REPORT

WESTMINSTER ST. LUKE'S SENIORS AFFORDABLE HOUSING

MISSISSAUGA, ON

PEDESTRIAN WIND STUDY
RWDI # 2003763
September 15, 2022

SUBMITTED TO

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EXECUTIVE SUMMARY

RWDI was retained to conduct a pedestrian wind assessment for the proposed Westminster St. Luke's Seniors Affordable Housing in Mississauga, ON. The assessment was based on the wind-tunnel testing conducted for the proposed development site under the Existing, and the Proposed configurations of the site and surroundings. The results were analysed using the regional wind climate records and evaluated against the RWDI Pedestrian Wind Criteria for pedestrian comfort (pertaining to common wind speeds conducive to different levels of human activity) and pedestrian safety (pertaining to infrequent but strong gusts that could affect a person's footing). The predicted wind conditions are presented in **Figures 1A** through **2B**, and **Table 1**, and are summarized as follows:

- Wind speeds at all areas assessed on and around the existing development site meet the pedestrian safety criterion and are suitable for the intended pedestrian use throughout the year.

- With the addition of the proposed development, an increase in wind speeds is predicted in the vicinity of the new building with conditions remaining comfortable for the intended use at all areas assessed.

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1 INTRODUCTION

RWDI was retained to conduct a pedestrian wind assessment for the proposed Westminster St. Luke's Seniors Affordable Housing in Mississauga, ON. This report presents the project objectives, approach and the main results from RWDI's assessment. Our Statement of Limitations as it pertains to this study can be found in Section 4 of this report.

1.1 Project Description

The proposed development site is located at the west corner of Westminster Place and Rathburn Road East (**Image 1**). The development will consist of an 8-storey building, that is approximately 32 m tall as an addition to the existing residential building at 4150 Westminster Place in Mississauga, ON.

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.

Image 1: Aerial View of 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 with existing 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 approximate 360 m radius around 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 47 specially designed wind speed sensors 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. The placement of wind measurement locations was based on our experience and understanding of the pedestrian usage for this site. Wind speeds were measured for 36 directions in 10-degree increments. 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.

