REPORT

688-698 BRANT STREET

BURLINGTON, ON

PEDESTRIAN WIND STUDY
RWDI # 2206583
January 12, 2023

SUBMITTED TO

Claudia Salgado
Brooklyn Construction
3410 S Service Road, Suite 101
Burlington, Ontario, L7N 3T2

CC: Alyson Naseer
Planner, Weston Consulting
anaseer@westonconsulting.com
268 Berkeley Street
Toronto, Ontario, M5A 2X5
T: 416.640.9917 ext. 278

SUBMITTED BY

Mu'taz Suleiman, M.Sc., EIT
Technical Coordinator
Mutaz.Suleiman@rwdi.com

Rose Babaei, Ph.D.
Senior Technical Coordinator
Rose.Babaei@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

CANADA'S BEST MANAGED COMPANIES Platinum member

This document is intended for the sole use of the party to whom it is addressed and may contain information that is privileged and/or confidential. If you have received this in error, please notify us immediately. Accessible document formats provided upon request.
® RWDI name and logo are registered trademarks in Canada and the United States of America
© 2021 Rowan Williams Davies & Irwin Inc. ("RWDI") ALL RIGHTS RESERVED

EXECUTIVE SUMMARY

RWDI was retained to conduct a pedestrian wind assessment for the proposed 688-698 Brant Street project in Burlington, ON. 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 Burlington 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 3B, and Table 1, and are summarized as follows:

EXISTING CONFIGURATION

- Wind speeds across the existing site are suitable for the intended pedestrian use of various areas throughout the year.
- Wind speeds at all locations assessed meet the pedestrian wind safety criterion.

PROPOSED CONFIGURATION

Grade Level

- With the proposed development in place, slightly elevated wind speeds on and around the site are observed. Wind conditions are suitable for the intended pedestrian usage throughout the year, except for an area under the breezeway to the south, where slightly higher wind speeds occur in the winter.
- Wind speeds at all the main entrances are shown to be appropriate throughout the year.
- The pedestrian wind safety criterion will be met at most locations at grade level, except for one location to the northeast, where the criterion is exceeded marginally (i.e., 1 km/h above the 90 km/h threshold).

Above Grade

- Wind speeds on all above-grade amenity areas are suitable for passive use in the summer, except for areas on the western portion. Higher-than-desired wind speeds are anticipated at most areas during the winter which may not be a concern due to reduced usage.
- Wind speeds that exceed the safety criterion occur at areas to the west and east of the amenity, and likely occur in the winter months, due to seasonally stronger winds.

  NOTE: Testing was completed without the presence of any hard or soft landscaping at grade nor on any amenity levels. The addition of such features would reduce the overall wind speeds.

TABLE OF CONTENTS

EXECUTIVE SUMMARY

1 INTRODUCTION 1

1.1 Project Description 1

1.2 Objectives 1

2 BACKGROUND AND APPROACH 2

2.1 Wind Tunnel Study Model 2

2.2 Meteorological Data 5

2.3 Burlington Pedestrian Wind Criteria 6

2.4 General Wind Flow Mechanisms 7

3 RESULTS AND DISCUSSION 8

3.1 Grade Level (Locations 1 through 79) 8

3.1.1 Existing Configuration 8

3.1.2 Proposed Configuration 8

3.2 Rooftop Outdoor Amenity Area (Locations 80 through 91) 9

4 STATEMENT OF LIMITATIONS 11

5 REFERENCES 13

LIST OF FIGURES

Figure 1A: Pedestrian Wind Comfort Conditions – Existing Configuration – Summer
Figure 1B: Pedestrian Wind Comfort Conditions – Proposed Configuration – Summer

Figure 2A: Pedestrian Wind Comfort Conditions – Existing Configuration – Winter
Figure 2B: Pedestrian Wind Comfort Conditions – Proposed Configuration – Winter

Figure 3A: Pedestrian Wind Safety Conditions – Existing Configuration – Annual
Figure 3B Pedestrian Wind Safety Conditions – Proposed Configuration – Annual

LIST OF TABLES

Table 1: Pedestrian Wind Comfort and Safety Conditions

1 INTRODUCTION

RWDI was retained to conduct a pedestrian wind assessment for the proposed 688-698 Brant Street project in Burlington, ON. This report presents the project objectives, approach, and the main results from RWDI's assessment and provides 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 at 688-698 of Brant Street, with Olga Drive to the north and Alfred Crescent to the west (**Image 1**). The development will consist of a 11-storey C-shaped condo building with ground floor retail space and townhouses and an outdoor amenity area on the roof level. The proposed building is approximately 42 m tall and has a stepped massing form.

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 Burlington criteria for gauging wind comfort and safety in pedestrian areas. The assessment focused on critical pedestrian areas, including building entrances, public sidewalks, and the rooftop shared amenity area.



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 91 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 and was reviewed by the City of Burlington. 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.

