The Boundary Layer Wind Tunnel Laboratory

Pedestrian Level Wind Study

3033 Dundas Street W
Mississauga, Ontario

BLWT-D082-IR1-2025
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Submitted To:

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MAIN FINDINGS

This report describes the pedestrian-level wind study performed at the Boundary Layer Wind Tunnel Laboratory for the proposed development at 3033 Dundas Street W, Mississauga ON. The site is described in more detail below. A detailed discussion of the results is contained in Section 3.5. A description of the criteria used can be found in Section 3.4.

Tests were carried out for two configurations described as follows, and as pictured in Figure 5:

> **Existing Site** - The existing is bare. An aerial view of the existing site can be seen in Figure 2.
>
> **Proposed Site** – The proposed development consists of a 12-storey multi-unit residential building. A perspective view of the building is shown in Figure 1.

Figure 9 indicates the 88 locations at which wind speeds were measured for the Existing configuration. Figure 10 indicates the 93 locations at which wind speeds were measured for the Proposed configuration. Locations 1-3 are on the Level 10 outdoor amenity space, Location 4 is on the Level 7 outdoor amenity space and Location 5 is on the Level 11 outdoor amenity space; these were only tested in the Proposed configuration.

The evaluation for safety is summarized schematically in Figure 11. Comfort results for each of summer and winter seasons are summarized schematically in Figures 12 and 13, respectively. These summarize the suitability of each measurement location with respect to pedestrian-level safety or comfort. The comfort and safety categories used correspond to those summarized in section 3.4.

Colour-coded diagrams further summarize the suitability of each measurement location with respect to pedestrian-level safety and pedestrian comfort for each tested configuration. Figure 14 presents these for safety considerations for the Existing configuration and Figure 15 for the Proposed configuration. For comfort considerations these are presented for the summer season in Figures 16 and 17 for the Existing and Proposed configurations, respectively. Figures 18 and 19 present comfort colour diagrams for the winter season for the Existing and Proposed configurations, respectively. The comfort and safety categories used in these figures correspond to those summarized in section 3.4, and consistent of those specified in the Mississauga Terms of Reference.

The introduction of a mid-rise building development in a suburban environment will invariably create local wind speed-ups for some wind directions. With that expectation, the focus is to identify and develop strategies to make wind conditions suitable for the intended usage for negatively affected areas.

Existing Site

The immediate site surroundings are comprised of a typical single storey retail environment, which includes large low-buildings with moderate sized open parking lots; this environment extends further toward the south. Beyond this there is typical suburban environment for directions northwesterly through to southwesterly directions (clockwise). Toward the west quadrant there is a substantial stretch of relatively open exposure. Aerial views of the Existing site are shown in Figure 2.

Given the suburban surroundings with expansive open exposure from the prominent westerly wind directions, it is not surprising that the measured wind speeds for the consistent with that for a typical suburban environment or marginally greater.

With respect to pedestrian safety, all tested locations meet the recommended criterion (see Figure 14) in the Existing configuration.

With respect to pedestrian comfort, in summer all measurement areas are rated for standing or sitting (see Figures 16). In winter, some nearby sidewalk areas are rated for walking while most are rating for standing (see Figure 18). In all cases, the measured wind speeds are suited for the intended usage for their respective areas.

Influence of Proposed Development

The proposed development was tested without any on-site or off-site landscaping and results can therefore be expected to be somewhat conservative. This may particularly be the case for the proposed parkette areas in the northwest part of the site property.

Given that the Existing Site and surroundings are comprised of many low buildings, the inclusion of a multi-level building will undoubtedly influence local winds at ground and over raised amenity areas. The proposed development is no exception, and its influence is most noticeable on and near the building site. The expectation then should not be to return winds to their pre-development state, but rather ensure that the winds in all areas are appropriate for the intended usage. For example, entry areas should be suited for standing or better, while walking classification would be suitable for typical sidewalk areas.

Typically, for a building of the height proposed, observed changes in wind speed at locations somewhat removed from the proposed development (say more than 50m away) are minimal, and not substantial enough to affect the comfort from a usage perspective. As such, those locations generally remain suited for the intended usage, or unchanged from the Existing configuration. Closer to the site, increases in the wind locally can often lead to a change of the comfort classification. However, this change in and of itself does not suggest that the associated wind speeds are unacceptable. For example, wind speeds at Locations 67, 68, and 69 along the sidewalk directly east of the development increase from standing to walking in the winter months, yet remain suitable for the intended sidewalk usage.

In summer, all ground level locations are rated for standing or better. Wind conditions during the summer season are therefore expected to be suited for the intended usage at all tested locations.

During the winter season, wind speeds are typically higher than those during the summer. At ground level locations throughout and near the development site some locations increase to a walking category. This is suitable for areas where pedestrians are passing through, such as sidewalk locations. At entry areas, a walking category would require mitigation to improve to standing. In this respect for comfort considerations, at ground level locations the following are noted for the winter season:

- Sidewalk locations along the northwest side of the intersection of Winston Churchill Boulevard with Dundas Street W increase to walking, yet remain suitable for sidewalk usage.
- Locations 10 and 12 at the corners of the northeast end of the building are rated for walking. These are not near entries and anticipated to be suited for the intended usage.
- Areas around the southwest end of the building are rated for walking during the winter season. Specifically, Location 6 on the north side of the building is near a drop-off and entrance to the medical center, and Location 17 is a medical entrance near the south corner. Both are rated for walking during the winter and will require mitigation to improve winds to the recommended comfort level of standing year-round for entryways.

With respect to the Level 9 outdoor amenity terrace, during the summer season winds are suited for standing activities along the north portion of the terrace, with the southwest area suited for walking. In the winter, the north side of the Level 9 outdoor amenity space is suitable for walking with the southwest area rated uncomfortable. Often, a summer sitting rating is recommended for terrace spaces where people are expected to linger. The winter rating will depend on the intended usage, but should be rated for walking or better unless access is to be restricted.

The small amenity terraces at Levels 7, 9, and 11 (Probe Locations 4, 5) on south side of the building are suitable for standing or better year-round.

Neighbouring properties and their entry areas are largely unaffected by the introduction of the proposed development.

With respect to safety, all tested locations meet the recommended criterion (see Figure 15) in the Existing configuration.

Mitigation Strategies

In areas that are windier than desired for the intended usage incorporating mitigation strategies will be beneficial.

Recessing the entrance doors on the northern and western sides of the building, near probe locations 6 and 17, would be beneficial. Alternatively, dense evergreens or locally placed windscreens will be required to improve the winds near these entryways. Planned landscaping will be beneficial around the entry areas (especially at Location 17 where the wind only marginally exceeds the standing category). Where possible, landscaping should incorporate evergreens to have greater winter benefit.

For the outdoor amenity terraces, testing was conducted modelling a 1m solid railing around the terrace perimeters. Increasing the perimeter railing height (to 2m or greater) would add some benefit at the main Level 9 terrace. In addition, localized windscreens or planters with coniferous plantings along the northern and western portions of the Level 9 amenity space should be considered. Examples of effective pedestrian level wind mitigation options can be seen in Figure 20. Depending on the level of comfort required, amenity features (vertical fireplaces, moderate height landscaping, windscreens, overhead trellises) may be required throughout the space.

1 THE WIND CLIMATE FOR MISSISSAUGA

1.1 Meteorological Data

The Integrated Surface Data (ISD) records are maintained by the National Climatic Data Center (NCDC), and provide a climatological database of approximately 20,000 stations around the world. The ISD contains many meteorological variables, typically recorded at intervals of 1 hour. An analysis of historical wind data from the Lester B. Pearson International Airport (ISD Station 716240) was performed to develop a statistical wind climate for Mississauga. The historical data consists of the time period 1982 – 2017.

Based on the analysis of hourly wind records probability distributions of wind speed and wind direction are developed for each of Safety and Comfort purposes. The models predict similar hourly mean wind speeds at 10m of about 14 m/s and 18.3m/s for return periods of 1 month and 1 year, respectively. These have been adjusted to be consistent with standard open country exposure and are shown in Figure 3.

1.2 Statistical Wind Climate Model

For the analysis of the wind tunnel data, the wind climate models are converted to a reference height of 500m using a standard open country exposure profile. The predicted wind speeds are similar between each model (safety and comfort) and are shown in Figure 3. The predicted hourly mean wind speed at the 500m reference height, used in the analysis and reporting of pedestrian-level wind speeds, is 33.4 m/s for a return period of 1 year.

The directional characteristics of winds associated with various return periods are plotted in terms of Relative Importance (%) in Figure 3a for the Safety climate, and Figure 3b for the Comfort climate. Both wind climate models indicate that westerly winds are the most important.

Based on the Urban Design Terms of Reference: Pedestrian Wind Comfort and Safety Studies, issued by the City of Mississauga [Ref 4], separate wind climates were developed to be used for the Comfort and Safety criteria. The development of the Safety climate utilized the complete set of historical wind data (i.e. 24 hours), while the development of the Comfort climate utilized a subset of historical wind data (i.e. between 06:00 and 23:00). The wind climate data are grouped on a two-season basis as follows:

- Summer: May through October
- Winter: November through April

The directional characteristics of winds associated with various return periods are plotted in terms of Relative Importance (%) in Figures 4a and 4b for the Safety (Annual) and Comfort (Seasonal) climates, respectively. Each wind climate model indicates that southwesterly winds are the most important.

The design probability distribution of hourly mean wind speed at 500m reference height and wind direction is shown in Appendix A. Annual and seasonal distributions are shown.

2 THE MODELLING OF THE SITE AND THE WIND

2.1 Overall Approach

The basic tool used is the Laboratory's boundary layer wind tunnel. The tunnel is designed with a very long test section, which allows extended models of upwind terrain to be placed in front of the model of the building under test. The modelling is done in more detail close to the site. The wind flow then develops characteristics which are similar to the wind over the terrain approaching the actual site. This methodology has been highly developed (see References 2 and 3) and is detailed below.

2.2 Model Design

Close-up views of the 1:400 scale model are shown in Figure 5a for the Existing configuration and Figure 5b for the Proposed configuration.

Aerodynamic model components:

The model of the 3033 Dundas Street W development model 3D printed in detail.

1. A detailed proximity model of the surrounding city built in block outline from Styrofoam for a radius of approximately 500m.
2. Generic models of upstream terrain, modelled by setting appropriate heights of generic roughness blocks and by turbulence-generating spires to produce wind characteristics representative of those at the project site.

The building model and the proximity model are rotated to simulate different wind directions with the upstream terrain being changed as appropriate.

The upstream terrain was modelled using generic roughness blocks and turbulence-generating spires to produce wind characteristics representative of those at the project site. Two different terrain models were used, these are shown in Figure 6 and the azimuth ranges over which they were used are shown in Figure 7.

Testing was carried out for 2 configurations of the surroundings, namely the Existing and Proposed. Photographs of each configuration during wind tunnel testing are shown in Figure 5.

Existing Site – The existing site consists of a bare lot. An aerial view of the existing site can be seen in Figure 2.

Proposed Site – The proposed 3033 Dundas Street W development consists of a 12-storey multi-unit residential building. A perspective view of the building is shown in Figure 1.

2.3 Characteristics of the Modelled Wind

Figure 8 presents the vertical profiles of the mean speed and of the intensity of the longitudinal component of turbulence, measured just upstream of the centre of the turntable, for the upstream terrain exposure.

The model profiles are good representations of the expected variation of full-scale wind speed and turbulence over relevant heights. The reference wind speed measured in the wind tunnel has been scaled such that the expected full-scale wind speeds over the lower 50m are achieved.

3 THE DETERMINATION OF PEDESTRIAN-LEVEL WIND SPEEDS

3.1 Overall Approach

Detailed measurements were made of pedestrian-level wind speeds at locations of interest around the project. Views of the model in the wind tunnel are shown in Figure 6 for each of the tested configurations. These wind-tunnel findings were then combined with the comfort and safety extratropical wind climates to provide statistical predictions of expected pedestrian-level wind speeds around the site.

Assessment for pedestrian safety is based on the gust wind speed predicted to occur 0.1% of time or approximately 9 hours in a year. Assessment for pedestrian comfort is based on the gust equivalent mean wind speed predicted to occur 80% of the time.

General descriptions of the testing and analysis procedure are given in Reference 1.

3.2 Model Instrumentation

Figure 9 indicates the 88 locations at which wind speeds were measured for the Existing configuration. Figure 10 indicates the 93 locations at which wind speeds were measured for the Proposed configuration. Locations 1-3 are on the Level 9 outdoor amenity space, Location 4 is on the Level 7 outdoor amenity space and Location 5 is on the Level 11 outdoor amenity space and were only tested in the Proposed configuration. Wind speed measurement locations were placed systematically along the sidewalk areas around the proposed development and on existing neighbouring pedestrian traffic routes and entrances.

Measurements were made using omni-directional pressure sensors which measure both mean and fluctuating components of the wind speed parallel to the ground at a height of about 1.5 to 2m in full scale.

3.3 Aerodynamic Data

Measurements were taken at 10° intervals for the full range of azimuths. Evaluation were made of the gust equivalent mean (GEM) wind speed and the gust speeds. The GEM wind speed is defined as the maximum of the mean wind speed or the gust wind speed divided by 1.85. The gust speed is evaluated as the mean speed + (3 x RMS speed).

The polar plots in Appendix B show the GEM wind speed at each of the sensors, expressed as a ratio of the mean wind speed at reference height. The angular coordinate gives the direction of the approach wind, relative to true North.

The radial magnitudes and the shapes of the polar plots in Appendix B provide valuable indications of the relative magnitudes of wind speeds at different locations and their sensitivity to the direction of the approach wind.

These plots can be useful to identify important wind directions that can influence conditions at a particular location. In turn, this information can be used to inform and develop mitigation strategies.

3.4 Statistical Prediction of Pedestrian-Level Winds

The directional characteristics of the extratropical wind climate are shown in Figure 4.

The predicted wind speeds are obtained by combining the statistical wind climate model of wind speed and direction with the aerodynamic data measured in the wind tunnel. Two types of prediction are provided:

1. Wind speeds exceeded during 0.1% of the time on an annual basis.
2. Wind speeds exceeded 20% of the time on a seasonal basis.

These predictions are compared against the following specified criteria to evaluate pedestrian comfort and safety:

CRITERIA	DESCRIPTION	GEM WIND SPEED EXCEEDED 20% OF THE TIME
Comfort level 4	**Sitting**	**≤ 10 km/h**
Comfort level 3	**Standing**	**≤ 15 km/h**
Comfort level 2	**Walking**	**≤ 20 km/h**
Comfort level 1	**Uncomfortable**	**> 20 km/h**

CRITERIA	DESCRIPTION	GUST WIND SPEED EXCEEDED 0.1% OF THE TIME
Safety level	**Exceeded**	**> 90 km/h**

The comfort categories are described as follows:

- **Comfort Level 4 - Sitting:** Calm or light breezes desired at outdoor restaurants and seating areas where one can read a paper without having it blown away
- **Comfort Level 3 - Standing:** Gentle breezes suitable for main building entrances and bus stops
- **Comfort Level 2 - Walking:** Relatively high speeds that can be tolerated if one's objective is to walk, run or cycle without lingering
- **Comfort Level 1 - Uncomfortable:** Strong winds of this magnitude are considered a nuisance for most activities, and wind mitigation is typically recommended

The safety category is described as follows:

- **Areas which exceed the Safety Level**: Excessive gust speeds that can adversely affect a pedestrian's balance and footing. Wind mitigation is typically required.

These criteria are consistent with pedestrian level wind study Terms of Reference for the City of Mississauga [Ref. 4].

3.5 Test Results and Discussion

The tested configurations include the Existing site and the Proposed development. These configurations are described in Section 2.2.

General broad-scale landscaping was not modelled during wind tunnel testing. Results can therefore be expected to reflect a somewhat conservative representation of expected wind conditions around the development in areas where trees and other landscaping elements will be present.

Figure 11 compares the predicted wind speeds at the various locations for the two tested configurations along with the criteria for pedestrian safety. Similar plots of predicted wind speeds compared to the criteria for pedestrian comfort can be found in Figures 12 and Figure 13 for summer and winter seasons, respectively.

Colour-coded diagrams are also used to summarize the suitability of each measurement location with respect to pedestrian safety and pedestrian comfort for each tested configuration. Figures 14 and 15 present these for safety considerations for the Existing and Proposed configurations, respectively. For comfort considerations colour-coded diagrams for the summer season are presented in Figures 16 and 17 for Existing and Proposed configurations, respectively. Similarly, Figures 18 and 19 present the comfort results for the winter season.

Results are discussed below for each of the tested configurations.

3.5.1 Existing Site Configuration

Results for the Existing configuration reflect current expected wind conditions at and around the 3033 Dundas Street W site.

