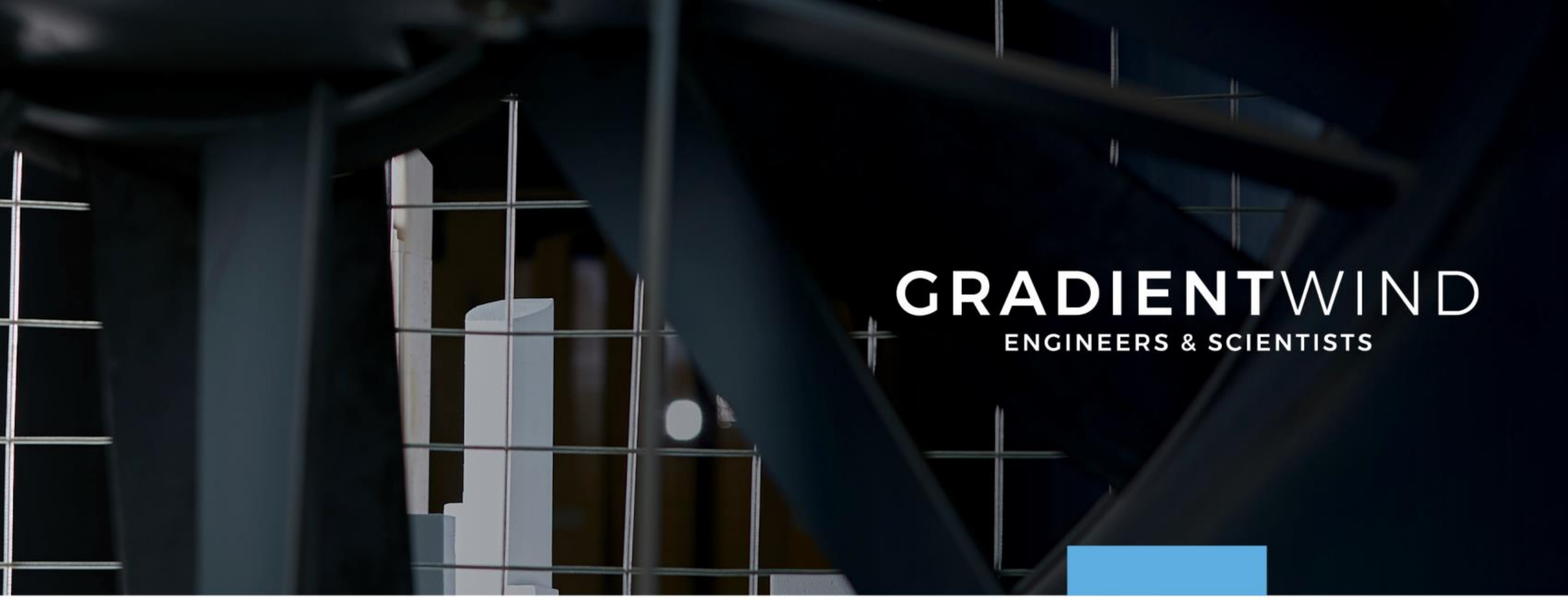

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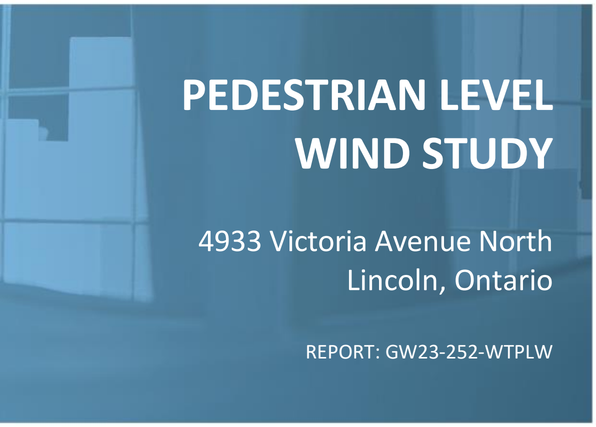
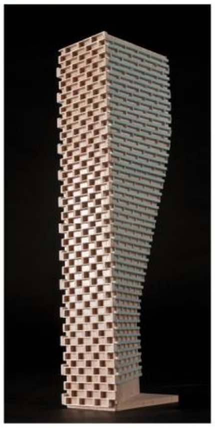
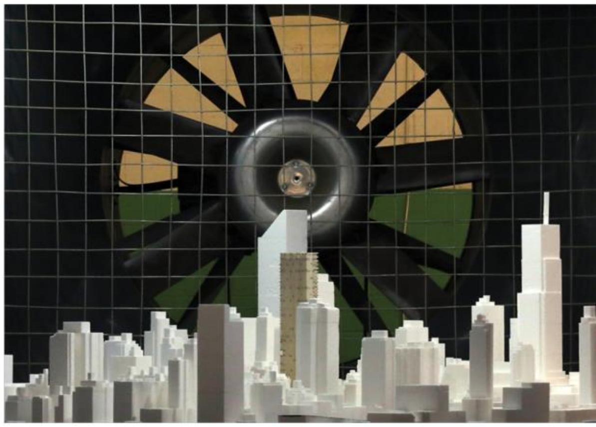


PEDESTRIAN LEVEL WIND STUDY

4933 Victoria Avenue North
Lincoln, Ontario

REPORT: GW23-252-WTPLW





March 13, 2024

PREPARED FOR
4933 Vic Court Globizen LP
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PREPARED BY
Cristiano Kondo, MESc., Junior Wind Scientist
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EXECUTIVE SUMMARY

This report describes a wind tunnel pedestrian level wind study undertaken to assess wind conditions for a proposed mixed-use development located at 4933 Victoria Avenue North in Lincoln, Ontario. Two configurations were studied: (i) *existing scenario*, including all approved, surrounding developments and without the proposed development, and (ii) *proposed scenario* with the proposed development in place. The study involves wind tunnel measurements of pedestrian wind speeds using a physical scale model, combined with meteorological data integration, to assess pedestrian comfort at key areas within and surrounding the study site. Grade-level areas investigated include sidewalks, walkways, laneways, parking areas, parks, nearby agricultural fields, retail patios, outdoor amenity areas, and building access points. Wind comfort is also evaluated over the various elevated terraces. The results and recommendations derived from these considerations are summarized in the following paragraphs and detailed in the subsequent report.

Our work is based on industry standard wind tunnel testing and data analysis procedures, architectural drawings provided by gh3* in December 2023 and updated on February 23, 2024, surrounding street layouts, as well as existing and approved future building massing information obtained from the City of Lincoln, and recent site imagery.

A complete summary of the predicted wind conditions is provided in Section 5 of this report and is also illustrated in Figures 2A through 4B, as well as Tables A1-A2 and B1-B3 in the appendices. Based on wind tunnel test results, meteorological data analysis, and experience with similar developments in the Niagara region, we conclude that the future wind conditions over all grade-level pedestrian wind-sensitive areas within and surrounding the study site will be acceptable for the intended uses on a seasonal basis.

Additionally, the Building B Level 2 and rooftop outdoor amenity terraces will be comfortable for sitting or more sedentary activities during the summer months, without the need for mitigation. To ensure that all remaining outdoor amenity terraces on Levels 3 and 4 will be similarly calm, mitigation is recommended, as described in Section 5.2

Within the context of typical weather patterns, which exclude anomalous localized storm events such as tornadoes and downbursts, no areas over the study site were found to experience conditions that could be considered unsafe.

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1. INTRODUCTION

This report describes a wind tunnel pedestrian level wind (PLW) study undertaken to assess wind conditions for a proposed mixed-use development located at 4933 Victoria Avenue North in Lincoln, Ontario. Two configurations were studied: (i) *existing scenario*, including all approved, surrounding developments and without the proposed development, and (ii) *proposed scenario* with the proposed development in place. The study was performed in accordance with industry standard wind tunnel testing techniques, architectural drawings provided by gh3* in December 2023 and updated on February 23, 2024, surrounding street layouts and existing and approved future building massing information, as well as recent site imagery.

2. TERMS OF REFERENCE

The focus of this wind tunnel pedestrian wind study is the proposed mixed-use development located at 4933 Victoria Avenue North in Lincoln, Ontario. The study site is situated directly on Lake Ontario's shoreline, bounded by Victoria Avenue North to the west and by Victoria Shores Park to the east.

The proposed development comprises four buildings forming an approximately "Y"-shaped planform open to the north: the stepped 15-storey condo building (Building A) to the northeast, the stepped 15-storey hotel building (Building B) to the northwest, and the stepped 14- and 5-storey residential buildings (Buildings C and D, respectively) to the southeast and southwest, respectively. The buildings are connected by a four-storey podium containing parking wrapped with residential units at Buildings C and D. A driveway connecting to Victoria Avenue North along the south elevation provides access to loading areas and both underground and above-ground parking. At grade, a common lobby and a retail space front Victoria Avenue North, a shared lobby between Buildings A and C is to the east, and residential units are located along the east elevation and the south side of the west elevation. Building B features a hotel lobby and restaurant, and Building A features indoor amenities and retail space, with both wings connected by a central covered outdoor pavilion. Outdoor amenities are located at the north and west elevations and at the southeast corner of Building A, a plaza between Buildings A and B, and retail patios to the north and east of Building B. Above grade, Buildings A, C, and D are reserved for residential use and Building B for hotel use. At Level 2, Building B steps back from the north and east elevations accommodating terraces, and Building A features an indoor amenity to the southwest. The floorplate sets back between the northeast and northwest wings at Level 3, accommodating outdoor and indoor amenities between Buildings A and B. The floorplate sets back at Level 4 accommodating outdoor amenities between Buildings A and C, and at the northwest corner of the building and further sets back to the base of each building at Level 5 accommodating a central green roof between the buildings. The floorplates rise to the full height, with progressive Building A setbacks from the north at Levels 6, 10, and 14, Building C progressive setbacks from the south at Levels 7, 9, 10, and 12, and a Building B north setback at Level 15 featuring a rooftop outdoor amenity.

Regarding wind exposures, the near-field surroundings (defined as an area falling within a 200-metre (m) radius of the subject site) include the open exposure of Lake Ontario from the northwest clockwise to the east, green spaces and low-rise residential buildings from east clockwise to the south, and open agricultural space in the remaining directions. Notably, Victoria Shores Park and Millenium Forest Park are directly east and west, respectively, with agriculture fields further to the west. The far-field surroundings (defined as the area beyond the near field and within a 2-kilometre (km) radius) include the open exposure of Lake Ontario from the west clockwise to the southeast and isolated low-rise buildings with open green spaces in the remaining compass azimuth directions.

Grade-level areas investigated include sidewalks, walkways, laneways, parking areas, parks, nearby agricultural fields, retail patios, outdoor amenity areas, and building access points. Wind comfort is also evaluated over the various elevated terraces. Figures 1A and 1B illustrate the *existing* and *proposed* study sites and surrounding context, respectively, and Photographs 1 through 6 depict the wind tunnel 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; (iii) recommend suitable mitigation measures, where required; and (iv) evaluate the influence of the proposed development on the existing wind conditions.

4. METHODOLOGY

The approach followed to quantify pedestrian wind conditions over the site is based on wind tunnel measurements of wind speeds at selected locations on a reduced-scale physical model, meteorological analysis of the Niagara Region wind climate, and synthesis of wind tunnel data with industry-accepted guidelines[1]. The following sections describe the analysis procedures, including a discussion of the pedestrian comfort and safety guidelines.

4.1 Wind Tunnel Context Modelling

A detailed PLW study is performed to determine the influence of local winds at the pedestrian level for a proposed development. The physical model of the proposed development and relevant surroundings, illustrated in Photographs 1 through 6 following the main text, was constructed at a scale of 1:400. The wind tunnel model includes all existing buildings and approved future developments within a full-scale diameter of approximately 840 metres. The general concept and approach to wind tunnel modelling is to provide building and topographic detail in the immediate vicinity of the study site on the surrounding model, and to rely on a length of wind tunnel upwind of the model to develop wind properties consistent with known turbulent intensity profiles that represent the surrounding terrain.

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

4.2 Wind Speed Measurements

The PLW study was performed by testing a total of 87 sensor locations on the scale model in Gradient Wind's wind tunnel. Of these 87 sensors, 78 were located at grade and the remaining 9 sensors were located over the various elevated terraces. Wind speed measurements were performed for each of the 88 sensors for 36 wind directions at 10° intervals. Figures 1A and 1B illustrate the *existing* and *proposed*

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[1] Niagara Region Pedestrian Level Wind Study Term of Reference Guide, July 2022

study sites and surrounding context, respectively, while sensor locations used to investigate wind conditions are illustrated in Figures 2A through 4B.