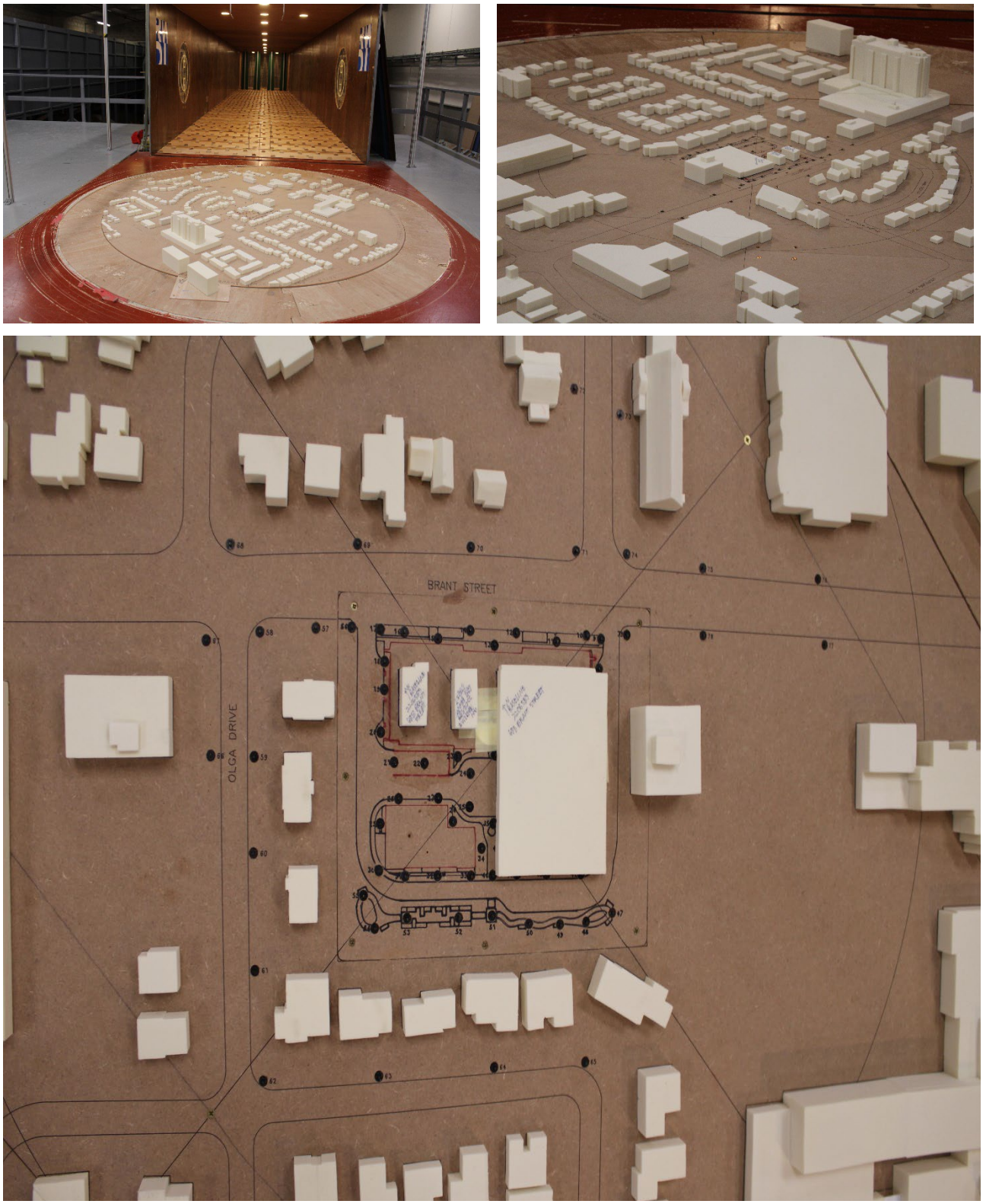


Image 2A: Wind Tunnel Study Model – Existing Configuration





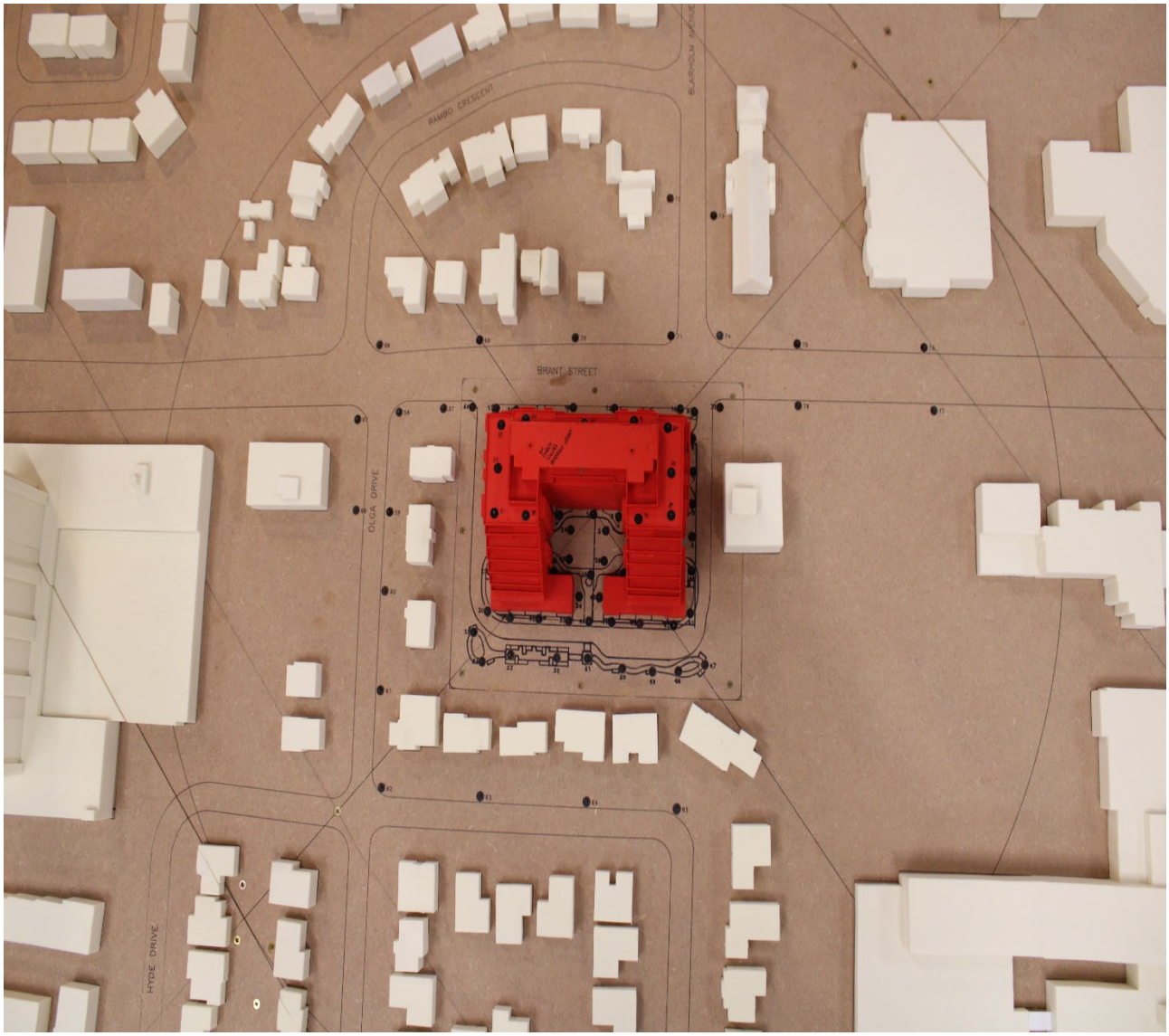
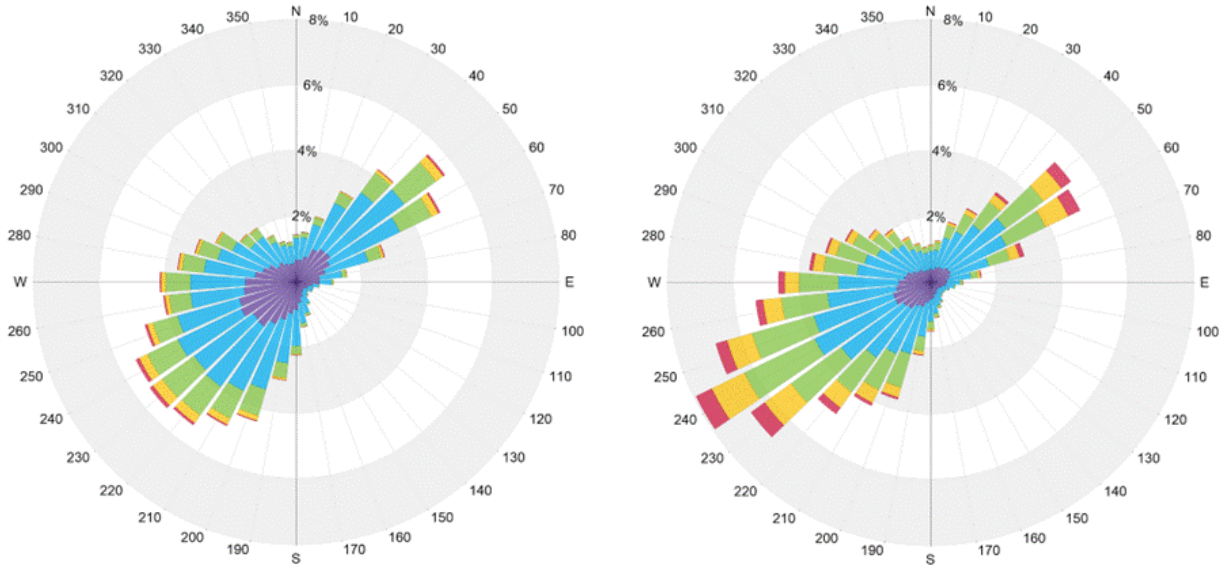


Image 2B: Wind Tunnel Study Model – Proposed Configuration

2.2 Meteorological Data

Wind statistics recorded at Hamilton 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 northeast and southwest directions are predominant in both the summer and winter, as indicated by the wind roses. Strong winds of a mean speed greater than 30 km/h, measured at the airport (at an anemometer height of 10 m), occur for 3.8% and 12.6% 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	3.9	2.3
1-10	33.7	21.7
11-20	43.1	39.5
21-30	15.5	23.9
31-40	3.0	9.0
>40	0.8	3.6

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

2.3 Burlington Pedestrian Wind Criteria

The Burlington pedestrian wind criteria, developed in March 2020, are specified in the Guidelines and Terms of Reference, "Pedestrian Level Wind Study". The following defines the criterion in detail.

