8 SHOREVIEW PLACE

STONEY CREEK, ONTARIO

PEDESTRIAN WIND TUNNEL STUDY

GNOBI #080023

JULY 7, 2023

PREPARED BY

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Table of Contents

1. INTRODUCTION

This report presents the findings of the pedestrian wind tunnel assessment conducted by Gnobi Consulting Inc. for the proposed development at 8 Shoreview Place in Stoney Creek, ON. The report outlines the study objectives, methodology, results, and recommendations for wind mitigation measures where necessary.

1.1. Project Overview

The project is a mixed development comprising of two towers of 25 and 37 storeys respectively, connected by a six-storey podium and seven-storey terrace featuring outdoor amenities. The site is situated on an irregular parcel of land with a total gross lot area of approximately 11,716 square meters. The surrounding area is primarily characterized by a mix of low-rise commercial and residential buildings to east, south and west, with Lake Ontario immediately to the north of the site. A 10-storey Seasons Retirement Community is located immediately to the east. John C. Munro Hamilton International Airport is located approximately 18.6k to the southwest.

Key pedestrian areas of concern include building entrances, above-grade amenity areas, surrounding sidewalks, and nearby parking lots. The main residential entrances are located near the mid-areas of the building along the southwest façade and underneath the podium at the main drop-off area.

Image 1: Aerial View of the Proposed Site, Source: Google Earth ™.

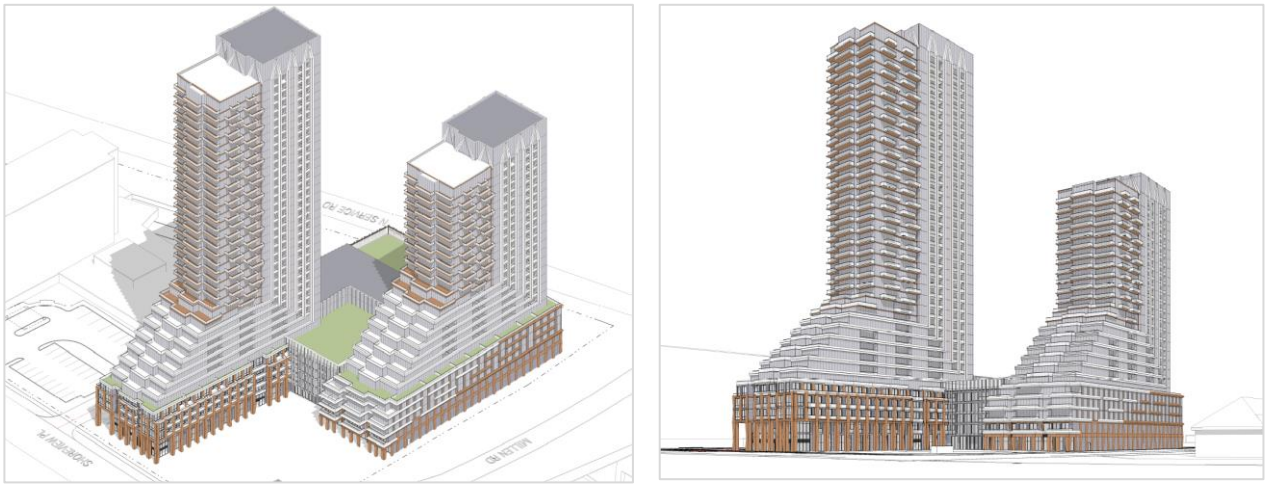

Image 2: 3D Model Rendering of the Project, Courtesy: Graziani Corazza Architects

1.2. Objectives

The primary objective of this study is to assess the wind conditions and their impact on pedestrians at various locations within and around the project site. The analysis focuses on identifying areas of concern and providing mitigation strategies to ensure optimal pedestrian comfort and safety.

1.3. Scope of the Study

The study considers both the existing conditions and the proposed design configuration within the context of the existing surroundings. The site configurations assessed included the following two scenarios:

(1) **Existing:** proposed site and existing surrounding buildings within the study area (**Image 3A**).

(2) **Proposed:** the proposed development plus existing surrounding buildings within the study area (**Image 3B**).

