REPORT

65 & 71 AGNES STREET

MISSISSAUGA, ON

PEDESTRIAN WIND STUDY
RWDI # 2102814
May 5, 2022

SUBMITTED TO

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EXECUTIVE SUMMARY

RWDI was retained to conduct a pedestrian wind assessment for the proposed 65 to 71 Agnes Street project in Mississauga, ON. Based on our wind-tunnel testing for the proposed project under the Existing and Proposed configurations, and the local wind records, the potential wind comfort and safety conditions are predicted as shown on site plans in Figures 1A through 2B, while the associated wind speeds are listed in Table 1. These results can be summarized as follows:

- Wind gusts that could affect pedestrian safety are not expected at any areas on and around the site in both the Existing and Proposed configurations.

- Existing wind conditions on and around the site are comfortable for the intended pedestrian use throughout the year.

- With the proposed project in place, wind conditions are predicted to remain generally suitable for the intended use of various grade level pedestrian areas throughout the year. Uncomfortable wind speeds are expected in a localized area at the southwest corner of the building during the winter.

- At the Level 4 outdoor amenity terrace, during the summer, appropriate wind conditions are predicted in the eastern half of the terrace while higher-than-desired wind speeds are predicted on the other half.

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1 INTRODUCTION

RWDI was retained to conduct a pedestrian wind assessment for the proposed 65 and 71 Agnes Street project in Mississauga, ON. This report presents the project objectives, background and approach, and discusses of the results from RWDI's assessment and provides conceptual wind control measures, where necessary.

1.1 Project Description

The project (site shown in Image 1) is located at the northwest intersection of Agnes Street and Cook Street. The project consists of a 29-storey residential building, with an outdoor amenity terrace on Level 4, on an existing lawn space.

1.2 Objectives

The objective of the study was to assess the effect of the proposed development on local conditions in pedestrian areas on and around the study site and provide recommendations for minimizing adverse effects, if needed. This quantitative assessment was based on wind speed measurements on a scale model of the project and its surroundings in one of RWDI's boundary-layer wind tunnels. These measurements were combined with the local wind records and compared to the Mississauga criteria for gauging wind comfort and safety in pedestrian areas. The assessment focused on critical pedestrian areas, including building entrances, public sidewalks and outdoor amenity areas.

Image 1: Aerial View of Existing Site and Surroundings (Photo Courtesy of Google™ Earth)

2 BACKGROUND AND APPROACH

2.1 Wind Tunnel Study Model

To assess the wind environment around the proposed project, a 1:300 scale model of the project site and surroundings was constructed for the wind tunnel tests of the following configurations:

A - Existing: Existing site and surroundings (Image 2A), and,

B - Proposed: Proposed project with existing surroundings (Image 2B).

The wind tunnel model included all relevant surrounding buildings and topography within an approximately 360m radius of the study site. The wind and turbulence profiles in the atmospheric boundary layer beyond the modelled area were also simulated in RWDI's wind tunnel. The wind tunnel model was instrumented with 68 wind speed sensors (i.e., 60 at grade and 8 on the Level 4 outdoor amenity area) to measure mean and gust speeds at a full-scale height of approximately 1.5 m above local grade in pedestrian areas throughout the study site. Wind speeds were measured for 36 directions in 10-degree increment. The measurements at each sensor location were recorded in the form of ratios of local mean and gust speeds to the mean wind speed at a reference height above the model. The placement of wind measurement locations was based on our experience and understanding of the pedestrian usage for this site and reviewed by the design team.

