLOSE UP OF FIGURE 2A

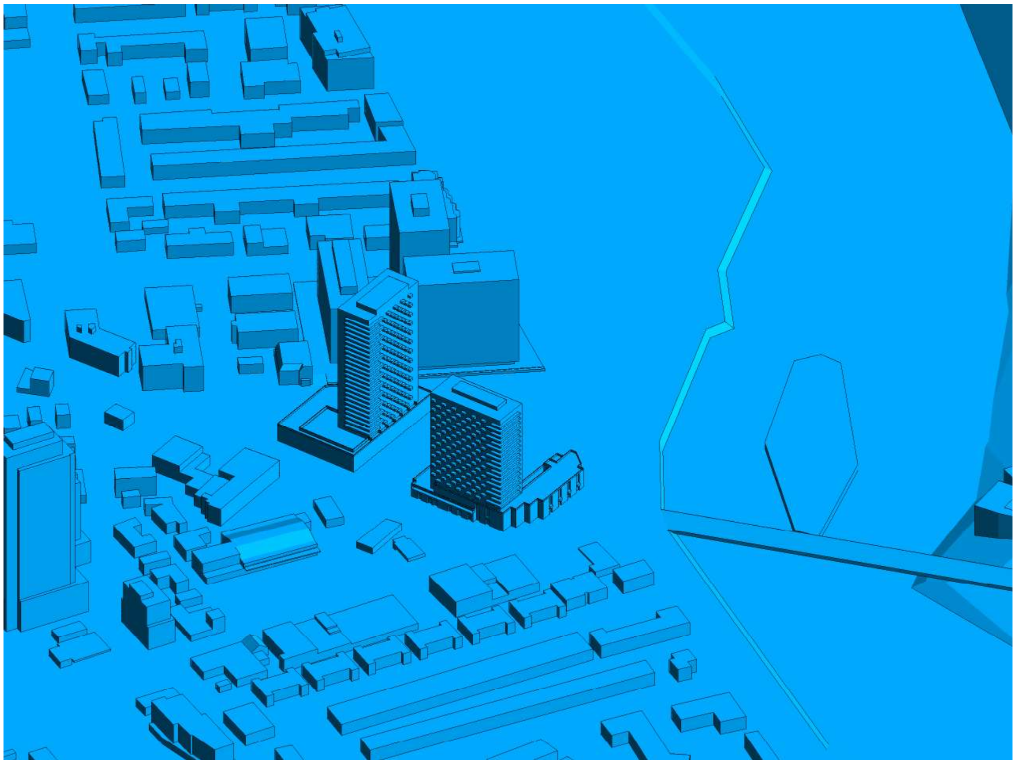


FIGURE 2C: COMPUTATIONAL MODEL, EXISTING MASSING, NORTH PERSPECTIVE

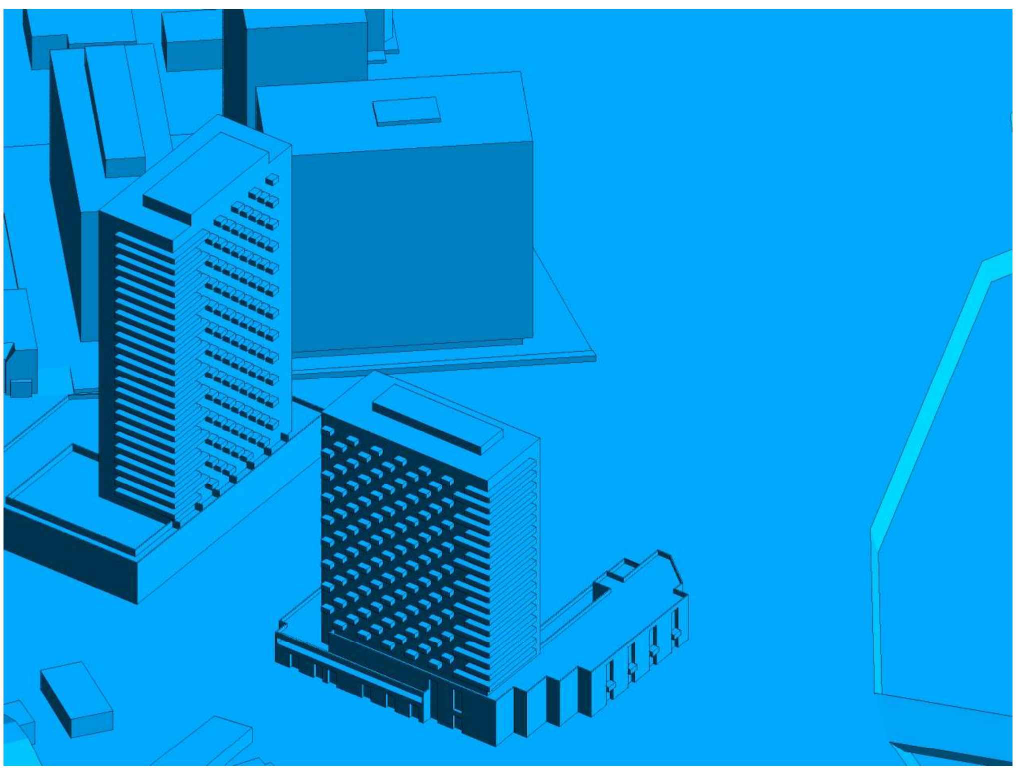


FIGURE 2D: CLOSE UP OF FIGURE 2C

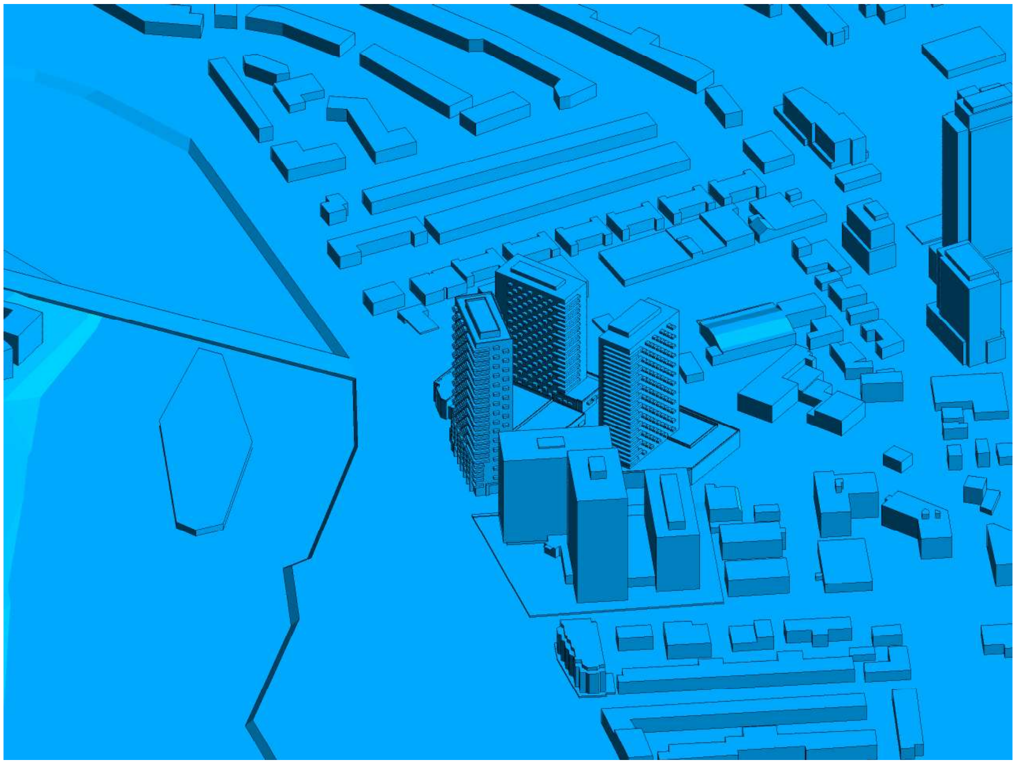


