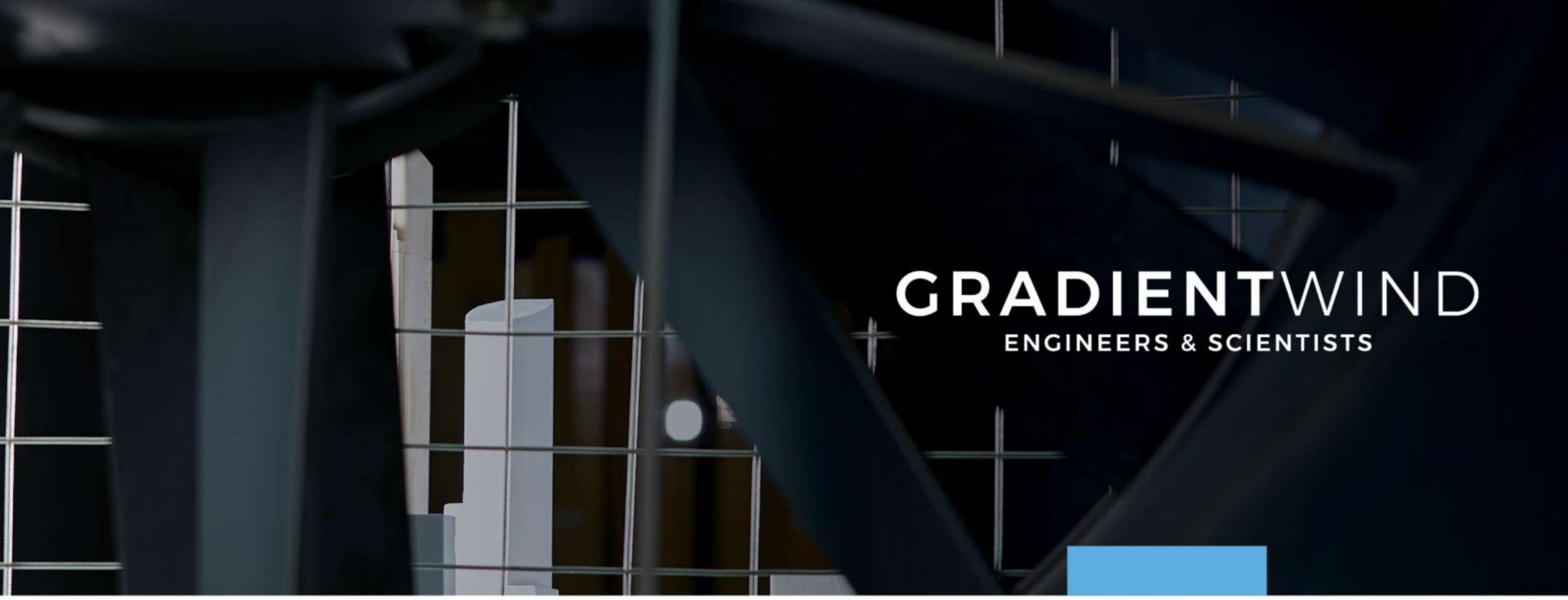
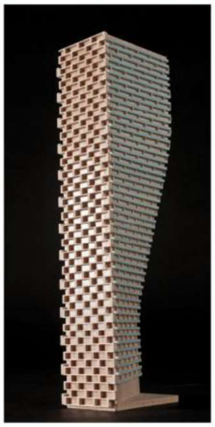


GRADIENTWIND
ENGINEERS & SCIENTISTS

PEDESTRIAN LEVEL WIND STUDY

1316 Carling Avenue
Ottawa, Ontario

Report: 25-156-PLW R1



March 5, 2026

PREPARED FOR
Homestead Land Holdings Limited
80 Johnson Street
Kingston, ON K7L 1X7

PREPARED BY
Sunny Kang, B.A.S., Project Coordinator
Justin Denne, M.A.Sc., Junior Wind Scientist
David Huitema, M.Eng., P.Eng., CFD Lead Engineer

EXECUTIVE SUMMARY

This report describes a pedestrian level wind (PLW) study undertaken to satisfy Zoning By-Law Amendment application submission requirements for the proposed residential development located at 1316 Carling Avenue 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) Most 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, transit stops, neighbouring surface parking lots, the existing surface parking to the east and west, proposed walkways, and in the vicinity of building access points, are considered acceptable.

    a. The walking comfort threshold is exceeded during the spring and winter seasons over a limited area of the drive aisle to the northwest; the exceedance of the criterion may be considered marginal. Given this and the minimal impact to pedestrian-accessible areas, the conditions over the area may be considered satisfactory.

2) During the typical use period (May to October, inclusive), conditions over the parkland and communal amenity area are predicted to be suitable for a mix of sitting and standing.

a. Comfort levels at designated seating areas may be improved by implementing targeted landscaping elements and wind barriers adjacent to sensitive-use areas such as tall wind screens and raised planters with dense plantings, in combination with strategically placed seating with high-back benches or other local wind mitigation, the extent of which is programming dependent.

3) Regarding the common amenity terrace serving the proposed development, conditions during the typical use period are predicted to be suitable for sitting along the façade and suitable for standing elsewhere.

a. The extent of mitigation measures is dependent on the programming of the terrace. A 1.8-m-tall wind screen along the full terrace perimeter is recommended in combination with inboard mitigation such as wind screens, overhead canopies, and other landscaping features.

4) 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.

Addendum: The PLW study was completed based on architectural drawings prepared by Alexander Wilson Architect Inc. in October 2025. Updated drawings were distributed to the consultant team in February 2026 with some changes to the proposed development. Most notably, the indoor amenity and common amenity terrace to the east at Level 5 have been relocated to Level 10; the results presented herein are for the Level 10 terrace. Additionally, the building height has increased by 2 metres (m). At grade, the central portion of the south façade has been setback by 3 m, a loading bay has replaced surface parking at the northwest corner, and the parking ramp to the west is now covered. Furthermore, the mechanical penthouse is now primarily situated to the east, instead of the west.

The noted revisions are not expected to significantly influence the pedestrian wind conditions at grade and the results and recommendations provided herein are expected remain representative of the current architectural design.

TABLE OF CONTENTS

1. INTRODUCTION

Gradient Wind Engineering Inc. (Gradient Wind) was retained by Homestead Land Holdings Limited to undertake a pedestrian level wind (PLW) study to satisfy Zoning By-Law Amendment application submission requirements for the proposed residential development located at 1316 Carling Avenue in Ottawa, Ontario (hereinafter referred to as “subject site” or “proposed development”). Our mandate within the current study is to investigate pedestrian wind conditions within and surrounding the subject site for the revised architectural massing design, 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 Alexander Wilson Architect Inc. in October 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 at 1316 Carling Avenue in Ottawa, situated approximately 160 metres (m) to the southwest of the intersection of Carling Avenue and Merivale Road on a parcel of land bordered by Carling Avenue to the northwest, Thames Street to the southeast, and existing low-rise commercial buildings with surface parking lots to the northeast and southwest. Throughout this report, Thames Street is referred to as project south. An existing high-rise residential building is to be retained to the north of the subject site. The proposed development comprises a rectangular 20-storey residential building, topped with a mechanical penthouse.

Above two underground parking levels, the ground floor includes a main entrance and a rental office near the northeast corner, bike storage near the southwest corner, a moving and waste area near the northwest corner, and residential units throughout the remainder of the level. A parkland and a communal amenity area are located to the south and west, respectively. The existing drive aisle from Carling Avenue is proposed to extend to Thames Street, providing access to existing surface parking along the east and west sides of the subject site and a parking ramp to the west. Levels 2-4 and 6-20 are reserved for residential occupancy, while Level 10 includes a party room to the south and residential units throughout the remainder of the level. The building steps back from the south elevation at Levels 5 and Level 10. A common amenity terrace is accommodated within the noted setback at Level 10.

The near-field surroundings (defined as an area within 200 m of the subject site) include a low-rise hotel with a surface parking lot to the east, low-rise commercial buildings with surface parking and low-rise residential dwellings from the east clockwise to the southeast, low-rise residential dwellings to the south and southwest, a mix of low-, mid-, and high-rise buildings and surface parking to the west, a mid-rise office building to the northwest, Carling Avenue followed by the Westgate Shopping Centre and surface parking to the north, and a high-rise building to the north-northeast. Notably, a development comprising four buildings ranging in height from 6 to 20 storeys is under construction at 1354 and 1376 Carling Avenue, approximately 100 m to the west of the proposed development. Additionally, a development comprising five towers (ranging in height from 24 to 36 storeys) is proposed within the lands currently occupied by the Westgate Shopping Centre at 1309 Carling Avenue. 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 low-rise suburban massing in all directions with the open fields of the Central Experimental Farm from the east clockwise to the south, approximately 715 m to the east, and isolated mid- and high-rise buildings in all directions. Notably, Highway 417 is located beyond the Westgate Shopping Centre to north, followed by Hampton Park.

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[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 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.

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.