With respect to pedestrian safety for the Existing Configuration (Figure 14):

1. All tested locations meet the recommended criterion.

With respect to pedestrian comfort for the Existing Configuration (Figures 16 and 18):

1. In summer (see Figure 16) all measurement areas are rated for standing or sitting.
2. In winter (see Figure 18) some local sidewalk areas are rated for walking; most areas are rating for standing.
3. In all cases, the measured wind speeds are expected to be suited for the intended usage for their respective areas.

Given the suburban surroundings with some local open spaces, it is not surprising that the measured wind speeds for the Existing site are generally consistent with a typical suburban environment or marginally greater.

3.5.2 Proposed Development Configuration

Tests of the Proposed development were carried out with the addition of the 12-storey 3033 Dundas Street W building installed in its planned location. All other details of the surroundings are unchanged from the Existing configuration.

With respect to pedestrian safety (Figure 15):

1. All tested locations meet the recommendations for pedestrian safety.

With respect to pedestrian comfort (Figures 17 and 19):

1. The proposed development has a moderate influence to wind speeds in and around it's immediate vicinity. As can be expected, the influence is generally most noticeable adjacent to the site and diminishes as the distance from the site increases.
2. At locations farther away from the project site small changes in wind speed do not notably affect the comfort classification, particularly in summer season. In the winter season, there are some sidewalk locations south and east of the building where the comfort category shifts from standing in the Existing condition to a walking category in the Proposed configuration, with just a marginal increase in the local wind speed. Nonetheless, the locations all remain suited for the intended sidewalk usage.
3. Neighbouring properties and their entry areas are largely unaffected by the introduction of the proposed development.
4. For ground level locations near or directly adjacent to the site, some variations in the predicted wind speeds are observed:
   - In summer (see Figure 17), all ground level locations are rated for standing or better. Wind conditions during the summer season are therefore expected to be suited for the intended usage.
   - During winter season (see Figure 19) wind speeds are typically higher than in summer. At locations near the development site, some sidewalk locations along increase to walking from standing. Sidewalk locations along the northwest side of the intersection of Winston Churchill Boulevard with Dundas Street W increase to walking. In all these cases, the areas remain suitable for typical sidewalk usage.
   - Locations 10 and 12 at the corners of the northeast end of the Proposed building are rated for walking. These are not near entries and therefore anticipated to be suited for the intended usage.

- The area around the southwest end of the building is largely rated for walking during the winter season. Specifically, Location 6 on the north side of the building is near a drop-off and entrance to the medical center, and Location 17 is a medical entrance near the south corner. These entry locations will require mitigation to improve winds to the recommended comfort level of standing year-round for entrances.

5. With respect to the rooftop amenity spaces:

   - Measurements at the Level 9 outdoor amenity space indicate that during the summer season winds are suited for standing activities along the north portion of the terrace, with the southwest area suited for walking. In the winter, the north side of the Level 9 outdoor amenity space is suitable for walking with the southwest area rated uncomfortable. Generally, a summer sitting rating is recommended for terrace spaces where people are expected to linger. The targeted winter rating will depend on the intended usage, but should be rated for walking or better unless access is to be restricted.

   - The smaller amenity terraces at Levels 7, 9, and 11 (Probe Locations 4, 5) on south side of the building are suitable for standing or better year-round.

   - The Level 12 terrace on the southwest end of the building was too shallow to permit wind measurement instrumentation at the model scale. As it is enclosed on three sides and overhead, it is expected that this area will be rated for standing or better year-round.

3.6 Seasonal Differences

The amount and type of activity for a given location can vary by season. For example, a terrace or outdoor amenity area may have limited or restricted usage during the winter season. Thus, in some cases it is valuable to look at the wind speeds and the corresponding classification of pedestrian comfort on a more detailed season-by-season basis.

In general, compared to annual wind speeds, wind speeds during the winter months are about 8% higher, and in the summer they are about 16% lower.

3.7 Summary Remarks

The proposed development can be expected to affect wind patterns locally in regions throughout the development site. This is consistent with the introduction of a relatively tall development to an otherwise homogeneous site with low-rise buildings. Nonetheless, conditions are expected to remain suitable for their intended uses subject to suggested mitigation, and to be confirmed at the detailed design stage.

With an expectation to changes in the local wind speeds, the focus should not be to return wind conditions to an 'as-it-was' state, but rather identify and develop strategies to make wind conditions suitable for the intended usage. For example, entry areas should have a comfort category consistent with standing activities, while sidewalks should meet the condition of being comfortable for walking.

In areas that are windier than that desired for the intended usage, incorporating mitigation strategies will be beneficial.

Recessing the entrance doors on the northern and western side of the building near the medical entrances, near probe Locations 6 and 17, would be beneficial for these entry areas. Alternatively, densely spaced evergreens or locally placed windscreens on either side of each entryway will be required to improve the winds in these areas.

For the Level 9 main outdoor amenity terrace, testing was conducted modelling a 1m tall solid railing around the terrace perimeter. Increasing the perimeter railing height (to 2m or greater) would be beneficial. In addition, localized windscreens or planters with coniferous plantings along the northern and western portions of the amenity space should be considered. Examples of effective pedestrian level wind mitigation options can be seen in Figure 20. Depending on the level of comfort required, amenity features (vertical fireplaces, moderate height landscaping, windscreens, overhead trellises) may be required throughout the space.

REFERENCES

1) "Wind Tunnel Testing: A General Outline", The Boundary Layer Wind Tunnel Laboratory, The University of Western Ontario, May 2007.

2) Davenport, A.G. and Isyumov, N., "The Application of the Boundary Layer Wind Tunnel to the Prediction of Wind Loading", International Research Seminar on Wind Effects on Buildings and Structures, Ottawa, Canada, September 1967, University of Toronto Press, 1968.

3) Surry, D. and Isyumov, N., "Model Studies of Wind Effects - A Perspective on the Problems of Experimental Technique and Instrumentation", Int. Congress on Instrumentation in Aerospace Simulation Facilities, 1975 Record, pp. 76-90.

4) Urban Design Terms of Reference, City of Mississauga Planning and Building Department, Development and Design Division. February 2023.

