

53 QUEEN STREET

DARTMOUTH, NS

PEDESTRIAN WIND STUDY

RWDI # 2204998

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SUBMITTED TO

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EXECUTIVE SUMMARY

RWDI was retained to conduct a pedestrian wind assessment for the proposed 53 Queen Street in Dartmouth, NS. 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 Wind Criteria prepared by Halifax Regional Municipality 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:

- Wind speeds at all locations assessed meet the pedestrian wind safety criterion and are comfortable for the intended pedestrian uses throughout the year.
- With the proposed development in place, wind speeds at all locations assessed meet the pedestrian wind safety criterion with an exception close to the garage entrance on the south side of the proposed building.
- Wind conditions on and around the site are considered comfortable for the intended uses throughout the year, including the main residential entrance and most sidewalks.
- Uncomfortable wind conditions are anticipated at the northwest and southwest corners of the proposed building in the winter at grade level. Wind speeds at the southeast corner are also higher than desired for an entrance in the winter. Conceptual wind control measures to reduce wind speeds are discussed in the report.
- Summer wind speeds on the above-grade terraces are observed to be comfortable for passive use at all areas assessed. Moderately elevated wind speeds on the terraces in the winter may be considered acceptable as these areas would be used less frequently during that time.



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1 INTRODUCTION

RWDI was retained to conduct a pedestrian wind assessment for the proposed 53 Queen Street in Dartmouth, NS. 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 on the northwest corner of the King Street and Queen Street intersection (Image 1). The proposed building is approximately 87.5 m tall consisting of a 26-storey residential building with terraces and balconies on multiple levels.

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



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 360m 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 77 specially designed wind speed sensors to measure mean and gust speeds at a full-scale height of approximately 1.5m 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 reviewed by the design team. 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.

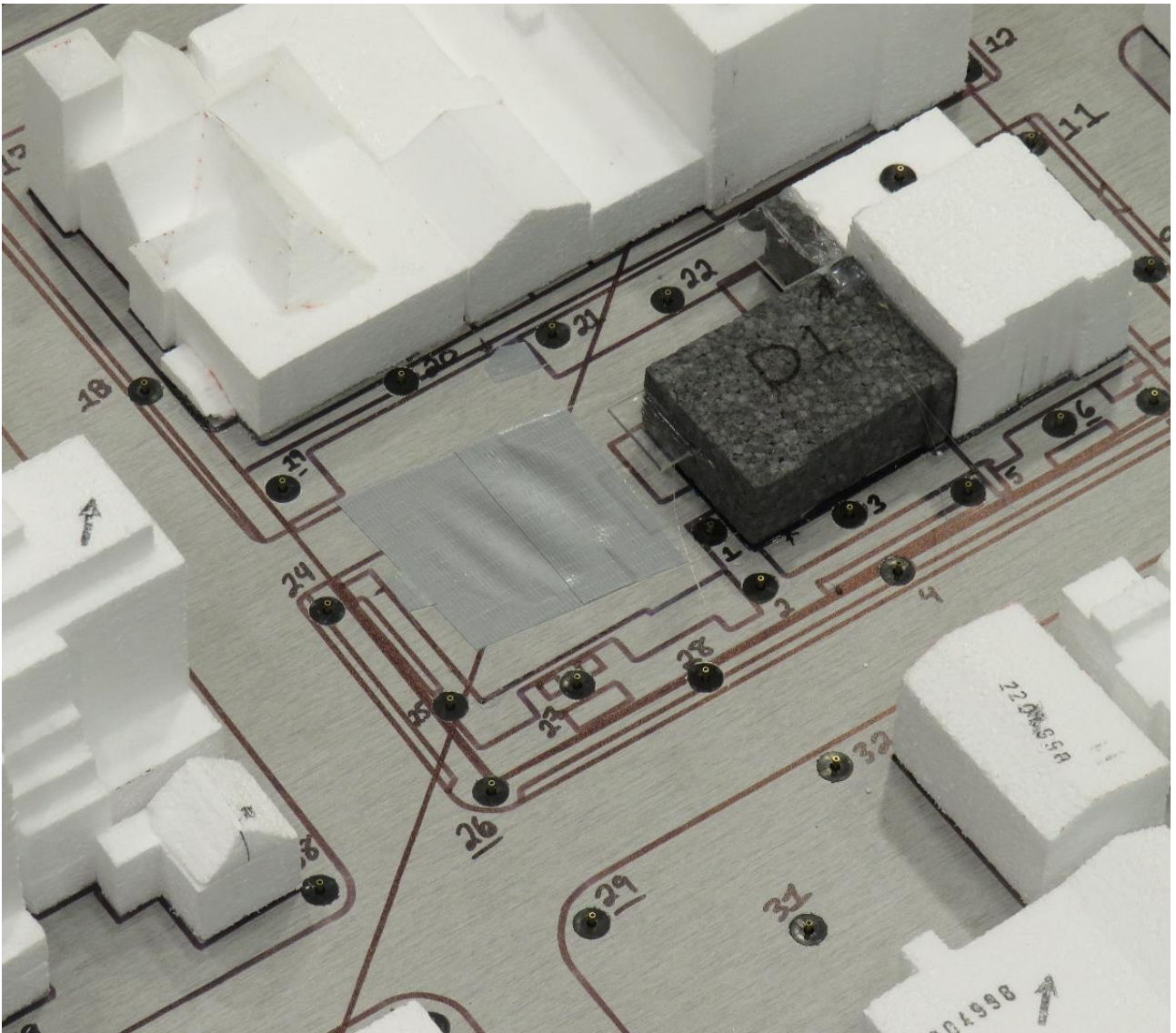


Image 2A: Wind Tunnel Study Model – Existing Configuration

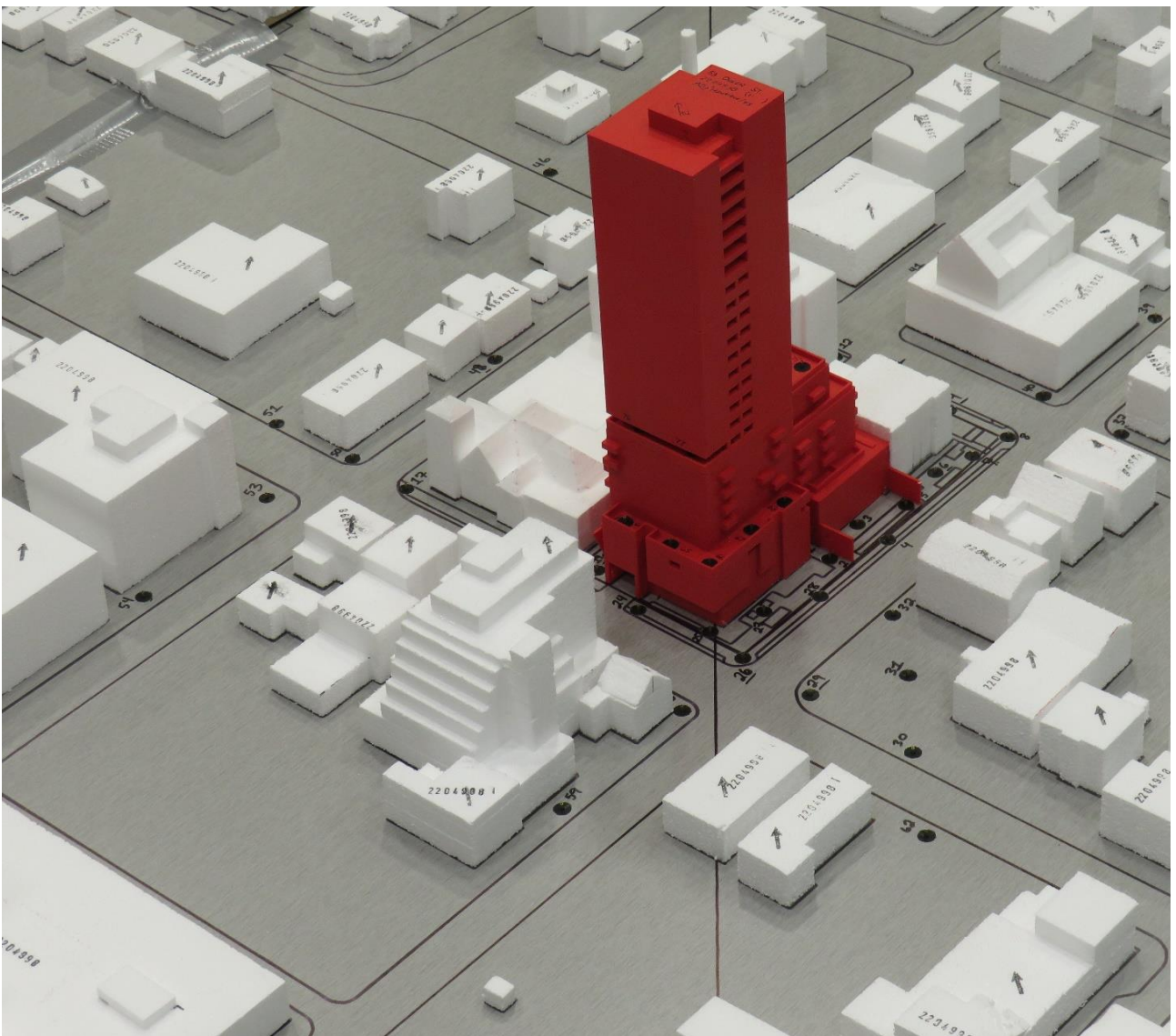


Image 2B: Wind Tunnel Study Model – Proposed Configuration

2.2 Wind Climate Data

Wind statistics recorded at Shearwater Airport between 1989 and 2019, 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. As indicated by the wind roses, the prevailing winds are from the southerly directions in the summer and from northwesterly directions in the winter. Strong winds of a mean speed greater than 30 km/h measured at the airport (at an anemometer height of 10 m) occur for 2.4% and 9.7% 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.

