REPORT

5566 ROBINSON STREET & 6158 ALLENDALE AVENUE

NIAGARA FALLS, ON

PEDESTRIAN WIND STUDY
RWDI # 2201139
August 26, 2022

SUBMITTED TO

La Pue International Inc.
(c/o Pawel Fugiel)

SUBMITTED BY

Henrique D.L. Gambassi, B.Sc., EIT
Technical Coordinator
henrique.delimagambassi@rwdi.com

Timothy Wiechers, M.Sc.
Technical Coordinator
Tim.Wiechers@rwdi.com

Dan Bacon
Senior Project Manager / Principal
Dan.Bacon@rwdi.com

RWDI
600 Southgate Drive
Guelph, Ontario, Canada N1G 4P6
T: 519.823.1311

EXECUTIVE SUMMARY

RWDI was retained to conduct a pedestrian wind assessment for the proposed project at 5566 Robinson Street & 6158 Allendale Avenue in Niagara Falls, ON (Image 1). The assessment was based on the wind-tunnel testing conducted for the proposed development site under the Existing and 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 appropriate 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 3B, and Table 1, and are summarized as follows:

- The proposed tower is significantly taller than its surroundings, and therefore will redirect winds to ground level.

- In the summer, wind conditions are considered appropriate for the intended pedestrian use at all locations on and around the project site in the Existing configuration. With the addition of the proposed tower, wind conditions at most grade-level locations remain appropriate for the intended pedestrian use, including the main entrances. Exceptions include uncomfortable wind speeds near the northwest and southeast building corners.

- During the winter, seasonally higher wind speeds are observed throughout the site under the Existing configuration. In the Proposed configuration, these stronger winds are anticipated to create several additional uncomfortable locations around the development.

- In most areas on the Level 7 outdoor amenity wind conditions are higher than desired for passive pedestrian use, particularly along the south side of the space.

- No exceedances of the wind safety criterion occur in the Existing configuration. In the Proposed configuration, wind conditions exceed the safety criterion at four locations on the north side of the project at grade-level and at four locations on the south side of the outdoor amenity space on Level 7.

- The design team is working with RWDI to assess the feasibility of design changes and mitigation options for the proposed tower.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1 INTRODUCTION

RWDI was retained to conduct a pedestrian wind assessment for the proposed 5566 Robinson Street & 6158 Allendale Avenue project in Niagara Falls, ON. This report presents the project objectives and approach, the results from RWDI's assessment, and offers conceptual wind control measures where necessary. 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 on the southeast side of the intersection between Robinson Street and Allendale Avenue. The development will consist of a 77-storey high rise tower with a 6-storey podium.

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 RWDI Criteria for gauging wind comfort and safety in pedestrian areas. The assessment focused on critical pedestrian areas, including building entrances and public sidewalks.

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

2 BACKGROUND AND APPROACH

2.1 Wind Tunnel Study Model

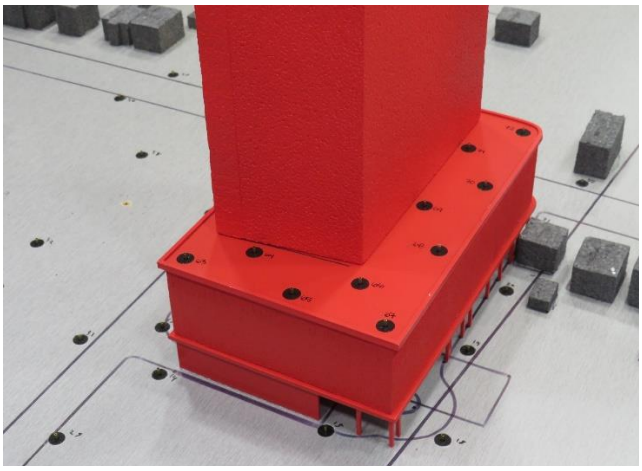
To assess the wind environment around the proposed project, a 1:300 scale model of the project site and surroundings was constructed for the wind tunnel tests of the following configurations:

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 54 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