FIGURE 2E: COMPUTATIONAL MODEL, PROPOSED MASSING, SOUTH PERSPECTIVE

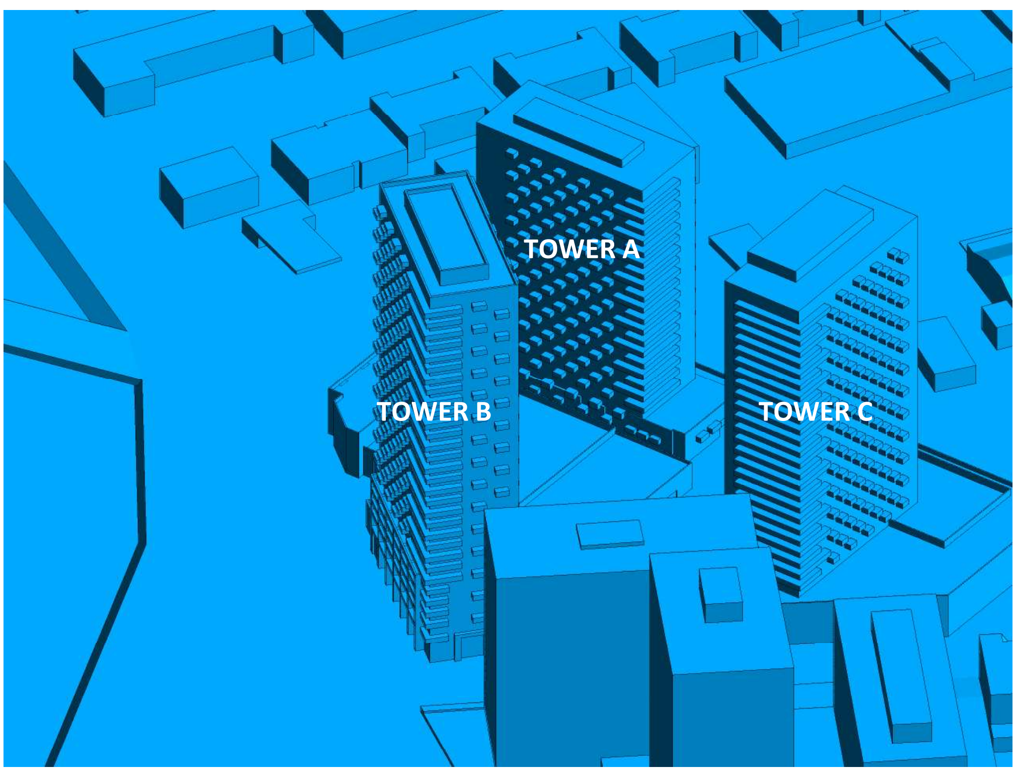


FIGURE 2F: CLOSE UP OF FIGURE 2E

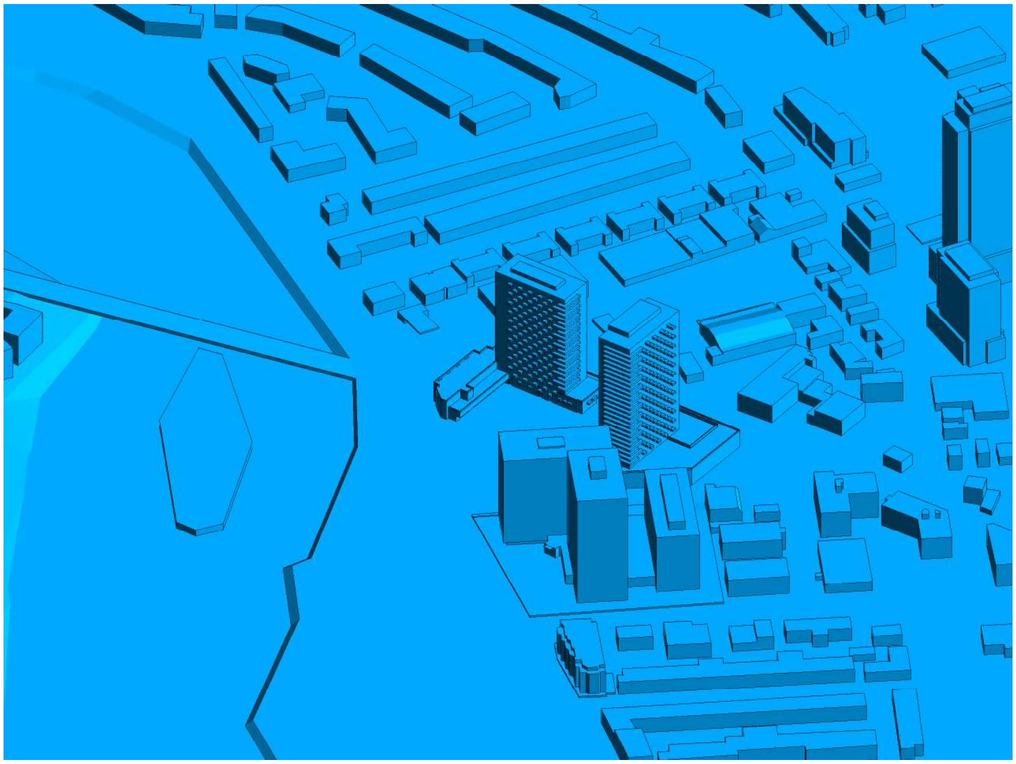


FIGURE 2G: COMPUTATIONAL MODEL, EXISTING MASSING, SOUTH PERSPECTIVE

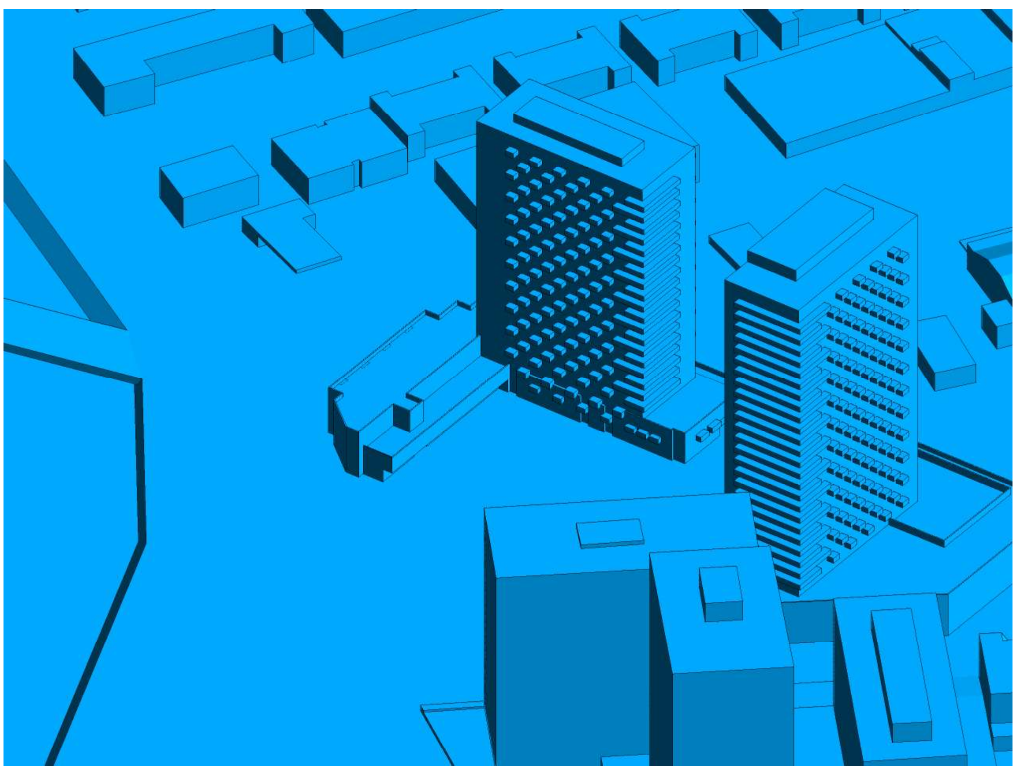