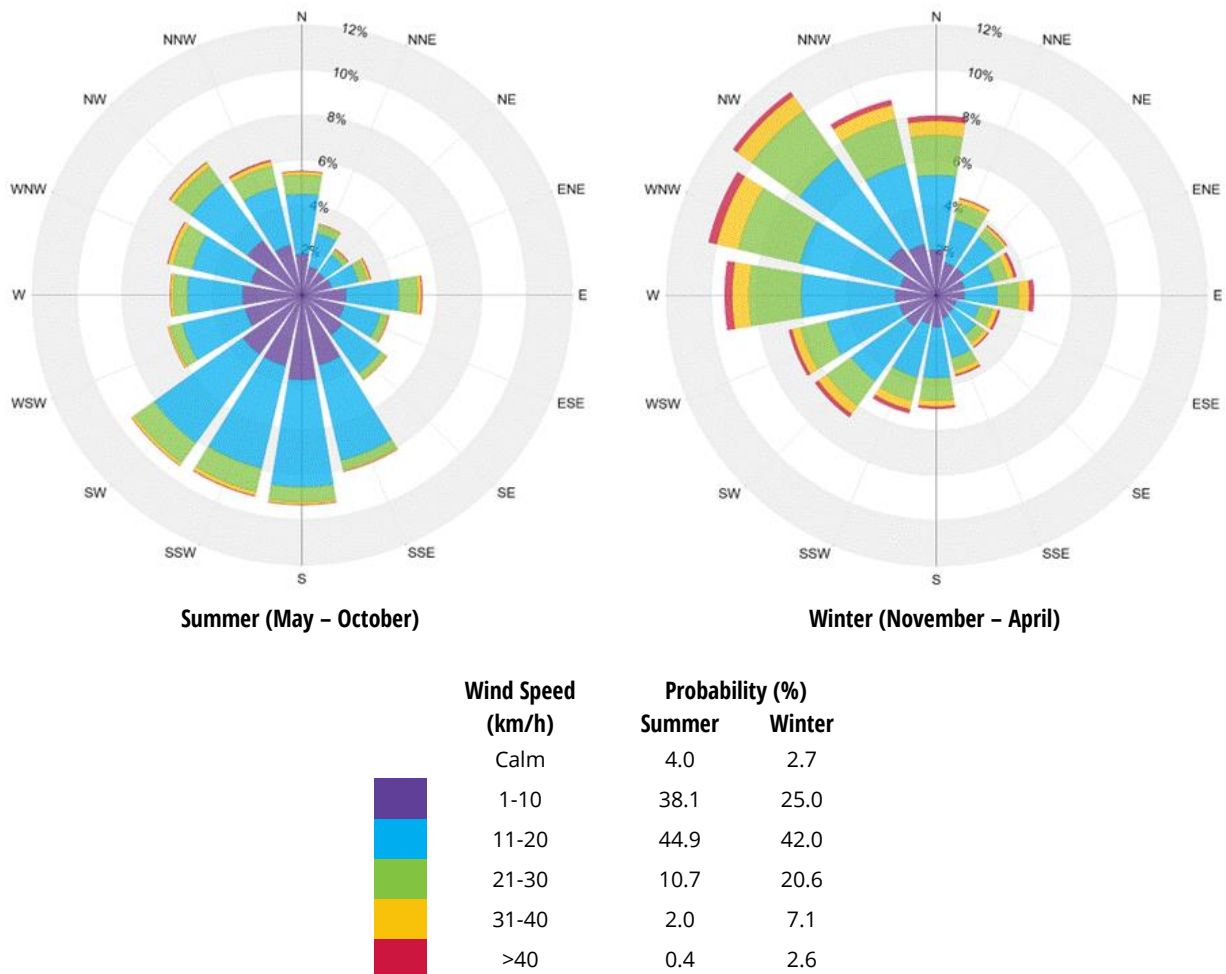


Image 3: Directional Distribution of Winds Approaching Shearwater Airport between 1989 and 2019

2.3 Pedestrian Wind Criteria

The criteria specified in the *Regional Centre Land Use By-Law (October 2021)* prepared by Halifax Regional Municipality are used in the current study and are presented below. The criteria consider pedestrian comfort (pertaining to common wind speeds conducive to different levels of human activity) and safety (pertaining to infrequent but strong gusts that could affect a person's footing).

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) $GEM\ Speed = \max(\text{Mean Speed}, \text{Gust Speed}/1.85)$ and $Gust\ Speed = \text{Mean Speed} + 3 * RMS\ Speed$;
- (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 Dartmouth, there are distinct differences in pedestrian outdoor behaviours between these two-time periods.

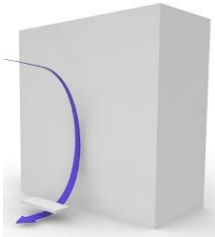
Safety Criterion	Gust Speed (km/h)	Description
Exceeded	> 90	Excessive gust speeds that can adversely affect a pedestrian's balance and footing. Wind mitigation is typically required.

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.

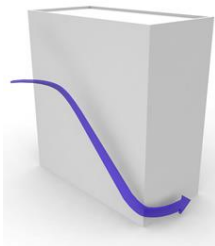
2.4 General Wind Flow Mechanisms

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



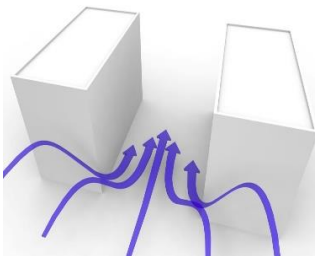
DOWNWASHING

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 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)

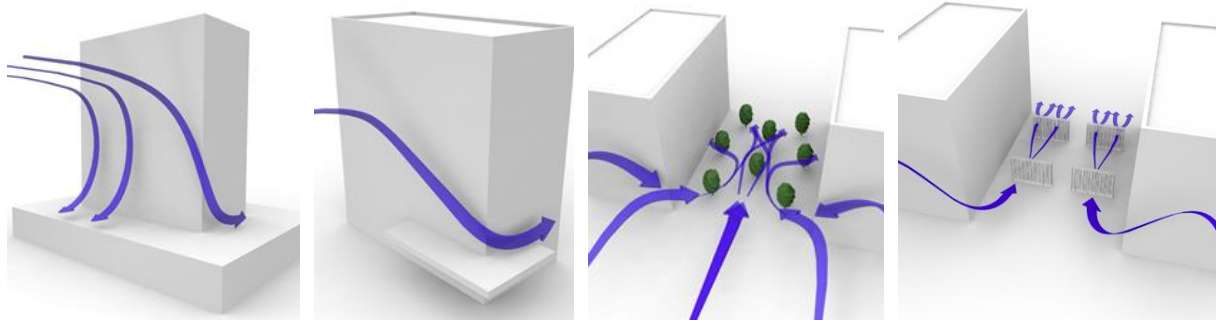


Image 5: Common Wind Control Measures

3 RESULTS AND DISCUSSION

The predicted wind conditions are shown on site plans in Figures 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.

Wind conditions that meet the safety criterion are predicted at all locations for both configurations assessed except one isolated location close to the garage entrance on the south side of the proposed building.

3.1 Grade Level (Locations 1 through 62)

3.1.1 Existing Configuration

Wind speeds on and around the site are generally expected to be low and comfortable for sitting or standing in the summer and winter (Figures 1A through 2B). In the winter, higher wind speeds comfortable for strolling are predicted in isolated areas further away from the site (Figure 2A). These wind conditions are suitable for the intended uses of various pedestrian areas.

3.1.2 Proposed Configuration

During the summer, wind conditions on and around the site are comfortable for sitting or standing at most locations (Figure 1B). Exceptions are western corner areas near Locations 19 and 23, where wind conditions are comfortable for strolling. These conditions are appropriate for the intended use.

Seasonally stronger wind speeds during the winter months are expected to result in higher wind speeds on the site, with wind conditions generally predicted to be comfortable for walking or better (Figure 2B). These conditions are considered appropriate for the intended pedestrian use of the sidewalks on and around the project site. A few locations with marginally uncomfortable conditions (i.e., 1-3 km/h above the 20 km/h threshold) near the northwest and southwest corners of the proposed building (Locations 19, 23 and 24 in Figure 2B). The gust wind speeds at Location 24 also exceed the safety limit (Figure 3B). The uncomfortable/unsafe wind speeds at these locations are driven primarily by corner acceleration of winds from the northwesterly directions.