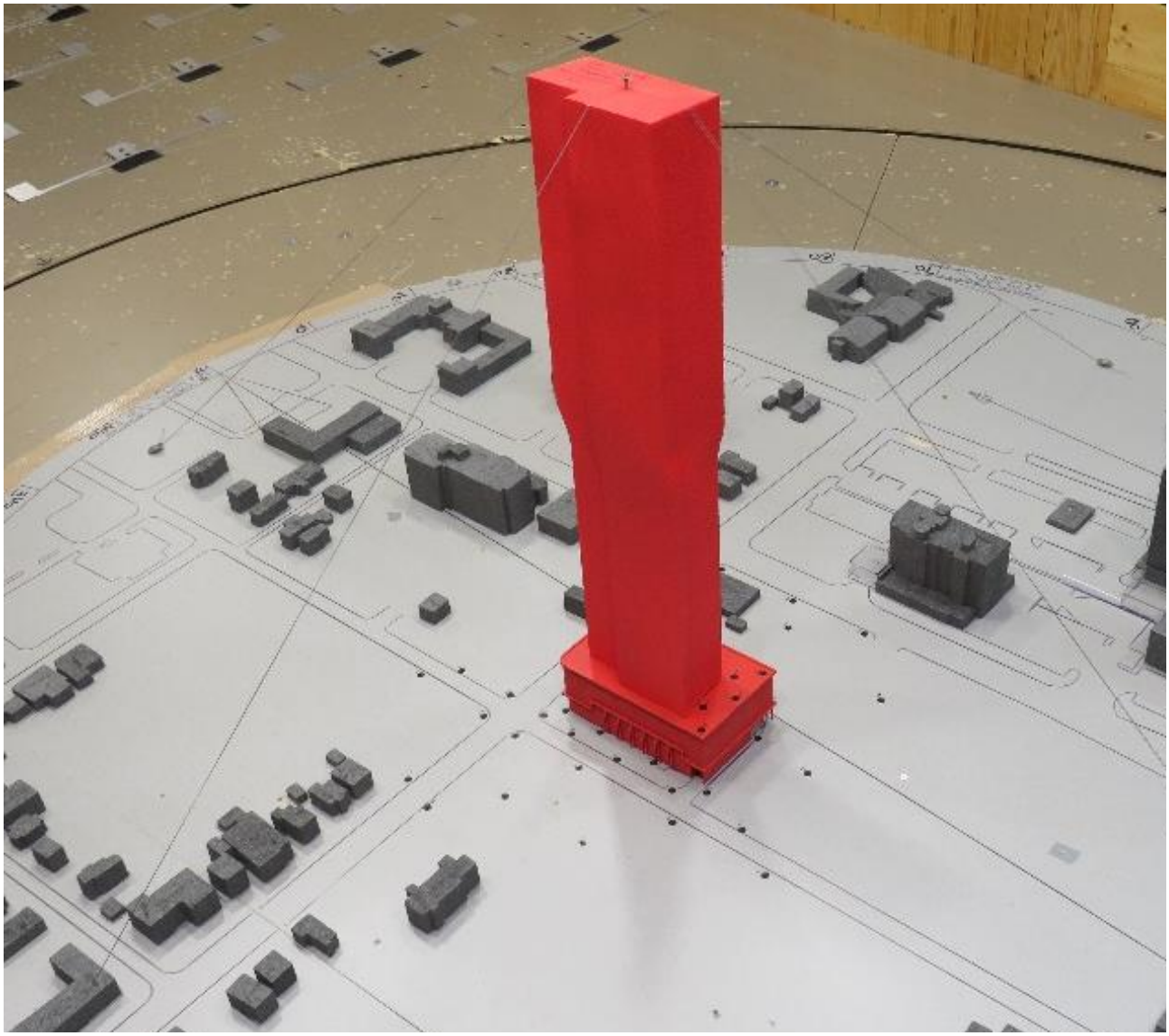
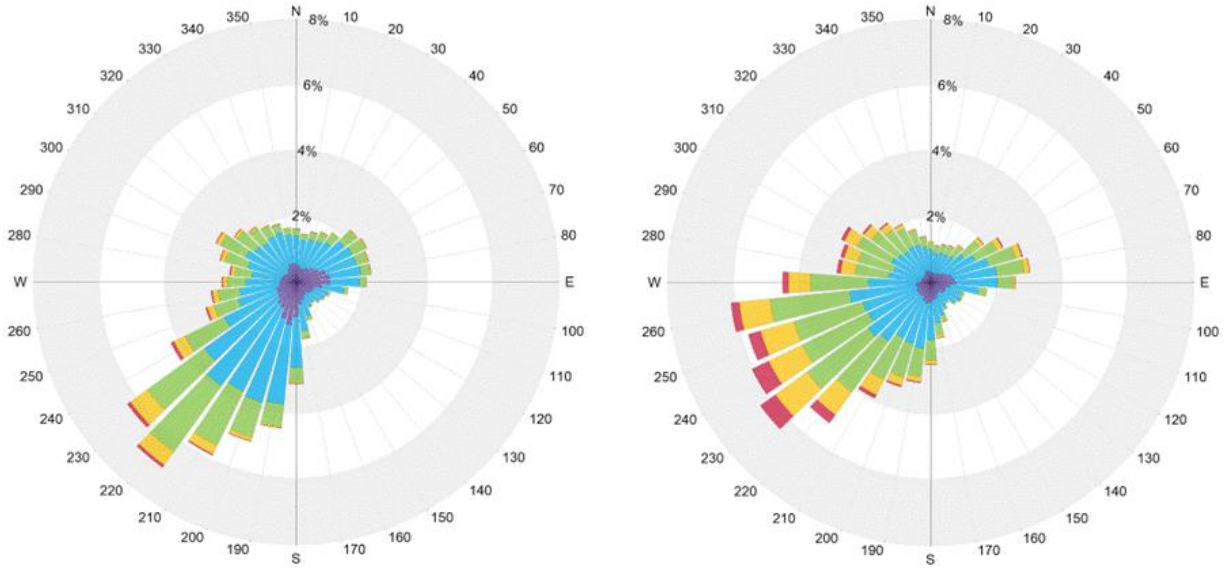


Image 2B: Wind Tunnel Study Model – Proposed Configuration

2.2 Wind Climate Data

Wind statistics recorded at the Niagara Falls 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 directions are predominant in both seasons, as indicated by the wind roses. Strong winds of a mean speed greater 30 km/h measured at the airport (at an anemometer height of 10 m) occur for 4.0% and 12.9% 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.



Wind Speed (km/h)	Probability (%) Summer	Winter
Calm	10.2	5.7
1-10	23.2	15.8
11-20	42.8	36.4
21-30	19.8	29.1
31-40	3.4	9.9
>40	0.6	3.0

Image 3: Directional Distribution of Winds Approaching the Niagara Falls International Airport between 1990 and 2020.

RWDI Pedestrian Wind Criteria

The RWDI pedestrian wind criteria, which have been developed by RWDI through research and consulting practice since 1974, are used in the current study. These criteria have been widely accepted by municipal authorities as well as by the building design and city planning community. Regional differences in wind climate and thermal conditions as well as variations in age, health, clothing, etc. can affect a person's perception of the wind climate. Therefore, comparisons of wind speeds for the existing and proposed building configurations are the most objective way in assessing local pedestrian wind conditions. In general, the combined effect of mean and gust speeds on pedestrian comfort can be quantified by a Gust Equivalent Mean (GEM).

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	≤ 14	Gentle breezes suitable for main building entrances, bus stops, and other places where pedestrians may linger
Strolling	≤ 17	Moderate winds that would be appropriate for window shopping and strolling along a downtown street, plaza or park
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 all pedestrian 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) Wind conditions are considered to be comfortable if the predicted GEM speeds are within the respective thresholds for at least 80% of the time between 6:00 and 23:00. Nightly hours between 0:00 and 5:00 are excluded from the wind analysis for comfort since limited usage of outdoor spaces is anticipated; and,
(3) Instead of standard four seasons, two periods of summer (May to October) and winter (November to April) are adopted in the wind analysis, because in a cold climate such as that found in Niagara Falls, there are distinct differences in pedestrian outdoor behaviours between these two-time periods.

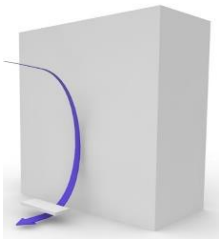
Safety Criterion	Gust Speed (km/h)	Description
Exceeded	> 90	Excessive gust speeds that can adversely affect a pedestrian's balance and footing. Wind mitigation is typically required.

Notes:

(1) Based on an annual exceedance of 9 hours or 0.1% of the time for 24 hours a day; and,
(2) Only gust speeds need to be considered in the wind safety criterion. These are usually rare events but deserve special attention in city planning and building design due to their potential safety impact on pedestrians.

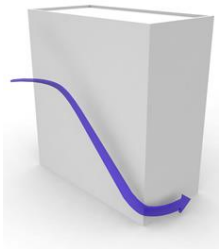
2.3 General Wind Flow Mechanisms

discussion of wind conditions, reference is made to the following wind flow mechanisms (Image 4):



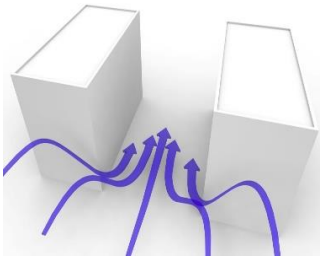
DOWNWASHING

Tall buildings tend to intercept the stronger winds at higher elevations and redirect them to the ground level. This is often the main cause for wind accelerations around large buildings at the pedestrian level.



