GRADIENTWIND
ENGINEERS & SCIENTISTS

June 14, 2023

Riverain Developments Inc.
109 Atlantic Avenue, Suite 302B
Toronto, ON M6K 1X4

Attn: Emily Roukhkian, Director of Development
emily@mainandmain.ca

Dear Ms. Roukhkian:

Re: Pedestrian Level Wind Study Addendum
2 Montreal Road, 280 Montgomery Street,
300 Montgomery Street, and 3 Selkirk Street, Ottawa
Gradient Wind File 20-077 June 2023

Gradient Wind Engineering Inc. (Gradient Wind) completed a computational pedestrian level wind (PLW) study to satisfy concurrent Official Plan Amendment (OPA) and Zoning By-Law Amendment (ZBLA) application submissions[1] for the proposed three phase development located at 2 Montreal Road, 280 Montgomery Street, 300 Montgomery Street, and 3 Selkirk Street in Ottawa, Ontario. The study was conducted based on architectural drawings of the proposed development provided by HOK Inc. in December 2020[2]. Following the completion of the noted study, a PLW addendum letter was provided to satisfy a Site Plan Control application submission[3] for Phase 1 of the proposed development (Tower A, currently under construction). The current architectural drawings for Phase 3 (Tower C), which were distributed to the consultant team in May 2023[4] in preparation for a Site Plan Control application submission for Phase 3 of the proposed development, include several changes: (i) a rectangular notch applied at the southwest corner of the 3-storey podium; (ii) private terraces at the podium rooftop along the west, south, and east elevations of Tower C; (iii) a common amenity terrace at the podium rooftop to the northeast of Tower C; and (iv) a reduction of approximately 1.5 m of the maximum building height.

[1] Gradient Wind Engineering Inc., '*3 Selkirk Street & 2 Montreal Road – Pedestrian Level Wind Study*', [Feb 4, 2021]
[2] HOK Inc., '*3 Selkirk Street & 2 Montreal Road*', [Dec 23, 2020]
[3] Gradient Wind Engineering Inc., '*3 Selkirk Street & 2 Montreal Road – Pedestrian Level Wind Study Addendum*', [Aug 12, 2021]
[4] Roderick Lahey Architects Inc., '*300 Montgomery Street*', [May 30, 2023]

The original study concluded that most grade-level areas within and surrounding the subject site were predicted to be acceptable for the intended pedestrian uses throughout the year. Specifically, wind comfort conditions over the walkways and sidewalks within the site and over the adjacent public sidewalks along Montreal Road, Montgomery Street, Selkirk Street, and North River Road were considered acceptable for the intended pedestrian uses throughout the year. Mitigation measures to provide wind comfort conditions suitable for the intended pedestrian uses throughout the year were recommended for the main entrance serving Tower C fronting the new interior road and the nearby bus stops along Montreal Road. Specifically, the noted main entrance was recommended to either be recessed within the façade by at least 2 m, flanked with 2-m-tall solid wind barriers, or replaced with sliding doors to ensure safe operability throughout the year, and typical shelters which provide pedestrian with a means to protect themselves from the elements, including during periods of strong wind activity, were recommended for the noted bus stops. Additionally, solid wind screens and/or coniferous plantings in dense arrangements were recommended around the parkland dedication area to the east of Tower C if conditions suitable for sitting were required over the area during the shoulder months of spring and autumn.

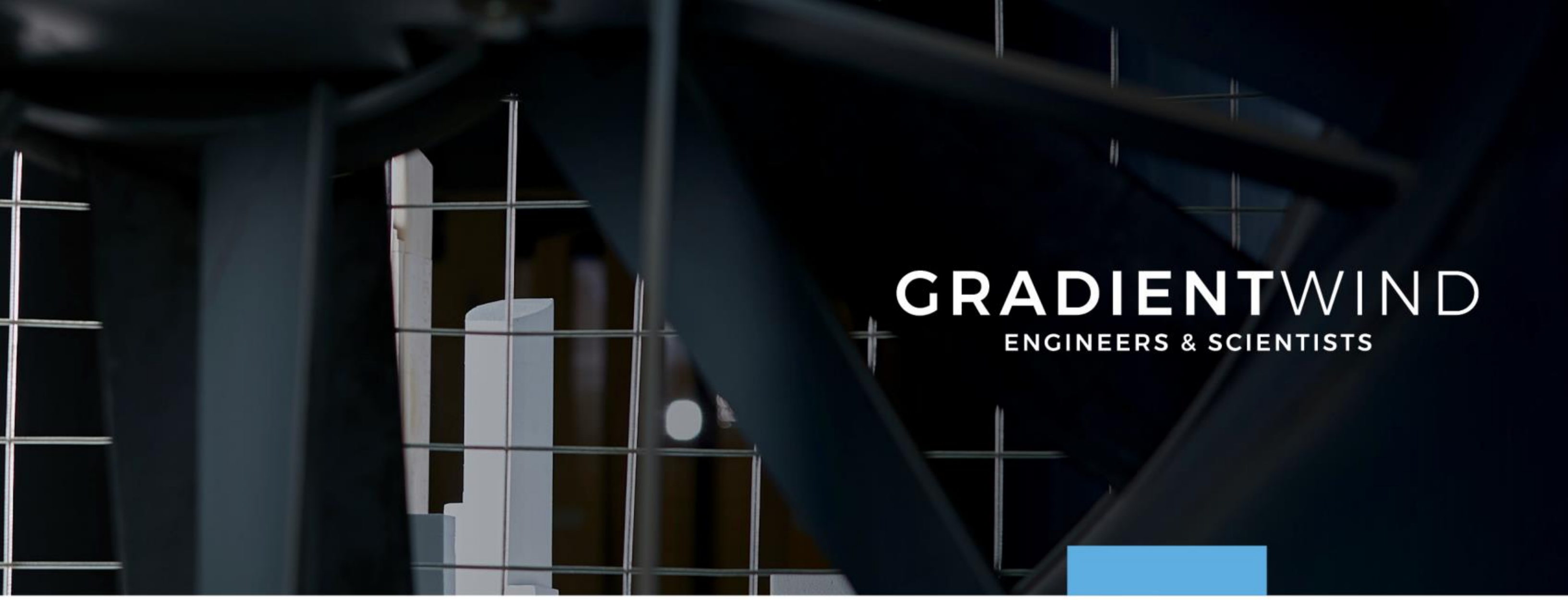
From a wind engineering perspective, the introduction of Phase 3 into the existing site massing, prior to the introduction of Phase 2 (Tower B), is not expected to significantly change the wind comfort conditions predicted in the detailed PLW study. Furthermore, the 2021 and 2023 massing designs for Phase 3 are similar. As such, the recommendations and conclusions provided in the detailed PLW report remain representative of the current massing. Regarding the common amenity terrace serving Phase 3 at the podium rooftop, Phase 1 and Tower C are expected to provide some sheltering effects from prominent winds, and wind comfort conditions within the noted common amenity are expected to be suitable for a mix of sitting and standing during the typical use period.

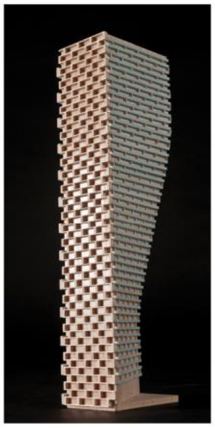
Sincerely,

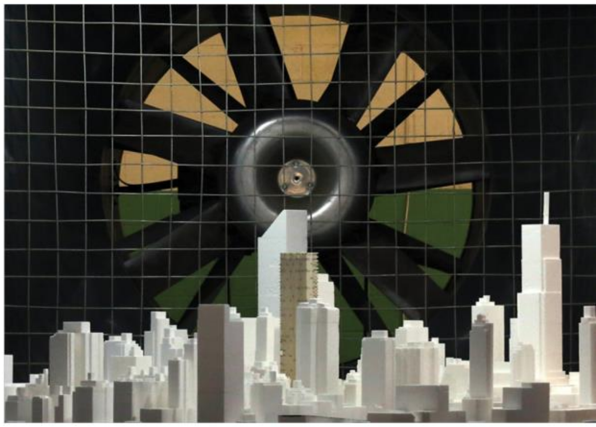
Gradient Wind Engineering Inc.