The main residential entrance of the proposed building is recessed from the east facade (Locations 1 and 2) and low wind speeds comfortable for sitting or standing are predicted throughout the year (Figures 1B and 2B). There is a commercial entrance at the southeast building corner (Location 25) where winter conditions are comfortable for walking (Figure 2B).

If lower wind speeds are desired for the commercial entrance, potential wind control measure may include relocating the entrance away from the corner, recessing the entrance into the building, and installing wind screens/planters on both sides of the entrance and a large canopy above the entrance - see Image 6 for examples.

If feasible, large corner canopies can be included for the southwest and northwest building corners to improve the uncomfortable wind conditions in the winter. Wind screens and other landscaping elements may also be considered for wind control (Image 6).



Image 6: Examples of Wind Control Features

3.2 Above-Grade Levels (Locations 63 through 77)

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

In the summer, wind conditions are anticipated to be comfortable for sitting or standing in all above-grade areas (Figure 1B), including Location 63 on an adjacent existing building. These conditions are appropriate for passive uses.



4 STATEMENT OF LIMITATIONS

Limitations

This report was prepared by Rowan Williams Davies & Irwin, Inc. (“RWDI”) for RHAD Architects (“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 RHAD Architects and used to construct the scale model of the proposed 53 Queen Street (“**Project Data**”).

File Name	File Type	Date Received (dd/mm/yyyy)
53 QUEEN_COORDINATION SET_2022.11.10.rvt	Revit	11/10/2022

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.

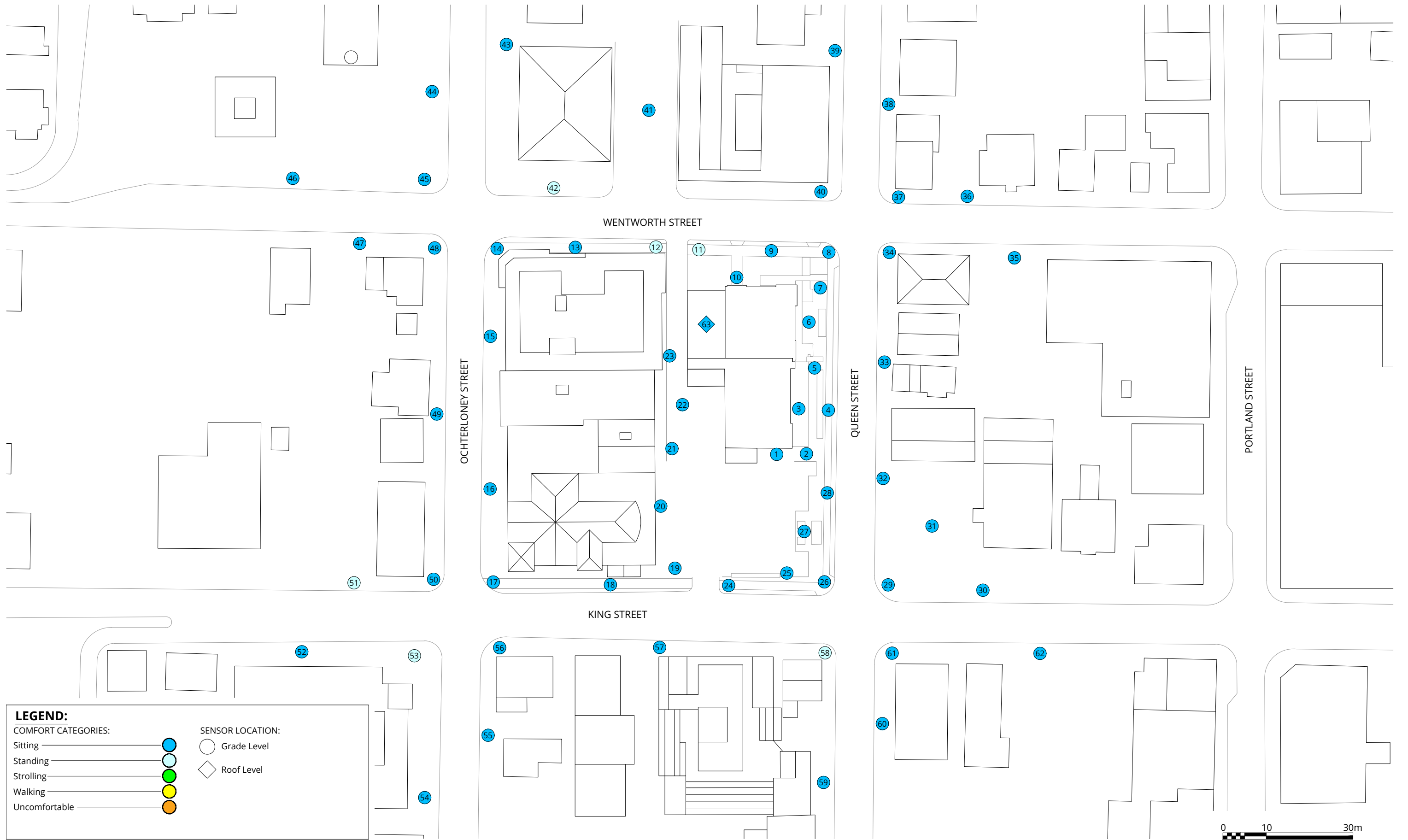


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FIGURES



Pedestrian Wind Comfort Conditions

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

53 Queen Street - Dartmouth, NS



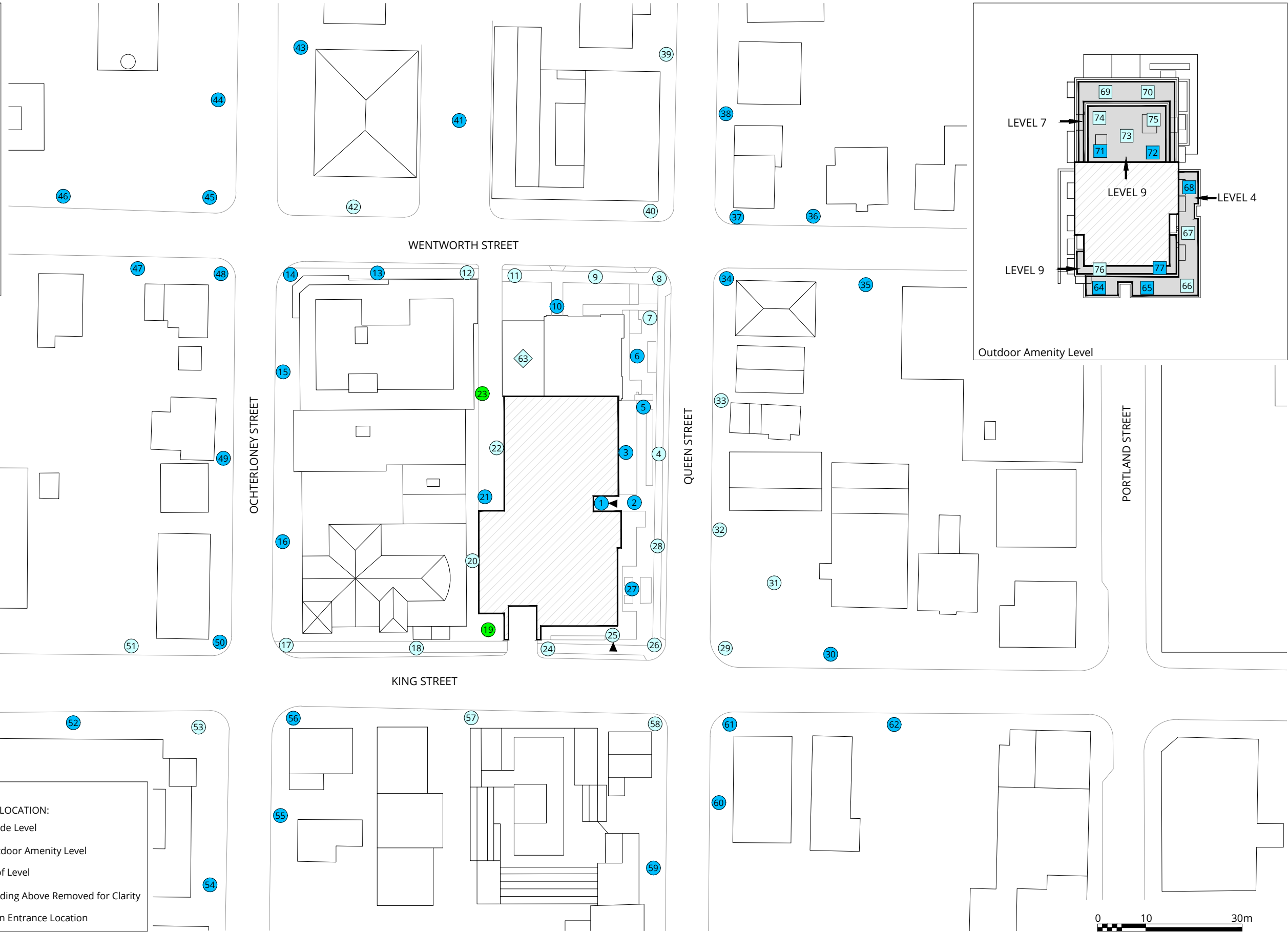
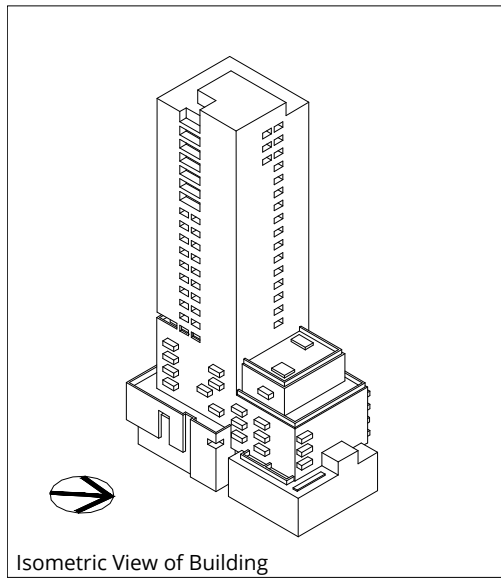
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Date Revised: Jan. 17, 2023