CORNER ACCELERATION

When wind moves around the buildings a localized increase in the wind activity or corner acceleration can be expected around the exposed building corners at pedestrian level. The effect is intensified when the wind approaches at an oblique angle to a tall façade and are deflected down and around the exposed corners.



CHANNELLING EFFECT

Wind flow tends to accelerate through the space between buildings, under bridges or in passages through buildings due to channelling effect caused by the narrow gap. The effect is intensified if the channel is aligned with the predominant wind direction.

Image 4: General Wind Flow Mechanisms

If these building/wind combinations occur for prevailing winds, there is a greater potential for increased wind activity. Design details such as setting back a tall tower from the edges of a podium, deep canopies close to ground level, wind screens, tall trees with dense landscaping, etc. (Image 5) can help reduce wind speeds. The choice and effectiveness of these measures would depend on the exposure and orientation of the site with respect to the prevailing wind directions and the size and massing of the proposed buildings.

Podium/tower setback, canopy, landscaping and wind screens (left to right)

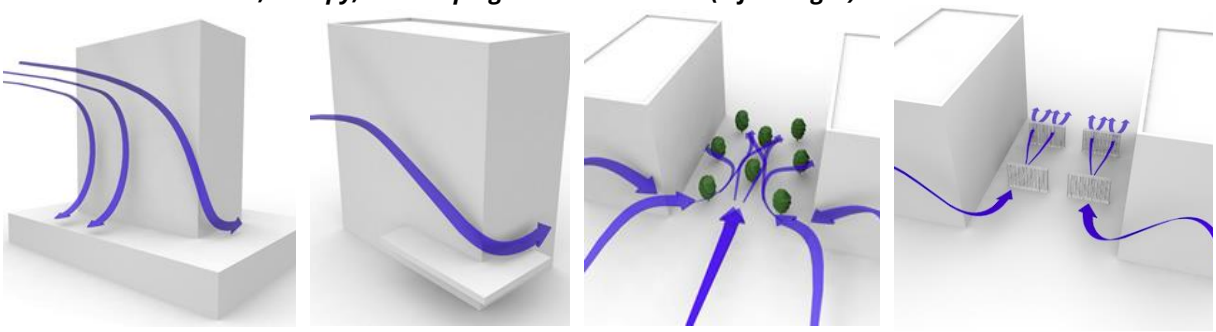


Image 5: Common Wind Control Measures

3 RESULTS AND DISCUSSION

The predicted wind conditions are shown on site plans in Figures 1 and 2 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 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 comfortable for standing or sitting are preferred at main entrances where pedestrians are apt to linger. Wind speeds comfortable for sitting or standing are ideal for areas intended for passive activities.

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 Existing Configuration

In the Existing configuration, wind speeds during the summer are suitable for passive actives both on- and off-site (Figure 1A). In the winter, slightly higher wind speeds are observed due to seasonal wind climate, but wind conditions remain appropriate for the level of pedestrian activity in the area (Figure 2A).

No exceedances of the wind safety criterion occur in the existing configuration (Figure 3A)

3.2 Proposed Configuration

The proposed tower is taller than is surroundings and has a significant amount of surface area exposed to the prevalent winds at higher altitudes. Winds intercepted by the tower downwash to lower levels and tend to accelerate around building corners, creating most of the pedestrian-level wind issues detected in the wind tunnel test (see Image 4).

3.2.1 Grade Level (Locations 1 through 44)

During the summer, wind speeds are uncomfortable at 4 locations (Locations 7, 8, 18, 41 in Figure 1B). In the winter, several uncomfortable locations occur due to the seasonally stronger wind climate (Figure 2B).

The most effective form of addressing windy conditions is through adjustments to the external building geometry. Possible adjustments that would be effective in improving pedestrian-level wind conditions include, but not limited to, increasing the curvature of corners, using a podium significantly larger than the tower base, adding tower setbacks and corner articulations, etc. A few examples are shown in Image 6.

The wind safety criterion is exceeded at four locations close to the north façade of the building (Locations 6, 7, 21, 41, 42 in Figure 3B).

Image 6: Towers with features that are beneficial for pedestrian-level winds.

The use of canopies and wind screens can also eliminate problematic wind conditions locally. Some examples are displayed in Image 7.

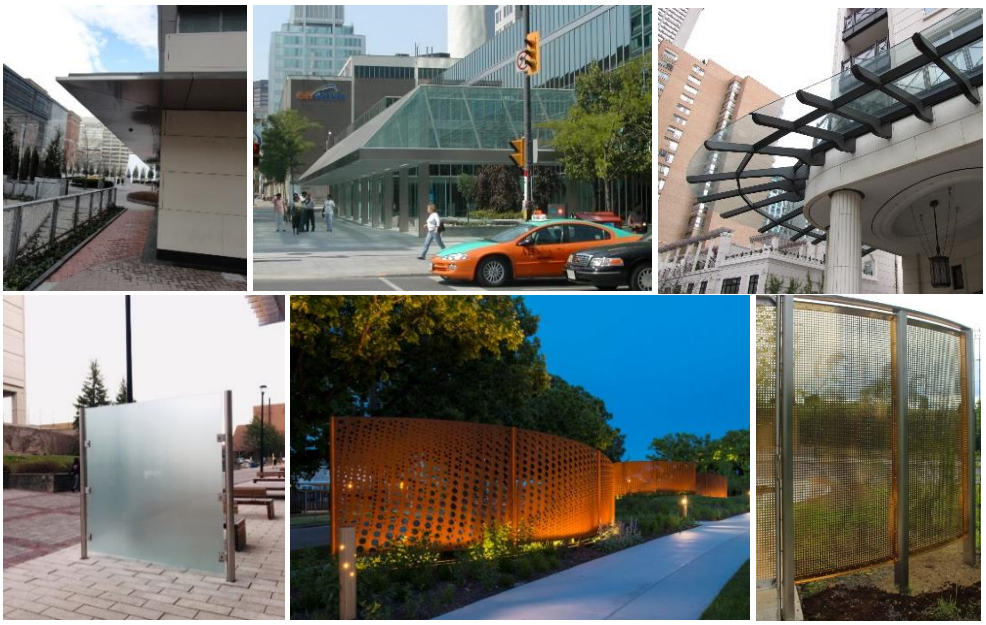


Image 7: Canopies and wind screens being used as wind control measures at grade level

Landscaping elements can also act as dissipative elements for the wind but should not be relied upon to address safety exceedances.

3.2.2 Podium (Locations 45 through 54)

During the summer, wind speeds are uncomfortable at 3 locations (Locations 47-49 Figure 1B). The number of uncomfortable locations increases during the winter (Figure 2B). Local wind conditions on the podium can be improved primarily through the use overhead protection in the form of porous screens or trellises, as a canopy (solid barrier) can redirect a part of the downwashing winds to grade level.

Uncomfortable or unsafe conditions on the podium may not be a serious concern since limited use of these areas is expected during the colder months.