Comfort Category	GEM Speed (km/h)	Description
Sitting	≤ 10	**Calm or light breezes** • Appropriate for dedicated seating areas such as cafés, patios, and outdoor amenity areas
Standing	≤ 14	**Gentle breezes** • Appropriate for main building entrances, bus stops, and other places where pedestrians may linger
Leisurely Walking	≤ 17	**Moderate winds** • Appropriate for shopping and strolling along retail streets and parks
Fast Walking	≤ 20	**Relative higher speed winds** • Appropriate for areas where pedestrians are walking, running, or cycling without lingering
Uncomfortable	> 20	**Strong winds** • Inappropriate due to nuisance for all pedestrian activities • Wind mitigation measures required

Notes:

(1) GEM is defined as the maximum of the mean wind speed or gust speed divided by 1.85 (whichever is larger). Gust speed can be directly measured in a wind tunnel or represented by mean wind speed + 3*RMS (Root Mean Square) wind speed.

(2) GEM speeds listed above are based on a seasonal exceedance of 20% of the time between 06:00 and 23:00. The criterion has been met if the wind speeds occur at least four out of five days.

Safety Criterion	Gust Speed (km/h)	Description
Exceeded	> 90	• Excessive gust speeds • Adverse effect on pedestrian's balance and footing • Wind mitigation is required

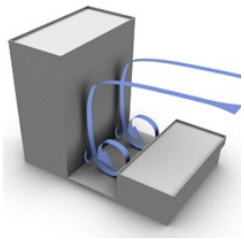
Notes:

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

(2) Gust speed can be directly measured in a wind tunnel or represented by mean wind speed + 3*RMS wind speed.

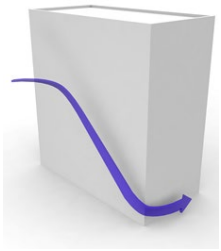
2.4 General Wind Flow Mechanisms

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



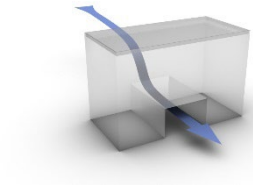
DOWNWASHING

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 stepped massing, 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.

Stepped massing, canopy, landscaping, and wind screens (left to right)

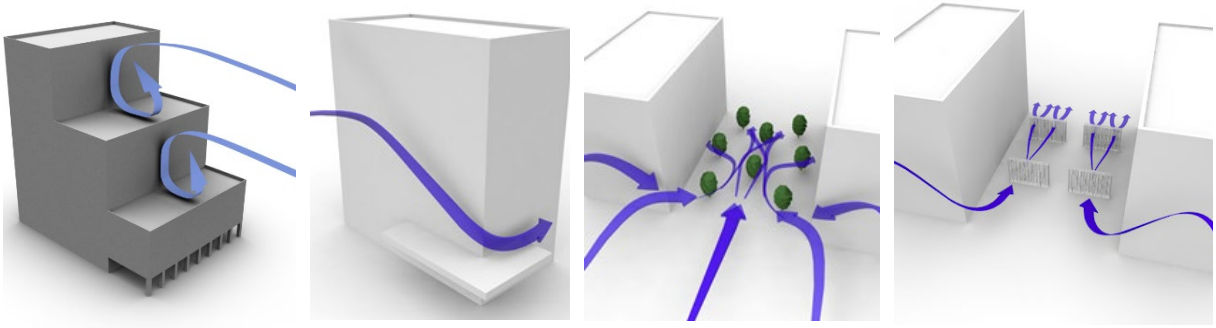


Image 5: Common Wind Control Measures

3 RESULTS AND DISCUSSION

The predicted wind conditions are shown on site plans in Figures 1A through 3B 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. 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 79)

Wind conditions comfortable for leisurely walking or fast 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.

3.1.1 Existing Configuration

Wind conditions on and around the existing site are comfortable for sitting or standing at all areas assessed in the summer (**Figure 1A**). In the winter, slightly elevated wind speeds, comfortable for standing, occur at most areas (**Figure 2A**). Slightly higher wind speeds and conditions comfortable for leisurely walking are expected at an isolated area along the sidewalk of Blairholm Avenue to the west of the site (Location 72 in **Figure 2A**). These wind conditions are suitable for the intended use of pedestrian areas.

Wind speeds that meet the safety criterion are predicted at all locations assessed (**Figure 3A**).

3.1.2 Proposed Configuration

With the proposed development in place, higher wind speeds occur on and around the site due to the building being taller than the surroundings and the resultant increased wind-building interactions (see **Image 4**). The podium on the east side and the stepped façade on the west side are positive design aspects which can help reduce the wind impact of the project at grade level (see **Image 5**).

During the summer, wind conditions on and around the sites are shown to be comfortable for sitting or standing at most locations (**Figure 1B**). Exceptions are localized areas around the northern corners and along the breezeways on the north and south wings where wind conditions comfortable for leisurely walking are observed (Locations 17, 27, 30 and 38 in **Figure 1B**). These conditions are considered appropriate for the intended use of the sidewalks and walkways.

In the winter, wind conditions comfortable for leisurely/fast walking or calmer are shown at most areas, apart from an area to the south under the breezeway, where marginally uncomfortable conditions are anticipated (Location 38 in **Figure 2B**). The uncomfortable wind speeds at this location are driven primarily by winds from the southwest downwashing off the building facades and channelling along the breezeway (see **Image 4**).

The main entrances of the proposed development are situated near Locations 1 and 13 in **Figures 1B** and **2B**. Wind speeds comfortable for sitting or standing occur at these locations throughout the year, which is appropriate.

Wind speeds are expected to meet the safety criterion at all grade-level locations assessed, except for an isolated area near the northeast corner of the development where winds marginally exceed the threshold (Location 17 in **Figure 3B** and **Table 1**).

To reduce wind speeds on the south breezeway and at the northeast corner, the design team may consider the use of landscaping or screens in those areas to diffuse the energy of accelerating winds and reduce wind activity. Examples are shown in **Image 6**.

3.2 Rooftop Outdoor Amenity Area (Locations 80 through 91)

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

Wind conditions comfortable for standing are observed at most amenity areas in the summer (**Figure 1B**), except for areas on the west part where elevated wind speeds and conditions comfortable for leisurely walking are anticipated (Locations 80, 89 and 90 in **Figure 1B**). These conditions are considered suitable for passive patron use. To achieve lower wind speeds, wind control features in the form of landscaping elements, screens, partitions, and trellises can be used around the designated seating and gathering areas to create calm wind and conditions conducive to sitting (see **Image 7** for examples). These test results were conducted without any landscaping features on the amenity levels.

During the colder months of the year, due to the seasonal increase in wind speeds, most locations on the amenity areas are expected to experience elevated wind activity (**Figure 2B**). This may be considered acceptable as outdoor areas would be used less frequently during the winter.

Wind speeds that exceed the safety criterion are anticipated at areas to the west and east of the amenity (Locations 80, 85, 89 and 90 in **Figure 3B**). These conditions will primarily occur in the winter when the winds are stronger, thus, they can be considered acceptable if pedestrian access to the rooftop would be limited during the winter.