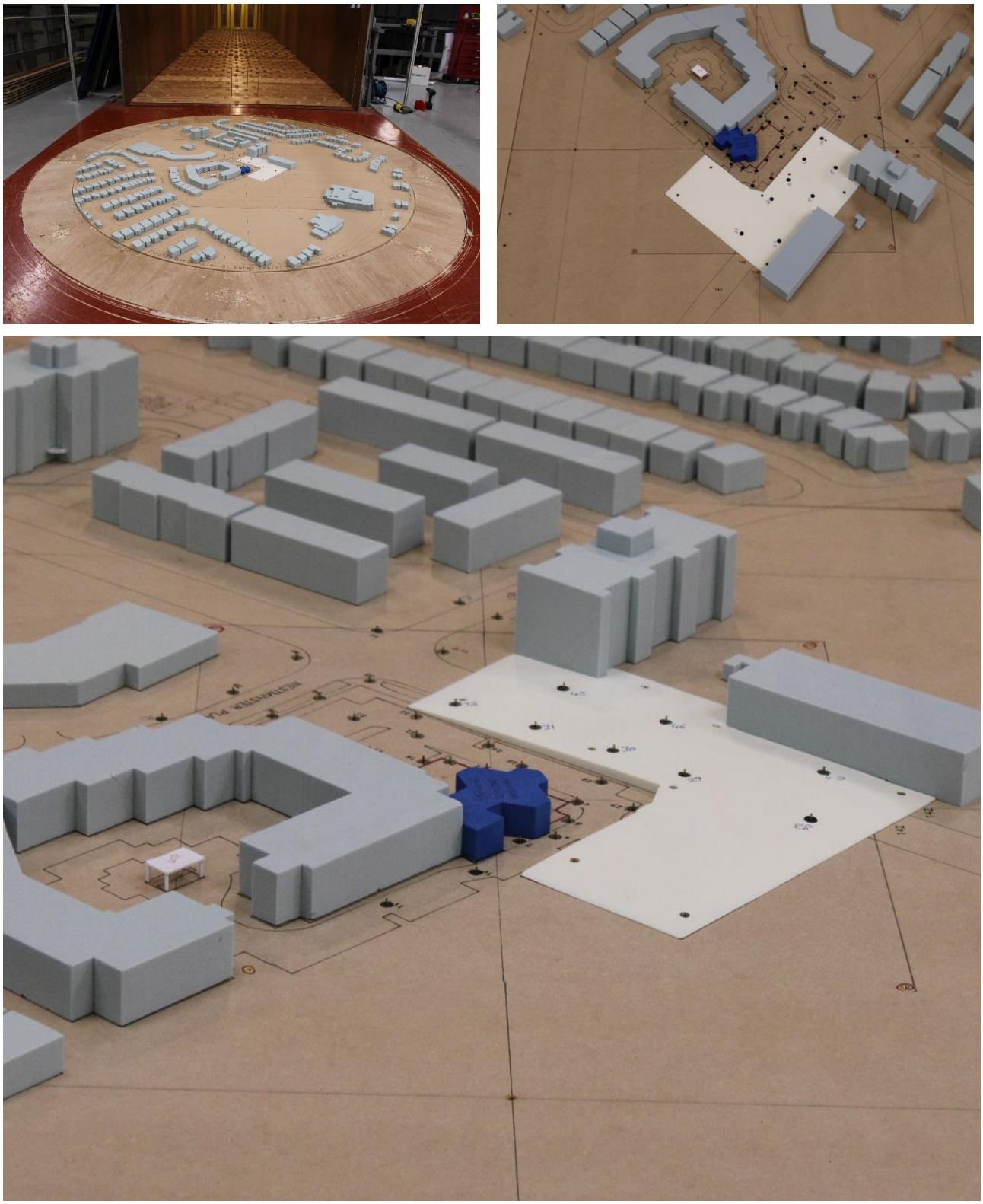


Image 2A: Wind Tunnel Study Model – Existing Configuration

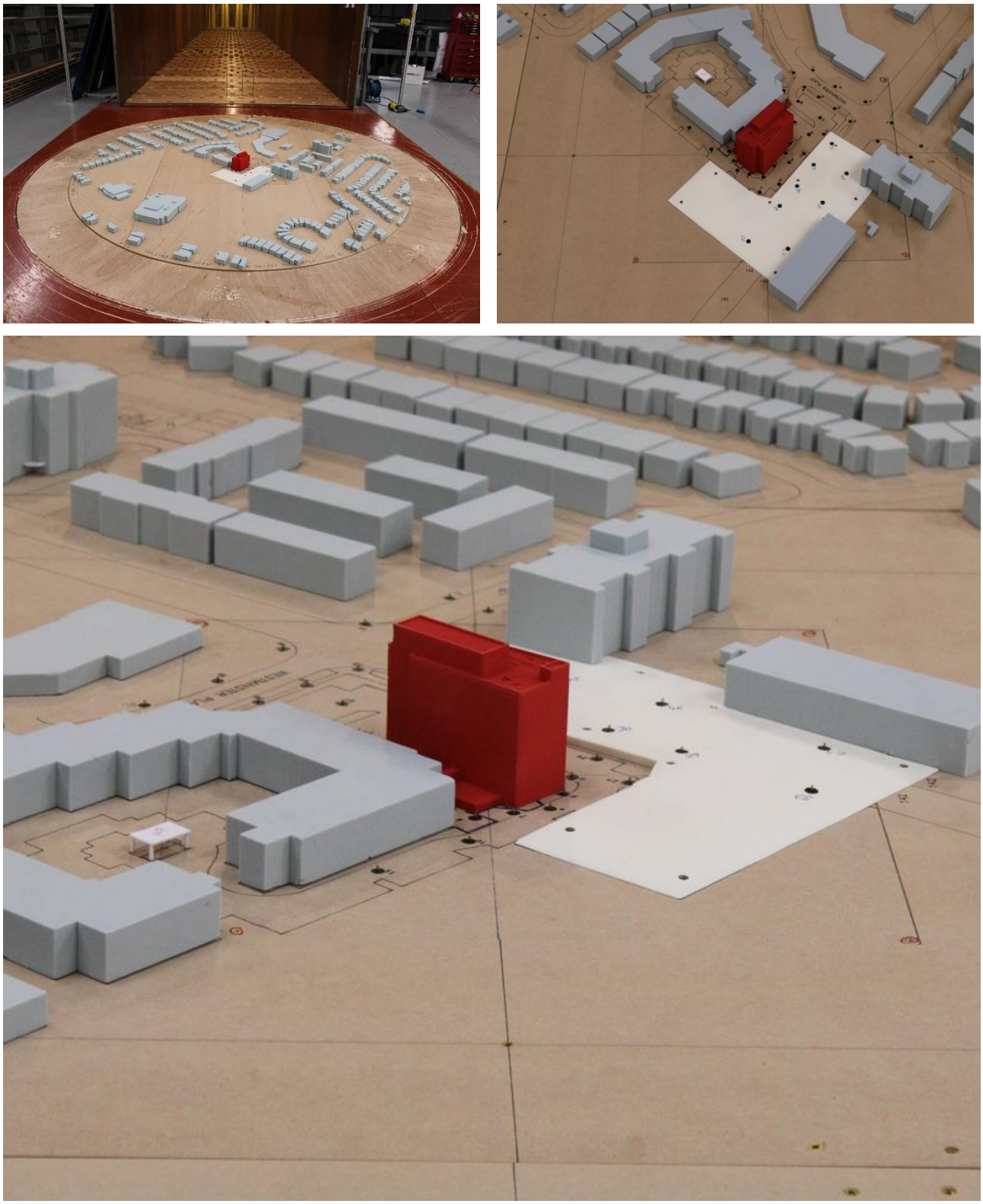
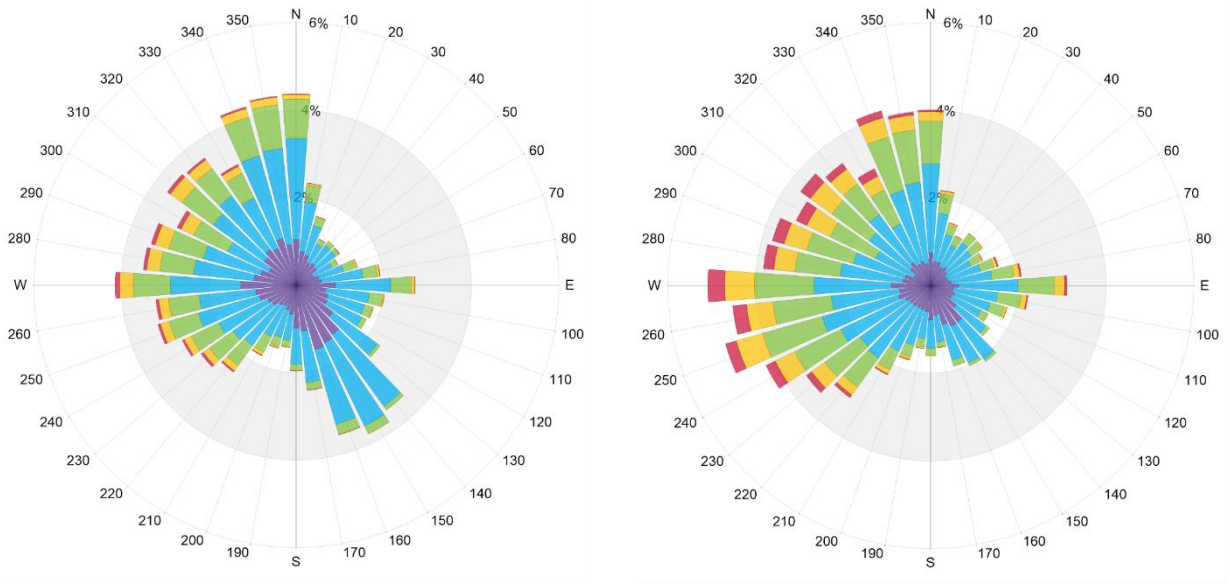