LICENSED PROFESSIONAL ENGINEER
J. D. FERRARO
100158495
June 14, 2023
PROVINCE OF ONTARIO

Justin Ferraro, P.Eng.
Principal







APPENDIX

ORIGINAL PEDESTRIAN LEVEL WIND STUDY

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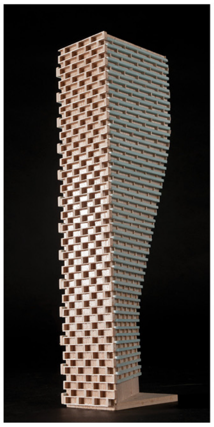
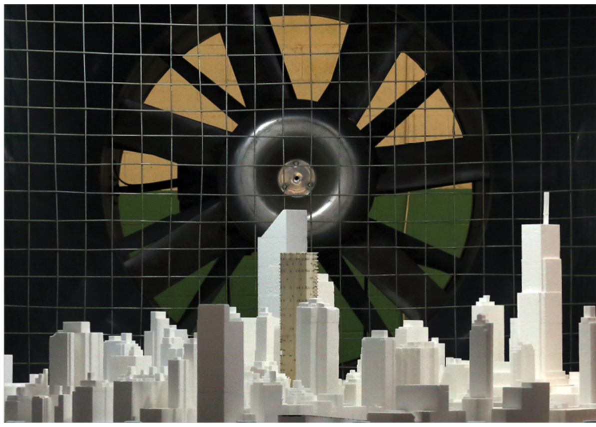
PEDESTRIAN LEVEL WIND STUDY

3 Selkirk Street & 2 Montreal Road
Ottawa, Ontario

Report: 20-077-PLW-R1





February 4, 2021

PREPARED FOR

Selkirk & Main Developments Inc.
109 Atlantic Avenue, Suite 302B
Toronto, ON M6K 1X4

PREPARED BY

Daniel Davalos, MESc., Junior Wind Scientist
Justin Ferraro, P.Eng., Principal

EXECUTIVE SUMMARY

This report describes a pedestrian level wind (PLW) study to satisfy the requirements for a joint Official Plan Amendment (OPA) and Zoning By-law Amendment (ZBA) application submission for a proposed multi-building development located at 3 Selkirk Street & 2 Montreal Road in Ottawa, Ontario (hereinafter referred to as "subject site"). Our mandate within this study is to investigate pedestrian wind comfort and safety within and surrounding the subject site, and to identify any areas where wind conditions may interfere with certain pedestrian activities so that mitigation measures may be considered, as 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-5, and summarized as follows:

1) Wind conditions at all grade-level areas within and surrounding the subject site are predicted to be acceptable for the intended pedestrian uses throughout the year. The only exceptions include the following areas:

    a. The main entrance serving Tower C, fronting the new interior road within the subject site, where conditions are predicted to be suitable for standing during the summer and autumn seasons, becoming suitable for strolling during the spring and winter seasons. To ensure normal and safe door operability throughout the year, particularly during the coldest months, we recommend recessing the entrance within the façade by at least 2 m. Alternatively, the entrance could either be flanked with 2-m-tall solid wind barriers or replaced with sliding doors.

    b. The bus stops along Montreal Road in the vicinity of the subject site, where conditions are predicted to be suitable for standing during the summer and autumn seasons, becoming mostly suitable for strolling during the spring and winter seasons. To achieve the standard comfort criterion during the coldest months of the year, the introduction of

a typical bus shelter would provide the necessary relief to the more vulnerable members of the population, particularly during strong wind events.

2) The parkland dedication area at grade level, situated to the immediate east of Tower C (Phase 3), is predicted to be suitable for sitting during the summer season. If sitting conditions are required during the shoulder months of spring and autumn, a comprehensive mitigation strategy comprising vertical wind barriers (solid or mostly solid wind screens and coniferous plantings in dense arrangements) would be required, which would be coordinated with the architects as the design evolves.

3) The city owned parkland, situated to the immediate southeast of the intersection of Montreal Road and North River Road / Cummings Bridge, is predicted to be suitable for sitting during the summer season, which is considered acceptable according to the comfort criteria in Section 4.4.

4) Regarding the various amenity terraces serving the full development at Level 2, conditions during the summer season are predicted to achieve the sitting comfort criterion, which is considered acceptable according to the comfort criteria in Section 4.4.

    a. The only exception involves the terrace to the south of Tower C at Level 2, which is predicted to be suitable for at least 70% of the time during the summer season. Since the terrace is narrow at nominally 1 m, the areas are not expected to support seating areas. As such, the noted wind conditions may be considered acceptable without mitigation.

5) Within the context of typical weather patterns, which exclude anomalous localized storm events such as tornadoes and downbursts, no pedestrian areas surrounding the subject site at grade level or within the common amenity terraces were found to experience conditions that could be considered dangerous, as defined in Section 4.4.

6) Regarding primary and secondary building access points, wind conditions predicted in this study are only applicable to pedestrian comfort and safety. As such, the results should not be construed to indicate wind loading on doors and associated hardware.

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1. INTRODUCTION

Gradient Wind Engineering Inc. (Gradient Wind) was retained by Selkirk & Main Developments Inc. to undertake a pedestrian level wind (PLW) study to satisfy the requirements for a joint Official Plan Amendment (OPA) and Zoning By-law Amendment (ZBA) application submission for a proposed multi-building development located at 3 Selkirk Street & 2 Montreal Road in Ottawa, Ontario (hereinafter referred to as "subject site"). Our mandate within this study is to investigate pedestrian wind comfort and safety within and surrounding the subject site, and to identify any areas where wind conditions may interfere with certain pedestrian activities so that mitigation measures may be considered, as 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 HOK, Inc. ("Issued for Rezoning Application", dated December 23, 2020), 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 & 2 Montreal Road in Ottawa. The subject 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.


Architectural Rendering, View from Cummings Bridge (Courtesy of HOK Architects)

The subject site comprises three buildings in separate phases with rectangular planforms at grade connected by a 1-storey podium. Phase 1 includes Tower 'A', of 22 storeys, which is located at the north of the site, with the long axis oriented along Montgomery Street. Phase 2 includes Tower 'B', of 32 storeys, which is located at the south of the site with the long axis oriented parallel to Tower A. Phase 3 includes Tower 'C', of 28 storeys, which is located at the east of the site with the long axis oriented perpendicular to Tower A.

The ground floor comprises various retail spaces, lobby space, and parking space. The mezzanine level comprises a continuation of the retail space and parking space. Level 2 comprises residential units and parking space. Levels 3 and above comprise residential units. Main building entrances are located along the new interior road, which connects Selkirk Street to Montgomery Street and intersects Tower A and Tower B from Tower C, near the centre of the west elevation of Tower C, near the northeast corner of Tower B, and near the southeast corner of Tower A.

At grade level, the noted interior road provides access to the parking structures serving Towers A and B, and Tower C. Parking is also provided at the mezzanine level for all towers, while an additional parking is provided at Level 2 for Tower C. The site also includes two levels of below-grade parking.

A large parkland dedication area is provided at grade level to the immediate east of Tower C, while city owned parkland is provided to the immediate west of the subject site where Montreal Road intersects North River Road. Amenity terraces serving the subject site are provided at Level 2, on the shared podium serving Towers A and B, and at the northwest corner and south end of the podium serving Tower C.

The near-field surroundings (defined as an area within 500 metres (m) of the subject site) are composed of low-rise residential dwellings from the west clockwise to the east, as well as to the south, and a mix of low-rise residential dwellings and mid- and high-rise developments to the south-southeast and the southwest. To the west, the Rideau River provides for slightly more open exposures. The far-field surroundings (defined as an area beyond the near-field but within a 5 kilometre (km) radius of the subject site) contribute primarily suburban wind exposures from all directions, although southwesterly winds are affect by the Ottawa downtown core and westerly and northerly winds are affect by the Ottawa River.

Key areas under consideration include surrounding sidewalks, walkways, building access points, nearby transit stops, the noted parkland dedication and city owned parkland, and the rooftop terraces. Figure 1 illustrates the subject site and surrounding context, while Figures 2A-2D illustrate the computational model used to conduct the study.

3. OBJECTIVES

The principal objectives of this study are to (i) determine pedestrian level wind comfort and safety 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 study 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[1]. 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 study 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 more conservative (i.e., windier) wind speed values.

[1] City of Ottawa Terms of References: Wind Analysis
https://documents.ottawa.ca/sites/default/files/torwindanalysis_en.pdf

4.2 Wind Speed Measurements

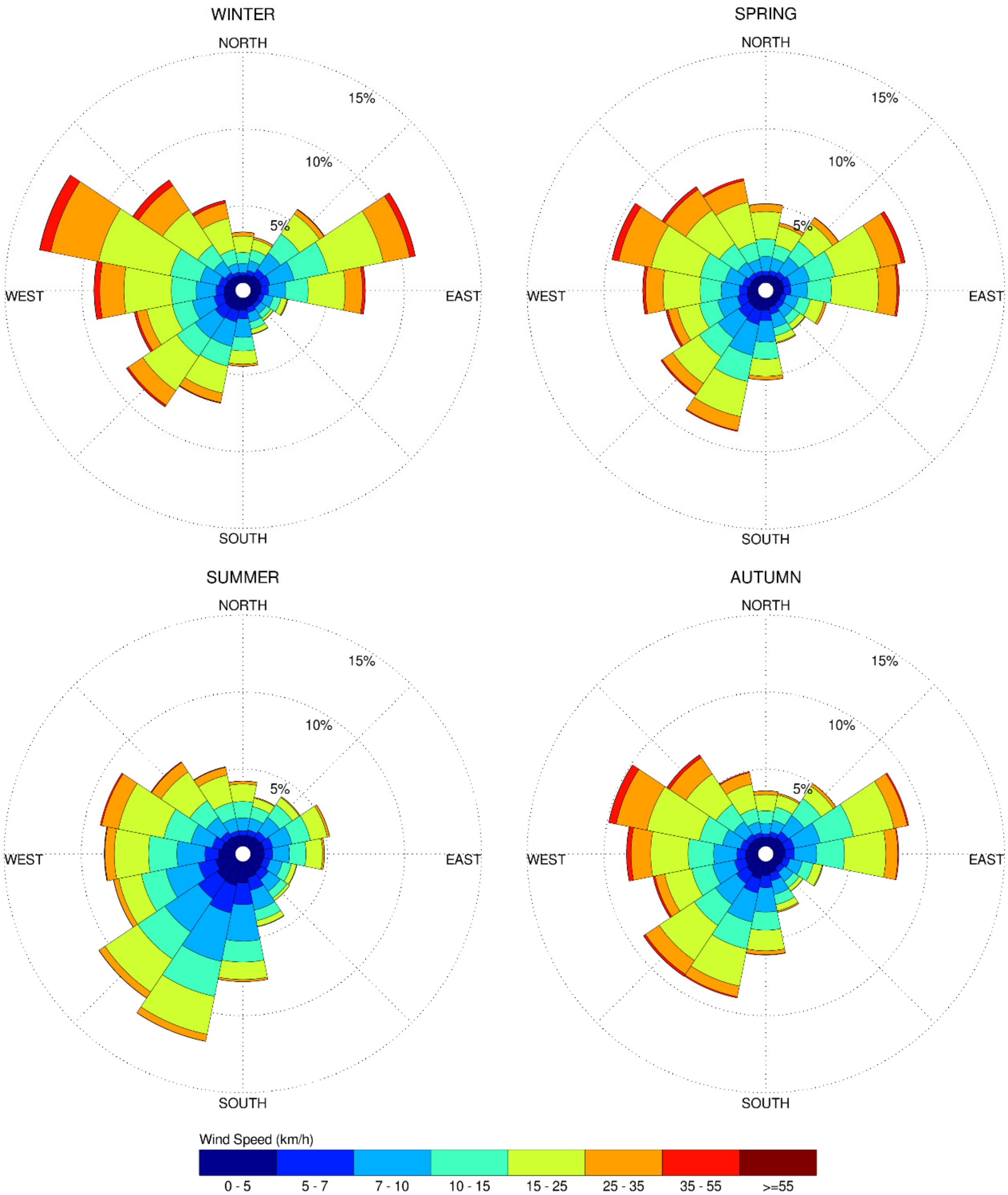
The PLW analysis was performed by simulating wind flows and gathering velocity data over a CFD model of the site for 12 wind directions. The CFD simulation model was centered on the study building, complete with surrounding massing within a diameter of approximately 820 m. Mean and peak wind speed data obtained over the study 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 amenity terraces 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 Meteorological Data Analysis