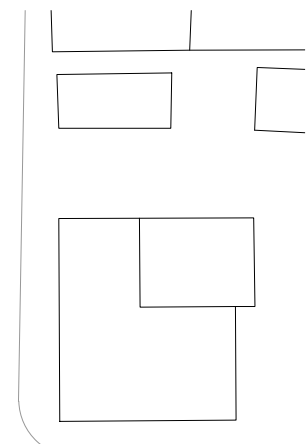
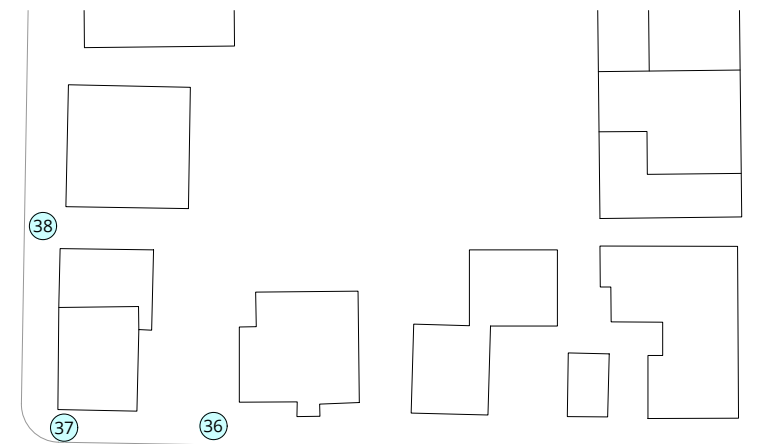
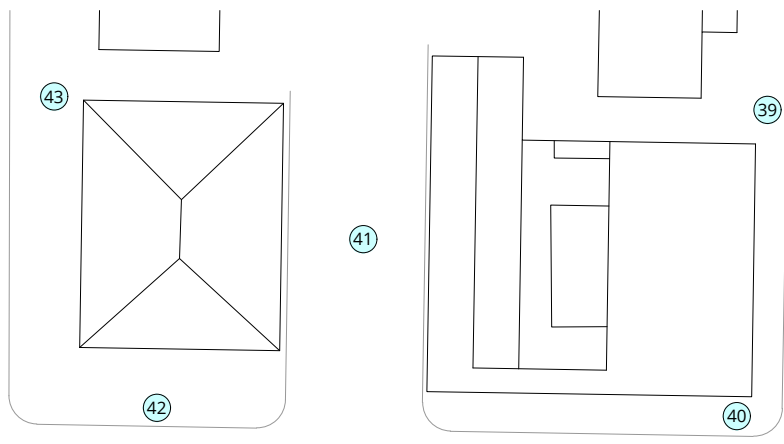
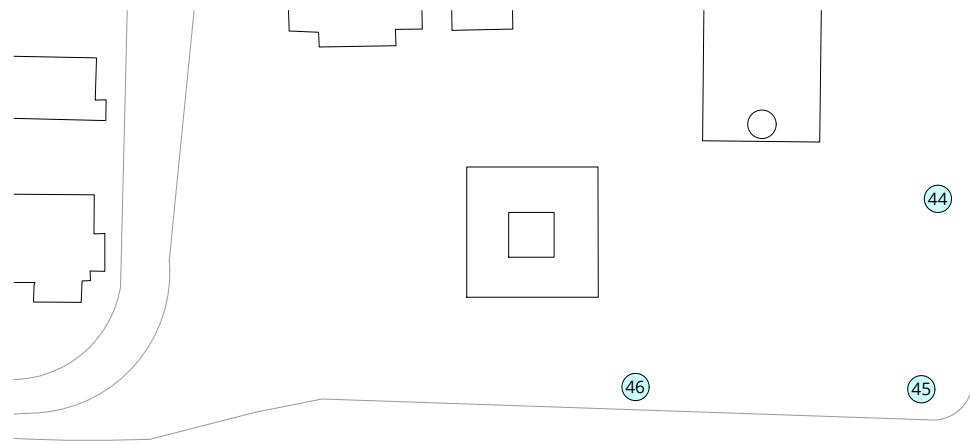
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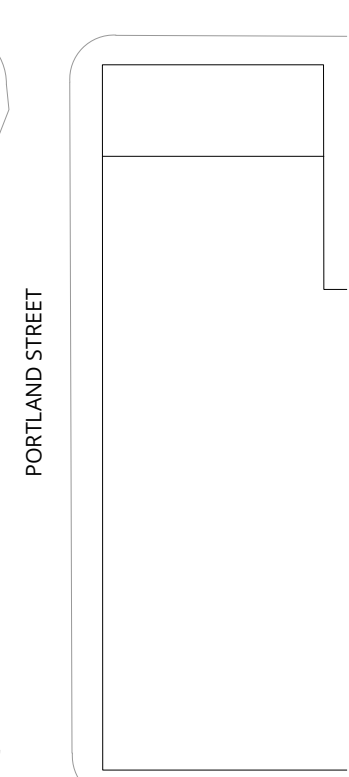
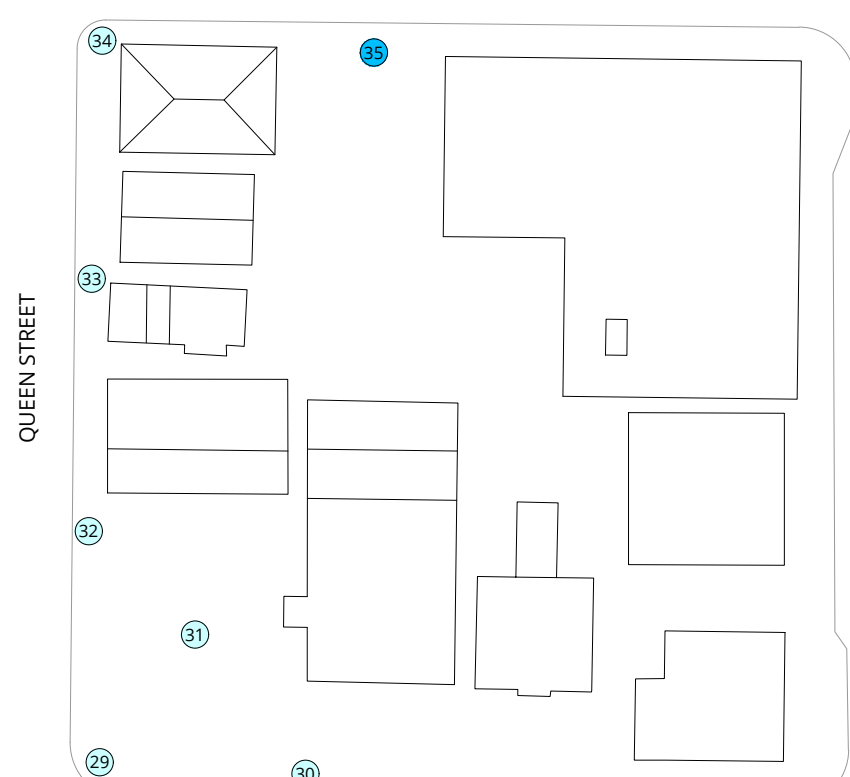
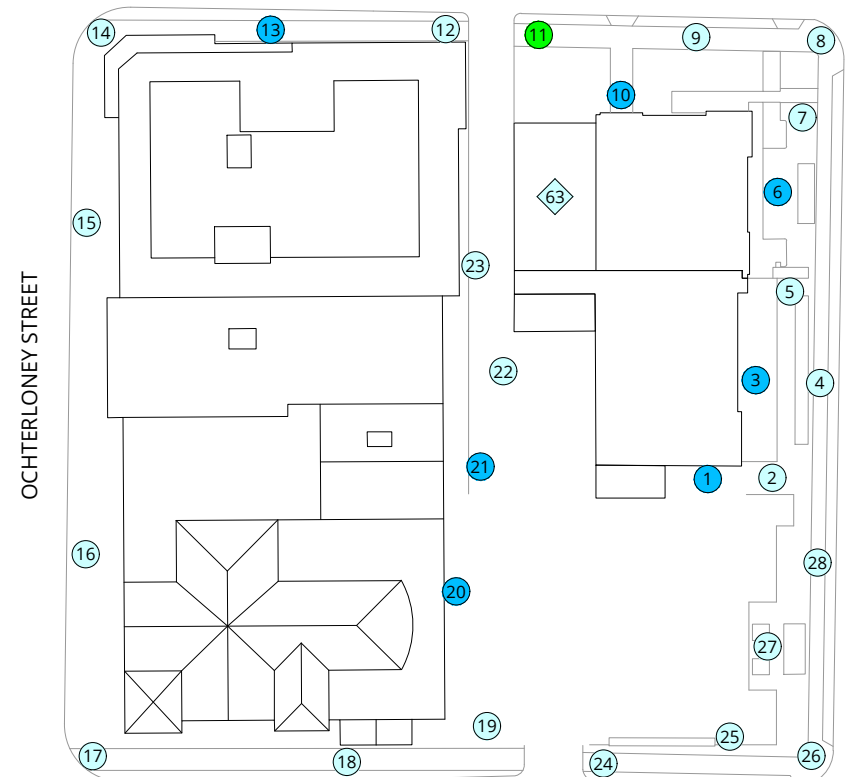
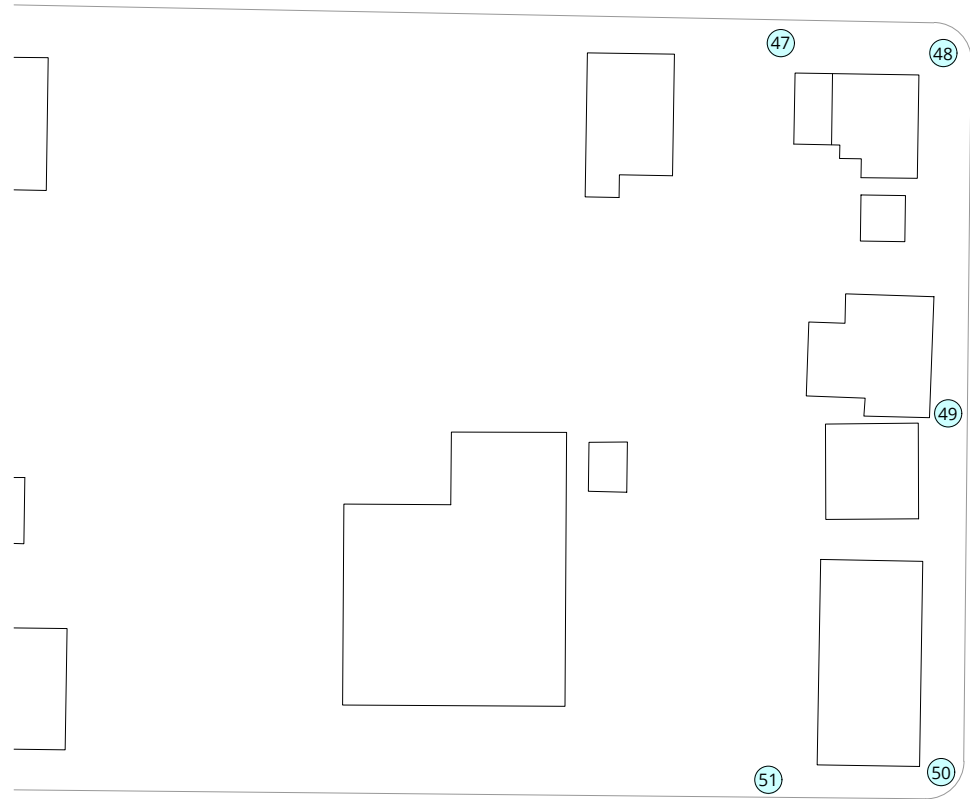