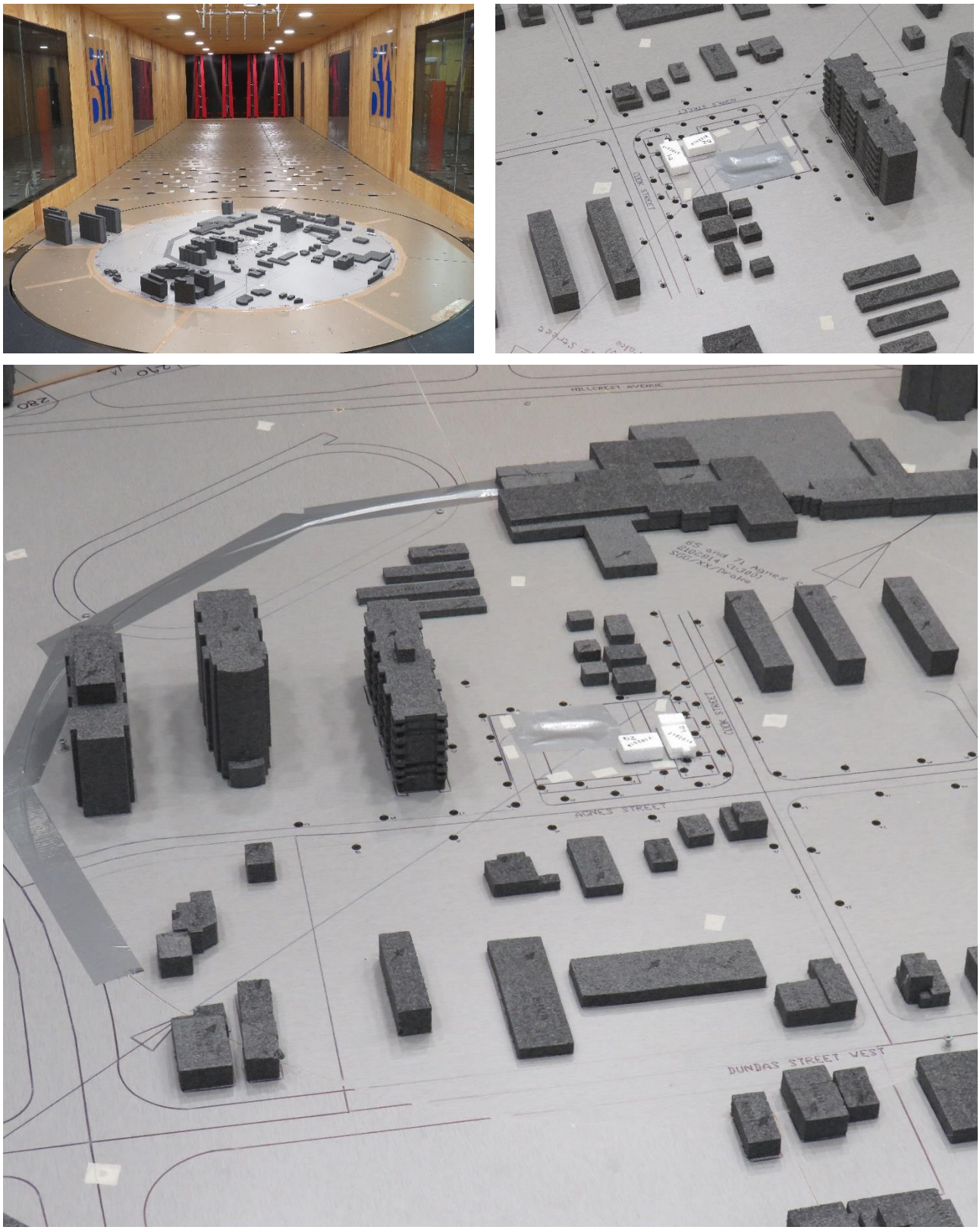


Image 2A: Wind Tunnel Study Model – Existing Configuration

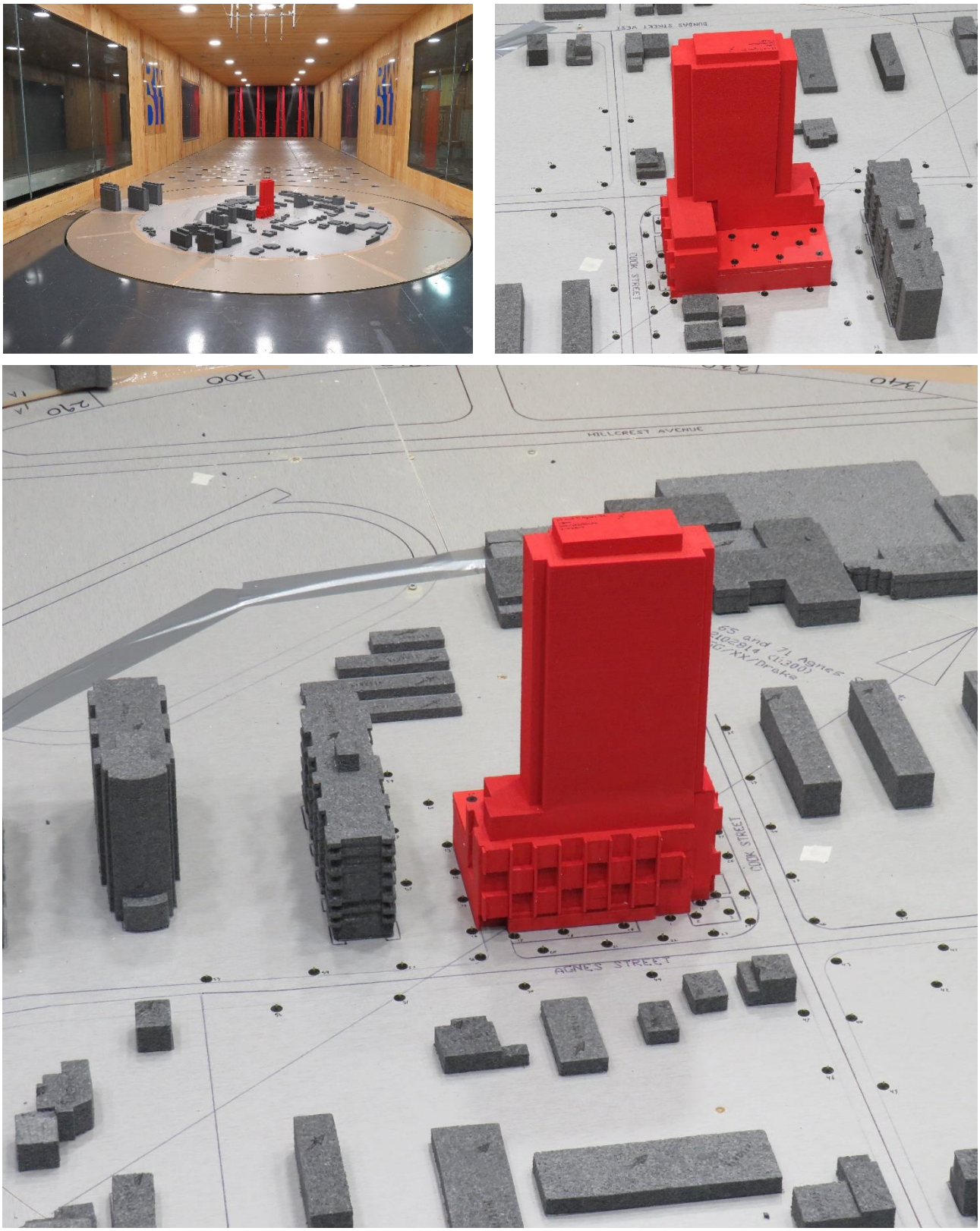
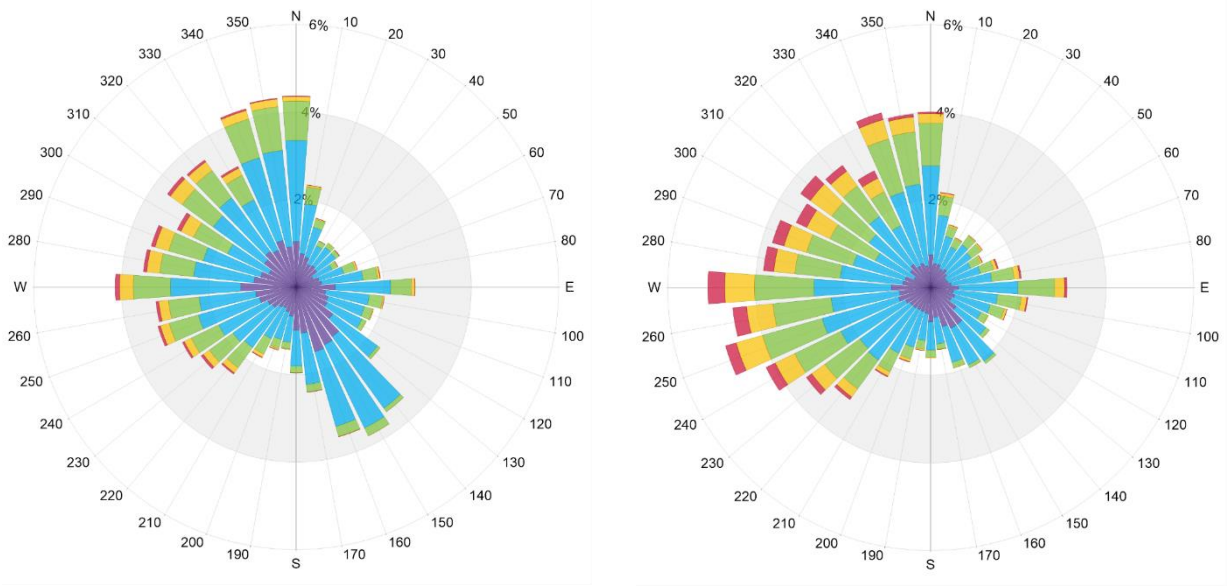


Image 2B: Wind Tunnel Study Model – Proposed Configuration

2.2 Meteorological Data

Wind statistics recorded at Toronto Pearson International Airport between 1990 and 2020, inclusive, were analyzed for the summer (May through October) and winter (November through April) seasons. Image 3 graphically depicts the directional distributions of wind frequencies and speeds for these two seasons. Winds from the southwest, west and northwest directions are predominant during both summer and winter. During the winter season, the prevailing winds from the east direction are also frequent, as indicated by the wind roses. The southeast winds are frequent in the summer, but typically of low wind speeds. Strong winds of a mean speed greater than 30 km/h measured at the airport (at an anemometer height of 10 m) occur for 4.8% and 11.4% of the time during the summer and winter seasons, respectively.