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 for each month of the year to determine the statistically prominent wind directions and corresponding speeds.

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 preferred 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 preference 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 Comfort and Safety Criteria – City of Ottawa

Pedestrian comfort and safety criteria are based on the mechanical effects of wind without consideration of other meteorological conditions (i.e., temperature, relative humidity). The comfort criteria assume that pedestrians are appropriately dressed for a specified outdoor activity during any given season. Five pedestrian comfort classes are based on 80% non-exceedance mean wind speed ranges, which include (1) Sitting; (2) Standing; (3) Strolling; (4) Walking; and (5) Uncomfortable. More specifically, the comfort classes and associated mean wind speed ranges are summarized as follows:

1) **Sitting:** 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.

2) **Standing:** 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.

3) **Strolling:** 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.

4) **Walking:** 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.

5) **Uncomfortable:** 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.

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. The gust speeds, and equivalent mean speeds, are selected based on 'The Beaufort Scale', presented on the following page, which describes the effects of forces produced by varying wind speed levels on objects. Gust speeds are included because 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.

THE BEAUFORT SCALE

Number	Description	Wind Speed (km/h)		Description
		Mean	Gust	
2	Light Breeze	6-11	9-17	Wind felt on faces
3	Gentle Breeze	12-19	18-29	Leaves and small twigs in constant motion; wind extends light flags
4	Moderate Breeze	20-28	30-42	Wind raises dust and loose paper; small branches are moved
5	Fresh Breeze	29-38	43-57	Small trees in leaf begin to sway
6	Strong Breeze	39-49	58-74	Large branches in motion; Whistling heard in electrical wires; umbrellas used with difficulty
7	Moderate Gale	50-61	75-92	Whole trees in motion; inconvenient walking against wind
8	Gale	62-74	93-111	Breaks twigs off trees; generally impedes progress

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 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 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 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 desired comfort classes, which are dictated by the location type for each region (i.e., a sidewalk, building entrance, amenity space, or other). An overview of common pedestrian location types and their desired comfort classes are summarized on the following page.

DESIRED PEDESTRIAN COMFORT CLASSES FOR VARIOUS LOCATION TYPES

Location Types	Desired Comfort Classes
Primary Building Entrance	Standing
Secondary Building Access Point	Standing / Strolling / Walking
Primary Public Sidewalk	Strolling / Walking
Secondary Public Sidewalk / Bicycle Path	Walking
Outdoor Amenity Space	Sitting / Standing / Strolling
Café / Patio / Bench / Garden	Sitting
Transit Stop	Sitting / Standing
Public Park / Plaza	Standing / Strolling
Garage / Service Entrance	Walking
Parking Lot	Strolling / Walking
Vehicular Drop-Off Zone	Standing / Strolling / Walking

5. RESULTS AND DISCUSSION

The following discussion of predicted pedestrian wind conditions is accompanied by Figures 3A-3D and Figures 4A-4D (following the main text), illustrating seasonal wind comfort conditions at grade level and within the elevated amenity terraces, respectively.

The colour contours indicate various wind comfort classes predicted for certain regions, which correspond to the City of Ottawa wind comfort criteria in Section 4.4. Wind conditions comfortable for sitting or more sedentary activities are represented by the colour green, standing are represented by yellow, strolling by orange, and walking by blue. Uncomfortable conditions are represented by magenta.

Additionally, Figures 5A and 5B illustrate the percentage of time grade level areas and the amenity terraces are predicted to be suitable for sitting, respectively. Pedestrian conditions are summarized below for each area of interest.

5.1 Wind Comfort Conditions – Grade Level

Montgomery Street: The sidewalks along Montgomery Street are predicted to be suitable for sitting during the summer season, transitioning to standing near the northeast corner of Tower A and at the intersection of Montgomery Street and the new interior road serving the subject site. During the spring and autumn seasons, the sidewalks are predicted to be suitable for standing, with strolling conditions within the windier areas noted previously. During the winter season, conditions are predicted to be suitable for walking, or better, at the northeast corner of Tower A, and suitable for strolling at the intersection of Montgomery Street and the interior road. These conditions are considered acceptable according to the comfort criteria in Section 4.4.

New Interior Road Connecting Montgomery Street to Selkirk Street, Building Entrances: The walkways along the new interior road are predicted to be suitable for standing during the summer season, becoming suitable for strolling during the autumn season. During the spring and winter seasons, conditions are predicted to be mixed between strolling and walking. These conditions are considered acceptable for walkways according to the comfort criteria in Section 4.4.

Main building entrances are located along the new interior road near the centre of the west elevation of Tower C, near the northeast corner of Tower B, and near the southeast corner of Tower A.

- Conditions in the vicinity of the main entrance serving Tower A are predicted to be suitable for sitting during the summer and autumn seasons, becoming suitable for standing during the spring and winter seasons. These conditions are considered acceptable according to the comfort criteria.
- Conditions in the vicinity of the main entrance serving Tower B are predicted to be suitable for sitting during the summer season, becoming suitable for standing during the remaining three seasons. These conditions are considered acceptable according to the comfort criteria.
- Conditions in the vicinity of the main entrance serving Tower C are predicted to be suitable for standing during the summer and autumn seasons, becoming suitable for strolling during the spring and winter seasons. To ensure normal and safe door operability throughout the year, particularly during the coldest months, we recommend recessing the entrance within the façade by at least 2 m. Alternatively, the entrance could either be flanked with 2-m-tall solid wind barriers or replaced with sliding doors.

The courtyard, located along the east side of the podium serving Towers A and B and situated to the immediate south of the main entrance serving Tower A, is predicted to be suitable for a mix of sitting and standing during the summer season, a mix of standing and strolling during the autumn season, becoming suitable for strolling during the spring and winter seasons. If sitting conditions are required during the typical use period of late spring to early autumn, a comprehensive mitigation strategy comprising vertical wind barriers (solid or mostly solid wind screens and coniferous plantings in dense arrangements) would be required, which would be coordinated with the architects as the design evolves.

Parkland Dedication Area: The parkland dedication area provided at grade level to the immediate east of Tower C is predicted to be suitable for sitting during the summer season, which is considered acceptable according to the comfort criteria in Section 4.4. During the remaining three colder seasons, the area is predicted to be mostly suitable for standing, while some areas are predicted to remain suitable for sitting. The calm conditions predicted during the summer season arise from the protection provided by the Tower C massing and its podium for many prominent westerly winds.

If sitting conditions are required during the shoulder months of spring and autumn, a comprehensive mitigation strategy comprising vertical wind barriers (solid or mostly solid wind screens and coniferous plantings in dense arrangements) would be required, which would be coordinated with the architects as the design evolves.

Selkirk Street: The sidewalks along Selkirk Street are predicted to be mostly suitable for standing during the summer season, while condition adjacent to the parkland dedication area are predicted to be suitable for sitting. During the remaining three seasons, conditions are predicted to be suitable for a mix of standing and strolling, while condition adjacent to the parkland dedication area are predicted to be suitable for a mix of sitting and standing. These conditions are considered acceptable according to the comfort criteria in Section 4.4.

North River Road: The sidewalks along North River Road are predicted to be mostly suitable for standing throughout the year. Additionally, during the spring and winter seasons, wind conditions at the intersection of North River Road and Selkirk Street are predicted to be suitable for strolling. These conditions are considered acceptable according to the comfort criteria in Section 4.4.

The bus stops on either side of North River Road are predicted to be suitable for standing throughout the year, which is acceptable according to the comfort criteria in Section 4.4.

Montreal Road and City Owned Parkland: The sidewalks along Montreal Road are predicted to be suitable for a mix of sitting and standing during the summer season. During the three colder seasons, the sidewalks are predicted to be mostly suitable for standing, although strolling conditions are predicted for the intersection of Montreal Road and Montgomery Street. During the spring and winter seasons, strolling conditions are also predicted for the intersection of Montreal Road and North River Road / Cummings Bridge. These conditions are considered acceptable according to the comfort criteria in Section 4.4.