Pedestrian Wind Comfort Conditions
 Proposed Configuration
 Summer (May to October, 6:00 to 23:00)
 53 Queen Street - Dartmouth, NS

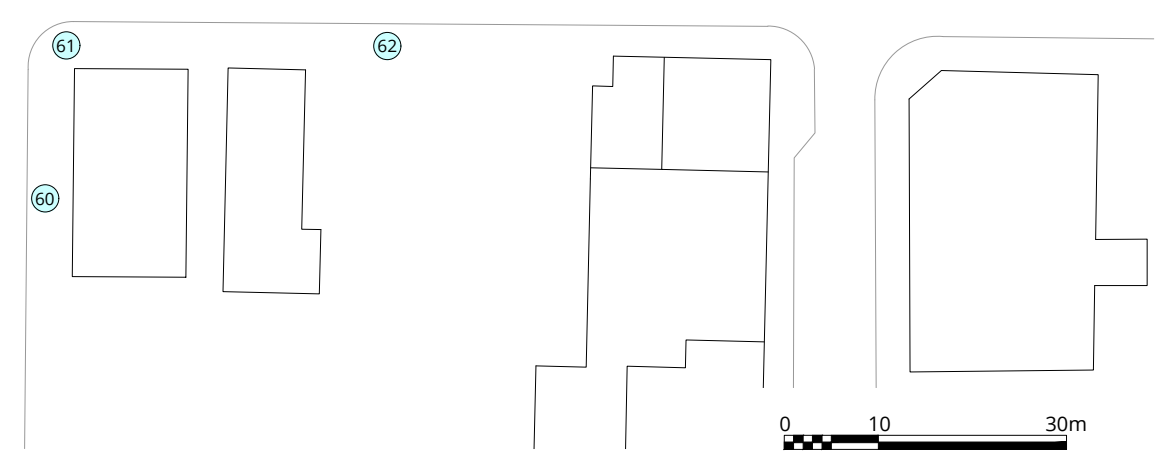
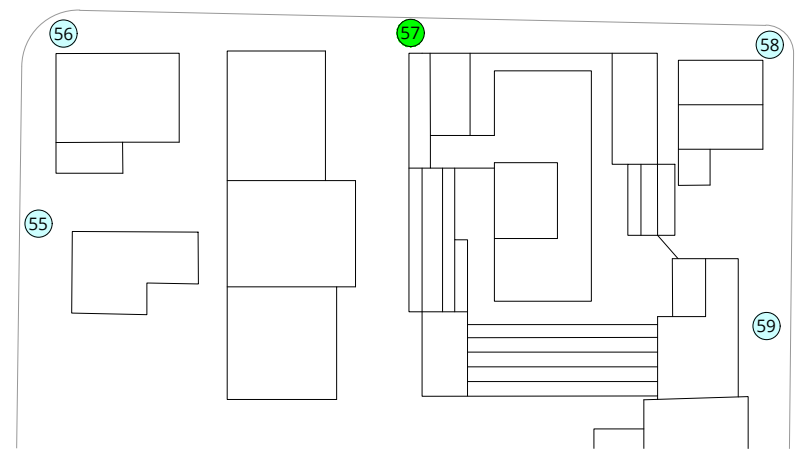
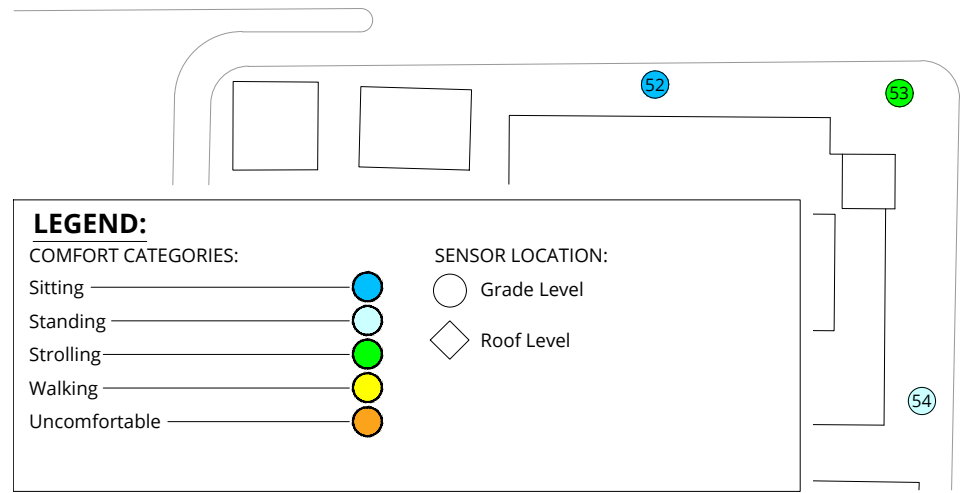
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WENTWORTH STREET



KING STREET



LEGEND:

COMFORT CATEGORIES:

- Sitting ●
- Standing ●
- Strolling ●
- Walking ●
- Uncomfortable ●

SENSOR LOCATION:

- Grade Level
- Roof Level



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

53 Queen Street - Dartmouth, NS



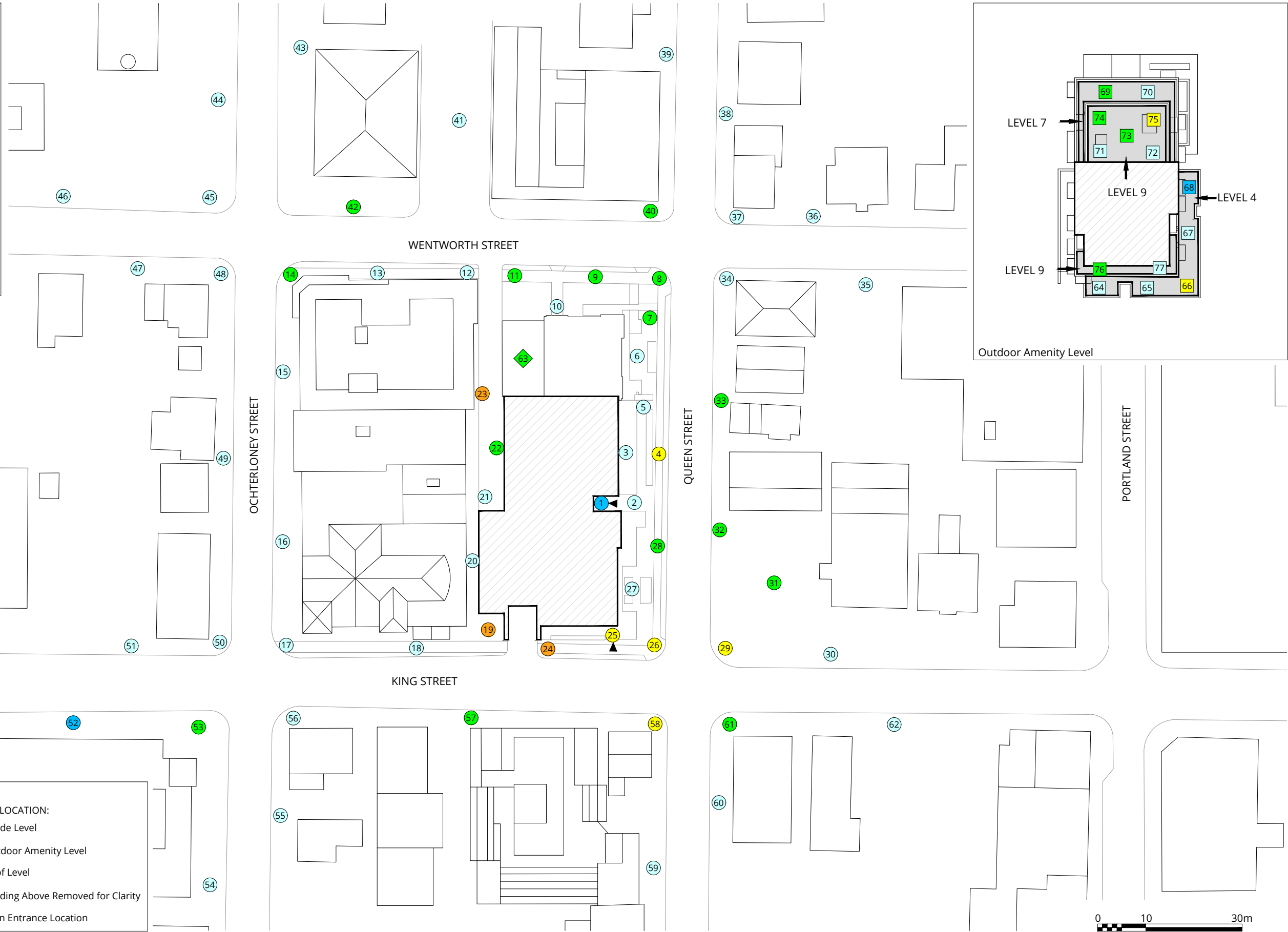
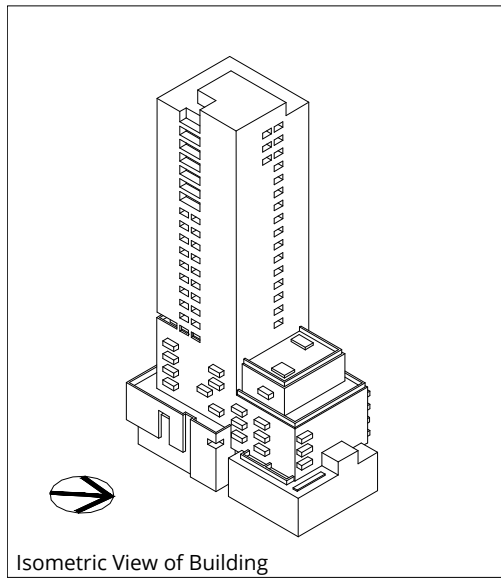
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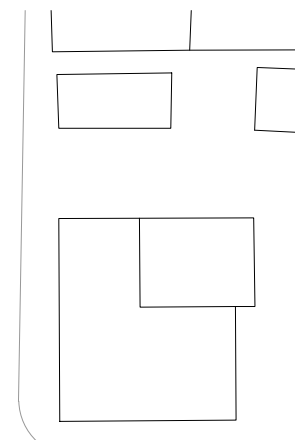
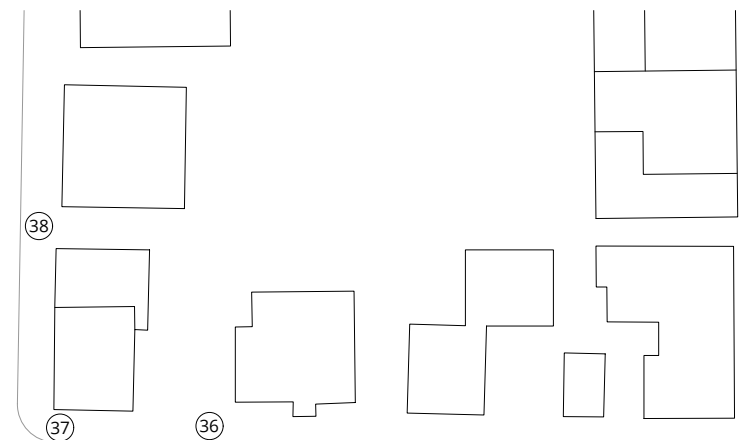