The wind safety criterion is exceeded at four locations on the Podium (Locations 45, 47-49, and 54 Figure 3B).

4 STATEMENT OF LIMITATIONS

Limitations

This report was prepared by Rowan Williams Davies & Irwin, Inc. ("RWDI") for La Pue International Inc. ("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 La Pue International Inc. and used to construct the scale model of the proposed development **("Project Data**")

File Name	File Type	Date Received (dd/mm/yyyy)
121034 - Niagara77 - 2022.04.01	RVT	20/07/2022

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.

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.

3. Williams, C.J., Soligo M.J. and Cote, J. (1992). "A Discussion of the Components for a Comprehensive Pedestrian Level Comfort Criteria," *Journal of Wind Engineering and Industrial Aerodynamics*, Vol.41-44, pp.2389-2390.

4. Soligo, M.J., Irwin, P.A., and Williams, C.J. (1993). "Pedestrian Comfort Including Wind and Thermal Effects," *Third Asia-Pacific Symposium on Wind Engineering*, Hong Kong.

5. Soligo, M.J., Irwin, P.A., Williams, C.J. and Schuyler, G.D. (1998). "A Comprehensive Assessment of Pedestrian Comfort Including Thermal Effects," *Journal of Wind Engineering and Industrial Aerodynamics*, Vol.77&78, pp.753-766.

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.

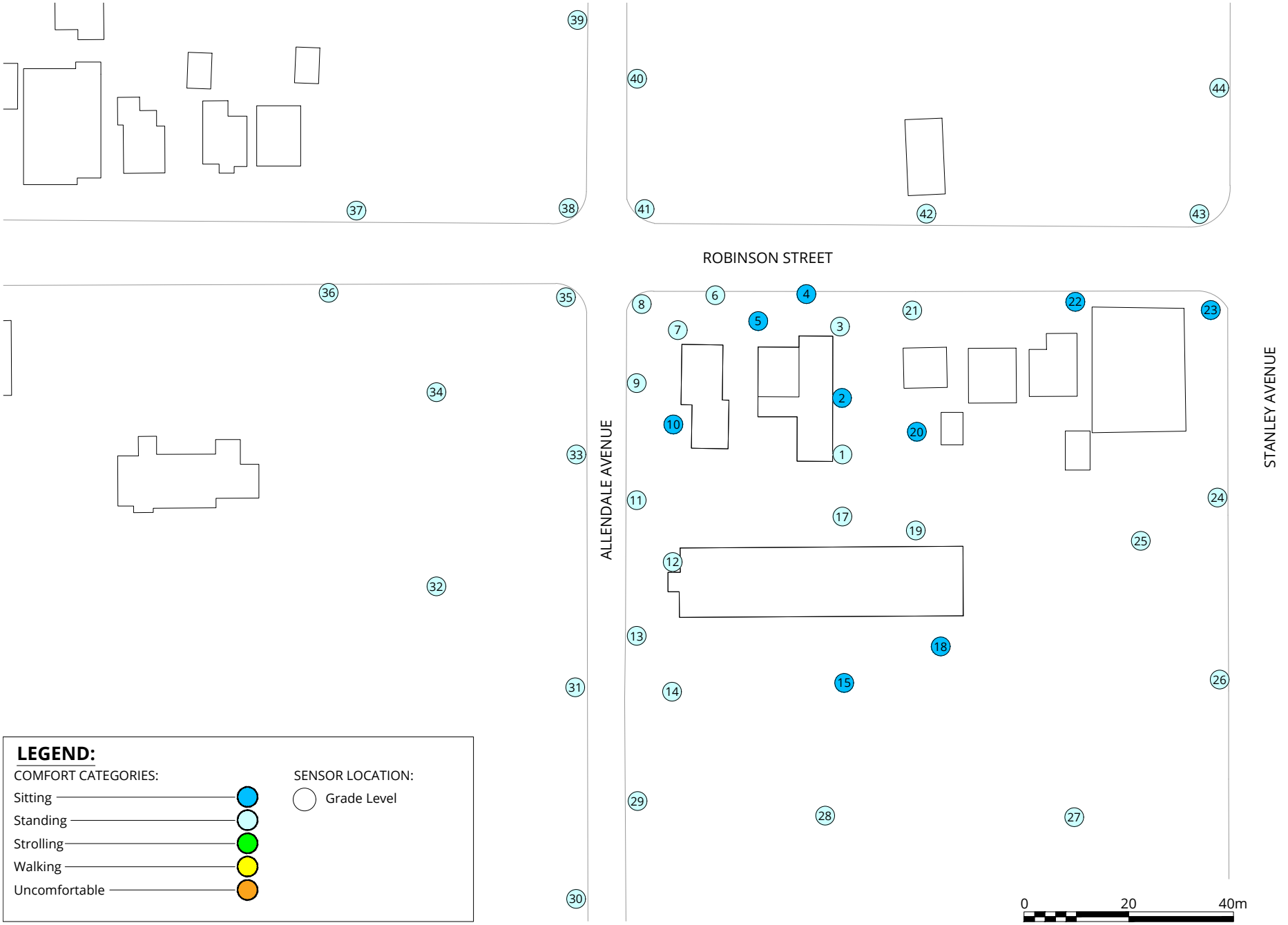
7. Lawson, T.V. (1973). "Wind Environment of Buildings: A Logical Approach to the Establishment of Criteria", *Report No. TVL 7321*, Department of Aeronautic Engineering, University of Bristol, Bristol, England.

8. Durgin, F. H. (1997). "Pedestrian Level Wind Criteria Using the Equivalent average", *Journal of Wind Engineering and Industrial Aerodynamics*, Vol. 66, pp.215-226.