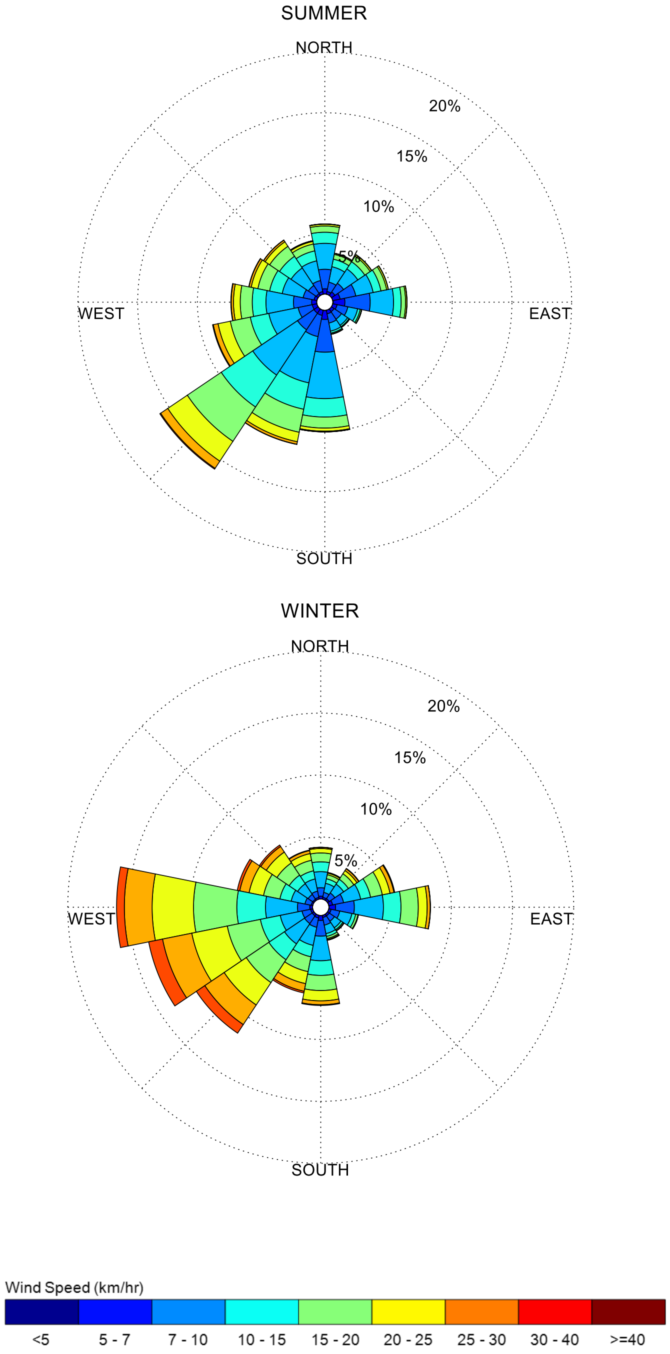
Mean and peak wind speed values for each location and wind direction were calculated from real-time pressure measurements, recorded at a sample rate of 500 samples per second, and taken over a 60-second time period. This period at model-scale corresponds approximately to one hour in full-scale, which matches the time frame of full-scale meteorological observations. Measured mean and gust wind speeds at grade were referenced to the wind speed measured near the ceiling of the wind tunnel to generate mean and peak wind speed ratios. Ceiling height in the wind tunnel represents the depth of the boundary layer of wind flowing over the earth's surface, referred to as the gradient height. Within this boundary layer, mean wind speed increases up to the gradient height and remains constant thereafter. Appendices C and D provide greater detail of the theory behind wind speed measurements. Wind tunnel measurements for this project, conducted in Gradient Wind's wind tunnel facility, meet or exceed guidelines found in the National Building Code of Canada 2015 and of 'Wind Tunnel Studies of Buildings and Structures', ASCE Manual 7 Reports on Engineering Practice No 67.

4.3 Meteorological Data Analysis

A statistical model for winds in Lincoln was developed from approximately 48-years of hourly meteorological wind data recorded at Niagara Falls International Airport and obtained from Environment and Climate Change Canada. Wind speed and direction data were divided into two distinct seasons, as stipulated in the noted Niagara Region Terms of Reference Guide[1]. More specifically, the summer season is defined as May through October, while the winter season is defined as November through April, inclusive.

The statistical model of the Lincoln 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 Lincoln, the most common winds concerning pedestrian comfort occur from the south clockwise to the west, and to a lesser extent from the east quadrant. The most common winds during the summer season occur for southwesterly wind directions. The directional preference and relative magnitude of the wind speed varies somewhat from season to season with the summer months displaying the calmest winds relative to the remaining seasonal periods. Also, by convection in microclimate studies, wind direction refers to the wind origin (e.g., a north wind blows from north to south).

SEASONAL DISTRIBUTION OF WINDS FOR VARIOUS PROBABILITIES NIAGARA FALLS INTERNATIONAL AIRPORT, NIAGARA FALLS



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 Guidelines

Pedestrian comfort and safety guidelines are based on the mechanical effects of wind without consideration of other meteorological conditions (i.e. temperature, relative humidity). The comfort guidelines assume that pedestrians are appropriately dressed for a specified outdoor activity during any given season. Since both mean and gust wind speeds affect pedestrian comfort, their combined effect is defined in the Niagara Region Terms of Reference[1]. More specifically, the criteria are defined as a Gust Equivalent Mean (GEM) wind speed, which is the greater of the mean wind speed or the gust wind speed divided by 1.85.

Four pedestrian comfort classes and corresponding GEM wind speed ranges are used to assess pedestrian comfort, which include: (i) Sitting; (ii) Standing; (iii) Walking; and (iv) Uncomfortable. More specifically, the comfort classes, wind speed ranges, and limiting criteria are summarized as follows:

(i) **Sitting** – GEM wind speeds below 10 km/h occurring more than 80% of the time would be considered acceptable for sedentary activities, including sitting.

(ii) **Standing** – GEM wind speeds below 15 km/h (i.e. 10-15 km/h) occurring more than 80% of the time are acceptable for activities such as standing, strolling or more vigorous activities.

(iii) **Walking** – GEM wind speeds below 20 km/h (i.e. 15-20 km/h) occurring more than 80% of the time are acceptable for walking or more vigorous activities.

(iv) **Uncomfortable** – Uncomfortable conditions are characterized by predicted values that fall below the 80% criterion for walking. Brisk walking and exercise, such as jogging, would be acceptable for moderate excesses of this criterion.

Gust wind speeds greater than 90 km/h, occurring more than 0.1% of the time on an annual basis, are 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 a vulnerable member of the population to fall.

Experience and research on people's perception of mechanical wind effects have shown that if the wind speed levels are exceeded more than 20% of the time, the activity level would be judged to be uncomfortable by most people. For instance, if GEM wind speeds 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 or more sedentary activities. Similarly, if GEM wind speeds 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 most of 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 at tested locations, the assessment of pedestrian comfort involves determining the suitability of the predicted wind conditions for their associated spaces. This step involves comparing the predicted comfort class to the desired comfort class, which is dictated by the location type represented by the sensor (i.e. a sidewalk, building entrance, amenity space, or other). An overview of common pedestrian location types and their desired comfort classes are summarized below.

DESIRED PEDESTRIAN COMFORT CLASSES FOR VARIOUS LOCATION TYPES

Location Types	Desired Comfort Classes
Primary Building Entrance	Standing
Secondary Building Access Point	Walking
Public Sidewalks / Pedestrian Walkways	Walking
Outdoor Amenity Spaces	Sitting / Standing
Cafés / Patios / Benches / Gardens	Sitting / Standing
Plazas	Standing / Walking
Transit Stops	Standing
Public Parks	Sitting / Walking
Garage / Service Entrances	Walking
Vehicular Drop-Off Zones	Walking
Laneways / Loading Zones	Walking

5. RESULTS AND DISCUSSION

Tables A1 and A2 in Appendix A provide a summary of seasonal comfort predictions for each sensor location under the *existing* massing scenario. Similarly, Tables B1-B3 in Appendix B provide the seasonal comfort predictions for under the *proposed* massing scenario. The tables indicate the 80% non-exceedance GEM wind speeds and corresponding comfort classifications as defined in Section 4.4. In other words, a wind speed threshold of 19.1 for the summer season indicates that 80% of the measured data falls at or below 19.1 km/h during the summer months and conditions are therefore suitable for walking, as the 80% threshold value falls within the exceedance range of 15-20 km/h for walking. The tables include the predicted threshold values for each sensor location during each season, accompanied by the corresponding predicted comfort class (i.e., sitting, standing, walking, etc.).

The most significant findings of the PLW study are summarized in Sections 5.1 and 5.2. To assist with understanding and interpretation, predicted conditions for the proposed development are also illustrated in colour-coded format in Figures 2A through 4B. Conditions suitable for sitting are represented by the colour blue, while standing is represented by green, and walking by yellow. Conditions considered uncomfortable for walking are represented by the colour orange. For locations where the wind safety criterion is exceeded, the sensor is highlighted in red.

5.1 Pedestrian Comfort Suitability – *Existing Scenario*

Based on the analysis of the measured data, consideration of local climate data, and the suitability descriptors provided in Tables A1 and A2 in Appendix A and illustrated in Figures 2A and 2B, this section summarizes the significant findings of the PLW study with respect to the *existing scenario*, as follows:

1. Some public sidewalks, walkways, laneways, and landscaped spaces within and surrounding the proposed development currently experience wind conditions suitable for walking or better throughout the year. Many exceptions include along Viceroy Avenue (Sensors 12, 13, & 14) and Vesper (Sensors 14 & 15), portions of Victoria Avenue North (Sensors 9, 12, 18, & 28), and several areas internal to the site (Sensors 29, 32, 33, 37, 38, 40-52, & 54), which exceeds the walking criterion during the winter months.
2. The existing Victoria Shores Park (Sensors 1-7) and Millennium Forest Park (Sensors 17, 19, 22, & 27) to the east and west of the study site, respectively, are currently generally suitable for walking or better throughout the year, with portions of Victoria Shore Park (Sensors 2, 3, & 5) and much of Millennium Forest Park (Sensors 17, 19, & 22) transitioning to uncomfortable for walking during the winter months.

3. The existing agricultural fields (Sensors 16, 20, & 23-25) directly west of Millennium Forest Park currently experiences wind conditions comfortable for walking during the summer months, transitioning to uncomfortable for walking during the winter months.

4. Within the context of typical weather patterns, which exclude anomalous localized storm events such as tornadoes and downbursts, no areas over the study site were found to experience wind conditions that are considered unsafe.

5.2 Pedestrian Comfort Suitability – *Proposed Scenario*

Based on the analysis of the measured data, consideration of local climate data, and the suitability descriptors provided in Tables B1-B3 in Appendix B and illustrated in Figures 3A through 4B, this section summarizes the significant findings of the PLW study with respect to the *proposed scenario*, as follows:

1. Most public sidewalks, walkways, laneways, landscaped spaces, and parking areas within and surrounding the proposed development will experience wind conditions suitable for walking or better throughout the year, which is acceptable for the intended uses of spaces and a significant improvement from existing conditions. Exceptions include Vesper laneway (Sensors 14 & 15) and isolated portions of the sidewalk along Victoria Avenue North to the northwest (Sensors 28, 29, & 61), which remain marginally uncomfortable for walking during the winter months. It is noteworthy that in all instances the exceedance of the walking comfort threshold is marginal, restricted to winter months, and wind speeds remain safe, as defined in Section 4.4.

   Considering the locations represented by Sensors 28, 29, and 61, the tall plantings of Millenium Forest Park, not represented in the testing, are expected to buffer salient southwesterly winds, therefore acceptable walking conditions are expected.

2. All primary entrances (including retail, lobby, and amenity) and all secondary building access points (including stairwell exits, loading areas, and vehicle entrances) throughout the proposed development will be comfortable for standing or better and walking or better, respectively, throughout the year, which is acceptable. If restaurant entrances are provided along the west elevation of the building (Sensors 60 and 61), it is recommended to either recess the doorways within the façade or provide flanking wind barriers and a canopy overhead to improve wind comfort and ensure acceptable door operation during windy periods.