Wind statistics were combined with the wind tunnel data to predict the frequency of occurrence of full-scale wind speeds. The full-scale wind predictions were then compared with the wind criteria for pedestrian comfort and safety.



Summer (May – October) **Winter (November – April)**

Wind Speed (km/h)	Probability (%) Summer	Winter
Calm	5.3	3.7
1-10	30.7	22.5
11-20	42.9	39.9
21-30	16.2	22.6
31-40	3.9	8.1
>40	0.9	3.3

Image 3: Directional Distribution of Winds Approaching Toronto Pearson International Airport between 1990 and 2020

2.3 Mississauga Pedestrian Wind Criteria

The Mississauga pedestrian wind criteria, developed in June 2014, are specified in the Urban Design Terms of Reference, "Pedestrian Wind Comfort and Safety Studies". The following defines the criterion in detail.

Comfort Category	GEM Speed (km/h)	Description
Sitting	≤ 10	Calm or light breezes desired for outdoor restaurants and seating areas where one can read a paper without having it blown away
Standing	≤ 15	Gentle breezes suitable for main building entrances and bus stops
Walking	≤ 20	Relatively high speeds that can be tolerated if one's objective is to walk, run or cycle without lingering
Uncomfortable	> 20	Strong winds of this magnitude are considered a nuisance for most activities, and wind mitigation is typically recommended

Notes:
(1) GEM Speed = max (Mean Speed, Gust Speed/1.85) and Gust Speed = Mean Speed + 3*RMS Speed,
(2) GEM speeds listed above are based on a seasonal exceedance of 20% of the time between 6:00 and 23:00.

Safety Criterion	Gust Speed (km/h)	Description
Exceeded	> 90	Excessive gust speeds that can adversely affect a pedestrian's balance and footing. Wind mitigation is typically required.

Notes:
(1) Based on an annual exceedance of 9 hours or 0.1% of the time for 24 hours a day.

3 RESULTS AND DISCUSSION

The predicted wind conditions are shown on site plans in Figures 1A through 2B, located in the "Figures" section of this report. These conditions and the associated wind speeds are also presented in Table 1, located in the "Tables" section.

In general, wind conditions comfortable for walking are appropriate for sidewalks and walkways as pedestrians will be active and less likely to remain in one area for prolonged periods of time. Lower wind speeds, conducive to sitting or standing, are preferred at building entrances where pedestrians are apt to linger. These low wind speeds are also suitable for areas such as outdoor amenities, where passive patron activities are anticipated, during the summer. The following is a detailed discussion of the suitability of the predicted wind conditions for the anticipated pedestrian use of each area of interest.

Wind conditions that meet the safety criterion are predicted at all locations for all configurations assessed.

3.1 Existing Configuration

Existing wind speeds on and around the site are generally calm and comfortable for sitting or standing in the summer (Figure 1A) and for walking or more passive use in the winter (Figure 2A). These conditions are considered appropriate for the intended pedestrian usage.

3.2 Proposed Configuration

3.2.1 Grade Level (Locations 1 through 60)

The addition of the proposed project to the site is generally expected to cause slightly higher wind speeds, compared to the Existing configuration, primarily because the proposed building is much taller relative to its surroundings. However, the podium, the articulated façade and tower setbacks are positive design features that will reduce the impact of winds redirected by the building towards the grade level.

During the summer, wind conditions on and around the site are generally predicted to be comfortable for walking or more passive use in most areas (Figure 1B), with wind speeds near the perimeter of the building expected to be generally comfortable for sitting or standing, which is appropriate.

During the winter, seasonally stronger winds are expected to cause increased wind speeds on and around the site (Figure 2B). Wind conditions comfortable for walking or standing are expected in most areas, which is appropriate, except for two locations near the southwest corner of the building where uncomfortable conditions are predicted (Locations 16 and 56 in Figure 2B). Uncomfortable conditions in the winter stem primarily from northwesterly through southwesterly prevailing winds channelling between the proposed building and the neighboring 96 Agnes Street building and further accelerating around the building corner. As noted earlier, the podium, the articulated façade and tower setbacks are all positive for wind control, and increased wind activity would be expected in their absence.

Reduced wind speeds at the southwest corner of the building can be achieved by adding windscreens or dense coniferous or marcescent landscaping between the proposed building and the 96 Agnes Street building. Deciduous

landscaping would shed their foliage during the winter months, when potentially adverse wind conditions are predicted, and would only provide minimal wind protection during the winter. Examples of windscreens and coniferous landscaping are shown in Image 4.

Image 4: Examples of Coniferous Landscaping (Top) and Windscreens (Bottom)

The main entrance of the building is located near Location 1 in Figures 1B and 2B. Wind conditions at this entrance are predicted to be comfortable for sitting in the summer and standing in the winter, which is suitable for an entrance location.

3.2.2 Level 4 Outdoor Amenity Terrace (Locations 61 to 68)

It is generally desirable for wind conditions on outdoor amenities intended for passive activities to be comfortable for sitting or standing more than 80% of the time in the summer. During the winter, these areas would not be used frequently, thus, increased wind activity would be considered acceptable.

During the summer, wind conditions comfortable for sitting or standing are generally predicted on the eastern side of the Level 4 outdoor amenity area (Locations 64 to 68 in Figure 1B); however, slightly higher wind speeds are predicted on the western side of the space (see conditions comfortable for walking at Locations 61 to 63).

Lower wind speeds on the terrace can be achieved with a combination of vertical and horizontal mitigation features such as tall parapets, windscreens, landscaping and trellises. RWDI can provide further guidance on the placement of wind control measures as the design and programming of the terrace evolves. Examples of wind control measures are shown in Image 5 below.

During the winter, generally higher wind speeds on the Level 4 terrace, including potentially uncomfortable conditions at one location, may be anticipated (Figure 2B); however, this may not be a concern as this area may not be used frequently during the colder months.