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



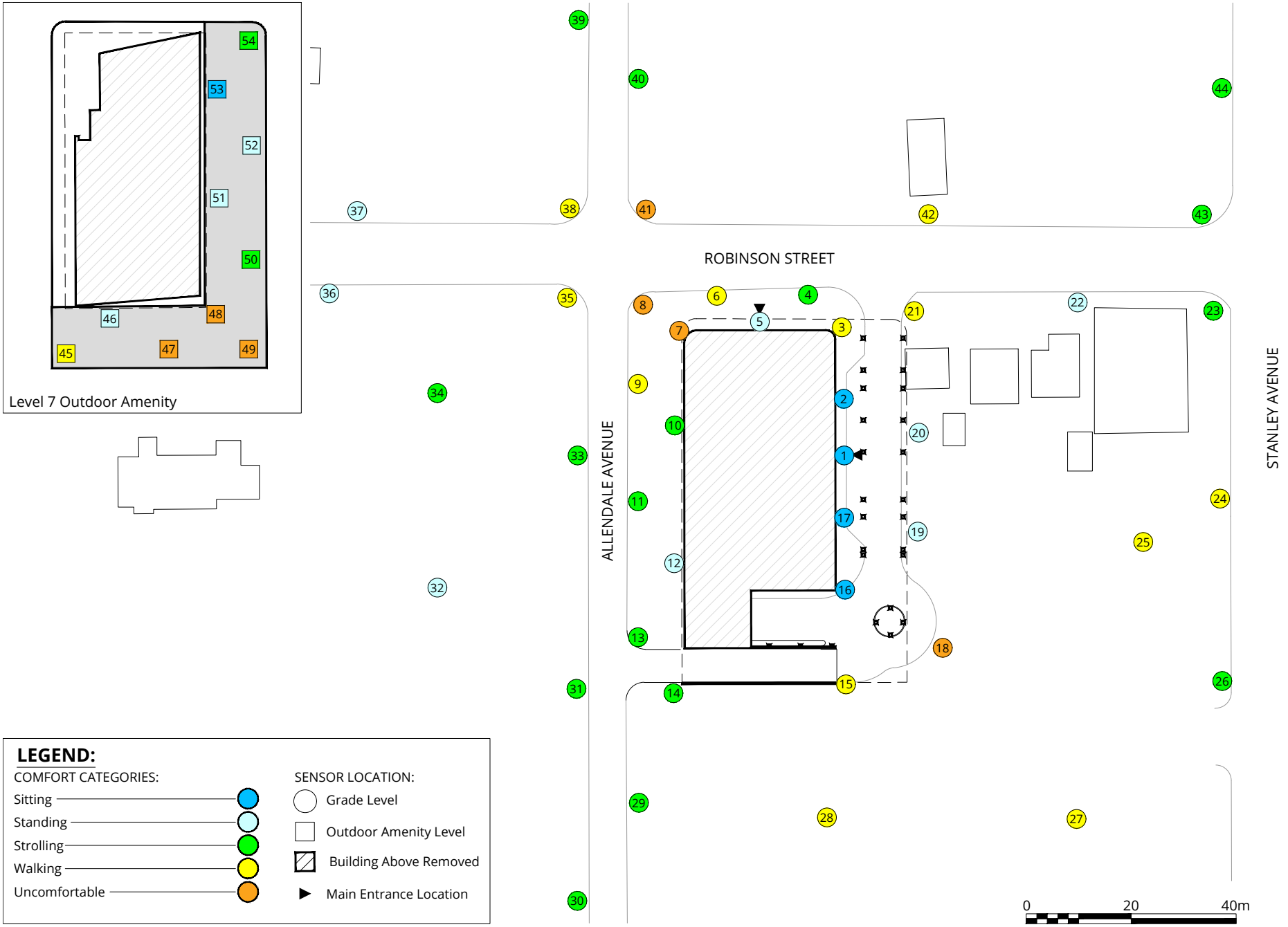
Pedestrian Wind Comfort Conditions
Existing Configuration
Summer (May to October, 6:00 to 23:00)

5566 Robinson Street & 6158 Allendale Avenue - Niagara Falls, ON

True North

Project #2201139

Drawn by: ALJM	Figure: 1A
Approx. Scale:	1:1000
Date Revised:	Aug. 11 ,2022



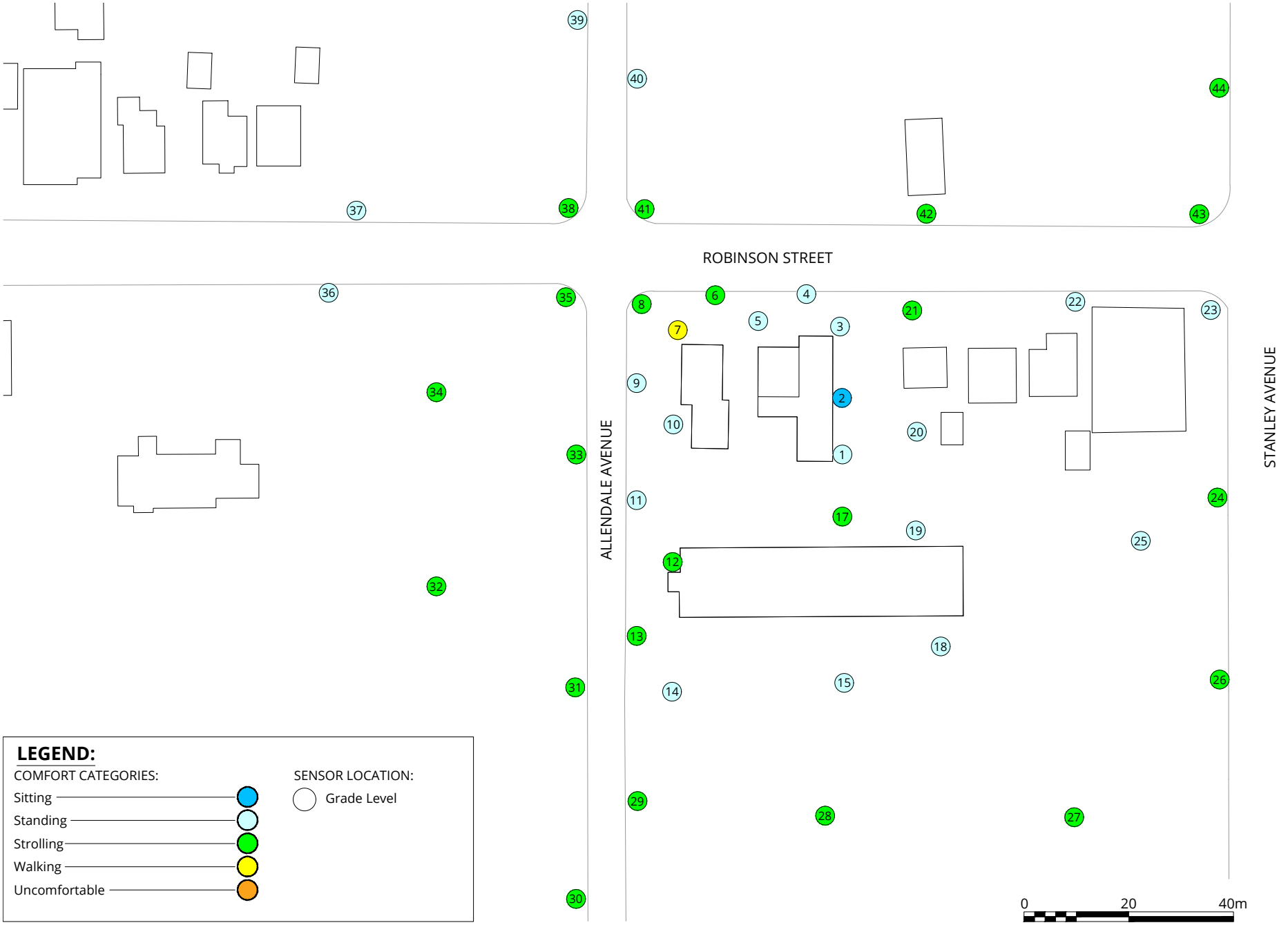
Pedestrian Wind Comfort Conditions
Proposed Configuration
Summer (May to October, 6:00 to 23:00)