---

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

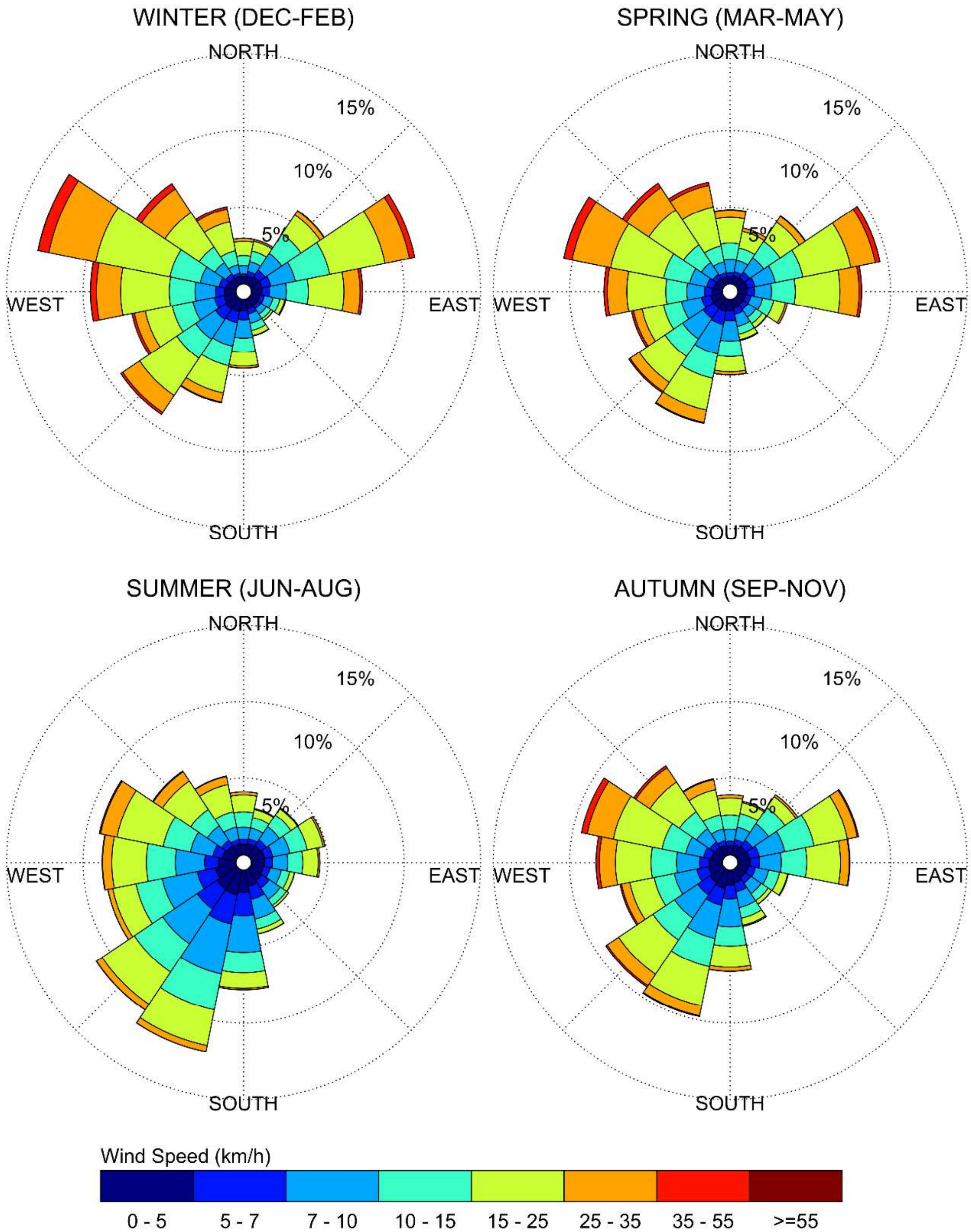
Measured wind speeds approximately 1.5 m above local grade and the common amenity terrace serving the proposed development at Level 10 were referenced to the wind speed at gradient height to generate mean and peak velocity ratios, which were used to calculate full-scale values. Gradient height represents 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 terraces serving the proposed development at Level 10. 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 7 and 9 illustrate wind comfort conditions at grade level and within the noted amenity terraces serving the proposed development, 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 and Transit Stop along Carling Avenue: Prior to and following the introduction of the proposed development, wind comfort conditions in the vicinity of the transit stop along Carling Avenue, which is served by a transit shelter, are predicted to be suitable for standing during the summer and autumn, becoming suitable for strolling during the winter and spring. The noted conditions are considered acceptable.

Following the introduction of the proposed development, wind comfort conditions over the public sidewalks along Carling Avenue are predicted to be suitable for standing, or better, during the summer and autumn, with an isolated region suitable for strolling during the autumn, becoming suitable for a mix of standing and strolling during the winter and spring, with an isolated region suitable for walking. The noted conditions are considered acceptable.

Conditions over the sidewalks along Carling Avenue under the existing massing are predicted to be suitable for strolling, or better, throughout the year, with an isolated region suitable for walking during the spring. While the introduction of the proposed development produces slightly windier conditions in comparison to existing conditions along Carling Avenue, wind comfort conditions with the proposed development are nevertheless considered acceptable for public sidewalks.

Thames Street: Following the introduction of the proposed development, conditions over Thames Street are predicted to be suitable for mostly sitting during the summer, becoming suitable for a mix of mostly sitting and standing throughout the remaining seasons. The noted conditions are considered acceptable.

Conditions over Thames Street under the existing massing are predicted to be suitable for sitting during the summer and autumn, becoming suitable for a mix of sitting and standing during the winter and spring. While the introduction of the proposed development produces modestly windier conditions in comparison to existing conditions, the predicted wind conditions are nevertheless considered acceptable.

Neighbouring Surface Parking Lots: Prior to and following the introduction of the proposed development, conditions over the nearby neighbouring surface parking lots to the east, south, and west are predicted to be suitable for mostly standing, or better, throughout the year . The noted conditions are considered acceptable.

Existing Surface Parking within the Subject Site: Prior to and following the introduction of the proposed development, conditions over the surface parking along the east and west of the subject site are predicted to be suitable for walking, or better, throughout the year. The noted conditions are considered acceptable.

Proposed Parkland and Communal Amenity Area: During the typical use period, conditions over the parkland and communal amenity area situated to the south and west of the proposed development are predicted to be suitable for a mix of sitting and standing. Specifically, sitting conditions are predicted central and to the west of the parkland and to the east and west of the communal amenity area, while standing conditions are predicted elsewhere throughout the remainder of the spaces. Comfort levels at designated seating areas within the parkland and communal amenity area may be improved by implementing targeted landscaping elements adjacent to sensitive-use areas such as tall wind screens, raised planters and planting beds or berms, in combination with strategically placed seating with high-back benches or other local wind mitigation, with the extent of the mitigation dependent on the programming and placement of seating areas within these spaces.

Proposed Walkways: Wind conditions over the walkways surrounding the proposed development are predicted to be suitable for a mix of sitting and standing during the summer and autumn, becoming suitable for strolling, or better, during the winter and spring, which is considered acceptable.

Proposed Drive Aisle: During the winter and spring seasons, an isolated region of conditions that may be considered occasionally uncomfortable for walking is predicted near the northwest corner of the proposed development, affecting a limited area of the proposed drive aisle. The noted region of windier conditions is predicted to be suitable for walking at least 77% and 78% of the time during the winter and spring seasons, respectively, representing exceedances of 3% and 2% of the walking criterion threshold.

Given the marginal exceedance of the walking threshold and the limited impact on pedestrian-accessible areas, the noted conditions may be considered as satisfactory. Of note, these isolated uncomfortable conditions will be ameliorated if future high-density massing that is proposed in place of the Westgate Shopping Centre at 1309 Carling Avenue is approved and constructed.

Building Access Points: Owing to the protection of the building façades, 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 – Level 10 Common Amenity Terrace

During the typical use period, wind comfort conditions over the common amenity terrace serving the proposed development at Level 10 are predicted to be suitable for sitting closer to the tower façade and suitable for standing throughout the remainder of the terrace.

To achieve the sitting comfort class in all areas during the typical use period, it is recommended to implement a wind screen along the full perimeter of the terrace. The wind screen, typically glazed and preferably solid, is recommended to extend at least 1.8 m above the local walking surface of the terrace. Mitigation inboard of the perimeter is also recommended, which could take the form of wind screens, raised planters, pergolas/trellises above seating areas, and other landscaping features targeted around sensitive-use areas. The extent of mitigation is dependent on the programming of the amenity terrace.

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) Most 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, transit stops, neighbouring surface parking lots, the existing surface parking to the east and west, proposed walkways, and in the vicinity of building access points, are considered acceptable.

    a. The walking comfort threshold is exceeded during the spring and winter seasons over a limited area of the drive aisle to the northwest; the exceedance of the criterion may be considered marginal. Given this and the minimal impact to pedestrian-accessible areas, the conditions over the area may be considered satisfactory.

2) During the typical use period (May to October, inclusive), conditions over the parkland and communal amenity area are predicted to be suitable for a mix of sitting and standing. Comfort levels at designated seating areas may be improved by implementing targeted landscaping elements and wind barriers adjacent to sensitive-use areas such as tall wind screens and raised planters with dense plantings, in combination with strategically placed seating with high-back benches or other local wind mitigation, the extent of which is programming dependent.

3) Regarding the common amenity terrace serving the proposed development, conditions during the typical use period are predicted to be suitable for sitting along the façade and suitable for standing elsewhere.

    a. The extent of mitigation measures is dependent on the programming of the terrace. A 1.8-m-tall wind screen along the full terrace perimeter is recommended in combination with inboard mitigation such as wind screens, overhead canopies, and other landscaping features.

4) 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,

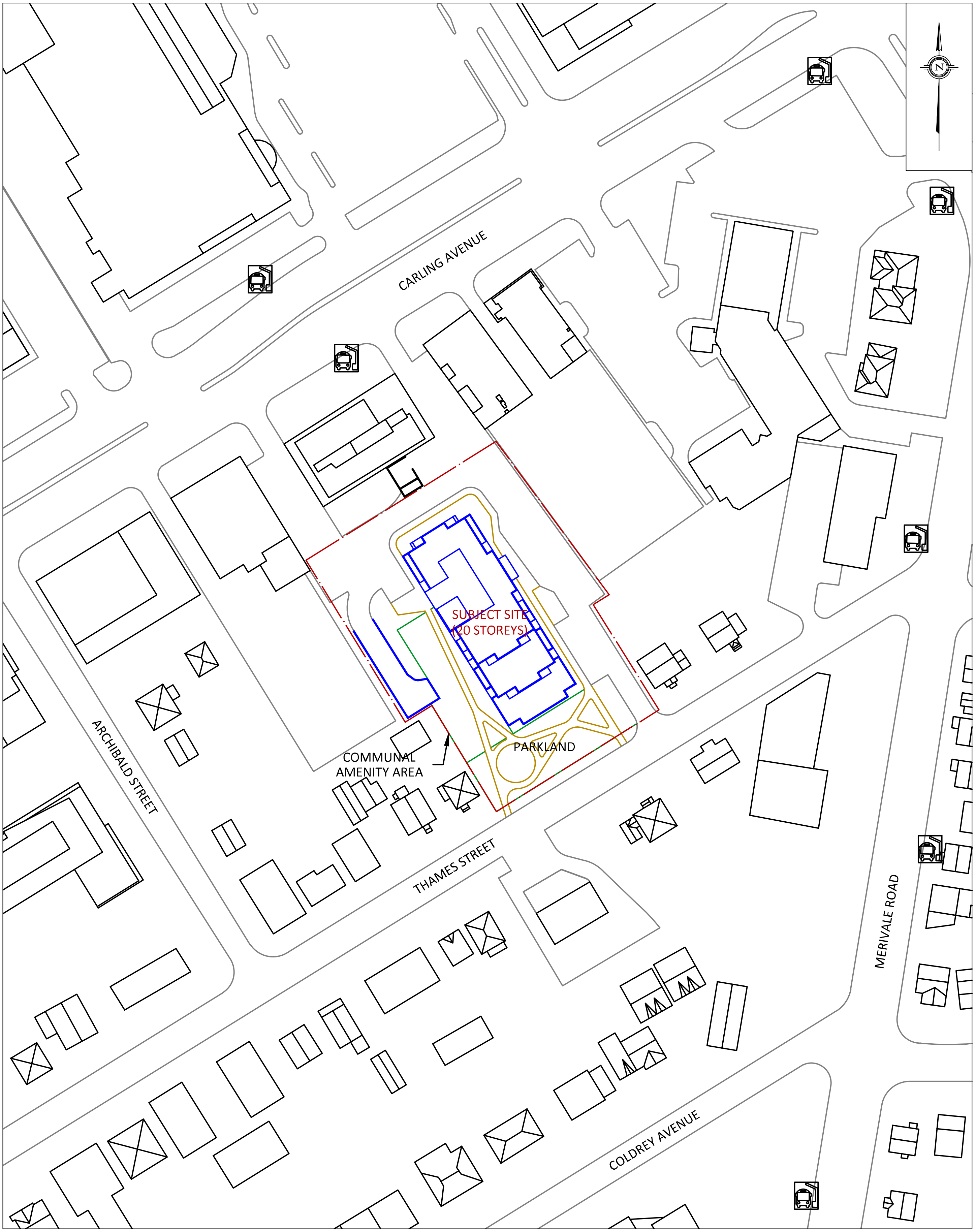
Gradient Wind Engineering Inc.

