PUBLIC ATTACHMENT 7

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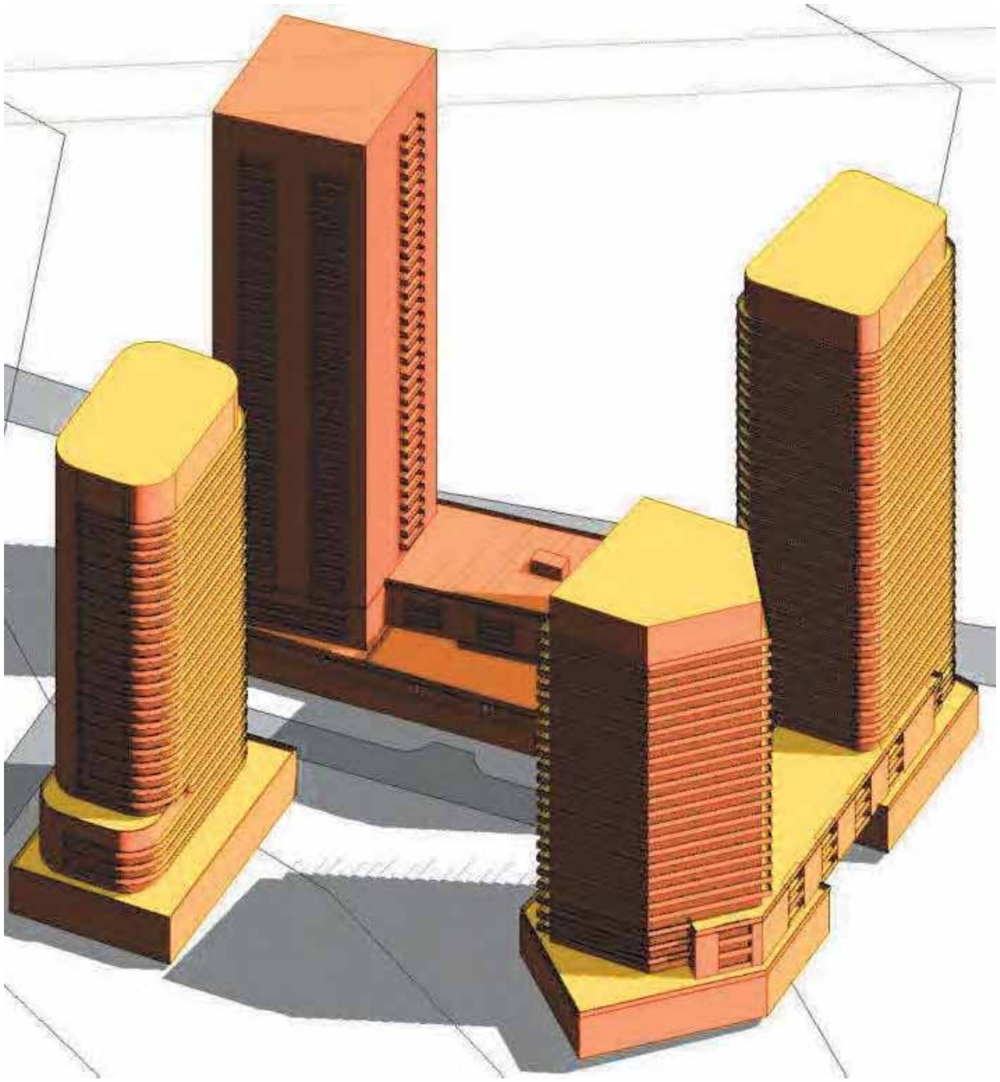
Date: April 18, 2023

Re: **Pedestrian Wind Assessment**
15-23 Toryork Drive
Toronto, Ontario
SLR Project #240.30246.00000



Credit: Giannone Petricone Associates Inc. Architects

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1.0 INTRODUCTION

SLR Consulting (SLR) was retained by Berkshire Axis Development Corp. to conduct a pedestrian wind analysis for the proposed 15-23 Toryork Drive development in Toronto, Ontario. This report is in support of the Zoning Bylaw Amendment (ZBA) resubmission application for the development. SLR previously conducted pedestrian wind assessment for the initial ZBA submission in September 2021.

1.1 Existing Site

The proposed development is located at 15-23 Toryork Drive, near the northwest corner of Weston Road and Finch Avenue West. The site is currently occupied by two low-rise commercial buildings. **Figure 1** provides an aerial view of the immediate study area. A virtual site visit was conducted by SLR using Google Earth images dated October 2020. Some of these images are included in **Figures 2a** through **2d**.

Immediately surrounding the site are low-rise commercial developments in all directions. Beyond the immediate surroundings, there are few mid to high-rise developments to the south of the project site. Lindy Lau Park is located approximately 250 m southwest of project site.

Typically, developments with Zoning Bylaw Approval and/or those currently under construction within a 500 m radius are included as existing surroundings. For the current assessment, the future development of Phase 1 and 2 of 3415 Weston Road was included.

Figure 1: Aerial view of existing site & surroundings
Credit: Google Earth Pro, dated 10/4/2022

Figure 2a: Toryork Drive looking east (site to the right)

Figure 2b: Toryork Drive looking west (site to the left)

Figure 2c: Toryork Drive looking south at the site

Figure 2d: Weston Road looking north (site to the left)

1.2 Proposed Development

The proposed development includes three blocks:

- Block 1 includes Tower A which is approximately 124 m in height and located at the northwest edge of the site along Toryork Drive, with three-storey and six-storey podium elements. The main entrances are located near the southwest corner of the building. There are retail entrances along the north facade, with secondary entrances and exits on the north, east and west facades.
- Block 2 is located on the east side of the site and includes two towers, Tower B is 118 m in height and Tower C is approximately 89 m tall. Both of these towers are located atop a six-storey podium. The main entrances to Tower B are on the west side of the podium, with retail entrances along the north and west facades, and secondary entrances are on the south facade. The main entrances to Tower C are also located on the west side of the podium, on the south side of the drive-thru. Secondary entrances are located along the north, east and west facades.
- Block 3 includes Tower D, which is located at the southwest edge of the site. Tower D is approximately 98 m tall. The main residential entrance is located near the northwest corner and secondary entrances are located along the north and east facade.

Amenity areas of the proposed development include a park between Towers C and D, outdoor amenity spaces/ Privately Owned Publicly Accessible Space (POPS) to the west of Towers B and C, and to the north and south of Tower D. In addition, outdoor amenity terraces of the proposed development are on the 3rd, 6th and 7th floors of the proposed towers.

Figure 3 illustrates the rendering of the proposed development.

1.3 Areas of Interest

Areas of interest for pedestrian wind conditions include those areas which pedestrians are expected to use on a frequent basis. Typically, these include sidewalks, main entrances, transit stops, plazas and parks. On-site areas of interest are shown in Figure 4.

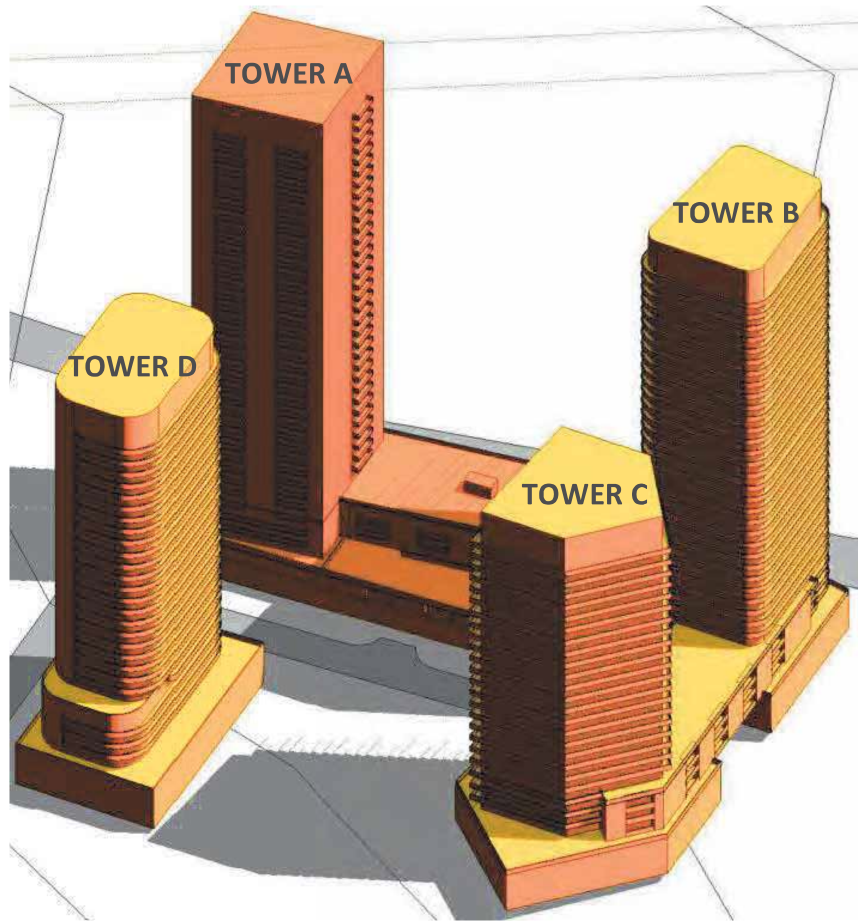


Figure 3: Rendering of proposed development
Credit: Giannone Petricone Associates Inc. Architects