FIGURES

VIEW FROM THE SOUTHWEST

FIGURE 1 PERSPECTIVE VIEWS OF THE PROPOSED BUILDINGS

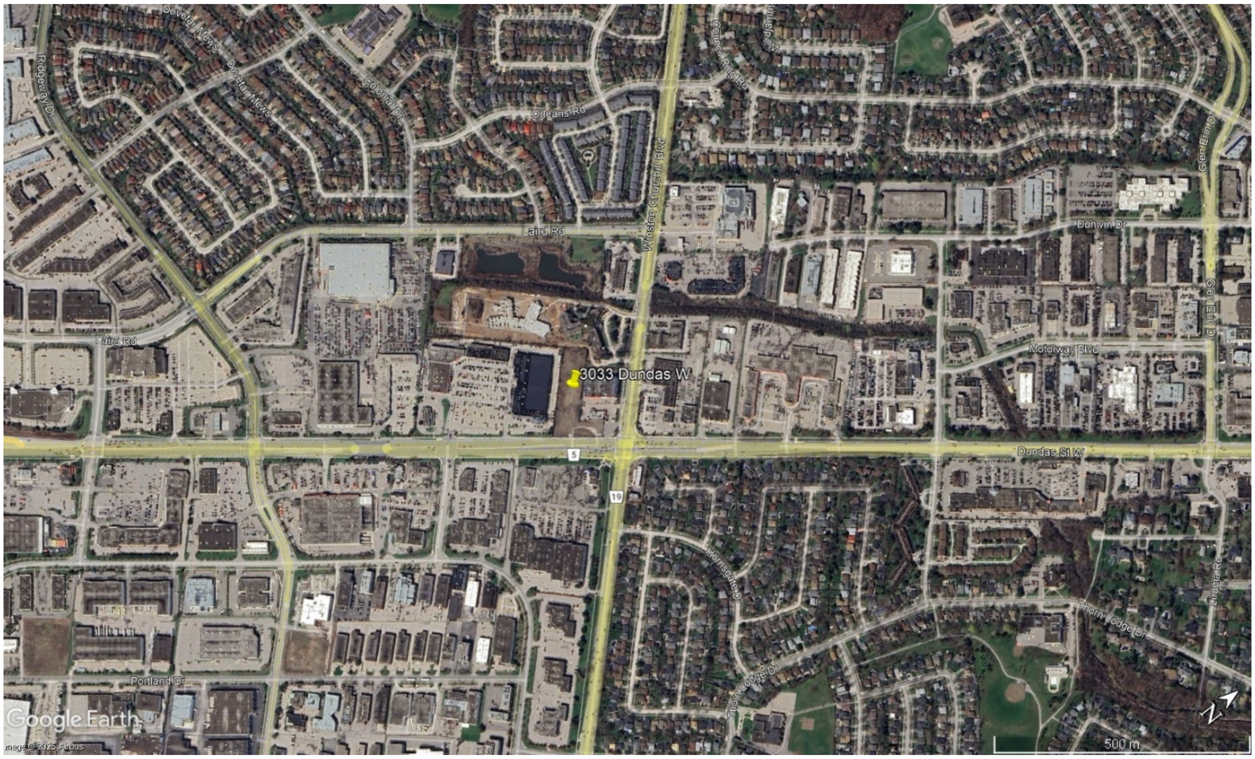


Photo Credit: Google

Photo Credit: Google

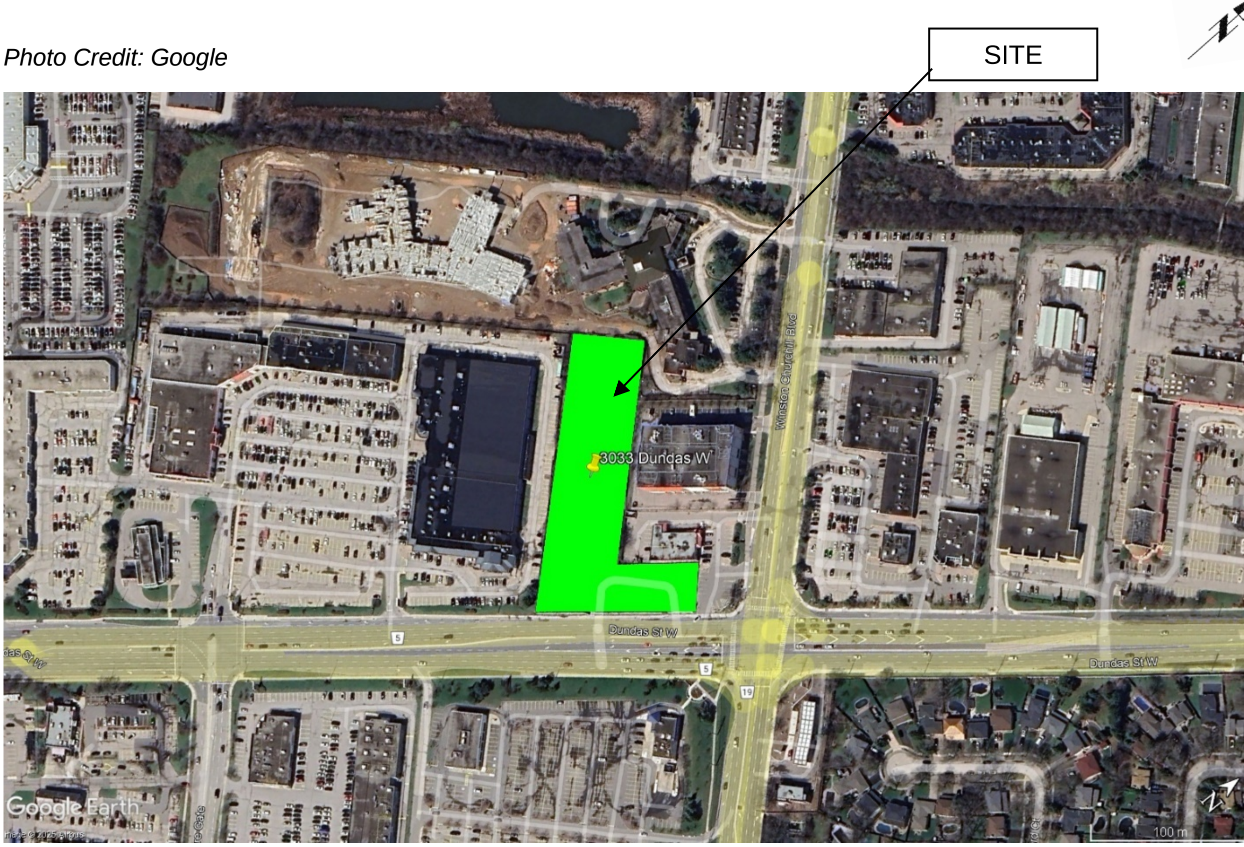


FIGURE 2 AERIAL VIEWS OF EXISTING SITE LOCATION

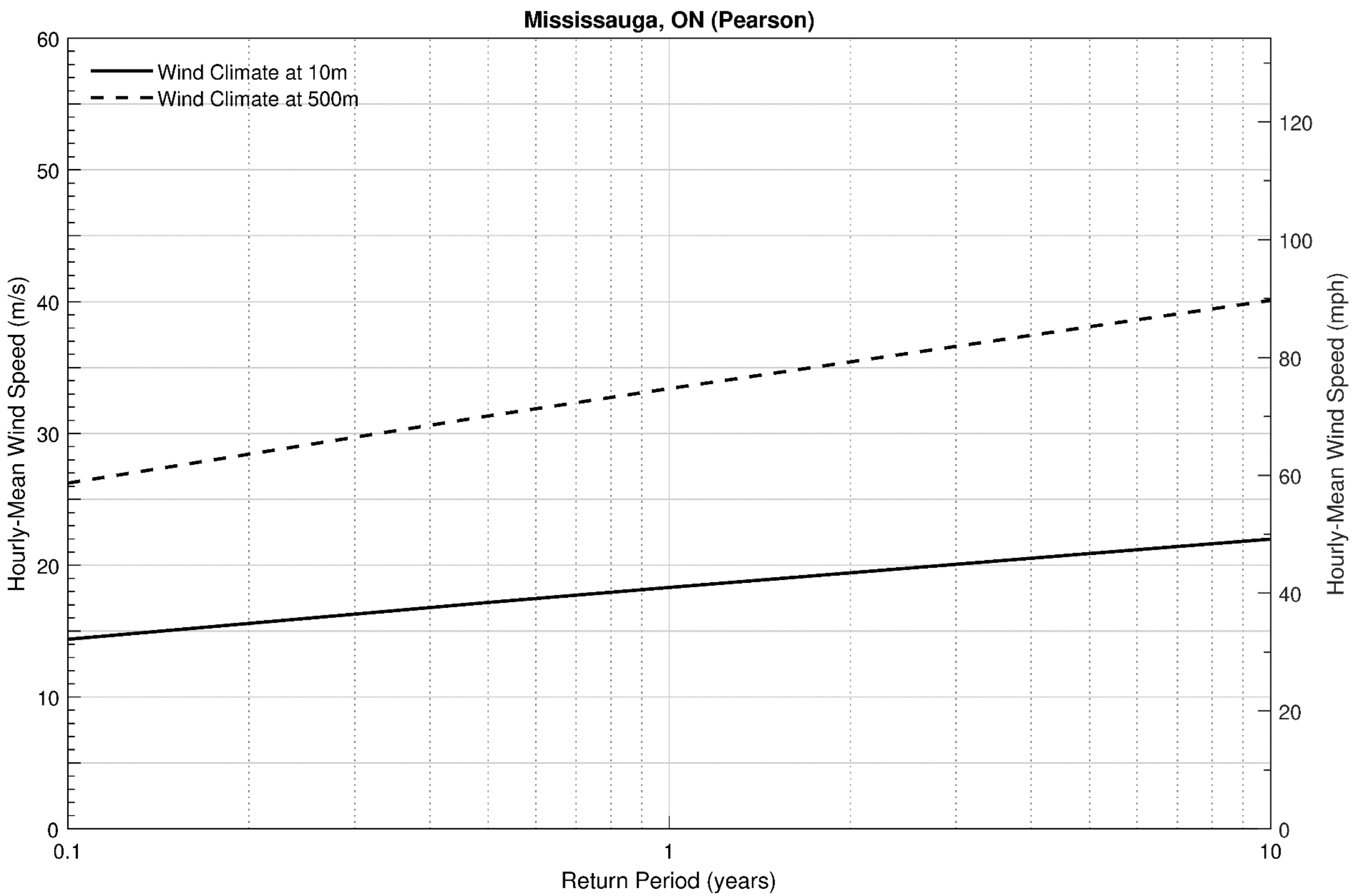


FIGURE 3 PREDICTED ANNUAL EXTREME WINDS SPEEDS FOR VARIOUS RETURN PERIODS

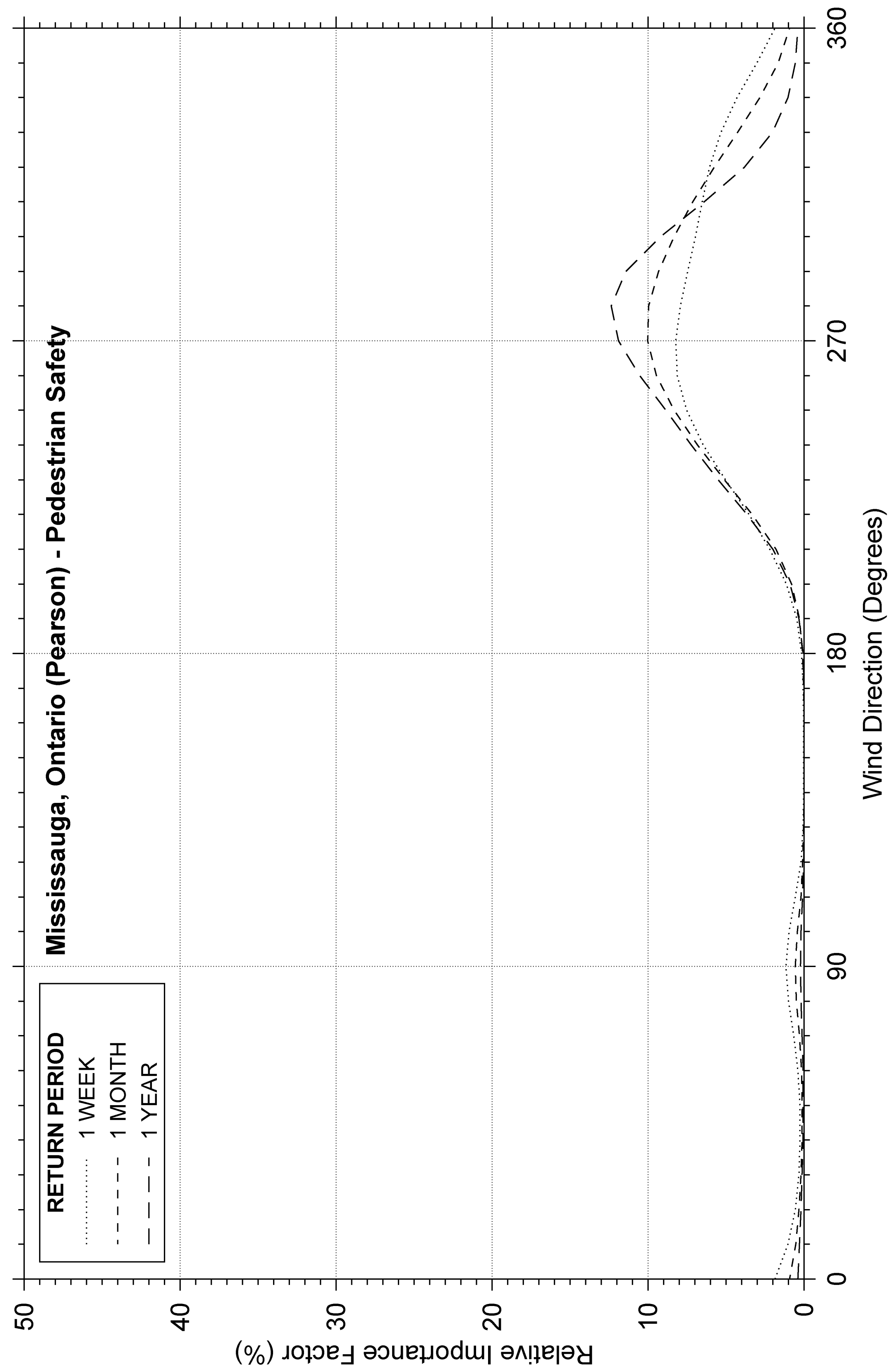


FIGURE 4a **RELATIVE IMPORTANCE OF AZIMUTHAL SECTOR TO THE PROBABILITY OF EXCEEDING VARIOUS RETURN-PERIOD WIND SPEEDS - ANNUAL**

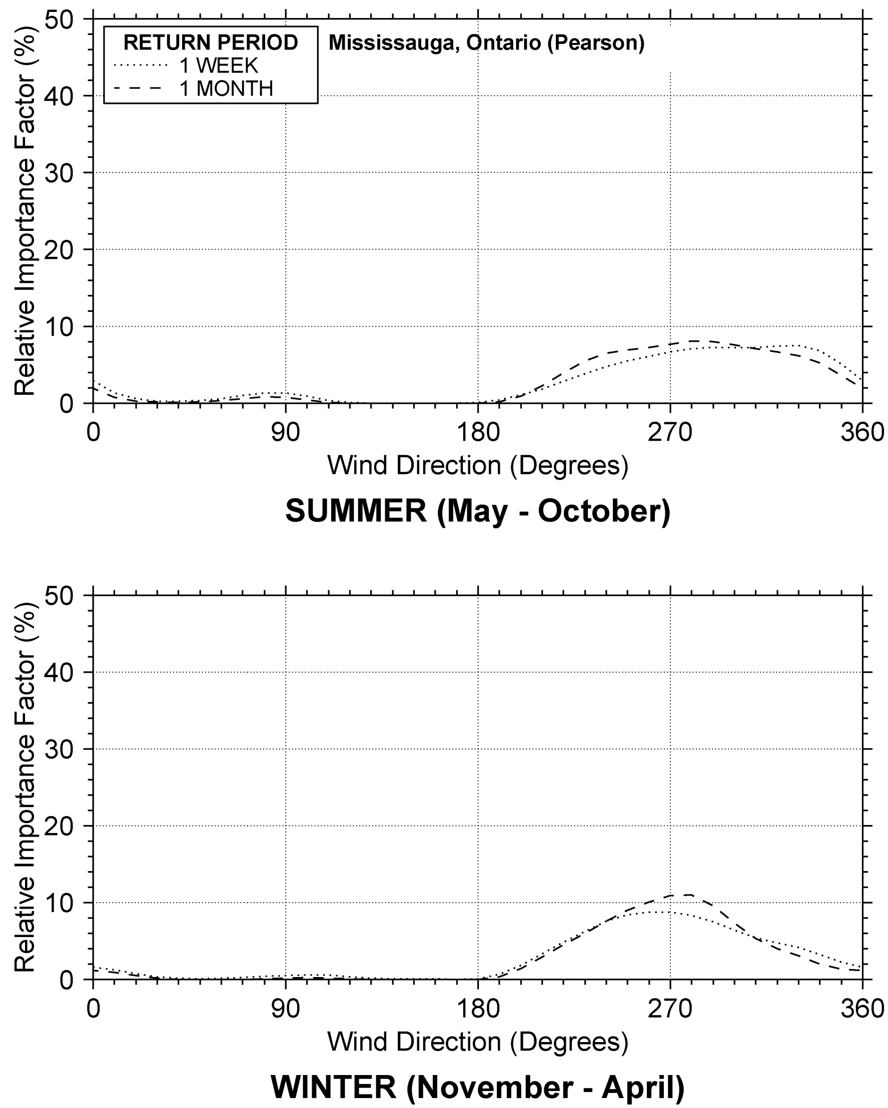
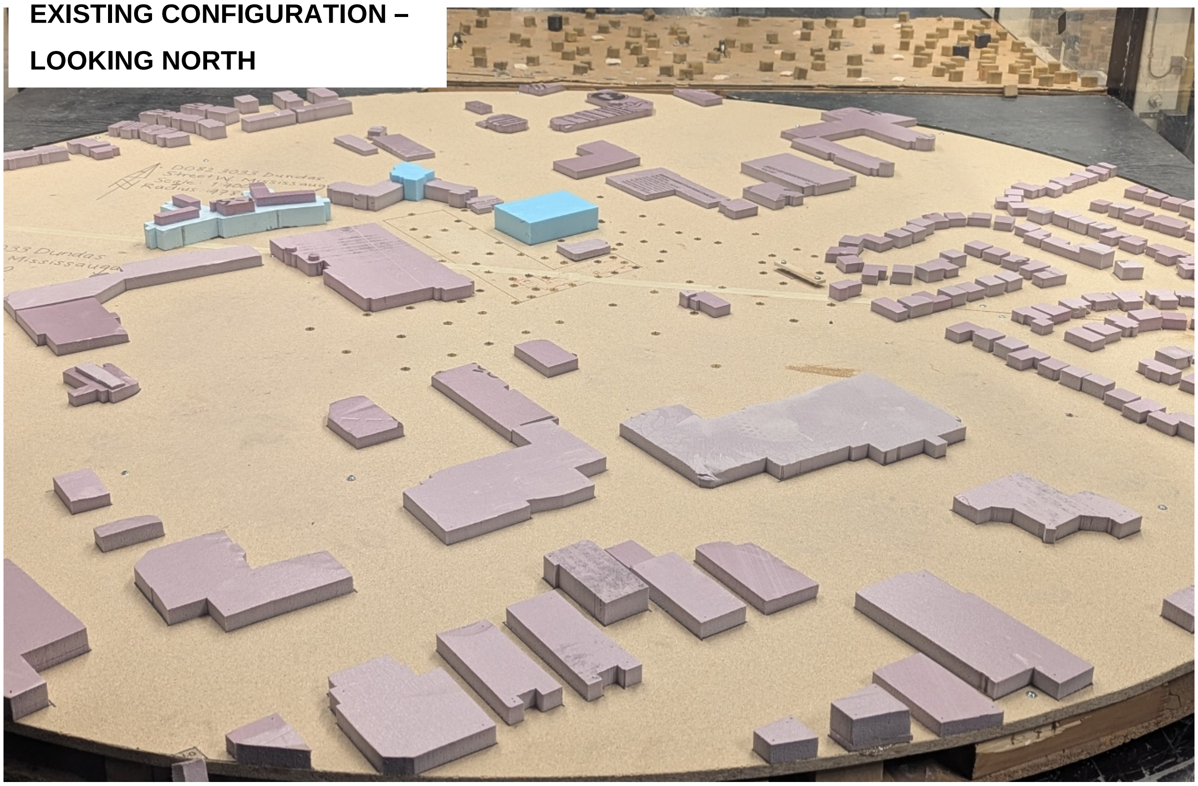


FIGURE 4b **RELATIVE IMPORTANCE OF AZIMUTHAL SECTOR TO THE PROBABILITY OF EXCEEDING VARIOUS RETURN-PERIOD WIND SPEEDS - SEASONAL**



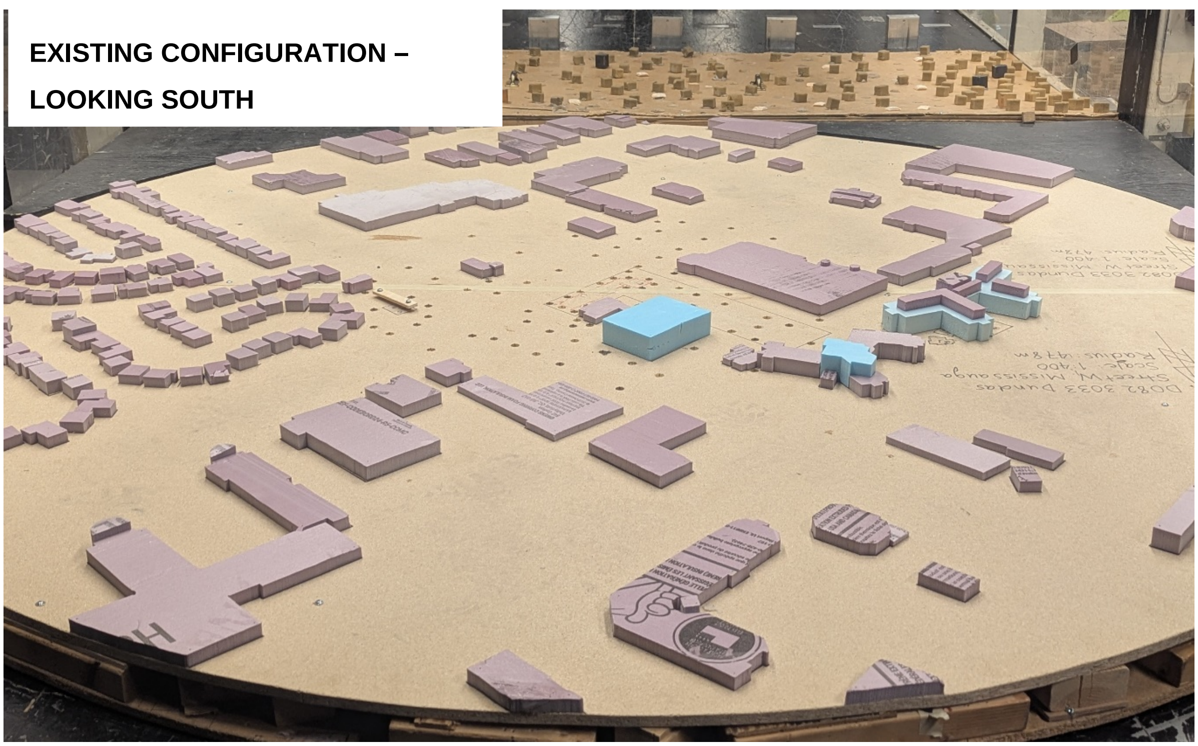
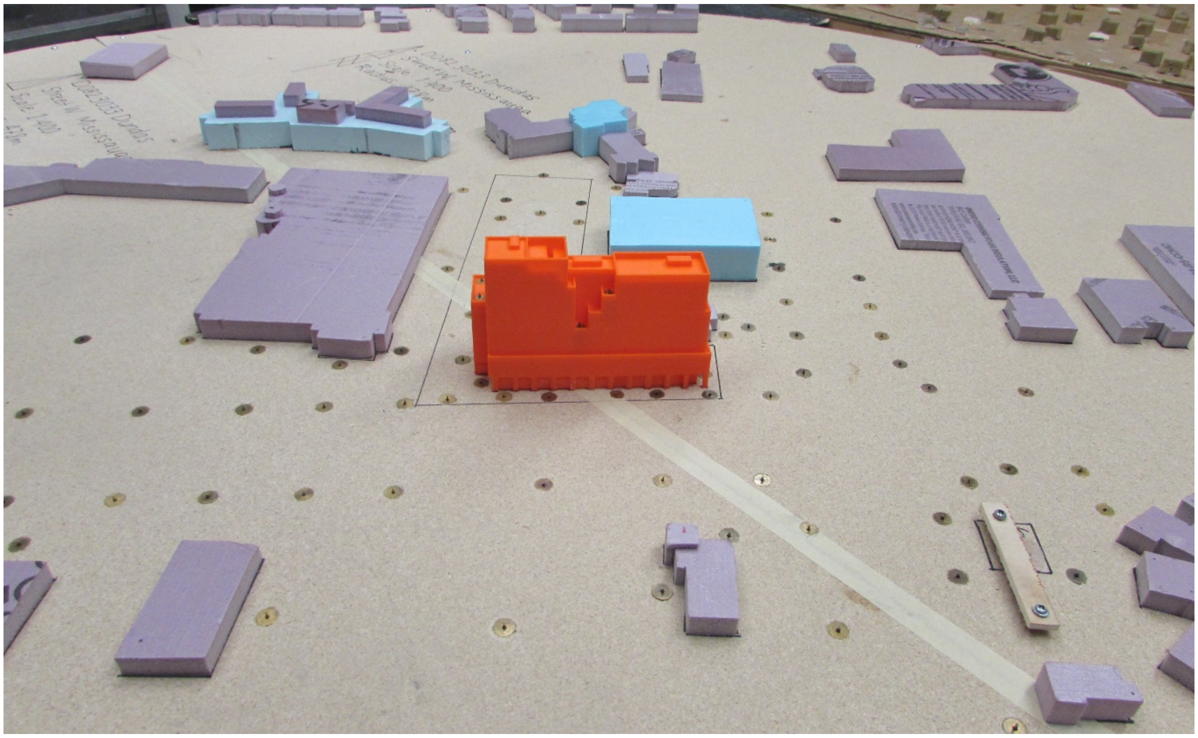