3. All proposed grade-level outdoor amenities (Sensors 31-34, 41, 42, 68, 73, 74, & 78) will generally be suitable for sitting or more sedentary activities during the summer months and standing or better during the winter months, which is appropriate for the intended uses of spaces. The proposed reflective pool/skating rink (Sensors 66 & 67) and central plaza (Sensor 69) will generally be suitable for standing throughout the year, which is acceptable. If seating conditions are desired in the central plaza, it is recommended to provide targeted wind barriers to the immediate northwest of designated seating areas.

5. All proposed restaurant patios (Sensors 62-65, 70, 71, & 76) will generally experience wind conditions suitable for sitting during the summer months, transitioning to suitability for standing or better throughout the rest of the year, which is acceptable for the intended uses of spaces.

4. The existing Victoria Shores Park (Sensors 1-7) and Millennium Forest Park (Sensors 17, 19, 22, & 27) to the east and west of the study site, respectively, will generally experience wind conditions suitable for standing during the summer and walking during the winter. An isolated portion of Victoria Shores Park to the south of the site (Sensor 7) will transition to uncomfortable conditions during the winter months. The noted wind conditions represent significant improvement from the existing conditions. Additionally, the existing tall plantings throughout these areas are expected to further reduce windspeeds during all seasons.

5. The existing agricultural field (Sensors 16, 20, & 23-25) directly west of Millennium Forest Park will generally experience wind conditions comfortable for walking throughout the year, with the northwest portion marginally exceeding the walking criterion during the winter months. The noted wind conditions represent an improvement from the existing conditions. Furthermore, the exceedance criterion is restricted to the winter and wind speed remains safe, as defined in Section 4.4. Consequently, mitigation is not necessary.

6. The outdoor amenity terrace at Level 2 (Sensor 79) will be calm and comfortable for sitting during the summer without the need for mitigation. The Level 3 and 4 terrace spaces (Sensors 80 & 81-86, respectively) will generally be suitable for standing during the summer months. To ensure conditions suitable for sitting or more sedentary activities throughout the summer months, it is recommended to raise terrace perimeter guards to at least 2.0 metres above the walking surface and/or provide targeted upwind barriers and overhead pergolas at designed seating areas.

Barriers may take the form of dense coniferous plantings in raised planters, high-solidity wind screens, or a combination thereof, and should measure at least 1.6 metres tall.

7. The rooftop terrace for Building B (Sensor 88) will be suitable for sitting or more sedentary activities during the summer months, without the need for mitigation.
8. Within the context of typical weather patterns, which exclude anomalous localized storm events such as tornadoes and downbursts, no areas over the study site were found to experience wind conditions that are considered unsafe.

6. CONCLUSIONS AND RECOMMENDATIONS

This report summarizes the methodology, results, and recommendations related to a pedestrian level wind study for a proposed mixed-use development located at 4933 Victoria Avenue North in Lincoln, Ontario. The study was performed in accordance with industry standard wind tunnel testing and data analysis procedures.

A complete summary of the predicted wind conditions is provided in Section 5 of this report and is also illustrated in Figures 2A through 4B, as well as Tables A1-A2 and B1-B3 in the appendices. Based on wind tunnel test results, meteorological data analysis, and experience with similar developments in the Niagara region, we conclude that the future wind conditions over all grade-level pedestrian wind-sensitive areas within and surrounding the study site will be acceptable for the intended uses on a seasonal basis.

Additionally, the Building B Level 2 and rooftop outdoor amenity terraces will be comfortable for sitting or more sedentary activities during the summer months, without the need for mitigation. To ensure that all remaining outdoor amenity terraces on Levels 3 and 4 will be similarly calm, mitigation is recommended, as described in Section 5.2

Within the context of typical weather patterns, which exclude anomalous localized storm events such as tornadoes and downbursts, no areas over the study site were found to experience conditions that could be considered unsafe.

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

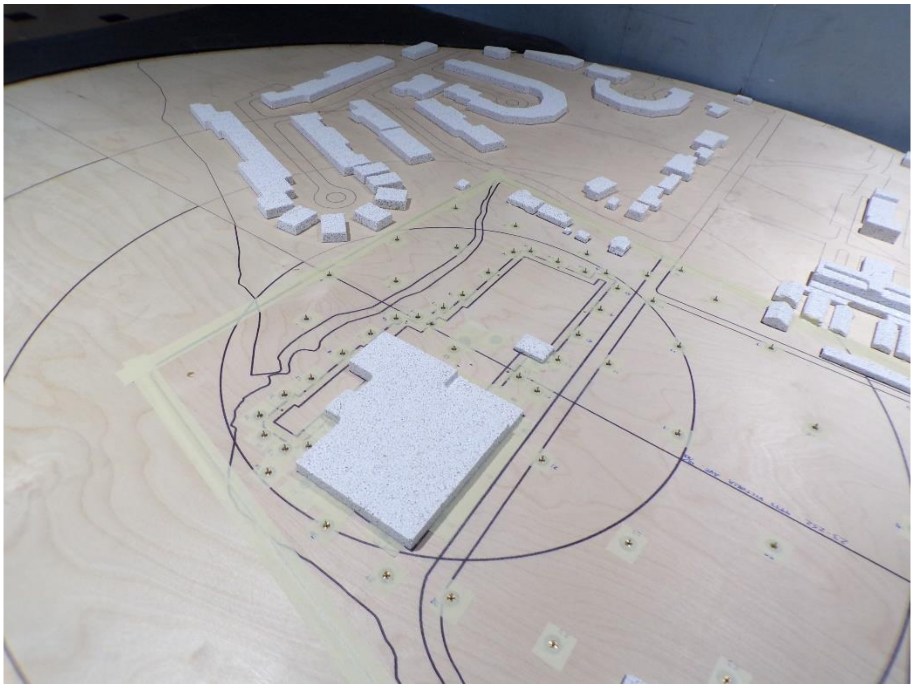
Sincerely,

Gradient Wind Engineering Inc.

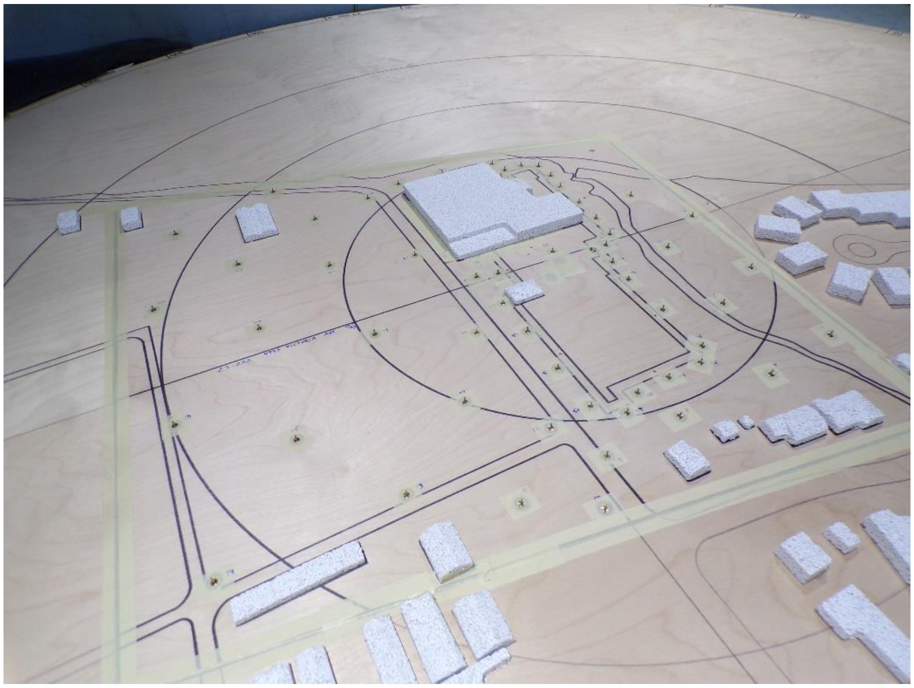
Cristiano Kondo, MESc.,
Junior Wind Scientist