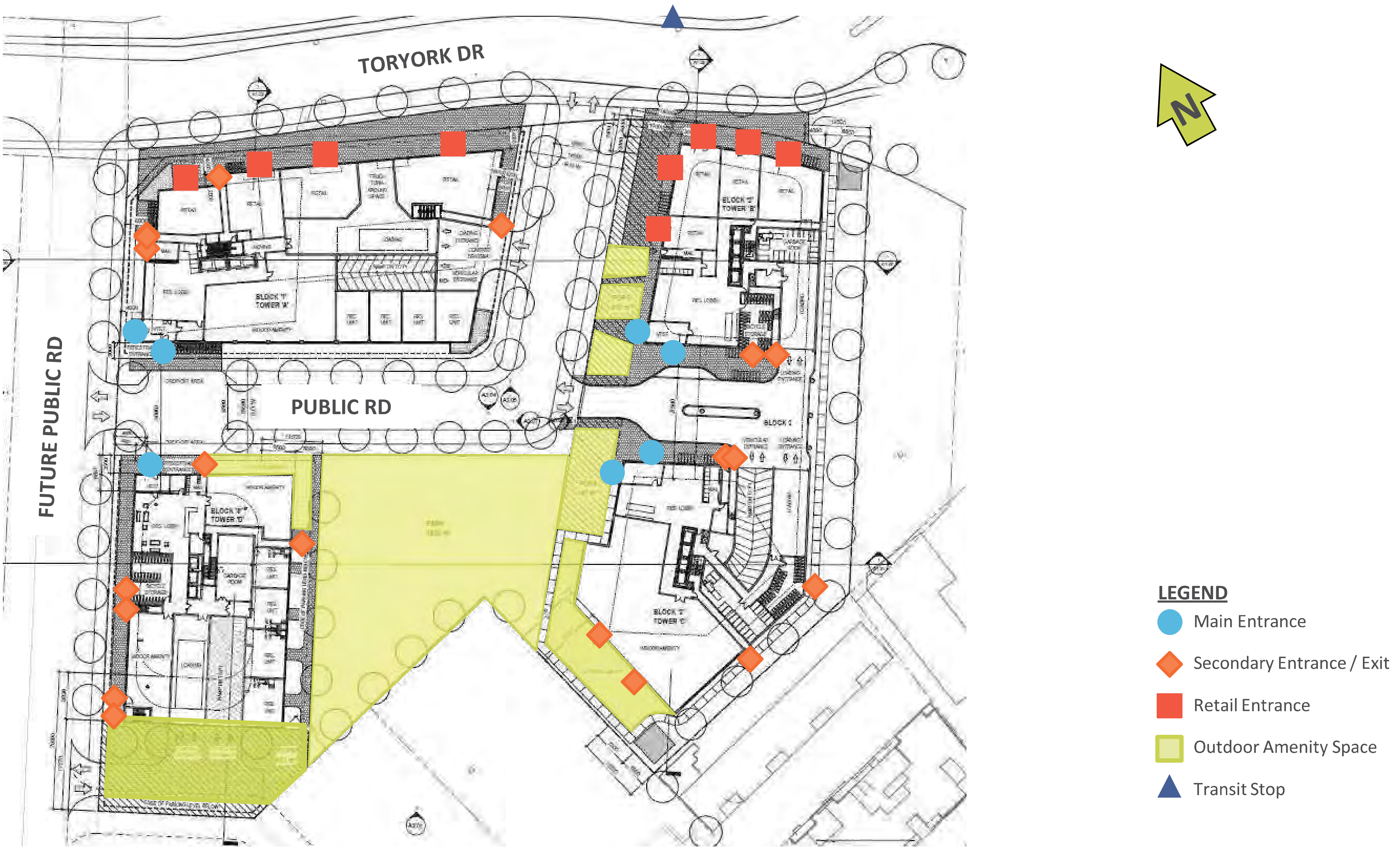


Figure 4a: Areas of interest – Grade level

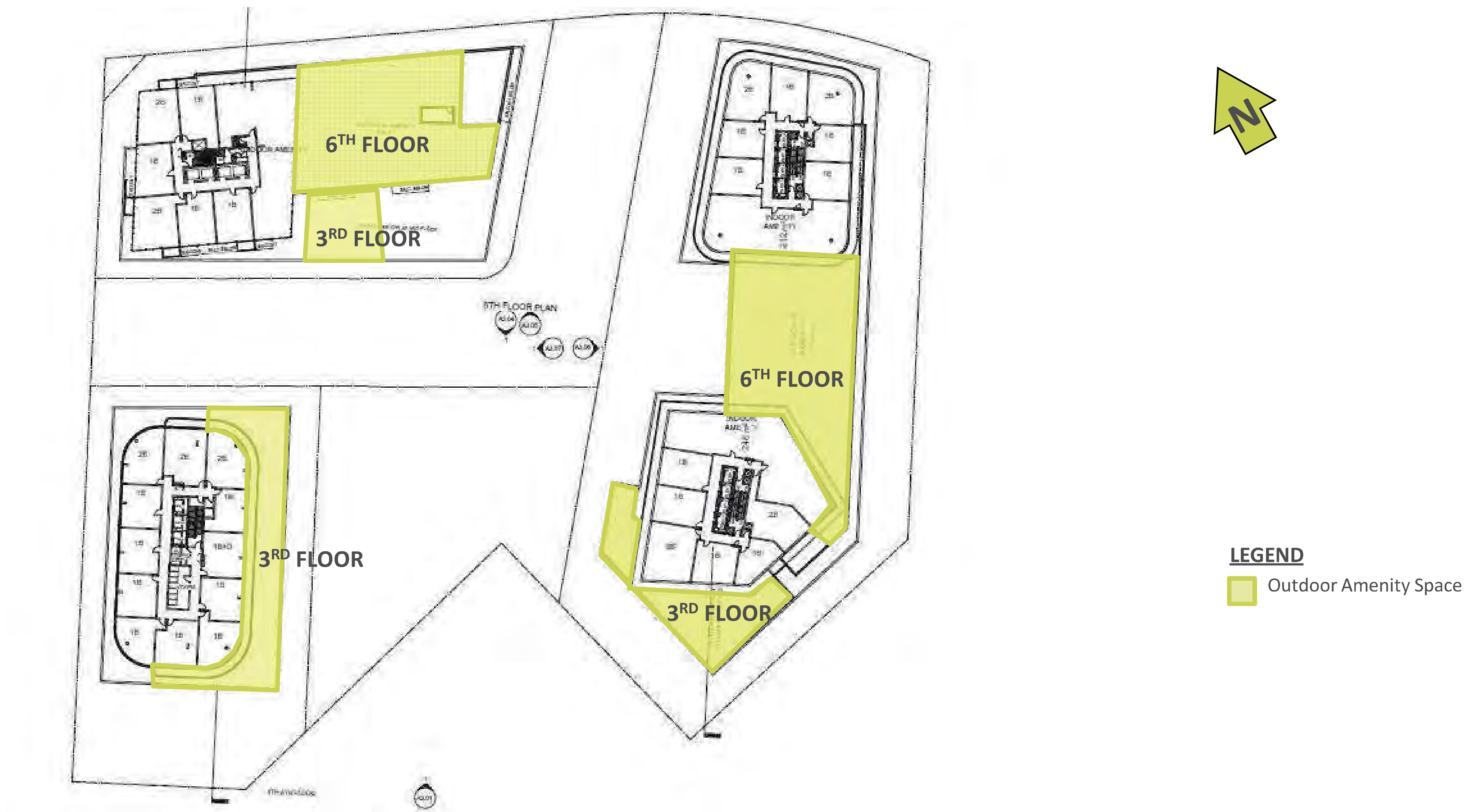


Figure 4b: Areas of interest – Above-grade level

2.0 APPROACH

A screening-level assessment was conducted using computational fluid dynamics (CFD). As with any simulation, there are some limitations with this modeling technique, specifically in the ability to simulate the turbulence, or gustiness, of the wind. Nonetheless, CFD analysis remains a useful tool to identify potential wind issues. This CFD-based wind speed assessment employs a comparable analysis methodology to that used in wind tunnel testing. The results of CFD modeling are also an excellent means of readily identifying relative changes in wind conditions associated with different site configurations or with alternative built forms.

2.1 Methodology

Wind comfort conditions for areas of interest were predicted on and around the development site to identify potentially problematic windy areas. A 3D model of the proposed development, as well as floor plans and elevations, were provided by Giannone Petricone Associates Inc. Architects on January 31, 2023. A view of the 3D model used in the computer wind comfort analysis is shown in **Figure 5**. This model included surrounding buildings within 350 m from the study site outer bounds. The simulations were performed using UrbaWind 3.3 by Meteodyn Inc.

The 3D space throughout the modeled area is filled with a three-dimensional grid. The CFD virtual wind tunnel calculates wind speed at each of the 3D grid points. The upstream “roughness” for each test direction is adjusted to reflect the upwind conditions and wind characteristics encountered around the actual site. Wind flows for 16 compass directions are simulated. Although wind speeds are calculated throughout the entire modeled area, wind comfort conditions are only plotted for a smaller area surrounding the proposed development.

SLR assessed two configurations for comparison purposes. The descriptions are as follows:

- **Existing Configuration:** Existing site with existing and ZBA-approved surroundings.
- **Proposed Configuration:** Proposed development with existing and ZBA-approved surroundings.

A view of two configurations are shown in **Figures 5a** and **5b**.

Wind flows were predicted for both the existing site, as well as with the proposed development for comparison purposes. The CFD-predicted wind speeds for all test directions and grid points were then combined with historical wind climate data for the region to predict the occurrence of wind speeds in the pedestrian realm, and to compare against wind criteria for comfort and safety; these results are shown in the various wind flow images. The analysis of wind conditions is undertaken for four seasons: Winter (December – February), Spring (March – May), Summer (June – August), and Autumn (September – November). However, only the seasonal extremes of summer and winter are discussed within the report. The results of the analysis for spring and autumn can be found in **Appendix A**.

Results are presented through discussion of the wind conditions along major streets and the areas of interest. The comfort criteria are based on predictions of localized wind forces combined with frequency of occurrence. Climate issues that influence a person’s overall “thermal” comfort, (e.g., temperature, humidity, wind chill, exposure to sun or shade, etc.) are not considered in the comfort rating.