FIGURE 5a CLOSE UP VIEWS OF THE PEDESTRIAN LEVEL WIND SPEED MODEL FOR THE 'EXISTING' CONFIGURATION

PROPOSED CONFIGURATION –

LOOKING NORTHWEST



PROPOSED CONFIGURATION –

LOOKING SOUTHEAST

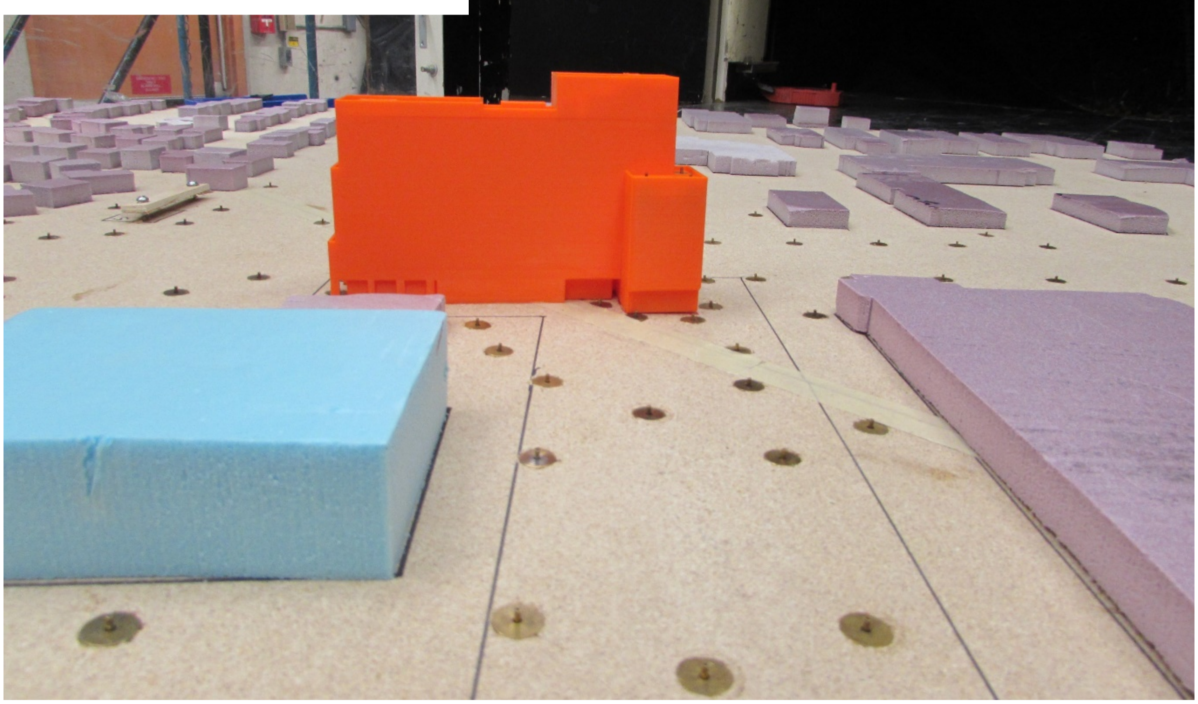
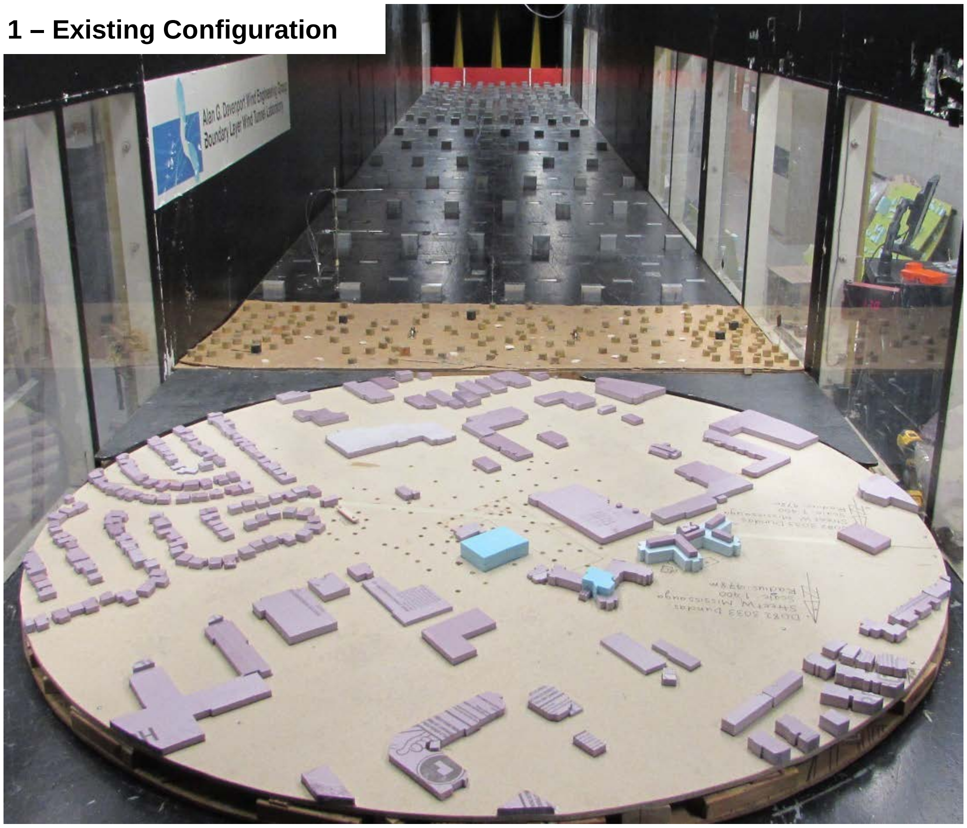


FIGURE 5b CLOSE UP VIEWS OF THE PEDESTRIAN LEVEL WIND SPEED MODEL FOR THE 'PROPOSED' CONFIGURATION

Exposure 1 – Existing Configuration



Exposure 2 – Proposed Configuration

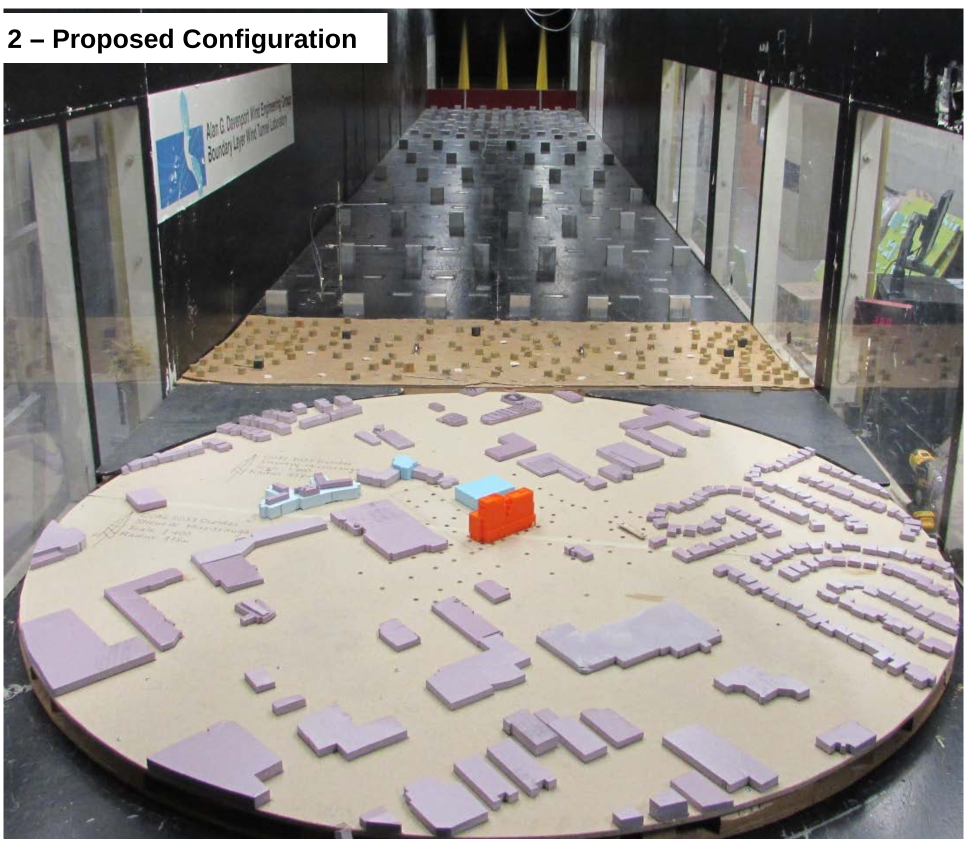


FIGURE 6　　PHOTOGRAPHS OF THE MODEL IN THE WIND TUNNEL SHOWING THE UPSTREAM TERRAIN MODEL (EXPOSURES) USED

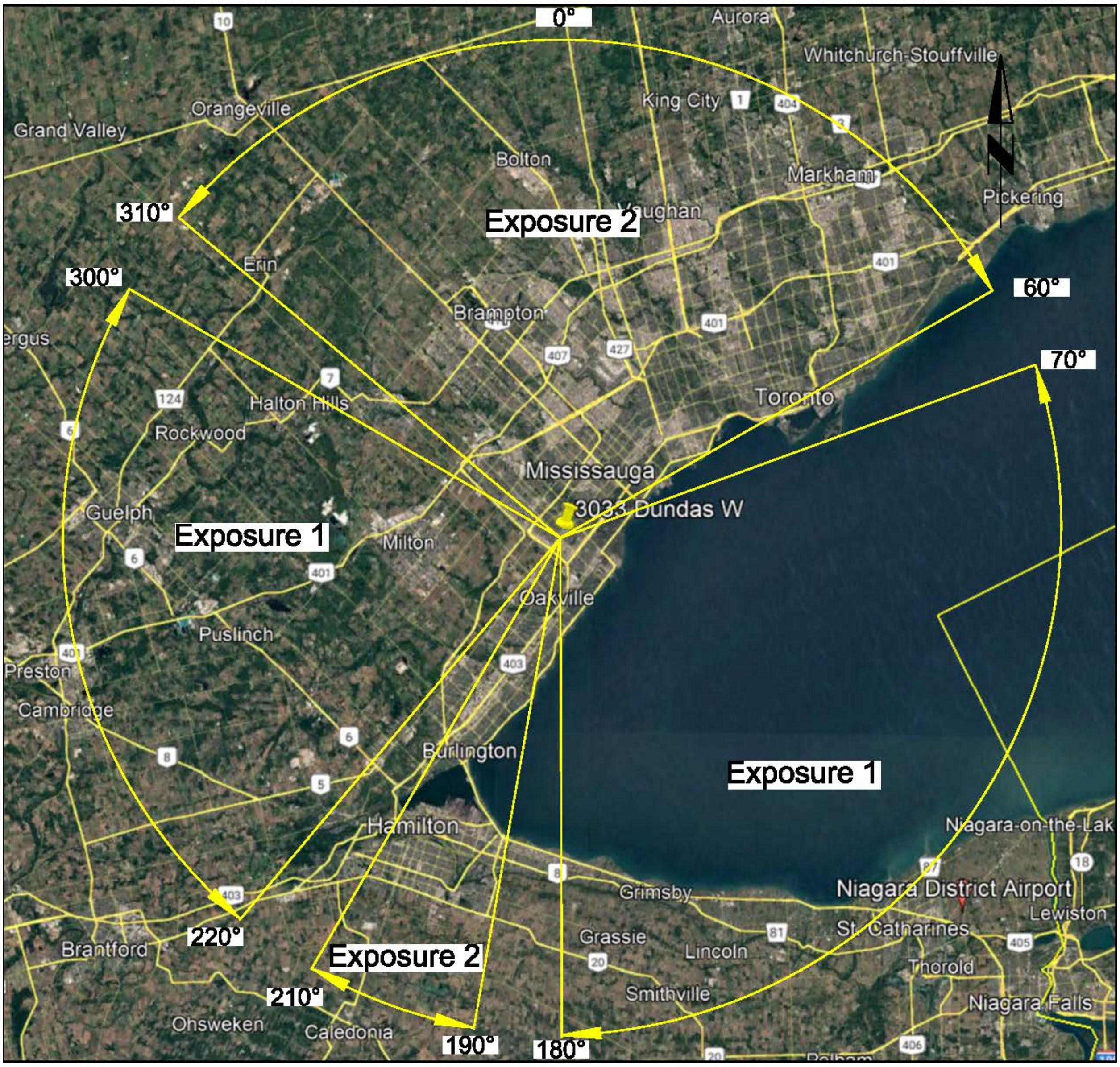


FIGURE 7 **AZIMUTH RANGES OVER WHICH THE UPSTREAM TERRAIN MODELS WERE USED**

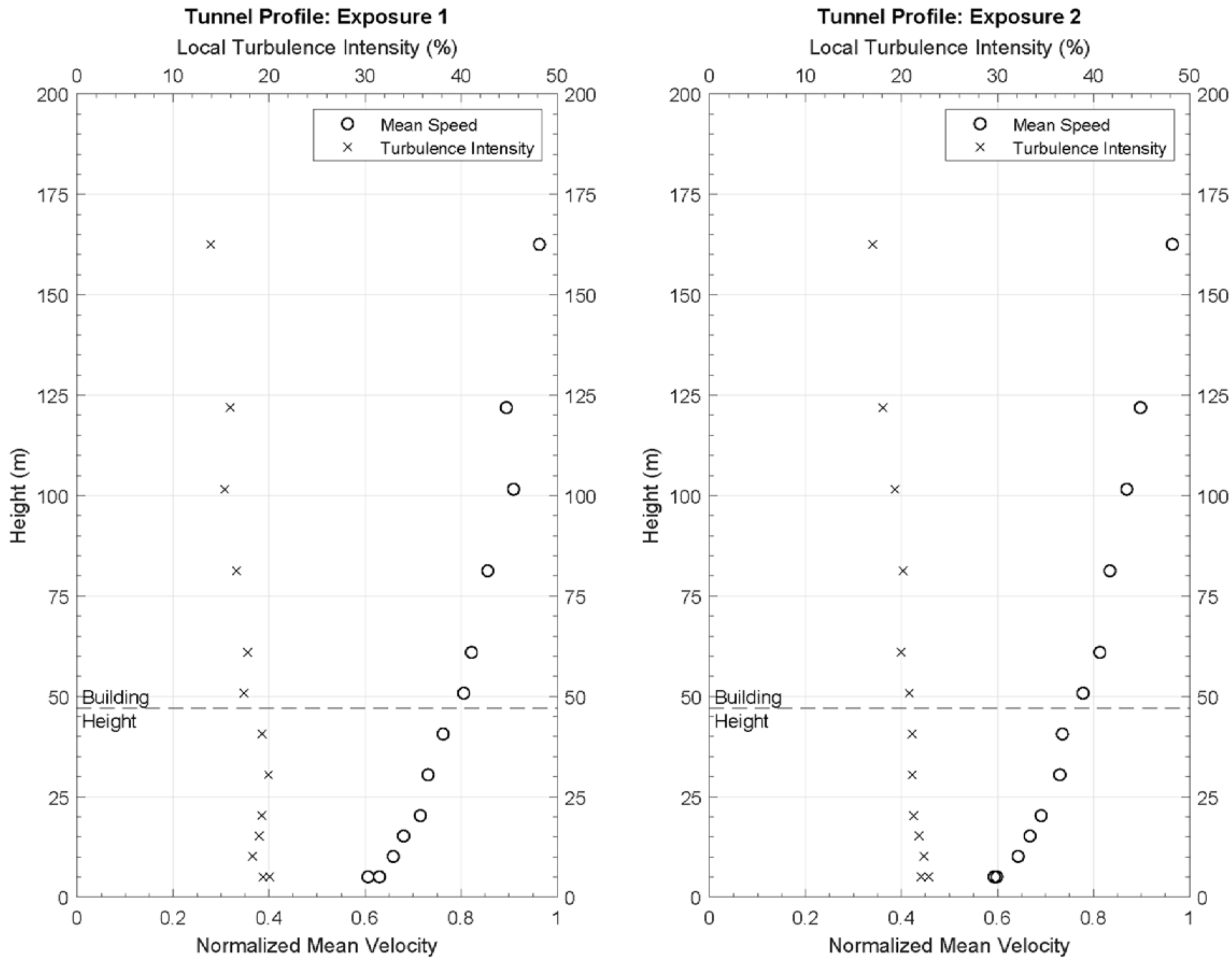


FIGURE 8 **VERTICAL PROFILES OF MEAN WIND SPEED AND LONGITUDINAL TURBULENCE INTENSITY MEASURED JUST UPSTREAM OF THE PROXIMITY MODEL.**