FIGURE 2H: CLOSE UP OF FIGURE 2G

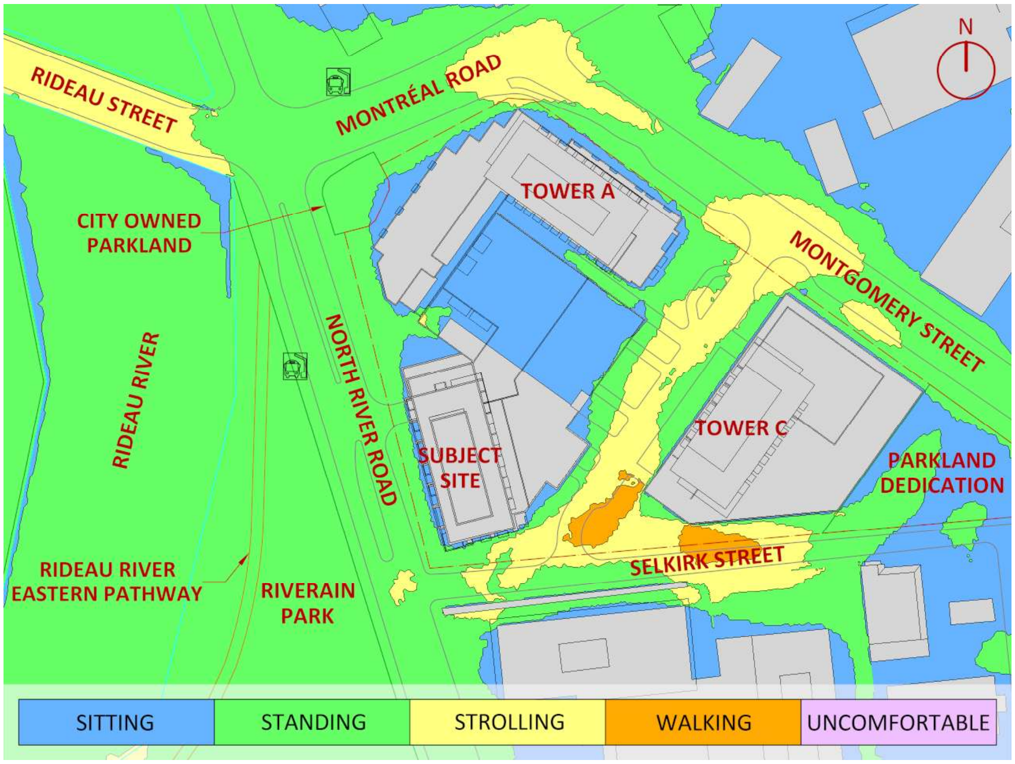


FIGURE 3A: SPRING – WIND COMFORT, GRADE LEVEL – PROPOSED MASSING

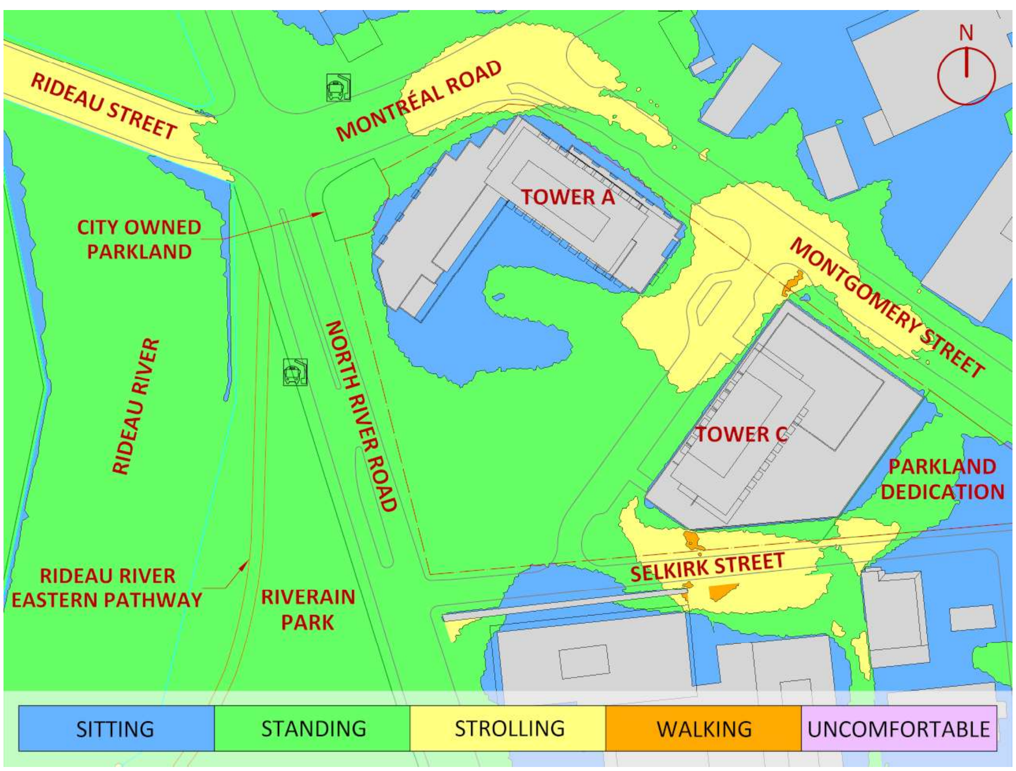


FIGURE 3B: SPRING – WIND COMFORT, GRADE LEVEL – EXISTING MASSING

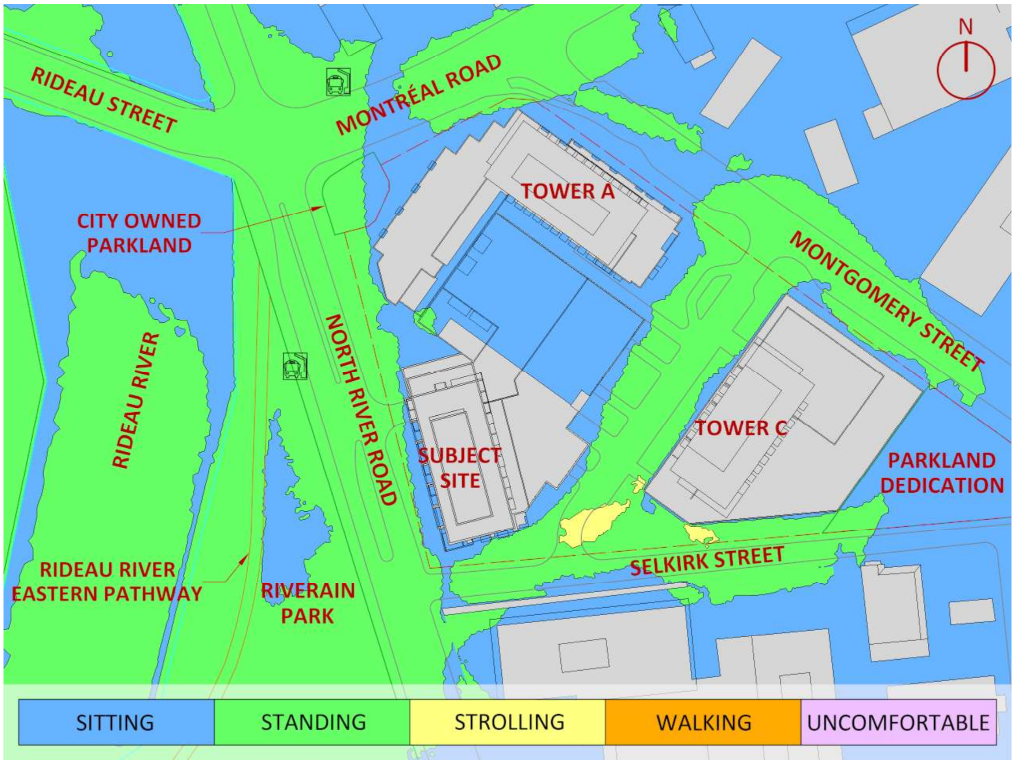