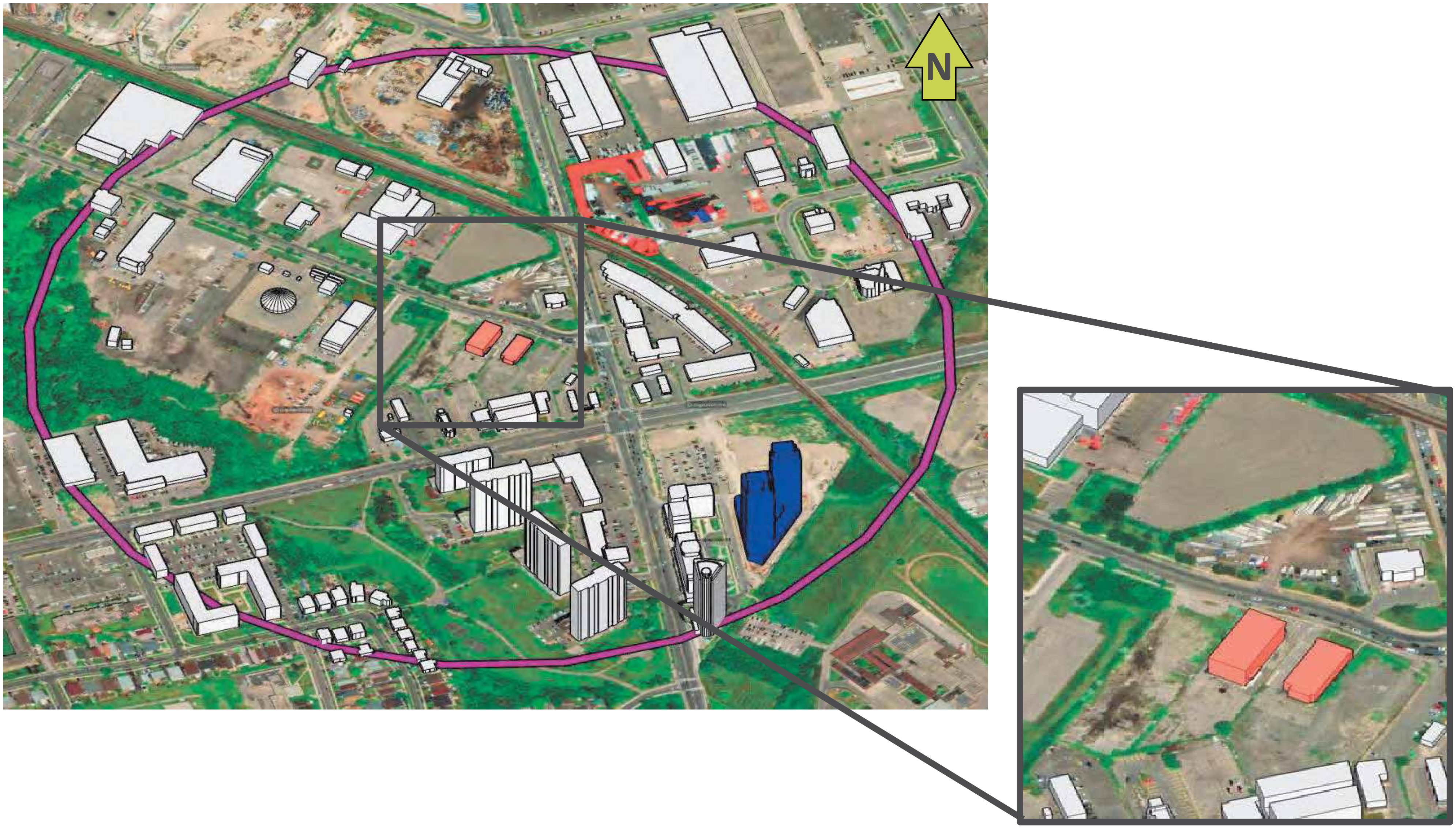


Figure 5a: Massing Model – Existing Configuration

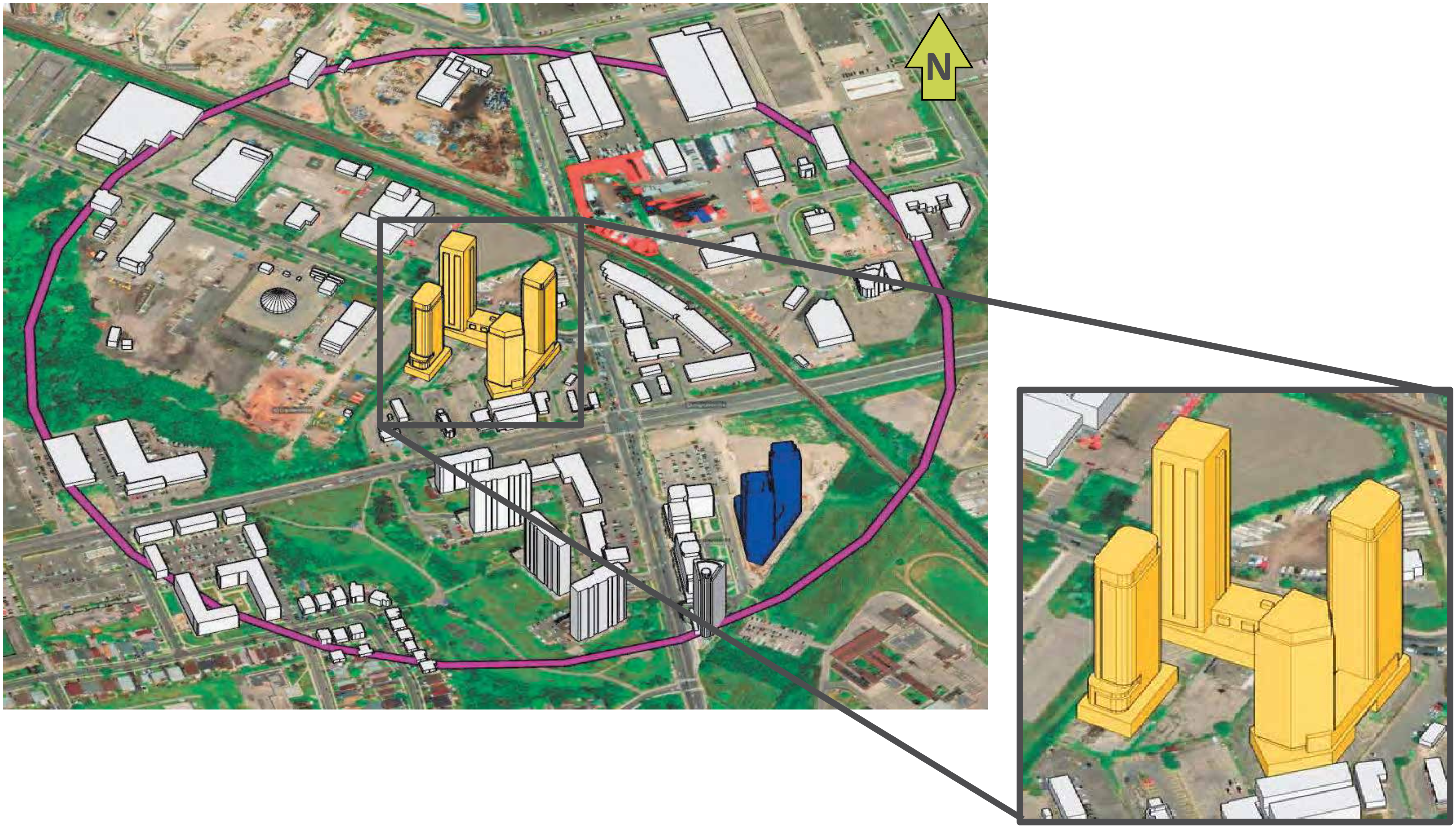


Figure 5b: Massing Model – Proposed Configuration

WIND CLIMATE

Wind data recorded at the Toronto Pearson International Airport for the period of 1991 to 2020 were obtained and analysed to create a wind climate model for the region. Annual and seasonal wind distribution diagrams ("wind roses") are shown in **Figure 6**. These diagrams illustrate the percentage of time wind blows from the 16 main compass directions. Of main interest are the longest peaks that identify the most frequently occurring wind directions. The annual wind rose indicates that wind approaching from the northwest quadrant are most prevalent. The seasonal wind roses readily show how the prevalent winds shift throughout the year.

The directions from which stronger winds (e.g., > 30 km/h) approach are also of interest as they have the highest potential of creating problematic wind conditions, depending upon site exposure and the building configurations. The wind roses in **Figure 6** also identify the directional frequency of these stronger winds, as indicated in the figure's legend colour key. On an annual basis, strong winds occur from the west-southwest through northwest to north directions. All wind speeds and directions were included in the wind climate model.

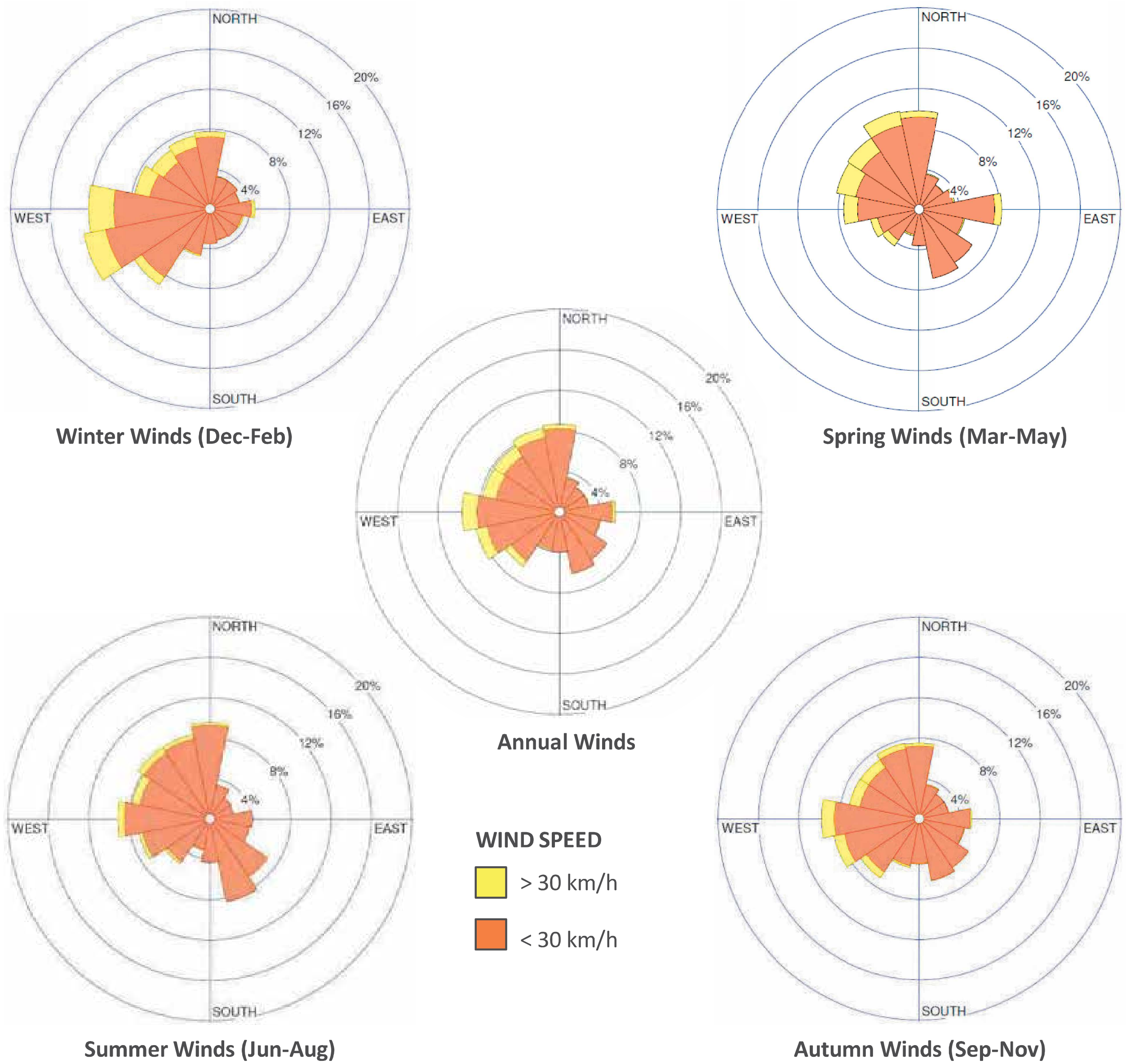


Figure 6: Wind Roses for Toronto Pearson International Airport (1991-2020)

3.0 PEDESTRIAN WIND CRITERIA

Wind comfort conditions are discussed in terms of being acceptable for certain pedestrian activities and are based on predicted wind force and the expected frequency of occurrence. Wind chill, clothing, humidity and exposure to direct sun, for example, all affect a person's thermal comfort; however, these influences are not considered in the wind comfort criteria.