LICENSED PROFESSIONAL ENGINEER
D. T. HUITEMA
100561777
March 05, 2026
PROVINCE OF ONTARIO

Justin Denne, M.A.Sc.
Junior Wind Scientist

David Huitema, M.Eng., P.Eng.
CFD Lead Engineer

Sunny Kang, B.A.S.
Project Coordinator



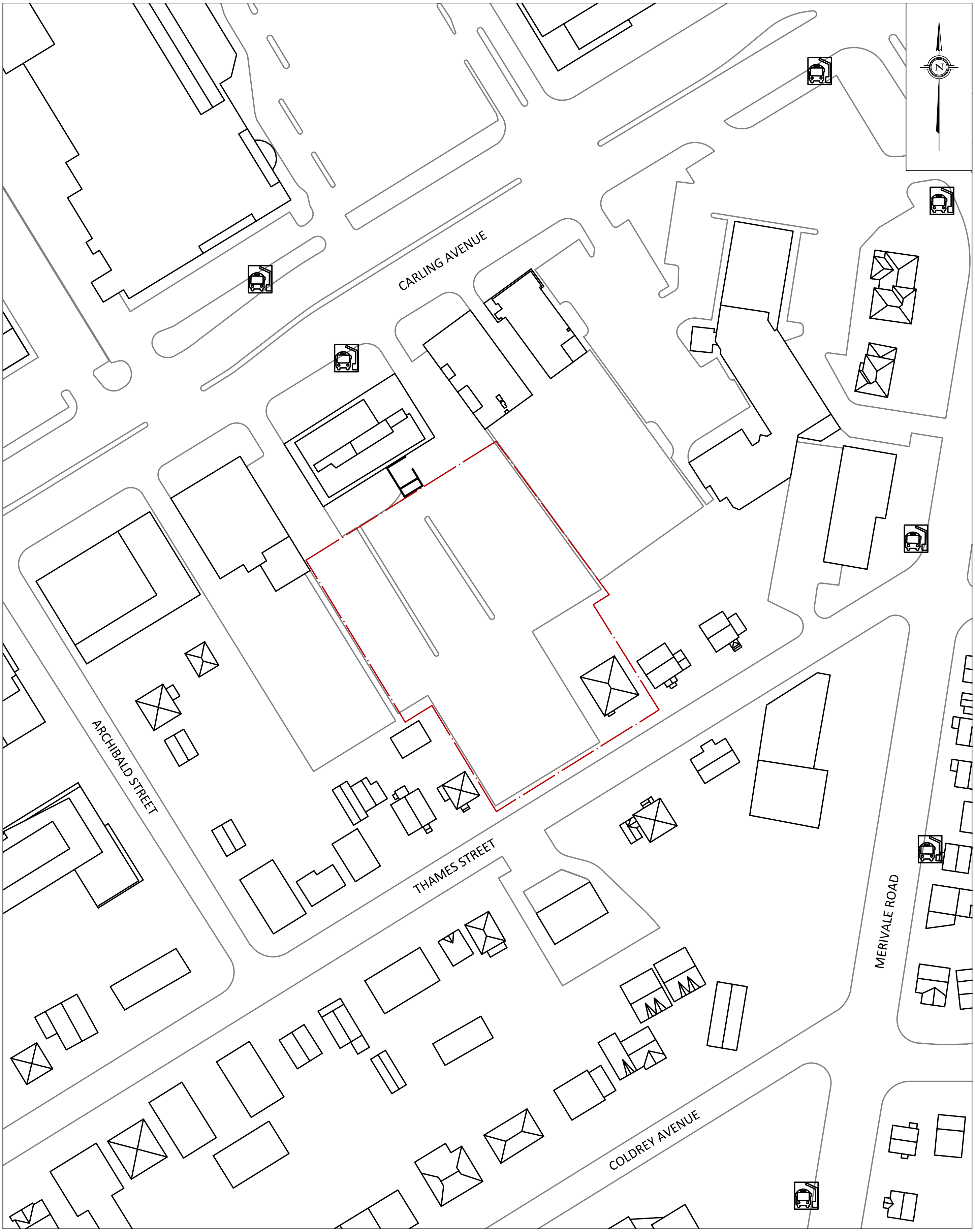
GRADIENTWIND
ENGINEERS & SCIENTISTS

127 WALGREEN ROAD, OTTAWA, ON
613 836 0934 • GRADIENTWIND.COM

PROJECT	1316 CARLING AVENUE, OTTAWA PEDESTRIAN LEVEL WIND STUDY		
SCALE	1:1500	DRAWING NO.	25-156-PLW-1A
DATE	OCTOBER 9, 2025	DRAWN BY	S.K.

DESCRIPTION

FIGURE 1A:
PROPOSED SITE PLAN AND SURROUNDING CONTEXT



GRADIENTWIND ENGINEERS & SCIENTISTS 127 WALGREEN ROAD, OTTAWA, ON 613 836 0934 • GRADIENTWIND.COM	PROJECT 1316 CARLING AVENUE, OTTAWA PEDESTRIAN LEVEL WIND STUDY		DESCRIPTION FIGURE 1B: EXISTING SITE PLAN AND SURROUNDING CONTEXT
	SCALE 1:1500	DRAWING NO. 25-156-PLW-1B	
	DATE OCTOBER 9, 2025	DRAWN BY S.K.	