Image 2B: Wind Tunnel Study Model – Proposed Configuration

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 and northwest quadrants are predominant throughout the year, as indicated by the wind roses. During the winter, prevailing winds from the east direction are also frequent, while the southeast winds are frequent in the summer, but typically of low 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 Mississauga wind criteria for pedestrian comfort and safety.



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 RWDI 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);
(2) GEM speeds listed above are based on a seasonal exceedance of 20% of the time.
(3) Wind speeds recorded between 6AM and midnight are considered in the comfort assignment pedestrian activity is expected to be minimal during the excluded nightly hours.

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.
(2) Wind speeds recorded for all 24 hours a day are considered in the safety assessment.

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 and the associated wind speeds are presented in **Table 1**, located in the "Tables" section of this report.

Wind conditions that meet the safety criterion are predicted at all locations for all configurations assessed. The following is a detailed discussion of the suitability of the predicted wind conditions for the anticipated pedestrian use of each area of interest.

3.1 Grade Level (Locations 1 through 47)

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 standing are preferred at building entrances where pedestrians are apt to linger.

3.1.1 Existing Configuration

The wind conditions at most areas on and around the existing site are comfortable for standing or calmer throughout the year (**Figures 1A** and **2A**). Higher wind speeds are expected to the southwest and southeast of the project site on Rathburn Road East and Westminster Place (Locations 28, and 42-45 in **Figure 2A**) where conditions are comfortable for walking in the winter. The conditions are considered appropriate for the intended pedestrian usage throughout the year.

3.1.2 Proposed Configuration

With the addition of the proposed project, an increase in wind speeds is predicted in the vicinity of the new building. Wind conditions on and around the site are predicted to remain comfortable for sitting or standing during the summer (**Figure 1B**). During the winter, due to seasonally stronger winds, slightly higher wind speeds comfortable for walking or standing are predicted throughout the project site and along the neighbouring streets (**Figure 2B**). The predicted wind conditions are considered appropriate for the intended pedestrian usage on sidewalks and on the open areas on-site throughout the year.

The main entrance of the proposed building is identified as Location 1, and the secondary entrance is Location 5 in **Figures 1B** and **2B**. Positively, the main entrance is located in a recessed corner that would be sheltered from wind effects and wind speeds comfortable for standing are predicted at the entrance throughout the year, which is considered appropriate. Wind speeds at the secondary side entrance are predicted to be comfortable for standing in the summer and for walking in the winter.

The wind speeds in winter at the secondary entrance are higher than desired for prolonged waiting but may be considered appropriate if the area will not be used frequently in the winter months. The existing elevated, densely treed area to the west of the site will afford some protection from the winds approaching from the west. If

improved conditions are desired near the side entrance in the winter, one of the following measures may also be considered:

- Locate the side entrance to sheltered/recessed re-entrant corner between Locations 5 and 4, where lower wind speeds are expected.
- Recess the entrance from the main façade that it is currently located on to create a sheltered alcove.
- Consider local vertical wind screens/coniferous plantings (at least 2m tall) on both sides and a canopy over the entrance (**Image 4**).