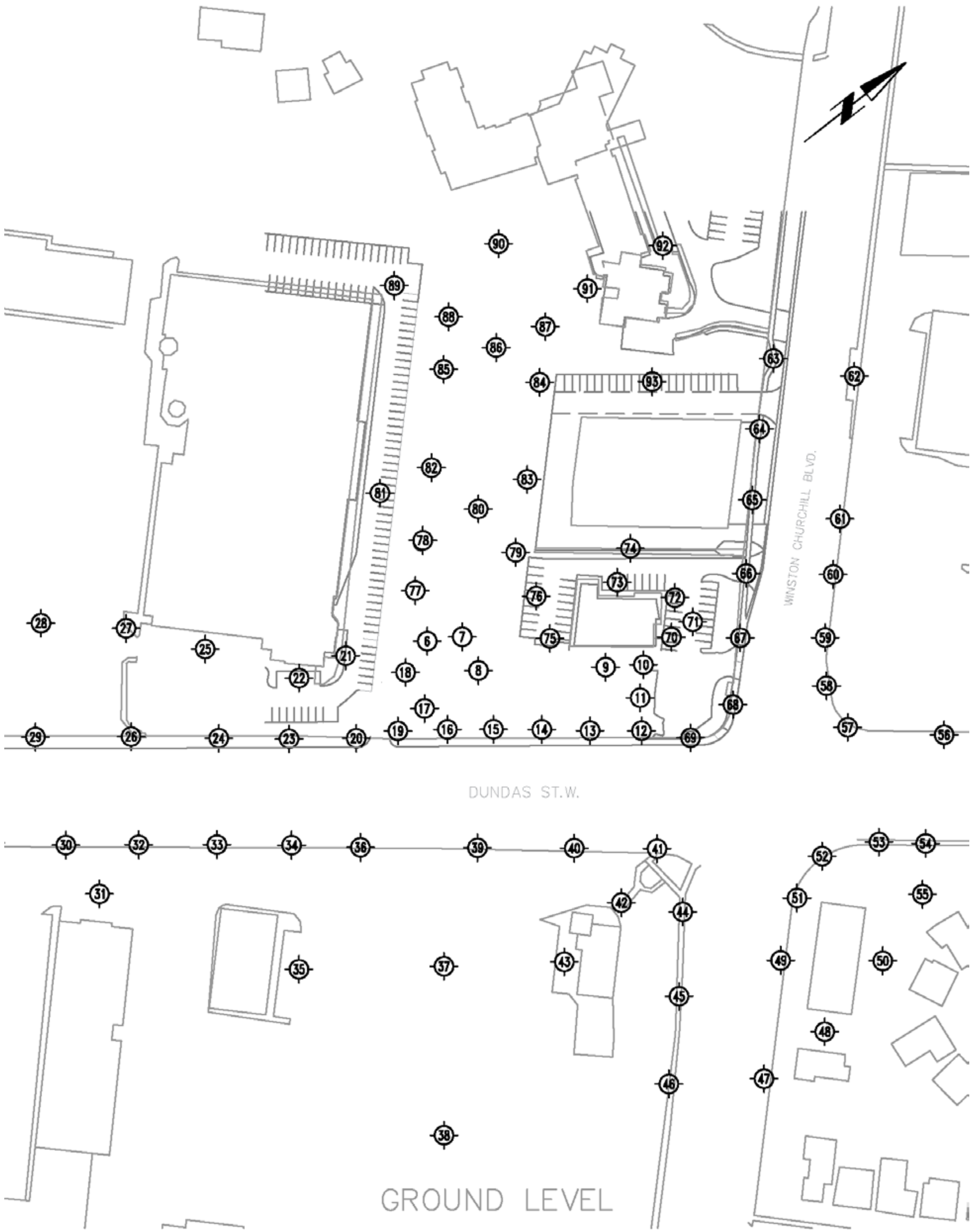


FIGURE 9 MEASUREMENT LOCATIONS FOR PEDESTRIAN-LEVEL WIND SPEEDS –EXISTING SITE

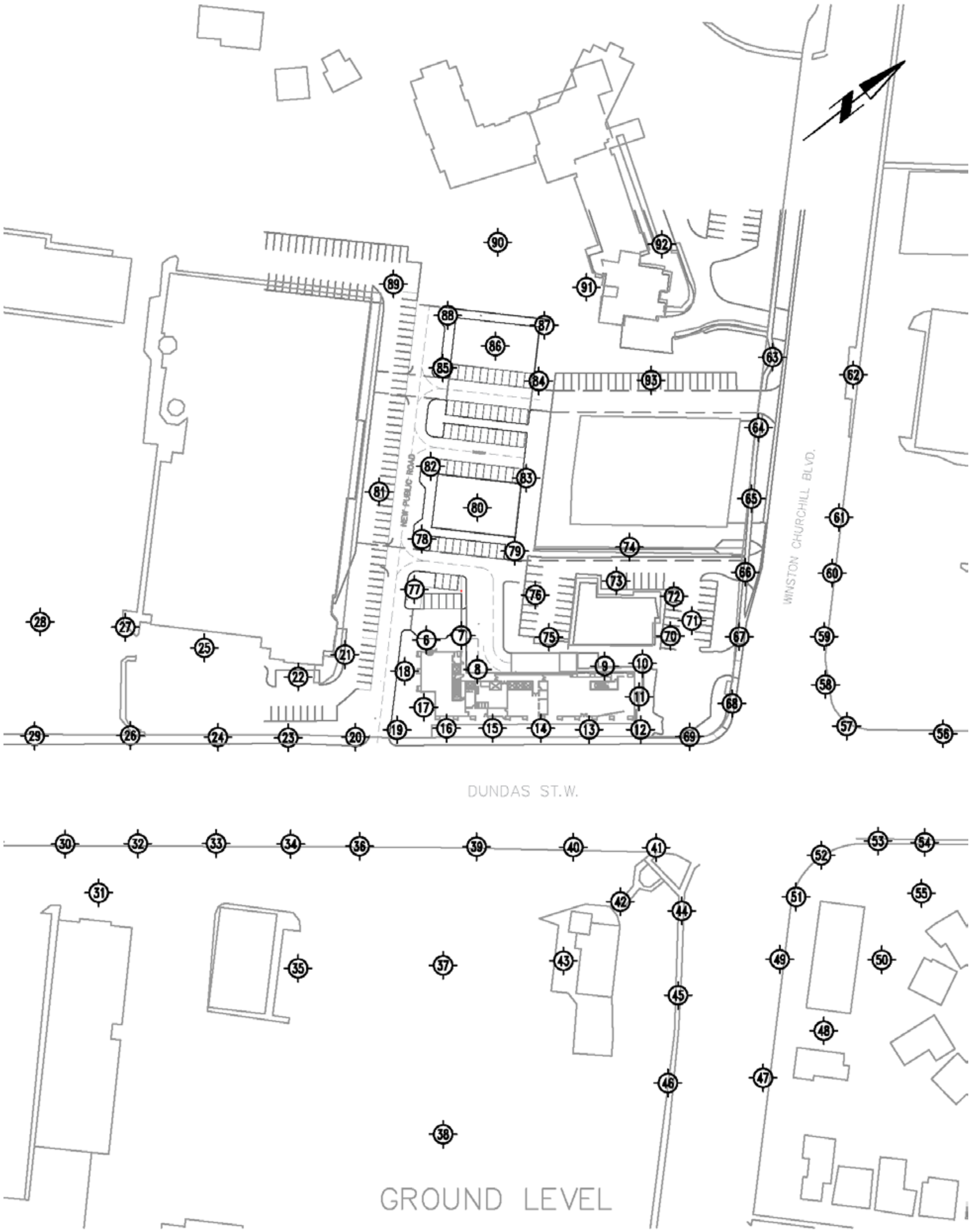


FIGURE 10a MEASUREMENT LOCATIONS FOR PEDESTRIAN-LEVEL WIND SPEEDS – PROPOSED DEVELOPMENT

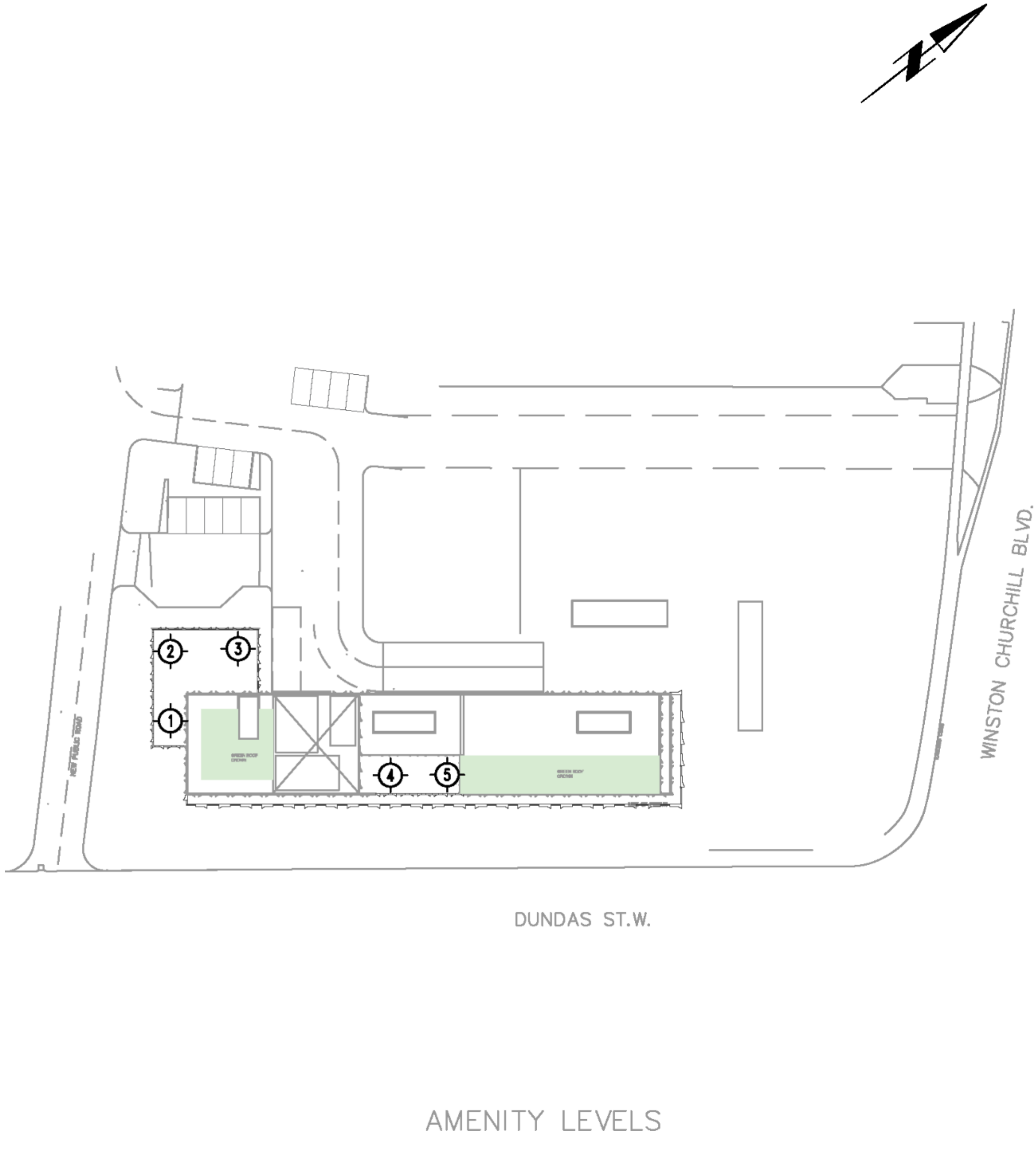


FIGURE 10b MEASUREMENT LOCATIONS FOR PEDESTRIAN-LEVEL WIND SPEEDS – PROPOSED DEVELOPMENT

FIGURE 11a PREDICTED WIND SPEEDS COMPARED WITH CRITERIA FOR PEDESTRIAN SAFETY

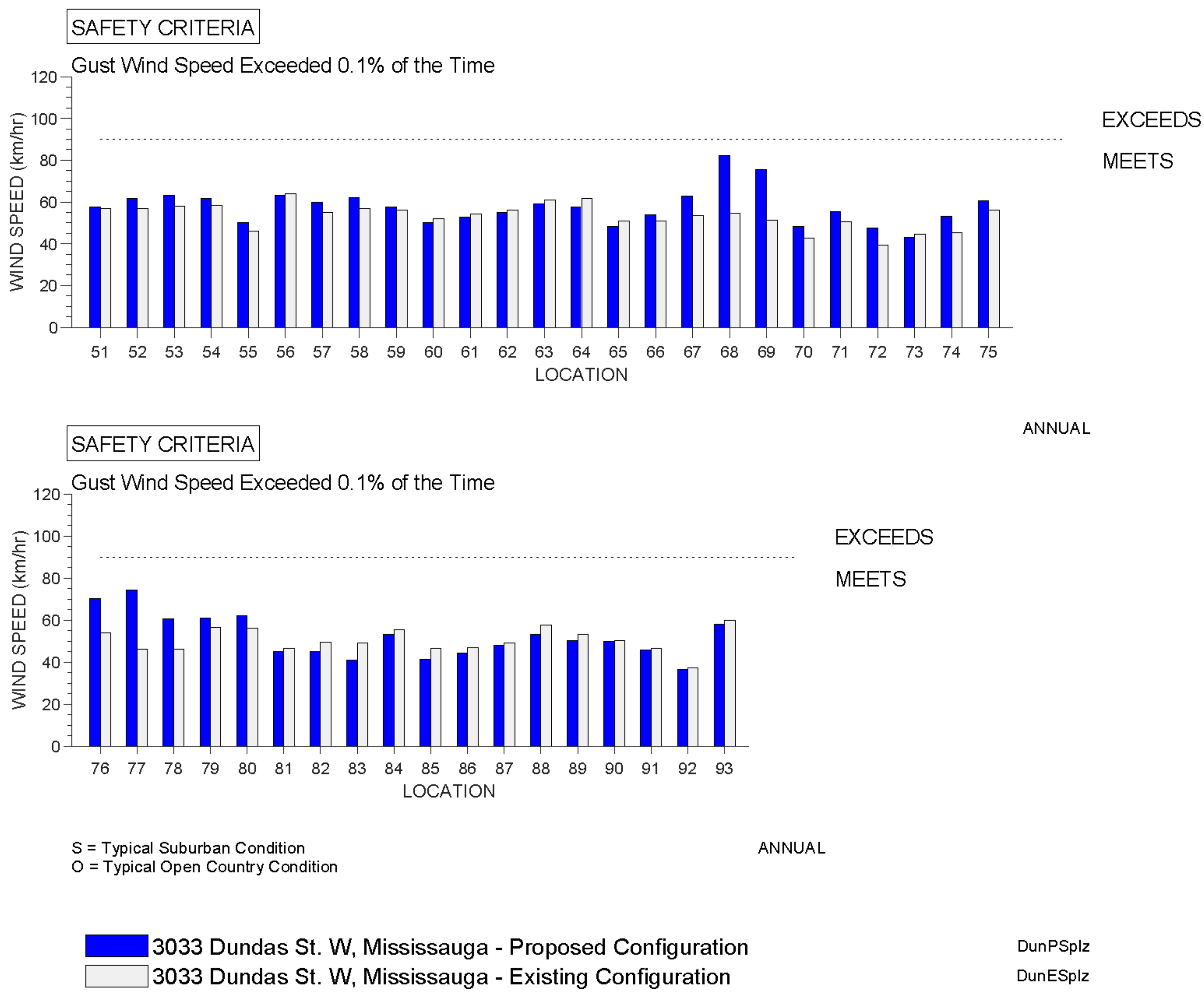


FIGURE 11b PREDICTED WIND SPEEDS COMPARED WITH CRITERIA FOR PEDESTRIAN SAFETY

FIGURE 12a PREDICTED WIND SPEEDS COMPARED WITH CRITERIA FOR PEDESTRIAN COMFORT – SUMMER