The city owned parkland, situated to the immediate southeast of the intersection of Montreal Road and North River Road / Cummings Bridge, is predicted to be suitable for sitting during the summer season, becoming suitable for standing during the three colder seasons. These conditions are considered acceptable according to the comfort criteria in Section 4.4.

The two bus stops on the north side of Montreal Road in the vicinity of the subject site are predicted to be suitable for standing during the summer and autumn seasons, becoming mostly suitable for strolling during the spring and winter seasons. To achieve the standard comfort criterion during the coldest months of the year, the introduction of a typical bus shelter would provide the necessary relief to the more vulnerable members of the population, particularly during strong wind events.

5.2 Wind Comfort Conditions – Amenity Terraces

Towers A and B, Level 2, West: Wind conditions are predicted to be suitable for sitting during the summer season, mostly suitable for sitting during the autumn season, becoming suitable for a mix of sitting and standing during the spring and winter seasons. These conditions are considered acceptable according to the comfort criteria in Section 4.4.

Towers A and B, Level 2, East: Wind conditions are predicted to be suitable for sitting during the summer season, mostly suitable for standing during the spring and autumn seasons, becoming mostly suitable for a mix of standing and strolling during the spring and winter seasons. These conditions are considered acceptable according to the comfort criteria in Section 4.4.

Tower C, Level 2, North: Wind conditions are predicted to be suitable for sitting during the summer season, and mostly suitable for sitting during the three colder seasons. Additionally, during the three colder seasons, conditions suitable for a mix of standing and strolling may occur at the extreme north end of the amenity terrace. These conditions are considered acceptable according to the comfort criteria in Section 4.4.

Tower C, Level 2, South: Wind conditions are predicted to be suitable for a mix of sitting and standing during the summer season, a mix of sitting, standing, and strolling during the spring and autumn seasons, and mostly suitable for a mix of standing and strolling during the winter season. Figure 5B illustrates that the amenity terrace is also predicted to be suitable for sitting for at least 70% of the time along the area extending nominally north-south, while the area extending nominally east-west is predicted to mostly achieve the sitting criterion. Since the terrace is narrow at nominally 1 m, the areas are not expected to support seating areas. As such, the noted wind conditions 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 surrounding the subject site at grade level or on the common elevated amenity terraces were found to experience conditions that could be considered dangerous, as defined in Section 4.4.

5.4 Applicability of Results

Wind conditions over surrounding sidewalks beyond the subject site, as well as at nearby primary building entrances, will be acceptable for their intended pedestrian uses during each seasonal period upon the introduction of the subject site. Pedestrian wind comfort and safety have been quantified for the specific configuration of existing and foreseeable construction around the study site. Future changes (i.e., 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 site would alter the wind profile approaching the site; and (ii) development in proximity to the site would cause changes to local flow patterns. In general, development in urban centers generally creates reduction in the mean wind speeds and localized increases in the gustiness of the wind.

Regarding primary and secondary building access points, wind conditions predicted in this study are only applicable to pedestrian comfort and safety. As such, the results should not be construed to indicate wind loading on doors and associated hardware.

6. CONCLUSIONS AND RECOMMENDATIONS

A complete summary of the predicted wind conditions for the subject site is provided in Section 5 and illustrated in Figures 3A-5B. 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, we conclude the following:

1) Wind conditions at all grade-level areas within and surrounding the subject site are predicted to be acceptable for the intended pedestrian uses throughout the year. The only exceptions include the following areas:

    a. The main entrance serving Tower C, fronting the new interior road within the subject site, where conditions are predicted to be suitable for standing during the summer and autumn seasons, becoming suitable for strolling during the spring and winter seasons. To ensure normal and safe door operability throughout the year, particularly during the coldest months, we recommend recessing the entrance within the façade by at least 2 m. Alternatively, the entrance could either be flanked with 2-m-tall solid wind barriers or replaced with sliding doors.

   b. The bus stops along Montreal Road in the vicinity of the subject site, where conditions are predicted to be suitable for standing during the summer and autumn seasons, becoming mostly suitable for strolling during the spring and winter seasons. To achieve the standard comfort criterion during the coldest months of the year, the introduction of a typical bus shelter would provide the necessary relief to the more vulnerable members of the population, particularly during strong wind events.

2) The parkland dedication area at grade level, situated to the immediate east of Tower C (Phase 3), is predicted to be suitable for sitting during the summer season. If sitting conditions are required during the shoulder months of spring and autumn, a comprehensive mitigation strategy comprising vertical wind barriers (solid or mostly solid wind screens and coniferous plantings in dense arrangements) would be required, which would be coordinated with the architects as the design evolves.

3) The city owned parkland, situated to the immediate southeast of the intersection of Montreal Road and North River Road / Cummings Bridge, is predicted to be suitable for sitting during the summer season, which is considered acceptable according to the comfort criteria in Section 4.4.

4) Regarding the various amenity terraces serving the full development at Level 2, conditions during the summer season are predicted to achieve the sitting comfort criterion, which is considered acceptable according to the comfort criteria in Section 4.4.

   a. The only exception involves the terrace to the south of Tower C at Level 2, which is predicted to be suitable for at least 70% of the time during the summer season. Since the terrace is narrow at nominally 1 m, the areas are not expected to support seating areas. As such, the noted wind conditions may be considered acceptable without mitigation.

5) Within the context of typical weather patterns, which exclude anomalous localized storm events such as tornadoes and downbursts, no pedestrian areas surrounding the subject site at grade level or within the common amenity terraces were found to experience conditions that could be considered dangerous, as defined in Section 4.4.

6) Regarding primary and secondary building access points, wind conditions predicted in this study are only applicable to pedestrian comfort and safety. As such, the results should not be construed to indicate wind loading on doors and associated hardware.

This concludes our PLW study and report. Please advise the undersigned of any questions or comments.

Sincerely,

Gradient Wind Engineering Inc.

LICENSED PROFESSIONAL ENGINEER
J. D. FERRARO
100158495
Feb 8, 2026
PROVINCE OF ONTARIO

Daniel Davalos, MESc.
Junior Wind Scientist

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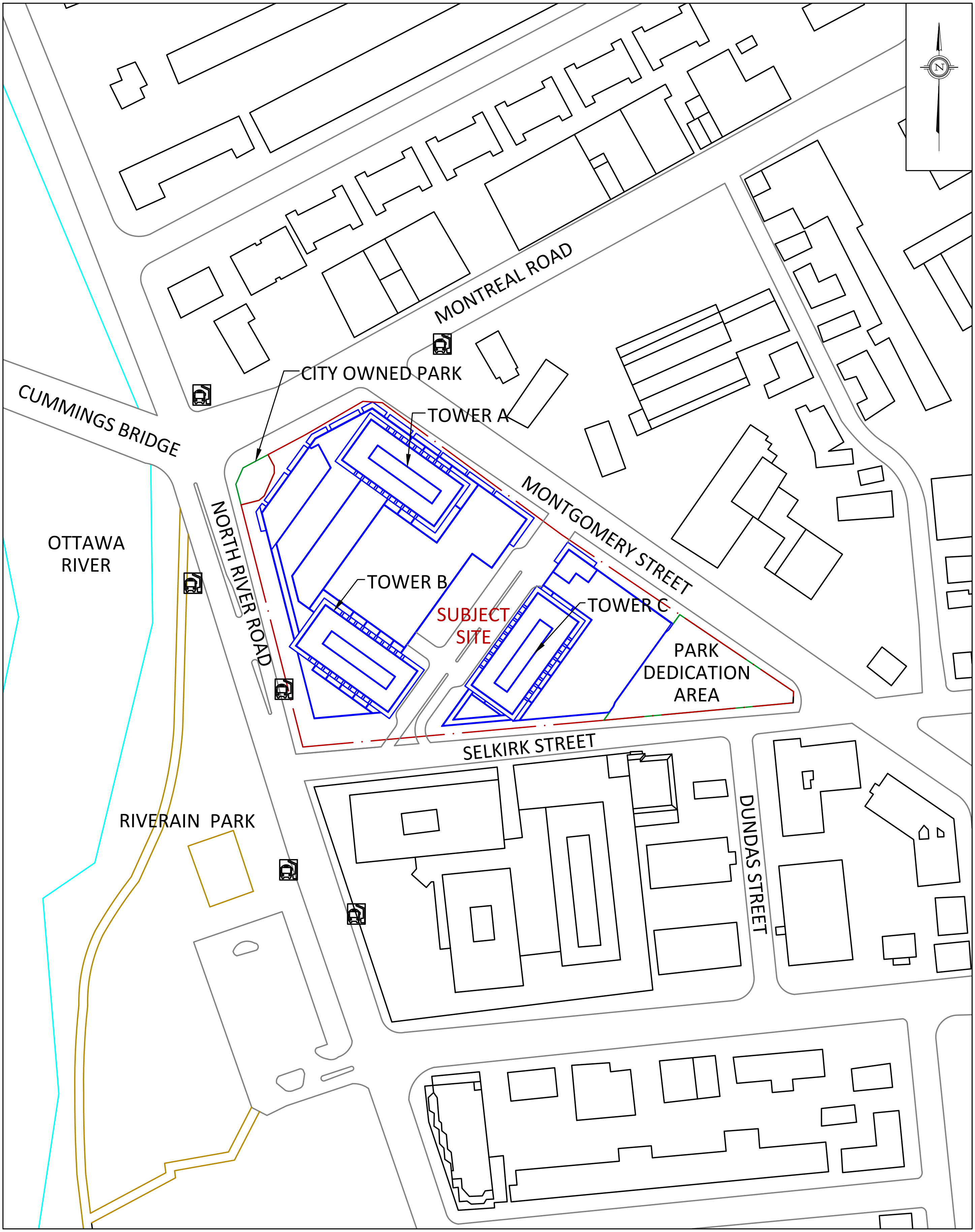

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PROJECT		DESCRIPTION
29 SELKIRK STREET, OTTAWA PEDESTRIAN LEVEL WIND STUDY		FIGURE 1: SITE PLAN AND SURROUNDING CONTEXT
SCALE: 1:2000	DRAWING NO.: 21-077-PLW-R1-1	
DATE: FEBRUARY 3, 2021	DRAWN BY: N.M.P.	