Image 4: Examples of wind control measures applicable to the secondary entrance

4 STATEMENT OF LIMITATIONS

Limitations

This report entitled Westminster St. Luke's Seniors Affordable Housing was prepared by Rowan Williams Davies & Irwin, Inc. ("RWDI") for SHS Consulting ("Client"). The findings and conclusions presented in this report have been prepared for the Client and are specific to the project described herein ("Project"). The conclusions and recommendations contained in this report are based on the information available to RWDI when this report was prepared.

The conclusions and recommendations contained in this report have also been made for the specific purpose(s) set out herein. Should the Client or any other third party utilize the report and/or implement the conclusions and recommendations contained therein for any other purpose or project without the involvement of RWDI, the Client or such third party assumes any and all risk of any and all consequences arising from such use and RWDI accepts no responsibility for any liability, loss, or damage of any kind suffered by Client or any other third party arising therefrom.

Finally, it is imperative that the Client and/or any party relying on the conclusions and recommendations in this report carefully review the stated assumptions contained herein and to understand the different factors which may impact the conclusions and recommendations provided.

Design Assumptions

RWDI confirms that the pedestrian wind assessment (the "**Assessment**") discussed herein was performed by RWDI in accordance with generally accepted professional standards at the time when the Assessment was performed and in the location of the Project. No other representations, warranties, or guarantees are made with respect to the accuracy or completeness of the information, findings, recommendations, or conclusions contained in this Report. This report is not a legal opinion regarding compliance with applicable laws.

The findings and recommendations set out in this report are based on the following information disclosed to RWDI. Drawings and information listed below were received from Kearns Mancini Architects Inc. and used to construct the scale model of the proposed Westminster St. Luke's Seniors Affordable Housing **("Project Data**")

File Name	File Type	Date Received (dd/mm/yyyy)
18-078 Westminster R2020 - 3D View - {3D - kellyfisher@kmai-com}	AutoCAD drawing	26/07/2022

The recommendations and conclusions are based on the assumption that the Project Data and Climate Data are accurate and complete. RWDI assumes no responsibility for any inaccuracy or deficiency in information it has received from others. In addition, the recommendations and conclusions in this report are partially based on historical data and can be affected by a number of external factors, including but not limited to Project design,

quality of materials and construction, site conditions, meteorological events, and climate change. As such, the conclusions and recommendations contained in this report do not list every possible outcome.

The opinions in this report can only be relied up on to the extent that the Project Data and Project Specific Conditions have not changed. Any change in the Project Data or Project Specific Conditions not reflected in this report can impact and/or alter the recommendations and conclusions in this report. Therefore, it is incumbent upon the Client and/or any other third party reviewing the recommendations and conclusions in this report to contact RWDI in the event of any change in the Project Data and Project Specific Conditions in order to determine whether any such change(s) may impact the assumptions upon which the recommendations and conclusions were made.

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.

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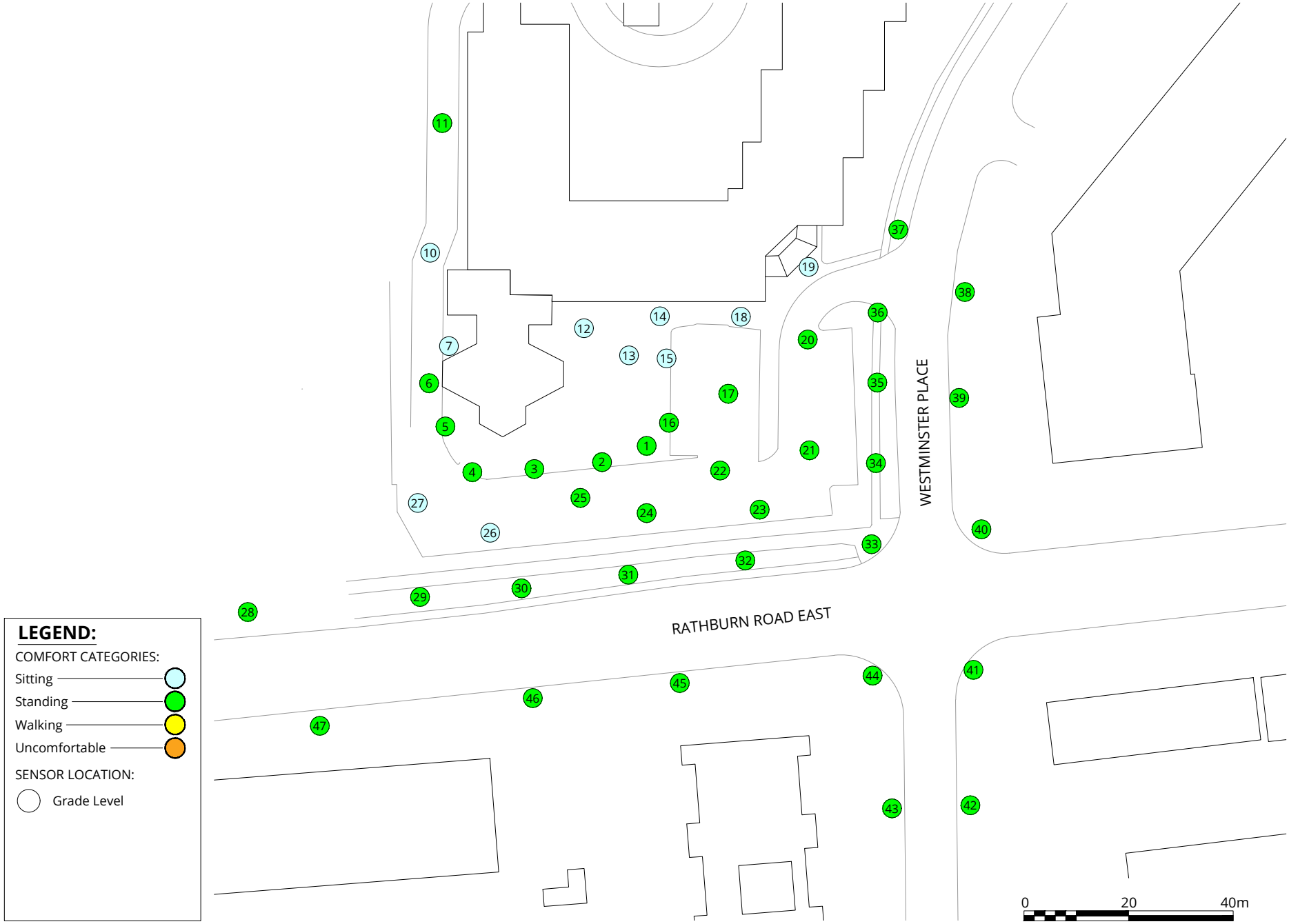
FIGURES