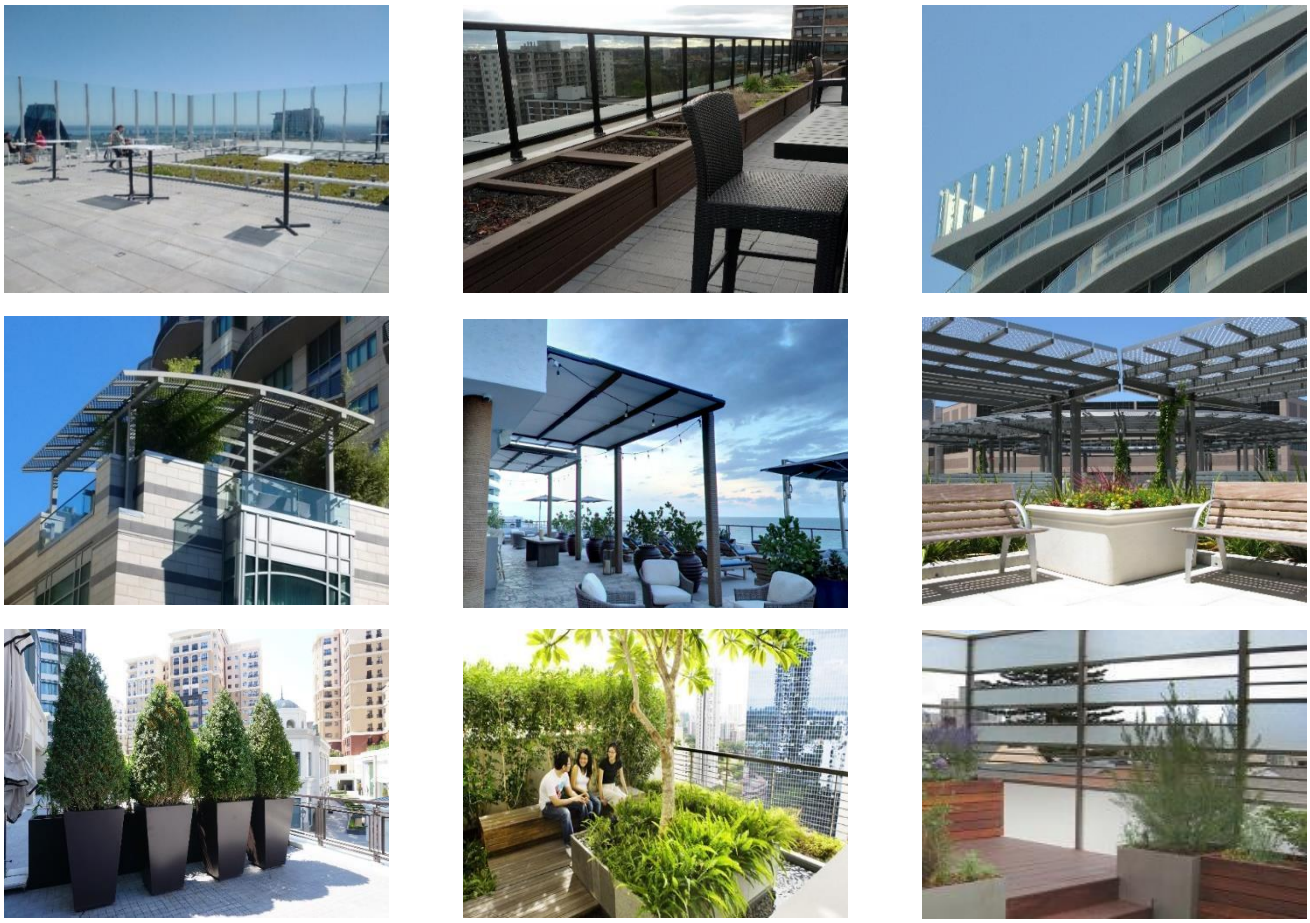


Image 5: Examples of Potential Wind Control Measures for the Level 4 Amenity Terrace

4 APPLICABILITY OF RESULTS

The wind conditions presented in this report pertain to the model of the 65-71 Agnes Street project constructed using the drawings and information listed below. Should there be any design changes that deviate from this list of drawings, the wind condition predictions presented may change. Therefore, if changes in the design are made, it is recommended that RWDI be contacted and requested to review their potential effects on wind conditions.

File Name	File Type	Date Received (dd/mm/yyyy)
2022-03-25_65 Agnes_ZBL Arch Coordination Set	PDF	29/03/2022
2022-03-28_65 Agnes-ZBL Architectural Coordination Set_CAD	CAD	29/03/2022

5 REFERENCES

1. ASCE Task Committee on Outdoor Human Comfort (2004). *Outdoor Human Comfort and Its Assessment*, 68 pages, American Society of Civil Engineers, Reston, Virginia, USA.

2. Williams, C.J., Hunter, M.A. and Waechter, W.F. (1990). "Criteria for Assessing the Pedestrian Wind Environment," *Journal of Wind Engineering and Industrial Aerodynamics*, Vol.36, pp.811-815.

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6. Williams, C.J., Wu, H., Waechter, W.F. and Baker, H.A. (1999). "Experiences with Remedial Solutions to Control Pedestrian Wind Problems," *Tenth International Conference on Wind Engineering*, Copenhagen, Denmark.

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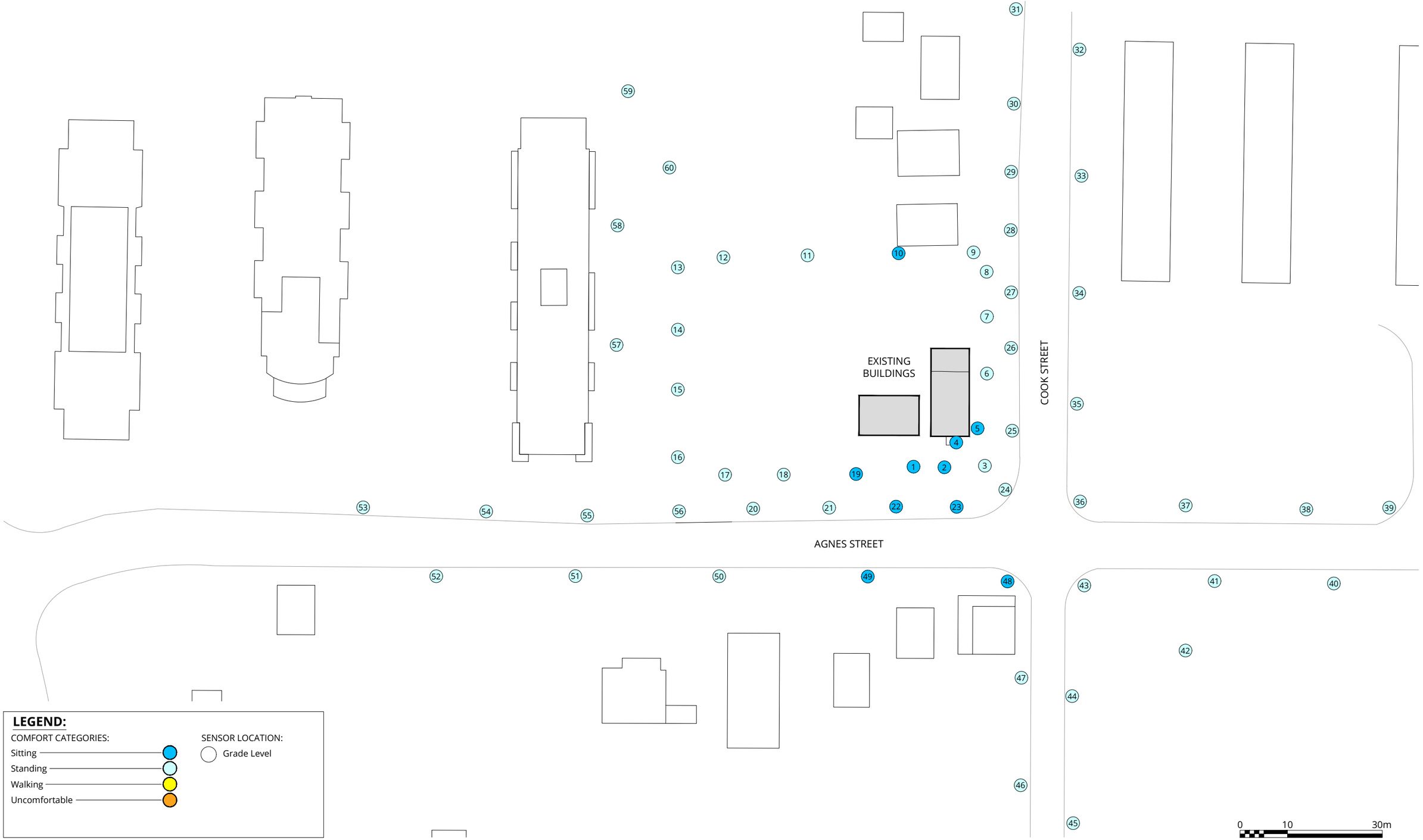
9. Wu, H. and Kriksic, F. (2012). "Designing for Pedestrian Comfort in Response to Local Climate", *Journal of Wind Engineering and Industrial Aerodynamics*, Vol.104-106, pp.397-407.