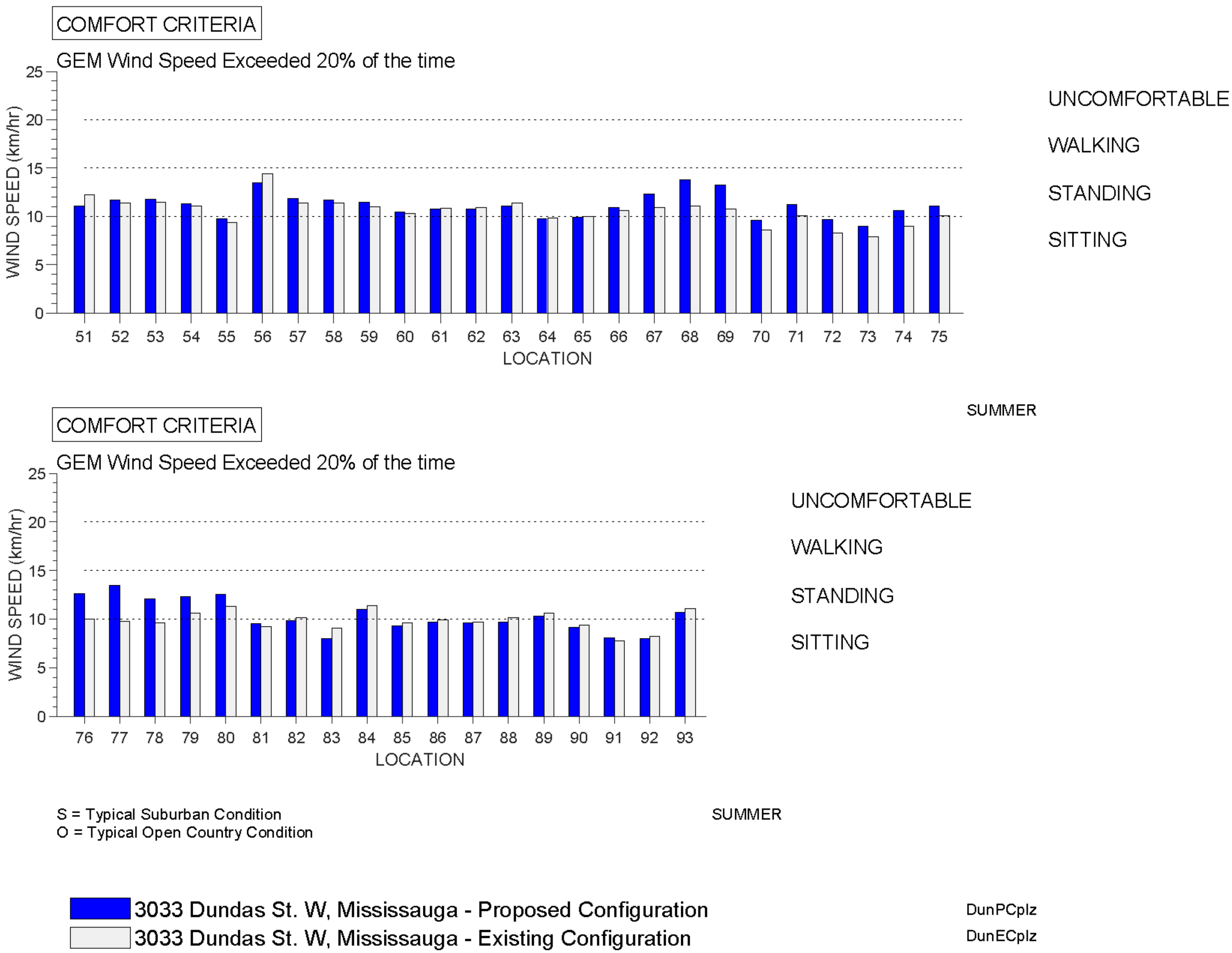


FIGURE 12b PREDICTED WIND SPEEDS COMPARED WITH CRITERIA FOR PEDESTRIAN COMFORT – SUMMER

FIGURE 13a PREDICTED WIND SPEEDS COMPARED WITH CRITERIA FOR PEDESTRIAN COMFORT – WINTER

FIGURE 13b PREDICTED WIND SPEEDS COMPARED WITH CRITERIA FOR PEDESTRIAN COMFORT – WINTER

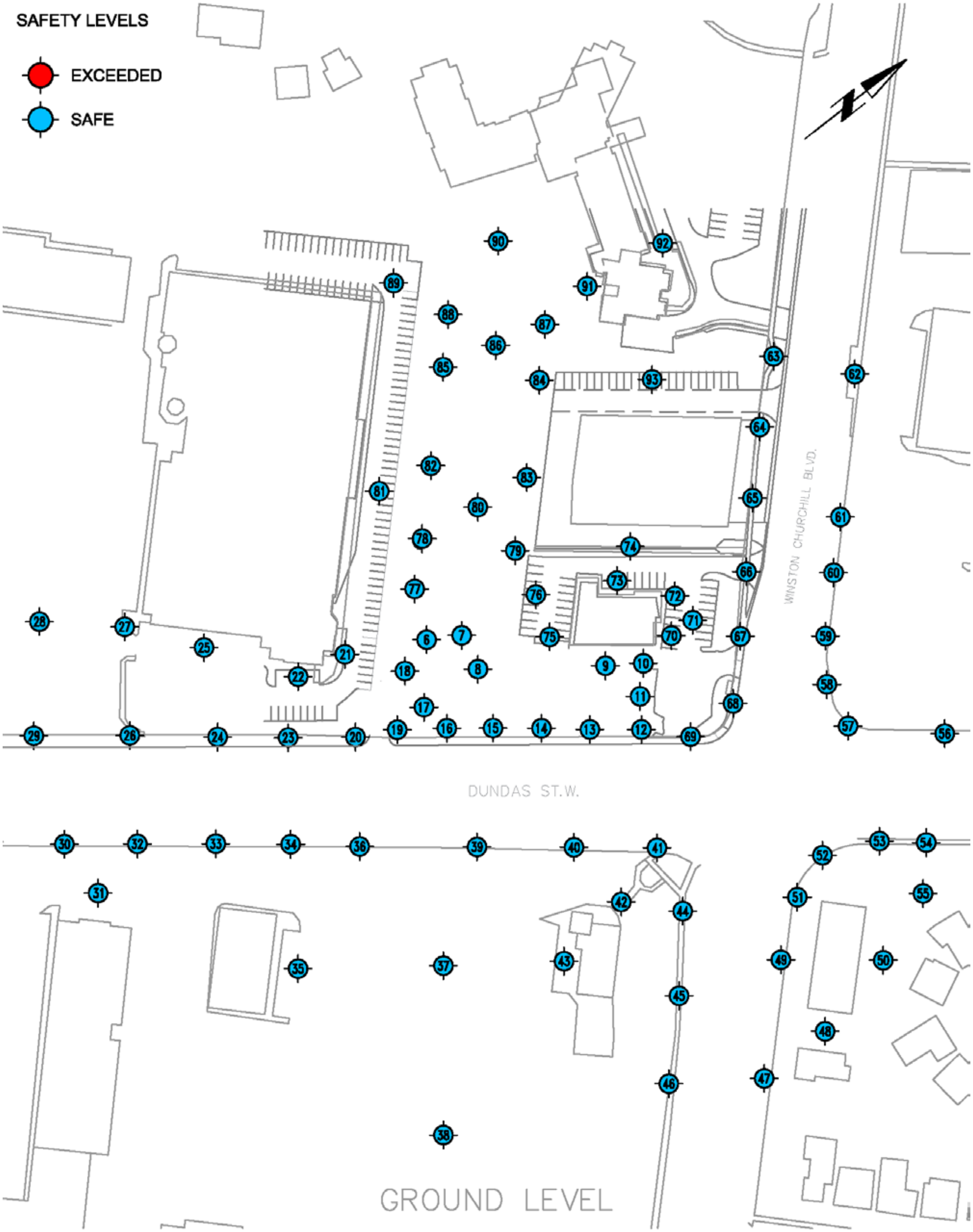


FIGURE 14 SUMMARY OF PREDICTED SAFETY LEVELS FOR PEDESTRIAN-LEVEL WIND SPEEDS – EXISTING SITE

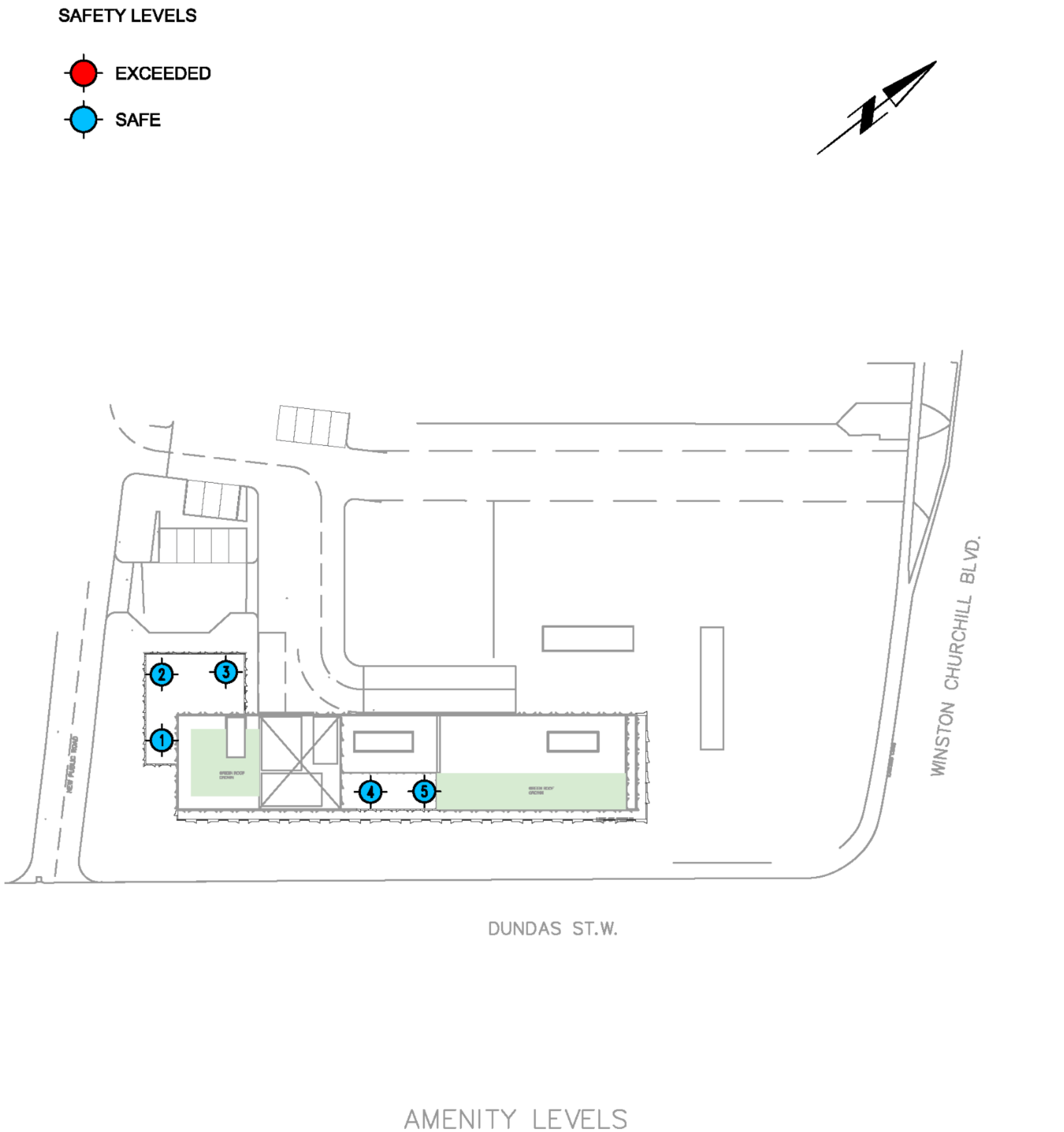


FIGURE 15a SUMMARY OF PREDICTED SAFETY LEVELS FOR PEDESTRIAN-LEVEL WIND SPEEDS – PROPOSED DEVELOPMENT

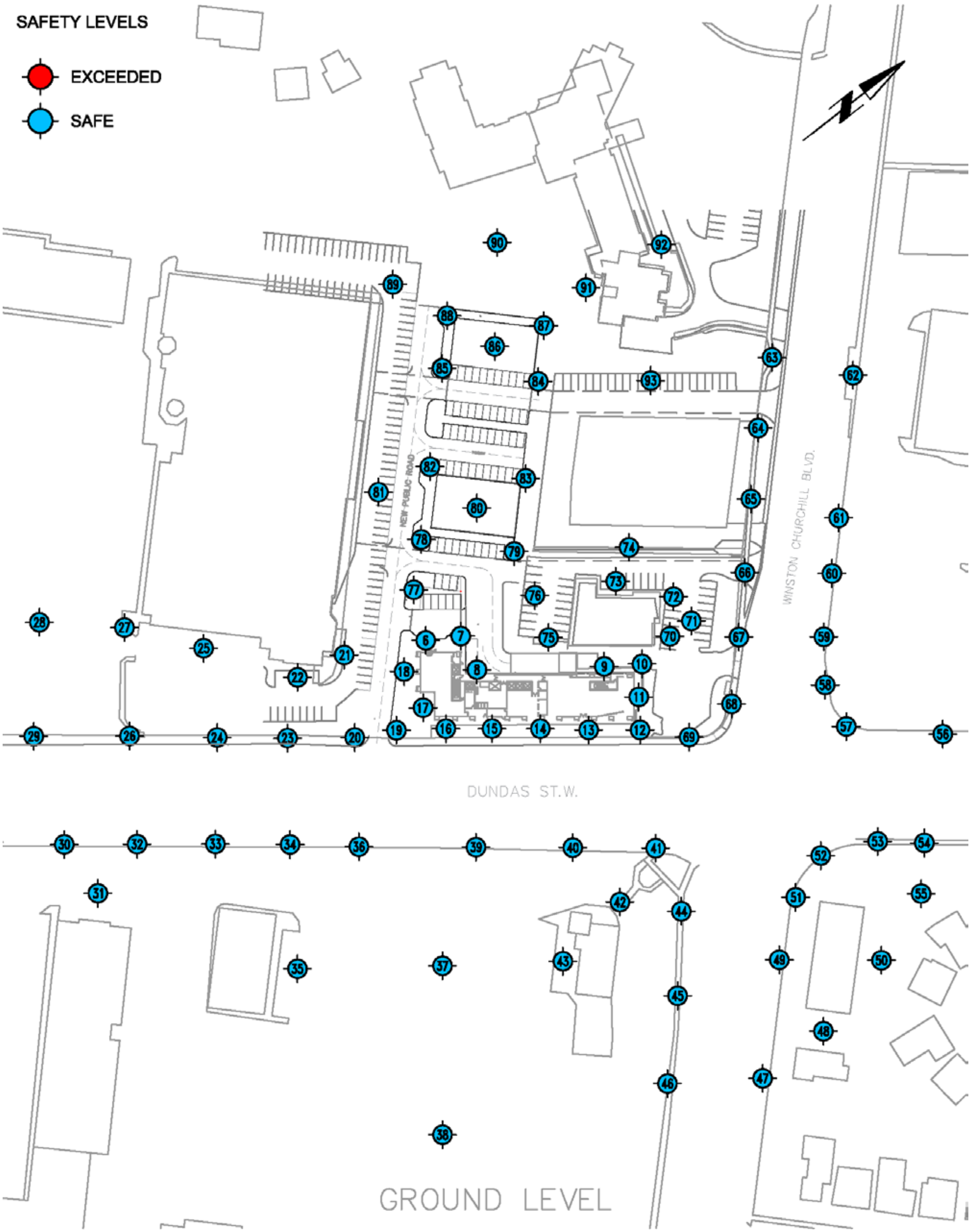