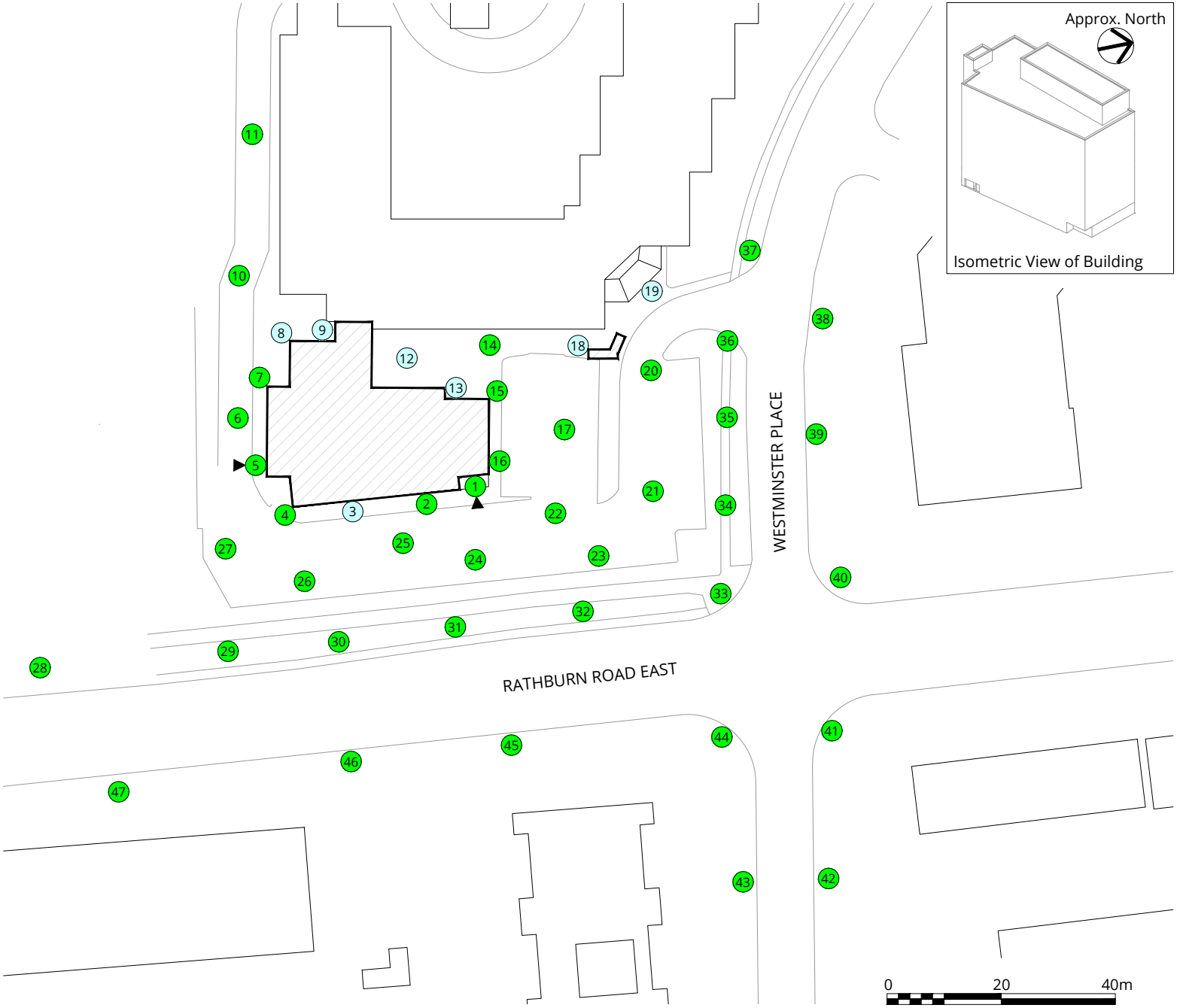
Pedestrian Wind Comfort Conditions
Existing Configuration
Summer (May to October, 6:00 to 23:00)