10. Wu, H., Williams, C.J., Baker, H.A. and Waechter, W.F. (2004), "Knowledge-based Desk-Top Analysis of Pedestrian Wind Conditions", *ASCE Structure Congress 2004,* Nashville, Tennessee.

FIGURES



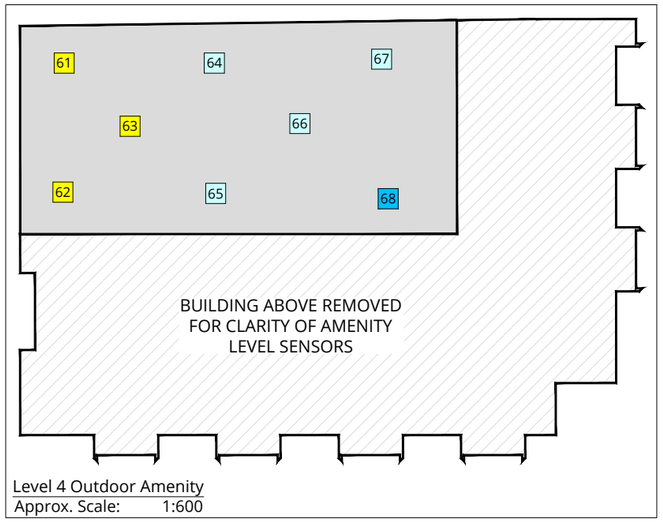
Pedestrian Wind Comfort Conditions
Existing Configuration
Summer (May to October, 6:00 to 23:00)

65 and 71 Agnes Street - Mississauga, ON

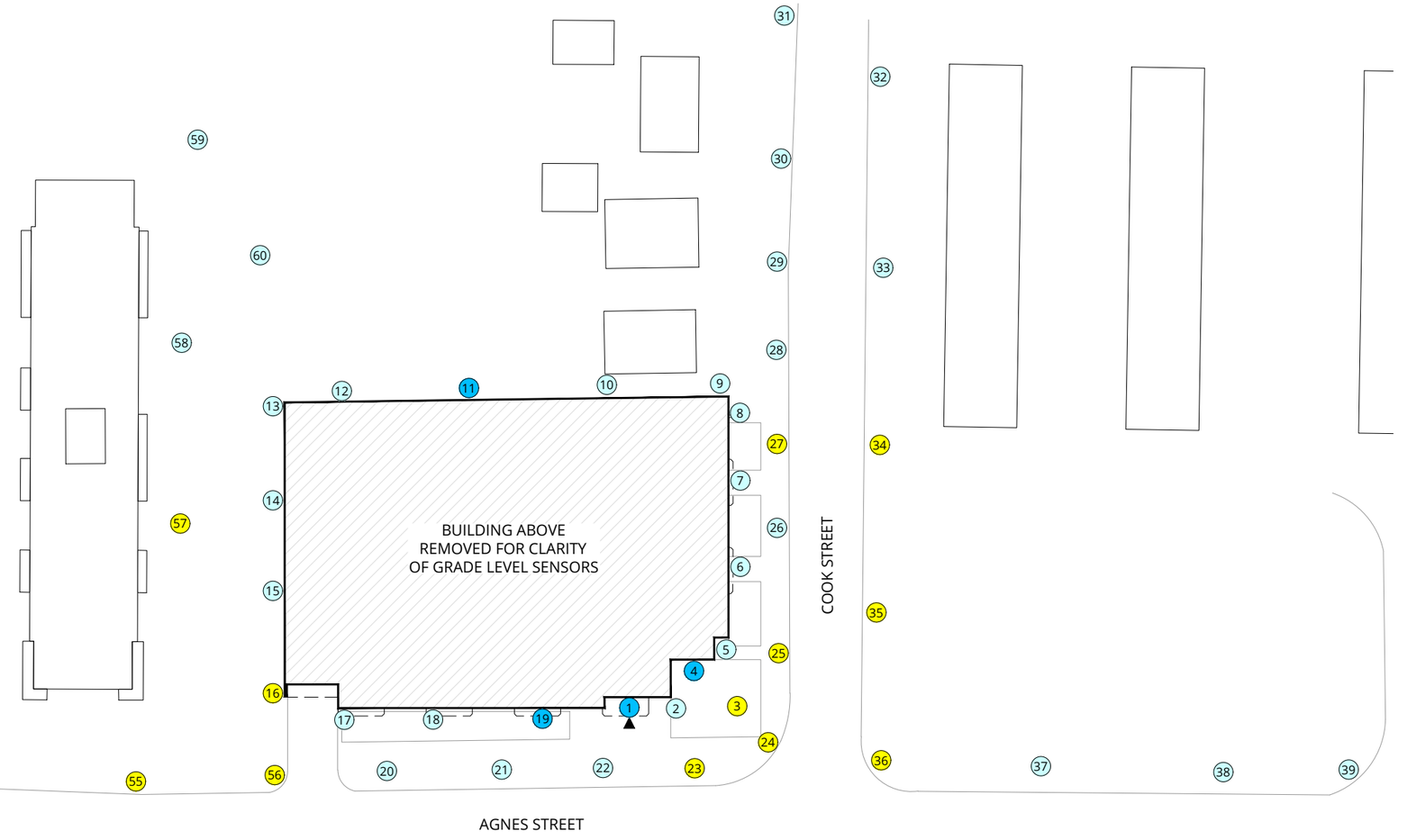
True North

Project #2102814

Drawn by: GRE	Figure: 1A
Approx. Scale:	1:750
Date Revised:	Apr. 26, 2022



Level 4 Outdoor Amenity
Approx. Scale: 1:600



LEGEND:

COMFORT CATEGORIES:
- Sitting
- Standing
- Walking
- Uncomfortable

SENSOR LOCATION:
- Grade Level
- Amenity Level
- Entrance Location

0 10 30m

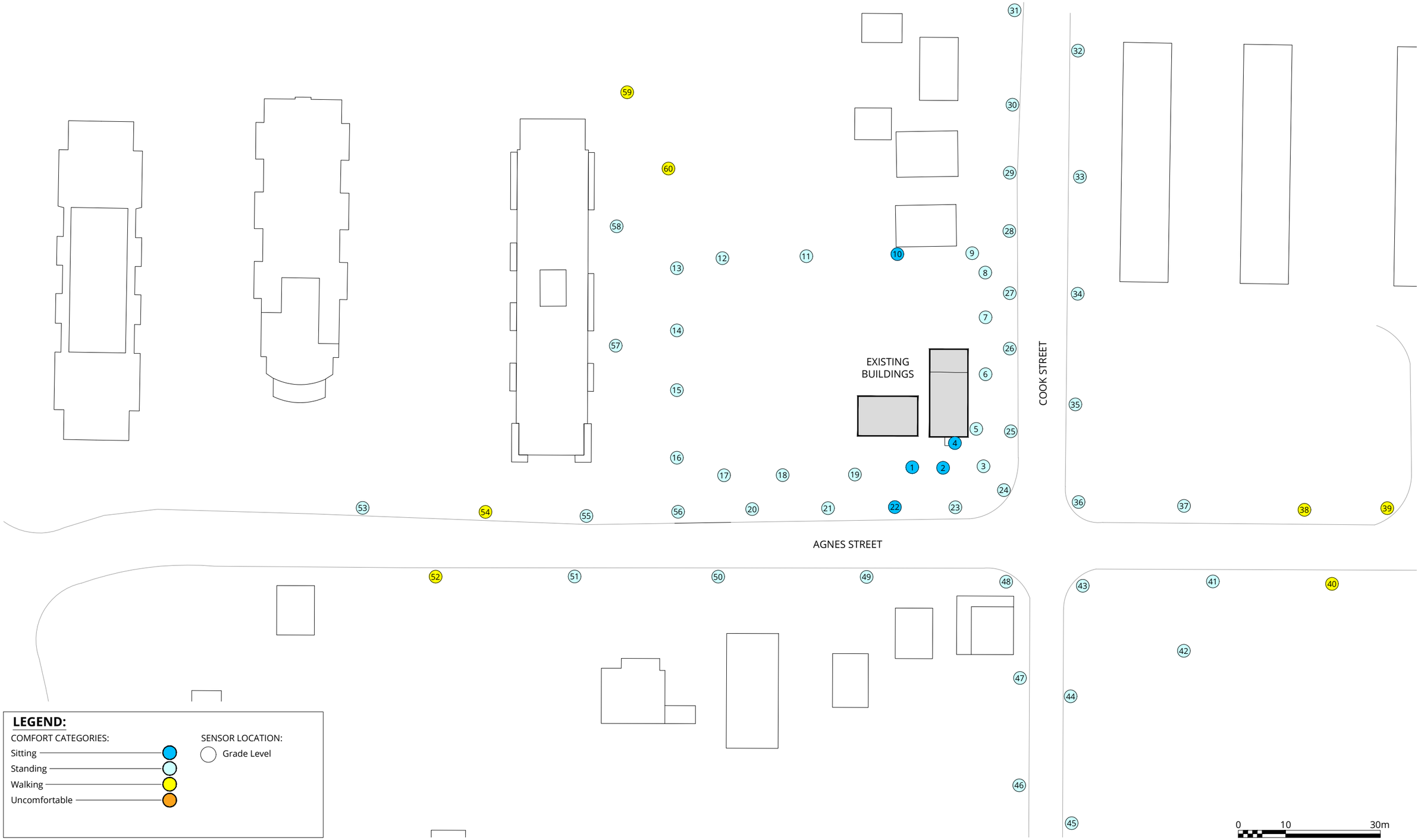
Pedestrian Wind Comfort Conditions
Proposed Configuration
Summer (May to October, 6:00 to 23:00)

65 and 71 Agnes Street - Mississauga, ON

True North

Project #2102814

Drawn by: GRE	Figure: 1B
Approx. Scale:	1:750
Date Revised:	Apr. 26, 2022



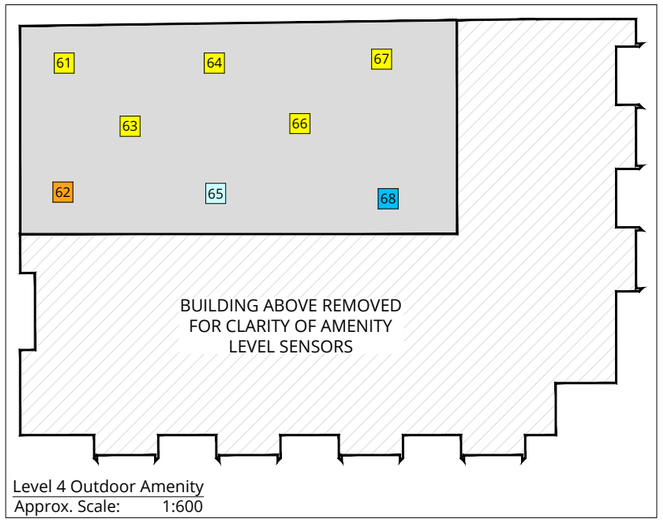
Pedestrian Wind Comfort Conditions
Existing Configuration
Winter (November to April, 6:00 to 23:00)