Image 6: Wind Control Measures Applicable to the Grade Level

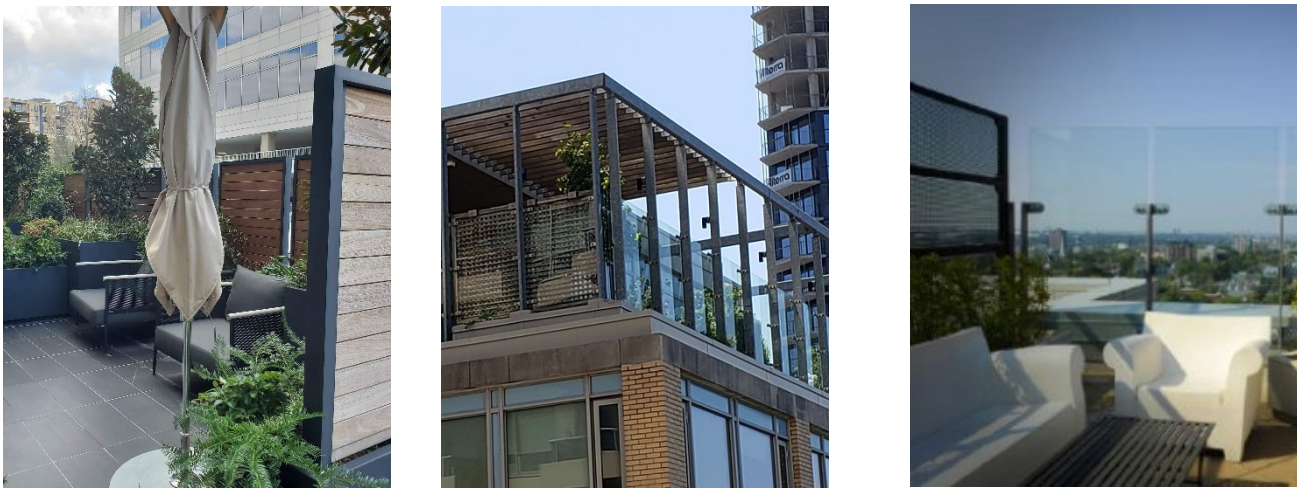


Image 7: Wind Control Measures Applicable to the Rooftop Amenity Area

4 STATEMENT OF LIMITATIONS

Limitations

This report was prepared by Rowan Williams Davies & Irwin, Inc. ("RWDI") for Brooklyn Construction ("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 Chamberlain Architect Services Limited and used to construct the scale model of the proposed 688-698 Brant Street project **("Project Data**")

File Name	File Type	Date Received (dd/mm/yyyy)
122023 - Brant - Coordination drawings - 2022-11-28	PDF	28/11/2022
3DView-{3D}	AutoCAD	29/11/2022

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 upon 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

RAMBO CRESCENT

BRANT STREET

BLAIRHOLM AVENUE

OLGA DRIVE

ALFRED CRESCENT

LEGEND:

COMFORT CATEGORIES:
- Sitting
- Standing
- Leisurely Walking
- Fast Walking
- Uncomfortable

SENSOR LOCATION:
- Grade Level

0 10 30m

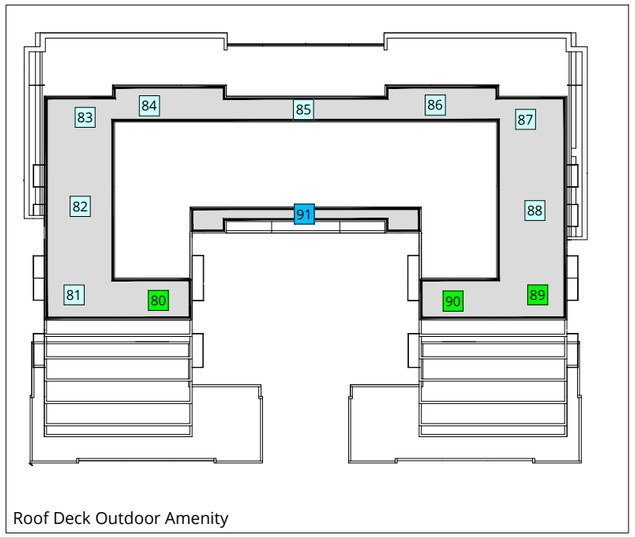
Pedestrian Wind Comfort Conditions
Existing Configuration
Summer (May to October, 6:00 to 23:00)