Nick Petersen, P.Eng.,
Wind Engineer

GW23-252-WTPLW



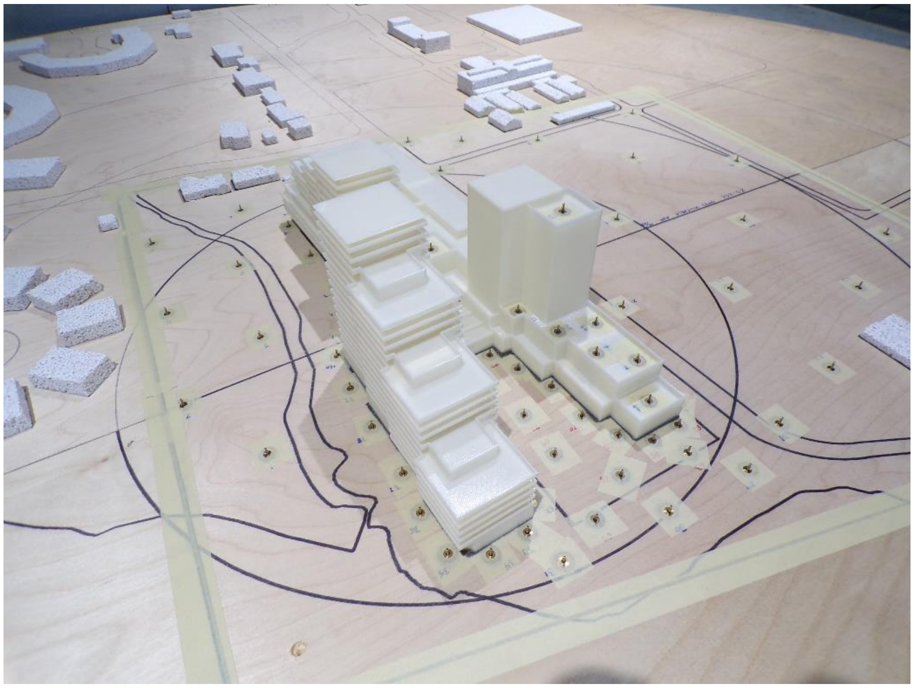
PHOTOGRAPH 1: CLOSE-UP VIEW OF EXISTING CONTEXT MODEL LOOKING SOUTHEAST



PHOTOGRAPH 2: CLOSE-UP VIEW OF EXISTING CONTEXT MODEL LOOKING NORTHEAST

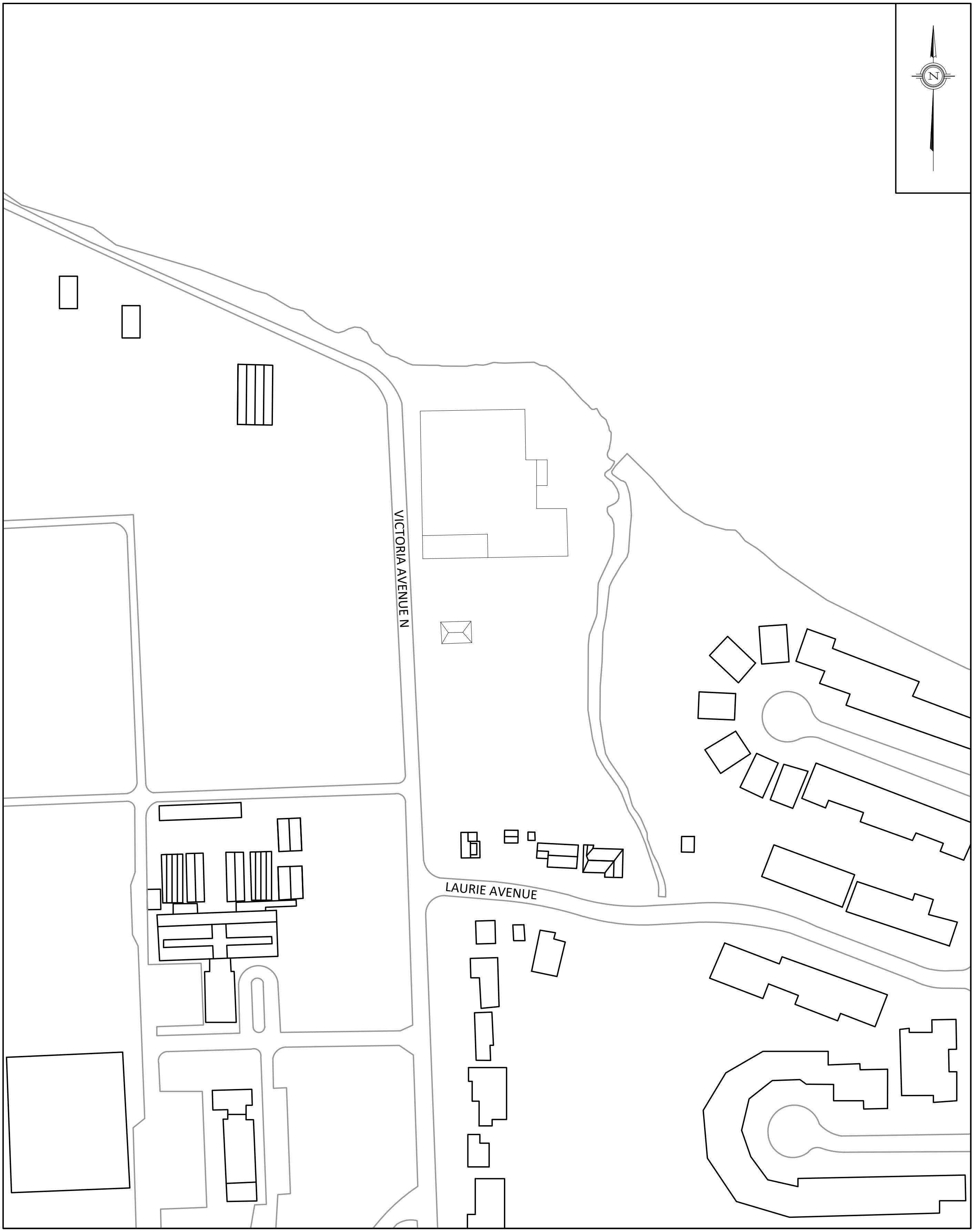
PHOTOGRAPH 3: <u>PROPOSED</u> STUDY MODEL INSIDE THE GWE WIND TUNNEL LOOKING DOWNWIND

PHOTOGRAPH 4: <u>PROPOSED</u> STUDY MODEL INSIDE THE GWE WIND TUNNEL LOOKING UPWIND



PHOTOGRAPH 5: CLOSE-UP VIEW OF PROPOSED STUDY MODEL LOOKING SOUTHWEST

PHOTOGRAPH 6: CLOSE-UP VIEW OF PROPOSED STUDY MODEL LOOKING SOUTHEAST



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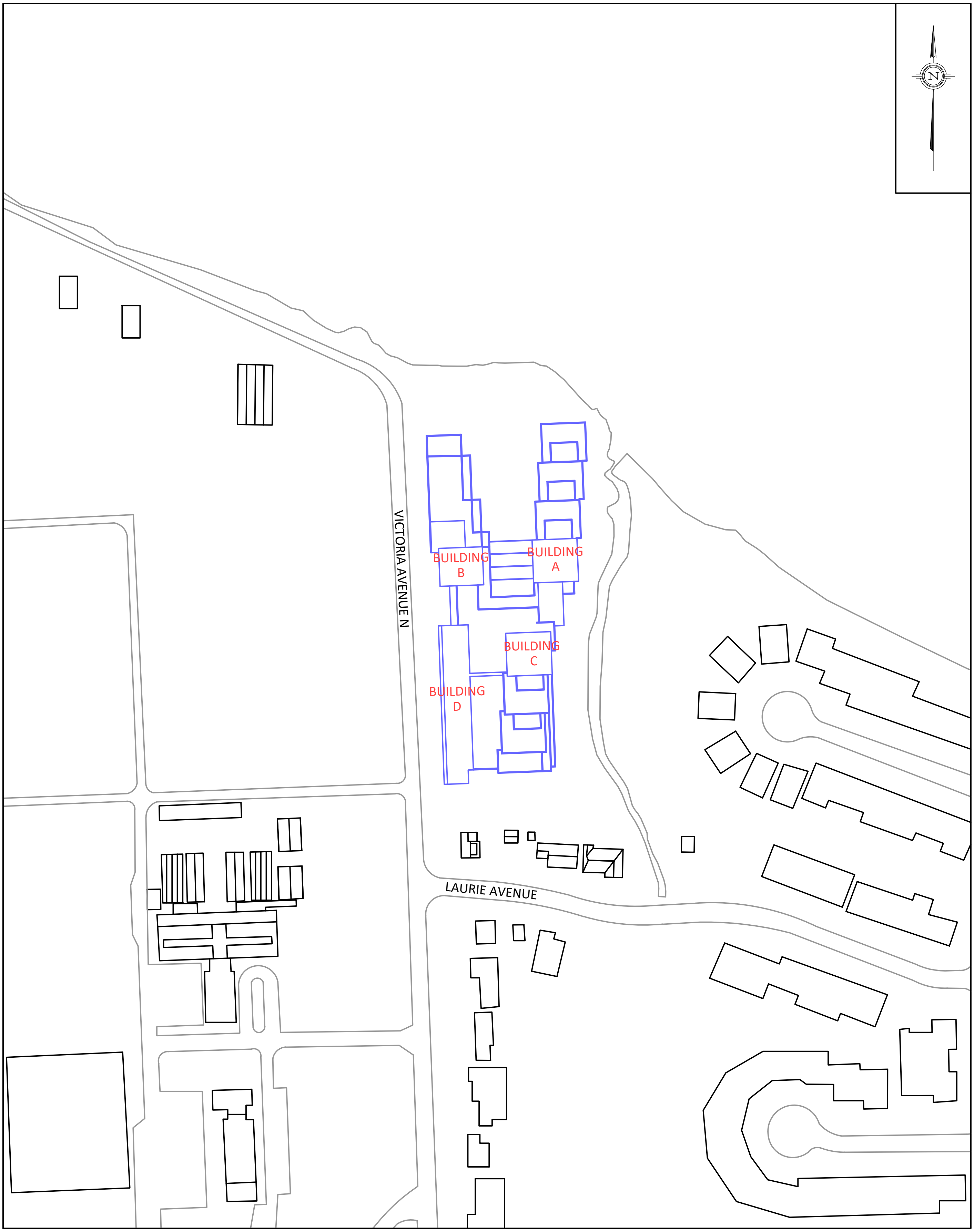
PROJECT	4933 VICTORIA AVE N, LINCOLN PEDESTRIAN LEVEL WIND STUDY		
SCALE	1:2500 (APPROX.)	DRAWING NO.	GW23-252-PLW-1A
DATE	JANUARY 4, 2024	DRAWN BY	C.E.

DESCRIPTION

FIGURE 1A:
EXISTING SITE PLAN
AND SURROUNDING CONTEXT



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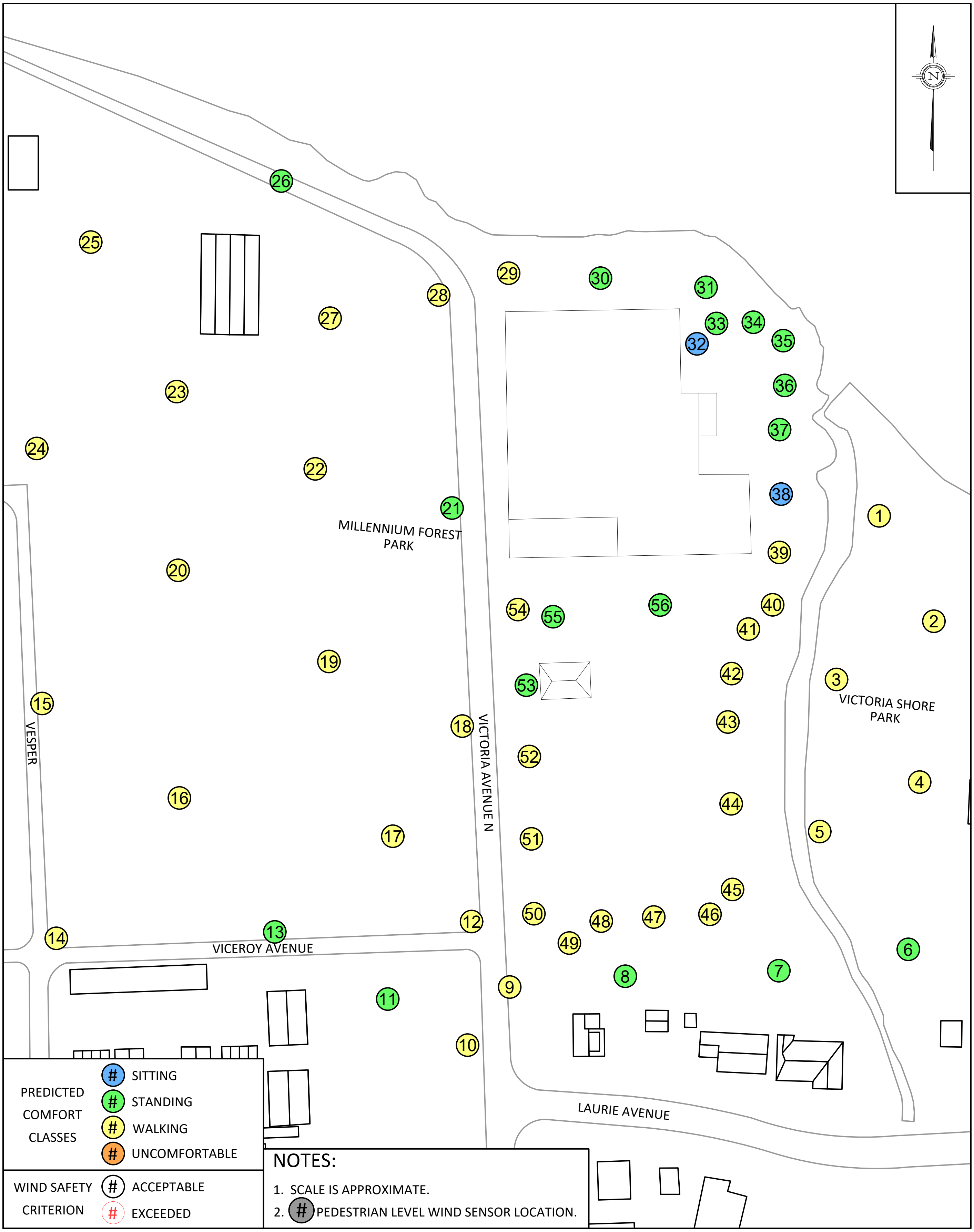
PROJECT 4933 VICTORIA AVE N, LINCOLN PEDESTRIAN LEVEL WIND STUDY		DESCRIPTION FIGURE 1B: PROPOSED SITE PLAN AND SURROUNDING CONTEXT
SCALE 1:2500 (APPROX.)	DRAWING NO. GW23-252-PLW-1B	
DATE JANUARY 4, 2024	DRAWN BY C.E.	