FIGURE 15b SUMMARY OF PREDICTED SAFETY LEVELS FOR PEDESTRIAN-LEVEL WIND SPEEDS – PROPOSED DEVELOPMENT

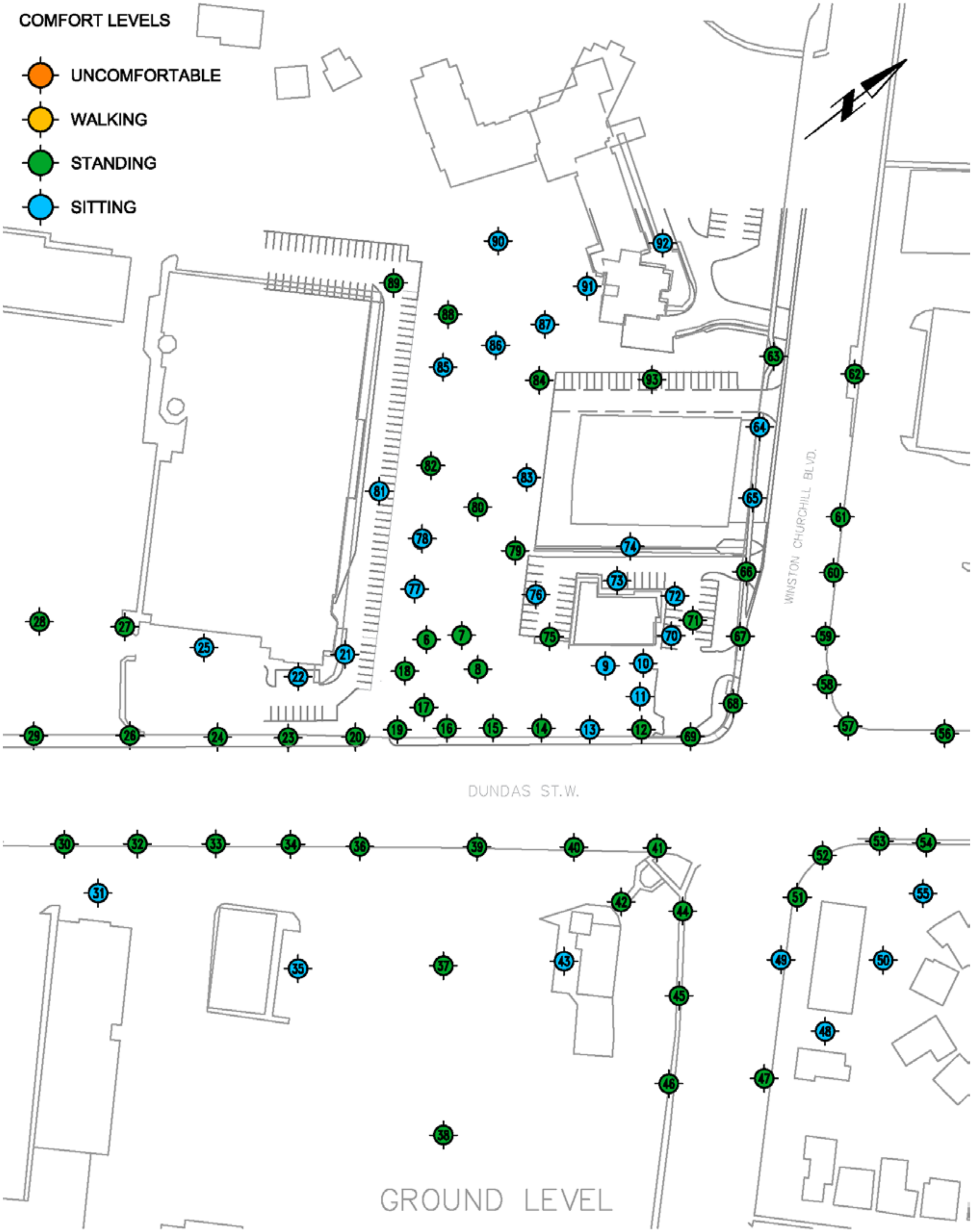
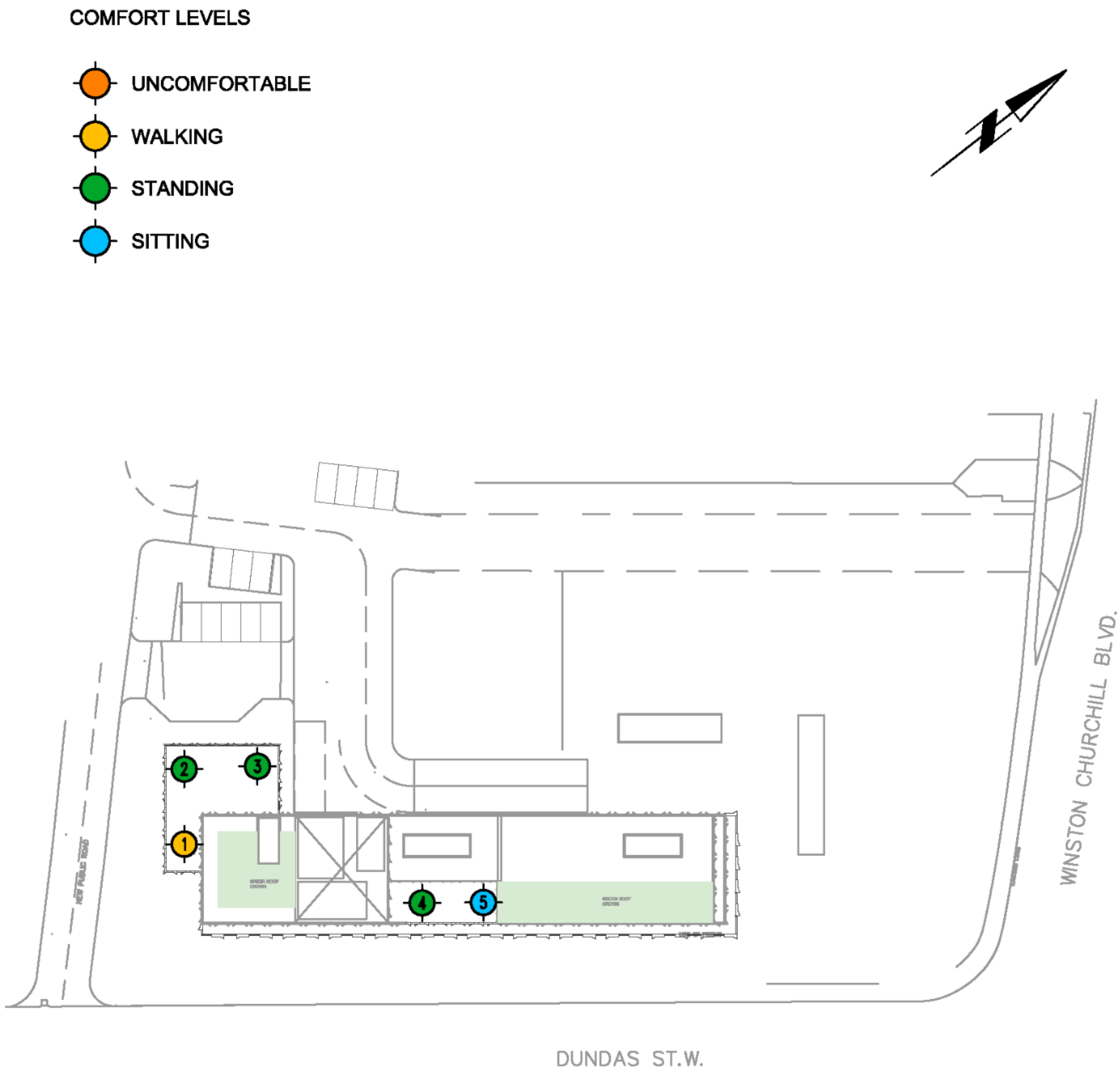


FIGURE 16 SUMMARY OF PREDICTED COMFORT LEVELS FOR PEDESTRIAN-LEVEL WIND SPEEDS – EXISTING SITE - SUMMER



AMENITY LEVELS

FIGURE 17a SUMMARY OF PREDICTED COMFORT LEVELS FOR PEDESTRIAN-LEVEL WIND SPEEDS – PROPOSED DEVELOPMENT - SUMMER

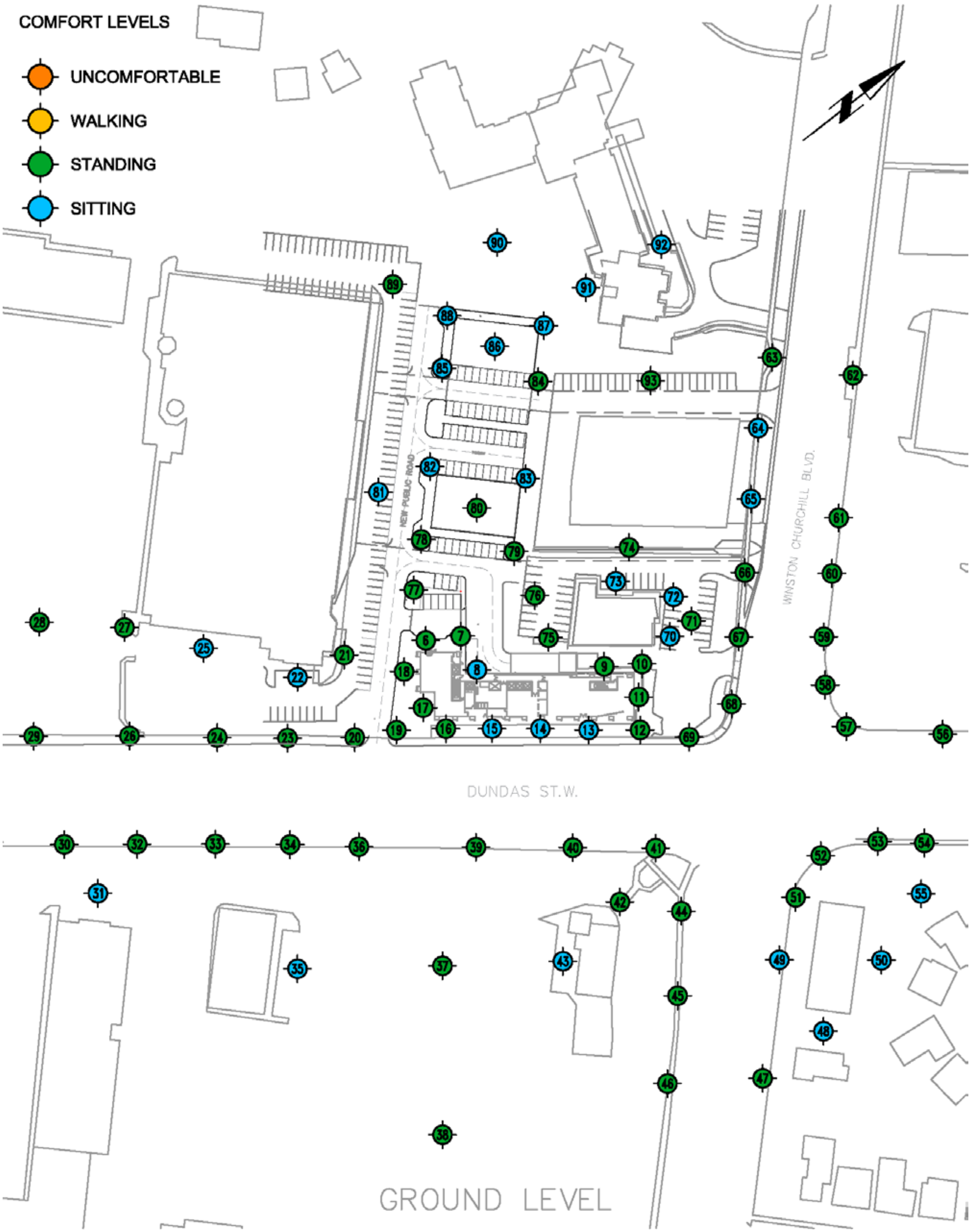


FIGURE 17b SUMMARY OF PREDICTED COMFORT LEVELS FOR PEDESTRIAN-LEVEL WIND SPEEDS – PROPOSED DEVELOPMENT - SUMMER

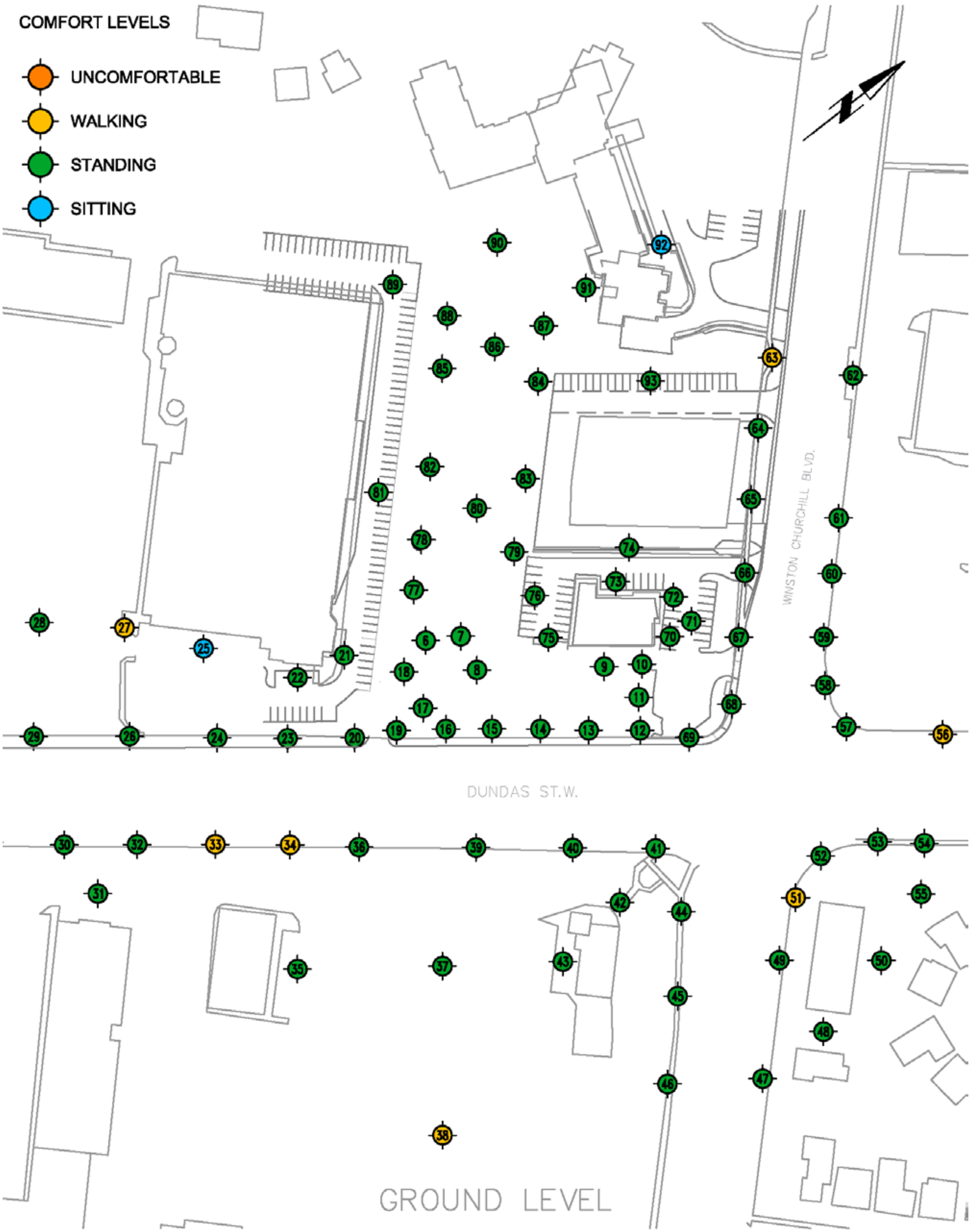
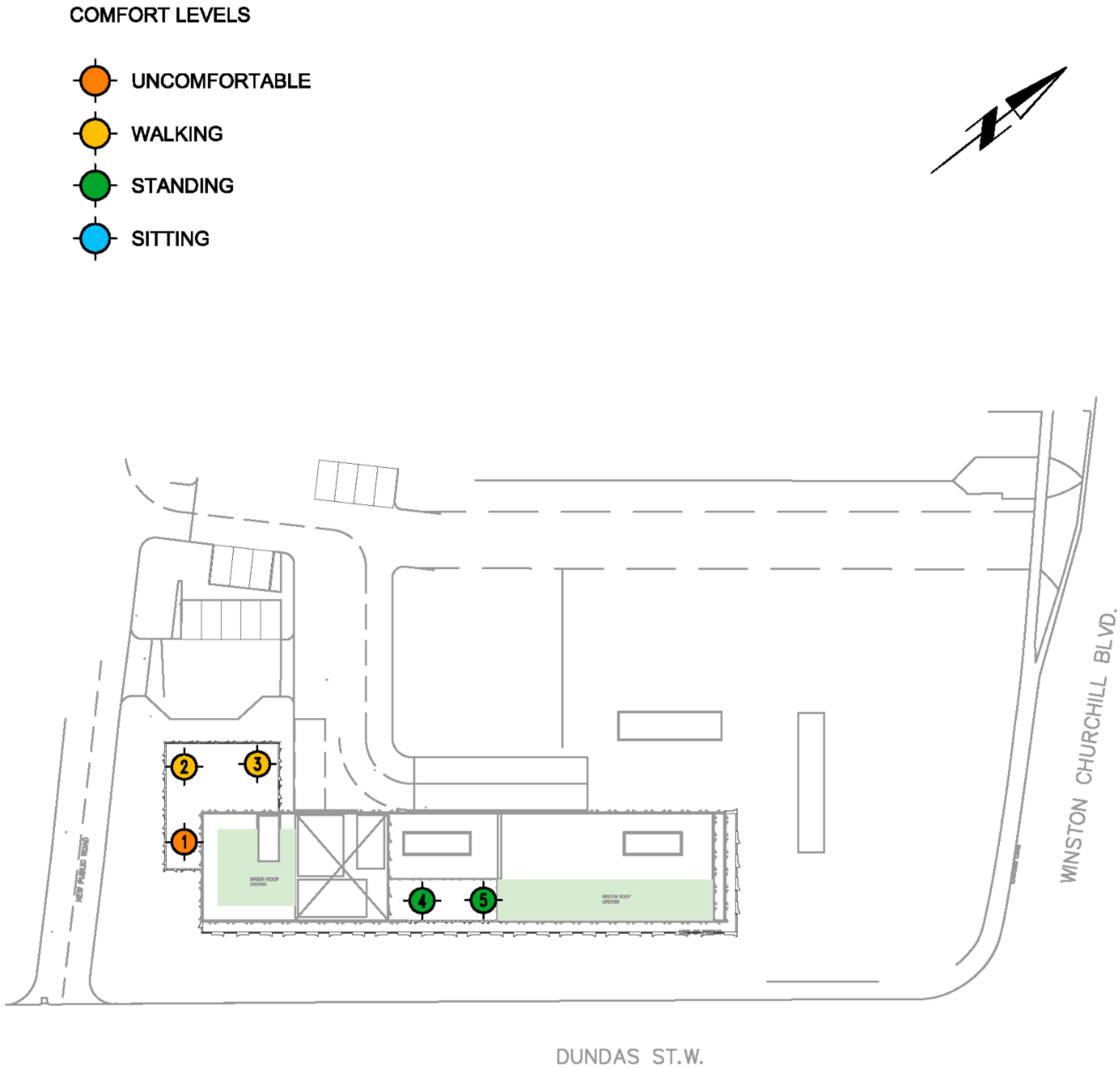