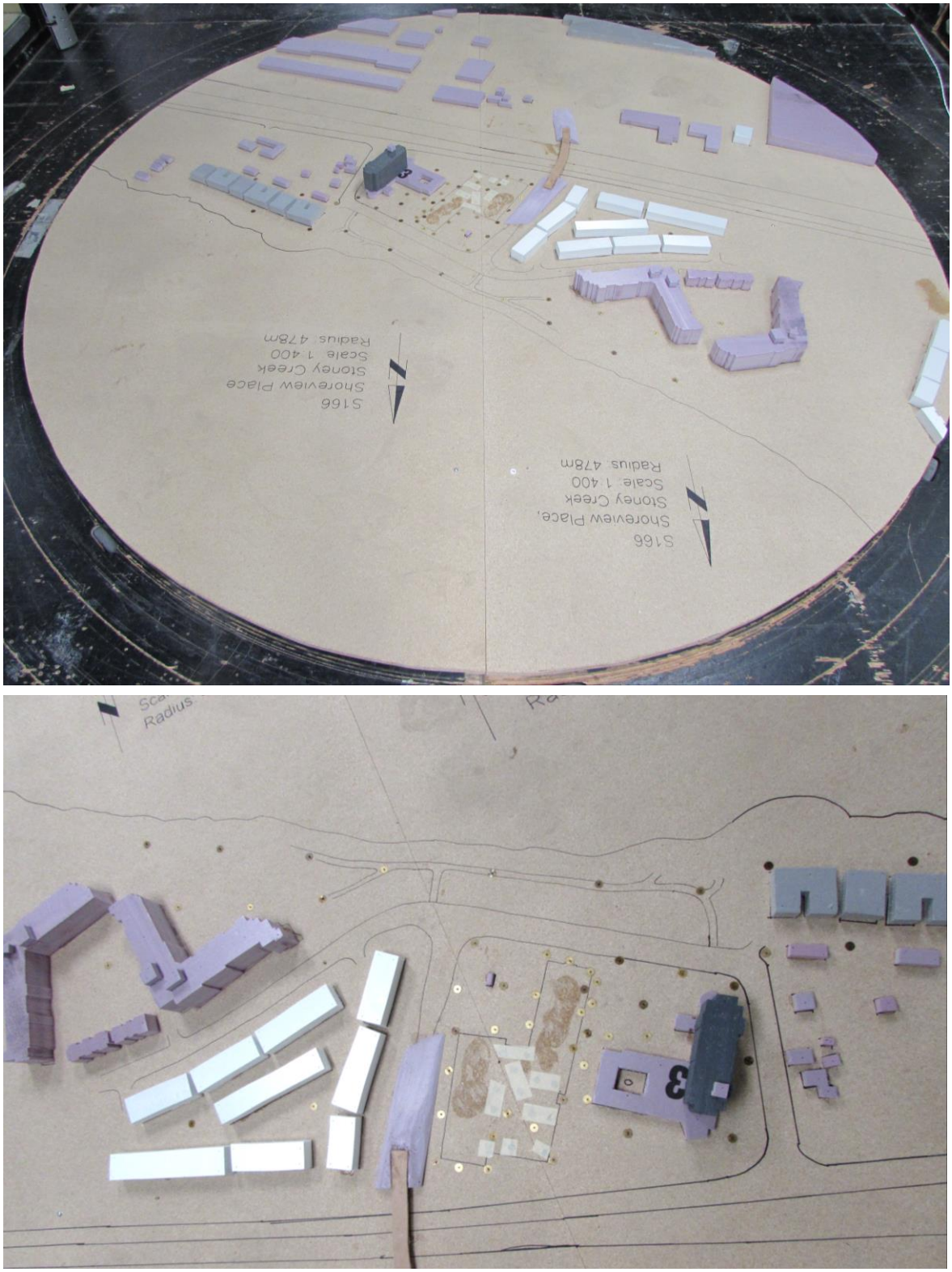

Image 3A: Wind Tunnel Model of the Existing Configuration

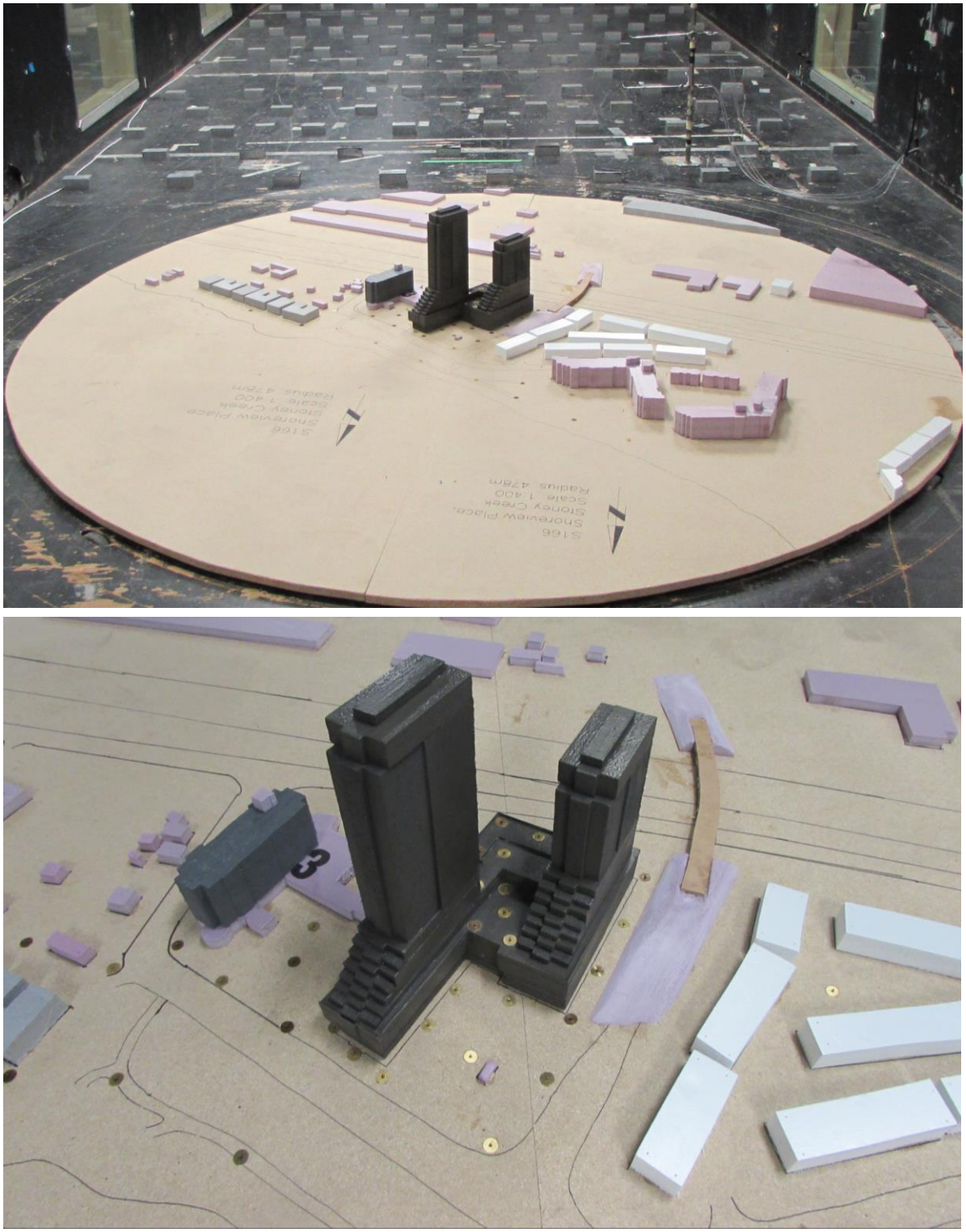

Image 3B: Wind Tunnel Model of the Proposed Configuration

2. METHODOLOGY

2.1. Physical Modelling / Wind Tunnel Testing

The study methodology involved wind tunnel testing of a 1:400 scale model representing the existing and proposed site configurations of the project. The model included the project site, surrounding buildings, and topography within a 480 m radius. 68 specially designed omnidirectional wind speed probes were placed at pedestrian areas of interest on and around the project, to measure the mean and gust wind speeds at a height of approximately 1.5 m above the local grade.

The wind tunnel tests simulated mean wind speed and wind gust profiles in the atmospheric boundary layer beyond the modeled area. Wind speed ratios (speed at sensor probe / speed at gradient height) recorded from the wind tunnel tests were then combined with long-term wind data from a reference meteorological station to predict the magnitude and frequency of wind speeds at various locations on and around the study area.

2.2. Meteorological Data Analysis

The local wind climate at the proposed site was evaluated using hourly wind data collected at John C. Munro Hamilton International Airport, situated at a height of 10 meters above ground level, as a point of reference. The wind roses in Image 4 below present the cumulative probability distribution of wind speeds for the spring (March to May), summer (June to August), fall (September to November), and winter (December to February) months. Analysis of the data reveals that spring and winter months are characterized by a higher frequency of strong winds than the summer and fall months and the strong winds occur primarily from the northeast and west northwest through southwest quadrants.

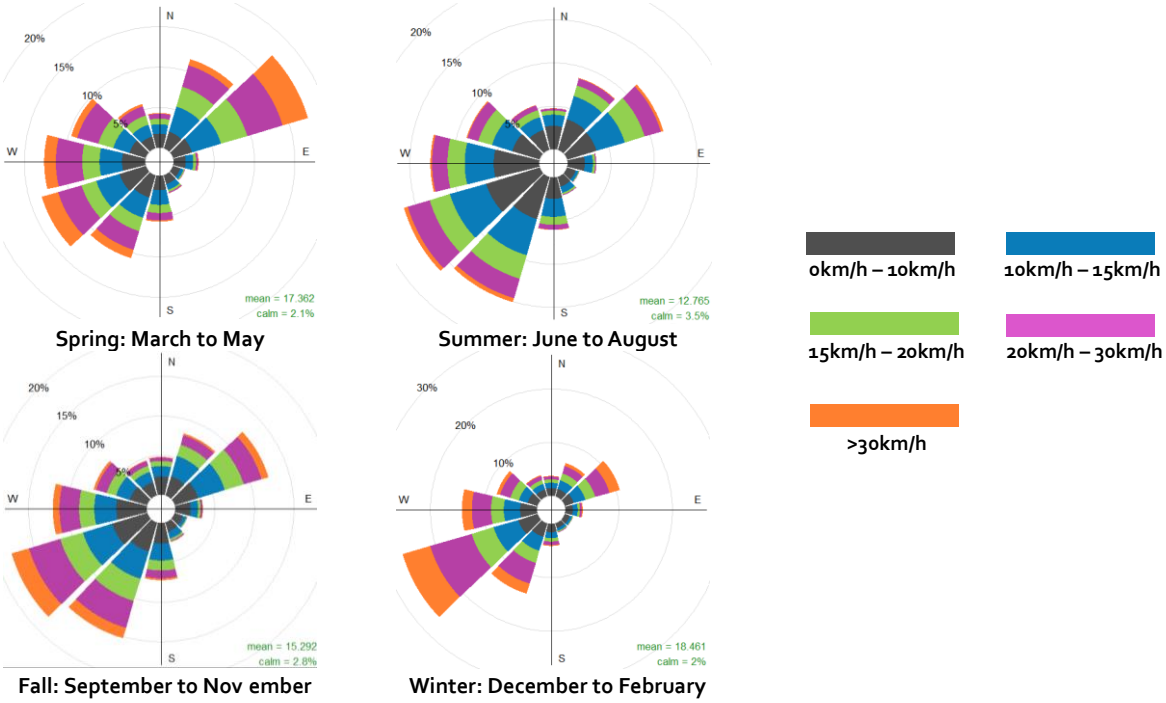

Image 4: Wind Data from John C. Munro Hamilton International Airport (1992 – 2022)

2.3. Wind Criteria

The pedestrian wind criteria used in the current study are specified in the pedestrian level wind Terms of Reference of most cities in southern Ontario and are commonly used in the city of Hamilton, ON. The wind criteria are an essential component of building design in urban areas. They are established guidelines that determine the maximum allowable wind speed and frequency of occurrence that pedestrians can safely and comfortably tolerate for various passive or active activities such as sitting, standing, strolling, or walking. The criteria are generally based on a combination of scientific data, engineering principles, and human experience. They take into consideration factors such as the intended use of the pedestrian spaces on and around the project.

TABLE 1: WIND CRITERIA FOR PEDESTRIAN COMFORT AND SAFETY

COMFORT CATEGORY	GEM* SPEED (km/h)	DESCRIPTION	AREA OF APPLICATION
Sitting	≤ 10	Light breezes desired for outdoor seating areas where one can read a paper without having it blown away.	**Park benches, restaurant seating, balconies, amenity terraces, etc. intended for relaxed, and usually seated activities.**
Standing	≤ 15	Gentle breezes suitable for passive pedestrian activities where a breeze may be tolerated	**Main entrances, bus-stops, and other outdoor areas where seated activities can be avoided.**
Walking	≤ 20	Relatively high speeds that can be tolerated during intentional walking, running and other active movements.	**Sidewalks, parking lots, alleyways, and areas where pedestrian activity is infrequent.**
Uncomfortable	> 20	Strong winds, considered a nuisance for most activities.	**May be accepted in areas not intended for pedestrian access**
Notes	**1) The required seasonal compliance is 80% of the time for the Sitting, Standing and Walking categories. The Uncomfortable categorization is applicable if the criteria for Walking are not met.** **2) Gust Equivalent[2] Mean (GEM) speed = maximum of either mean speed or gust speed/1.85. The gust speed can be measured directly from wind tunnel or estimated as *mean speed + (3 x RMS speed)*.** **3) Comfort calculations are to be based on wind events recorded between 6:00 and 23:00 daily.** **4) Threshold wind speeds are lower in the winter to account for wind-chill, to consider outdoor comfort in alignment with the Winter City Design Guidelines.**		
SAFETY CRITERION / WIND HAZARD	**GUST SPEED (km/h)**	**DESCRIPTION**	**AREA OF APPLICATION**
Exceeded Y/N? **Yes --** **No --**	> 90	Excessive gust speeds can adversely affect a pedestrian's balance and footing. Wind mitigation is typically required.	**All areas assessed**
Notes	**5) Wind safety assessment is to be based on wind events recorded for 24 hours a day.**		

The wind criteria referenced include two primary categories:

2.3.1. Pedestrian Wind Safety / Hazard

Pedestrian safety is correlated with gust wind speeds that exceed the threshold (90 km/h) capable of negatively impacting a pedestrian's stability and balance. When wind speeds capable of destabilizing an individual, at around 90 km/h, occur more than 0.1% of the time or for a duration of 9 hours per year, the wind conditions can be classified as hazardous.

2.3.2. Pedestrian Wind Comfort

Sitting (≤ 10 km/h): Tranquil breezes desired for passive pedestrian activities such as outdoor dining or seating areas.