FIGURE 4A: SUMMER – WIND COMFORT, GRADE LEVEL – PROPOSED MASSING

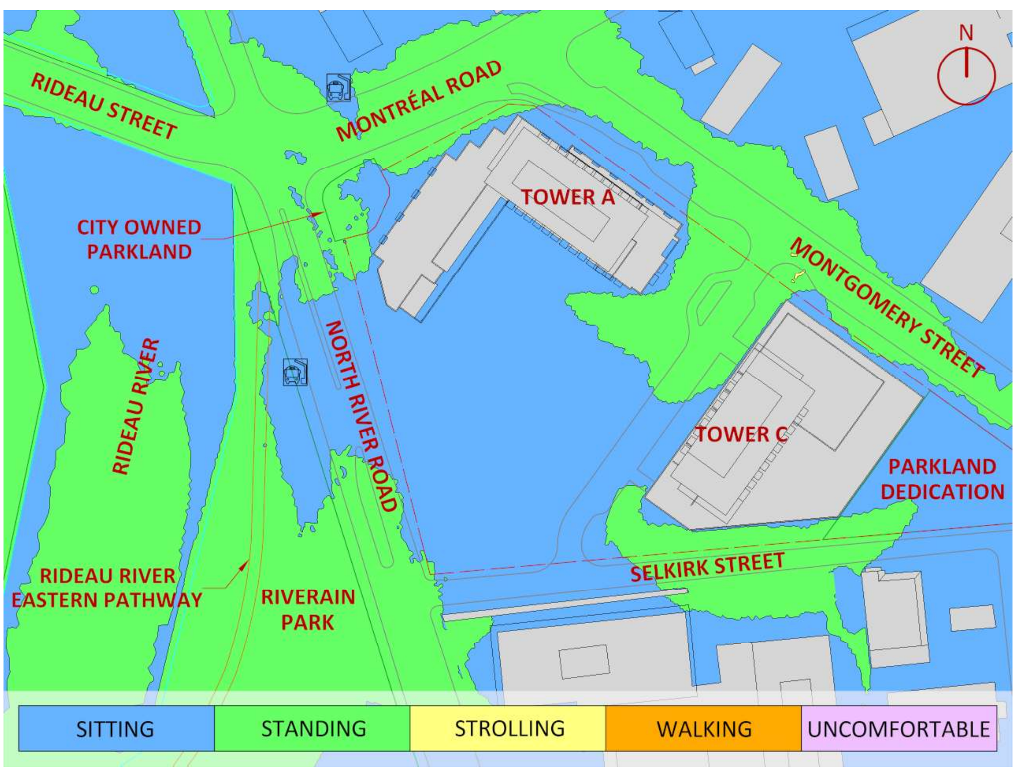


FIGURE 4B: SUMMER – WIND COMFORT, GRADE LEVEL – EXISTING MASSING

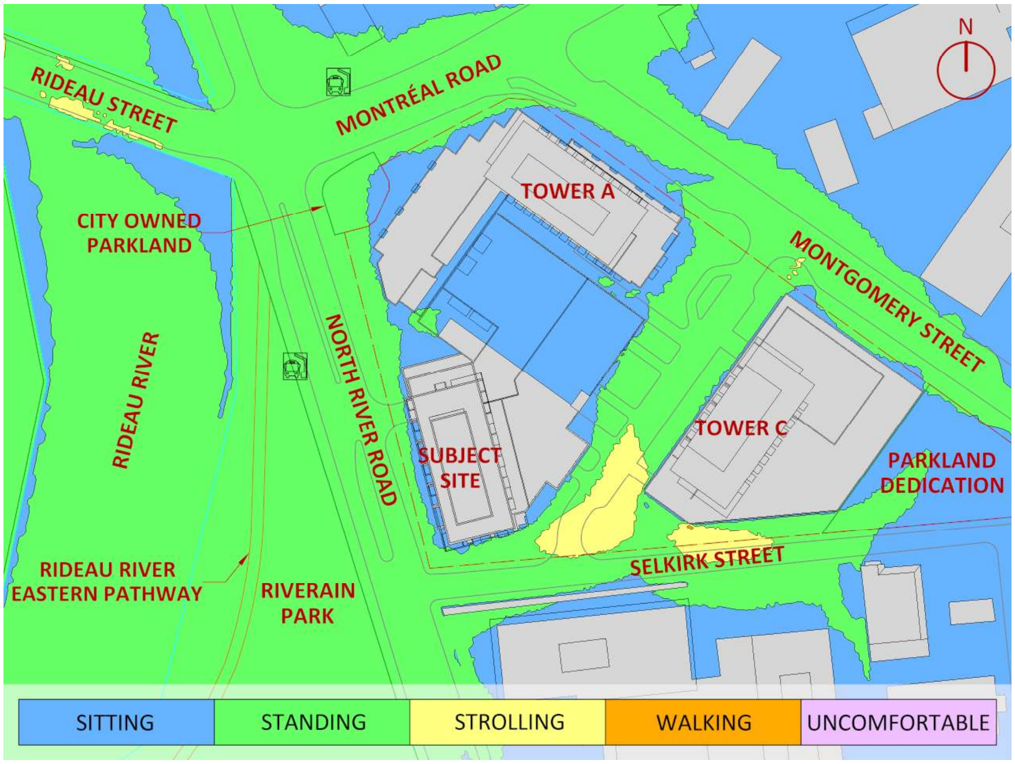


FIGURE 5A: AUTUMN – WIND COMFORT, GRADE LEVEL – PROPOSED MASSING