PREDICTED COMFORT CLASSES
- 🟦 SITTING
- 🟩 STANDING
- 🟨 WALKING
- 🟧 UNCOMFORTABLE

WIND SAFETY CRITERION
- # ACCEPTABLE
- # EXCEEDED

NOTES:

1. SCALE IS APPROXIMATE.
2. # PEDESTRIAN LEVEL WIND SENSOR LOCATION.

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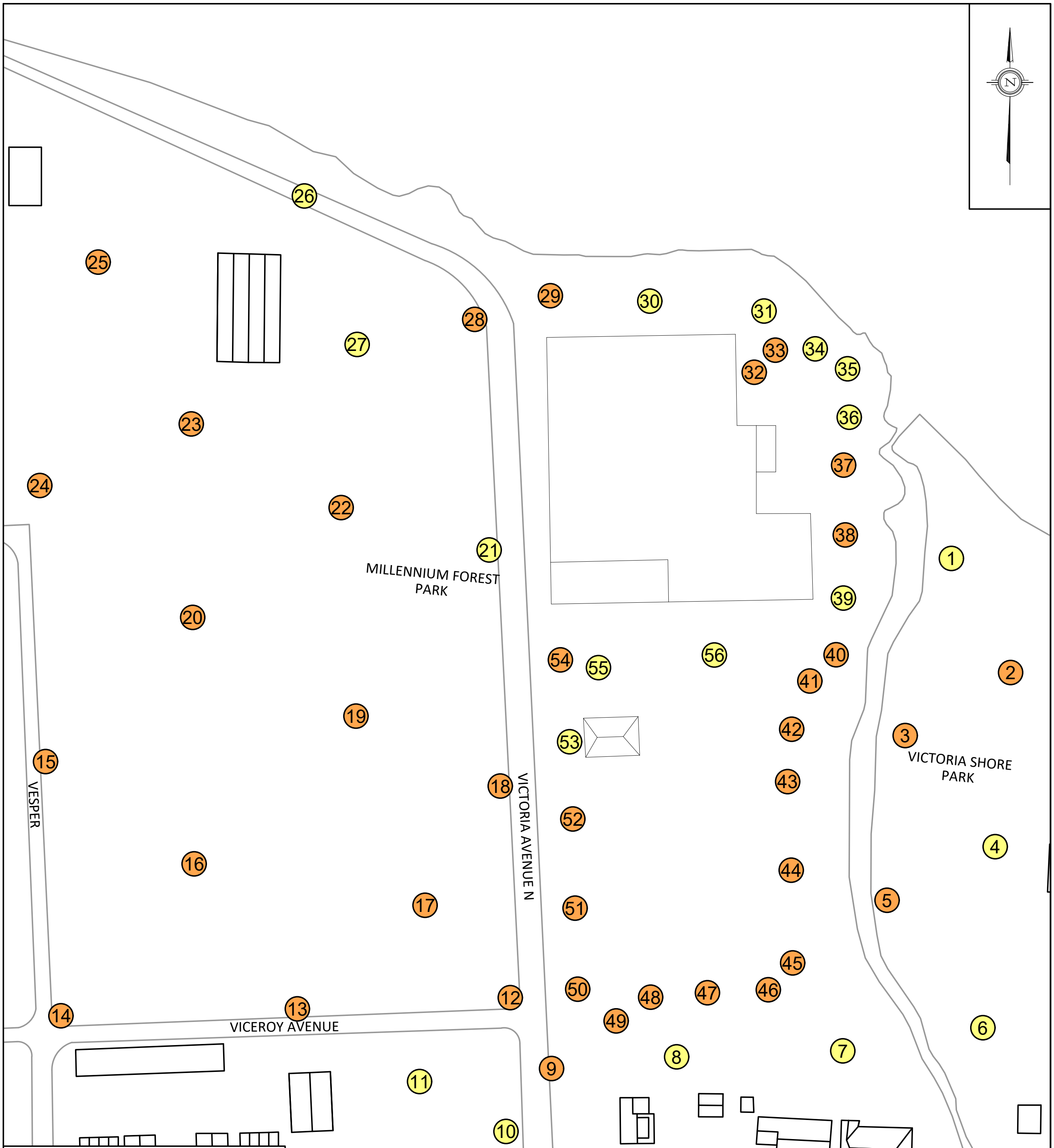
PROJECT	4933 VICTORIA AVE N, LINCOLN PEDESTRIAN LEVEL WIND STUDY
SCALE	1:1500 (APPROX.)
DRAWING NO.	GW23-252-PLW-2A
DATE	MARCH 14, 2024
DRAWN BY	C.E.
DESCRIPTION	FIGURE 2A: SUMMER EXISTING GROUND FLOOR PLAN PEDESTRIAN COMFORT PREDICTIONS



PREDICTED COMFORT CLASSES
- # SITTING
- # STANDING
- # WALKING
- # UNCOMFORTABLE

WIND SAFETY CRITERION
- # ACCEPTABLE
- # EXCEEDED

NOTES:

1. SCALE IS APPROXIMATE.
2. # PEDESTRIAN LEVEL WIND SENSOR LOCATION.

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PROJECT
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PEDESTRIAN LEVEL WIND STUDY

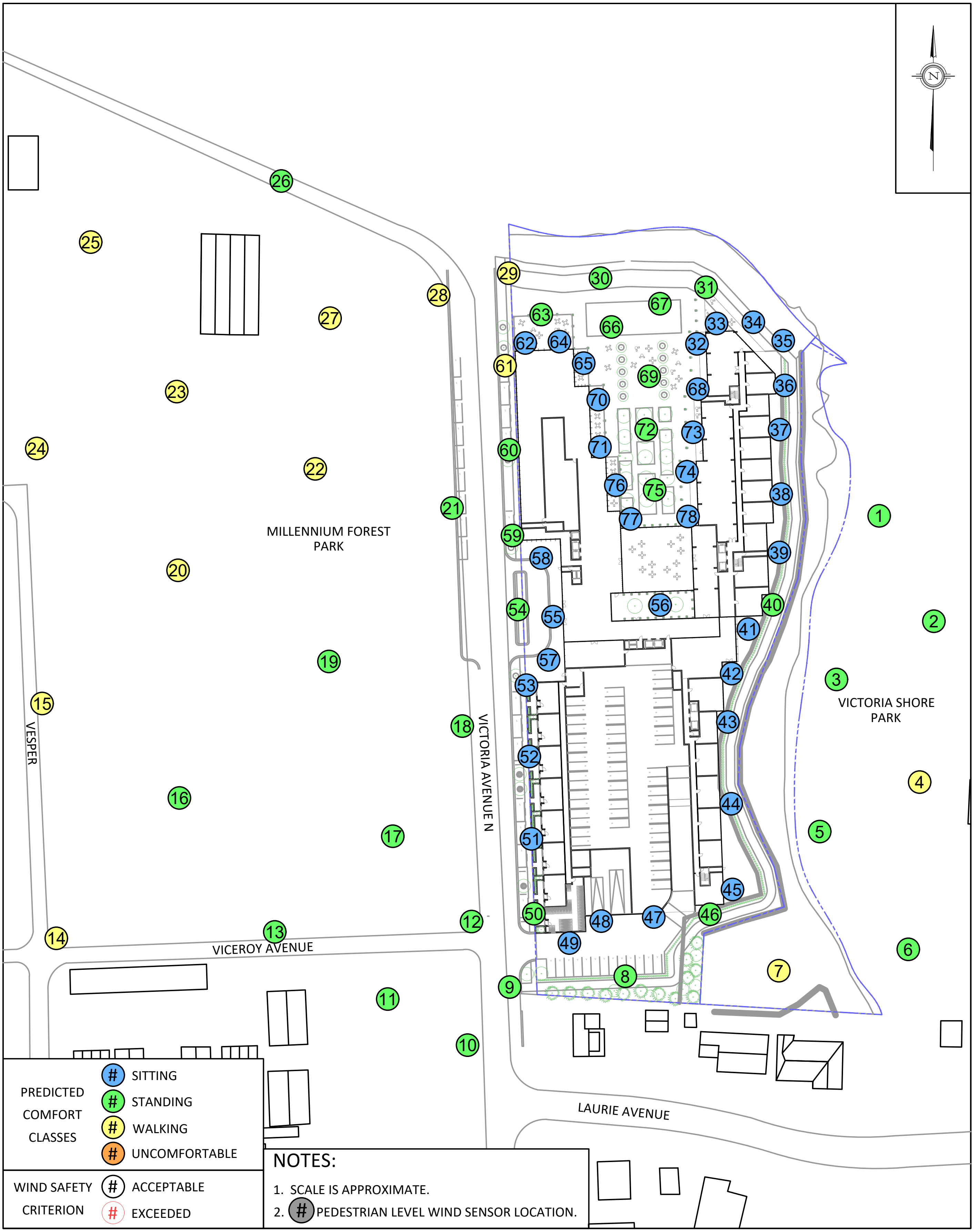
SCALE
1:1500 (APPROX.)

DRAWING NO.
GW23-252-PLW-2B

DATE
MARCH 14, 2024

DRAWN BY
C.E.

DESCRIPTION
FIGURE 2B: WINTER
EXISTING GROUND FLOOR PLAN
PEDESTRIAN COMFORT PREDICTIONS



PREDICTED COMFORT CLASSES	🔵 #	SITTING
	🟢 #	STANDING
	🟡 #	WALKING
	🟠 #	UNCOMFORTABLE
WIND SAFETY CRITERION	#	ACCEPTABLE
	#	EXCEEDED

NOTES:

1. SCALE IS APPROXIMATE.
2. # PEDESTRIAN LEVEL WIND SENSOR LOCATION.

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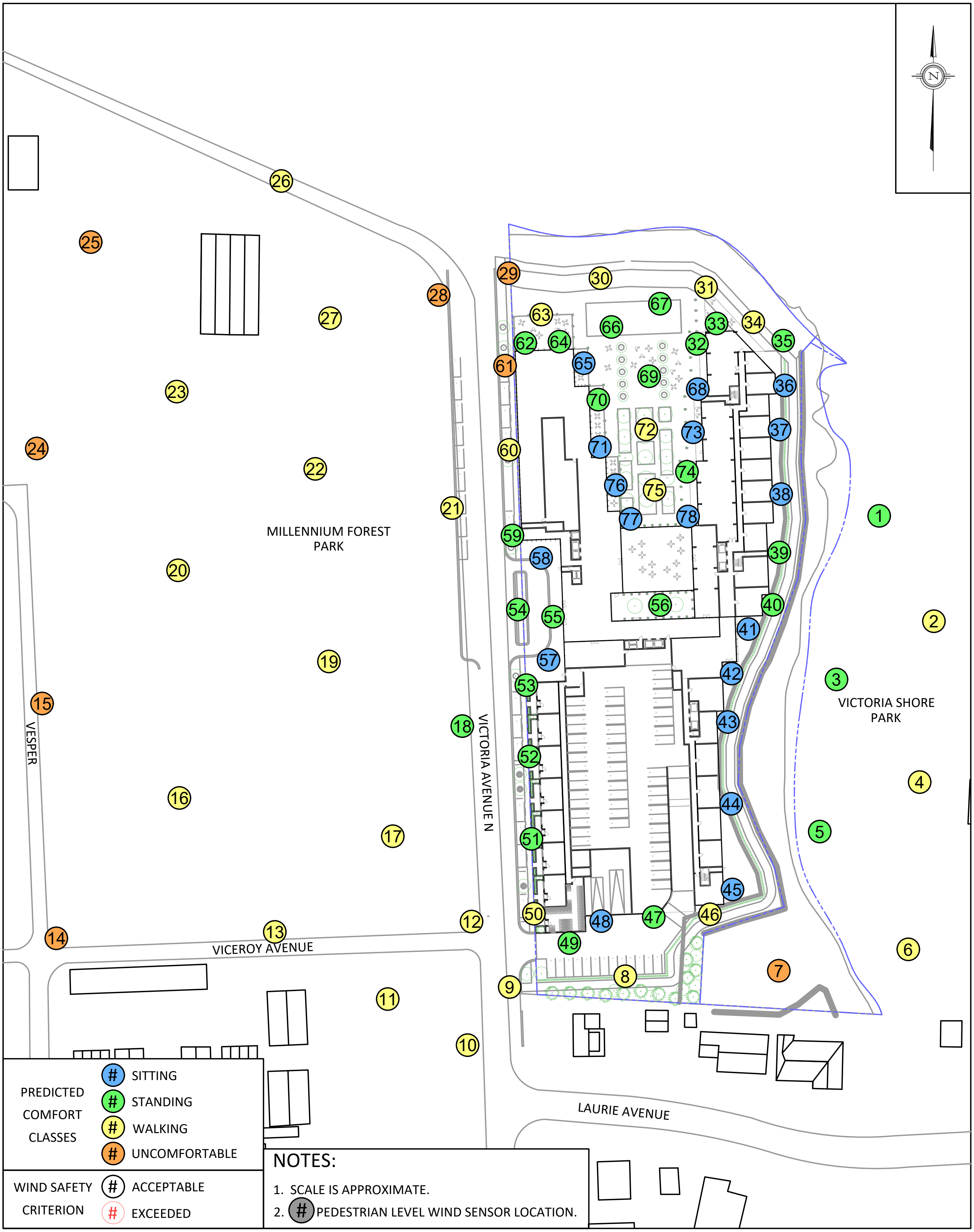
PROJECT	4933 VICTORIA AVE N, LINCOLN PEDESTRIAN LEVEL WIND STUDY		
SCALE	1:1500 (APPROX.)	DRAWING NO.	GW23-252-PLW-3A
DATE	MARCH 14, 2024	DRAWN BY	C.E.