Standing (≤ 15 km/h): Suitable for areas where pedestrians are apt to linger such as main building entrances, drop-off areas, parks and bus stops.

Walking (≤ 20 km/h): Relatively high speeds but are considered suitable for active pedestrian activities such as walking, running or cycling.

Uncomfortable (>20km/h): wind speeds exceeding 20km/h more than 20% of the time.

To determine suitable wind conditions for pedestrian activities such as sitting, standing, or walking, it is recommended that the associated mean wind speeds be expected for at least 80% of the time (approximately five and half out of seven days). In areas where winds surpass the 20km/h limit for over 20% of the time or surpass the wind safety threshold, wind control measures are typically required to ensure the safety and comfort of individuals.

3. RESULTS AND DISCUSSION

The report's Appendix section includes Table 1, which provides data on wind speeds measured at various locations under different site configurations: existing and proposed. The analysis takes into account hazard and comfort criteria, considering both annual (for wind hazard) and seasonal periods (for wind comfort), as well as specific time frames throughout the day. Visual representations of the assessed conditions are presented in Figures 1.1 through 5.2 in the Appendix.

3.1. Existing Configuration

The current wind conditions at and around the proposed site are suitable for the intended use and provide a comfortable environment throughout the year. These conditions range from being comfortable for pedestrians to sit, stand, or walk. During the summer and fall seasons, the wind conditions are generally calm compared to the spring and winter, where slightly higher wind levels are present. However, even during these seasons, the wind conditions remain within a comfortable range for the intended use.

In terms of wind gusts and hazards, the assessment reveals that the annual wind gust/hazard criterion is met in all the areas examined, except for a localized area situated to the east of the neighboring 10-storey Seasons Retirement Community building. In this specific area, there is a slight exceedance of the wind hazard criterion, indicating a marginal increase in the potential wind hazards.

Overall, the existing wind conditions are favorable for the intended use, with some variations throughout the seasons. Although there is a marginal exceedance of the wind hazard criterion in a localized area near the adjacent building, the majority of the assessed areas meet the criteria for a safe and comfortable environment.

3.2. Proposed Design

3.2.1. Positive Design Features

The proposed project has several positive design features that are considered beneficial for favorable wind speeds and should be retained in the final design. These include: (1) the proposed setbacks and stepped design of the tower along the north façade facing Lake Ontario which will reduce the impact of approaching from the northeast quadrant that may be redirected down to grade by the tower (2) the proposed vestibule at the main residential entrances and well as the recessed location of the entrances away from strong prevailing winds approaching from the northeast or southwest and northwest quadrants (3) the proposed 1.8m deep canopy and (4) the location of the main drop off area away from the prevailing winds.

3.2.2. Wind Flow around the Proposed Project

In general, wind tends to flow smoothly over buildings with uniform height. However, taller buildings disrupt this smooth flow by intercepting and redirecting the wind, resulting in downwashing and corner acceleration. When wind flows around the corners of tall buildings, it can cause localized increases in wind activity known as corner acceleration. Additionally, when two tall buildings are close to each other, the gap between them can act as a channel, accelerating the wind that passes through it.

With the proposed building being 25 and 37 storeys tall, it will redirect stronger winds at higher elevations down to pedestrian areas at ground level. Furthermore, the close proximity of the towers is likely to create channeling of wind flows through them.

3.2.3. Wind Conditions in the Proposed Configuration

During the summer and fall seasons, the wind conditions around the project are generally expected to be comfortable for the intended use, allowing for sitting, standing, or walking. However, slightly higher wind speeds are anticipated in the fall, particularly near the northwest corner of Tower A and southeast corner of the undercut area. These specific locations may experience marginally uncomfortable wind speeds, surpassing the comfort threshold by 1 km/h (Location 18 and 24 in Figure 3.2).

On Level 6 and the roof of Level 7, the outdoor amenity spaces are predicted to have comfortable wind speeds for pedestrians to stand in most areas. Additionally, there is a localized area to the south of Tower B on Level 6 where sitting would also be comfortable. During the fall season, the podium spaces between the towers may encounter slightly higher wind speeds due to stronger prevailing winds. Some areas will remain suitable for standing, while

others will have wind conditions conducive to active pedestrian activities like walking. The southeast corner of Tower B is expected to continue to have calm wind speeds suitable for passive pedestrian activities such as sitting.

In the spring and winter seasons, the site is expected to experience stronger prevailing winds, resulting in elevated wind conditions in some localized areas. Despite this, wind speeds suitable for pedestrians to stand or walk are predicted throughout most of the site. However, specific areas north of Tower A or west of Tower B, as well as the southwest and southeast corners of the site, are predicted to be uncomfortable due to higher prevailing wind speeds from the northeast quadrant. The commercial and residential entrances are predicted to generally have comfortable wind speeds for the intended use, except for the west residential entrance near Location 16, where wind speeds suitable for walking are anticipated. This is slightly higher than desired for an entrance where pedestrians tend to linger. During the winter, the wind conditions at grade are predicted to improve slightly or are generally comparable to those in the spring.

On Level 6 and the roof of Level 7, the amenity spaces are expected to have wind conditions ranging from comfortable for standing to comfortable for walking. However, there may be a few locations where wind channels between the towers and exposure to the northeast and southwest directions could create potentially uncomfortable conditions.

The wind gust or hazard criterion is also projected to be exceeded at certain locations on the ground level and above, particularly near the north areas of Tower A or west of Tower B at grade, as well as the southeast corner of the site. Exceedances of the wind gust/hazard criterion are anticipated on Level 6 and at a localized area on Level 7.

3.2.4. Wind Mitigation Measures

Following the initial wind tunnel test, the design team has implemented various soft and hardscape elements as well as design modifications aimed at improving wind speeds in areas where uncomfortable and potentially dangerous wind conditions are predicted. These measures include:

- Strategic placement of coniferous landscaping throughout the site: Coniferous trees have been strategically placed in specific locations to mitigate the impact of strong prevailing northeasterly winds near windy areas to the north of Tower A and west of Tower B (Locations 15, 17, 18, and 41 in Figure 5.2). Refer to the appendix section for a copy of the landscaping plan by Whitehouse Urban Design Landscape Architects and Urban Designers.
- Recessed design of the ground floor area north of Tower A: The ground floor area north of Tower A has been recessed to minimize the impact of winds accelerating around the northwest corner at grade. This design modification will improve wind speeds near Locations 17 and 18.
- Placement of coniferous trees or landscaping near the southeast corner/drop-off area and east of the driveway: Coniferous trees or landscaping have been strategically placed in these areas to enhance wind gust conditions near Location 24.
- Proposed 2.8m tall parapets on the Level 6 amenity level and canopy/roof overhang on the south area of the Level 6 amenity: These additions are intended to create sheltered spaces on the Level 6 amenity, allowing patrons to engage in passive activities like seating or outdoor dining.

As the design progresses, it is recommended to conduct further wind tunnel testing to verify the effectiveness of the aforementioned mitigation measures. This testing will also explore any additional adjustments or changes required to address potentially hazardous wind gust conditions in specific areas.

Image 5A: Proposed Landscaping Plan

Image 5B: Overhang to the North of Tower A to Improve Conditions in the Area

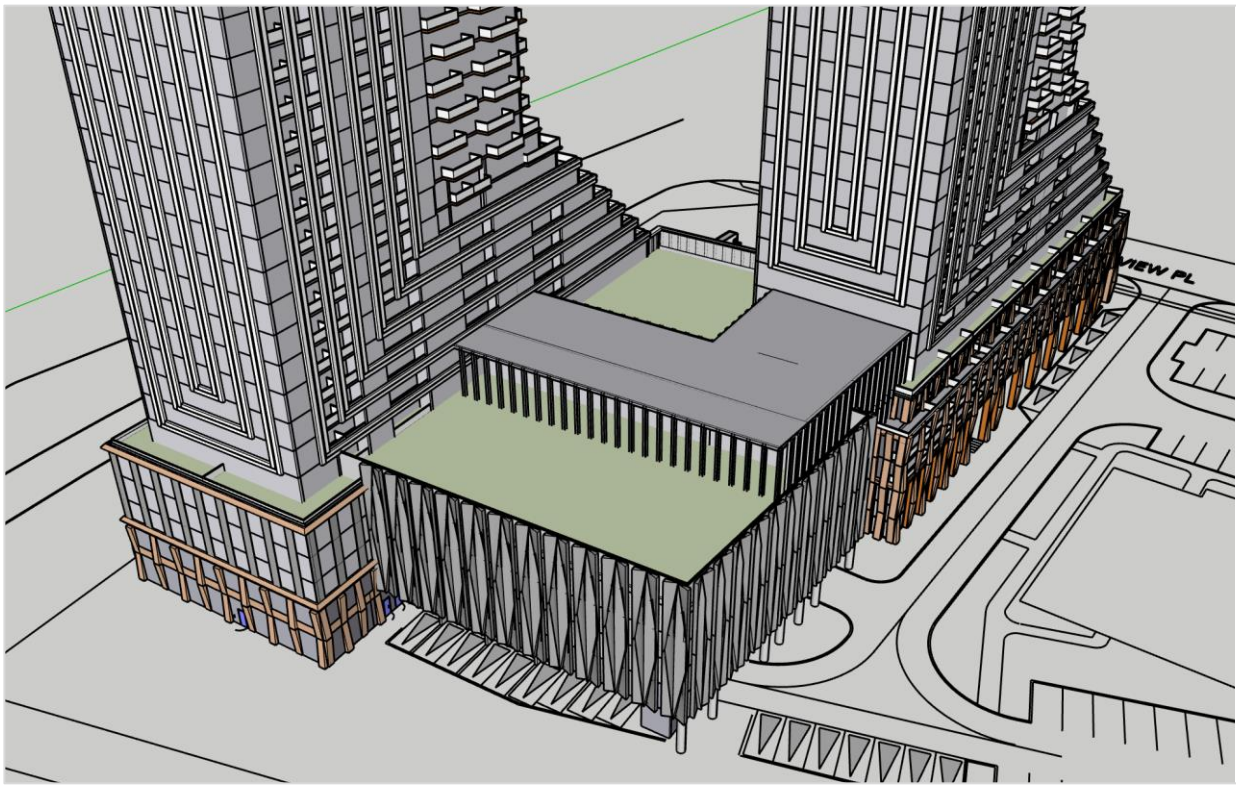

Image 5C: Overhang and 2.8m Tall Parapet on Level 6

4. CONCLUSION

In conclusion, the results of the analysis demonstrate that the existing wind conditions at the proposed site are generally favorable for the intended use, providing a comfortable environment throughout the year. The existing configuration of the site shows comfortable wind conditions for pedestrians to sit, stand, or walk, with summer and fall seasons generally being calmer compared to spring and winter. While slightly higher wind speeds are observed in some areas during these seasons, they still remain within a comfortable range.