The comfort criteria, which are based on certain predicted hourly GEM wind speeds being exceeded 20% of the time, are summarized in **Table 1**. By allowing for a 20% exceedance, it assumes wind speeds will be comfortable for the corresponding activity at least four out of five days. The comfort criteria consider only daytime hours, between 6:00am and 11:00pm. GEM is defined as the maximum mean wind speed or the gust wind speed divided by 1.85.

The criterion for wind safety in the table is based on hourly gust wind speeds that are exceeded nine hours per year (approximately 0.1% of the time). When the criterion is exceeded, wind mitigation measures are advised. The wind safety criterion is shown in **Table 2**.

These criteria are based on the *Pedestrian Level Wind Study Terms of Reference Guide* of the City of Toronto, which came into effect in June of 2022.

Table 1: Wind Comfort Criteria

Comfort Category	Comfort Ranges for GEM Wind Speed Exceeded 20% of the Time	Description of Wind Comfort
Sitting	0 to 10 km/h	Light breezes desired for outdoor seating areas where one can read a paper without having it blown away.
Standing	0 to 15 km/h	Gentle breezes suitable for passive pedestrian activities where a breeze may be tolerated.
Walking	0 to 20 km/h	Relatively high speeds that can be tolerated during intentional walking, running and other active movements.
Uncomfortable	> 20 km/h	Strong winds, considered a nuisance for most activities.

Table 2: Wind Safety Criterion

Activity	Safety Criterion Gust Wind Speed Exceeded 0.1% of the Time	Description of Wind Effects
Any	> 90 km/h	Excessive gust speeds that can adversely affect safety and a pedestrian's balance and footing. Wind mitigation is typically required.

4.0 RESULTS

Figures 7a through **10b** present graphical images of the wind comfort conditions for the summer and winter months around the proposed development. These represent the seasonal extremes of best and worst case. **Appendix A** presents the wind comfort conditions for spring and autumn. The "comfort zones" shown are based on an integration of wind speed and frequency for all 16 wind directions tested with the seasonal wind climate model. The presence of mature trees can lead to wind comfort levels that are marginally more comfortable than shown, during seasons when foliage is present. **Appendix B** presents the wind safety conditions on an annual basis.

There are generally accepted wind comfort levels that are desired for various pedestrian uses. However, in some regions these may be difficult to achieve in the winter due to the overall climate. For sidewalks, walkways loading areas and laneways, wind comfort suitable for walking is desirable year-round. For main entrances, transit stops, and outdoor amenity spaces intended for pets, wind conditions conducive to standing are preferred throughout the year. For areas such as park benches, seating for restaurants and cafes, and outdoor amenity spaces, including play areas for children, wind conditions suitable for sitting are desired throughout the year, as calmer winds are expected for the comfort of patrons and the public.

4.1 Building Entrances & Walkways

Existing wind conditions on-site are expected to be comfortable for sitting or standing year-round (**Figures 7a** and **8a**).

In the Proposed Configuration, wind conditions on-site are predicted to be predominantly comfortable for standing during the summer (**Figure 7b**). During the winter, wind conditions are predicted to be suitable for walking or better (**Figure 8b**).

Wind conditions at the main entrances and all other retail and/or secondary entrances are expected to be suitable for sitting or standing during the summer, which is desirable for the intended use (**Figure 9a**). Similar wind conditions are predicted for most of the main entrances during the winter, with the exception of Towers A and D, where wind conditions are predicted to be conducive to walking at the entrances (**Figure 9b**). To improve wind conditions at these entrances, we recommend locating the doors at least 5m away from building corners, as corners tend to be windier due to local acceleration of wind flows. In addition, wind control features, such as vertical wind screens, etc., should be considered to the north and west of the entrances. We also suggest including large canopies wrapping around the southwest corner of Tower A and the northwest corner of Tower B.

4.2 Outdoor Amenity Spaces

Wind conditions in the proposed park on-site are predicted to be comfortable for sitting or standing in the summer (**Figure 9a**). During the winter months, similar wind conditions are expected, with the exception of a small area near the east edge of the park, where wind conditions conducive to walking are predicted (**Figure 9b**). In the outdoor amenity spaces and POPS to the west of Tower B, wind conditions are expected to be comfortable for standing (**Figure 9a**). During the winter, wind conditions are predicted to be suitable for walking or better (**Figure 9b**).

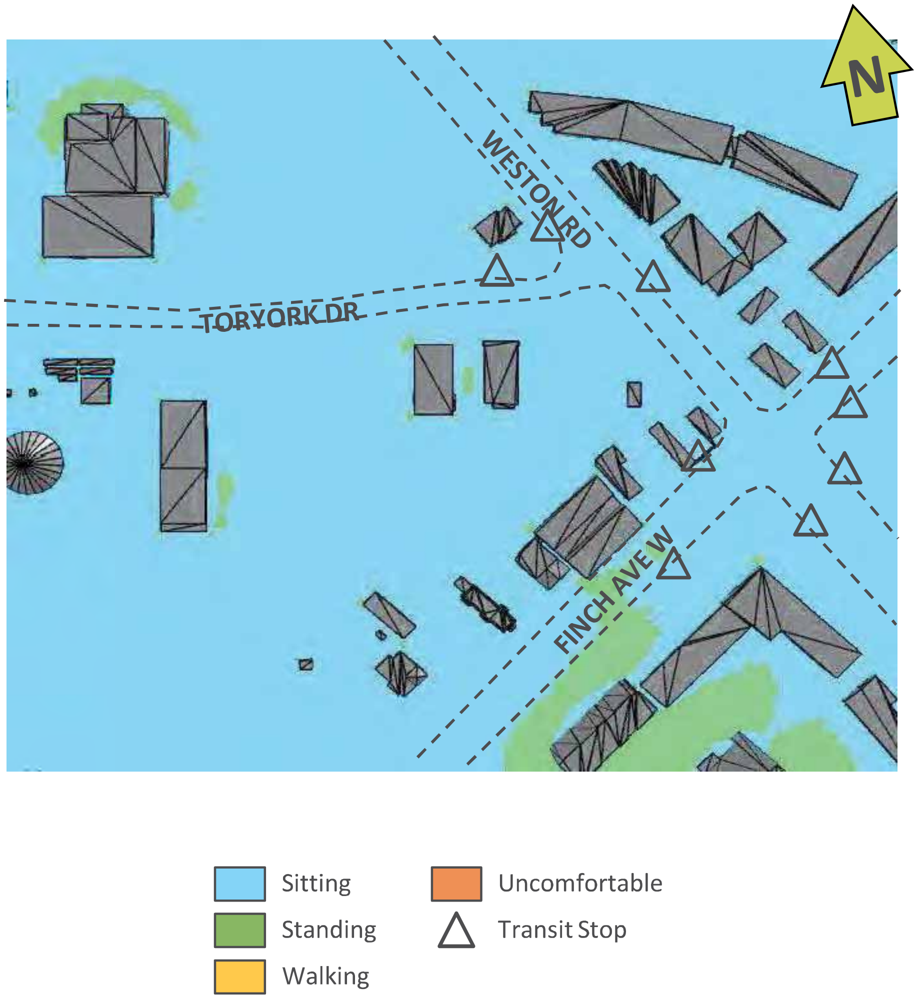


Figure 7a: Existing Configuration – Pedestrian Wind Comfort Summer – On-site & Surrounding Areas

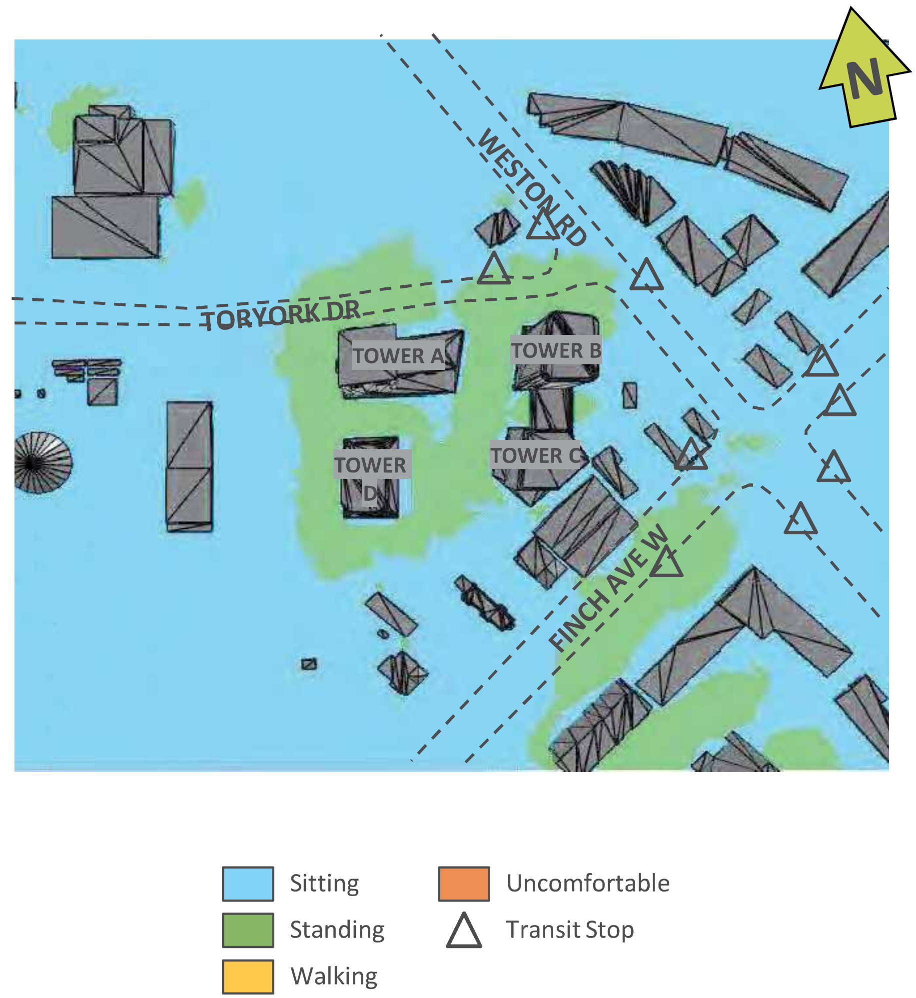


Figure 7b: Proposed Configuration – Pedestrian Wind Comfort Summer – On-site & Surrounding Areas