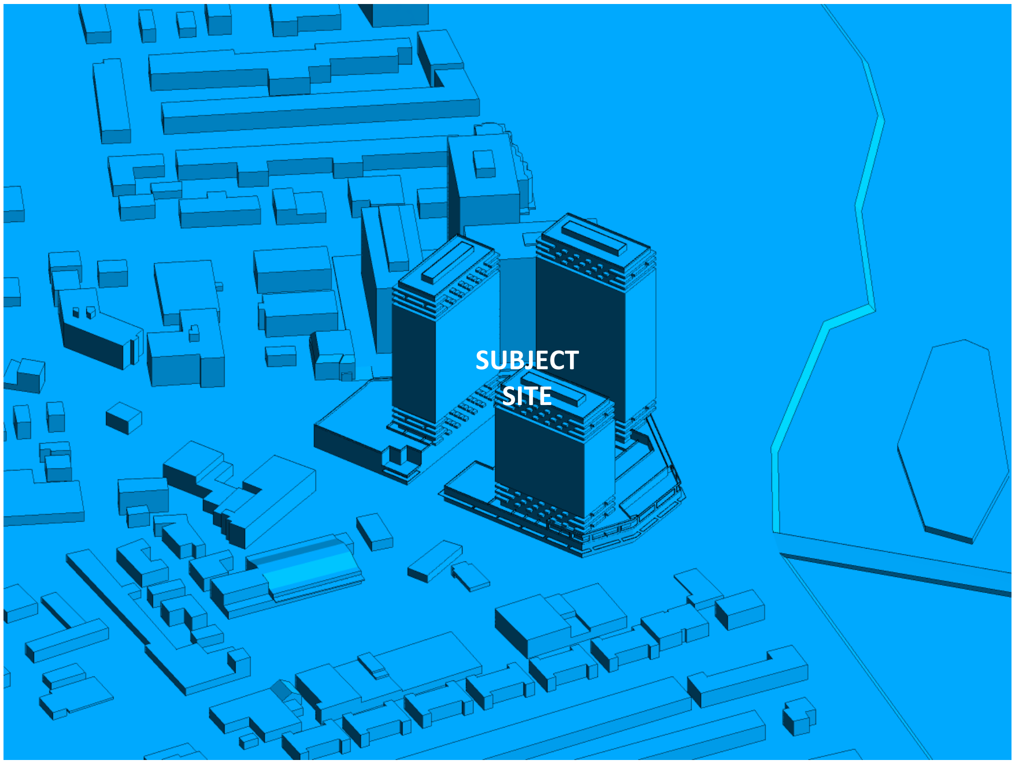


FIGURE 2A: COMPUTATIONAL MODEL, NORTH PERSPECTIVE

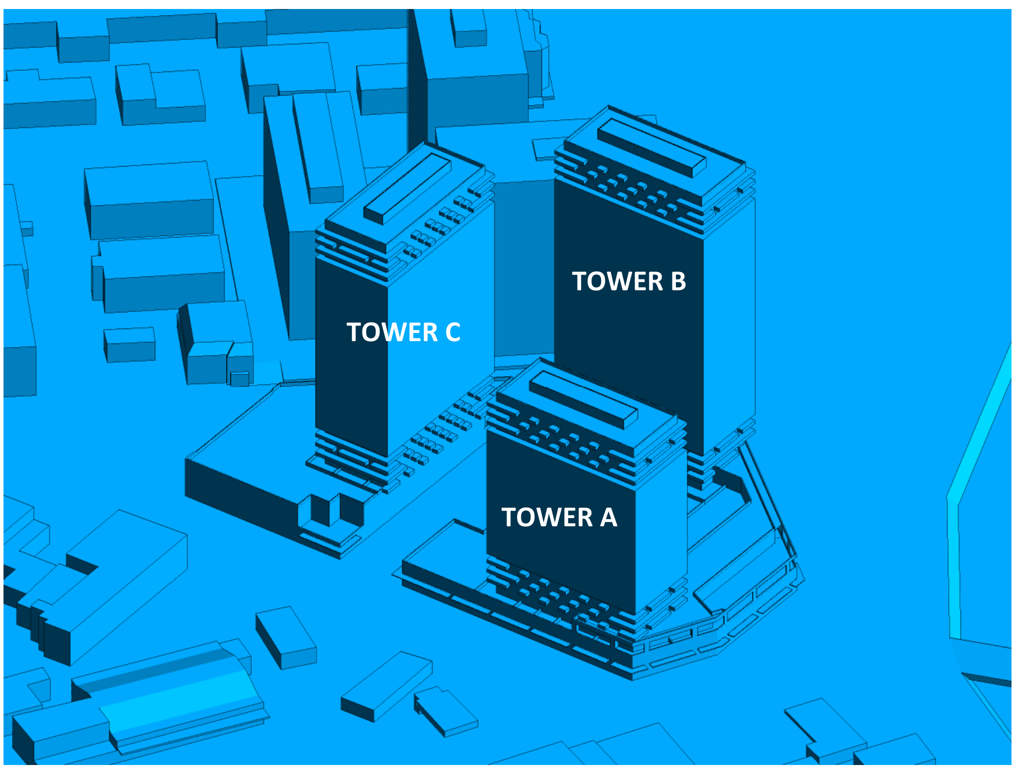


FIGURE 2B: CLOSE UP OF FIGURE 2A

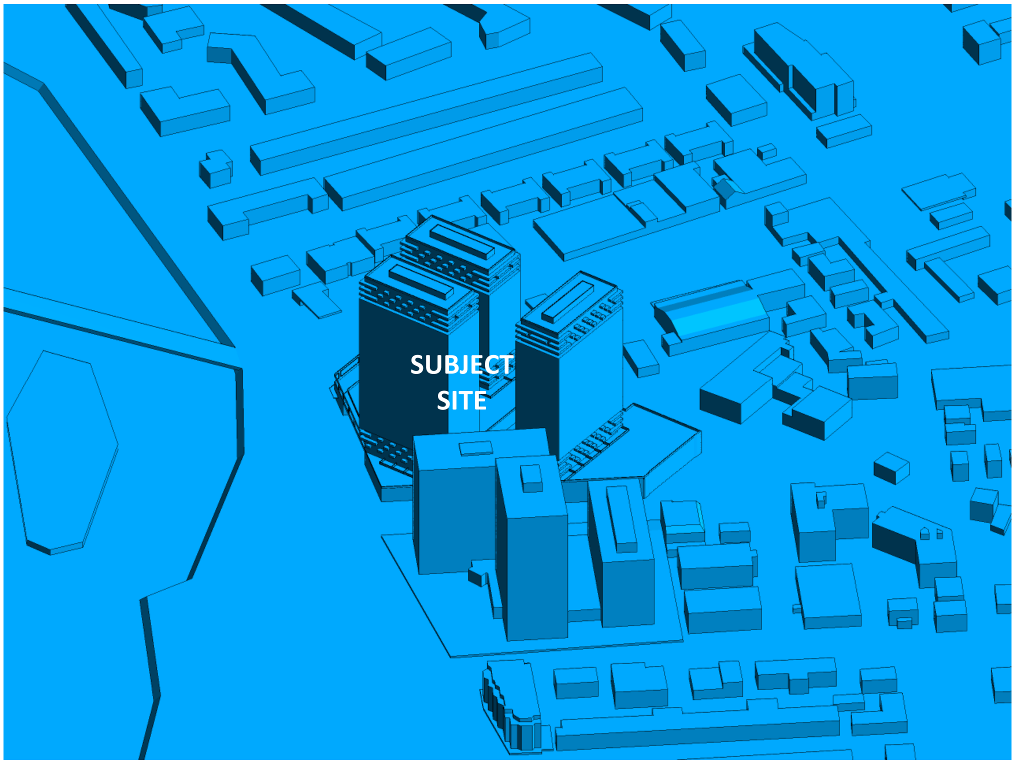


FIGURE 2C: COMPUTATIONAL MODEL, SOUTH PERSPECTIVE

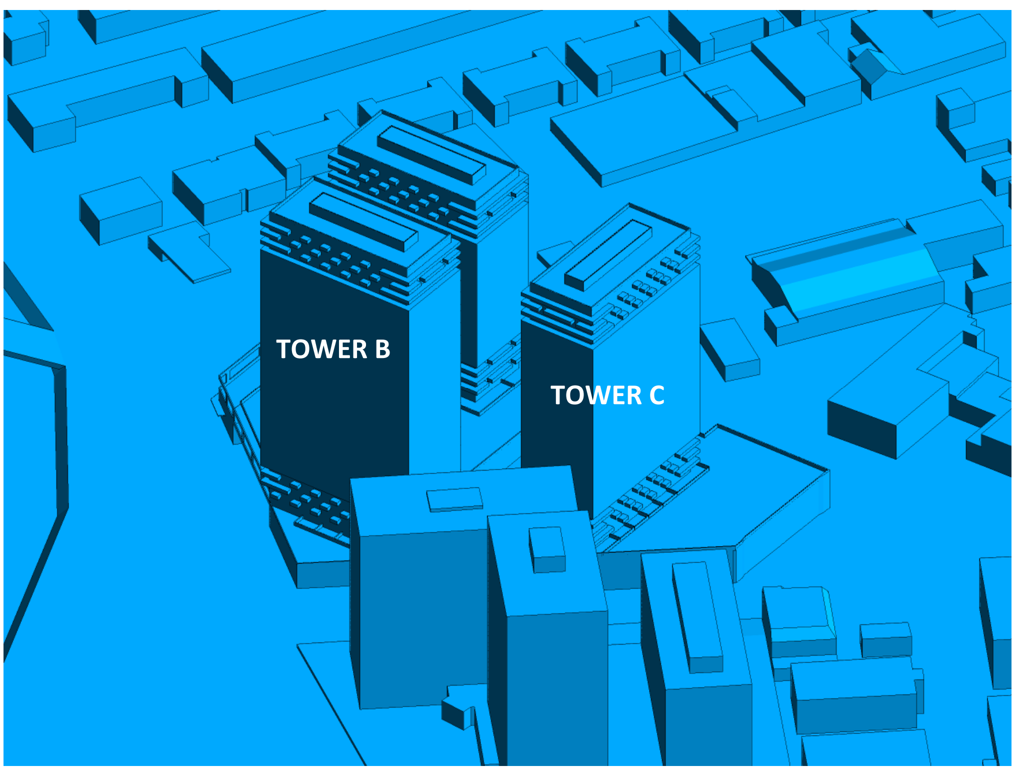


FIGURE 2D: CLOSE UP OF FIGURE 2C

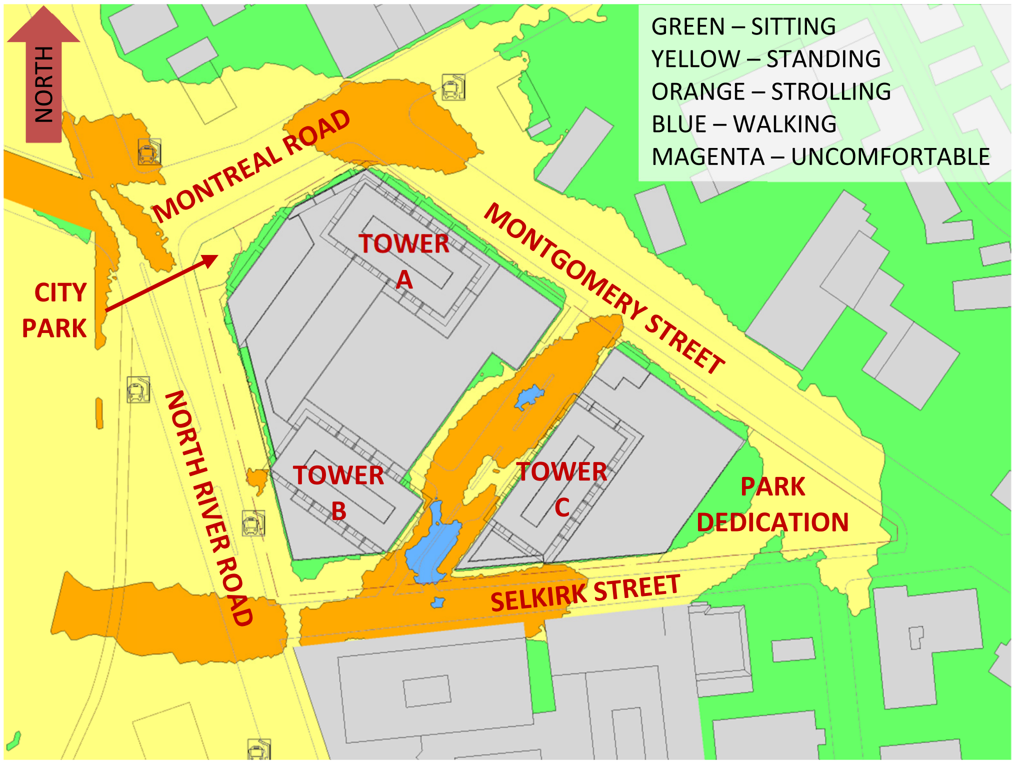


FIGURE 3A: SPRING – WIND CONDITIONS AT GRADE LEVEL

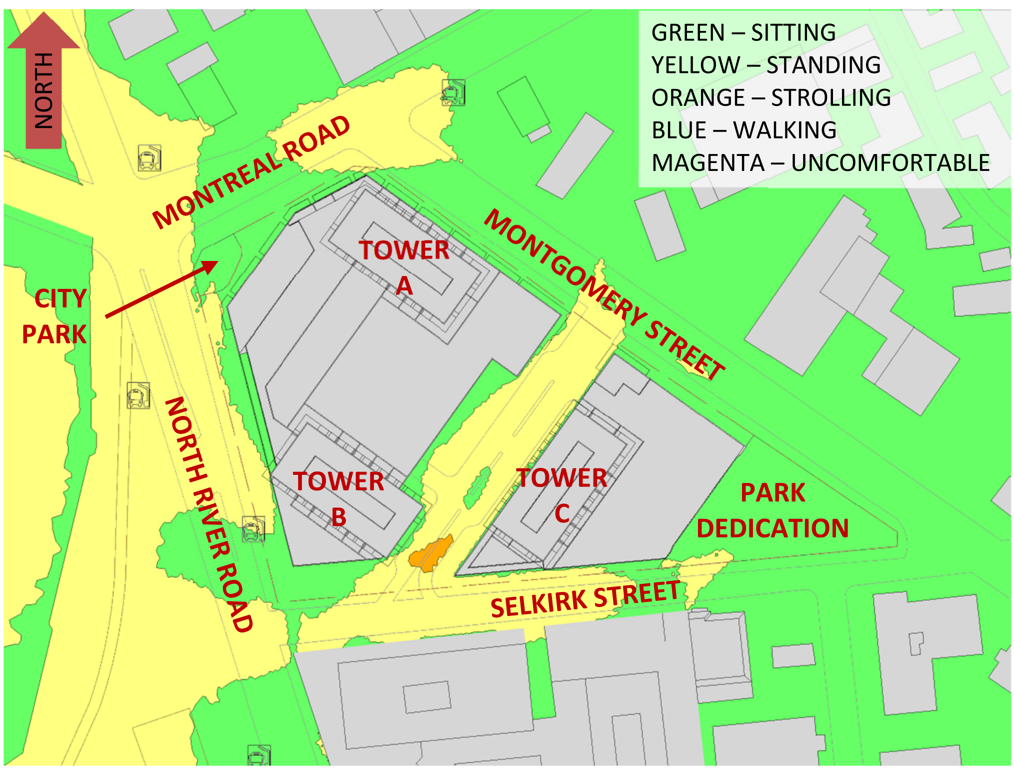


FIGURE 3B: SUMMER – WIND CONDITIONS AT GRADE LEVEL

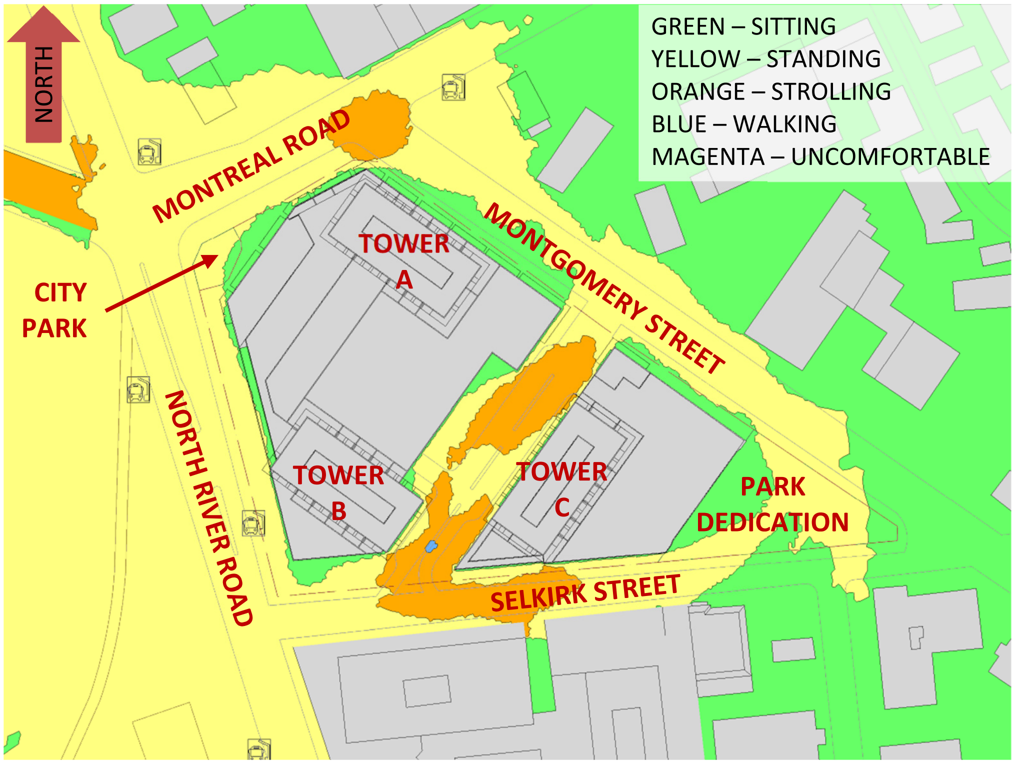


FIGURE 3C: AUTUMN – WIND CONDITIONS AT GRADE LEVEL