65 and 71 Agnes Street - Mississauga, ON

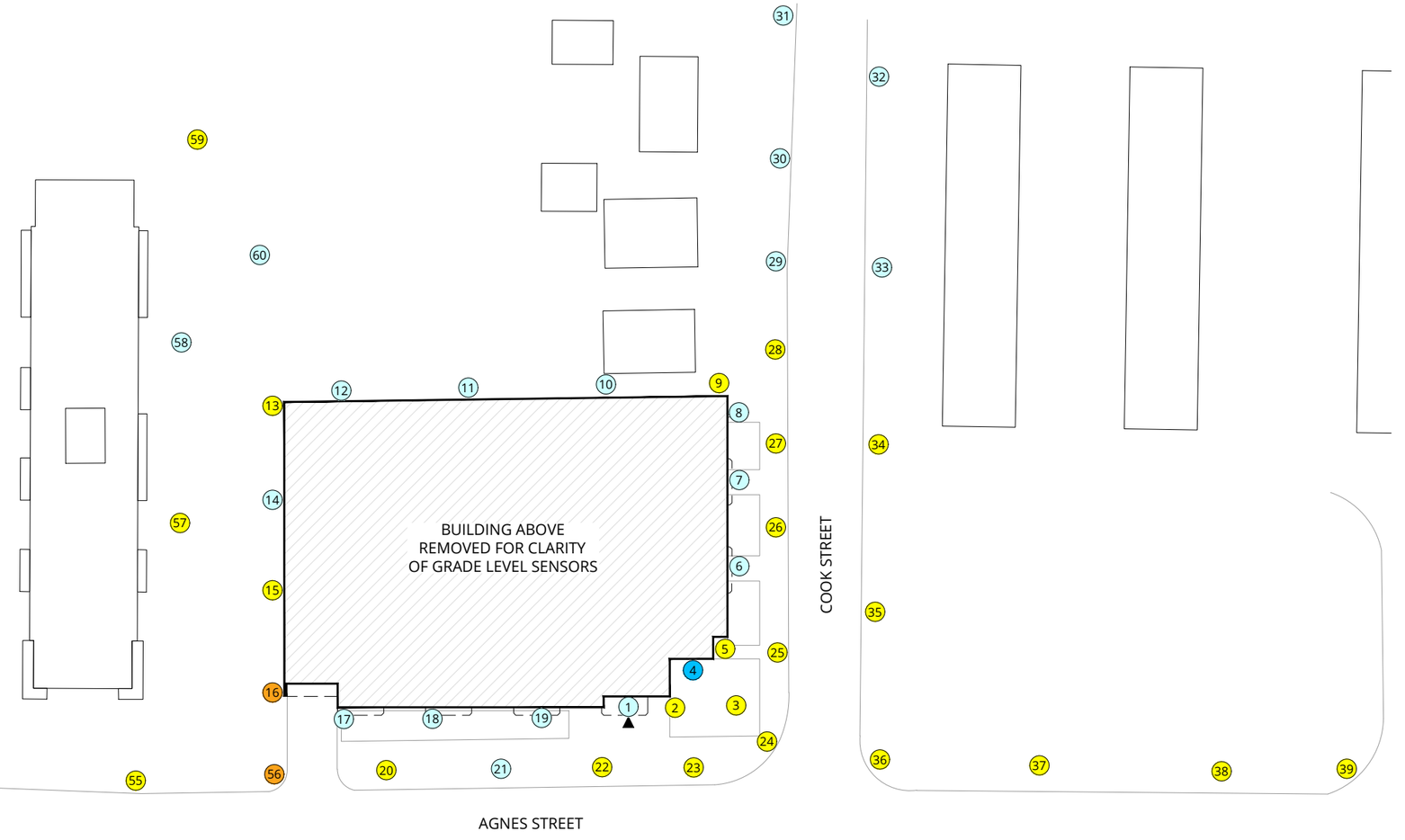
True North

Project #2102814

Drawn by:	GRE	Figure:	2A
Approx. Scale:	1:750		
Date Revised:	Apr. 26, 2022		



Level 4 Outdoor Amenity
Approx. Scale: 1:600



LEGEND:

COMFORT CATEGORIES:
- Sitting
- Standing
- Walking
- Uncomfortable

SENSOR LOCATION:
- Grade Level
- Amenity Level
- Entrance Location

0 10 30m

Pedestrian Wind Comfort Conditions
Proposed Configuration
Winter (November to April, 6:00 to 23:00)

65 and 71 Agnes Street - Mississauga, ON

True North

Project #2102814

Drawn by:	GRE	Figure:	2B
Approx. Scale:	1:750		
Date Revised:	Apr. 26, 2022		

TABLES

Table 1: Pedestrian Wind Comfort and Safety Conditions

Location	Configuration	Wind Comfort				Wind Safety	
		Summer		Winter		Annual	
		Speed (km/h)	Rating	Speed (km/h)	Rating	Speed (km/h)	Rating
1	Existing	8	Sitting	9	Sitting	40	Pass
	Proposed	10	Sitting	11	Standing	51	Pass
2	Existing	8	Sitting	9	Sitting	42	Pass
	Proposed	15	Standing	16	Walking	63	Pass
3	Existing	11	Standing	13	Standing	57	Pass
	Proposed	18	Walking	20	Walking	74	Pass
4	Existing	7	Sitting	8	Sitting	44	Pass
	Proposed	8	Sitting	9	Sitting	46	Pass
5	Existing	10	Sitting	12	Standing	56	Pass
	Proposed	15	Standing	17	Walking	71	Pass
6	Existing	11	Standing	13	Standing	60	Pass
	Proposed	12	Standing	14	Standing	60	Pass
7	Existing	11	Standing	13	Standing	54	Pass
	Proposed	12	Standing	14	Standing	59	Pass
8	Existing	11	Standing	13	Standing	56	Pass
	Proposed	11	Standing	12	Standing	64	Pass
9	Existing	11	Standing	13	Standing	57	Pass
	Proposed	13	Standing	16	Walking	75	Pass
10	Existing	7	Sitting	9	Sitting	43	Pass
	Proposed	12	Standing	15	Standing	71	Pass
11	Existing	12	Standing	14	Standing	62	Pass
	Proposed	10	Sitting	11	Standing	50	Pass
12	Existing	12	Standing	14	Standing	61	Pass
	Proposed	12	Standing	14	Standing	60	Pass
13	Existing	13	Standing	15	Standing	63	Pass
	Proposed	15	Standing	17	Walking	68	Pass
14	Existing	13	Standing	15	Standing	61	Pass
	Proposed	12	Standing	13	Standing	54	Pass
15	Existing	14	Standing	15	Standing	60	Pass
	Proposed	15	Standing	17	Walking	69	Pass
16	Existing	14	Standing	15	Standing	60	Pass
	Proposed	20	Walking	23	Uncomfortable	80	Pass
17	Existing	12	Standing	13	Standing	50	Pass
	Proposed	11	Standing	14	Standing	68	Pass
18	Existing	12	Standing	14	Standing	60	Pass
	Proposed	11	Standing	14	Standing	63	Pass