The assessment also reveals that the majority of the assessed areas meet the criteria for a safe and comfortable environment, with the exception of a localized area near the neighboring building where a marginal exceedance of the wind hazard criterion exists. This highlights the importance of considering specific areas for potential wind hazards.

The proposed design of the project incorporates positive features such as setbacks, stepped design, vestibules, canopies, and the location of the drop-off area, which contribute to favorable wind speeds. However, the taller buildings and close proximity between them may disrupt the smooth flow of wind, resulting in corner acceleration and channeling effects.

During the summer and fall seasons, the wind conditions around the project are expected to be comfortable, with slightly higher wind speeds in specific locations. The outdoor amenity spaces on Level 6 and the roof of Level 7 are predicted to provide comfortable conditions for standing and sitting. In contrast, the spring and winter seasons are characterized by stronger prevailing winds, leading to elevated wind conditions in localized areas. Despite this, suitable wind speeds for pedestrians to stand or walk are predicted throughout most of the site.

Since the completion of the initial wind tunnel test, the design has been enhanced with a range of soft and hardscape wind mitigation elements, including an overhang near the north of Tower A, strategic placement of coniferous landscaping throughout the site, taller parapets around the perimeter of the Level 6 amenity and the addition of an overhang to the south of the Level 6 amenity area. These additions aim to improve the wind conditions in areas where undesirable or potentially hazardous wind speeds are anticipated. To ensure the effectiveness of these wind mitigation measures and address any remaining comfort and safety concerns at the site, we recommend additional wind tunnel testing at an appropriate stage of the design. This testing will allow for verification of the measures' efficacy and exploration of potential refinements that may be necessary.

5. STUDY APPLICABILITY

The assessment presented in this report pertains to the proposed development at 8 Shoreview Place in Stoney Creek, ON and is predicated on the Site Plan Approval application architectural drawings and 3D massing model provided by Graziani Corazza Architects dated May 15, 2023, and an updated set with design with wind mitigation measures received June 28, 2023, as well as updated Landscaping plan received from Whitehouse Urban Design Landscape Architects and Urban Designers July 4, 2023. Should there be any substantial modifications to the design, Gnobi Consulting Inc. is available to evaluate their potential impact on the pedestrian wind conditions discussed in this report. It is incumbent upon others to initiate this process by contacting Gnobi Consulting Inc.

6. REFERENCES

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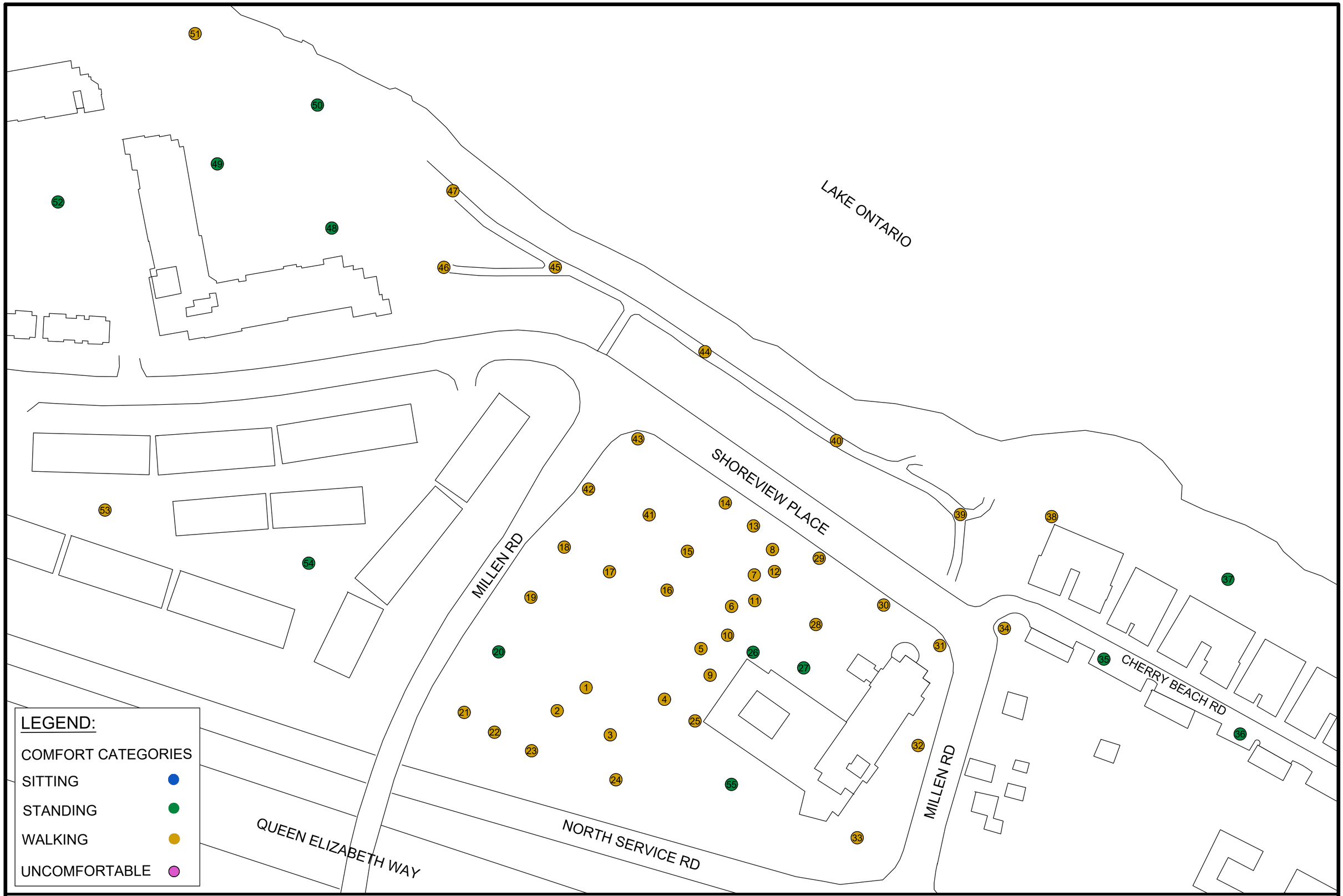
FIGURES



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8 SHOREVIEW PLACE

STONEY CREEK, ON

PEDESTRIAN LEVEL WIND TUNNEL STUDY

N

EXISTING - SPRING (MARCH - MAY)

Hours: 6:00 - 23:00

Gnobi Project #:080023

Date: JUNE 6, 2023

1.1

Scale:1:24

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8 SHOREVIEW PLACE

STONEY CREEK, ON

PEDESTRIAN LEVEL WIND TUNNEL STUDY

PROPOSED - SPRING (MARCH - MAY)