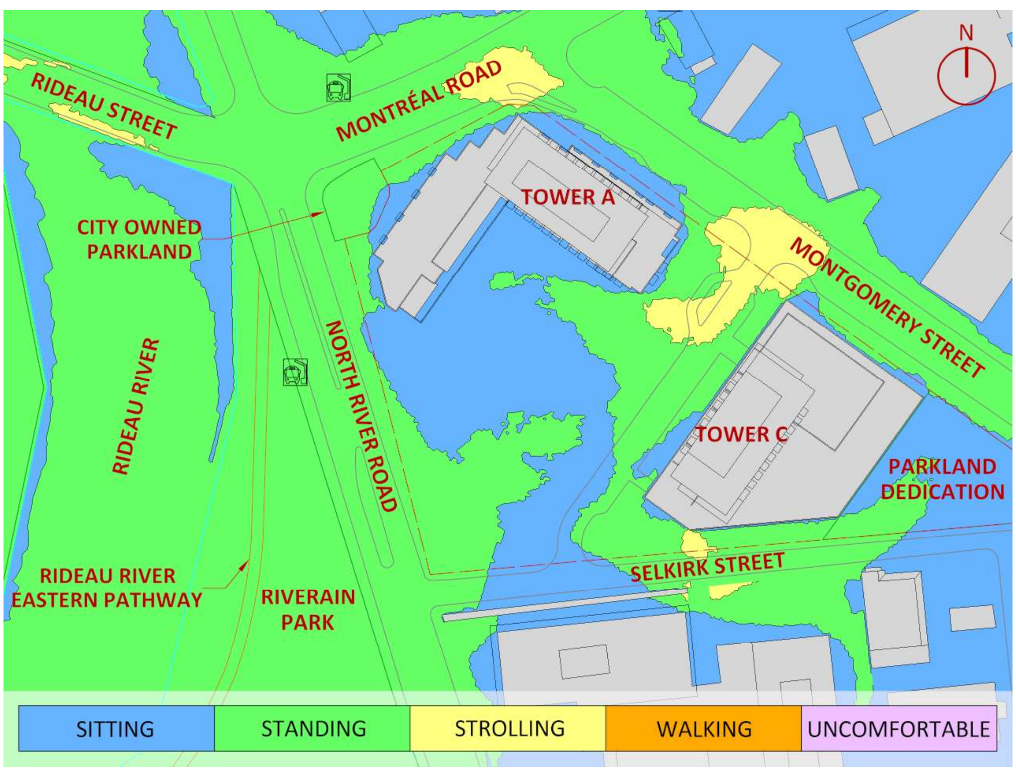


FIGURE 5B: AUTUMN – WIND COMFORT, GRADE LEVEL – EXISTING MASSING

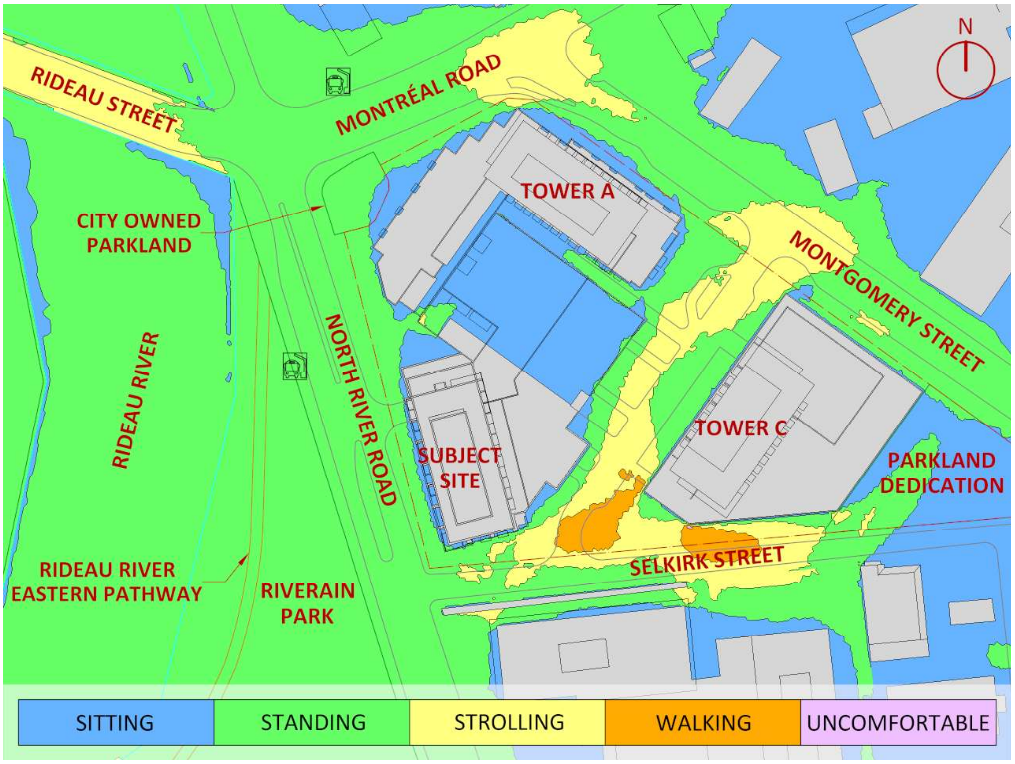


FIGURE 6A: WINTER – WIND COMFORT, GRADE LEVEL – PROPOSED MASSING

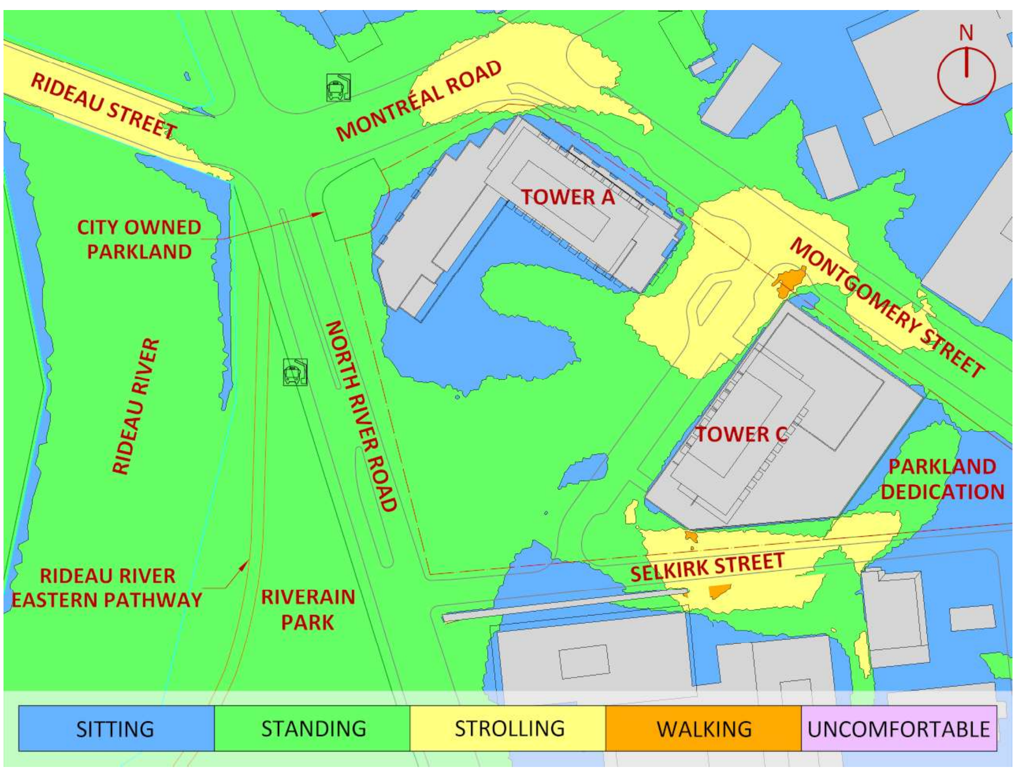