Table 1: Pedestrian Wind Comfort and Safety Conditions

Location	Configuration	Wind Comfort				Wind Safety	
		Summer		Winter		Annual	
		Speed (km/h)	Rating	Speed (km/h)	Rating	Speed (km/h)	Rating
19	Existing	10	Sitting	11	Standing	47	Pass
	Proposed	10	Sitting	12	Standing	58	Pass
20	Existing	12	Standing	14	Standing	57	Pass
	Proposed	13	Standing	16	Walking	70	Pass
21	Existing	11	Standing	13	Standing	54	Pass
	Proposed	13	Standing	15	Standing	67	Pass
22	Existing	9	Sitting	10	Sitting	42	Pass
	Proposed	14	Standing	17	Walking	67	Pass
23	Existing	10	Sitting	12	Standing	49	Pass
	Proposed	18	Walking	20	Walking	75	Pass
24	Existing	12	Standing	14	Standing	59	Pass
	Proposed	18	Walking	20	Walking	76	Pass
25	Existing	12	Standing	14	Standing	63	Pass
	Proposed	18	Walking	20	Walking	73	Pass
26	Existing	12	Standing	14	Standing	62	Pass
	Proposed	15	Standing	18	Walking	70	Pass
27	Existing	12	Standing	14	Standing	63	Pass
	Proposed	16	Walking	19	Walking	81	Pass
28	Existing	12	Standing	13	Standing	61	Pass
	Proposed	15	Standing	17	Walking	68	Pass
29	Existing	11	Standing	13	Standing	60	Pass
	Proposed	12	Standing	14	Standing	60	Pass
30	Existing	11	Standing	13	Standing	61	Pass
	Proposed	12	Standing	13	Standing	62	Pass
31	Existing	11	Standing	13	Standing	52	Pass
	Proposed	12	Standing	14	Standing	60	Pass
32	Existing	12	Standing	14	Standing	63	Pass
	Proposed	13	Standing	14	Standing	58	Pass
33	Existing	12	Standing	15	Standing	67	Pass
	Proposed	14	Standing	15	Standing	68	Pass
34	Existing	13	Standing	15	Standing	66	Pass
	Proposed	18	Walking	20	Walking	72	Pass
35	Existing	12	Standing	15	Standing	64	Pass
	Proposed	18	Walking	20	Walking	73	Pass
36	Existing	12	Standing	15	Standing	63	Pass
	Proposed	17	Walking	19	Walking	74	Pass

Table 1: Pedestrian Wind Comfort and Safety Conditions

Location	Configuration	Wind Comfort				Wind Safety	
		Summer		Winter		Annual	
		Speed (km/h)	Rating	Speed (km/h)	Rating	Speed (km/h)	Rating
37	Existing	13	Standing	15	Standing	62	Pass
	Proposed	15	Standing	17	Walking	68	Pass
38	Existing	14	Standing	17	Walking	72	Pass
	Proposed	15	Standing	18	Walking	74	Pass
39	Existing	14	Standing	17	Walking	72	Pass
	Proposed	15	Standing	18	Walking	74	Pass
40	Existing	13	Standing	16	Walking	69	Pass
	Proposed	14	Standing	17	Walking	72	Pass
41	Existing	13	Standing	15	Standing	63	Pass
	Proposed	14	Standing	16	Walking	68	Pass
42	Existing	12	Standing	15	Standing	62	Pass
	Proposed	14	Standing	16	Walking	69	Pass
43	Existing	12	Standing	15	Standing	61	Pass
	Proposed	14	Standing	17	Walking	72	Pass
44	Existing	12	Standing	15	Standing	65	Pass
	Proposed	15	Standing	18	Walking	78	Pass
45	Existing	12	Standing	15	Standing	61	Pass
	Proposed	13	Standing	16	Walking	70	Pass
46	Existing	11	Standing	13	Standing	54	Pass
	Proposed	13	Standing	16	Walking	67	Pass
47	Existing	11	Standing	13	Standing	52	Pass
	Proposed	15	Standing	17	Walking	75	Pass
48	Existing	9	Sitting	11	Standing	49	Pass
	Proposed	11	Standing	13	Standing	57	Pass
49	Existing	10	Sitting	12	Standing	49	Pass
	Proposed	16	Walking	18	Walking	72	Pass
50	Existing	12	Standing	14	Standing	57	Pass
	Proposed	15	Standing	18	Walking	79	Pass
51	Existing	12	Standing	13	Standing	58	Pass
	Proposed	13	Standing	15	Standing	62	Pass
52	Existing	13	Standing	16	Walking	67	Pass
	Proposed	15	Standing	19	Walking	74	Pass
53	Existing	13	Standing	15	Standing	63	Pass
	Proposed	14	Standing	17	Walking	66	Pass
54	Existing	13	Standing	16	Walking	70	Pass
	Proposed	16	Walking	20	Walking	77	Pass

Table 1: Pedestrian Wind Comfort and Safety Conditions

Location	Configuration	Wind Comfort				Wind Safety	
		Summer		Winter		Annual	
		Speed (km/h)	Rating	Speed (km/h)	Rating	Speed (km/h)	Rating
55	Existing	13	Standing	14	Standing	62	Pass
	Proposed	16	Walking	19	Walking	74	Pass
56	Existing	13	Standing	15	Standing	60	Pass
	Proposed	18	Walking	22	Uncomfortable	84	Pass
57	Existing	12	Standing	14	Standing	61	Pass
	Proposed	18	Walking	20	Walking	78	Pass
58	Existing	12	Standing	14	Standing	65	Pass
	Proposed	14	Standing	15	Standing	76	Pass
59	Existing	14	Standing	17	Walking	68	Pass
	Proposed	14	Standing	16	Walking	72	Pass
60	Existing	14	Standing	17	Walking	71	Pass
	Proposed	14	Standing	15	Standing	71	Pass
61	Existing	-	-	-	-	-	-
	Proposed	16	Walking	19	Walking	74	Pass
62	Existing	-	-	-	-	-	-
	Proposed	18	Walking	21	Uncomfortable	87	Pass
63	Existing	-	-	-	-	-	-
	Proposed	16	Walking	19	Walking	79	Pass
64	Existing	-	-	-	-	-	-
	Proposed	14	Standing	17	Walking	69	Pass
65	Existing	-	-	-	-	-	-
	Proposed	11	Standing	13	Standing	63	Pass
66	Existing	-	-	-	-	-	-
	Proposed	13	Standing	16	Walking	69	Pass
67	Existing	-	-	-	-	-	-
	Proposed	13	Standing	16	Walking	68	Pass
68	Existing	-	-	-	-	-	-
	Proposed	8	Sitting	10	Sitting	47	Pass

Season	Months	Hours
Summer	May - October	6:00 - 23:00 for comfort
Winter	November - April	6:00 - 23:00 for comfort
Annual	January - December	0:00 - 23:00 for safety

Configurations	
Existing	Existing site and surroundings
Proposed	Project with existing surroundings

Comfort Speed (km/h) (20% Seasonal Exceedance)	
≤ 10	Sitting
11 - 15	Standing
16 - 20	Walking
> 20	Uncomfortable

Safety Speed (km/h) (0.1% Annual Exceedance)	
≤ 90	Pass
> 90	Exceeded