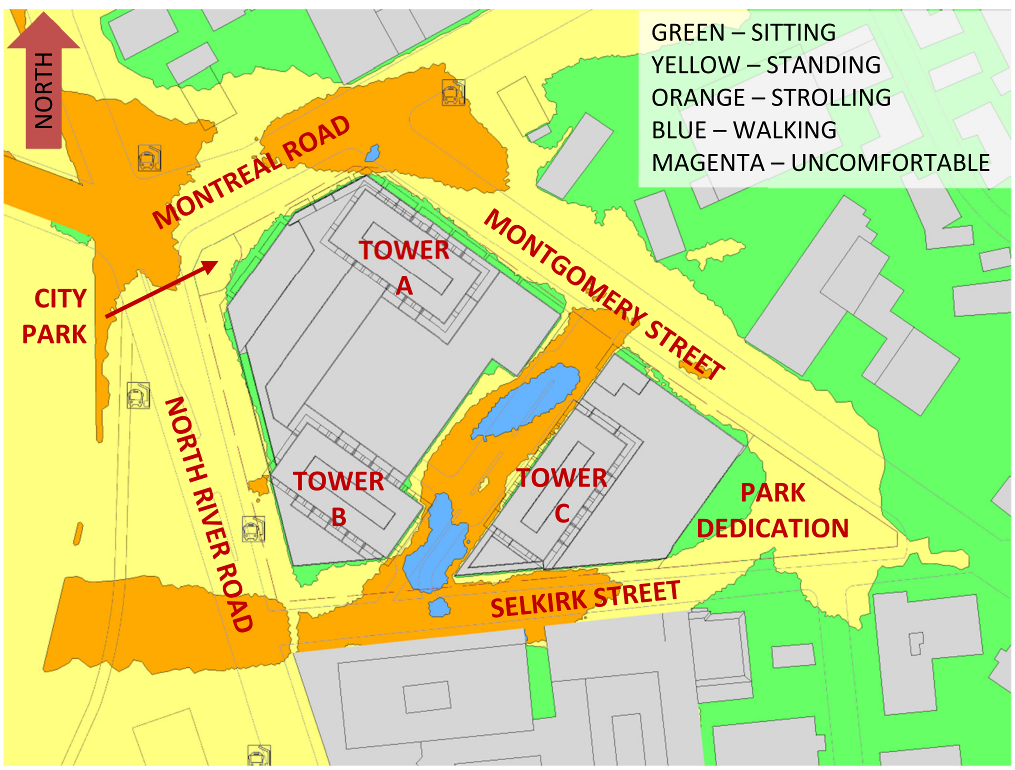


FIGURE 3D: WINTER – WIND CONDITIONS AT GRADE LEVEL

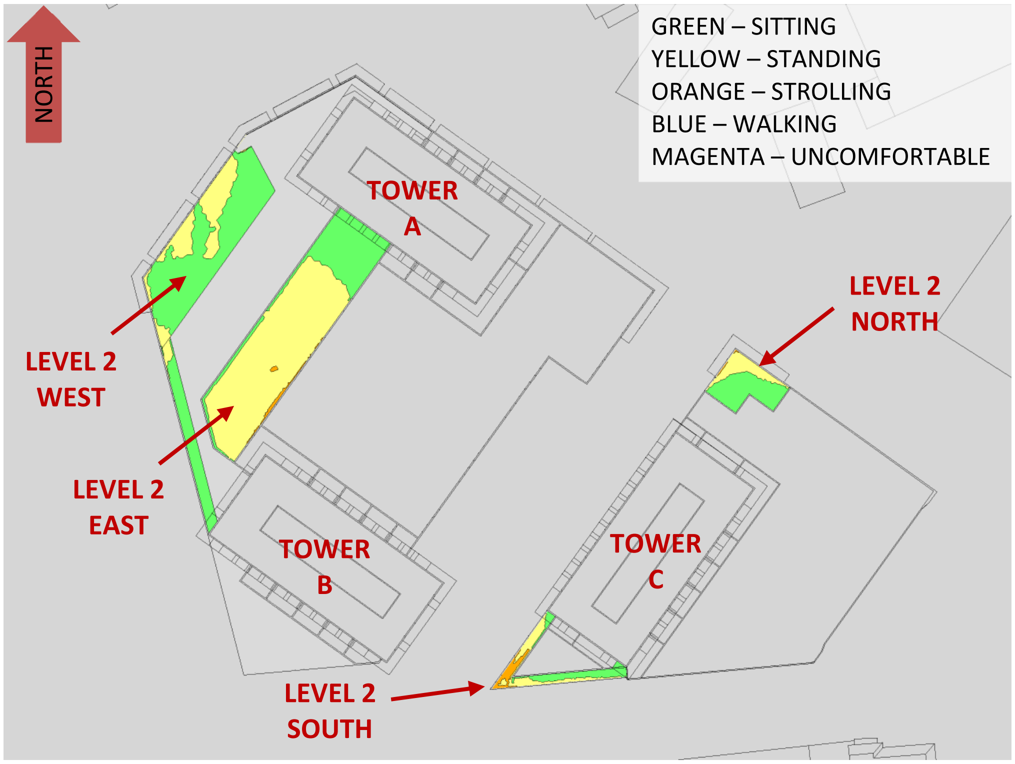


FIGURE 4A: SPRING – WIND CONDITIONS WITHIN COMMON AMENITY TERRACES

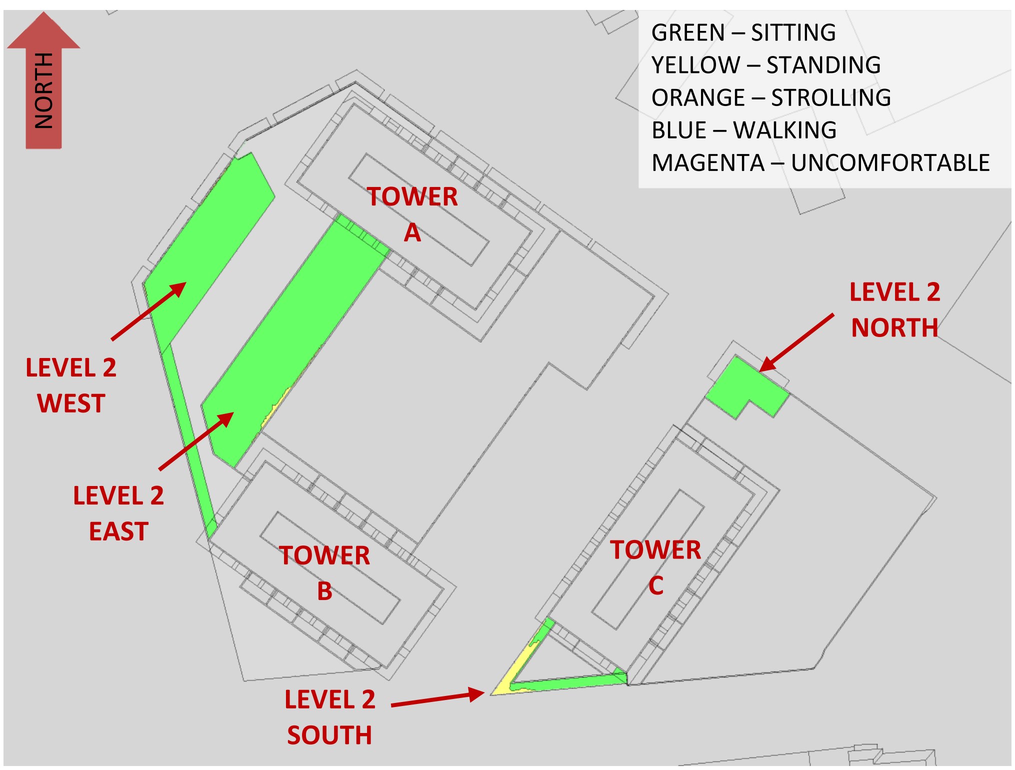


FIGURE 4B: SUMMER – WIND CONDITIONS WITHIN COMMON AMENITY TERRACES

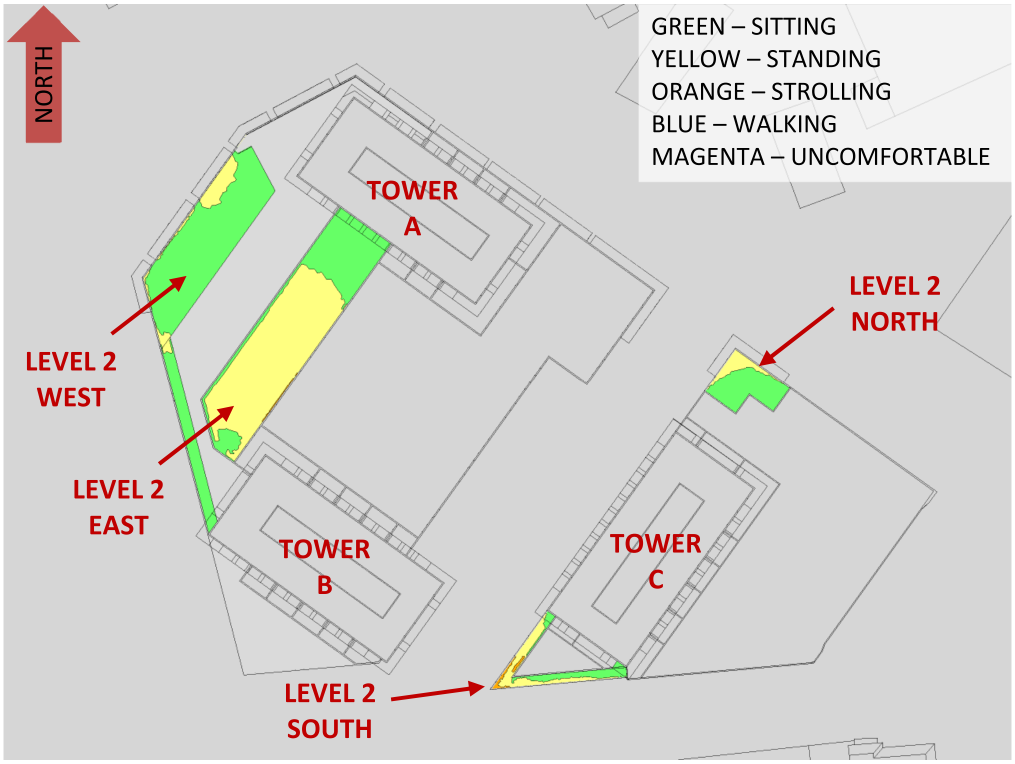


FIGURE 4C: AUTUMN – WIND CONDITIONS WITHIN COMMON AMENITY TERRACES

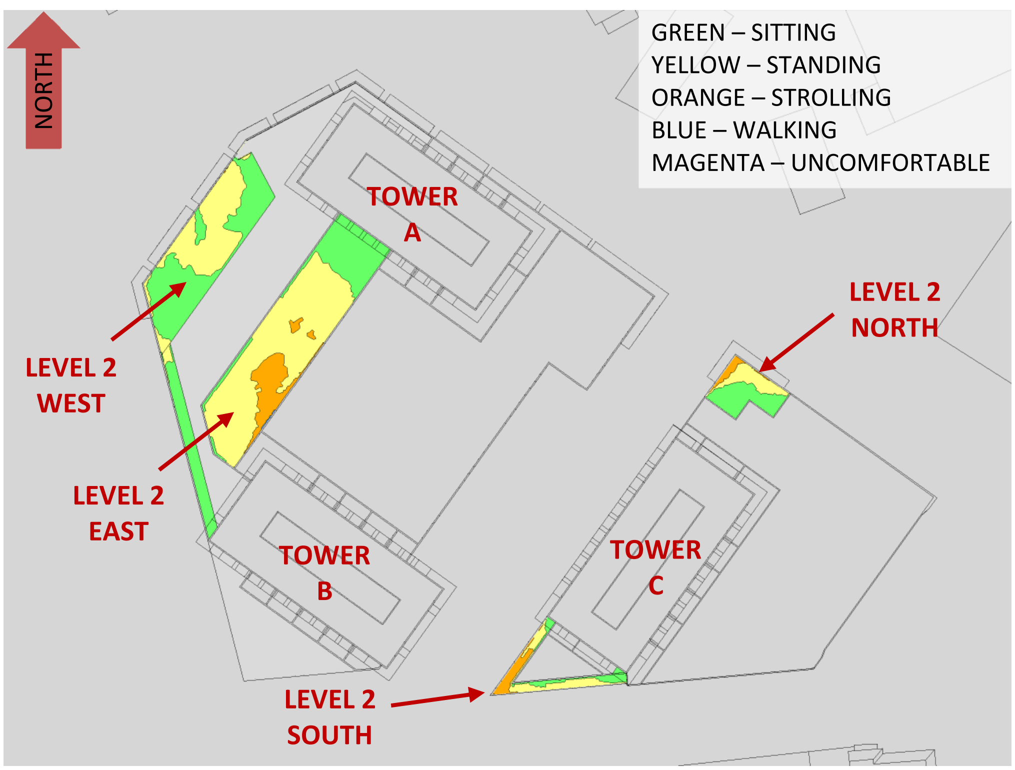


FIGURE 4D: WINTER – WIND CONDITIONS WITHIN COMMON AMENITY TERRACES

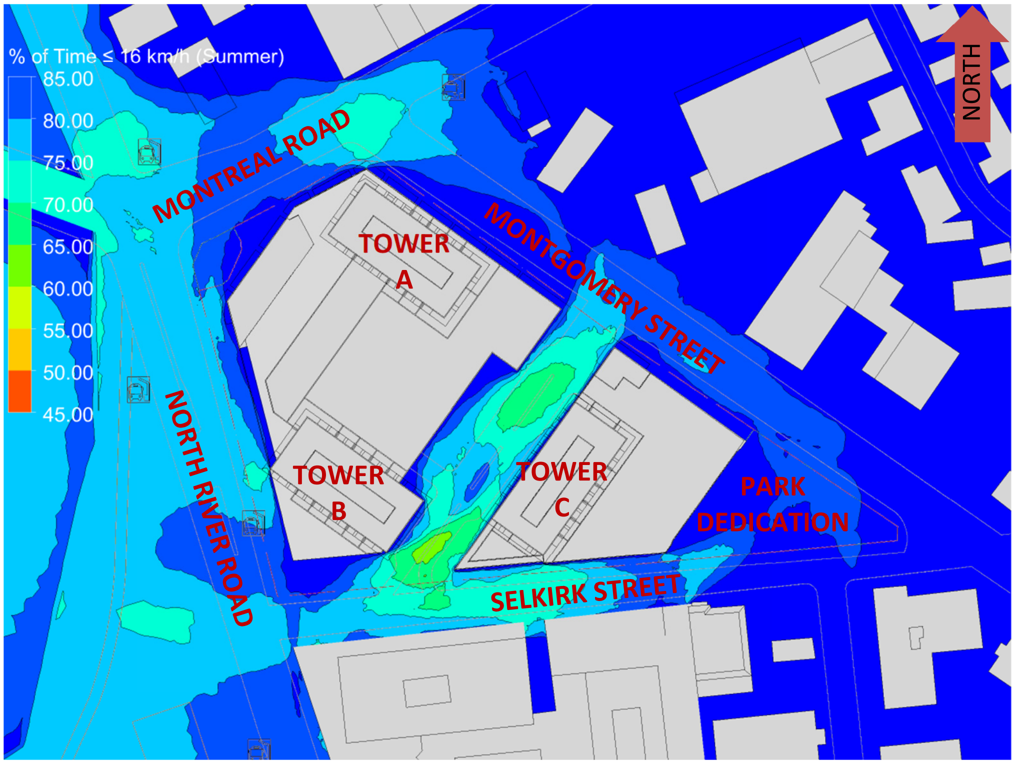
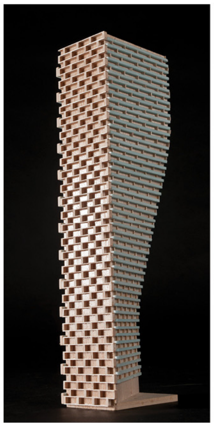
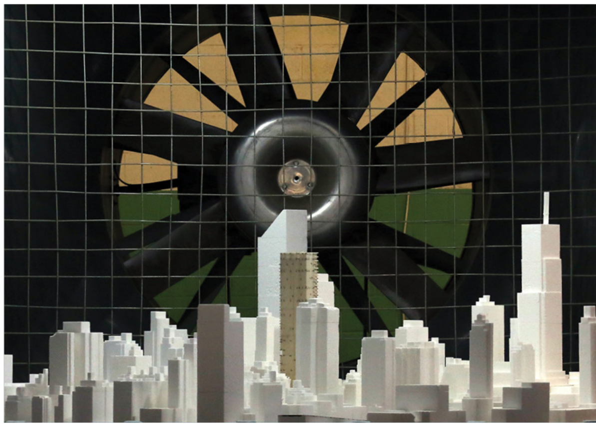