FIGURE 6B: WINTER – WIND COMFORT, GRADE LEVEL – EXISTING MASSING

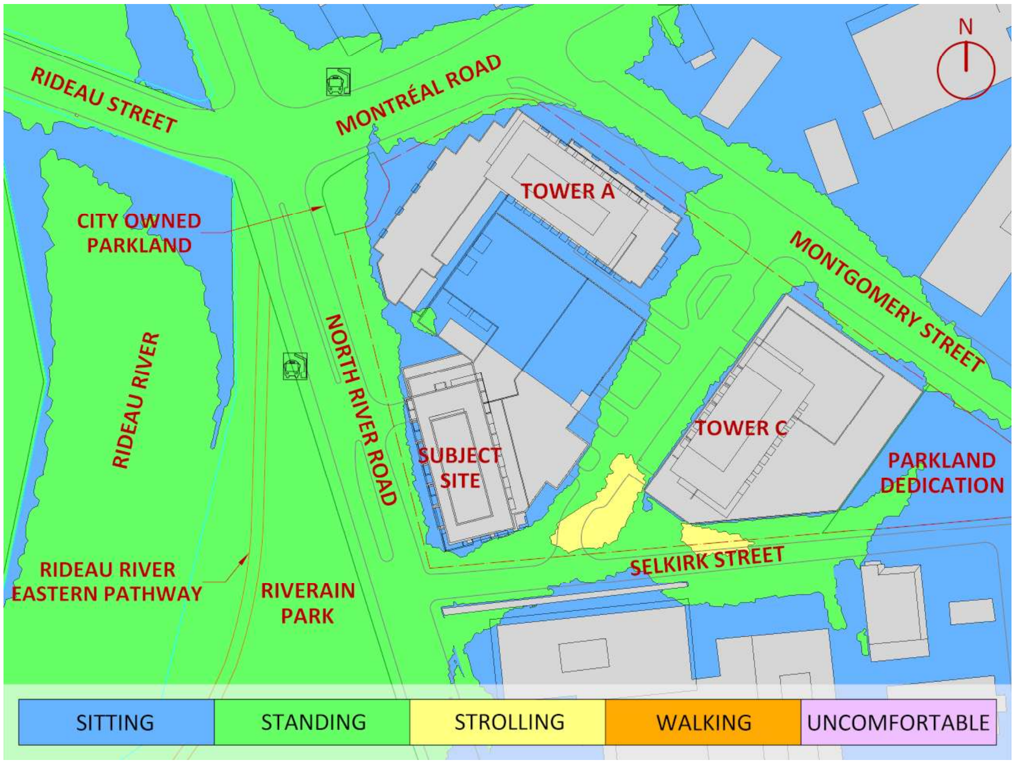


FIGURE 7A: TYPICAL-USE PERIOD – WIND COMFORT, GRADE LEVEL – PROPOSED MASSING

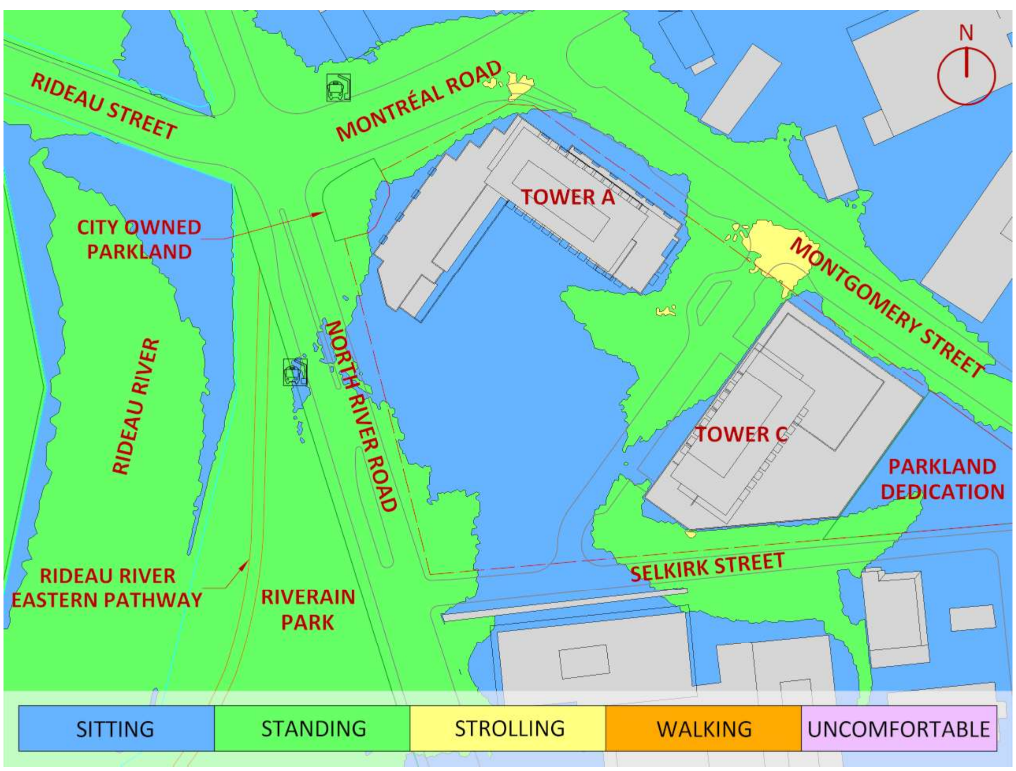


FIGURE 7B: TYPICAL-USE PERIOD – WIND COMFORT, GRADE LEVEL – EXISTING MASSING