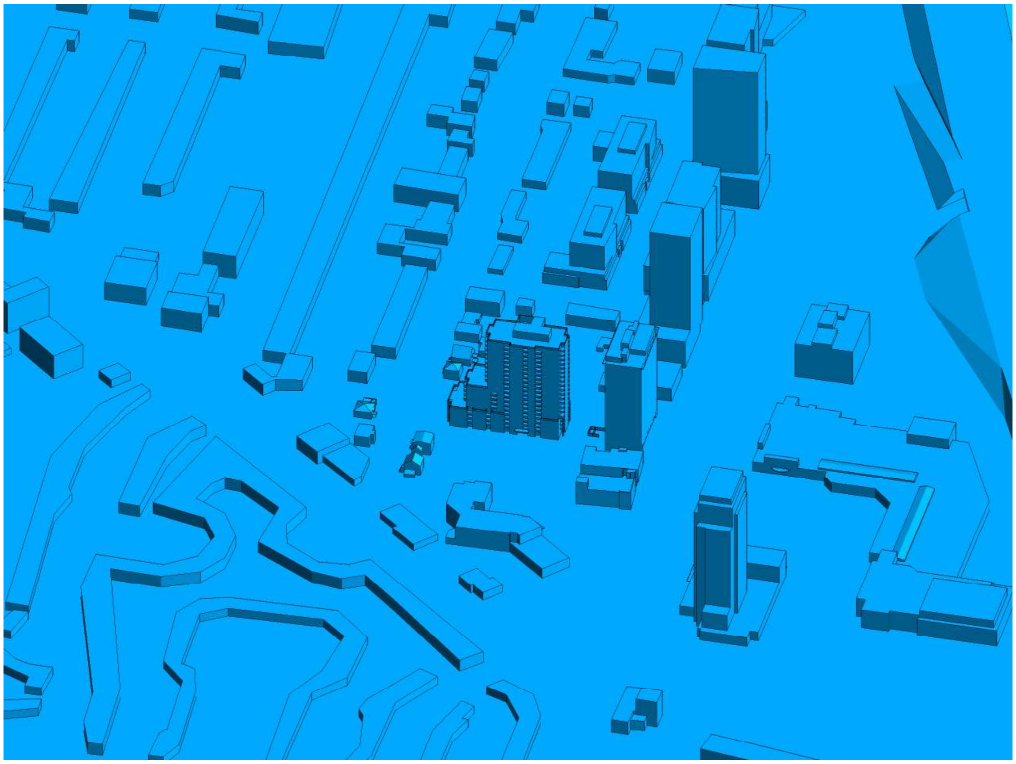


FIGURE 2A: COMPUTATIONAL MODEL, PROPOSED MASSING, NORTHEAST PERSPECTIVE

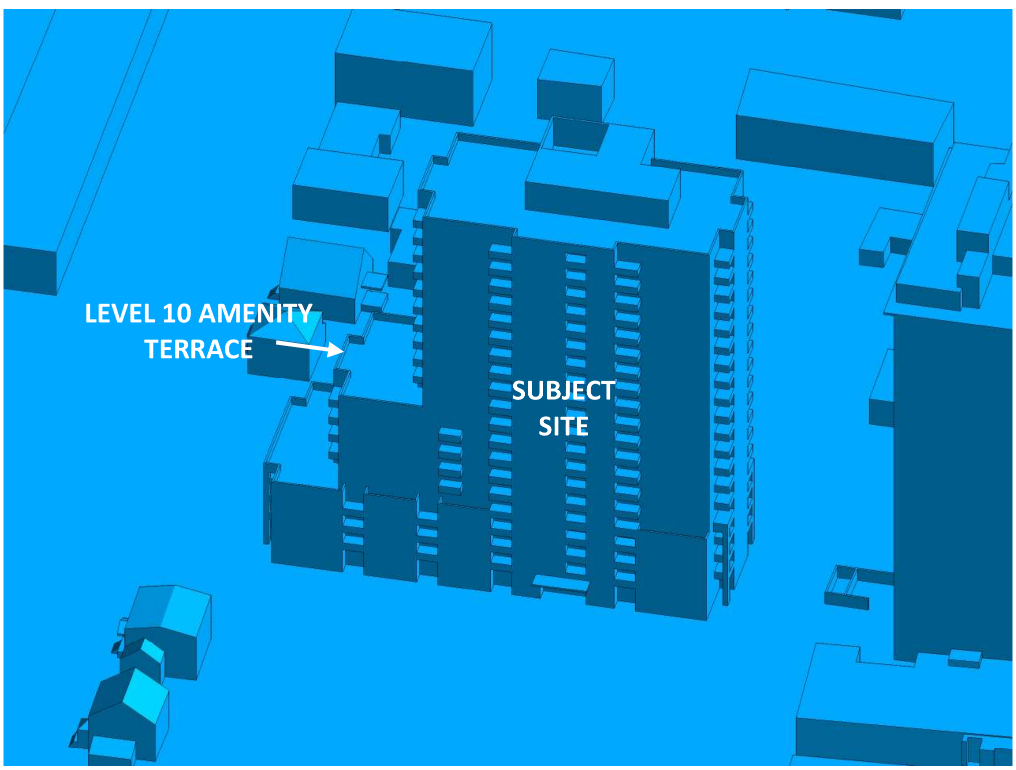


FIGURE 2B: CLOSE UP OF FIGURE 2A

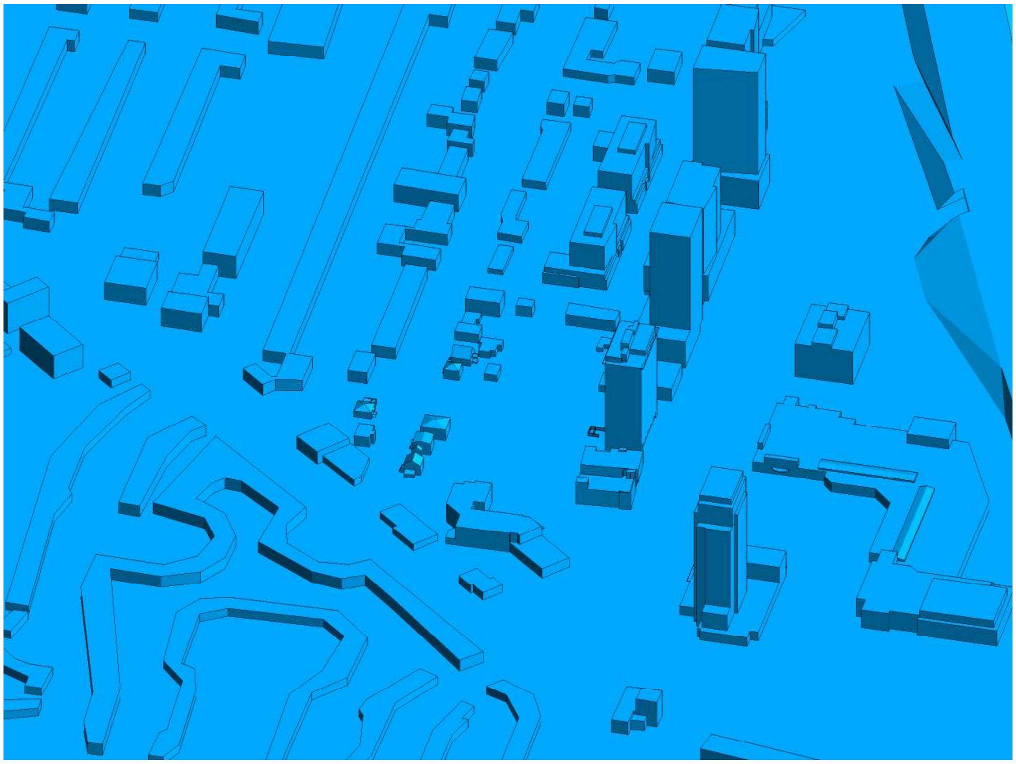


FIGURE 2C: COMPUTATIONAL MODEL, EXISTING MASSING, NORTHEAST PERSPECTIVE

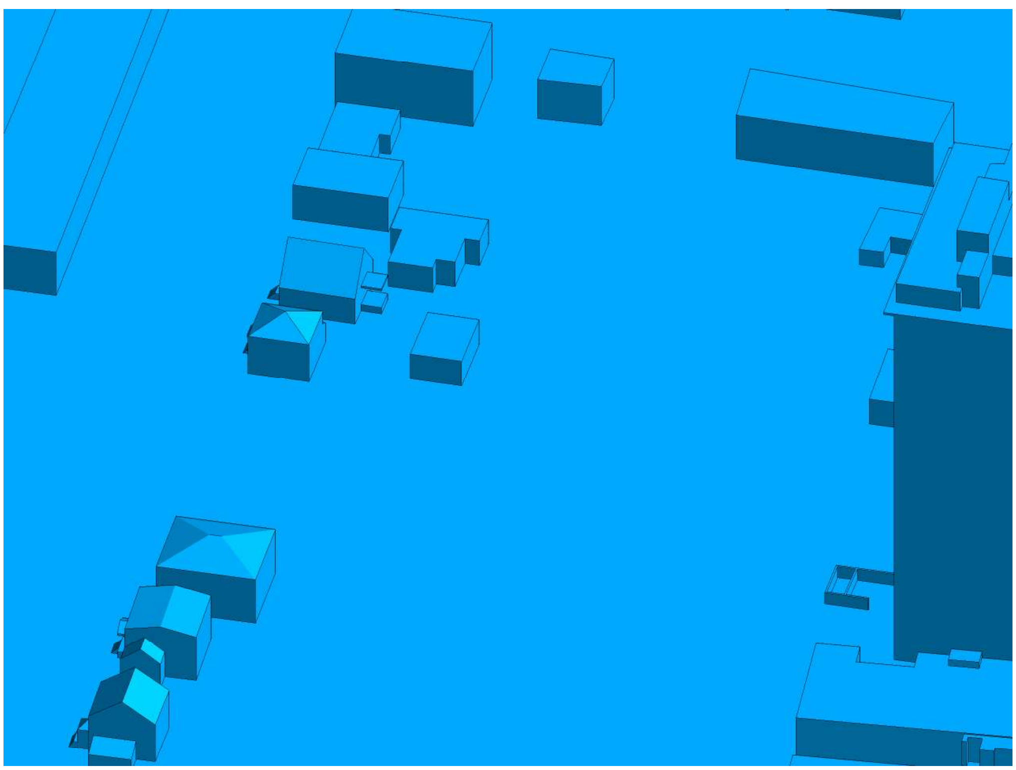


FIGURE 2D: CLOSE UP OF FIGURE 2C

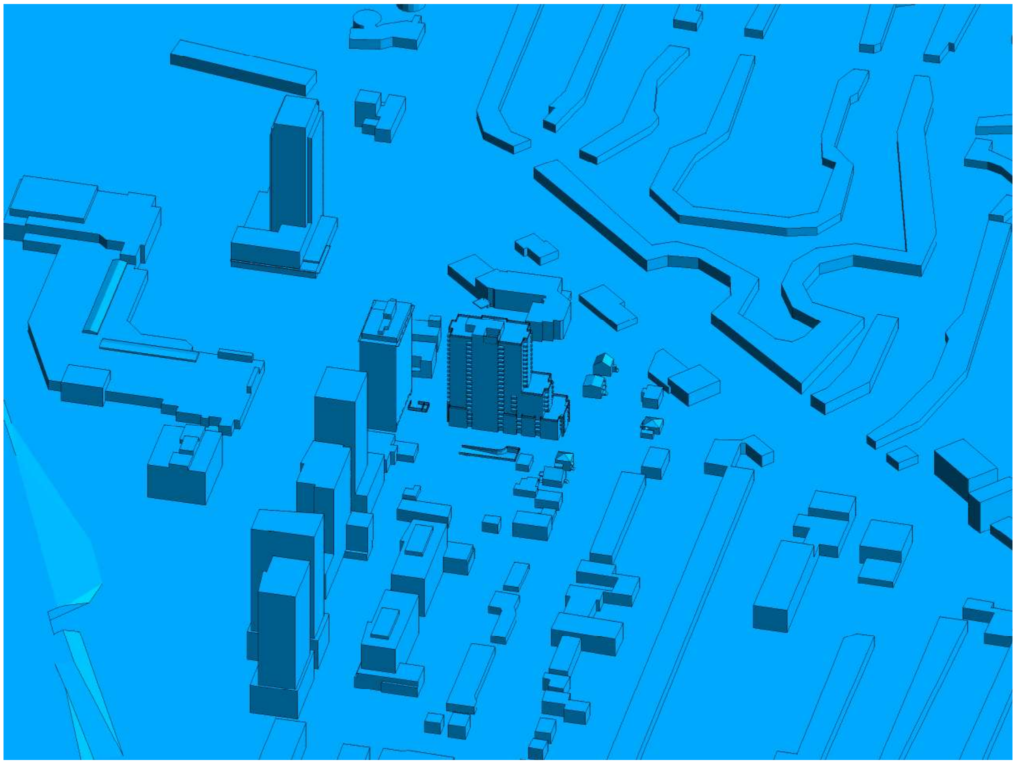


FIGURE 2E: COMPUTATIONAL MODEL, PROPOSED MASSING, SOUTHWEST PERSPECTIVE

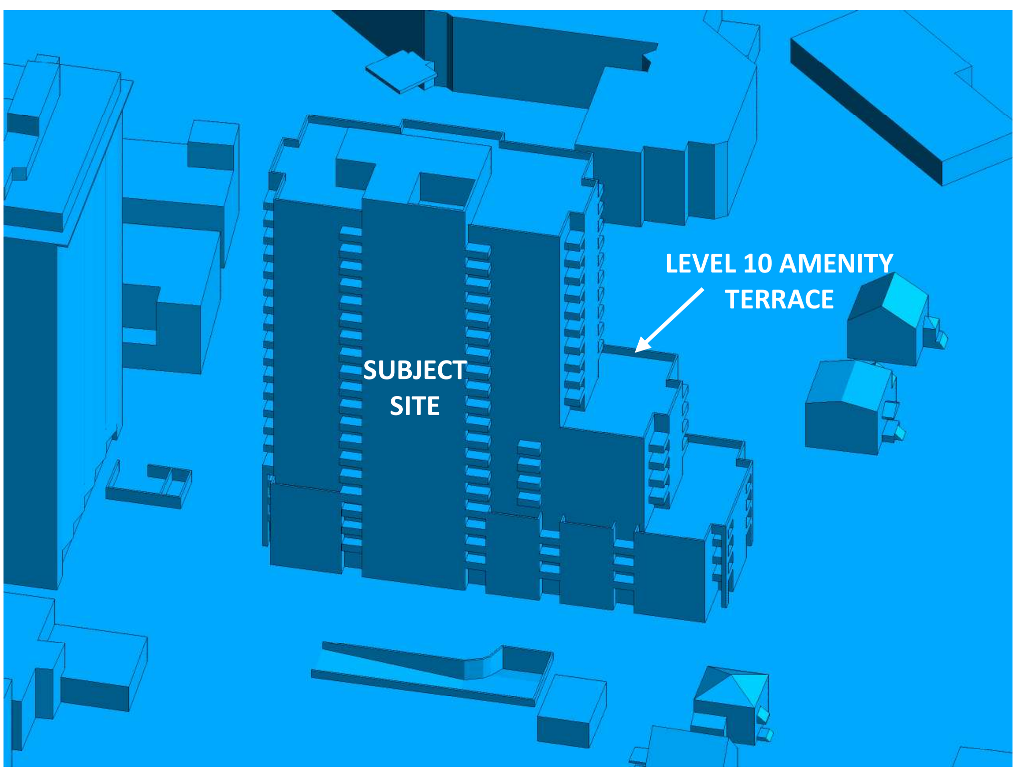


FIGURE 2F: CLOSE UP OF FIGURE 2E