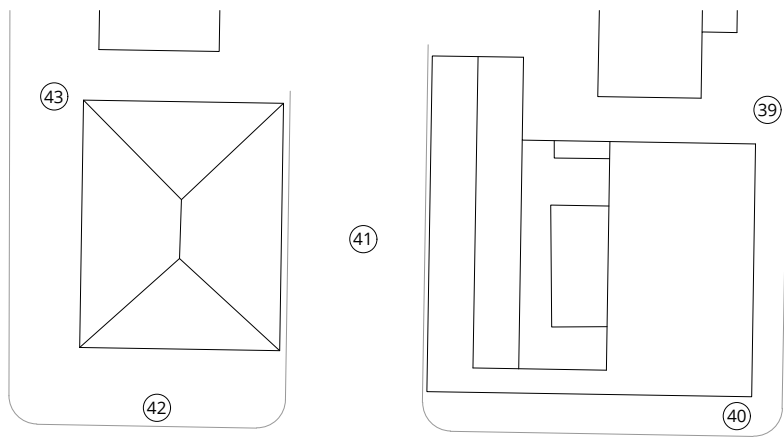
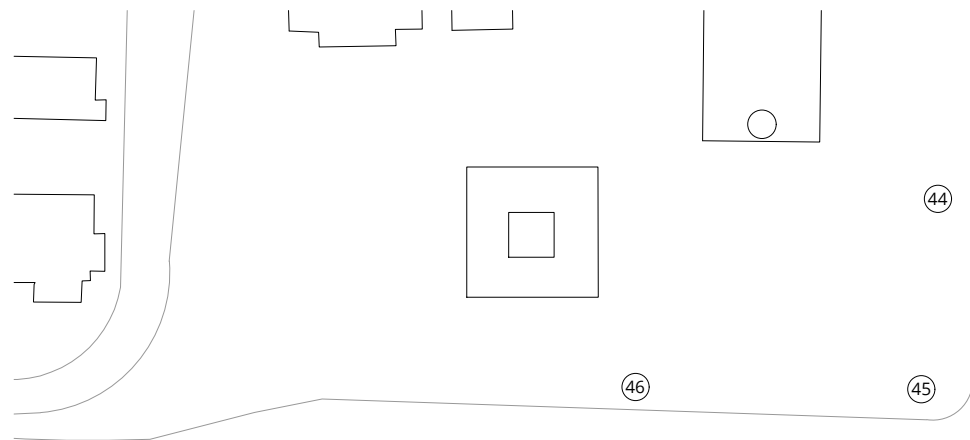
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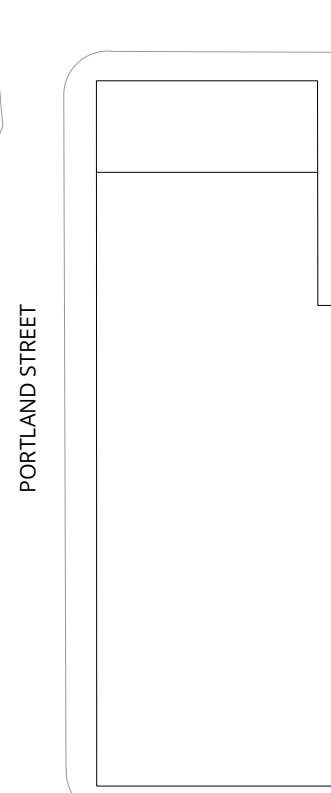
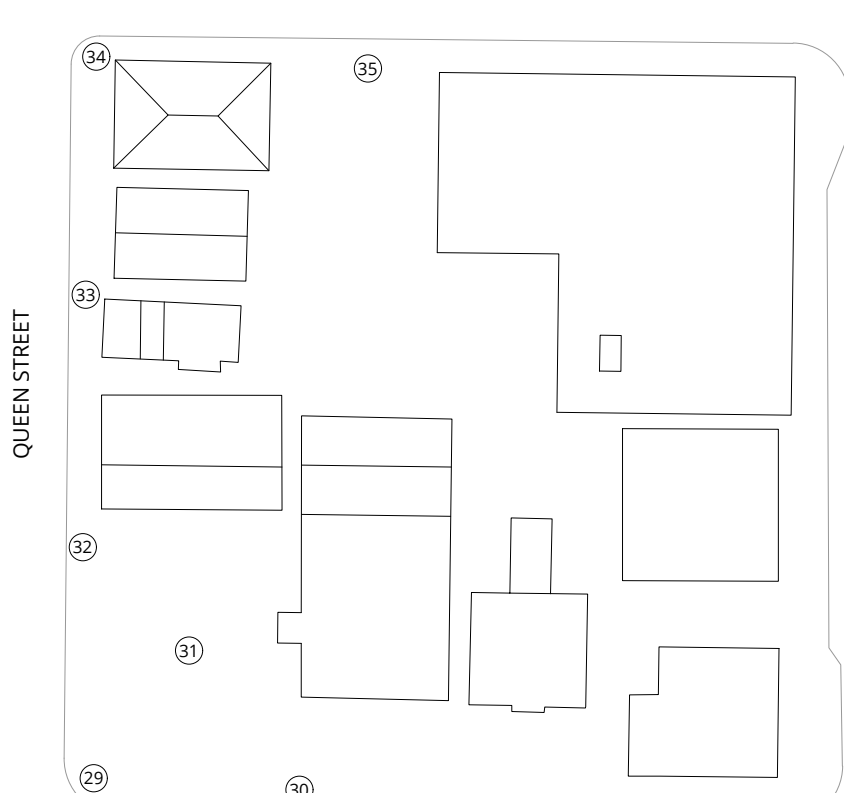
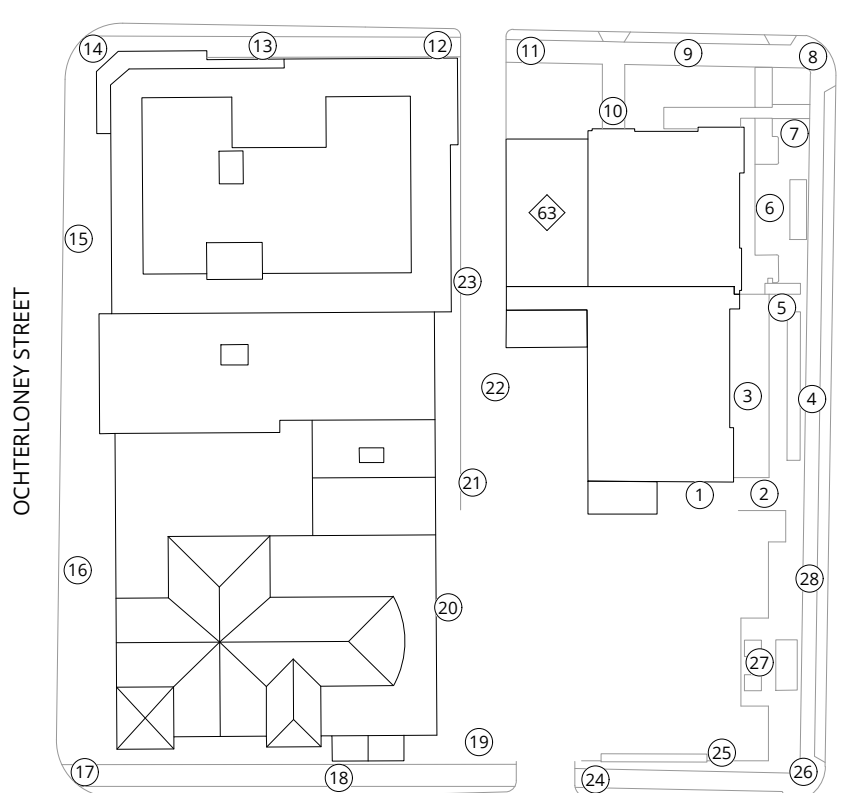
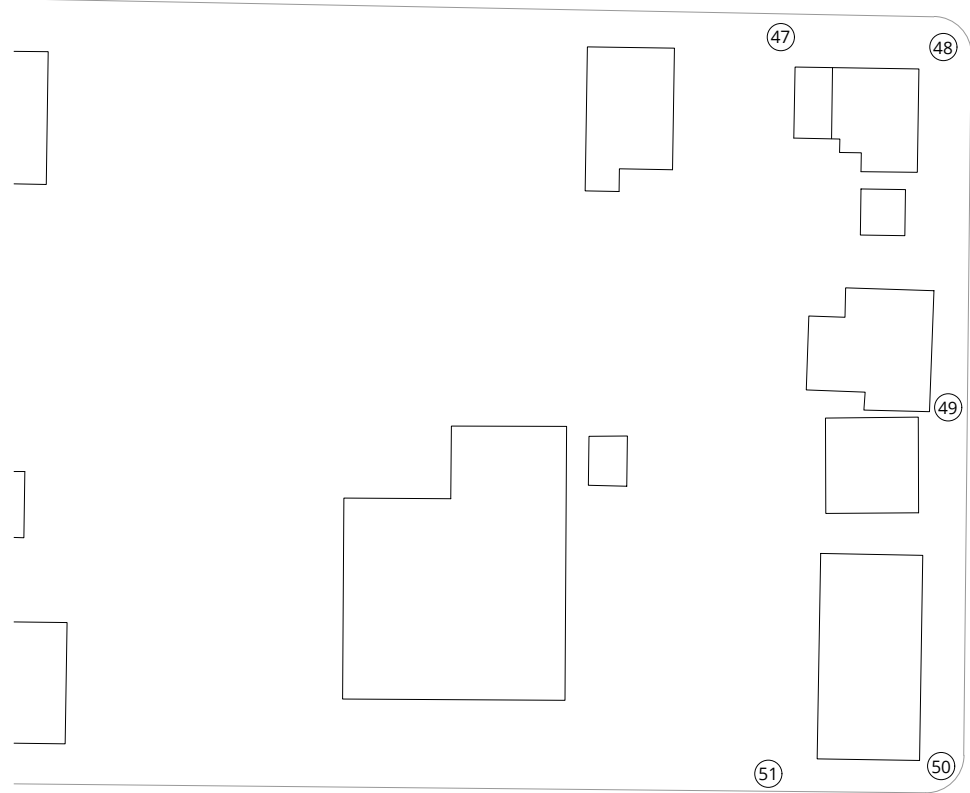