Westminster St. Luke's Seniors Affordable Housing - Mississauga, ON

True North

Project #2003763

Drawn by: GRE	Figure: 1A
Approx. Scale:	1:1000
Date Revised:	Sep. 2, 2022



LEGEND:

COMFORT CATEGORIES:

- Sitting
- Standing
- Walking
- Uncomfortable

SENSOR LOCATION:

- Grade Level
- Entrance Location
- Building Above Removed for Clarity

Pedestrian Wind Comfort Conditions

Proposed Configuration

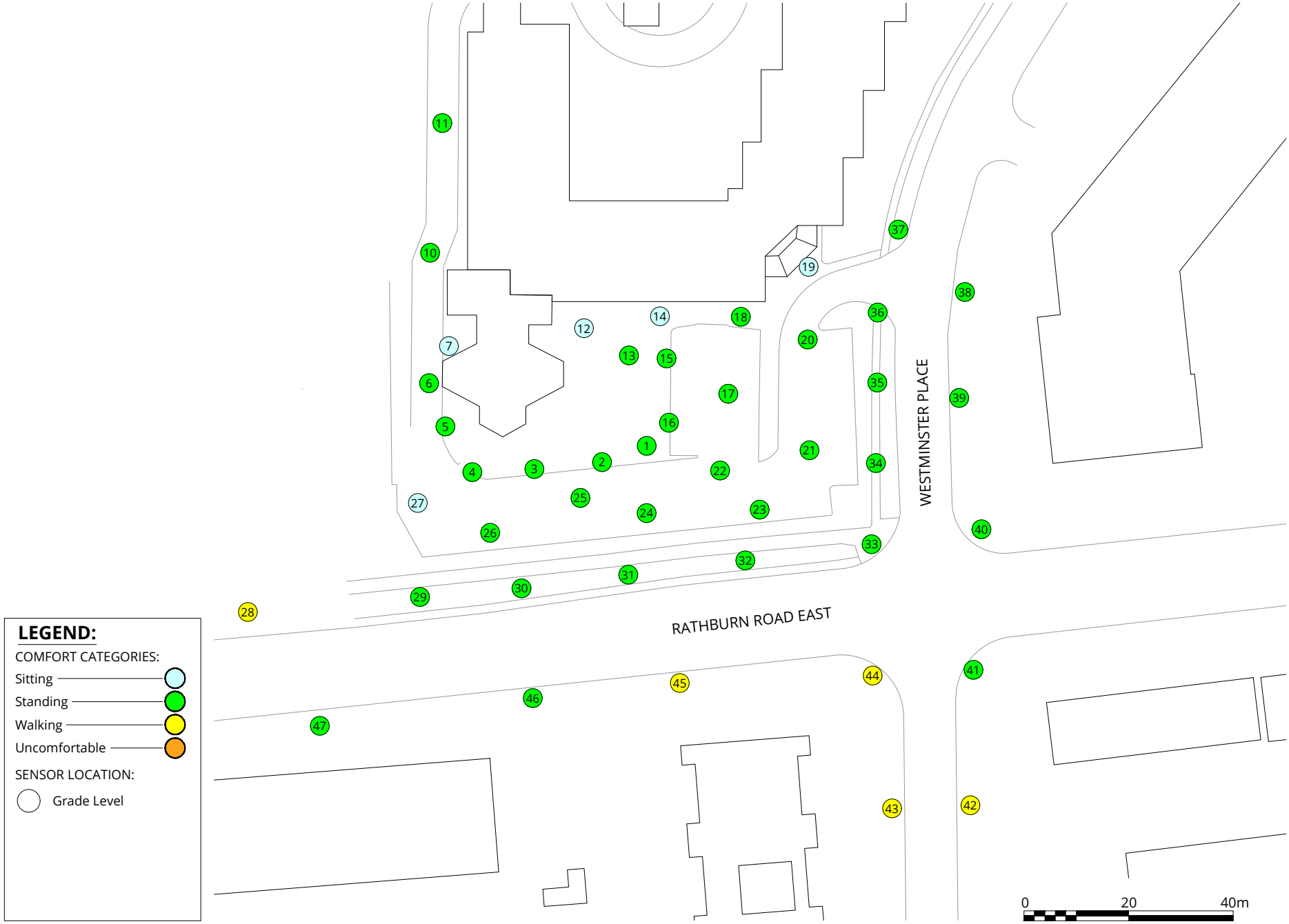
Summer (May to October, 6:00 to 23:00)