FIGURE 5A: SUMMER – PERCENTAGE OF TIME SUITABLE FOR SITTING, GRADE LEVEL

FIGURE 5B: SUMMER – PERCENTAGE OF TIME SUITABLE FOR SITTING, AMENITY TERRACES





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 (i.e., the area that it 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	0.22
49	0.23
74	0.24
103	0.24
167	0.24
197	0.24
217	0.25
237	0.27
262	0.26
282	0.24
302	0.23
324	0.24

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].

$$I(Z) = \begin{cases} 0.1\left(\frac{Z}{Z_g}\right)^{-\alpha-0.05}, & Z > 10\text{ m} \\ 0.1\left(\frac{10}{Z_g}\right)^{-\alpha-0.05}, & Z \leq 10\text{ m} \end{cases}$$ Equation (2)

$$L_t(Z) = \begin{cases} 100\text{ m}\sqrt{\frac{Z}{30}}, & Z > 30\text{ m} \\ 100\text{ m}, & Z \leq 30\text{ m} \end{cases}$$ Equation (3)

where, I = turbulence intensity, 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

[1] P. Arya, "Chapter 10: Near-neutral Boundary Layers," in *Introduction to Micrometeorology*, San Diego, California, Academic Press, 2001.

[2] S. A. Hsu, E. A. Meindl and D. B. Gilhousen, "Determining the Power-Law WInd Profile Exponent under Near-neutral Stability Conditions at Sea," vol. 33, no. 6, 1994.

[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 Engieering Symposium, IWES 2003*, Taiwan, 2003.