688-698 Brant Street - Burlington, ON

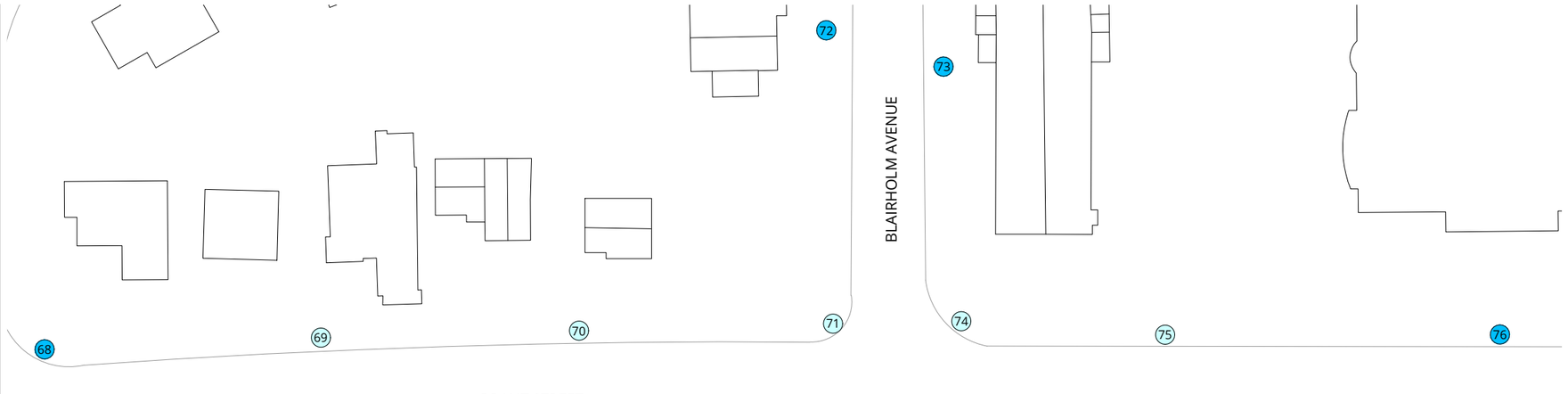
True North

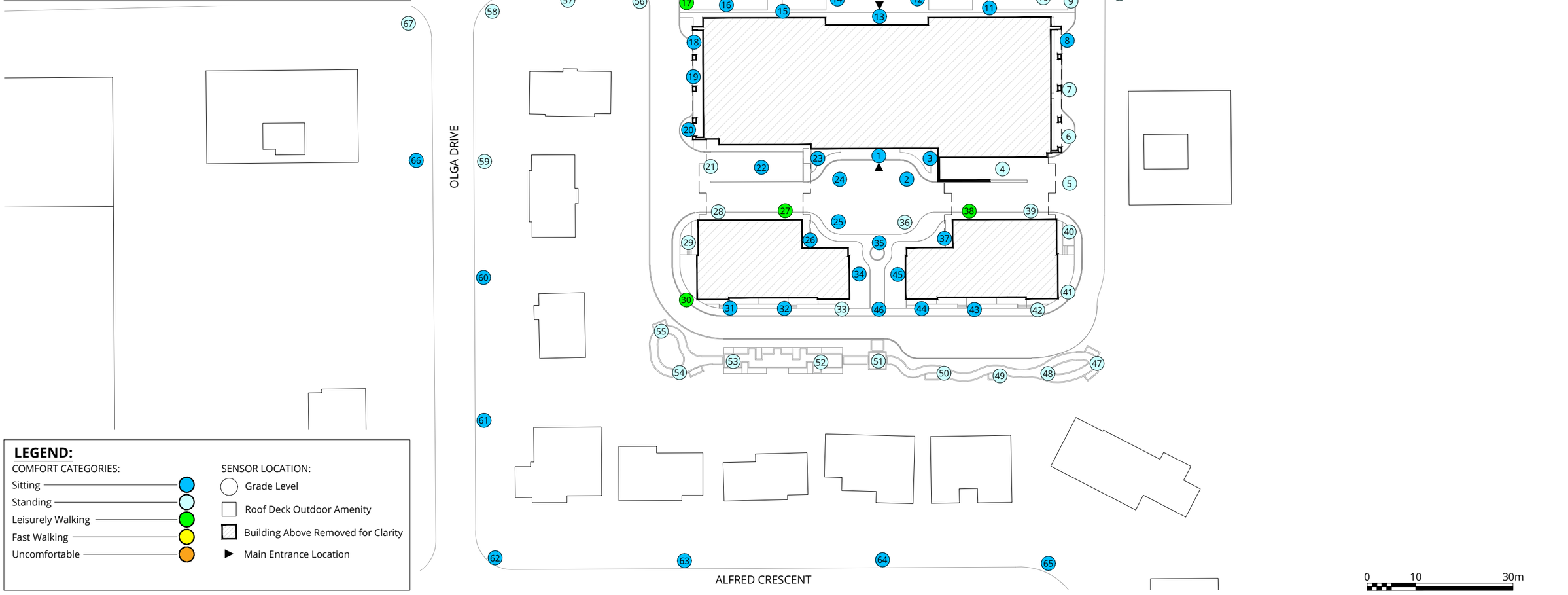
Project #2206583

Drawn by: GRE	Figure: 1A
Approx. Scale:	1:800
Date Revised:	Jan. 10, 2023



Roof Deck Outdoor Amenity





LEGEND:

COMFORT CATEGORIES:
- Sitting
- Standing
- Leisurely Walking
- Fast Walking
- Uncomfortable

SENSOR LOCATION:
- Grade Level
- Roof Deck Outdoor Amenity
- Building Above Removed for Clarity
- Main Entrance Location

0 10 30m

Pedestrian Wind Comfort Conditions

Proposed Configuration

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

688-698 Brant Street - Burlington, ON

True North

Project #2206583

Drawn by:	GRE	Figure:	1B
Approx. Scale:	1:800		
Date Revised:	Jan. 10, 2023		

RAMBO CRESCENT

BRANT STREET

BLAIRHOLM AVENUE

OLGA DRIVE

ALFRED CRESCENT

LEGEND:

COMFORT CATEGORIES:
- Sitting
- Standing
- Leisurely Walking
- Fast Walking
- Uncomfortable

SENSOR LOCATION:
- Grade Level

0 10 30m

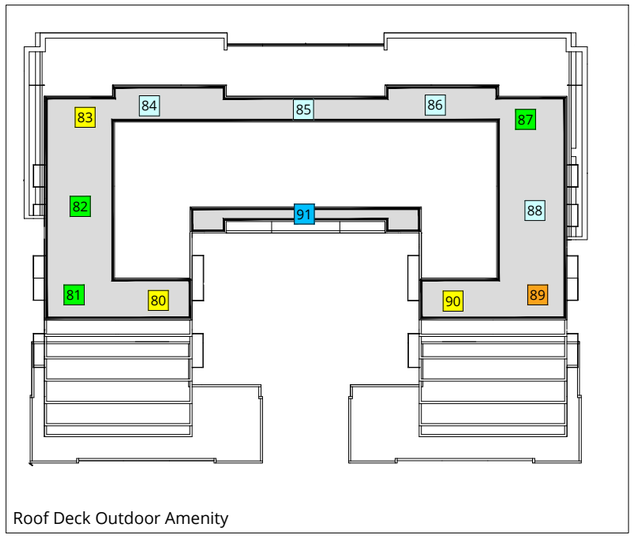
Pedestrian Wind Comfort Conditions
Existing Configuration
Winter (November to April, 6:00 to 23:00)

688-698 Brant Street - Burlington, ON

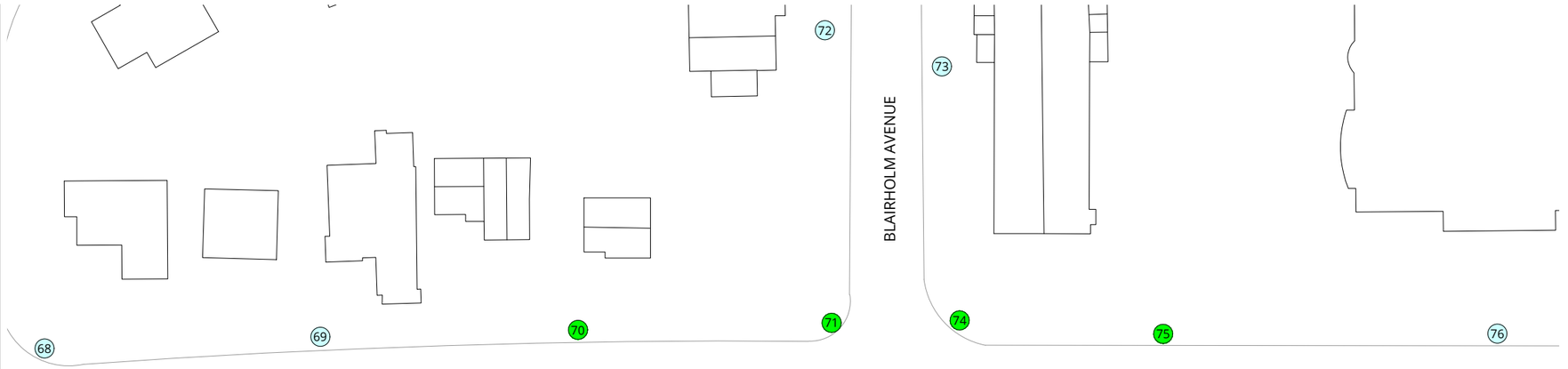
True North

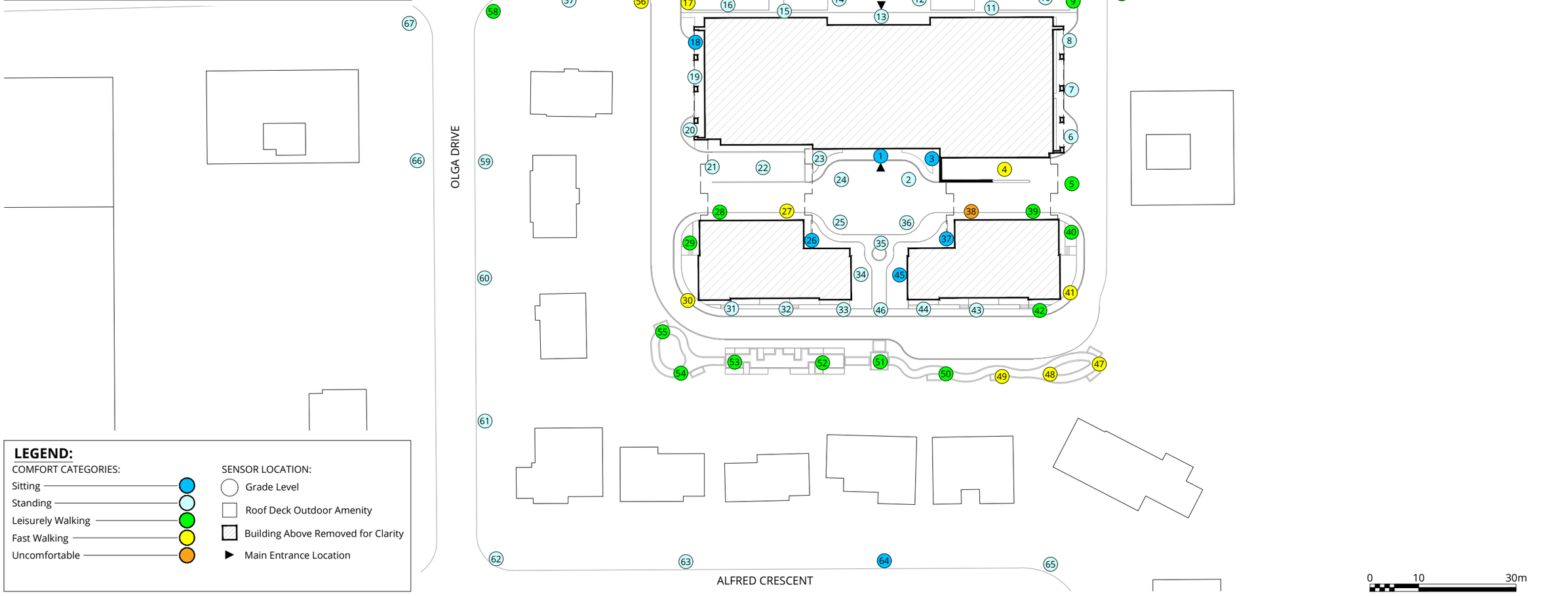
Project #2206583

Drawn by: GRE	Figure: 2A
Approx. Scale:	1:800
Date Revised:	Jan. 10, 2023



Roof Deck Outdoor Amenity





LEGEND:

COMFORT CATEGORIES:
- Sitting
- Standing
- Leisurely Walking
- Fast Walking
- Uncomfortable

SENSOR LOCATION:
- Grade Level
- Roof Deck Outdoor Amenity
- Building Above Removed for Clarity
- Main Entrance Location

0 10 30m

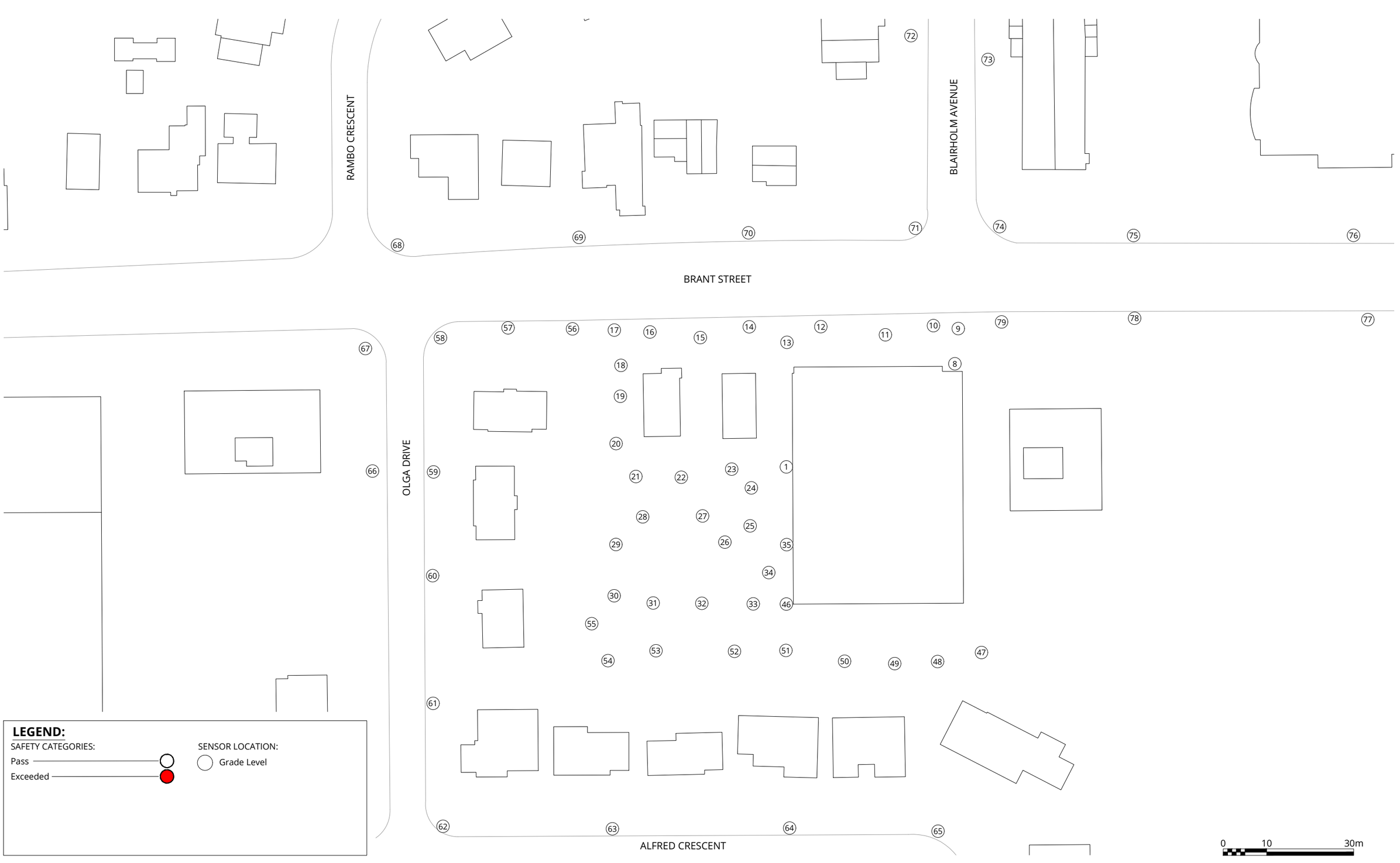
Pedestrian Wind Comfort Conditions
Proposed Configuration
Winter (November to April, 6:00 to 23:00)

688-698 Brant Street - Burlington, ON

True North

Project #2206583

Drawn by:	GRE	Figure:	2B
Approx. Scale:	1:800		
Date Revised:	Jan. 10, 2023		



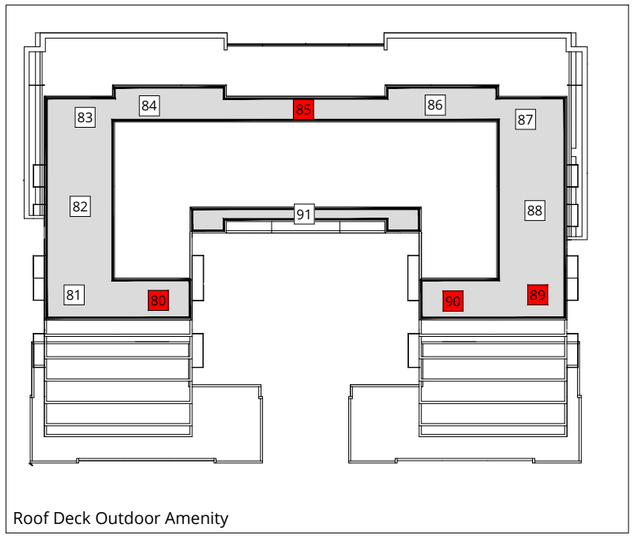
Pedestrian Wind Safety Conditions
Existing Configuration
Annual (January to December, 0:00 to 23:00)