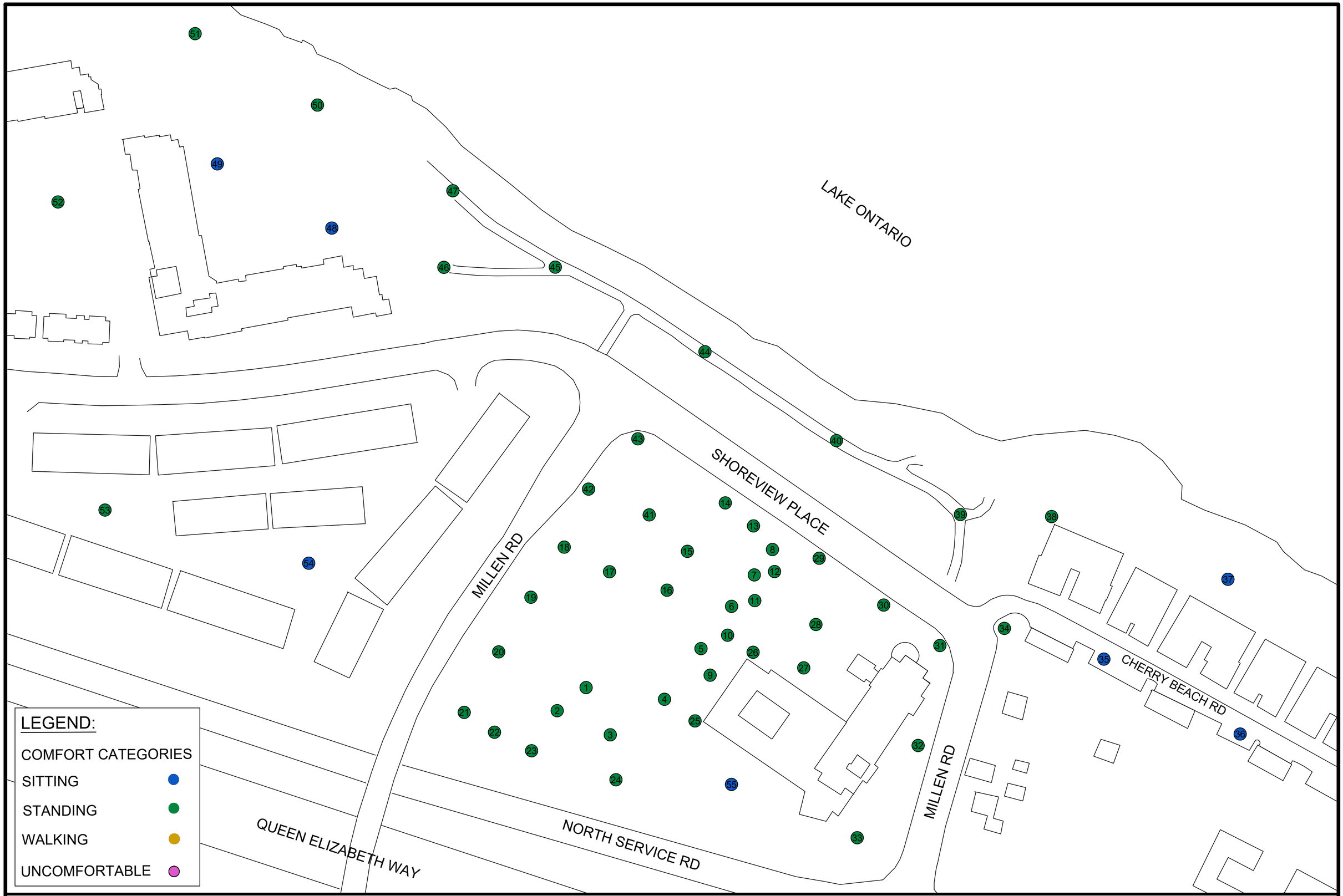
Hours: 6:00 - 23:00

Gnobi Project #:080023

Date: JUNE 6, 2023

1.2

Scale:1:24



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8 SHOREVIEW PLACE

STONEY CREEK, ON

PEDESTRIAN LEVEL WIND TUNNEL STUDY

N

EXISTING - SUMMER (JUNE - AUGUST)

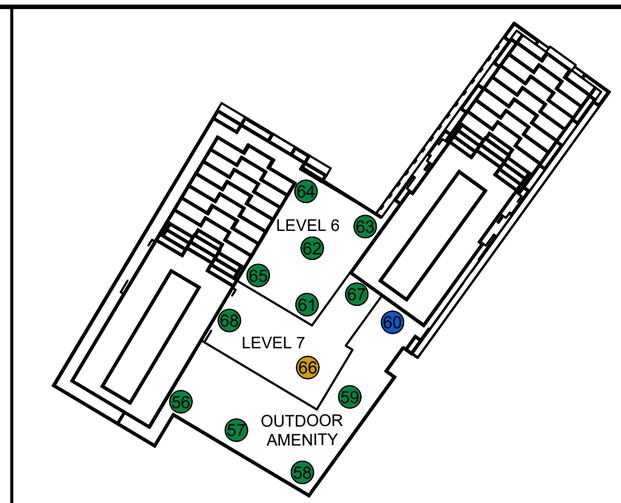
Hours: 6:00 - 23:00

Gnobi Project #:080023

Date: JUNE 6, 2023

2.1

Scale:1:24



ABOVE GRADE LEVEL LOCATIONS

LAKE ONTARIO

SHOREVIEW PLACE

MILLEN RD

MILLEN RD

CHERRY BEACH RD

QUEEN ELIZABETH WAY

NORTH SERVICE RD

LEGEND:

COMFORT CATEGORIES

SITTING

STANDING

WALKING

UNCOMFORTABLE

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2.2

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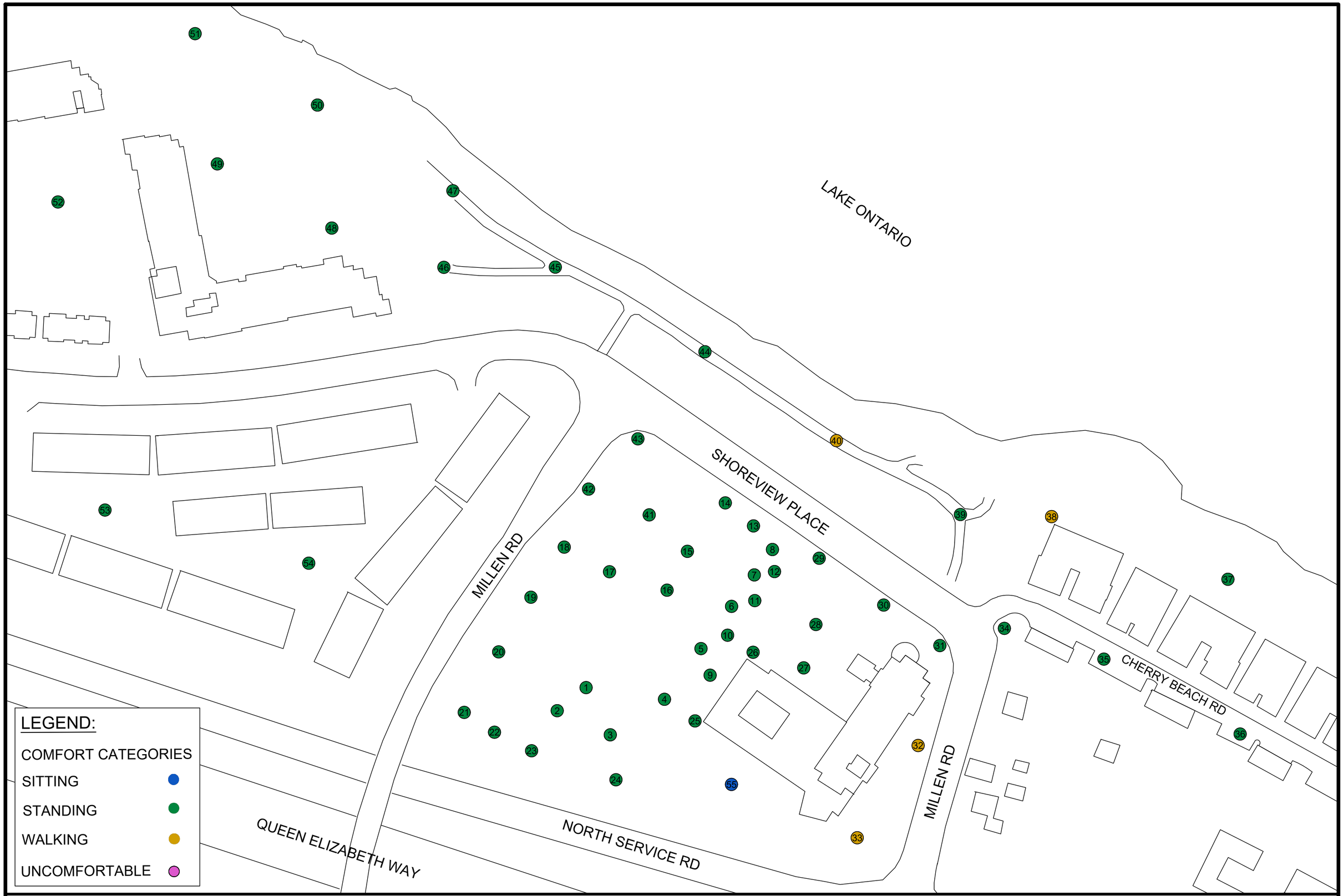

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8 SHOREVIEW PLACE

STONEY CREEK, ON

PEDESTRIAN LEVEL WIND TUNNEL STUDY

N

EXISTING - FALL (SEPTEMBER - NOVEMBER)

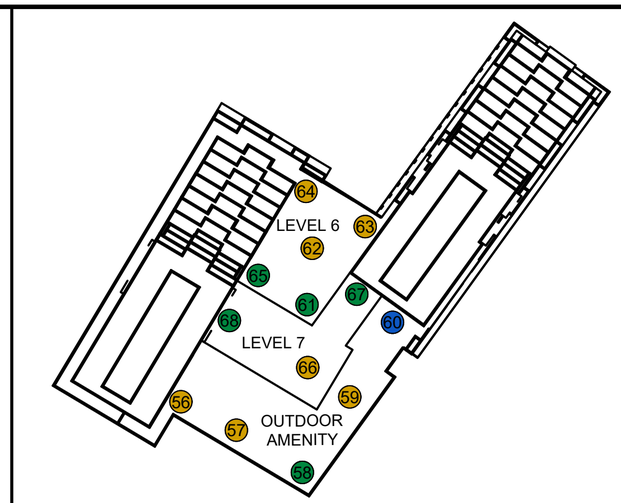
Hours: 6:00 - 23:00

Gnobi Project #:080023

Date: JUNE 6, 2023

3.1

Scale:1:24



ABOVE GRADE LEVEL LOCATIONS

LAKE ONTARIO

SHOREVIEW PLACE

MILLEN RD

MILLEN RD

CHERRY BEACH RD

QUEEN ELIZABETH WAY

NORTH SERVICE RD

LEGEND:

COMFORT CATEGORIES

SITTING

STANDING

WALKING

UNCOMFORTABLE

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PEDESTRIAN LEVEL WIND TUNNEL STUDY