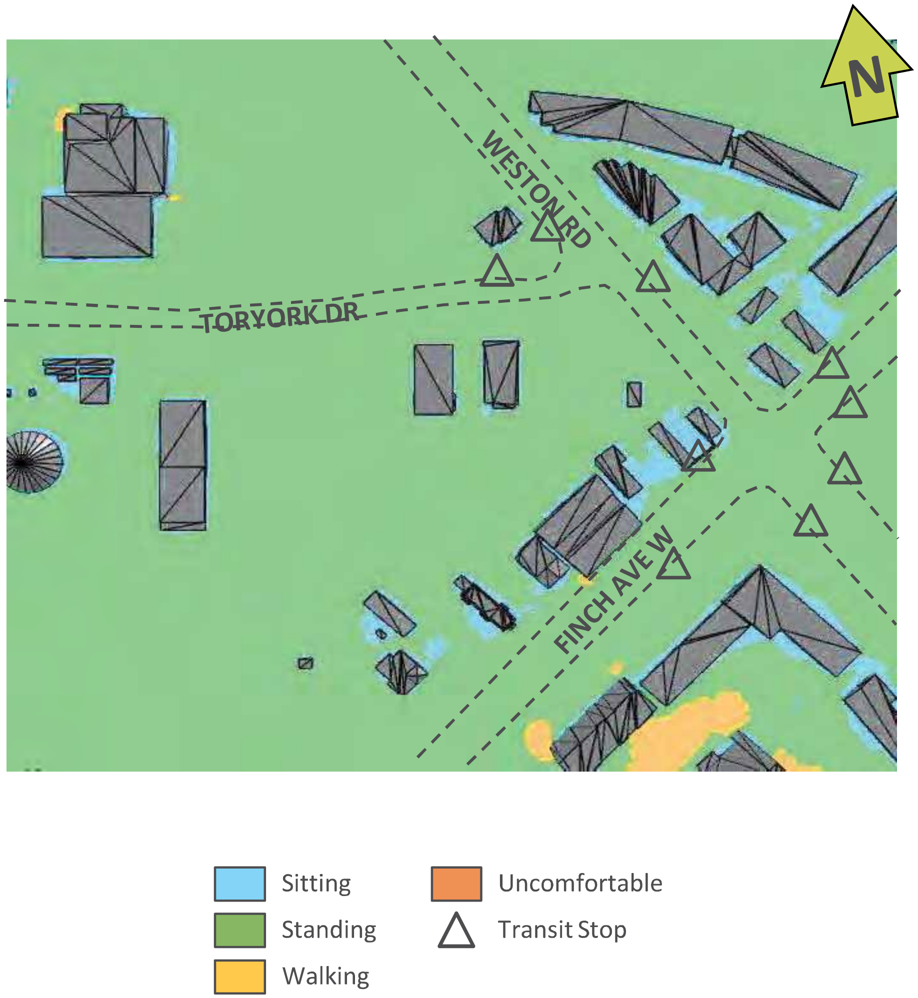


Figure 8a: **Existing Configuration – Pedestrian Wind Comfort Winter – On-site & Surrounding Areas**

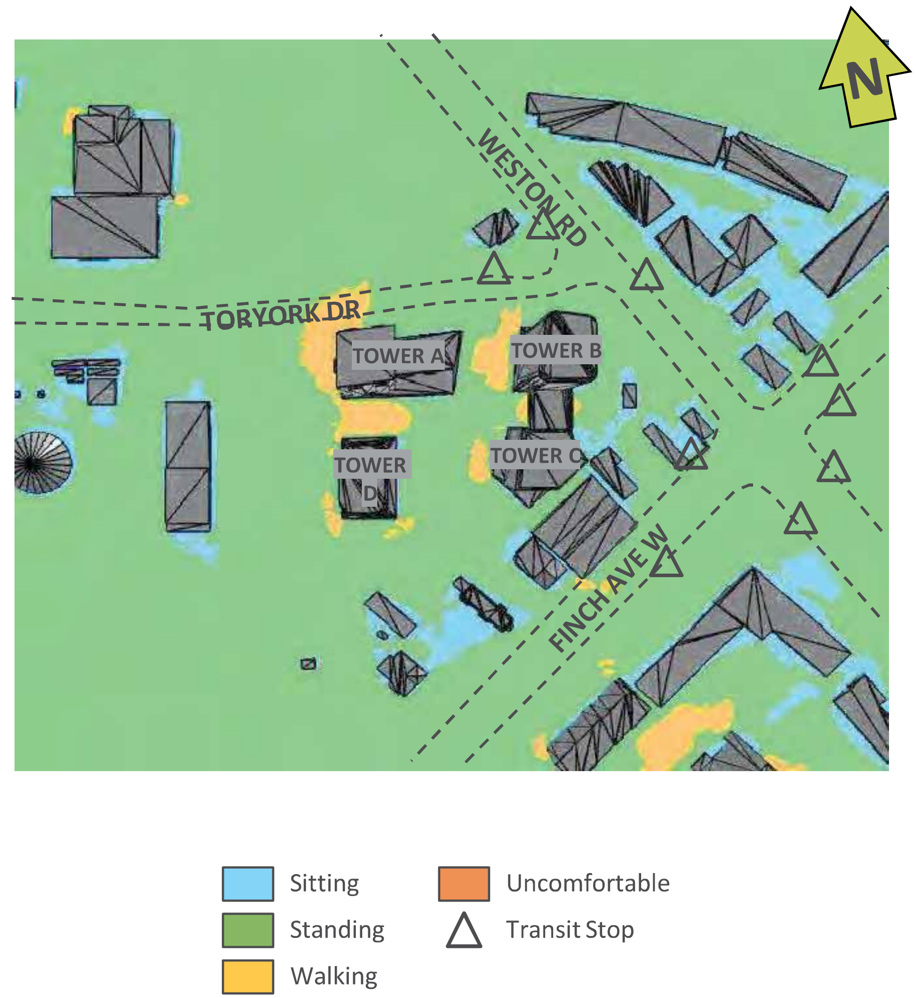
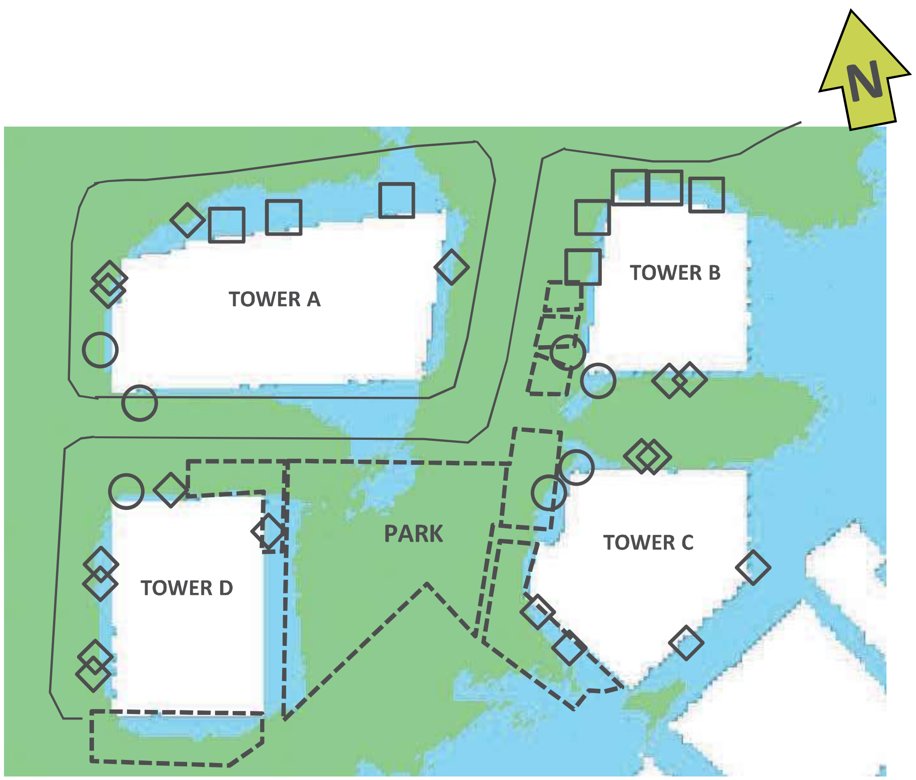


Figure 8b: **Proposed Configuration – Pedestrian Wind Comfort Winter – On-site & Surrounding Areas**



Sitting | Uncomfortable | Main Entrance
Standing | Transit Stop | Secondary Entrance/Exit
Walking | Amenity Space | Commercial Entrance

Figure 9a: Proposed Configuration – Pedestrian Wind Comfort Summer – Building Entrances & Walkways

Sitting | Uncomfortable | Main Entrance
Standing | Transit Stop | Secondary Entrance/Exit
Walking | Amenity Space | Commercial Entrance

Figure 9b: Proposed Configuration – Pedestrian Wind Comfort Winter – Building Entrances & Walkways

In the outdoor amenity space and POPS to the west of Tower C, wind conditions are predicted to be comfortable for sitting or standing in the summer and walking or better in the winter months (**Figures 9a** and **9b**).

Wind conditions in the outdoor amenity spaces to the north and south of Tower D are predicted to be comfortable for sitting or standing in the summer. During the winter, these areas are expected to be comfortable for walking or better.

If calmer wind conditions are desired at grade level outdoor amenity spaces in the winter months, we suggest including vertical elements (i.e., fences, etc.) along the north and west edges of these spaces. Such features should be a minimum 2.2 m tall to be effective.

Outdoor terraces are located on the 3rd and 6th floor of Tower A. Wind conditions on the 3rd floor terrace are generally predicted to be comfortable for sitting or standing during the summer, which is considered suitable for the intended use (**Figure 10a**). During the winter, wind conditions are predicted to be comfortable for walking or better, with uncomfortable wind conditions along the south edge (**Figure 10b**).