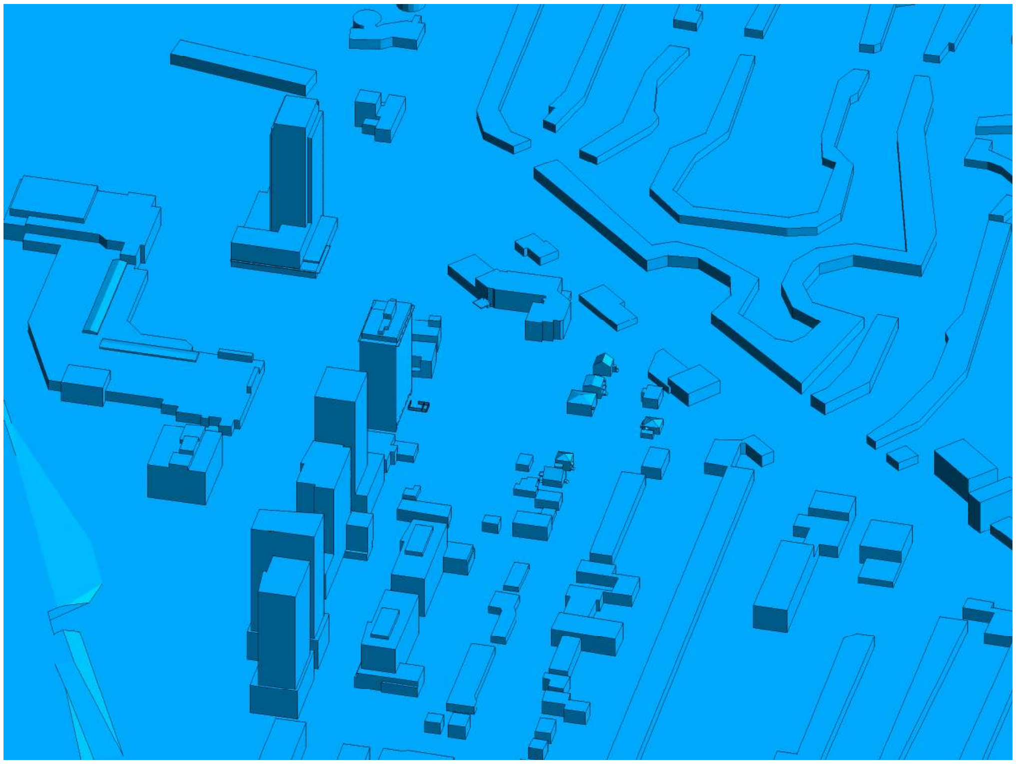


FIGURE 2G: COMPUTATIONAL MODEL, EXISTING MASSING, SOUTHWEST PERSPECTIVE

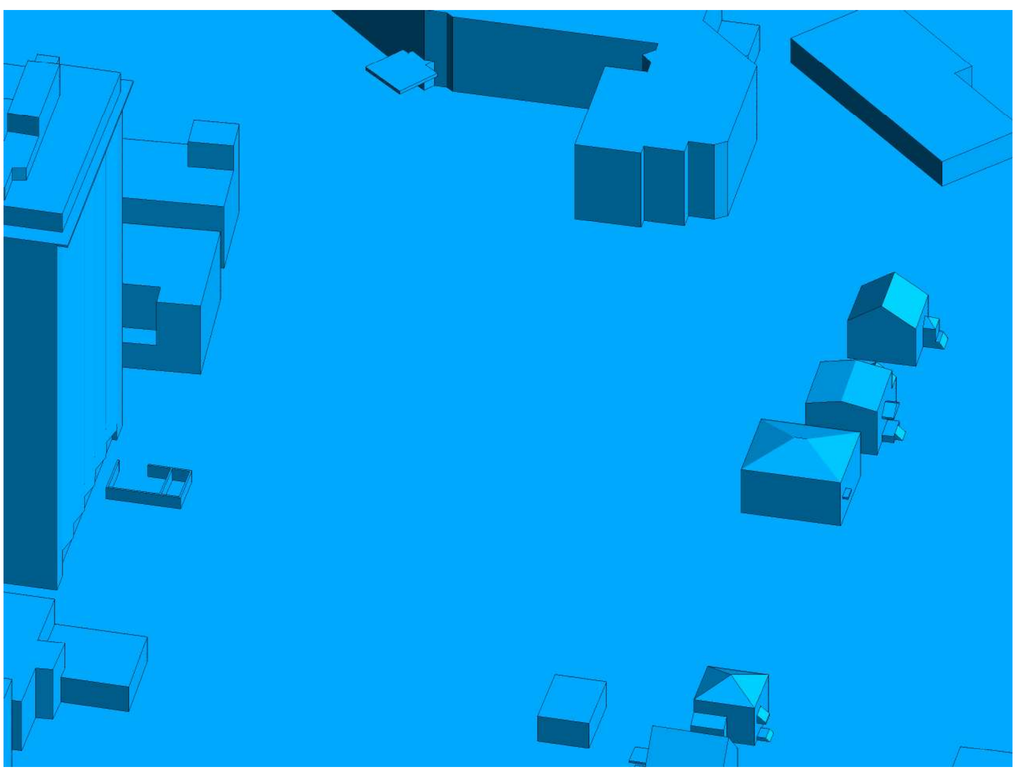


FIGURE 2H: CLOSE UP OF FIGURE 2G

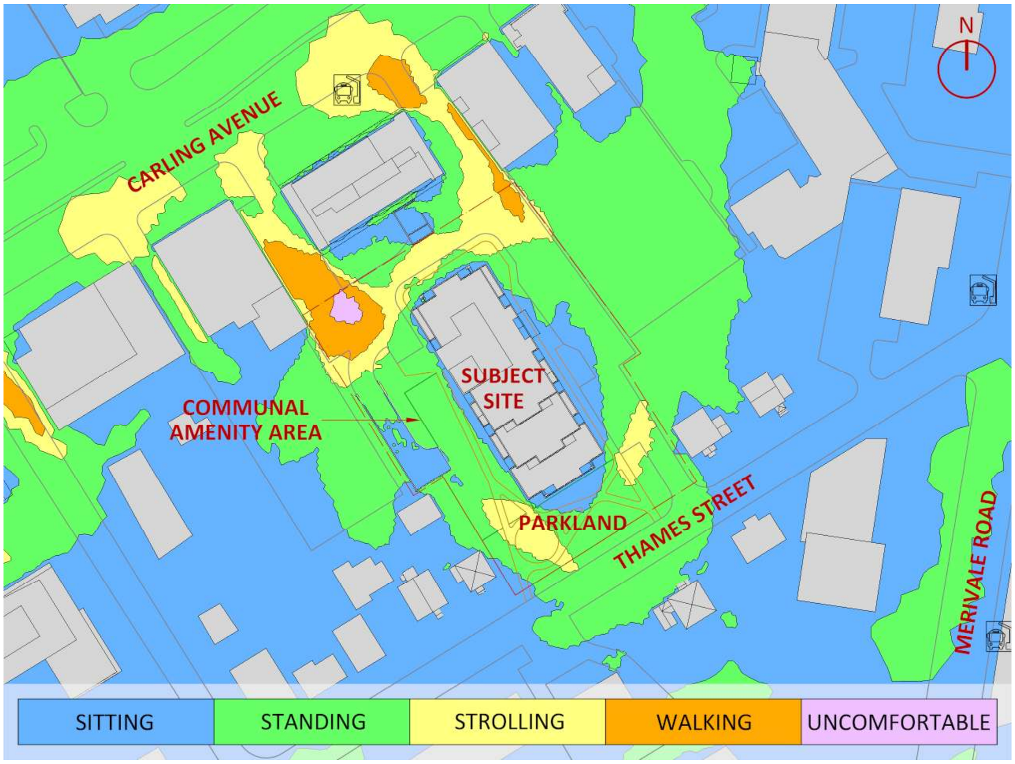


FIGURE 3A: SPRING – WIND COMFORT, GRADE LEVEL – PROPOSED MASSING

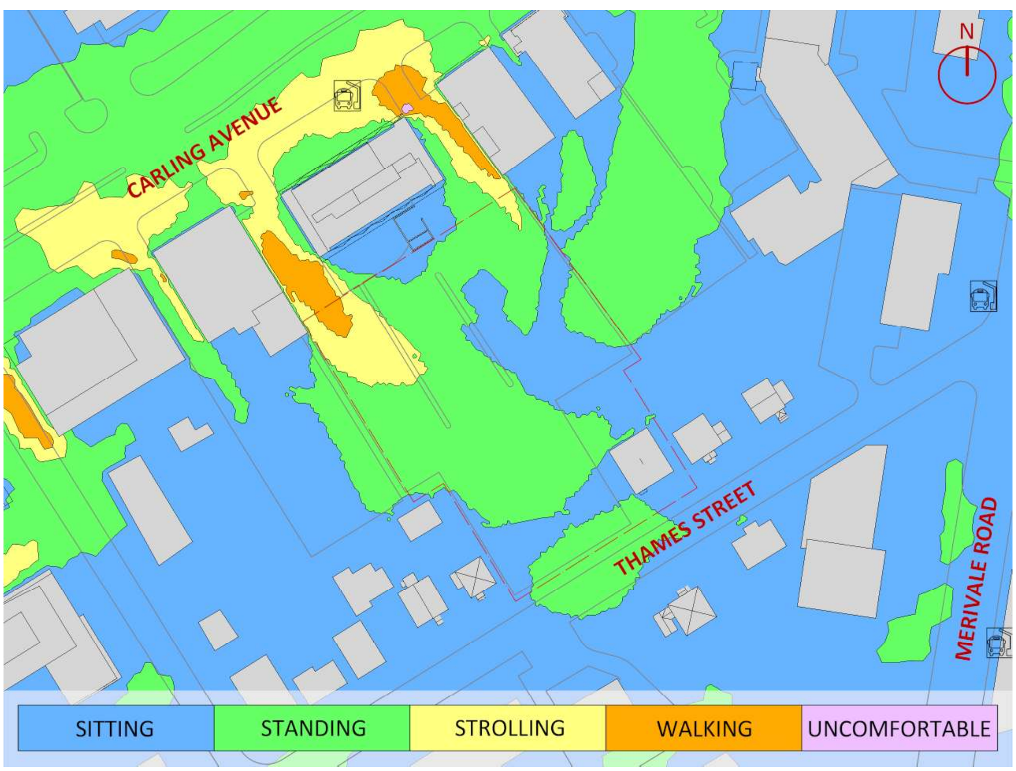


FIGURE 3B: SPRING – WIND COMFORT, GRADE LEVEL– EXISTING MASSING

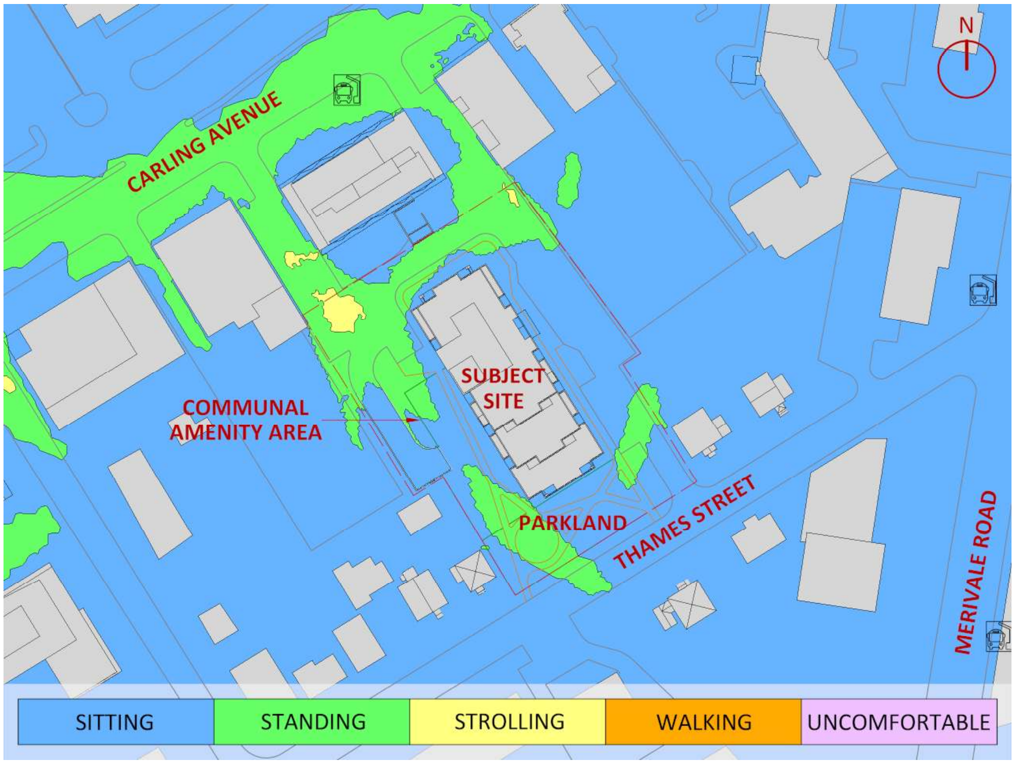


FIGURE 4A: SUMMER – WIND COMFORT, GRADE LEVEL – PROPOSED MASSING

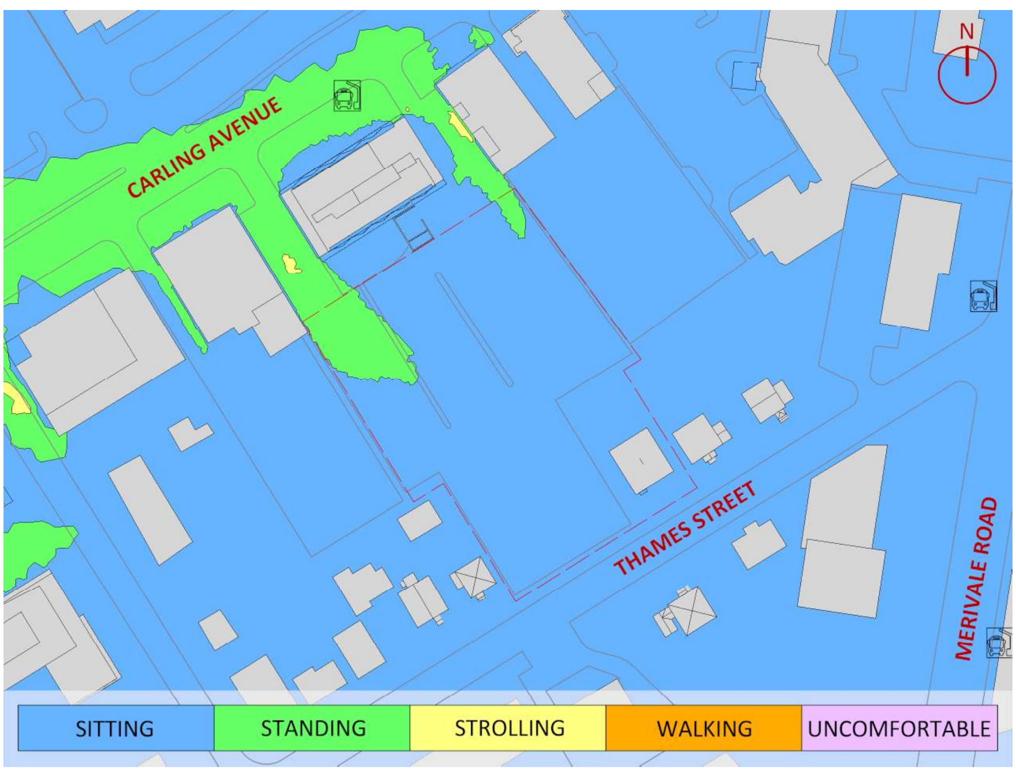