688-698 Brant Street - Burlington, ON

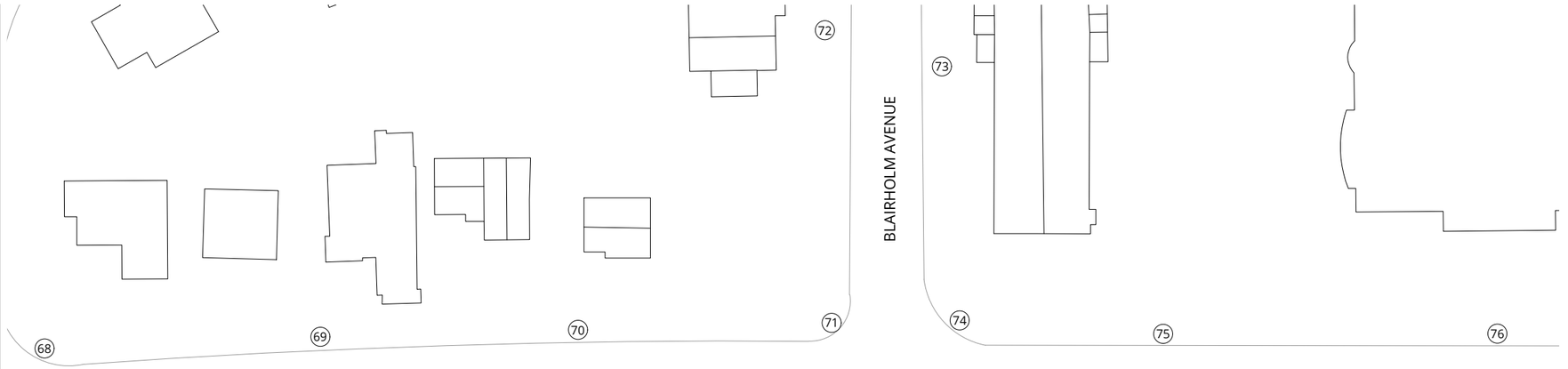
True North

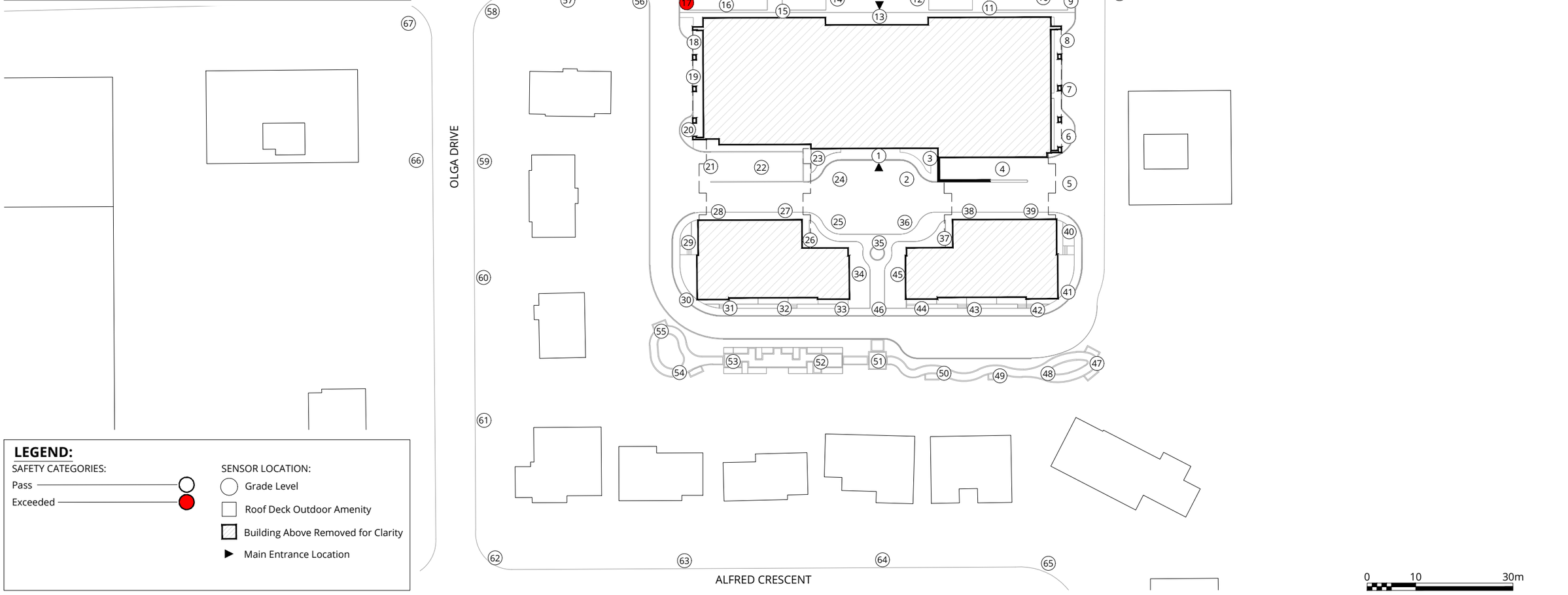
Project #2206583

Drawn by: GRE	Figure: 3A
Approx. Scale:	1:800
Date Revised:	Jan. 10, 2023



Roof Deck Outdoor Amenity





LEGEND:

SAFETY CATEGORIES:
- Pass
- Exceeded

SENSOR LOCATION:
- Grade Level
- Roof Deck Outdoor Amenity
- Building Above Removed for Clarity
- Main Entrance Location