Around Tower C, wind conditions on the 3rd floor terrace are expected to be comfortable for standing or walking in the summer (**Figure 10a**). During the winter, wind conditions are predicted to be comfortable for walking or better, with uncomfortable wind conditions noted in some perimeter areas (**Figure 10b**). On the 6th floor terrace, wind conditions are generally predicted to be comfortable for walking throughout the year. However, uncomfortable wind conditions are expected along the west edge of the space during the summer (**Figure 10a**) and on the north half of the terrace during the winter months (**Figure 10b**).

On the 3rd floor terrace of Tower D, wind conditions are generally predicted to be comfortable for walking or better throughout the year. However, uncomfortable wind conditions are expected along the north and south edges of the space during the winter (**Figure 10b**). On the 7th floor terrace, wind conditions are predicted to be comfortable for walking in the summer. During the winter, uncomfortable wind conditions are predicted for this terrace (**Figures 10b**).

We recommend the design team consider a terrace plan that would minimize use or restrict access to the windiest areas. The most wind sensitive uses (i.e., passive activities) would ideally be planned for the areas with the most comfortable wind conditions (blue and green regions in **Figures 10a** and **10b**). Once programming for the terraces is confirmed, wind mitigation concepts, such as perimeter screens, wind screens, trellis features, etc., could then be considered where necessary.

4.3 Surrounding Sidewalks

In the Existing Configuration, wind conditions along the sidewalks of Toryork Drive, Weston Road and Finch Avenue West are expected to be comfortable for walking or better year-round. Wind conditions at all transit stops along Toryok Drive, Weston Road and Finch Avenue West are expected to be comfortable for sitting or standing year-round (**Figures 7a and 8a**).

With the proposed development in place, wind conditions are also predicted to remain suitable for walking or better throughout the year on the surrounding sidewalks (**Figure 8b**). Wind conditions at the transit stops are predicted to remain similar to the existing wind conditions.

These wind conditions are satisfactory for the anticipated use.

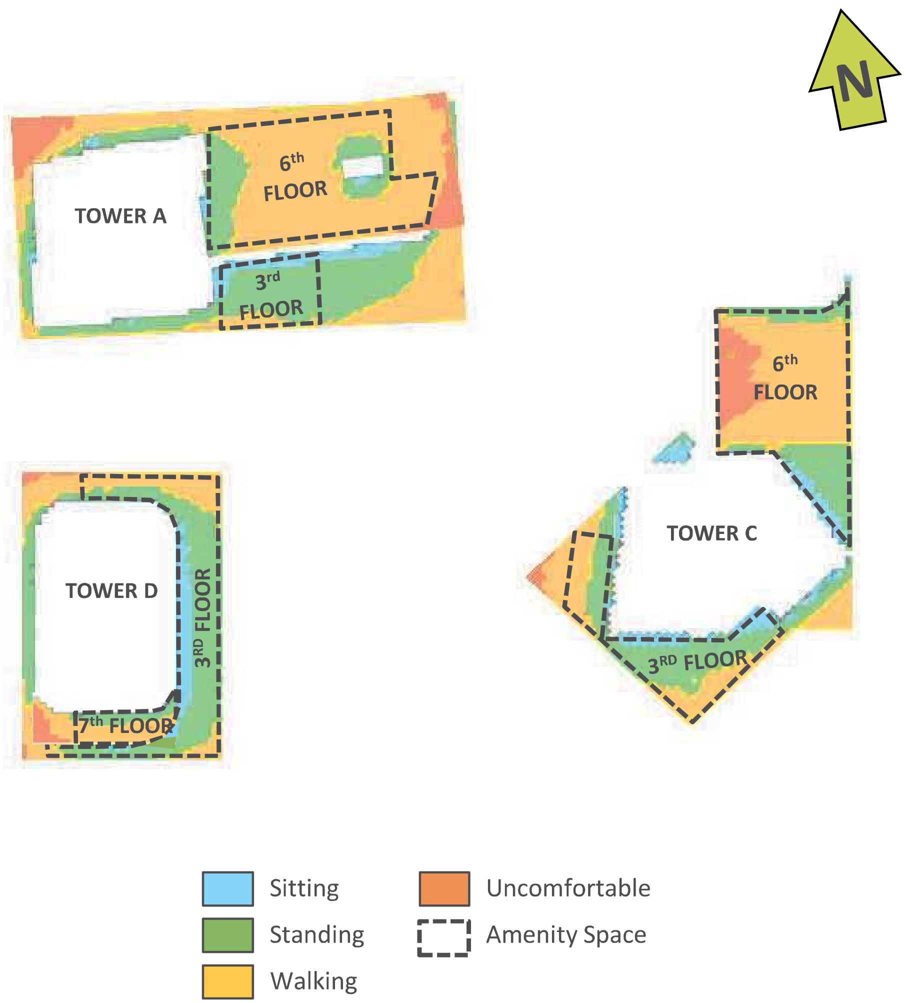


Figure 10a: Proposed Configuration – Pedestrian Wind Comfort Summer – Amenity Terraces

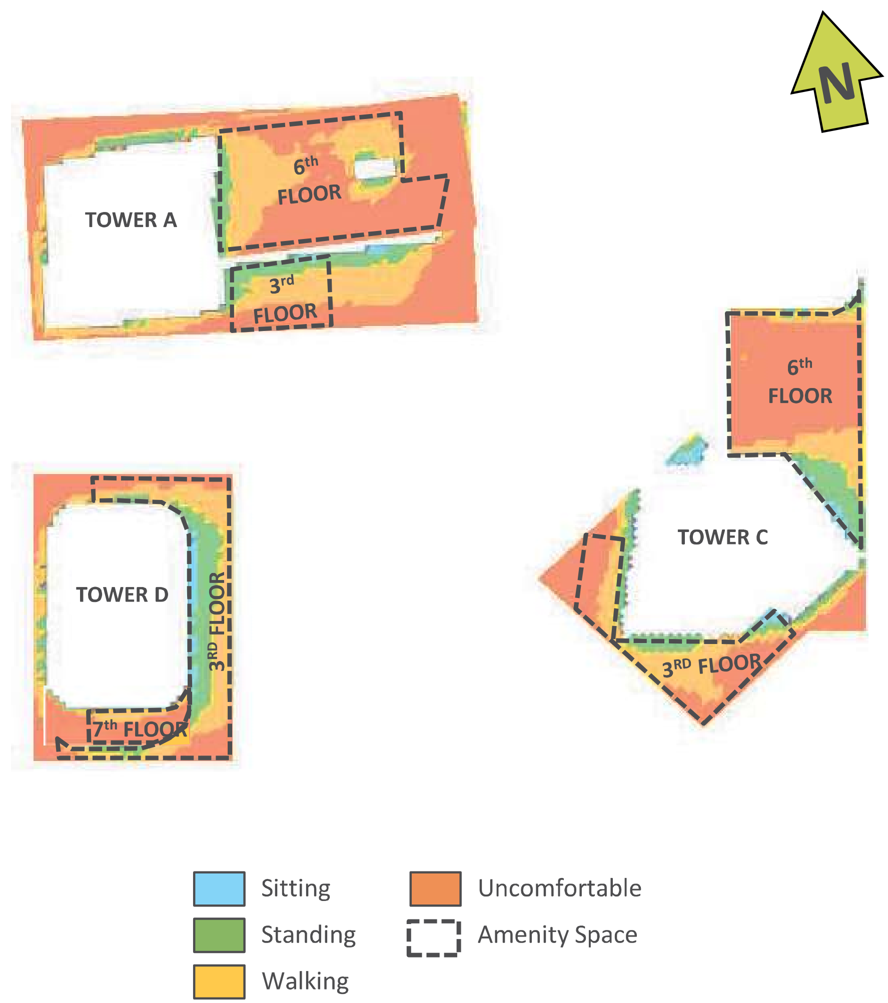


Figure 10b: Proposed Configuration – Pedestrian Wind Comfort Winter – Amenity Terraces

4.4 Wind Safety

In the Existing Configuration the wind safety criterion is predicted to be met in most areas at grade-level on an annual basis. The exceptions are a few localized sidewalk areas and building corners on the east side of Finch Avenue West (**Appendix B**).

In the Proposed Configuration, the wind safety criterion is expected to be met in almost all on-site areas except the following:

- At the northwest and southwest corners of Tower A.
- On the driveway between the entrances to Towers B and C.
- At the southwest corner of Tower D.
- On the proposed amenity terraces.

Off-site, the wind safety conditions are generally similar to the Existing Configuration (**Appendix B**).

Wind control measures described in **Sections 4.1** and **4.2** will be beneficial to eliminate the safety concern on-site. SLR will work with the design team to refine wind control measures prior to the next submission.

5.0 CONCLUSIONS & RECOMMENDATIONS

The pedestrian wind conditions predicted for the proposed development at 15-23 Toryork Drive in Toronto have been assessed through computational fluid dynamics modeling techniques. Based on the results of our assessment, the following conclusions have been reached:

- The wind safety criterion is met in most areas on an annual basis both the Existing and Proposed Configurations. The exceptions include a few localized areas on-site and off-site, as well as on the proposed terraces. Wind control measures are recommended.
- Wind conditions at most of the entrances and exits are predicted to be predominantly comfortable for sitting or standing during the summer and winter. In a few areas, winter winds achieve windier than desired wind conditions. Wind control measures are recommended for these areas.
- Wind conditions in the on-site park and outdoor amenity areas are predicted to be suitable for the intended use in summer months with windier conditions anticipated in the winter. As winter use is anticipated, the parkland landscape plan should incorporate wind control features.
- Overall, the wind conditions on the outdoor amenity terraces of the proposed development are windier than desired. Wind control features are recommended and should be developed as the design progresses.
- On the sidewalks surrounding the proposed development, including the transit stops, wind conditions are predicted to be suitable for the intended use.

6.0 LIMITATIONS OF LIABILITY

This report has been prepared and the work referred to in this report has been undertaken by SLR Consulting (Canada) Ltd. (SLR) for Berkshire Axis Development Corp. , hereafter referred to as the “Client”. It is intended for the sole and exclusive use of the Client. The report has been prepared in accordance with the Scope of Work and agreement between SLR and the Client. Other than by the Client and by the City of Toronto in their role as land use planning approval authorities, copying or distribution of this report or use of or reliance on the information contained herein, in whole or in part, is not permitted unless payment for the work has been made in full and express written permission has been obtained from SLR.

This report has been prepared in a manner generally accepted by professional consulting principles and practices for the same locality and under similar conditions. No other representations or warranties, expressed or implied, are made.