Westminster St. Luke's Seniors Affordable Housing - Mississauga, ON

Project #2003763

True North

Drawn by:	GRE	Figure:	1B
Approx. Scale:	1:1000		
Date Revised:	Sep. 2, 2022		



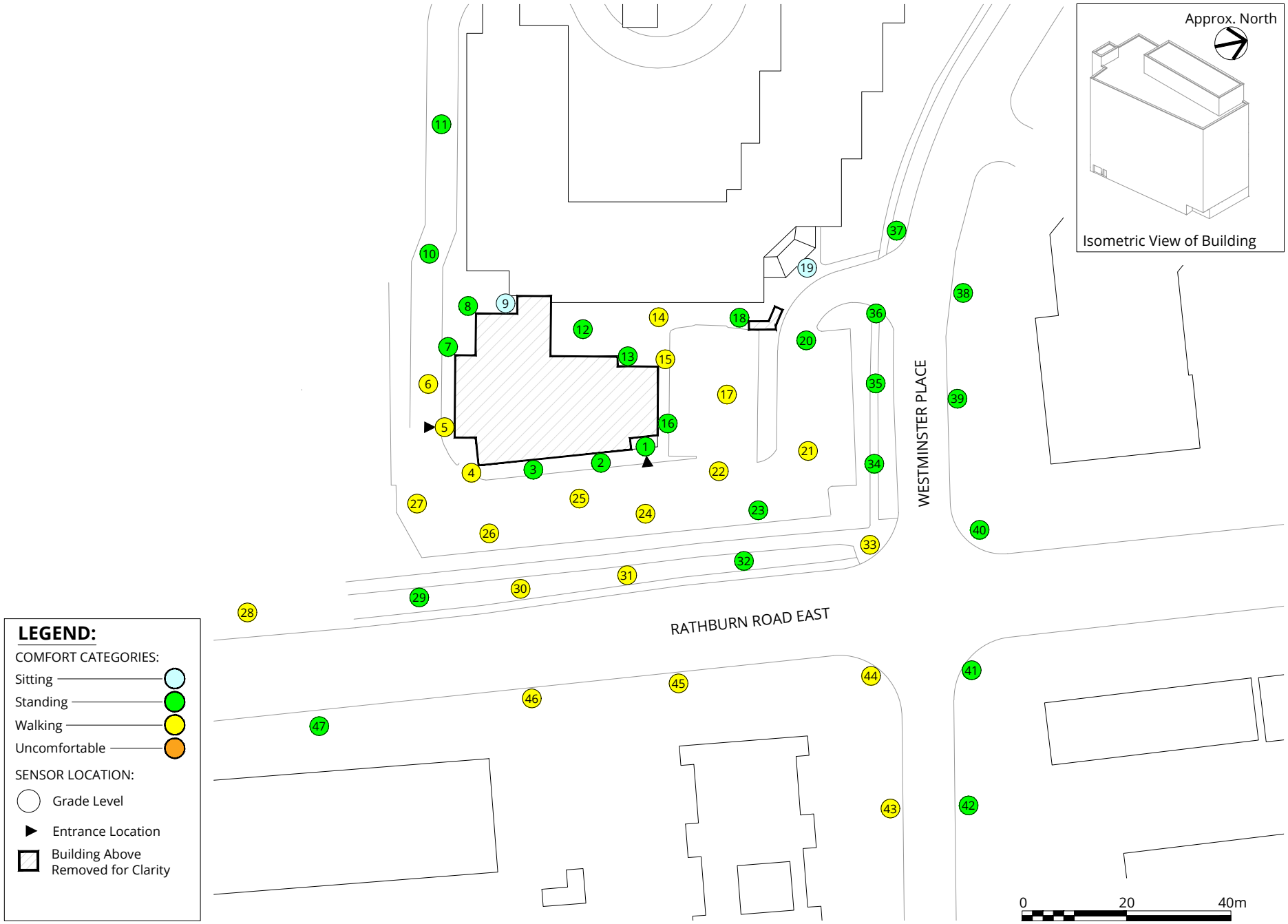
Pedestrian Wind Comfort Conditions
Existing Configuration
Winter (November to April, 6:00 to 23:00)