N

PROPOSED - FALL (SEPTEMBER - NOVEMBER)

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3.2

Scale:1:24

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8 SHOREVIEW PLACE

STONEY CREEK, ON

PEDESTRIAN LEVEL WIND TUNNEL STUDY

N

EXISTING - WINTER (DECEMBER - FEBRUARY)

Hours: 6:00 - 23:00

Gnobi Project #:080023

Date: JUNE 6, 2023

4.1

Scale:1:24

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PROPOSED - WINTER (DECEMBER - FEBRUARY)

Hours: 6:00 - 23:00

Gnobi Project #:080023

Date: JUNE 6, 2023

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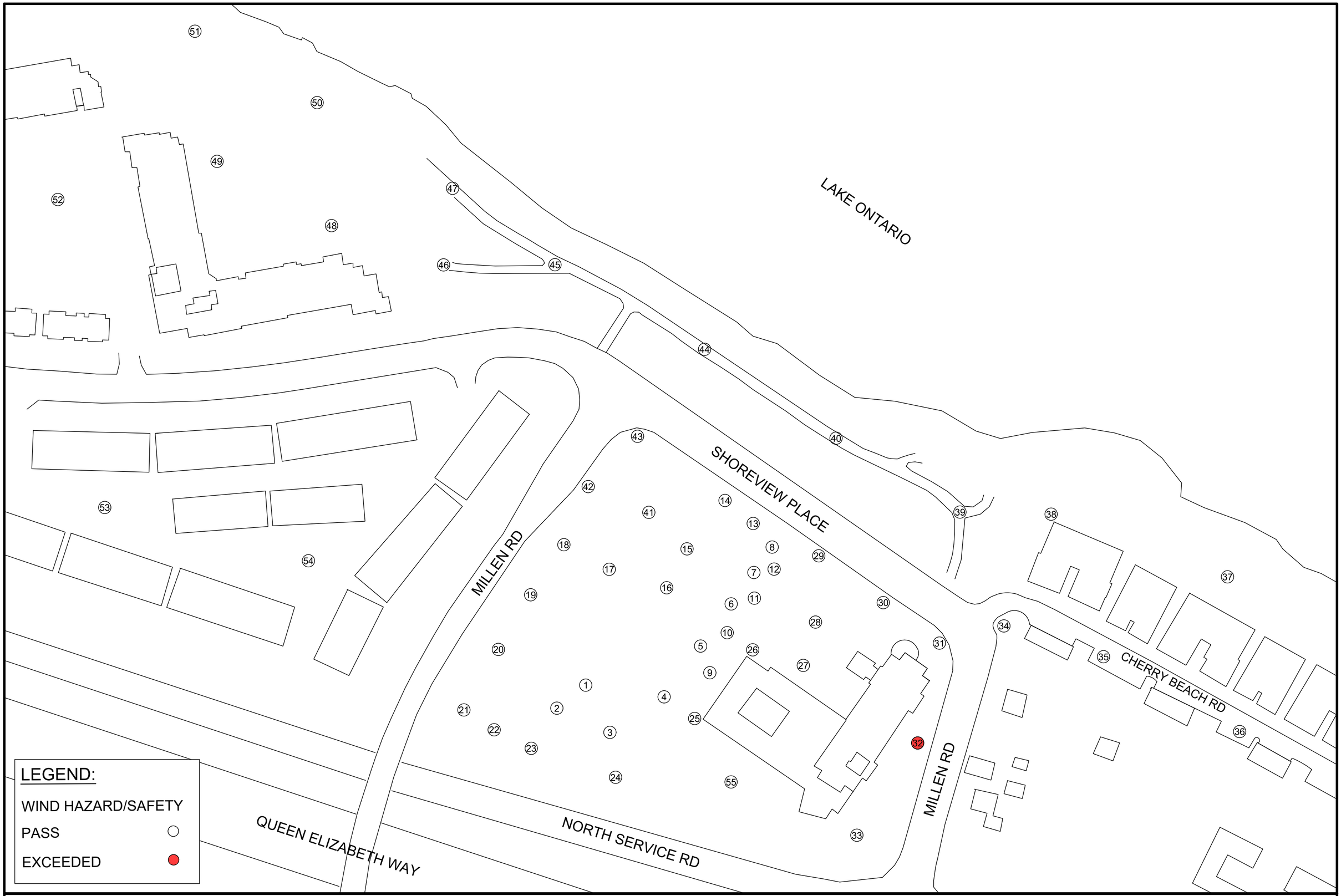

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8 SHOREVIEW PLACE

STONEY CREEK, ON

PEDESTRIAN LEVEL WIND TUNNEL STUDY

EXISTING - WIND HAZARD (JAN - DEC.)

Hours: 0:00 - 23:00

Gnobi Project #:080023

Date: JUNE 6, 2023

5.1

Scale:1:24

LAKE ONTARIO

SHOREVIEW PLACE

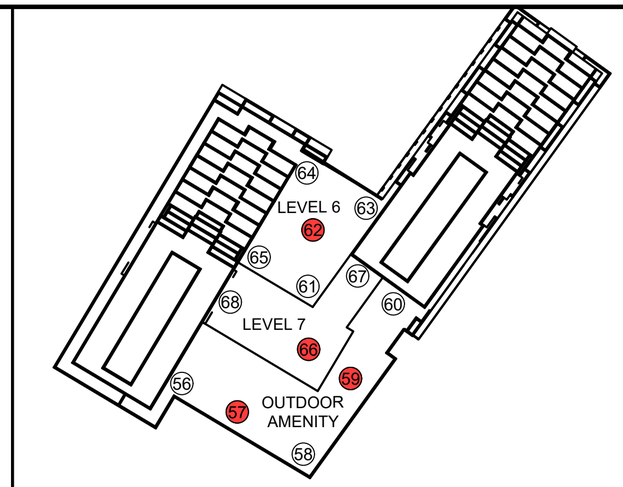
MILLEN RD

CHERRY BEACH RD

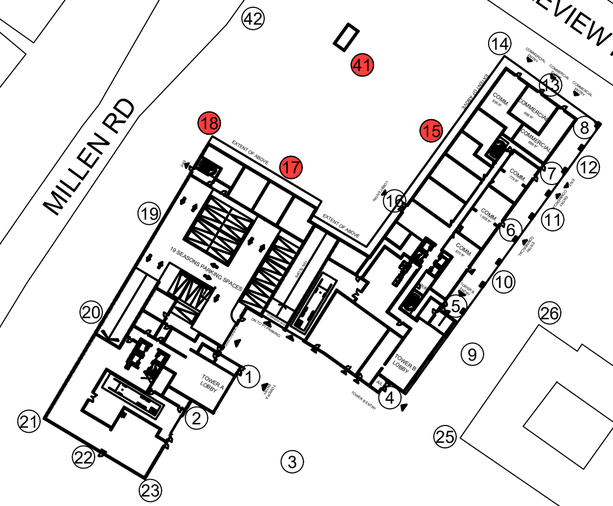
QUEEN ELIZABETH WAY

NORTH SERVICE RD

MILLEN RD



ABOVE GRADE LEVEL LOCATIONS



LEGEND:

WIND HAZARD/SAFETY

PASS

EXCEEDED

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(226)-343-0728

8 SHOREVIEW PLACE

STONEY CREEK, ON

PEDESTRIAN LEVEL WIND TUNNEL STUDY

PROPOSED - WIND HAZARD (JAN - DEC.)