FIGURE 8A: SPRING – WIND COMFORT, LEVEL 3 COMMON AMENITY TERRACE

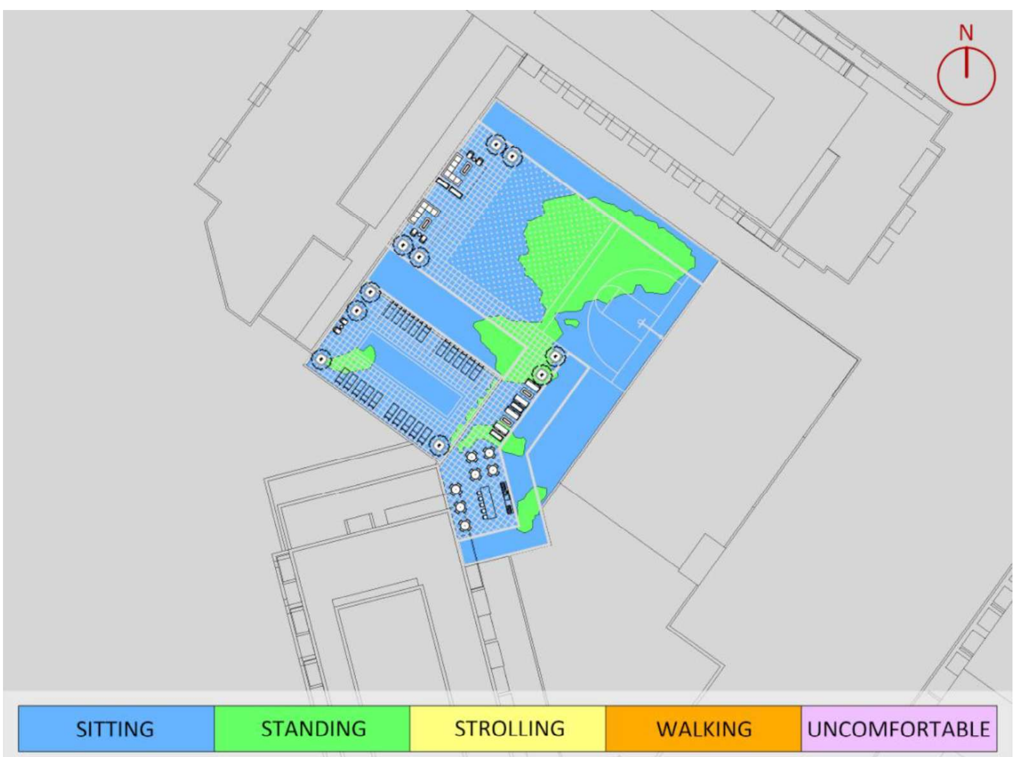


FIGURE 8B: SUMMER – WIND COMFORT, LEVEL 3 COMMON AMENITY TERRACE

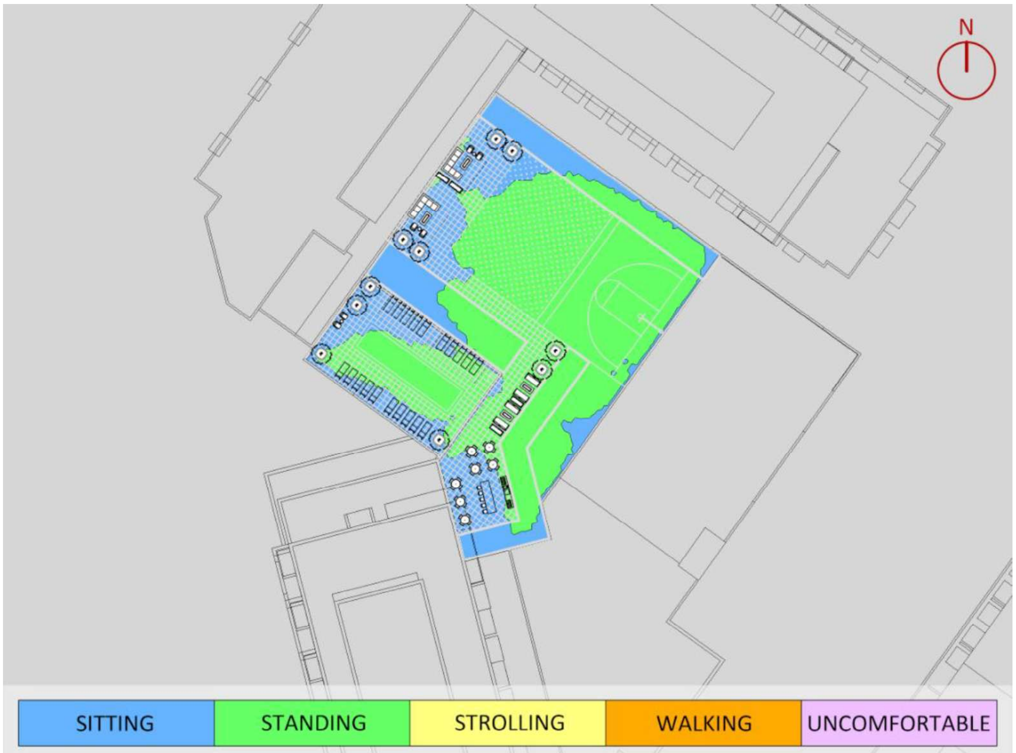
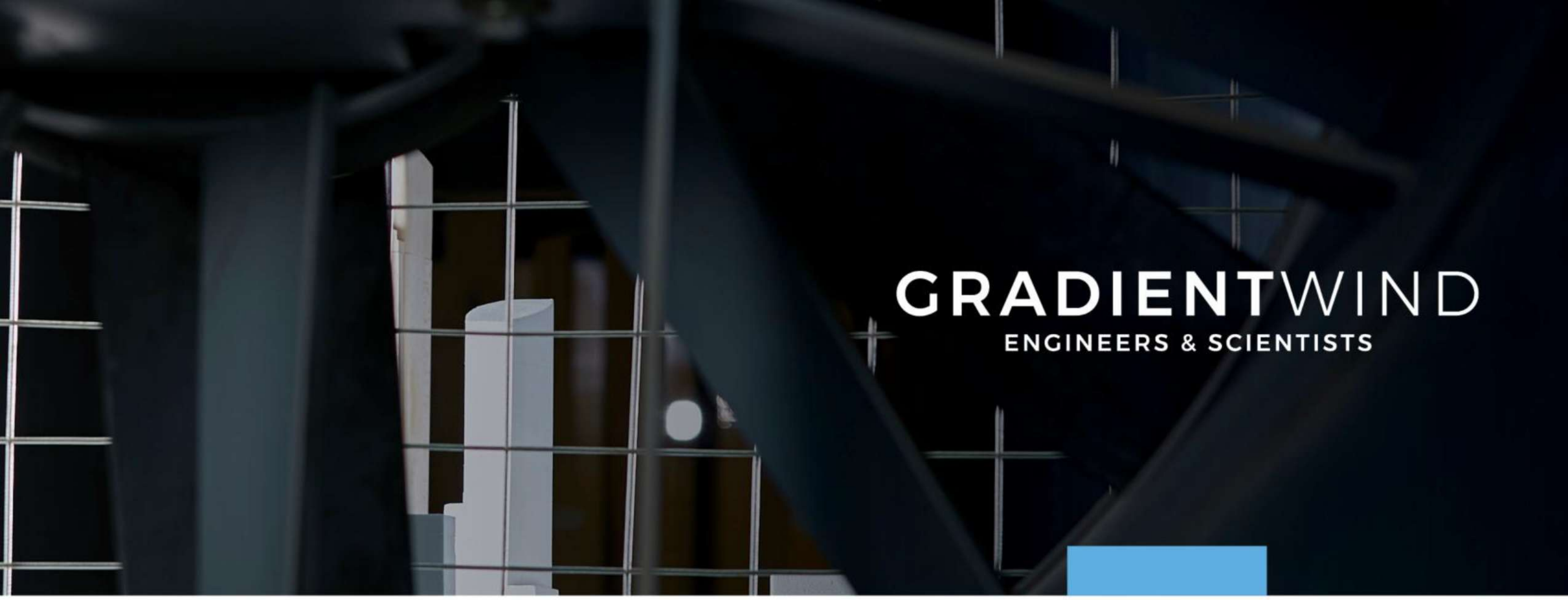