0 10 30m

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

688-698 Brant Street - Burlington, ON

True North

Project #2206583

Drawn by:	GRE	Figure:	3B
Approx. Scale:	1:800		
Date Revised:	Jan. 10, 2023		

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	6	Sitting	8	Sitting	36	Pass
	Proposed	7	Sitting	9	Sitting	34	Pass
2	Existing	-	-	-	-	-	-
	Proposed	8	Sitting	11	Standing	45	Pass
3	Existing	-	-	-	-	-	-
	Proposed	6	Sitting	7	Sitting	31	Pass
4	Existing	-	-	-	-	-	-
	Proposed	14	Standing	19	Fast Walking	84	Pass
5	Existing	-	-	-	-	-	-
	Proposed	13	Standing	17	Leisurely Walking	83	Pass
6	Existing	-	-	-	-	-	-
	Proposed	11	Standing	13	Standing	76	Pass
7	Existing	-	-	-	-	-	-
	Proposed	11	Standing	13	Standing	84	Pass
8	Existing	6	Sitting	7	Sitting	48	Pass
	Proposed	9	Sitting	11	Standing	75	Pass
9	Existing	9	Sitting	10	Sitting	49	Pass
	Proposed	13	Standing	16	Leisurely Walking	73	Pass
10	Existing	8	Sitting	10	Sitting	44	Pass
	Proposed	11	Standing	13	Standing	71	Pass
11	Existing	8	Sitting	10	Sitting	42	Pass
	Proposed	9	Sitting	12	Standing	60	Pass
12	Existing	8	Sitting	10	Sitting	43	Pass
	Proposed	9	Sitting	11	Standing	46	Pass
13	Existing	9	Sitting	12	Standing	53	Pass
	Proposed	9	Sitting	11	Standing	56	Pass
14	Existing	8	Sitting	9	Sitting	47	Pass
	Proposed	9	Sitting	11	Standing	56	Pass
15	Existing	10	Sitting	12	Standing	48	Pass
	Proposed	9	Sitting	11	Standing	63	Pass
16	Existing	9	Sitting	11	Standing	46	Pass
	Proposed	10	Sitting	12	Standing	81	Pass
17	Existing	9	Sitting	12	Standing	48	Pass
	Proposed	15	Leisurely Walking	19	Fast Walking	91	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
18	Existing	9	Sitting	12	Standing	52	Pass
	Proposed	7	Sitting	9	Sitting	42	Pass
19	Existing	10	Sitting	12	Standing	59	Pass
	Proposed	9	Sitting	12	Standing	66	Pass
20	Existing	9	Sitting	12	Standing	49	Pass
	Proposed	10	Sitting	12	Standing	68	Pass
21	Existing	9	Sitting	11	Standing	45	Pass
	Proposed	11	Standing	14	Standing	58	Pass
22	Existing	9	Sitting	11	Standing	55	Pass
	Proposed	10	Sitting	12	Standing	54	Pass
23	Existing	7	Sitting	10	Sitting	40	Pass
	Proposed	9	Sitting	11	Standing	47	Pass
24	Existing	8	Sitting	10	Sitting	48	Pass
	Proposed	10	Sitting	13	Standing	54	Pass
25	Existing	8	Sitting	10	Sitting	44	Pass
	Proposed	10	Sitting	13	Standing	54	Pass
26	Existing	8	Sitting	10	Sitting	43	Pass
	Proposed	6	Sitting	8	Sitting	37	Pass
27	Existing	9	Sitting	11	Standing	49	Pass
	Proposed	15	Leisurely Walking	19	Fast Walking	80	Pass
28	Existing	9	Sitting	11	Standing	45	Pass
	Proposed	13	Standing	15	Leisurely Walking	63	Pass
29	Existing	9	Sitting	11	Standing	49	Pass
	Proposed	12	Standing	15	Leisurely Walking	65	Pass
30	Existing	9	Sitting	11	Standing	49	Pass
	Proposed	15	Leisurely Walking	18	Fast Walking	75	Pass
31	Existing	8	Sitting	11	Standing	46	Pass
	Proposed	10	Sitting	12	Standing	55	Pass
32	Existing	8	Sitting	10	Sitting	43	Pass
	Proposed	9	Sitting	11	Standing	45	Pass
33	Existing	8	Sitting	10	Sitting	43	Pass
	Proposed	11	Standing	14	Standing	55	Pass
34	Existing	7	Sitting	9	Sitting	43	Pass
	Proposed	8	Sitting	11	Standing	46	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	6	Sitting	8	Sitting	34	Pass
	Proposed	10	Sitting	13	Standing	56	Pass
36	Existing	-	-	-	-	-	-
	Proposed	11	Standing	13	Standing	58	Pass
37	Existing	-	-	-	-	-	-
	Proposed	7	Sitting	10	Sitting	46	Pass
38	Existing	-	-	-	-	-	-
	Proposed	16	Leisurely Walking	22	Uncomfortable	89	Pass
39	Existing	-	-	-	-	-	-
	Proposed	13	Standing	17	Leisurely Walking	78	Pass
40	Existing	-	-	-	-	-	-
	Proposed	11	Standing	15	Leisurely Walking	72	Pass
41	Existing	-	-	-	-	-	-
	Proposed	14	Standing	18	Fast Walking	84	Pass
42	Existing	-	-	-	-	-	-
	Proposed	11	Standing	15	Leisurely Walking	69	Pass
43	Existing	-	-	-	-	-	-
	Proposed	9	Sitting	12	Standing	49	Pass
44	Existing	-	-	-	-	-	-
	Proposed	9	Sitting	12	Standing	49	Pass
45	Existing	-	-	-	-	-	-
	Proposed	8	Sitting	10	Sitting	41	Pass
46	Existing	8	Sitting	10	Sitting	41	Pass
	Proposed	10	Sitting	13	Standing	50	Pass
47	Existing	9	Sitting	11	Standing	44	Pass
	Proposed	14	Standing	18	Fast Walking	75	Pass
48	Existing	8	Sitting	11	Standing	42	Pass
	Proposed	14	Standing	19	Fast Walking	76	Pass
49	Existing	9	Sitting	10	Sitting	43	Pass
	Proposed	14	Standing	18	Fast Walking	74	Pass
50	Existing	8	Sitting	10	Sitting	42	Pass
	Proposed	13	Standing	17	Leisurely Walking	68	Pass
51	Existing	8	Sitting	9	Sitting	38	Pass
	Proposed	12	Standing	16	Leisurely Walking	62	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
52	Existing	8	Sitting	10	Sitting	40	Pass
	Proposed	13	Standing	16	Leisurely Walking	66	Pass
53	Existing	8	Sitting	10	Sitting	44	Pass
	Proposed	13	Standing	16	Leisurely Walking	65	Pass
54	Existing	8	Sitting	11	Standing	47	Pass
	Proposed	13	Standing	16	Leisurely Walking	67	Pass
55	Existing	9	Sitting	12	Standing	53	Pass
	Proposed	14	Standing	17	Leisurely Walking	74	Pass
56	Existing	9	Sitting	11	Standing	46	Pass
	Proposed	14	Standing	18	Fast Walking	83	Pass
57	Existing	8	Sitting	10	Sitting	42	Pass
	Proposed	11	Standing	14	Standing	83	Pass
58	Existing	10	Sitting	13	Standing	50	Pass
	Proposed	12	Standing	15	Leisurely Walking	71	Pass
59	Existing	10	Sitting	13	Standing	54	Pass
	Proposed	11	Standing	14	Standing	59	Pass
60	Existing	10	Sitting	12	Standing	53	Pass
	Proposed	10	Sitting	13	Standing	71	Pass
61	Existing	11	Standing	14	Standing	56	Pass
	Proposed	10	Sitting	13	Standing	66	Pass
62	Existing	10	Sitting	12	Standing	50	Pass
	Proposed	10	Sitting	13	Standing	62	Pass
63	Existing	7	Sitting	9	Sitting	37	Pass
	Proposed	8	Sitting	11	Standing	41	Pass
64	Existing	7	Sitting	10	Sitting	39	Pass
	Proposed	8	Sitting	10	Sitting	44	Pass
65	Existing	9	Sitting	11	Standing	48	Pass
	Proposed	10	Sitting	12	Standing	73	Pass
66	Existing	10	Sitting	13	Standing	53	Pass
	Proposed	10	Sitting	12	Standing	53	Pass
67	Existing	10	Sitting	13	Standing	51	Pass
	Proposed	11	Standing	14	Standing	64	Pass
68	Existing	9	Sitting	12	Standing	48	Pass
	Proposed	10	Sitting	12	Standing	51	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
69	Existing	9	Sitting	11	Standing	54	Pass
	Proposed	11	Standing	13	Standing	67	Pass
70	Existing	8	Sitting	10	Sitting	41	Pass
	Proposed	13	Standing	17	Leisurely Walking	78	Pass
71	Existing	10	Sitting	13	Standing	54	Pass
	Proposed	12	Standing	15	Leisurely Walking	64	Pass
72	Existing	12	Standing	15	Leisurely Walking	60	Pass
	Proposed	10	Sitting	12	Standing	53	Pass
73	Existing	10	Sitting	13	Standing	60	Pass
	Proposed	9	Sitting	12	Standing	51	Pass
74	Existing	10	Sitting	12	Standing	56	Pass
	Proposed	12	Standing	15	Leisurely Walking	62	Pass
75	Existing	11	Standing	14	Standing	56	Pass
	Proposed	12	Standing	15	Leisurely Walking	60	Pass
76	Existing	9	Sitting	11	Standing	43	Pass
	Proposed	9	Sitting	12	Standing	47	Pass
77	Existing	11	Standing	14	Standing	54	Pass
	Proposed	11	Standing	14	Standing	59	Pass
78	Existing	11	Standing	13	Standing	55	Pass
	Proposed	12	Standing	14	Standing	59	Pass
79	Existing	10	Sitting	13	Standing	54	Pass
	Proposed	12	Standing	15	Leisurely Walking	69	Pass
80	Existing	-	-	-	-	-	-
	Proposed	15	Leisurely Walking	20	Fast Walking	94	Exceeded
81	Existing	-	-	-	-	-	-
	Proposed	14	Standing	17	Leisurely Walking	78	Pass
82	Existing	-	-	-	-	-	-
	Proposed	13	Standing	16	Leisurely Walking	80	Pass
83	Existing	-	-	-	-	-	-
	Proposed	14	Standing	18	Fast Walking	79	Pass
84	Existing	-	-	-	-	-	-
	Proposed	12	Standing	14	Standing	87	Pass
85	Existing	-	-	-	-	-	-
	Proposed	11	Standing	13	Standing	96	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
86	Existing	-	-	-	-	-	-
	Proposed	11	Standing	13	Standing	73	Pass
87	Existing	-	-	-	-	-	-
	Proposed	14	Standing	17	Leisurely Walking	87	Pass
88	Existing	-	-	-	-	-	-
	Proposed	11	Standing	13	Standing	74	Pass
89	Existing	-	-	-	-	-	-
	Proposed	16	Leisurely Walking	22	Uncomfortable	94	Exceeded
90	Existing	-	-	-	-	-	-
	Proposed	15	Leisurely Walking	19	Fast Walking	94	Exceeded
91	Existing	-	-	-	-	-	-
	Proposed	7	Sitting	9	Sitting	40	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	Leisurely Walking
18 - 20	Fast Walking
> 20	Uncomfortable

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