Westminster St. Luke's Seniors Affordable Housing - Mississauga, ON

Project #2003763

True North

Drawn by: GRE	Figure: 2A
Approx. Scale:	1:1000
Date Revised:	Sep. 2, 2022



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

Westminster St. Luke's Seniors Affordable Housing - Mississauga, ON

Project #2003763

True North

Drawn by: GRE	Figure: 2B
Approx. Scale:	1:1000
Date Revised:	Sep. 2, 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	11	Standing	13	Standing	54	Pass
	Proposed	13	Standing	13	Standing	60	Pass
2	Existing	11	Standing	14	Standing	56	Pass
	Proposed	11	Standing	12	Standing	53	Pass
3	Existing	11	Standing	14	Standing	62	Pass
	Proposed	10	Sitting	12	Standing	51	Pass
4	Existing	11	Standing	14	Standing	63	Pass
	Proposed	13	Standing	17	Walking	87	Pass
5	Existing	11	Standing	14	Standing	71	Pass
	Proposed	14	Standing	17	Walking	78	Pass
6	Existing	12	Standing	14	Standing	62	Pass
	Proposed	14	Standing	17	Walking	75	Pass
7	Existing	8	Sitting	10	Sitting	45	Pass
	Proposed	12	Standing	13	Standing	60	Pass
8	Existing	-	-	-	-	-	-
	Proposed	10	Sitting	12	Standing	53	Pass
9	Existing	-	-	-	-	-	-
	Proposed	9	Sitting	10	Sitting	45	Pass
10	Existing	10	Sitting	12	Standing	53	Pass
	Proposed	11	Standing	12	Standing	49	Pass
11	Existing	11	Standing	13	Standing	55	Pass
	Proposed	11	Standing	12	Standing	54	Pass
12	Existing	7	Sitting	8	Sitting	37	Pass
	Proposed	10	Sitting	11	Standing	51	Pass
13	Existing	9	Sitting	11	Standing	49	Pass
	Proposed	10	Sitting	12	Standing	59	Pass
14	Existing	8	Sitting	8	Sitting	42	Pass
	Proposed	14	Standing	17	Walking	78	Pass
15	Existing	10	Sitting	12	Standing	51	Pass
	Proposed	13	Standing	16	Walking	79	Pass
16	Existing	11	Standing	13	Standing	55	Pass
	Proposed	11	Standing	12	Standing	63	Pass
17	Existing	11	Standing	13	Standing	54	Pass
	Proposed	14	Standing	17	Walking	76	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
18	Existing	10	Sitting	11	Standing	49	Pass
	Proposed	10	Sitting	13	Standing	55	Pass
19	Existing	7	Sitting	8	Sitting	35	Pass
	Proposed	6	Sitting	7	Sitting	34	Pass
20	Existing	12	Standing	13	Standing	53	Pass
	Proposed	11	Standing	13	Standing	53	Pass
21	Existing	12	Standing	14	Standing	54	Pass
	Proposed	14	Standing	16	Walking	69	Pass
22	Existing	12	Standing	14	Standing	57	Pass
	Proposed	15	Standing	17	Walking	75	Pass
23	Existing	11	Standing	13	Standing	56	Pass
	Proposed	13	Standing	15	Standing	66	Pass
24	Existing	11	Standing	13	Standing	57	Pass
	Proposed	15	Standing	17	Walking	69	Pass
25	Existing	11	Standing	14	Standing	56	Pass
	Proposed	14	Standing	16	Walking	74	Pass
26	Existing	10	Sitting	12	Standing	47	Pass
	Proposed	14	Standing	17	Walking	67	Pass
27	Existing	8	Sitting	10	Sitting	42	Pass
	Proposed	13	Standing	16	Walking	65	Pass
28	Existing	13	Standing	16	Walking	65	Pass
	Proposed	13	Standing	16	Walking	63	Pass
29	Existing	12	Standing	15	Standing	59	Pass
	Proposed	12	Standing	15	Standing	60	Pass
30	Existing	12	Standing	14	Standing	55	Pass
	Proposed	13	Standing	16	Walking	61	Pass
31	Existing	13	Standing	15	Standing	57	Pass
	Proposed	14	Standing	17	Walking	66	Pass
32	Existing	12	Standing	14	Standing	61	Pass
	Proposed	12	Standing	14	Standing	62	Pass
33	Existing	12	Standing	14	Standing	57	Pass
	Proposed	13	Standing	16	Walking	66	Pass
34	Existing	12	Standing	14	Standing	55	Pass
	Proposed	13	Standing	15	Standing	65	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
35	Existing	12	Standing	14	Standing	56	Pass
	Proposed	13	Standing	15	Standing	66	Pass
36	Existing	12	Standing	14	Standing	57	Pass
	Proposed	12	Standing	13	Standing	51	Pass
37	Existing	12	Standing	13	Standing	55	Pass
	Proposed	11	Standing	12	Standing	50	Pass
38	Existing	13	Standing	15	Standing	59	Pass
	Proposed	12	Standing	14	Standing	58	Pass
39	Existing	12	Standing	14	Standing	56	Pass
	Proposed	12	Standing	14	Standing	57	Pass
40	Existing	12	Standing	14	Standing	57	Pass
	Proposed	12	Standing	14	Standing	58	Pass
41	Existing	12	Standing	15	Standing	58	Pass
	Proposed	13	Standing	15	Standing	59	Pass
42	Existing	13	Standing	16	Walking	65	Pass
	Proposed	13	Standing	15	Standing	64	Pass
43	Existing	14	Standing	17	Walking	72	Pass
	Proposed	13	Standing	16	Walking	67	Pass
44	Existing	13	Standing	16	Walking	69	Pass
	Proposed	13	Standing	16	Walking	68	Pass
45	Existing	13	Standing	16	Walking	65	Pass
	Proposed	14	Standing	17	Walking	66	Pass
46	Existing	13	Standing	15	Standing	62	Pass
	Proposed	13	Standing	16	Walking	63	Pass
47	Existing	12	Standing	14	Standing	65	Pass
	Proposed	12	Standing	14	Standing	62	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	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