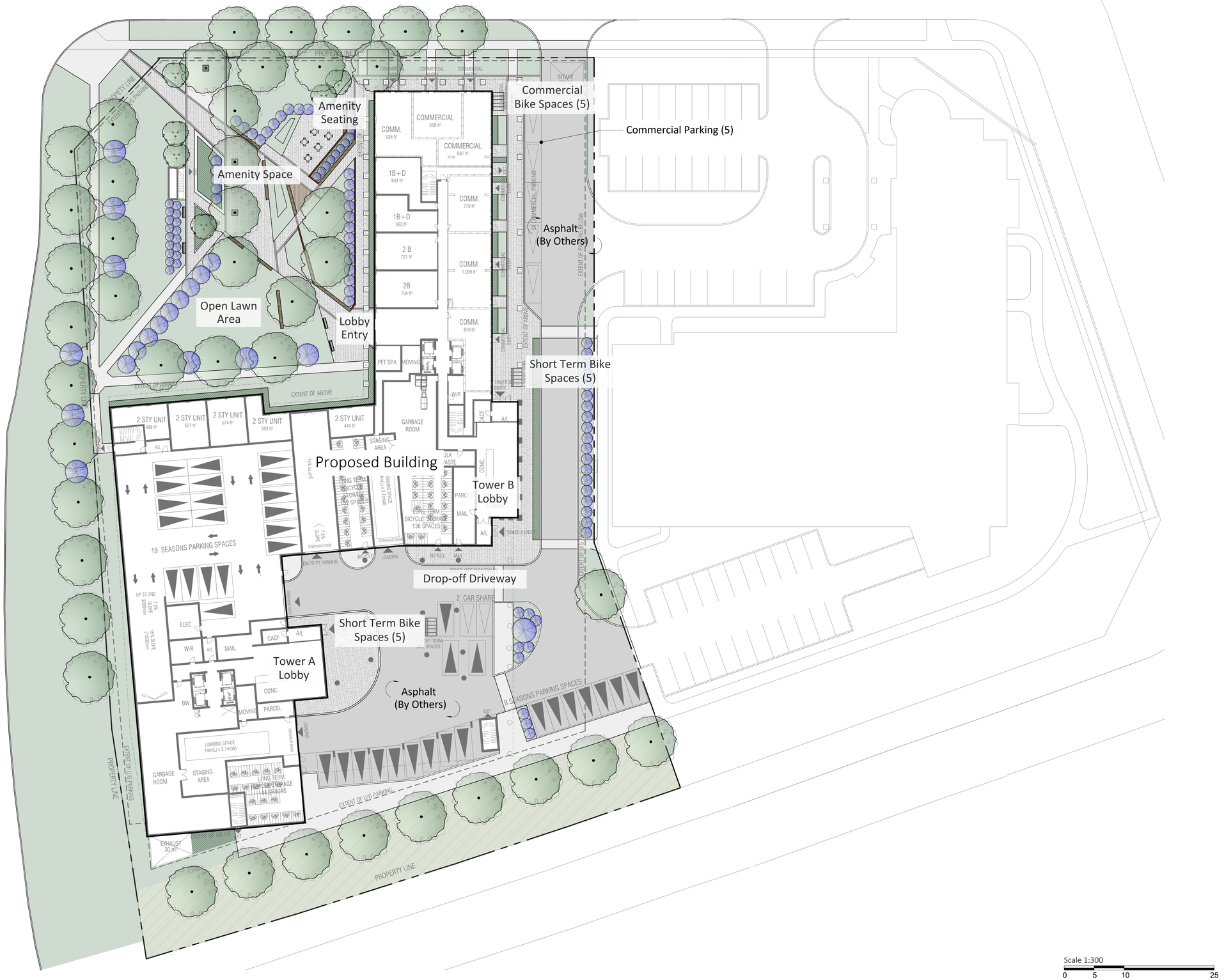
Hours: 0:00 - 23:00

Gnobi Project #:080023

Date: JUNE 6, 2023

5.2

Scale:1:24



Scale 1:300

0 5 10 25

KEY MAP

LEGEND:

- Concrete
- Asphalt
- Sod
- (116.90) Proposed Elevation
- 116.90 Existing Elevation
- Extend of Building Overhang
- Extend of Underground Parking
- Proposed Vegetation
- Deciduous Tree
- Coniferous Tree

Landscape Notes

1. Dimensions are shown in meters unless noted otherwise. Do not scale drawings.
2. Contractor to review layout on site with Landscape Architect prior to commencing work.
3. Contractor to verify grades and identify discrepancies prior to initiating work. Report any changes, discrepancies, or substitutions to the Landscape Architect for review prior to work.
4. It is the contractor's responsibility to locate and verify all existing utilities and services prior to construction.
5. Plant material support systems must be removed by the contractor at time of final acceptance. No extras will be paid to complete this work.
6. Contractor to provide minimum one (1) year warranty from date accepted on all work unless otherwise specified.
7. Grading and servicing shown is for information purposes. For grading and servicing information refer to engineering drawings.
8. For lighting information and power distribution refer to the electrical drawings.
9. Drawings are for construction only if Landscape Architects stamp is signed and dated by the Landscape Architect, and plans are approved by the Municipality.
10. Tree planting within the municipal right-of-way to be undertaken by the Municipality unless noted otherwise.
11. Unless otherwise specified all landscaped areas are to be sodded.
12. Unless otherwise specified, all undeveloped areas shall be undisturbed and kept free and clear of debris.
13. The Owner is to be aware of the Migratory Birds Convention Act, 1994. This Act is implemented by Environment Canada and the Owner is to make every effort to avoid removal of vegetation from the period of March 31st to August 31st

STAMP:

NOT FOR CONSTRUCTION

WHITEHOUSE URBAN DESIGN
LANDSCAPE ARCHITECTS & URBAN DESIGNERS

REVISIONS / SUBMISSIONS

NO.	DESCRIPTION	DATE:
1	For DRP	2023-xx-xx

CLIENT:

Seasons Retirement Communities (Stoney Creek) GP Inc.

PROJECT TITLE:

Shoreview

SHEET TITLE:

Landscape Concept

DWG No. L1	**DRAWN BY:** JJ
SHEET No. 1 of 1	**DESIGN BY:** LWS and JJ
PROJECT No: 087-23	**CHECKED BY:** LWS
SCALE: As shown	**NORTH ARROW:**

Whitehouse Urban Design Inc.
3 Studebaker Place, Unit 1, Hamilton, ON L8L 0C8
905-546-1087

TABLES

Table 1: Pedestrian Wind Comfort and Safety Conditions

Wind Probe	Configuration	Hazard Criterion		Comfort Criteria							
		Annual: January - December		Spring: March - May		Summer: June - August		Fall: September - November		Winter: December - February	
		Hours: 0:00 - 23:00		Hours: 6:00 - 23:00		Hours: 6:00 - 23:00		Hours: 6:00 - 23:00		Hours: 6:00 - 23:00	
		Gust (km/h)	Exceeded Yes/No?	Mean (km/h)	Comfort Category	Mean (km/h)	Comfort Category	Mean (km/h)	Comfort Category	Mean (km/h)	Comfort Category
Loc. 1	Existing	72	No	17	Walking	12	Standing	15	Standing	17	Walking
	Proposed	29	No	7	Sitting	5	Sitting	6	Sitting	6	Sitting
Loc. 2	Existing	69	No	17	Walking	12	Standing	14	Standing	16	Walking
	Proposed	24	No	6	Sitting	4	Sitting	5	Sitting	6	Sitting
Loc. 3	Existing	69	No	17	Walking	12	Standing	14	Standing	16	Walking
	Proposed	67	No	12	Standing	10	Sitting	12	Standing	15	Standing
Loc. 4	Existing	66	No	16	Walking	12	Standing	14	Standing	15	Standing
	Proposed	62	No	13	Standing	11	Standing	13	Standing	14	Standing
Loc. 5	Existing	72	No	17	Walking	12	Standing	15	Standing	17	Walking
	Proposed	60	No	13	Standing	9	Sitting	11	Standing	11	Standing
Loc. 6	Existing	70	No	17	Walking	12	Standing	15	Standing	17	Walking
	Proposed	69	No	15	Standing	10	Sitting	12	Standing	13	Standing
Loc. 7	Existing	72	No	17	Walking	12	Standing	15	Standing	17	Walking
	Proposed	69	No	14	Standing	10	Sitting	11	Standing	12	Standing
Loc. 8	Existing	73	No	17	Walking	12	Standing	15	Standing	17	Walking
	Proposed	90	No	19	Walking	13	Standing	15	Standing	15	Standing
Loc. 9	Existing	73	No	16	Walking	11	Standing	14	Standing	16	Walking
	Proposed	85	No	19	Walking	13	Standing	15	Standing	16	Walking
Loc. 10	Existing	73	No	17	Walking	12	Standing	15	Standing	17	Walking
	Proposed	79	No	17	Walking	12	Standing	14	Standing	14	Standing
Loc. 11	Existing	70	No	17	Walking	12	Standing	14	Standing	16	Walking
	Proposed	85	No	16	Walking	11	Standing	13	Standing	13	Standing
Loc. 12	Existing	72	No	17	Walking	12	Standing	14	Standing	16	Walking
	Proposed	89	No	19	Walking	13	Standing	15	Standing	15	Standing
Loc. 13	Existing	74	No	18	Walking	13	Standing	15	Standing	17	Walking
	Proposed	63	No	13	Standing	9	Sitting	11	Standing	12	Standing
Loc. 14	Existing	73	No	18	Walking	12	Standing	15	Standing	17	Walking
	Proposed	89	No	**21**	**Uncomfortable**	14	Standing	16	Walking	19	Walking
Loc. 15	Existing	72	No	18	Walking	13	Standing	15	Standing	17	Walking
	Proposed	**96**	**Yes**	18	Walking	12	Standing	14	Standing	17	Walking
Loc. 16	Existing	74	No	18	Walking	13	Standing	15	Standing	17	Walking
	Proposed	82	No	16	Walking	11	Standing	13	Standing	15	Standing
Loc. 17	Existing	73	No	17	Walking	12	Standing	15	Standing	16	Walking
	Proposed	**102**	**Yes**	20	Walking	14	Standing	15	Standing	18	Walking
Loc. 18	Existing	71	No	16	Walking	11	Standing	14	Standing	15	Standing
	Proposed	**100**	**Yes**	**25**	**Uncomfortable**	17	Walking	**21**	**Uncomfortable**	**24**	**Uncomfortable**
Loc. 19	Existing	74	No	17	Walking	12	Standing	14	Standing	15	Standing
	Proposed	70	No	17	Walking	12	Standing	15	Standing	18	Walking
Loc. 20	Existing	62	No	15	Standing	11	Standing	13	Standing	15	Standing
	Proposed	70	No	16	Walking	12	Standing	15	Standing	16	Walking
Loc. 21	Existing	73	No	16	Walking	11	Standing	13	Standing	14	Standing
	Proposed	81	No	**22**	**Uncomfortable**	16	Walking	19	Walking	**21**	**Uncomfortable**
Loc. 22	Existing	72	No	17	Walking	12	Standing	14	Standing	16	Walking
	Proposed	52	No	13	Standing	9	Sitting	11	Standing	13	Standing
Loc. 23	Existing	74	No	17	Walking	12	Standing	14	Standing	16	Walking
	Proposed	83	No	18	Walking	14	Standing	16	Walking	20	Walking
Loc. 24	Existing	69	No	17	Walking	12	Standing	14	Standing	16	Walking
	Proposed	**101**	**Yes**	**24**	**Uncomfortable**	18	Walking	**21**	**Uncomfortable**	**25**	**Uncomfortable**