DESCRIPTION

FIGURE 3A: SUMMER
PROPOSED GROUND FLOOR PLAN
PEDESTRIAN COMFORT PREDICTIONS



PREDICTED COMFORT CLASSES

- 🟦 # SITTING
- 🟩 # STANDING
- 🟨 # WALKING
- 🟧 # UNCOMFORTABLE

WIND SAFETY CRITERION

- # ACCEPTABLE
- # EXCEEDED

NOTES:

1. SCALE IS APPROXIMATE.
2. # PEDESTRIAN LEVEL WIND SENSOR LOCATION.

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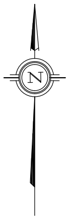
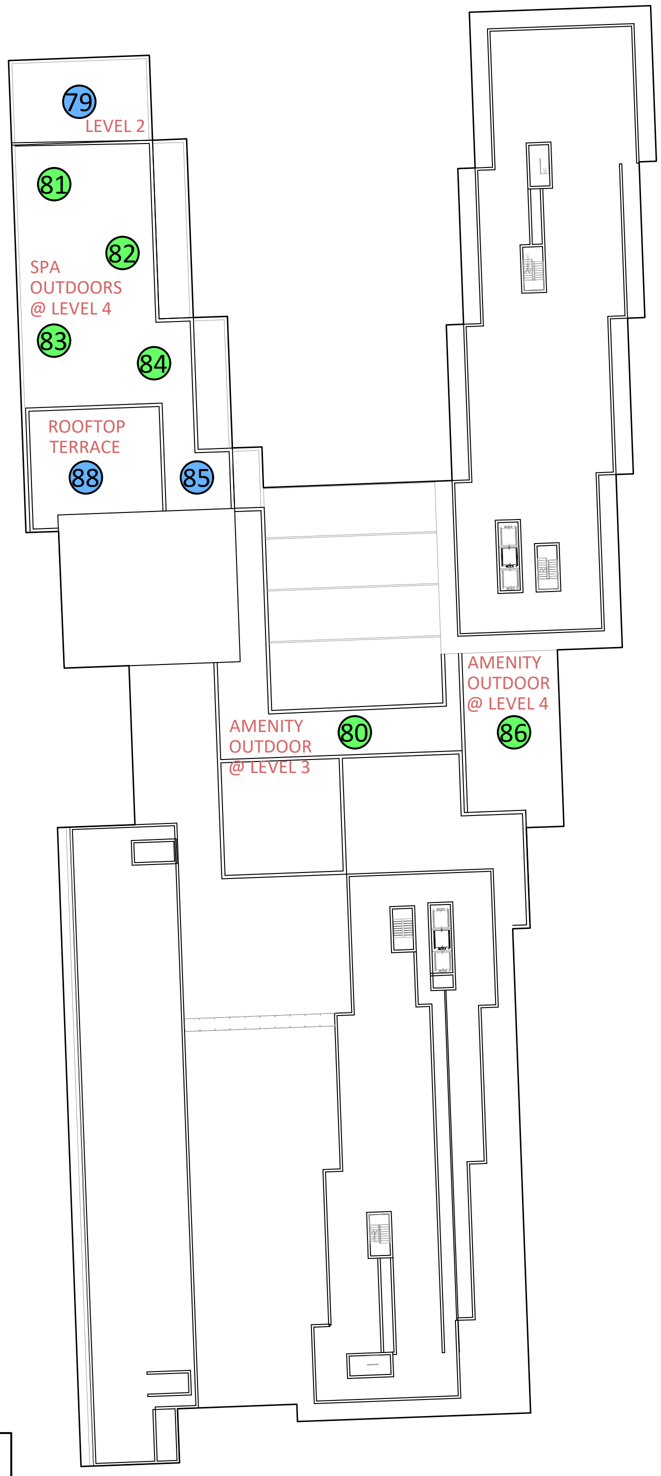
PROJECT 4933 VICTORIA AVE N, LINCOLN PEDESTRIAN LEVEL WIND STUDY		DESCRIPTION FIGURE 3B: WINTER PROPOSED GROUND FLOOR PLAN PEDESTRIAN COMFORT PREDICTIONS
SCALE 1:1500 (APPROX.)	DRAWING NO. GW23-252-PLW-3B	
DATE MARCH 14, 2024	DRAWN BY C.E.	





PREDICTED COMFORT CLASSES		
	🔵 #	SITTING
	🟢 #	STANDING
	🟡 #	WALKING
	🟠 #	UNCOMFORTABLE

WIND SAFETY CRITERION		
	○ #	ACCEPTABLE
	○ #	EXCEEDED

NOTES:

1. SCALE IS APPROXIMATE.
2. ● # PEDESTRIAN LEVEL WIND SENSOR LOCATION.

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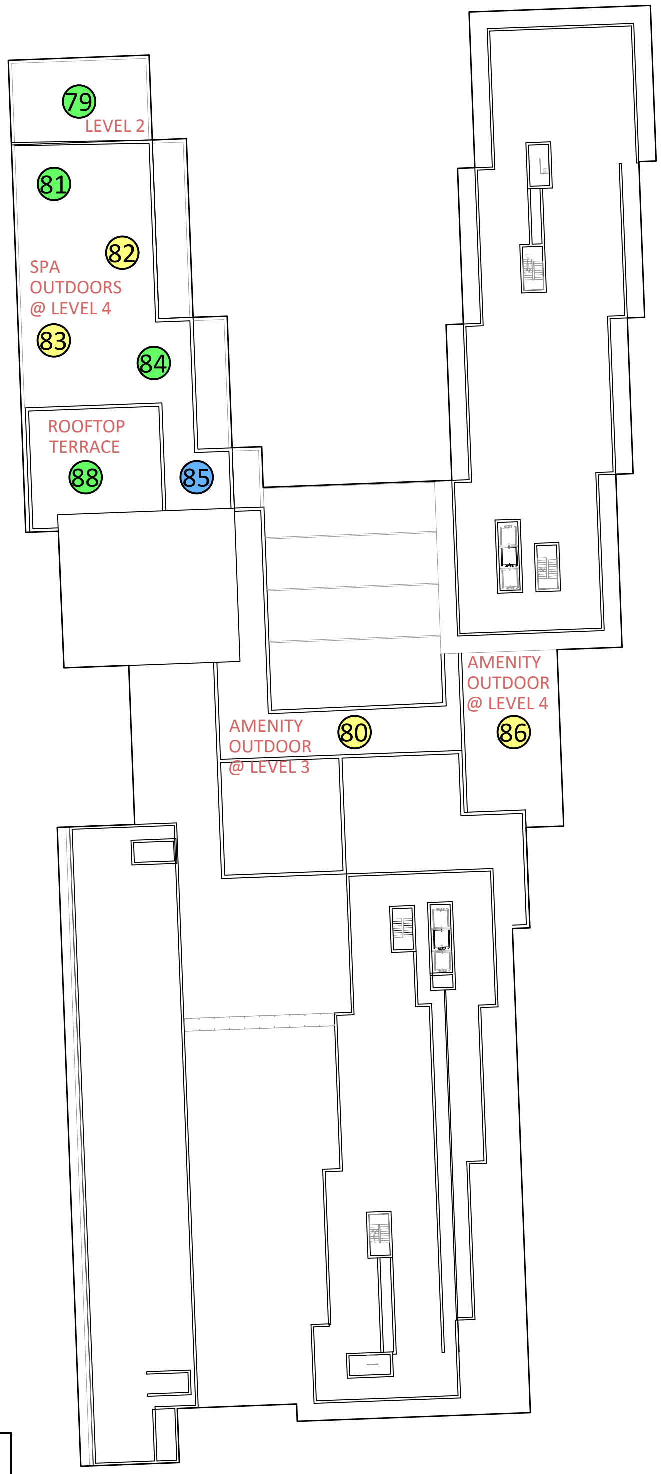
PROJECT: 4933 VICTORIA AVE N, LINCOLN PEDESTRIAN LEVEL WIND STUDY		DESCRIPTION: FIGURE 4A: SUMMER OUTDOOR AMENITY FLOOR PLAN PEDESTRIAN COMFORT PREDICTIONS
SCALE: 1:900 (APPROX.)	DRAWING NO. GW23-252-PLW-4A	
DATE: MARCH 14, 2024	DRAWN BY: C.E.	



PREDICTED COMFORT CLASSES
- 🔵 SITTING
- 🟢 STANDING
- 🟡 WALKING
- 🟠 UNCOMFORTABLE

WIND SAFETY CRITERION
- ○ ACCEPTABLE
- ○ EXCEEDED

NOTES:

1. SCALE IS APPROXIMATE.
2. ● PEDESTRIAN LEVEL WIND SENSOR LOCATION.

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PEDESTRIAN LEVEL WIND STUDY

SCALE 1:900 (APPROX.)
DRAWING NO. GW23-252-PLW-4B
DATE MARCH 14, 2024
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DESCRIPTION
FIGURE 4B: WINTER
OUTDOOR AMENITY FLOOR PLAN
PEDESTRIAN COMFORT PREDICTIONS

APPENDIX A

PEDESTRIAN COMFORT SUITABILITY, TABLES A1-A2 (EXISTING SCENARIO)

Guidelines	
Pedestrian Comfort	**20% exceedance wind speed** 0-10 km/h = Sitting, 10-15 km/h = Standing, 15-20 km/h = Walking, >20 km/h = Uncomfortable
Pedestrian Safety	**0.1% exceedance wind speed** 0-90 km/h = Safe

TABLE A1: SUMMARY OF PEDESTRIAN COMFORT (EXISTING SCENARIO)

Sensor	Pedestrian Comfort				Pedestrian Safety	
	Summer		Winter		Annual	
	Wind Speed	Comfort Class	Wind Speed	Comfort Class	Wind Speed	Safety Class
1	15.5	Walking	18.8	Walking	53.9	Safe
2	16.5	Walking	20.8	Uncomfortable	59.2	Safe
3	16.9	Walking	21.7	Uncomfortable	62.8	Safe
4	15.2	Walking	19.6	Walking	56.0	Safe
5	15.7	Walking	21.1	Uncomfortable	59.9	Safe
6	14.8	Standing	19.7	Walking	55.0	Safe
7	12.9	Standing	18.7	Walking	53.9	Safe
8	14.2	Standing	19.3	Walking	55.7	Safe
9	15.7	Walking	20.2	Uncomfortable	56.9	Safe
10	15.5	Walking	19.3	Walking	57.5	Safe
11	14.8	Standing	19.0	Walking	53.9	Safe
12	16.1	Walking	21.5	Uncomfortable	59.1	Safe
13	14.5	Standing	20.6	Uncomfortable	58.0	Safe
14	17.2	Walking	22.6	Uncomfortable	63.1	Safe
15	17.1	Walking	21.9	Uncomfortable	58.7	Safe
16	16.8	Walking	22.2	Uncomfortable	59.8	Safe
17	16.3	Walking	22.1	Uncomfortable	61.8	Safe
18	16.3	Walking	21.3	Uncomfortable	58.9	Safe
19	16.7	Walking	21.9	Uncomfortable	59.1	Safe
20	16.9	Walking	21.6	Uncomfortable	59.3	Safe
21	14.3	Standing	18.2	Walking	50.6	Safe
22	16.9	Walking	21.7	Uncomfortable	59.4	Safe
23	16.2	Walking	21.2	Uncomfortable	56.3	Safe
24	17.4	Walking	22.3	Uncomfortable	59.6	Safe
25	16.9	Walking	21.3	Uncomfortable	60.0	Safe
26	14.6	Standing	19.6	Walking	53.9	Safe
27	15.9	Walking	19.3	Walking	55.1	Safe
28	16.5	Walking	20.3	Uncomfortable	56.2	Safe
29	17.0	Walking	21.9	Uncomfortable	63.0	Safe
30	10.9	Standing	16.3	Walking	49.3	Safe
31	13.4	Standing	19.2	Walking	54.8	Safe
32	7.5	Sitting	9.5	Sitting	29.8	Safe
33	10.9	Standing	13.9	Standing	51.0	Safe
34	12.2	Standing	16.0	Walking	48.3	Safe

Guidelines	
Pedestrian Comfort	**20% exceedance wind speed** 0-10 km/h = Sitting, 10-15 km/h = Standing, 15-20 km/h = Walking, >20 km/h = Uncomfortable
Pedestrian Safety	**0.1% exceedance wind speed** 0-90 km/h = Safe

TABLE A2: SUMMARY OF PEDESTRIAN COMFORT (EXISTING SCENARIO)