Pedestrian Wind Comfort Conditions
 Proposed Configuration
 Winter (November to April, 6:00 to 23:00)
 53 Queen Street - Dartmouth, NS

True North 
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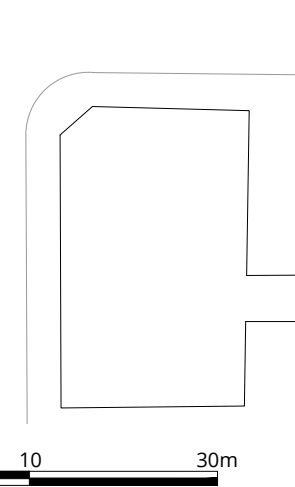
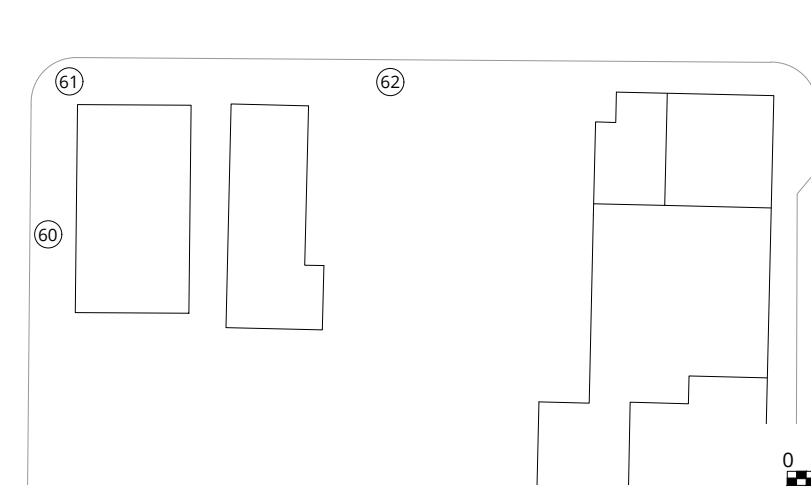
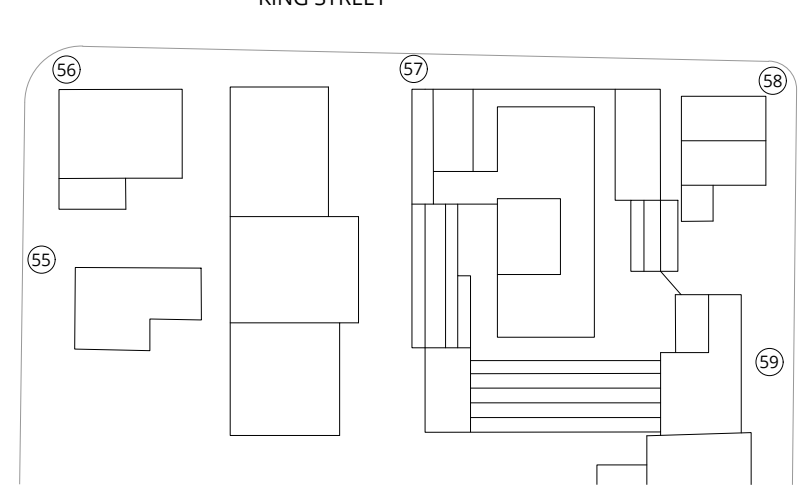
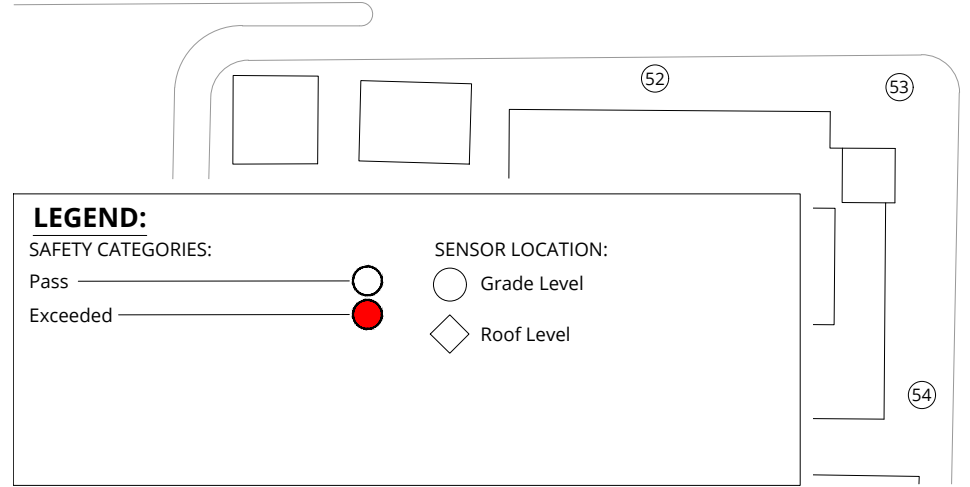


WENTWORTH STREET



PORTLAND STREET

KING STREET



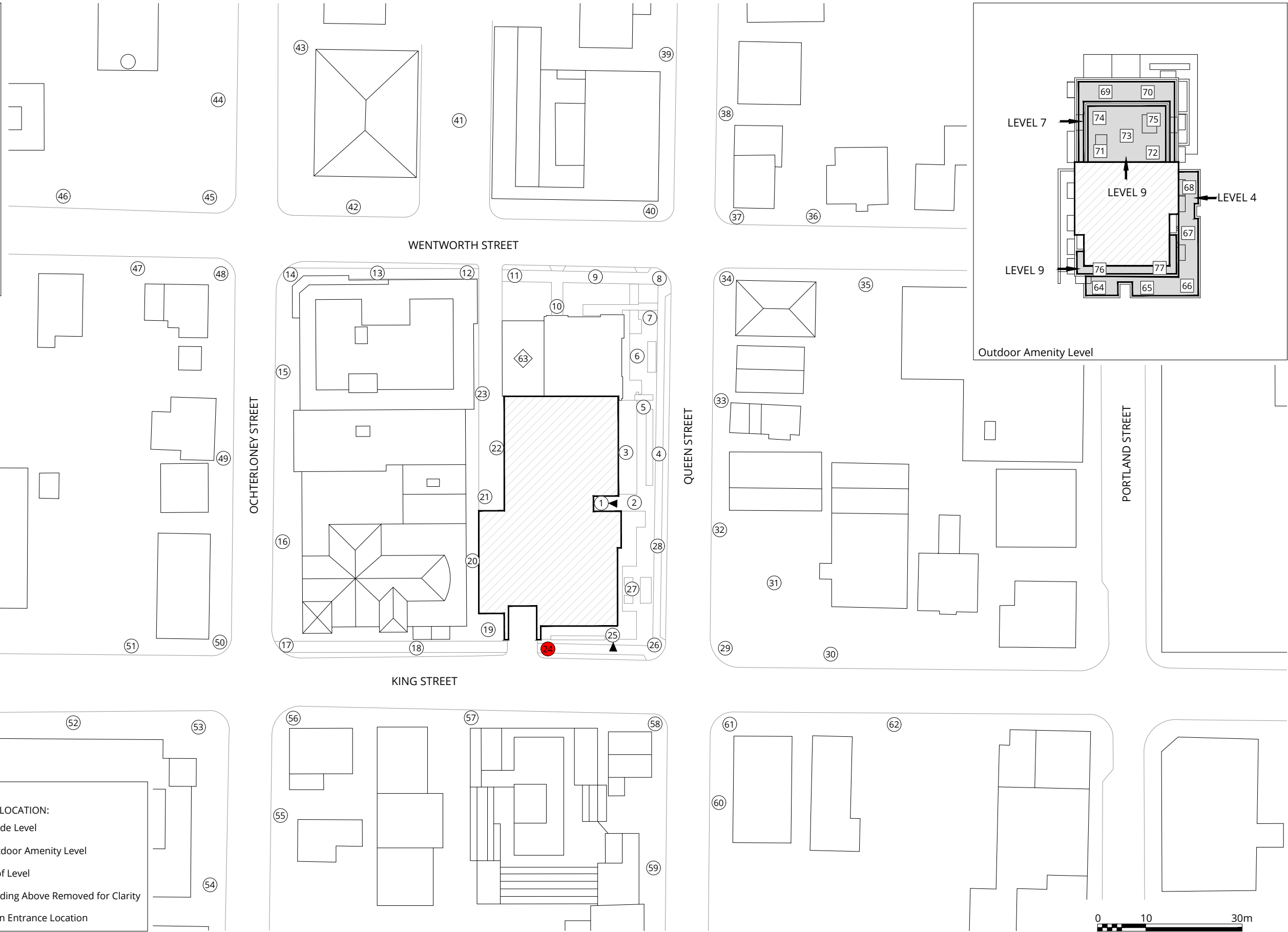
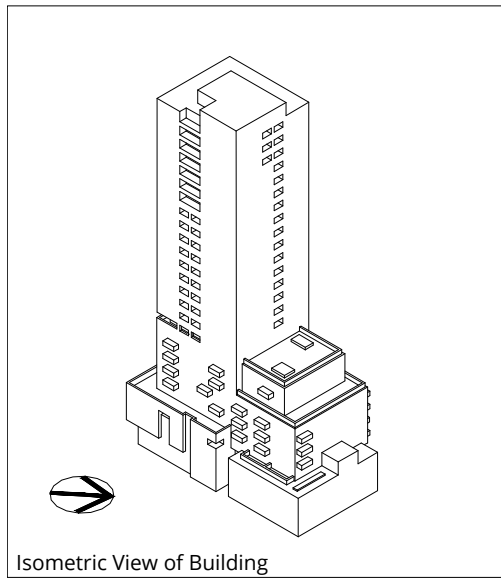
LEGEND:
 SAFETY CATEGORIES:
 Pass ———— ○
 Exceeded ———— ●
 SENSOR LOCATION:
 ○ Grade Level
 ◇ Roof Level



Pedestrian Wind Safety Conditions
 Existing Configuration
 Annual (January to December, 0:00 to 23:00)
 53 Queen Street - Dartmouth, NS

True North
 Drawn by: ALJM Figure: 3A
 Approx. Scale: 1:800
 Date Revised: Jan. 17, 2023
 Project #2204998





LEGEND:

SAFETY CATEGORIES:


- Pass (white circle)
- Exceeded (red circle)

SENSOR LOCATION:

- Grade Level (white circle)
- Outdoor Amenity Level (hatched square)
- Roof Level (diamond)
- Building Above Removed for Clarity (black square)
- Main Entrance Location (black triangle)



Pedestrian Wind Safety Conditions
 Proposed Configuration
 Annual (January to December, 0:00 to 23:00)
 53 Queen Street - Dartmouth, NS

True North 

Drawn by: ALJM Figure: 3B
 Approx. Scale: 1:800
 Date Revised: Jan. 17, 2023



Project #2204998

A large decorative graphic on the left side of the page, featuring a blue triangle in the top-left corner and a large, light gray semi-circle that curves from the top-left towards the bottom-right. The word 'TABLES' is centered within the gray area.

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

Season	Months	Hours	Comfort Speed (km/h)	Safety Speed (km/h)
Summer	May - October	6:00 - 23:00 for comfort	(20% Seasonal Exceedance)	(0.1% Annual Exceedance)
Winter	November - April	6:00 - 23:00 for comfort	≤ 10 Sitting	≤ 90 Pass
Annual	January - December	0:00 - 23:00 for safety	11 - 14 Standing	> 90 Exceeded
Configurations				
Existing	Existing site and surroundings			
Proposed	Project with existing surroundings			
			15 - 17 Strolling	
			18 - 20 Walking	
			> 20 Uncomfortable	