Opinions and recommendations contained in this report are based on conditions that existed at the time the services were performed and are intended only for the client, purposes, locations, time frames and project parameters as outlined in the Scope or Work and agreement between SLR and the Client. The data reported, findings, observations and conclusions expressed are limited by the Scope of Work. SLR is not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. SLR does not warranty the accuracy of information provided by third party sources.

7.0 REFERENCES

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Appendix A

Pedestrian Wind Comfort Analysis

Spring (March - May) and Autumn (September - November)

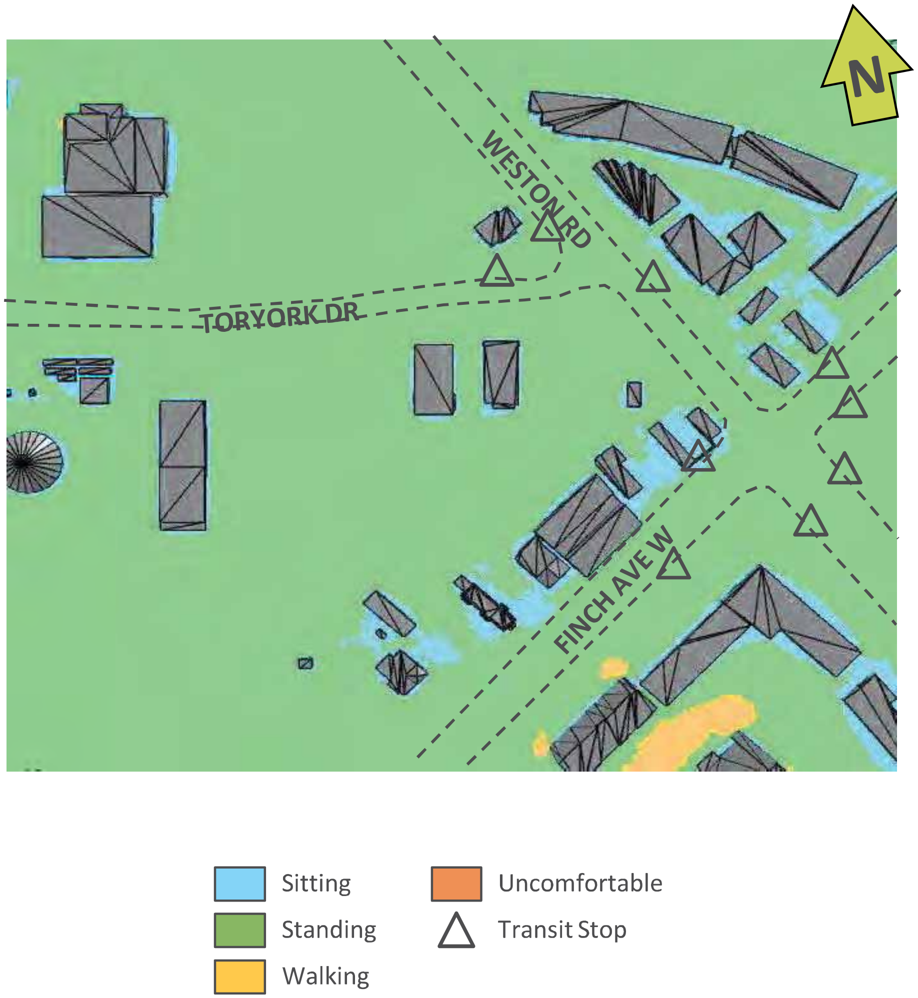


Figure A1a: Existing Configuration – Pedestrian Wind Comfort Spring – On-site & Surrounding Areas

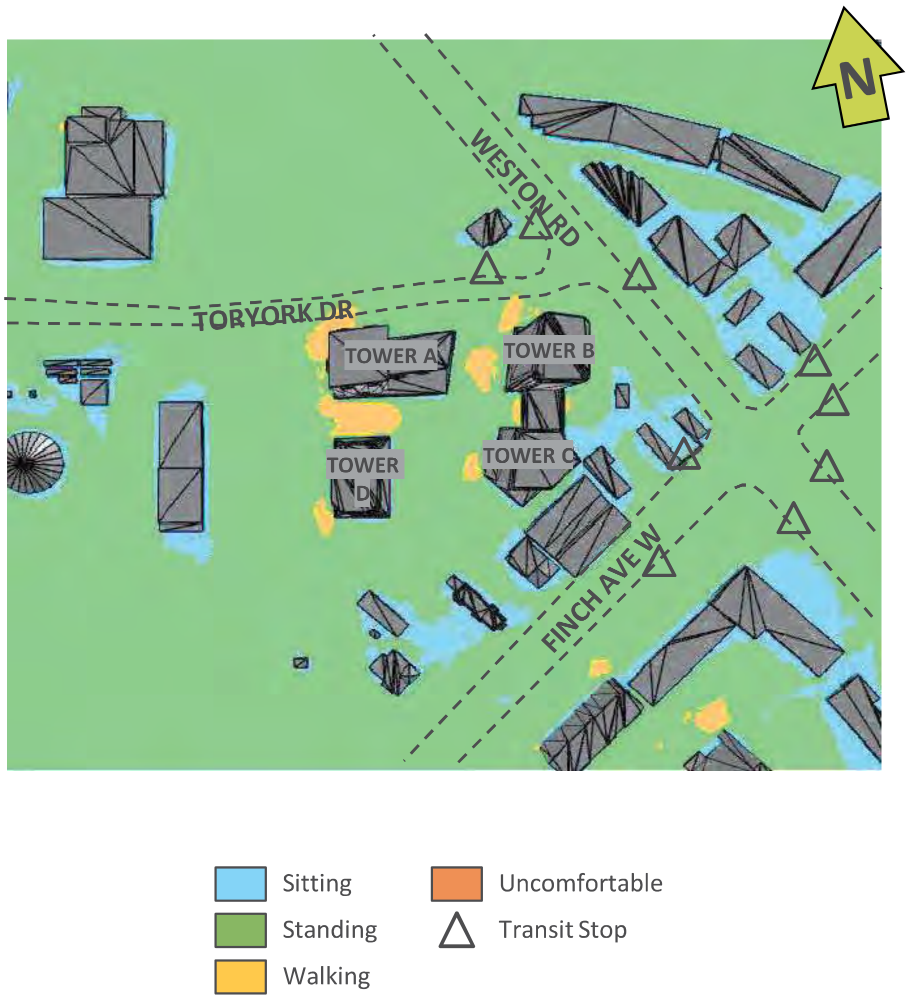
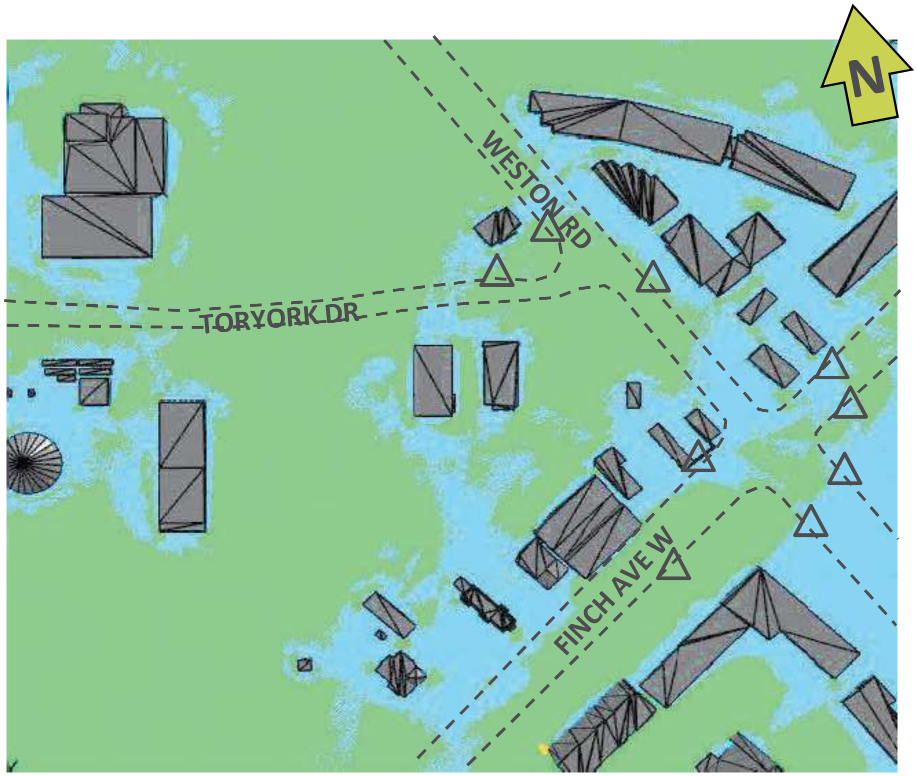


Figure A1b: Proposed Configuration – Pedestrian Wind Comfort Spring – On-site & Surrounding Areas

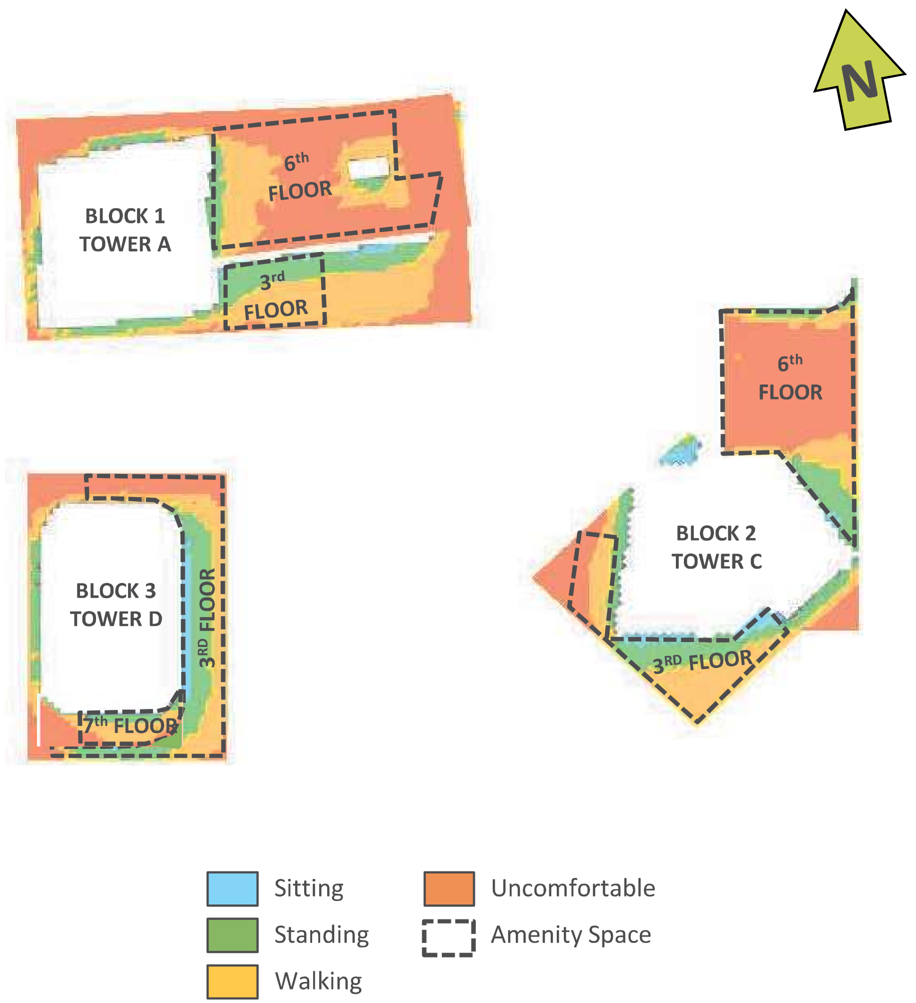


Sitting
Standing
Walking
Uncomfortable
Transit Stop

Figure A2a: Existing Configuration – Pedestrian Wind Comfort Autumn – On-site & Surrounding Areas