Sensor	Pedestrian Comfort				Pedestrian Safety	
	Summer		Winter		Annual	
	Wind Speed	Comfort Class	Wind Speed	Comfort Class	Wind Speed	Safety Class
35	12.8	Standing	16.4	Walking	47.4	Safe
36	12.3	Standing	15.8	Walking	46.4	Safe
37	11.0	Standing	14.0	Standing	42.8	Safe
38	10.0	Sitting	12.1	Standing	41.7	Safe
39	15.7	Walking	18.8	Walking	61.7	Safe
40	15.8	Walking	20.6	Uncomfortable	61.7	Safe
41	17.0	Walking	22.4	Uncomfortable	67.5	Safe
42	16.6	Walking	21.6	Uncomfortable	61.0	Safe
43	16.1	Walking	21.2	Uncomfortable	63.1	Safe
44	16.0	Walking	21.3	Uncomfortable	61.0	Safe
45	15.3	Walking	20.7	Uncomfortable	59.4	Safe
46	15.1	Walking	20.5	Uncomfortable	58.5	Safe
47	15.4	Walking	20.8	Uncomfortable	59.9	Safe
48	15.7	Walking	21.1	Uncomfortable	59.2	Safe
49	15.6	Walking	21.0	Uncomfortable	61.2	Safe
50	16.4	Walking	21.7	Uncomfortable	59.7	Safe
51	16.5	Walking	22.2	Uncomfortable	61.0	Safe
52	16.4	Walking	22.1	Uncomfortable	62.3	Safe
53	13.7	Standing	17.7	Walking	48.8	Safe
54	15.3	Walking	21.0	Uncomfortable	58.3	Safe
55	14.5	Standing	20.0	Walking	59.3	Safe
56	12.6	Standing	17.5	Walking	53.9	Safe

APPENDIX B

PEDESTRIAN COMFORT SUITABILITY, TABLES B1-B3
(PROPOSED SCENARIO)

Guidelines	
Pedestrian Comfort	**20% exceedance wind speed** 0-10 km/h = Sitting, 10-15 km/h = Standing, 15-20 km/h = Walking, >20 km/h = Uncomfortable
Pedestrian Safety	**0.1% exceedance wind speed** 0-90 km/h = Safe

TABLE B1: SUMMARY OF PEDESTRIAN COMFORT (PROPOSED SCENARIO)

Sensor	Pedestrian Comfort				Pedestrian Safety	
	Summer		Winter		Annual	
	Wind Speed	Comfort Class	Wind Speed	Comfort Class	Wind Speed	Safety Class
1	12.1	Standing	13.6	Standing	52.7	Safe
2	13.1	Standing	15.4	Walking	51.2	Safe
3	13.1	Standing	15.0	Standing	50.2	Safe
4	15.6	Walking	18.2	Walking	60.6	Safe
5	13.3	Standing	14.7	Standing	54.0	Safe
6	14.3	Standing	18.7	Walking	59.1	Safe
7	16.0	Walking	21.0	Uncomfortable	64.4	Safe
8	13.0	Standing	19.2	Walking	65.8	Safe
9	13.6	Standing	19.8	Walking	56.4	Safe
10	14.1	Standing	19.4	Walking	52.9	Safe
11	13.2	Standing	17.8	Walking	53.4	Safe
12	12.1	Standing	16.1	Walking	47.6	Safe
13	12.8	Standing	18.2	Walking	53.1	Safe
14	15.8	Walking	20.6	Uncomfortable	59.0	Safe
15	16.1	Walking	20.3	Uncomfortable	55.4	Safe
16	15.0	Standing	19.4	Walking	54.9	Safe
17	12.3	Standing	15.7	Walking	48.4	Safe
18	10.7	Standing	13.1	Standing	43.6	Safe
19	13.7	Standing	16.6	Walking	50.0	Safe
20	15.2	Walking	18.8	Walking	53.9	Safe
21	14.0	Standing	16.1	Walking	52.4	Safe
22	15.1	Walking	18.4	Walking	52.3	Safe
23	15.3	Walking	19.0	Walking	53.4	Safe
24	16.9	Walking	21.2	Uncomfortable	57.8	Safe
25	16.5	Walking	20.7	Uncomfortable	59.2	Safe
26	13.7	Standing	18.2	Walking	51.9	Safe
27	15.8	Walking	19.2	Walking	56.7	Safe
28	16.1	Walking	20.4	Uncomfortable	59.4	Safe
29	17.4	Walking	22.7	Uncomfortable	69.4	Safe
30	12.0	Standing	17.3	Walking	57.1	Safe
31	11.9	Standing	18.2	Walking	57.9	Safe
32	7.7	Sitting	10.7	Standing	41.0	Safe
33	9.0	Sitting	12.8	Standing	50.7	Safe
34	9.9	Sitting	15.4	Walking	56.6	Safe
35	9.1	Sitting	11.6	Standing	53.2	Safe

Guidelines	
Pedestrian Comfort	**20% exceedance wind speed** 0-10 km/h = Sitting, 10-15 km/h = Standing, 15-20 km/h = Walking, >20 km/h = Uncomfortable
Pedestrian Safety	**0.1% exceedance wind speed** 0-90 km/h = Safe

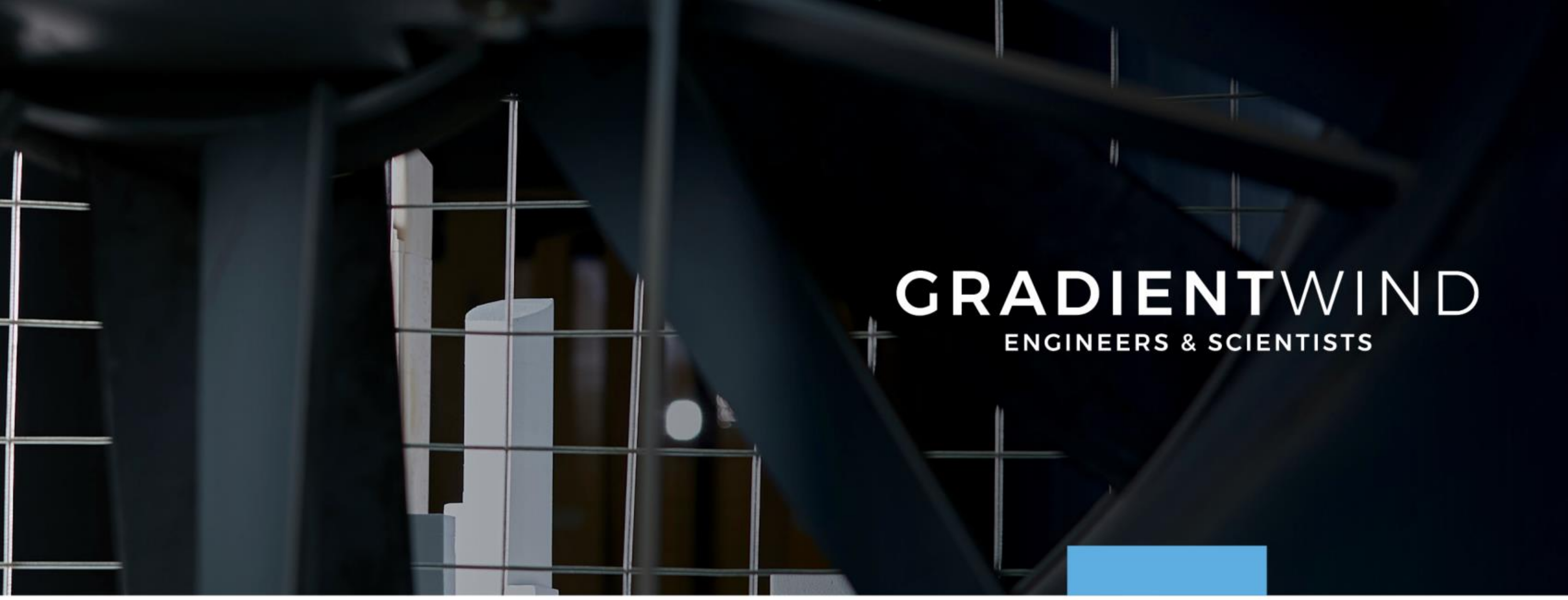
TABLE B2: SUMMARY OF PEDESTRIAN COMFORT (PROPOSED SCENARIO)

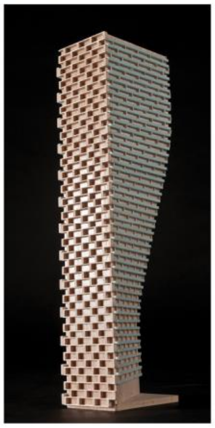
Sensor	Pedestrian Comfort				Pedestrian Safety	
	Summer		Winter		Annual	
	Wind Speed	Comfort Class	Wind Speed	Comfort Class	Wind Speed	Safety Class
36	7.9	Sitting	9.8	Sitting	41.3	Safe
37	7.0	Sitting	8.6	Sitting	30.7	Safe
38	8.3	Sitting	9.8	Sitting	35.8	Safe
39	8.7	Sitting	10.1	Standing	37.5	Safe
40	10.1	Standing	12.0	Standing	43.7	Safe
41	6.0	Sitting	7.6	Sitting	27.4	Safe
42	5.8	Sitting	7.2	Sitting	25.3	Safe
43	6.2	Sitting	7.8	Sitting	27.2	Safe
44	7.5	Sitting	9.0	Sitting	35.0	Safe
45	7.6	Sitting	9.2	Sitting	47.1	Safe
46	12.7	Standing	15.5	Walking	59.9	Safe
47	8.1	Sitting	10.9	Standing	44.1	Safe
48	7.2	Sitting	9.2	Sitting	36.8	Safe
49	9.7	Sitting	12.8	Standing	59.1	Safe
50	11.9	Standing	17.9	Walking	60.4	Safe
51	10.0	Sitting	12.7	Standing	48.0	Safe
52	9.2	Sitting	11.3	Standing	44.9	Safe
53	9.8	Sitting	12.1	Standing	46.3	Safe
54	11.5	Standing	14.7	Standing	49.2	Safe
55	8.2	Sitting	11.0	Standing	39.4	Safe
56	8.6	Sitting	10.5	Standing	38.2	Safe
57	6.3	Sitting	8.2	Sitting	31.2	Safe
58	6.6	Sitting	8.6	Sitting	34.2	Safe
59	12.3	Standing	14.0	Standing	52.6	Safe
60	13.5	Standing	16.7	Walking	59.2	Safe
61	17.3	Walking	22.7	Uncomfortable	82.1	Safe
62	8.8	Sitting	11.3	Standing	48.3	Safe
63	11.3	Standing	16.9	Walking	60.2	Safe
64	8.5	Sitting	11.3	Standing	43.0	Safe
65	7.1	Sitting	9.2	Sitting	39.4	Safe
66	10.2	Standing	13.7	Standing	45.7	Safe
67	10.7	Standing	14.8	Standing	53.2	Safe
68	7.2	Sitting	9.7	Sitting	37.0	Safe
69	10.2	Standing	14.0	Standing	56.2	Safe
70	8.7	Sitting	11.6	Standing	46.6	Safe

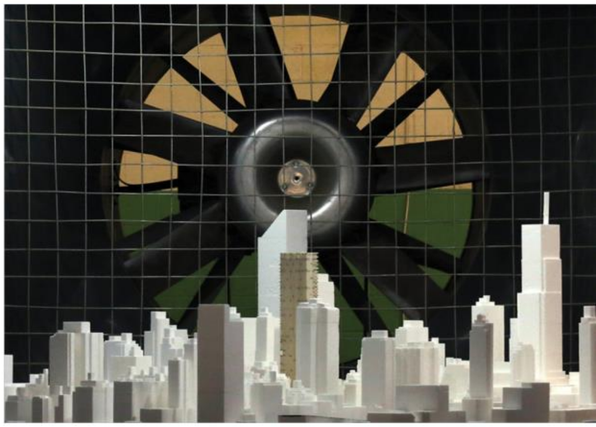
Guidelines	
Pedestrian Comfort	**20% exceedance wind speed** 0-10 km/h = Sitting, 10-15 km/h = Standing, 15-20 km/h = Walking, >20 km/h = Uncomfortable
Pedestrian Safety	**0.1% exceedance wind speed** 0-90 km/h = Safe

TABLE B3: SUMMARY OF PEDESTRIAN COMFORT (PROPOSED SCENARIO)