FIGURE 4B: SUMMER – WIND COMFORT, GRADE LEVEL– EXISTING MASSING

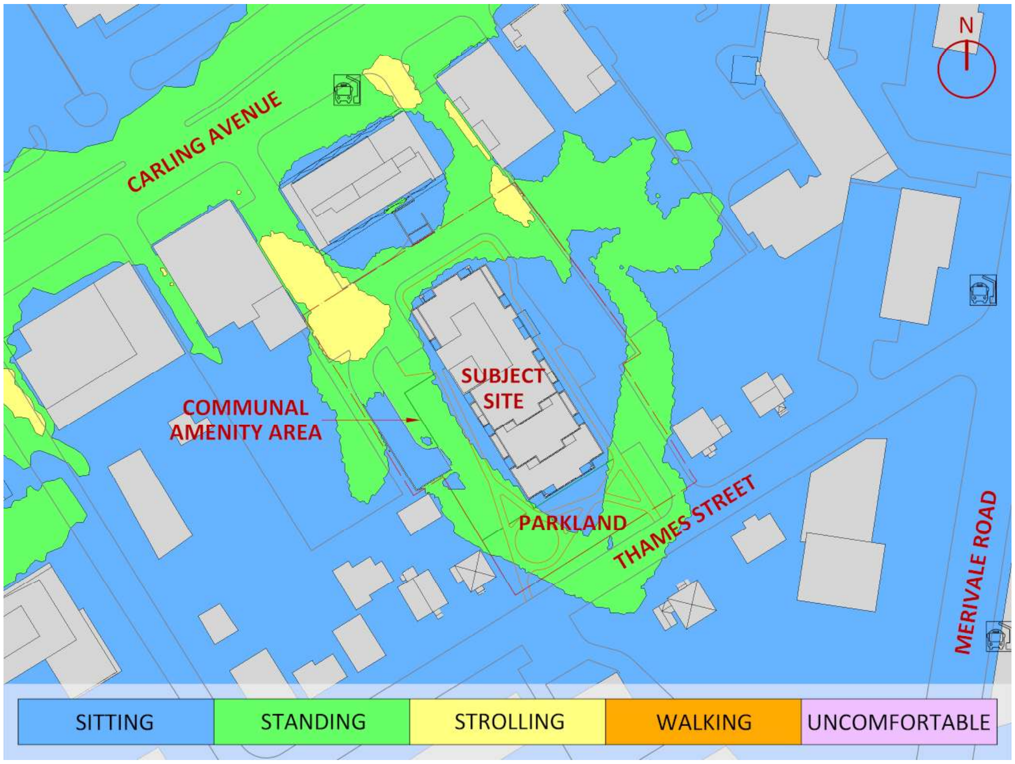


FIGURE 5A: AUTUMN – WIND COMFORT, GRADE LEVEL – PROPOSED MASSING

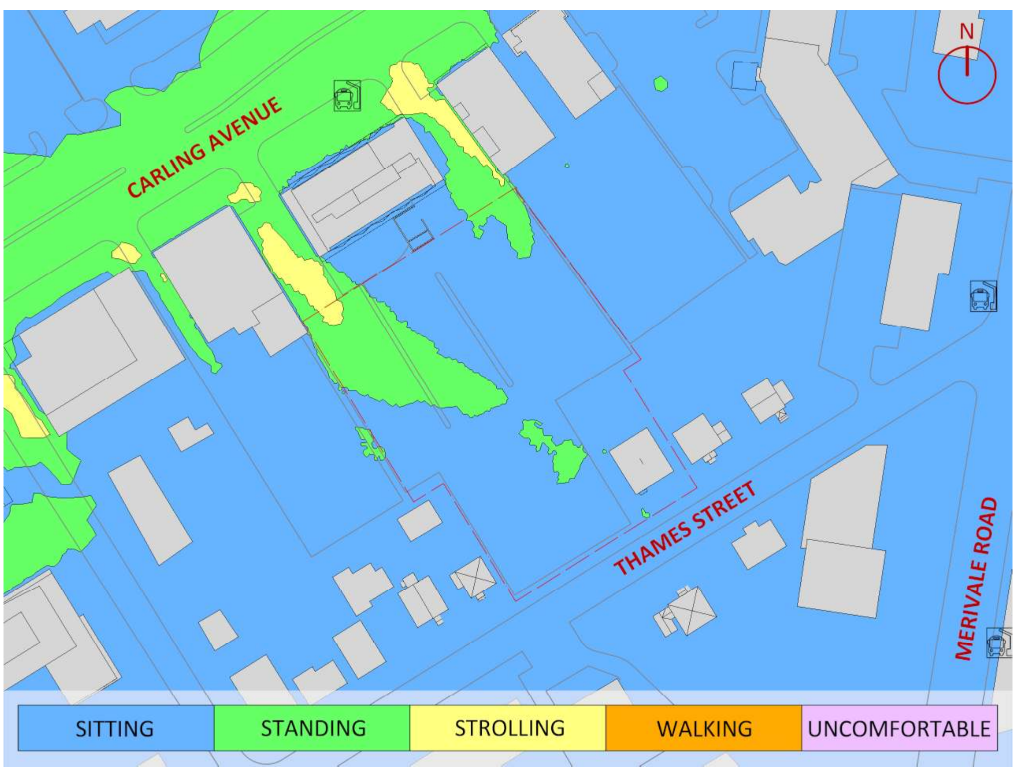


FIGURE 5B: AUTUMN – WIND COMFORT, GRADE LEVEL– EXISTING MASSING

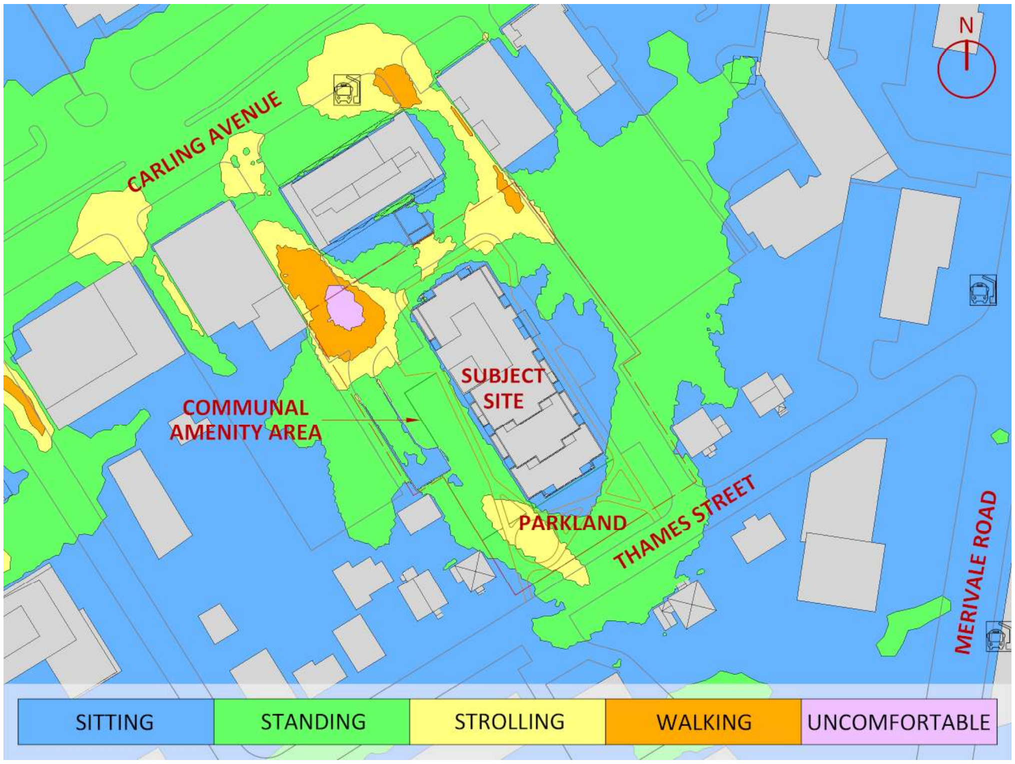


FIGURE 6A: WINTER – WIND COMFORT, GRADE LEVEL – PROPOSED MASSING

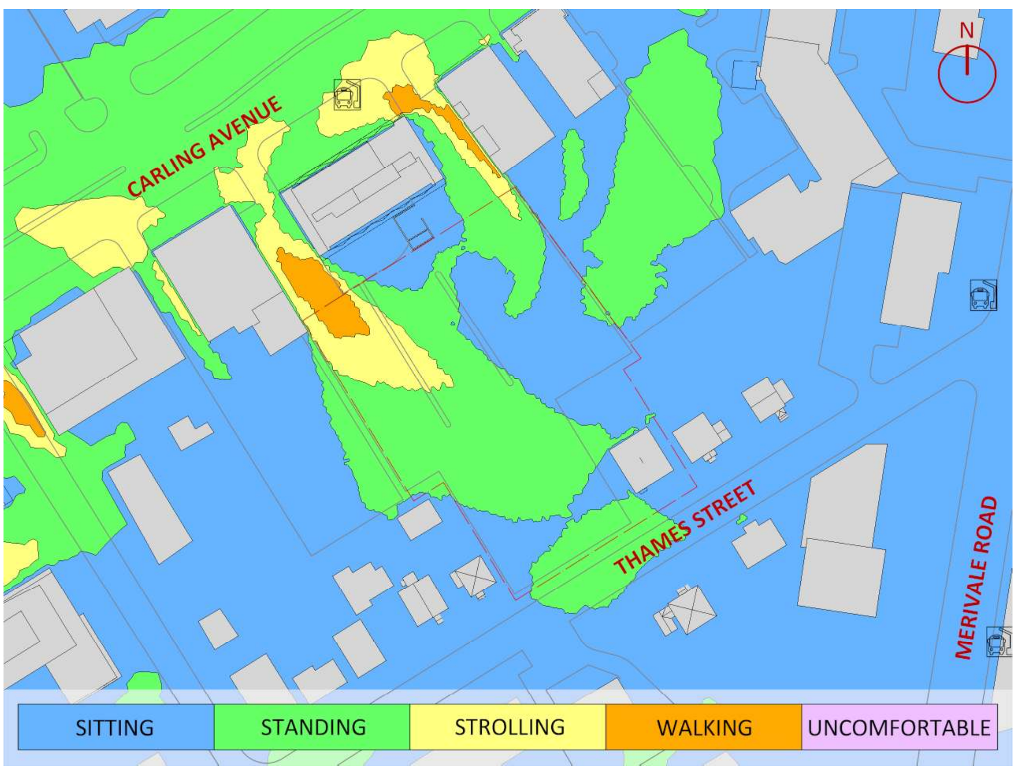


FIGURE 6B: WINTER – WIND COMFORT, GRADE LEVEL– EXISTING MASSING

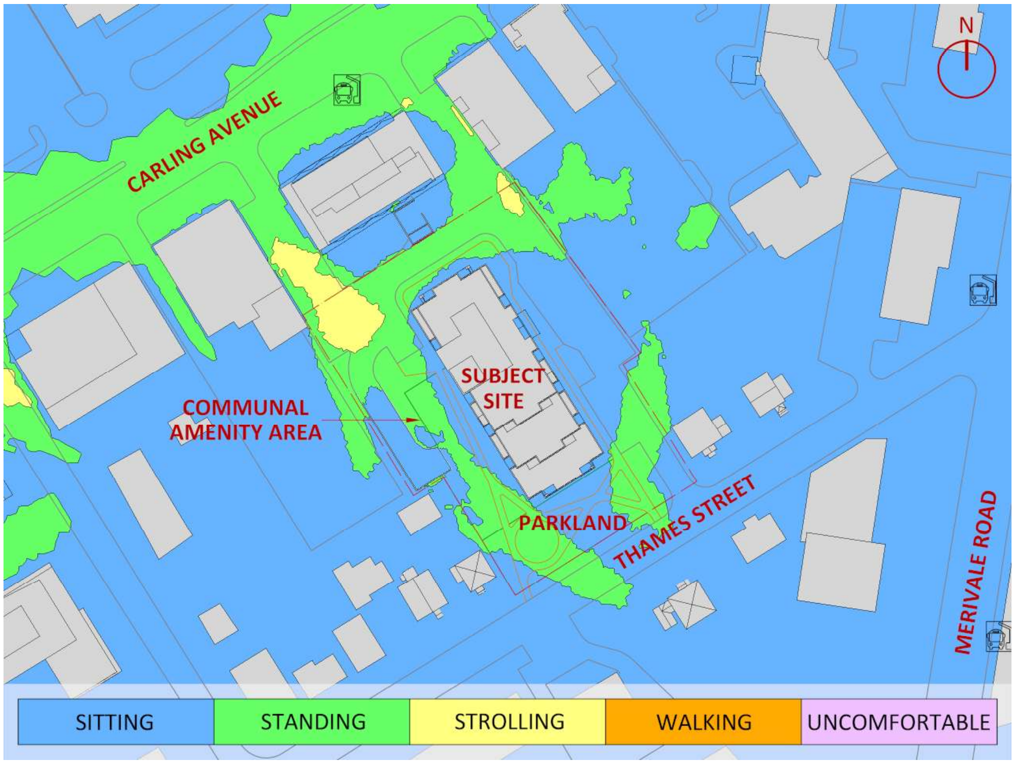


FIGURE 7: TYPICAL USE PERIOD – WIND COMFORT, GRADE LEVEL – PROPOSED MASSING