Sitting
Standing
Walking
Uncomfortable
Transit Stop

Figure A2b: Proposed Configuration – Pedestrian Wind Comfort Autumn – On-site & Surrounding Areas



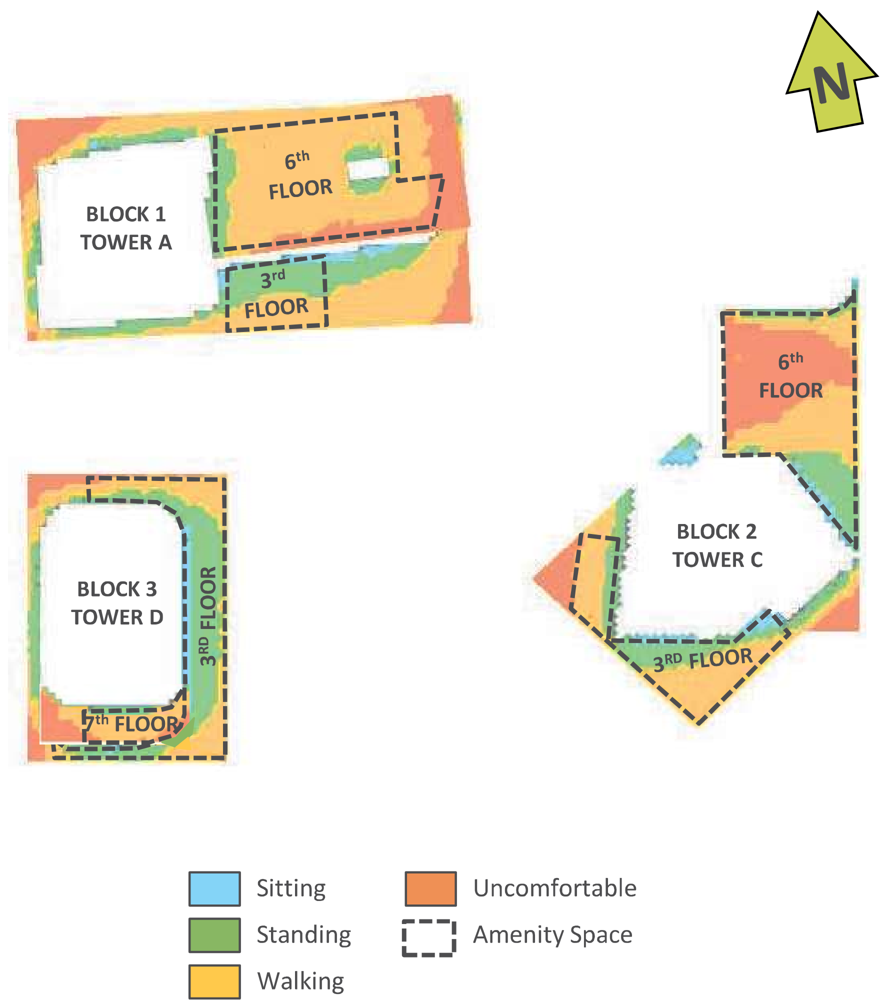


Figure A3a: Proposed Configuration – Pedestrian Wind Comfort Summer – Amenity Terraces

Figure A3b: Proposed Configuration – Pedestrian Wind Comfort Winter – Amenity Terraces

Appendix B

Pedestrian Wind Safety Analysis

Annual

Figure B1a: Existing Configuration – Wind Safety Annual – On-site & Surrounding Areas

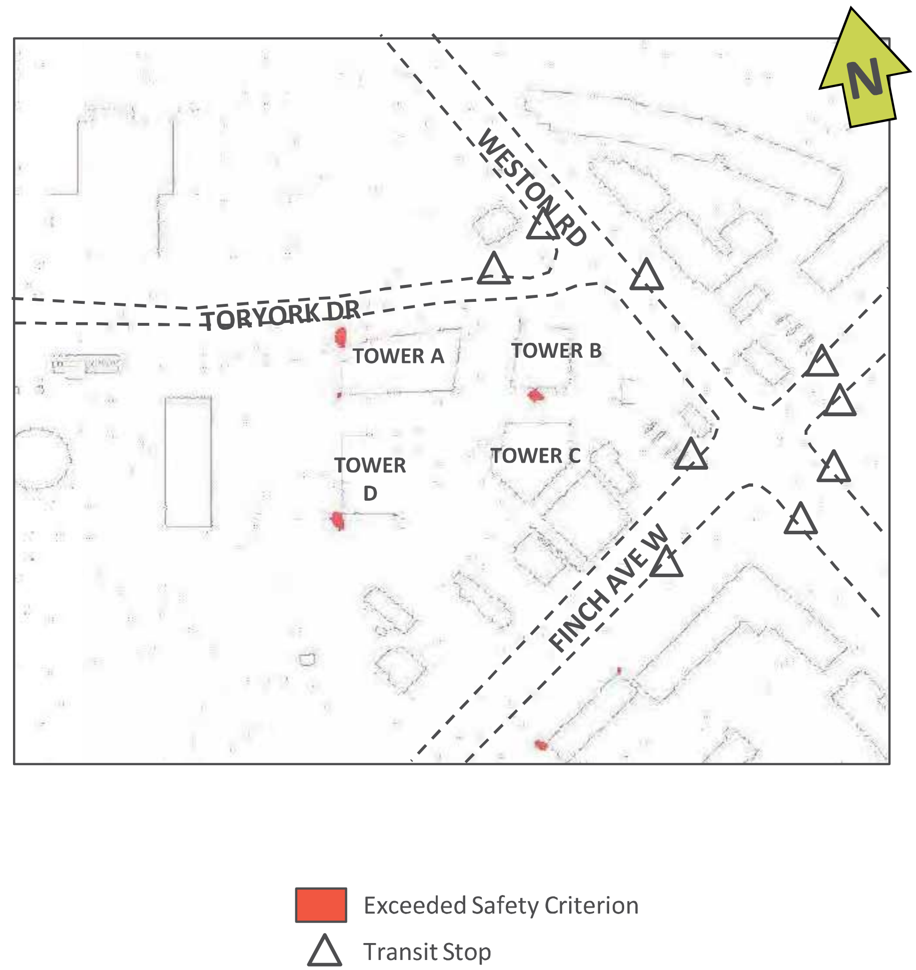


Figure B1b: Proposed Configuration – Wind Safety Annual – On-site & Surrounding Areas

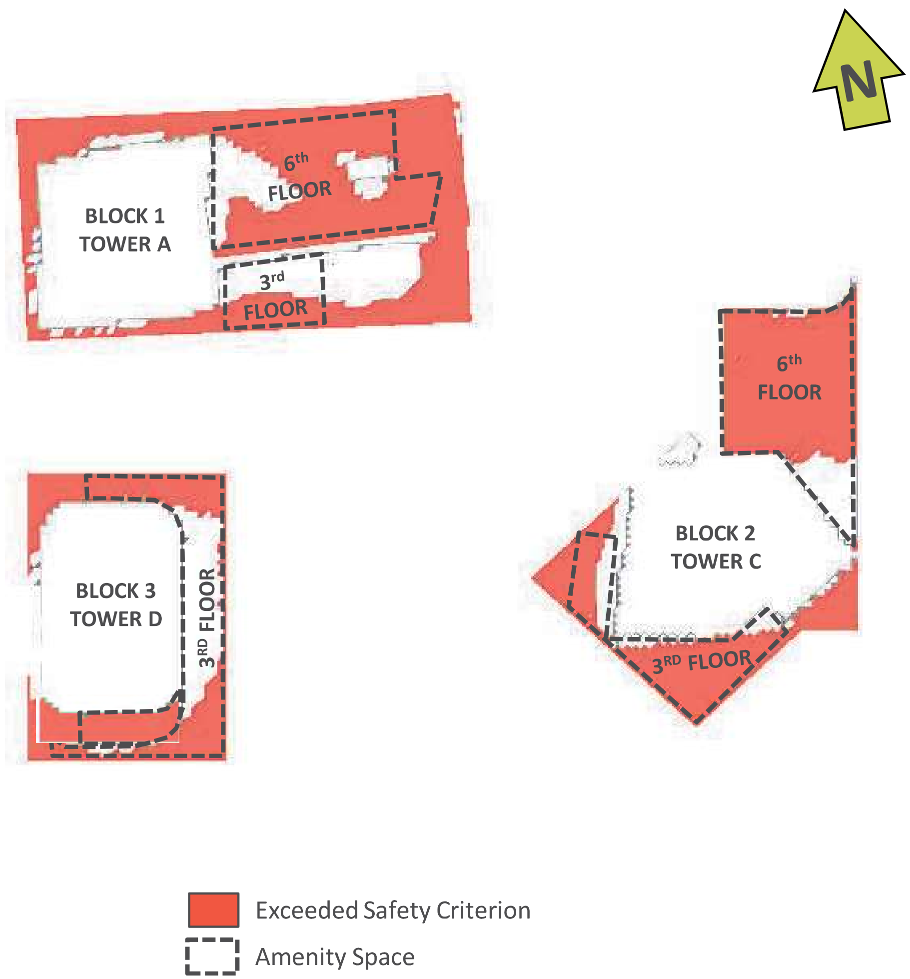


Figure A3a: Proposed Configuration – Pedestrian Wind Comfort Summer – Amenity Terraces