Sensor	Pedestrian Comfort				Pedestrian Safety	
	Summer		Winter		Annual	
	Wind Speed	Comfort Class	Wind Speed	Comfort Class	Wind Speed	Safety Class
71	7.1	Sitting	9.4	Sitting	37.7	Safe
72	10.8	Standing	15.1	Walking	57.1	Safe
73	7.8	Sitting	9.8	Sitting	37.4	Safe
74	8.5	Sitting	12.0	Standing	45.0	Safe
75	10.9	Standing	15.7	Walking	54.8	Safe
76	7.5	Sitting	9.7	Sitting	34.0	Safe
77	7.2	Sitting	9.7	Sitting	35.4	Safe
78	7.4	Sitting	9.8	Sitting	34.1	Safe
79	8.0	Sitting	10.3	Standing	40.4	Safe
80	12.8	Standing	15.7	Walking	70.4	Safe
81	11.2	Standing	13.6	Standing	53.3	Safe
82	12.7	Standing	17.0	Walking	72.5	Safe
83	13.3	Standing	17.7	Walking	75.6	Safe
84	10.7	Standing	14.7	Standing	51.0	Safe
85	6.9	Sitting	8.9	Sitting	36.7	Safe
86	11.9	Standing	15.1	Walking	53.4	Safe
87	NOT TESTED					
88	8.4	Sitting	10.5	Standing	36.8	Safe







APPENDIX C

WIND TUNNEL SIMULATION OF THE NATURAL WIND

WIND TUNNEL SIMULATION OF THE NATURAL WIND

Wind flowing over the surface of the earth develops a boundary layer due to the drag produced by surface features such as vegetation and man-made structures. Within this boundary layer, the mean wind speed varies from zero at the surface to the gradient wind speed at the top of the layer. The height of the top of the boundary layer is referred to as the gradient height, above which the velocity remains more-or-less constant for a given synoptic weather system. The mean wind speed is taken to be the average value over one hour. Superimposed on the mean wind speed are fluctuating (or turbulent) components in the longitudinal (i.e. along wind), vertical and lateral directions. Although turbulence varies according to the roughness of the surface, the turbulence level generally increases from nearly zero (smooth flow) at gradient height to maximum values near the ground. While for a calm ocean the maximum could be 20%, the maximum for a very rough surface such as the center of a city could be 100%, or equal to the local mean wind speed. The height of the boundary layer varies in time and over different terrain roughness within the range of 400 metres (m) to 600 m.

Simulating real wind behaviour in a wind tunnel requires simulating the variation of mean wind speed with height, simulating the turbulence intensity, and matching the typical length scales of turbulence. It is the ratio between wind tunnel turbulence length scales and turbulence scales in the atmosphere that determines the geometric scales that models can assume in a wind tunnel. Hence, when a 1:200 scale model is quoted, this implies that the turbulence scales in the wind tunnel and the atmosphere have the same ratios. Some flexibility in this requirement has been shown to produce reasonable wind tunnel predictions compared to full scale. In model scale the mean and turbulence characteristics of the wind are obtained with the use of spires at one end of the tunnel and roughness elements along the floor of the tunnel. The fan is located at the model end and wind is pulled over the spires, roughness elements and model. It has been found that, to a good approximation, the mean wind profile can be represented by a power law relation, shown below, giving height above ground versus wind speed.

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

Where; ***U*** = mean wind speed, U_g = gradient wind speed, ***Z*** = height above ground, Z_g = depth of the boundary layer (gradient height) and α is the power law exponent.

Figure B1 on the following page plots three velocity profiles for open country, and suburban and urban exposures.

The exponent α varies according to the type of upwind terrain; α ranges from 0.14 for open country to 0.33 for an urban exposure. Figure C2 illustrates the theoretical variation of turbulence for open country, suburban and urban exposures.

The integral length scale of turbulence can be thought of as an average size of gust in the atmosphere. Although it varies with height and ground roughness, it has been found to generally be in the range of 100 m to 200 m in the upper half of the boundary layer. Thus, for a 1:300 scale, the model value should be between 1/3 and 2/3 of a metre. Integral length scales are derived from power spectra, which describe the energy content of wind as a function of frequency. There are several ways of determining integral length scales of turbulence. One way is by comparison of a measured power spectrum in model scale to a non-dimensional theoretical spectrum such as the Davenport spectrum of longitudinal turbulence. Using the Davenport spectrum, which agrees well with full-scale spectra, one can estimate the integral scale by plotting the theoretical spectrum with varying L until it matches as closely as possible the measured spectrum:

$$f \times S(f) = \frac{\dfrac{4(Lf)^2}{U_{10}{}^2}}{\left[1 + \dfrac{4(Lf)^2}{U_{10}{}^2}\right]^{\frac{4}{3}}}$$

Where, f is frequency, S(f) is the spectrum value at frequency f, U10 is the wind speed 10 m above ground level, and L is the characteristic length of turbulence.

Once the wind simulation is correct, the model, constructed to a suitable scale, is installed at the center of the working section of the wind tunnel. Different wind directions are represented by rotating the model to align with the wind tunnel center-line axis.

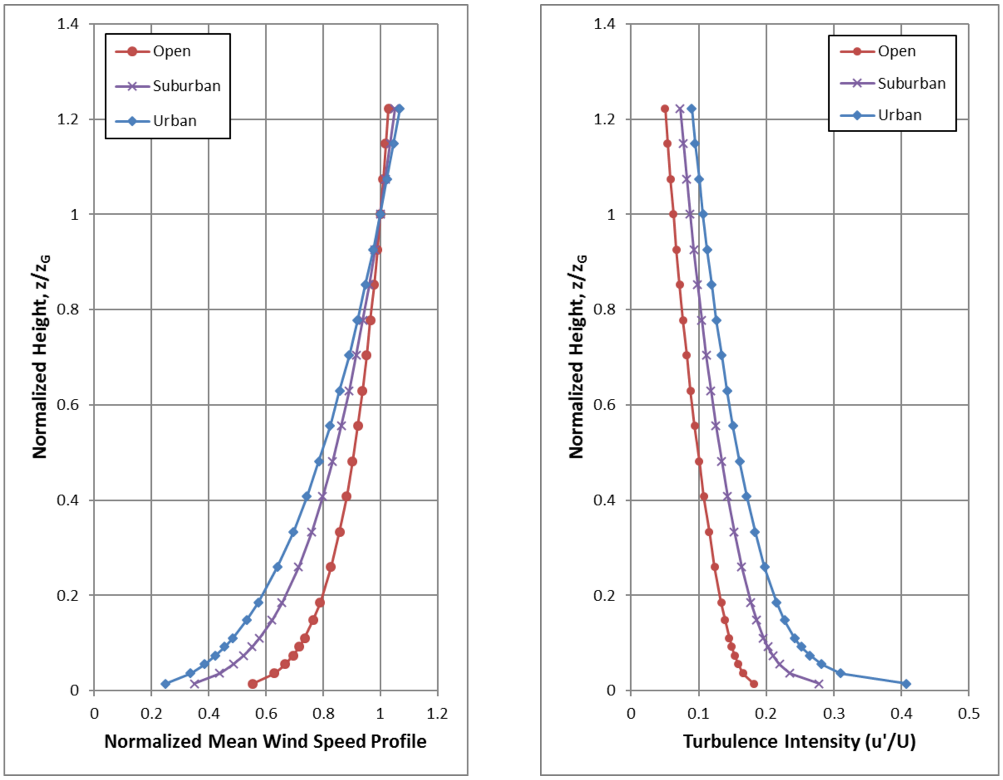


**FIGURE C1 (LEFT): MEAN WIND SPEED PROFILES;
FIGURE C2 (RIGHT): TURBULENCE INTENSITY PROFILES**

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3. ESDU, ‘Characteristics of Atmospheric Turbulence Near the Ground’, 74030

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APPENDIX D

PEDESTRIAN LEVEL WIND MEASUREMENT METHODOLOGY

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PEDESTRIAN LEVEL WIND MEASUREMENT METHODOLOGY

Pedestrian level wind studies are performed in a wind tunnel on a physical model of the study buildings at a suitable scale. Instantaneous wind speed measurements are recorded at a model height corresponding to 1.5 m full scale using either a hot wire anemometer or a pressure-based transducer. Measurements are performed at any number of locations on the model and usually for 36 wind directions. For each wind direction, the roughness of the upwind terrain is matched in the wind tunnel to generate the correct mean and turbulent wind profiles approaching the model.

The hot wire anemometer is an instrument consisting of a thin metallic wire conducting an electric current. It is an omni-directional device equally sensitive to wind approaching from any direction in the horizontal plane. By compensating for the cooling effect of wind flowing over the wire, the associated electronics produce an analog voltage signal that can be calibrated against velocity of the air stream. For all measurements, the wire is oriented vertically so as to be sensitive to wind approaching from all directions in a horizontal plane.

The pressure sensor is a small cylindrical device that measures instantaneous pressure differences over a small area. The sensor is connected via tubing to a transducer that translates the pressure to a voltage signal that is recorded by computer. With appropriately designed tubing, the sensor is sensitive to a suitable range of fluctuating velocities.

For a given wind direction and location on the model, a time history of the wind speed is recorded for a period of time equal to one hour in full-scale. The analog signal produced by the hot wire or pressure sensor is digitized at a rate of 400 samples per second. A sample recording for several seconds is illustrated in Figure D1. This data is analyzed to extract the mean, root-mean-square (rms) and the peak of the signal. The peak value, or gust wind speed, is formed by averaging a number of peaks obtained from sub-intervals of the sampling period. The mean and gust speeds are then normalized by the wind tunnel gradient wind speed, which is the speed at the top of the model boundary layer, to obtain mean and gust ratios. At each location, the measurements are repeated for 36 wind directions to produce normalized polar plots, which will be provided upon request.

In order to determine the duration of various wind speeds at full scale for a given measurement location the gust ratios are combined with a statistical (mathematical) model of the wind climate for the project site. This mathematical model is based on hourly wind data obtained from one or more meteorological stations (usually airports) close to the project location. The probability model used to represent the data is the Weibull distribution expressed as:

$$P\left(>U_g\right) = A_\theta \bullet \exp\left[\left(-\frac{U_g}{C\theta}\right)^{K\theta}\right]$$

Where,

$P (> U_g)$ is the probability, fraction of time, that the gradient wind speed **U_g** is exceeded; **θ** is the wind direction measured clockwise from true north, ***A***, ***C***, ***K*** are the Weibull coefficients, (Units: A - dimensionless, C - wind speed units [km/h] for instance, K - dimensionless). **A_θ** is the fraction of time wind blows from a 10° sector centered on θ.

Analysis of the hourly wind data recorded for a length of time, on the order of 10 to 30 years, yields the **A_θ**, **C_θ** and **K_θ** values. The probability of exceeding a chosen wind speed level, say 20 km/h, at sensor *N* is given by the following expression:

$$P_N(>20) = \Sigma_\theta P\left[\frac{(>20)}{\left(\frac{U_N}{U_g}\right)}\right]$$

$$P_N\,(>20) \quad = \quad \Sigma_\theta\, P\,\{>20/(U_N/Ug)\}$$

Where, **U_N/U_g** is the gust velocity ratios, where the summation is taken over all 36 wind directions at 10° intervals.

If there are significant seasonal variations in the weather data, as determined by inspection of the C_θ and K_θ values, then the analysis is performed separately for two or more times corresponding to the groupings of seasonal wind data. Wind speed levels of interest for predicting pedestrian comfort are based on the comfort guidelines chosen to represent various pedestrian activity levels as discussed in the main text.

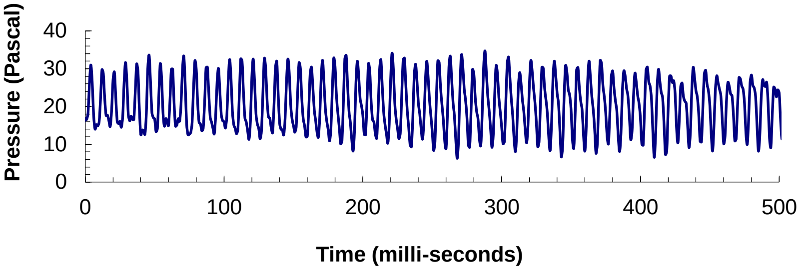

FIGURE D1: TIME VERSUS VELOCITY TRACE FOR A TYPICAL WIND SENSOR

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