5566 Robinson Street & 6158 Allendale Avenue - Niagara Falls, ON

True North

Project #2201139

Drawn by: ALJM	Figure: 1B
Approx. Scale:	1:1000
Date Revised:	Aug. 11 ,2022



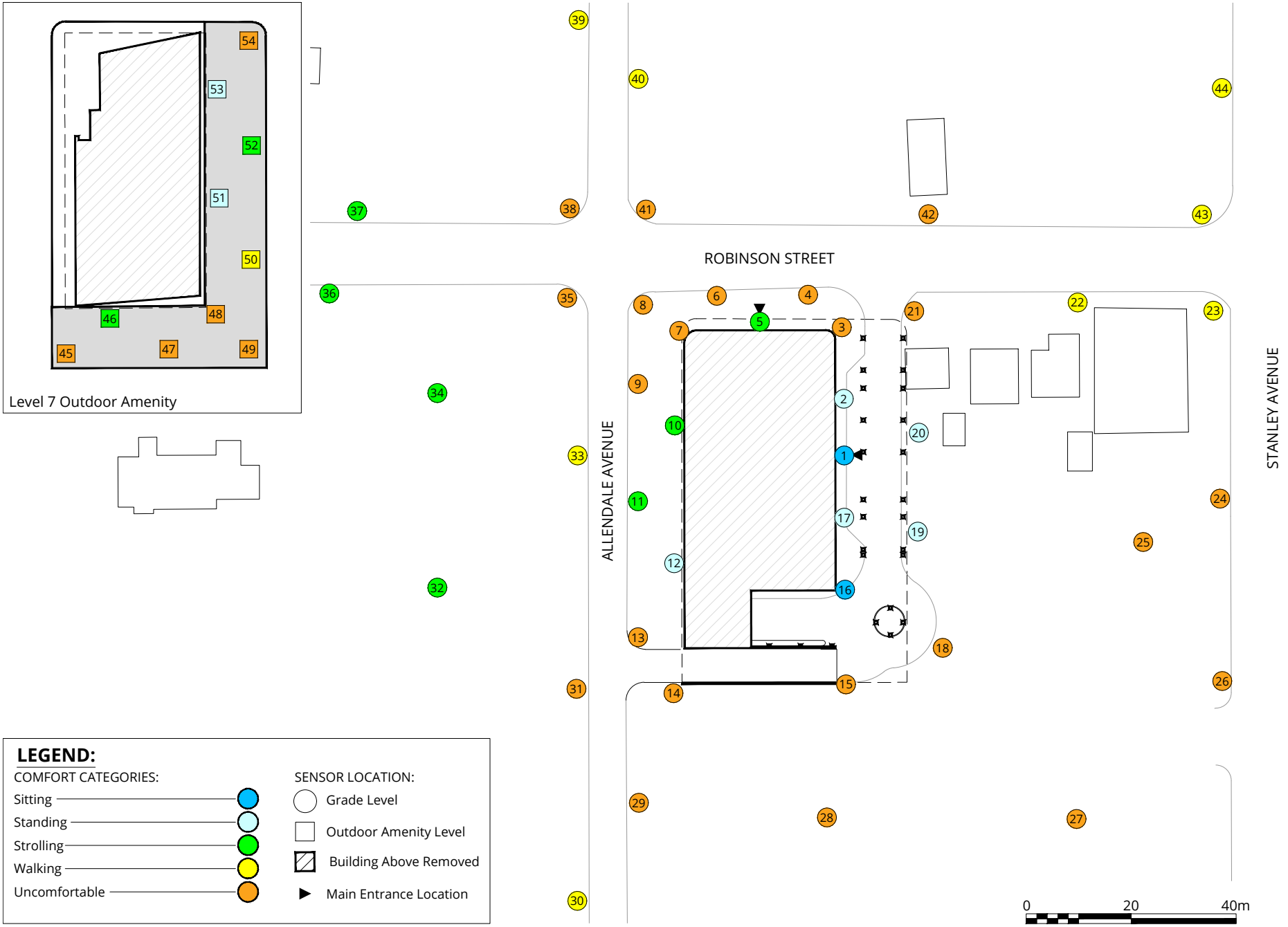
Pedestrian Wind Comfort Conditions
Existing Configuration
Winter (November to April, 6:00 to 23:00)

5566 Robinson Street & 6158 Allendale Avenue - Niagara Falls, ON

True North

Project #2201139

Drawn by: ALJM	Figure: 2A
Approx. Scale:	1:1000
Date Revised:	Aug. 11 ,2022



Pedestrian Wind Comfort Conditions

Proposed Configuration

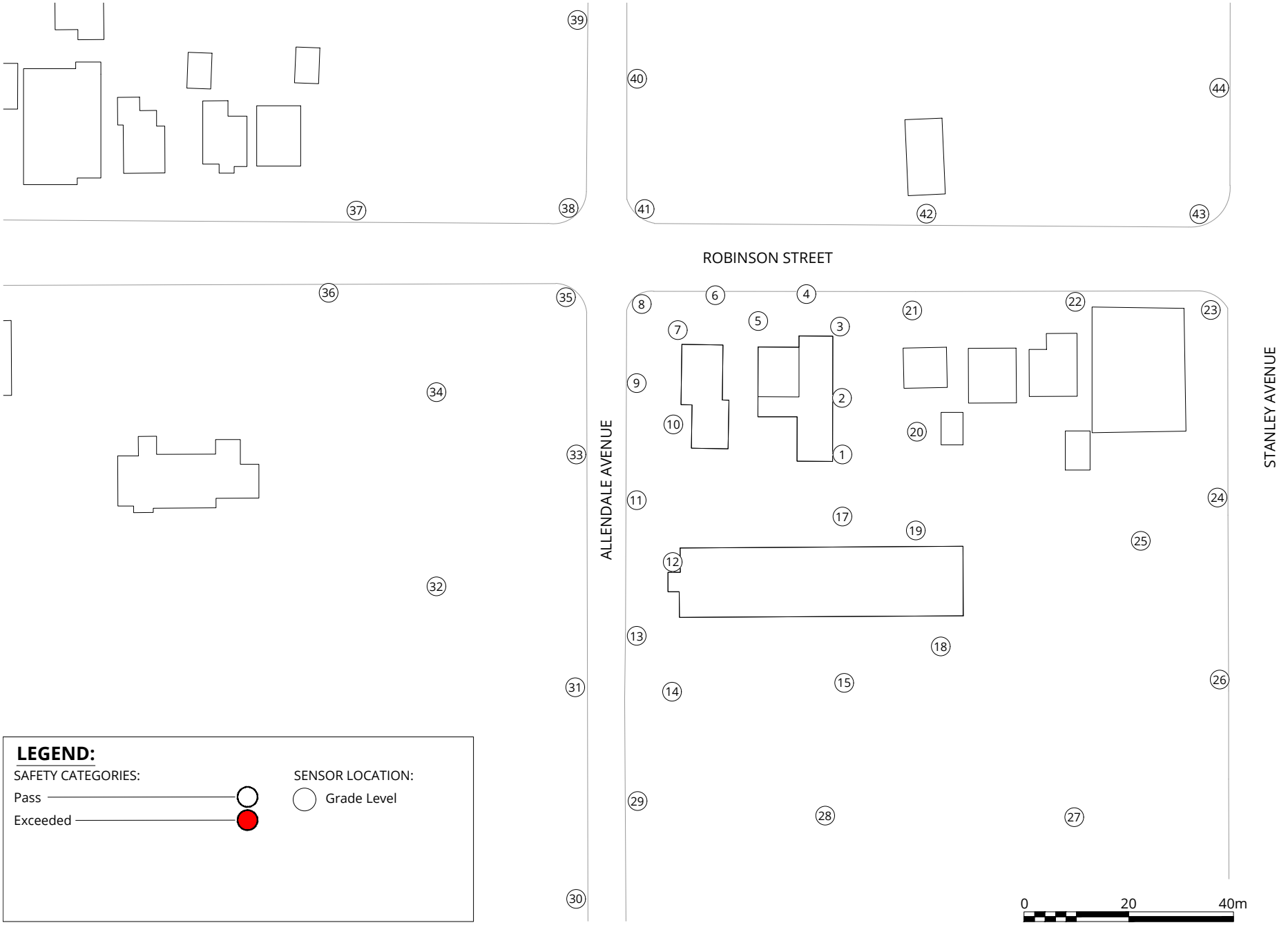
Winter (November to April, 6:00 to 23:00)