Wind Probe	Configuration	Hazard Criterion		Comfort Criteria							
		Annual: January - December		Spring: March - May		Summer: June - August		Fall: September - November		Winter: December - February	
		Hours: 0:00 - 23:00		Hours: 6:00 - 23:00		Hours: 6:00 - 23:00		Hours: 6:00 - 23:00		Hours: 6:00 - 23:00	
		Gust (km/h)	Exceeded Yes/No?	Mean (km/h)	Comfort Category	Mean (km/h)	Comfort Category	Mean (km/h)	Comfort Category	Mean (km/h)	Comfort Category
Loc. 25	Existing	68	No	16	Walking	12	Standing	15	Standing	17	Walking
	Proposed	76	No	19	Walking	14	Standing	17	Walking	19	Walking
Loc. 26	Existing	69	No	15	Standing	11	Standing	13	Standing	15	Standing
	Proposed	71	No	16	Walking	11	Standing	13	Standing	14	Standing
Loc. 27	Existing	71	No	15	Standing	11	Standing	12	Standing	14	Standing
	Proposed	60	No	14	Standing	10	Sitting	12	Standing	13	Standing
Loc. 28	Existing	77	No	17	Walking	12	Standing	14	Standing	16	Walking
	Proposed	76	No	18	Walking	13	Standing	15	Standing	16	Walking
Loc. 29	Existing	74	No	18	Walking	12	Standing	15	Standing	17	Walking
	Proposed	73	No	18	Walking	12	Standing	14	Standing	15	Standing
Loc. 30	Existing	75	No	17	Walking	12	Standing	14	Standing	17	Walking
	Proposed	74	No	17	Walking	13	Standing	15	Standing	17	Walking
Loc. 31	Existing	75	No	18	Walking	13	Standing	15	Standing	16	Walking
	Proposed	75	No	17	Walking	12	Standing	14	Standing	15	Standing
Loc. 32	Existing	**91**	**Yes**	19	Walking	13	Standing	16	Walking	19	Walking
	Proposed	**93**	**Yes**	20	Walking	14	Standing	17	Walking	19	Walking
Loc. 33	Existing	89	No	20	Walking	15	Standing	17	Walking	20	Walking
	Proposed	90	No	**21**	**Uncomfortable**	15	Standing	18	Walking	**21**	**Uncomfortable**
Loc. 34	Existing	63	No	16	Walking	12	Standing	14	Standing	16	Walking
	Proposed	66	No	16	Walking	12	Standing	14	Standing	15	Standing
Loc. 35	Existing	49	No	12	Standing	9	Sitting	11	Standing	13	Standing
	Proposed	50	No	12	Standing	9	Sitting	11	Standing	12	Standing
Loc. 36	Existing	50	No	12	Standing	9	Sitting	11	Standing	13	Standing
	Proposed	48	No	12	Standing	9	Sitting	11	Standing	12	Standing
Loc. 37	Existing	55	No	13	Standing	10	Sitting	11	Standing	13	Standing
	Proposed	55	No	13	Standing	10	Sitting	11	Standing	13	Standing
Loc. 38	Existing	79	No	20	Walking	14	Standing	17	Walking	19	Walking
	Proposed	77	No	20	Walking	14	Standing	16	Walking	18	Walking
Loc. 39	Existing	75	No	18	Walking	13	Standing	15	Standing	17	Walking
	Proposed	71	No	19	Walking	13	Standing	15	Standing	17	Walking
Loc. 40	Existing	70	No	18	Walking	13	Standing	16	Walking	18	Walking
	Proposed	76	No	18	Walking	13	Standing	15	Standing	17	Walking
Loc. 41	Existing	73	No	18	Walking	12	Standing	15	Standing	17	Walking
	Proposed	**103**	**Yes**	**23**	**Uncomfortable**	16	Walking	18	Walking	**21**	**Uncomfortable**
Loc. 42	Existing	77	No	18	Walking	13	Standing	15	Standing	17	Walking
	Proposed	88	No	**23**	**Uncomfortable**	17	Walking	20	Walking	**23**	**Uncomfortable**
Loc. 43	Existing	72	No	17	Walking	12	Standing	15	Standing	16	Walking
	Proposed	78	No	20	Walking	15	Standing	17	Walking	20	Walking
Loc. 44	Existing	63	No	16	Walking	11	Standing	13	Standing	15	Standing
	Proposed	64	No	16	Walking	12	Standing	14	Standing	17	Walking
Loc. 45	Existing	69	No	17	Walking	12	Standing	14	Standing	16	Walking
	Proposed	68	No	17	Walking	12	Standing	14	Standing	16	Walking
Loc. 46	Existing	66	No	16	Walking	11	Standing	13	Standing	14	Standing
	Proposed	65	No	15	Standing	11	Standing	13	Standing	14	Standing
Loc. 47	Existing	66	No	16	Walking	11	Standing	13	Standing	15	Standing
	Proposed	65	No	15	Standing	11	Standing	13	Standing	15	Standing
Loc. 48	Existing	64	No	13	Standing	9	Sitting	11	Standing	13	Standing
	Proposed	64	No	13	Standing	9	Sitting	11	Standing	12	Standing
Loc. 49	Existing	63	No	14	Standing	10	Sitting	11	Standing	13	Standing
	Proposed	64	No	13	Standing	10	Sitting	11	Standing	13	Standing
Loc. 50	Existing	62	No	15	Standing	11	Standing	12	Standing	14	Standing
	Proposed	62	No	15	Standing	11	Standing	12	Standing	14	Standing
Loc. 51	Existing	65	No	17	Walking	12	Standing	14	Standing	17	Walking
	Proposed	64	No	16	Walking	12	Standing	13	Standing	16	Walking

Wind Probe	Configuration	Hazard Criterion		Comfort Criteria							
		Annual: January - December		Spring: March - May		Summer: June - August		Fall: September - November		Winter: December - February	
		Hours: 0:00 - 23:00		Hours: 6:00 - 23:00		Hours: 6:00 - 23:00		Hours: 6:00 - 23:00		Hours: 6:00 - 23:00	
		Gust (km/h)	Exceeded Yes/No?	Mean (km/h)	Comfort Category	Mean (km/h)	Comfort Category	Mean (km/h)	Comfort Category	Mean (km/h)	Comfort Category
Loc. 52	Existing	65	No	15	Standing	11	Standing	13	Standing	15	Standing
	Proposed	65	No	15	Standing	11	Standing	13	Standing	15	Standing
Loc. 53	Existing	74	No	16	Walking	12	Standing	14	Standing	17	Walking
	Proposed	72	No	16	Walking	12	Standing	14	Standing	17	Walking
Loc. 54	Existing	51	No	13	Standing	9	Sitting	11	Standing	13	Standing
	Proposed	52	No	12	Standing	9	Sitting	11	Standing	13	Standing
Loc. 55	Existing	49	No	12	Standing	9	Sitting	10	Sitting	12	Standing
	Proposed	74	No	16	Walking	11	Standing	13	Standing	16	Walking
Loc. 56	Existing	--	--	--	--	--	--	--	--	--	--
	Proposed	86	No	18	Walking	14	Standing	16	Walking	20	Walking
Loc. 57	Existing	24	No	6	Sitting	4	Sitting	5	Sitting	5	Sitting
	Proposed	**101**	**Yes**	20	Walking	14	Standing	17	Walking	20	Walking
Loc. 58	Existing	--	--	--	--	--	--	--	--	--	--
	Proposed	83	No	19	Walking	13	Standing	15	Standing	18	Walking
Loc. 59	Existing	--	--	--	--	--	--	--	--	--	--
	Proposed	**93**	**Yes**	20	Walking	14	Standing	17	Walking	20	Walking
Loc. 60	Existing	--	--	--	--	--	--	--	--	--	--
	Proposed	52	No	11	Standing	8	Sitting	10	Sitting	13	Standing
Loc. 61	Existing	--	--	--	--	--	--	--	--	--	--
	Proposed	77	No	17	Walking	12	Standing	15	Standing	16	Walking
Loc. 62	Existing	--	--	--	--	--	--	--	--	--	--
	Proposed	**102**	**Yes**	**22**	**Uncomfortable**	15	Standing	18	Walking	20	Walking
Loc. 63	Existing	--	--	--	--	--	--	--	--	--	--
	Proposed	86	No	18	Walking	14	Standing	17	Walking	18	Walking
Loc. 64	Existing	--	--	--	--	--	--	--	--	--	--
	Proposed	90	No	**21**	**Uncomfortable**	15	Standing	18	Walking	20	Walking
Loc. 65	Existing	--	--	--	--	--	--	--	--	--	--
	Proposed	73	No	16	Walking	11	Standing	13	Standing	14	Standing
Loc. 66	Existing	--	--	--	--	--	--	--	--	--	--
	Proposed	**104**	**Yes**	**23**	**Uncomfortable**	17	Walking	19	Walking	**23**	**Uncomfortable**
Loc. 67	Existing	--	--	--	--	--	--	--	--	--	--
	Proposed	67	No	15	Standing	12	Standing	14	Standing	16	Walking
Loc. 68	Existing	--	--	--	--	--	--	--	--	--	--
	Proposed	67	No	15	Standing	11	Standing	12	Standing	14	Standing

Notes:

Annual wind Hazard probability of exceedance = 0.1%

Seasonal Wind Comfort Probability of Exceedance = 20%

Abbreviations:

Loc. = Location

# of Configurations Assessed: Two (2)

Existing: Existing Surrounding Buildings

Proposed: Proposed Towers + Existing Surrounding Buildings

GNOBI CONSULTING INC.

Wind Engineering & Microclimate Consultants

www.gnobiconsulting.com