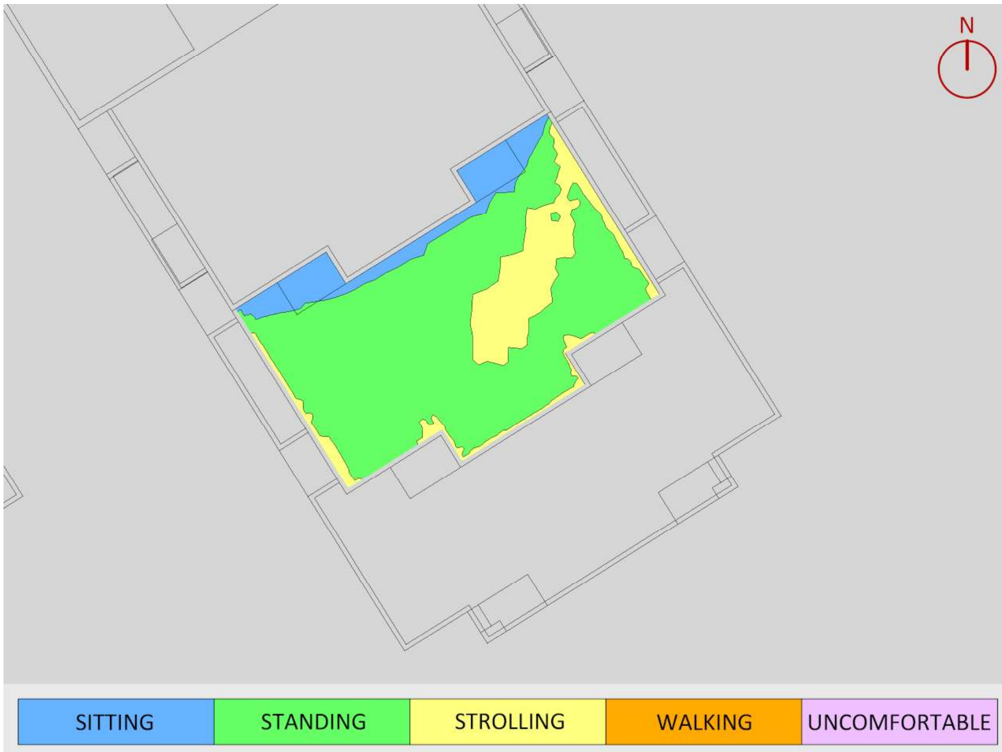


FIGURE 8A: SPRING – WIND COMFORT, LEVEL 10 AMENITY TERRACE

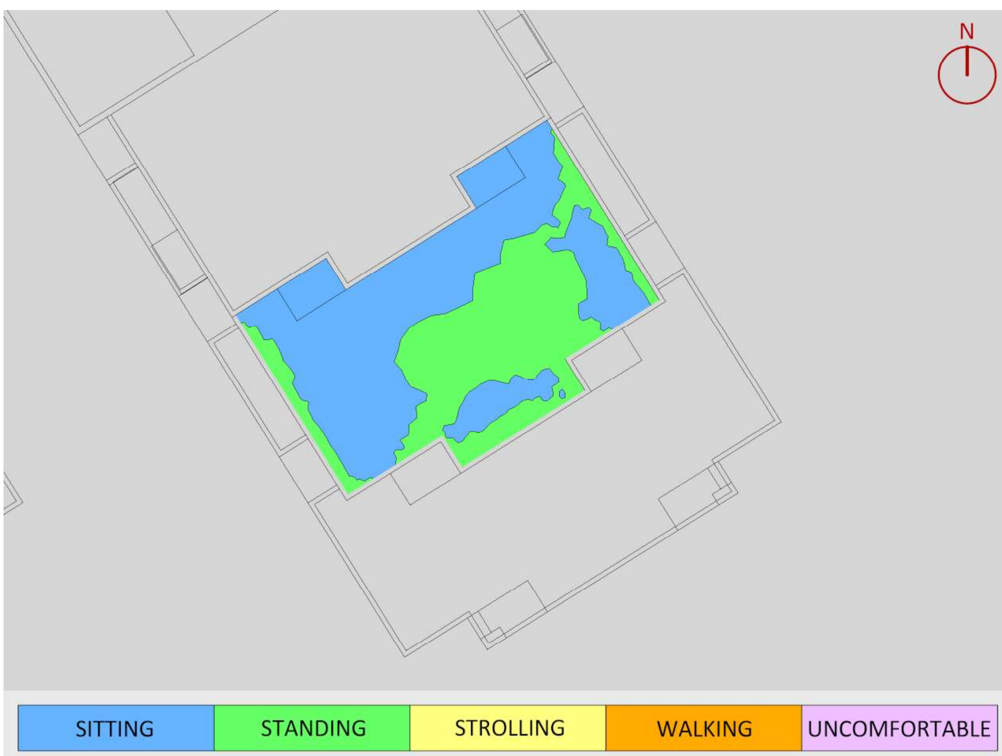


FIGURE 8B: SUMMER – WIND COMFORT, LEVEL 10 AMENITY TERRACE

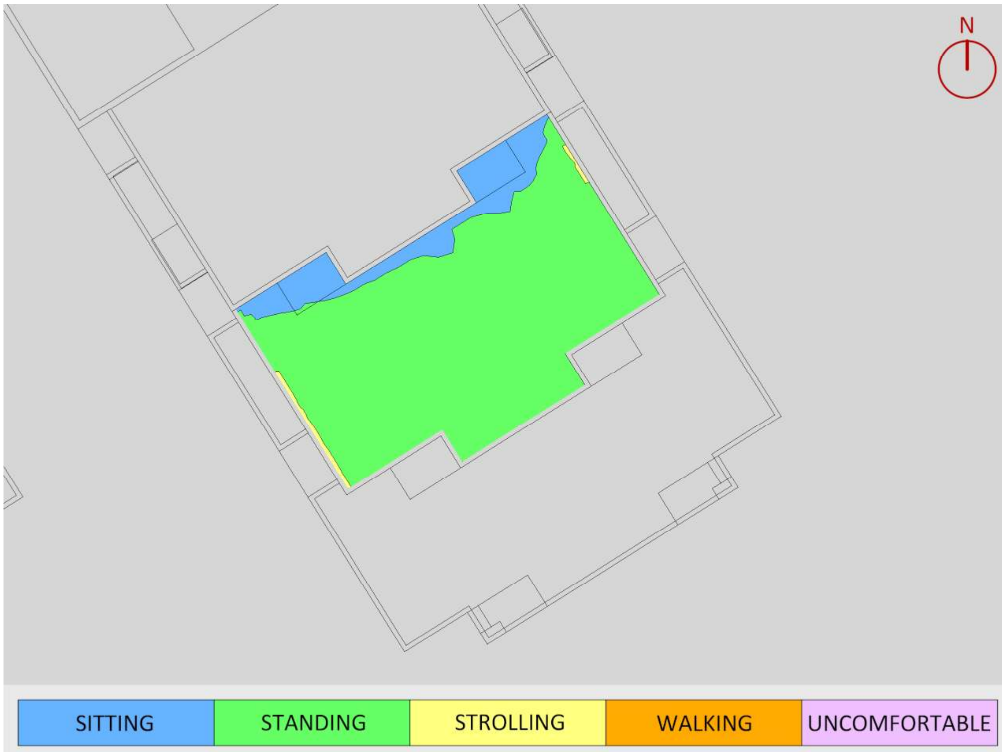


FIGURE 8C: AUTUMN – WIND COMFORT, LEVEL 10 AMENITY TERRACE

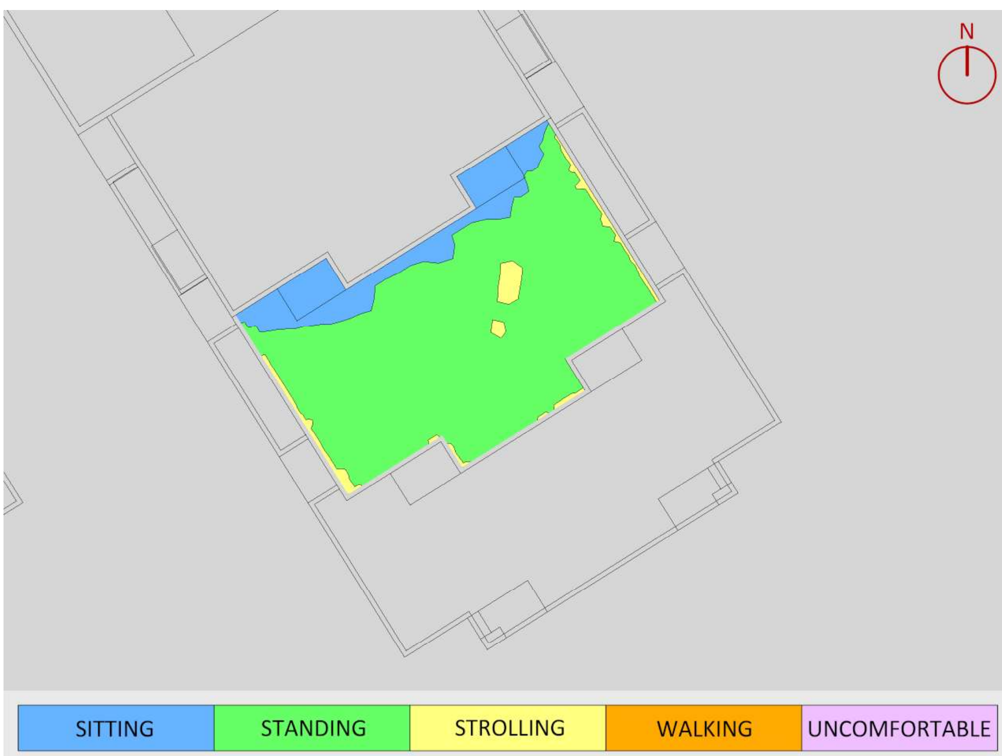


FIGURE 8D: WINTER – WIND COMFORT, LEVEL 10 AMENITY TERRACE

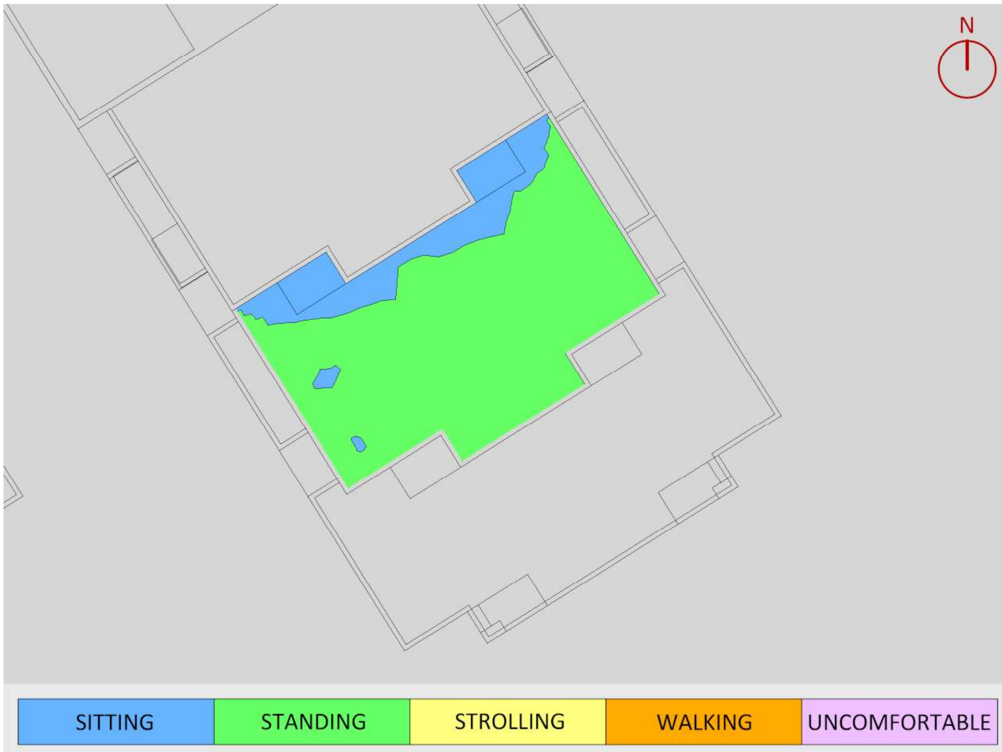


FIGURE 9: TYPICAL USE PERIOD – WIND COMFORT, LEVEL 10 AMENITY TERRACE

APPENDIX A

SIMULATION OF THE ATMOSPHERIC BOUNDARY LAYER

127 WALGREEN ROAD, OTTAWA, ON, CANADA K0A 1L0 | 613 836 0934
GRADIENTWIND.COM

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	0.24
22.5	0.24
45	0.24
67.5	0.21
90	0.21
112.5	0.22
135	0.24
157.5	0.24
180	0.24
202.5	0.25
225	0.24
247.5	0.24
270	0.24
292.5	0.24
315	0.23
337.5	0.23

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).

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

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

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 Engineering Symposium, IWES 2003*, Taiwan, 2003.