5566 Robinson Street & 6158 Allendale Avenue - Niagara Falls, ON

True North

Project #2201139

Drawn by: ALJM	Figure: 2B
Approx. Scale:	1:1000
Date Revised:	Aug. 11 ,2022



LEGEND:

SAFETY CATEGORIES:

Pass

Exceeded

SENSOR LOCATION:

Grade Level

Pedestrian Wind Safety Conditions

Existing Configuration

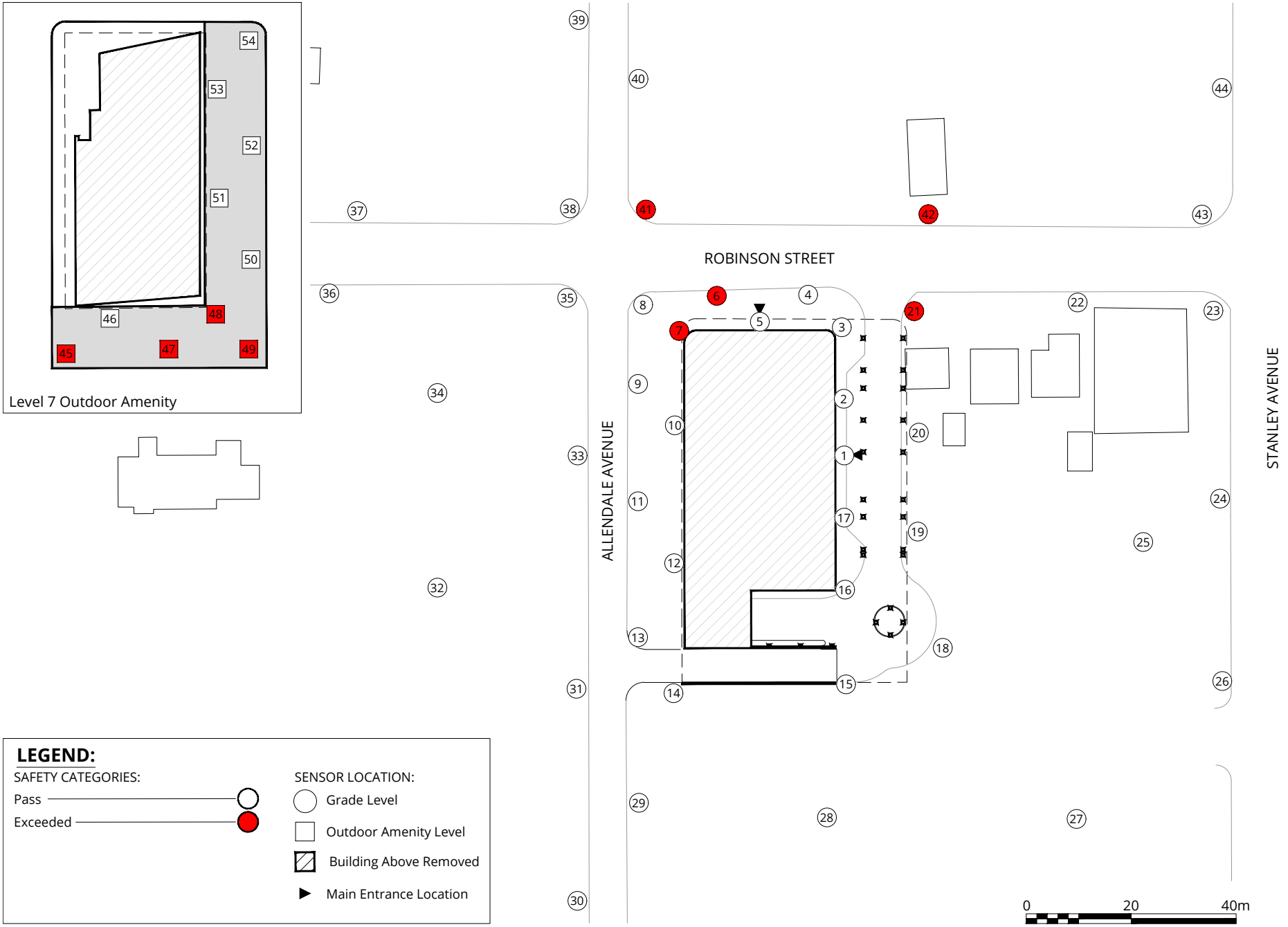
Annual (January to December, 0:00 to 23:00)

5566 Robinson Street & 6158 Allendale Avenue - Niagara Falls, ON

True North

Project #2201139

Drawn by: ALJM	Figure: 3A
Approx. Scale:	1:1000
Date Revised:	Aug. 11 ,2022



Pedestrian Wind Safety Conditions
Proposed Configuration
Annual (January to December, 0:00 to 23:00)