FIGURE 8C: AUTUMN – WIND COMFORT, LEVEL 3 COMMON AMENITY TERRACE

FIGURE 8D: WINTER – WIND COMFORT, LEVEL 3 COMMON AMENITY TERRACE

FIGURE 9: TYPICAL USE PERIOD – WIND COMFORT, LEVEL 3 COMMON AMENITY TERRACE



APPENDIX A

SIMULATION OF THE ATMOSPHERIC BOUNDARY LAYER

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SIMULATION OF THE ATMOSPHERIC BOUNDARY LAYER

The atmospheric boundary layer (ABL) is defined by the velocity and turbulence profiles according to industry standard practices. The mean wind profile can be represented, to a good approximation, by a power law relation, Equation (1), giving height above ground versus wind speed (1), (2).

$$U = U_g \left(\frac{Z}{Z_g} \right)^{\alpha} \qquad \text{Equation (1)}$$

where $\boldsymbol{U}$ = mean wind speed, $\boldsymbol{U_g}$ = gradient wind speed, $\boldsymbol{Z}$ = height above ground, $\boldsymbol{Z_g}$ = depth of the boundary layer (gradient height), and α is the power law exponent.

For the model, U_g is set to 6.5 metres per second (m/s), which approximately corresponds to the 60% mean wind speed for Ottawa based on historical climate data and statistical analyses. When the results are normalized by this velocity, they are relatively insensitive to the selection of gradient wind speed.

Z_g is set to 540 m. The selection of gradient height is relatively unimportant, so long as it exceeds the building heights surrounding the subject site. The value has been selected to correspond to our physical wind tunnel reference value.

α is determined based on the upstream exposure of the far-field surroundings (that is, the area that is not captured within the simulation model).

Table 1 presents the values of α used in this study, while Table 2 presents several reference values of α. When the upstream exposure of the far-field surroundings is a mixture of multiple types of terrain, the α values are a weighted average with terrain that is closer to the subject site given greater weight.

TABLE 1: UPSTREAM EXPOSURE (ALPHA VALUE) VS TRUE WIND DIRECTION

Wind Direction (Degrees True)	Alpha Value (α)
0	0.25
22.5	0.25
45	0.25
67.5	0.25
90	0.24
112.5	0.26
135	0.25
157.5	0.25
180	0.22
202.5	0.23
225	0.25
247.5	0.26
270	0.26
292.5	0.26
315	0.23
337.5	0.25

TABLE 2: DEFINITION OF UPSTREAM EXPOSURE (ALPHA VALUE)

Upstream Exposure Type	Alpha Value (α)
Open Water	0.14-0.15
Open Field	0.16-0.19
Light Suburban	0.21-0.24
Heavy Suburban	0.24-0.27
Light Urban	0.28-0.30
Heavy Urban	0.31-0.33

The turbulence model in the computational fluid dynamics (CFD) simulations is a two-equation shear-stress transport (SST) model, and thus the ABL turbulence profile requires that two parameters be defined at the inlet of the domain. The turbulence profile is defined following the recommendations of the Architectural Institute of Japan for flat terrain (3).

$$I(Z) = \begin{cases} 0.1\left(\frac{Z}{Z_g}\right)^{-\alpha-0.05}, & Z > 10\text{ m} \\ 0.1\left(\frac{10}{Z_g}\right)^{-\alpha-0.05}, & Z \le 10\text{ m} \end{cases}$$

Equation (2)

$$L_t(Z) = \begin{cases} 100\text{ m}\sqrt{\frac{Z}{30}}, & Z > 30\text{ m} \\ 100\text{ m}, & Z \le 30\text{ m} \end{cases}$$

Equation (3)

where ***I*** = turbulence intensity, $\boldsymbol{L_t}$ = turbulence length scale, ***Z*** = height above ground, and **α** is the power law exponent used for the velocity profile in Equation (1).

Boundary conditions on all other domain boundaries are defined as follows: the ground is a no-slip surface; the side walls of the domain have a symmetry boundary condition; the top of the domain has a specified shear, which maintains a constant wind speed at gradient height; and the outlet has a static pressure boundary condition.

REFERENCES

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[3] Y. Tamura, H. Kawai, Y. Uematsu, K. Kondo, and T. Okhuma, "Revision of AIJ Recommendations for Wind Loads on Buildings," in *The International Wind Engineering Symposium, IWES 2003*, Taiwan, 2003.