5566 Robinson Street & 6158 Allendale Avenue - Niagara Falls, ON

True North

Project #2201139

Drawn by: ALJM	Figure: 3B
Approx. Scale:	1:1000
Date Revised:	Aug. 11 ,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	11	Standing	64	Pass
	Proposed	9	Sitting	10	Sitting	39	Pass
2	Existing	10	Sitting	10	Sitting	56	Pass
	Proposed	10	Sitting	11	Standing	48	Pass
3	Existing	11	Standing	13	Standing	48	Pass
	Proposed	18	Walking	24	Uncomfortable	81	Pass
4	Existing	9	Sitting	12	Standing	46	Pass
	Proposed	16	Strolling	21	Uncomfortable	79	Pass
5	Existing	9	Sitting	11	Standing	40	Pass
	Proposed	12	Standing	16	Strolling	67	Pass
6	Existing	11	Standing	15	Strolling	61	Pass
	Proposed	18	Walking	27	Uncomfortable	114	Exceeded
7	Existing	14	Standing	18	Walking	65	Pass
	Proposed	25	Uncomfortable	32	Uncomfortable	107	Exceeded
8	Existing	12	Standing	15	Strolling	55	Pass
	Proposed	23	Uncomfortable	28	Uncomfortable	90	Pass
9	Existing	11	Standing	12	Standing	46	Pass
	Proposed	19	Walking	22	Uncomfortable	80	Pass
10	Existing	10	Sitting	13	Standing	49	Pass
	Proposed	15	Strolling	17	Strolling	69	Pass
11	Existing	11	Standing	14	Standing	48	Pass
	Proposed	15	Strolling	17	Strolling	64	Pass
12	Existing	13	Standing	15	Strolling	65	Pass
	Proposed	13	Standing	14	Standing	57	Pass
13	Existing	12	Standing	15	Strolling	49	Pass
	Proposed	16	Strolling	21	Uncomfortable	73	Pass
14	Existing	11	Standing	14	Standing	49	Pass
	Proposed	17	Strolling	23	Uncomfortable	79	Pass
15	Existing	10	Sitting	13	Standing	49	Pass
	Proposed	20	Walking	24	Uncomfortable	84	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
16	Existing	-	-	-	-	-	-
	Proposed	7	Sitting	9	Sitting	45	Pass
17	Existing	13	Standing	15	Strolling	69	Pass
	Proposed	9	Sitting	11	Standing	43	Pass
18	Existing	10	Sitting	14	Standing	50	Pass
	Proposed	21	Uncomfortable	25	Uncomfortable	84	Pass
19	Existing	11	Standing	14	Standing	50	Pass
	Proposed	11	Standing	14	Standing	57	Pass
20	Existing	10	Sitting	12	Standing	46	Pass
	Proposed	11	Standing	14	Standing	58	Pass
21	Existing	12	Standing	15	Strolling	62	Pass
	Proposed	19	Walking	26	Uncomfortable	101	Exceeded
22	Existing	9	Sitting	12	Standing	44	Pass
	Proposed	14	Standing	19	Walking	73	Pass
23	Existing	9	Sitting	12	Standing	46	Pass
	Proposed	15	Strolling	19	Walking	72	Pass
24	Existing	13	Standing	16	Strolling	57	Pass
	Proposed	18	Walking	22	Uncomfortable	83	Pass
25	Existing	12	Standing	14	Standing	51	Pass
	Proposed	19	Walking	24	Uncomfortable	89	Pass
26	Existing	13	Standing	15	Strolling	53	Pass
	Proposed	17	Strolling	22	Uncomfortable	76	Pass
27	Existing	12	Standing	15	Strolling	54	Pass
	Proposed	18	Walking	23	Uncomfortable	87	Pass
28	Existing	12	Standing	16	Strolling	56	Pass
	Proposed	19	Walking	25	Uncomfortable	87	Pass
29	Existing	13	Standing	16	Strolling	57	Pass
	Proposed	16	Strolling	23	Uncomfortable	78	Pass
30	Existing	13	Standing	16	Strolling	57	Pass
	Proposed	15	Strolling	20	Walking	68	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
31	Existing	13	Standing	16	Strolling	56	Pass
	Proposed	16	Strolling	21	Uncomfortable	78	Pass
32	Existing	13	Standing	17	Strolling	57	Pass
	Proposed	14	Standing	16	Strolling	61	Pass
33	Existing	12	Standing	15	Strolling	50	Pass
	Proposed	17	Strolling	20	Walking	71	Pass
34	Existing	13	Standing	16	Strolling	57	Pass
	Proposed	15	Strolling	17	Strolling	63	Pass
35	Existing	13	Standing	15	Strolling	58	Pass
	Proposed	20	Walking	24	Uncomfortable	83	Pass
36	Existing	12	Standing	14	Standing	52	Pass
	Proposed	12	Standing	15	Strolling	56	Pass
37	Existing	12	Standing	14	Standing	53	Pass
	Proposed	14	Standing	16	Strolling	57	Pass
38	Existing	12	Standing	15	Strolling	55	Pass
	Proposed	18	Walking	22	Uncomfortable	76	Pass
39	Existing	12	Standing	14	Standing	51	Pass
	Proposed	15	Strolling	18	Walking	62	Pass
40	Existing	12	Standing	14	Standing	52	Pass
	Proposed	17	Strolling	20	Walking	73	Pass
41	Existing	13	Standing	16	Strolling	60	Pass
	Proposed	21	Uncomfortable	27	Uncomfortable	91	Exceeded
42	Existing	11	Standing	15	Strolling	63	Pass
	Proposed	19	Walking	28	Uncomfortable	117	Exceeded
43	Existing	12	Standing	15	Strolling	54	Pass
	Proposed	15	Strolling	20	Walking	75	Pass
44	Existing	12	Standing	15	Strolling	56	Pass
	Proposed	15	Strolling	19	Walking	78	Pass
45	Existing	-	-	-	-	-	-
	Proposed	19	Walking	27	Uncomfortable	99	Exceeded

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
46	Existing	-	-	-	-	-	-
	Proposed	13	Standing	16	Strolling	89	Pass
47	Existing	-	-	-	-	-	-
	Proposed	22	Uncomfortable	29	Uncomfortable	116	Exceeded
48	Existing	-	-	-	-	-	-
	Proposed	24	Uncomfortable	28	Uncomfortable	108	Exceeded
49	Existing	-	-	-	-	-	-
	Proposed	23	Uncomfortable	28	Uncomfortable	99	Exceeded
50	Existing	-	-	-	-	-	-
	Proposed	17	Strolling	20	Walking	85	Pass
51	Existing	-	-	-	-	-	-
	Proposed	11	Standing	13	Standing	54	Pass
52	Existing	-	-	-	-	-	-
	Proposed	14	Standing	17	Strolling	73	Pass
53	Existing	-	-	-	-	-	-
	Proposed	10	Sitting	13	Standing	55	Pass
54	Existing	-	-	-	-	-	-
	Proposed	16	Strolling	21	Uncomfortable	80	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 - 14	Standing
15 - 17	Strolling
18 - 20	Walking
> 20	Uncomfortable

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