FIGURE 18 SUMMARY OF PREDICTED <u>COMFORT</u> LEVELS FOR PEDESTRIAN-LEVEL WIND SPEEDS – EXISTING SITE - WINTER



AMENITY LEVELS

FIGURE 19a SUMMARY OF PREDICTED COMFORT LEVELS FOR PEDESTRIAN-LEVEL WIND SPEEDS – PROPOSED DEVELOPMENT - WINTER

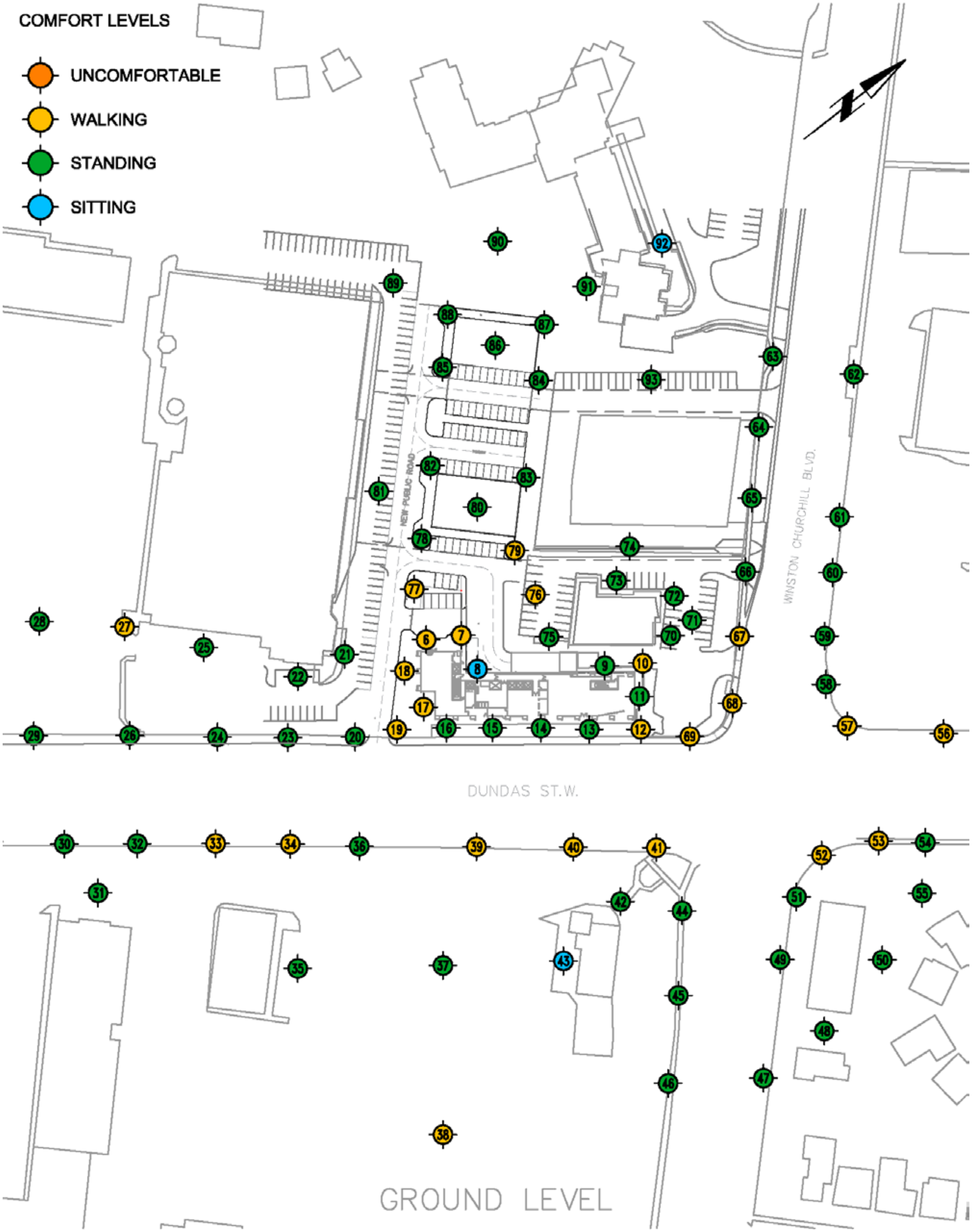


FIGURE 19b SUMMARY OF PREDICTED COMFORT LEVELS FOR PEDESTRIAN-LEVEL WIND SPEEDS – PROPOSED DEVELOPMENT - WINTER

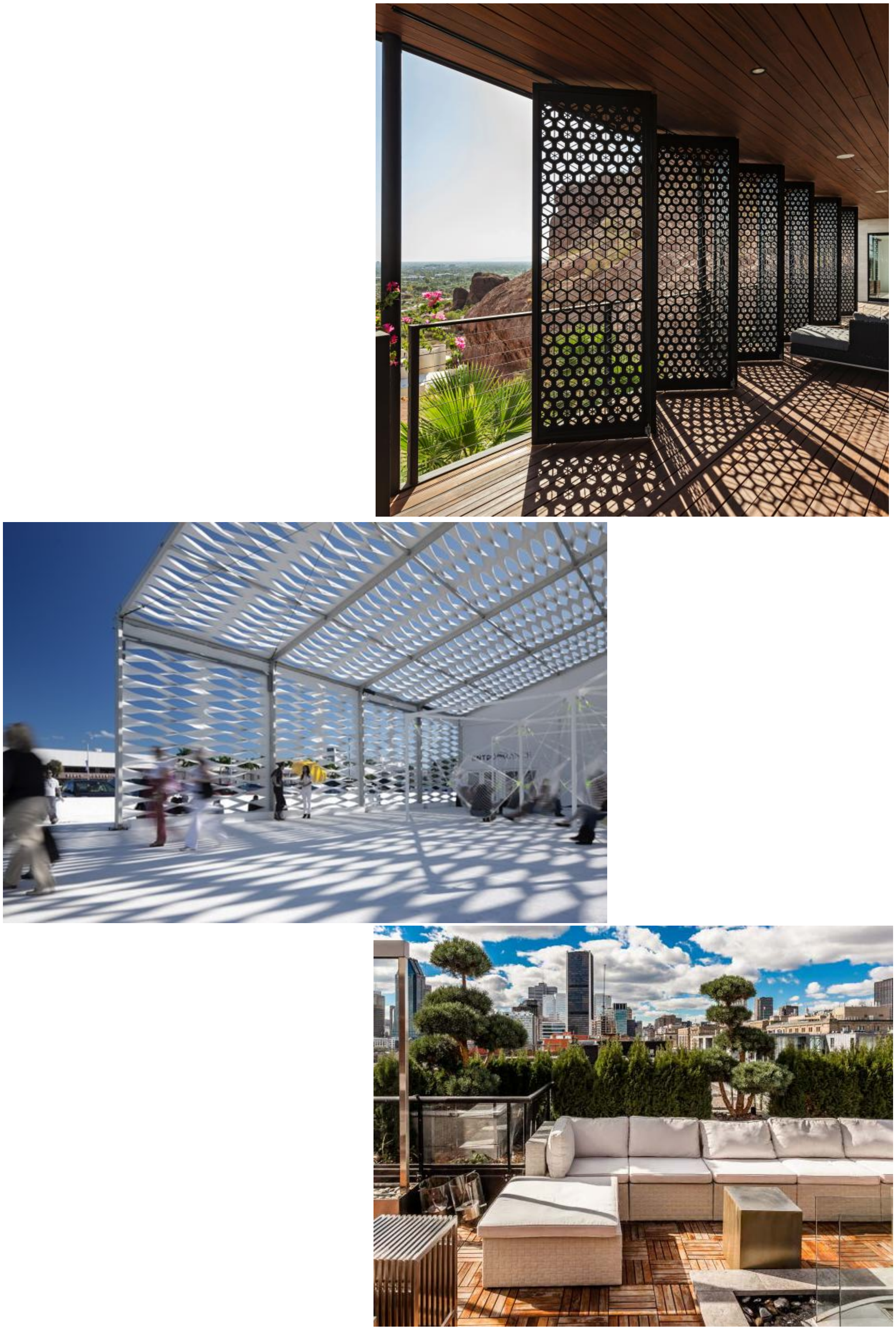


FIGURE 20 EXAMPLES OF VARIOUS MITIGATION OPTIONS FOR THE OUTDOOR AMENITY AREAS

APPENDIX A

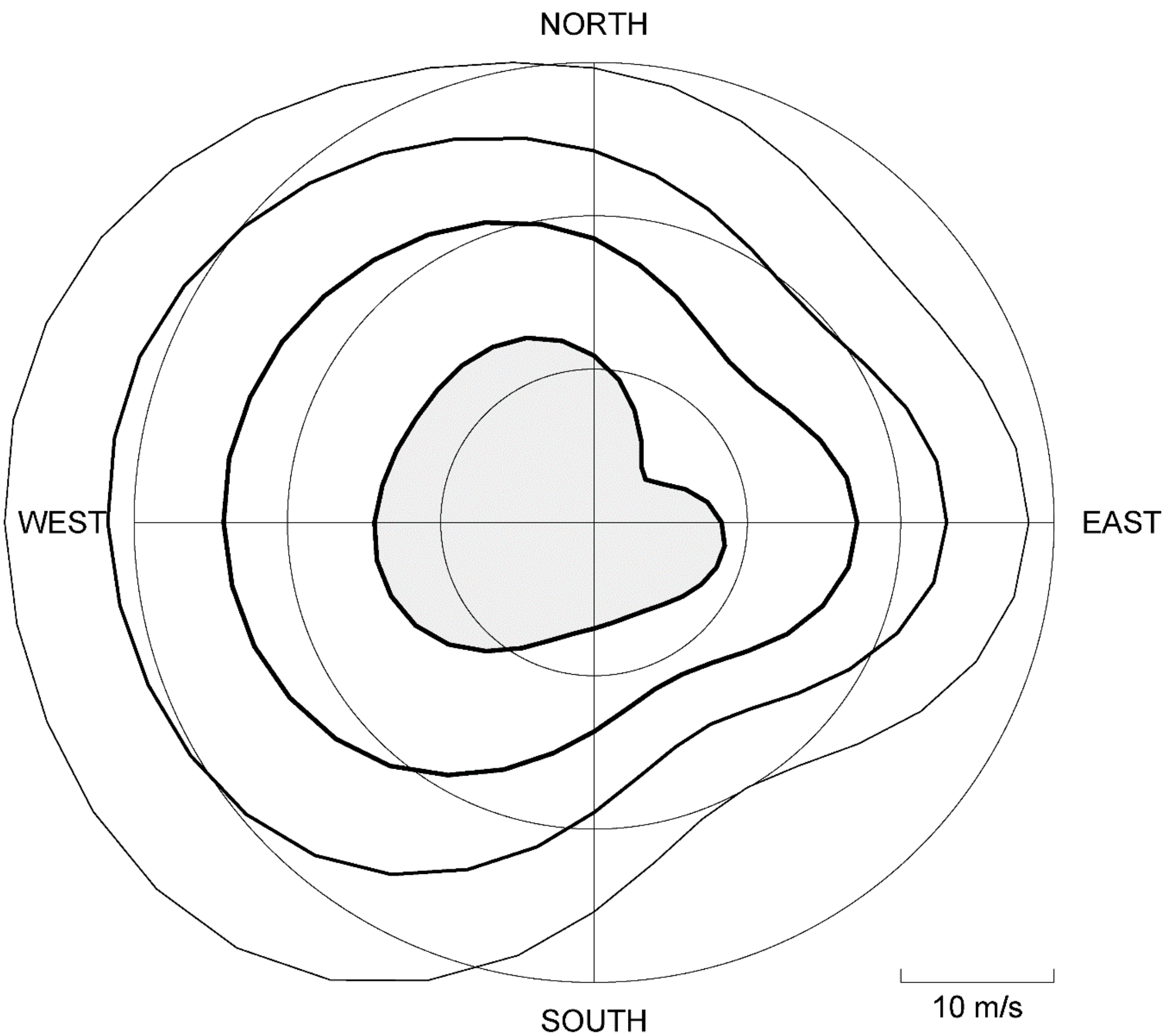
PROBABILITY DISTRIBUTIONS OF WIND SPEED AND DIRECTION

In the plots, the radial distance represents the wind speed at a reference height of 500 m in standard open country exposure. Contours are plotted for four probability levels: the innermost contour is for a probability level of 0.01 or 1% of the time. The other contours represent 0.1%, 0.01% and 0.001% of the time. Thus, the more-common winds are represented by the inner contours and the more-rare winds by the outer contours.

These plots have been derived using data at 16 compass directions, which were interpolated to every 10°. Thus, a point on the innermost contour would represent the wind speed that is exceeded 1% of the time within a 10° sector centred on that wind direction.

To determine the probability of exceeding a particular wind speed at a particular direction, interpolate between the contour levels. For example, to determine the probability of exceeding 20 m/s from the west, find the point on the plot corresponding to this speed and direction. In this case (for 20 m/s at 270°), the probability of exceeding 20 m/s from the west falls between the 1% and 0.1% contours and is approximately 0.35%.

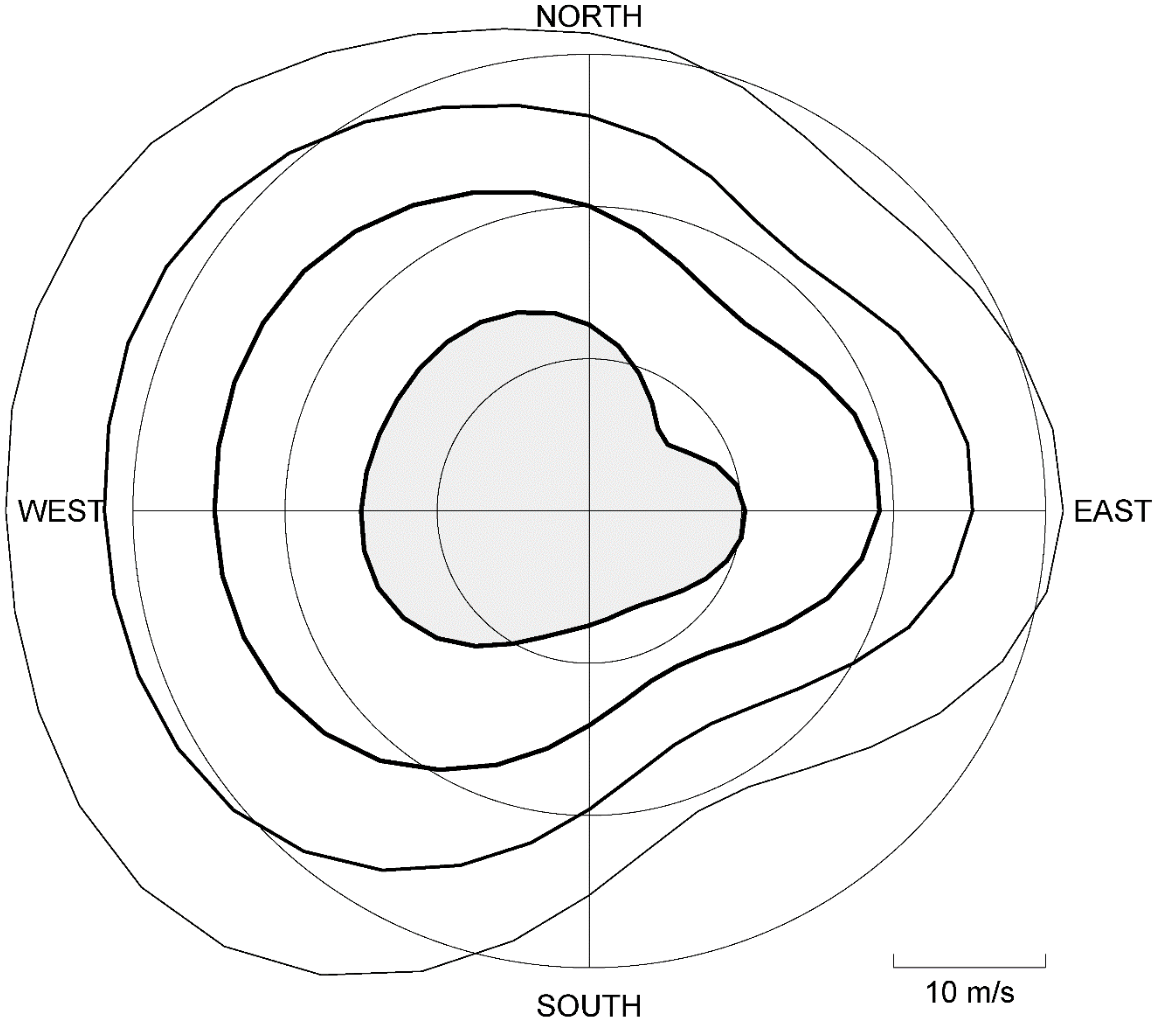
The probability of a particular wind speed being exceeded regardless of direction can be obtained by summing the probabilities of exceeding that wind speed at every 10° over the full 360° azimuth range.



ANNUAL

A point on the innermost contour represents the wind speed exceeded 1% of the time within a 10 degree sector centred on that direction. Other contours represent probability levels of: 0.1%, 0.01% and 0.001% respectively.

Mississauga, ON (Pearson) - Pedestrian Safety



ANNUAL

A point on the innermost contour represents the wind speed exceeded 1% of the time within a 10 degree sector centred on that direction. Other contours represent probability levels of: 0.1%, 0.01% and 0.001% respectively.

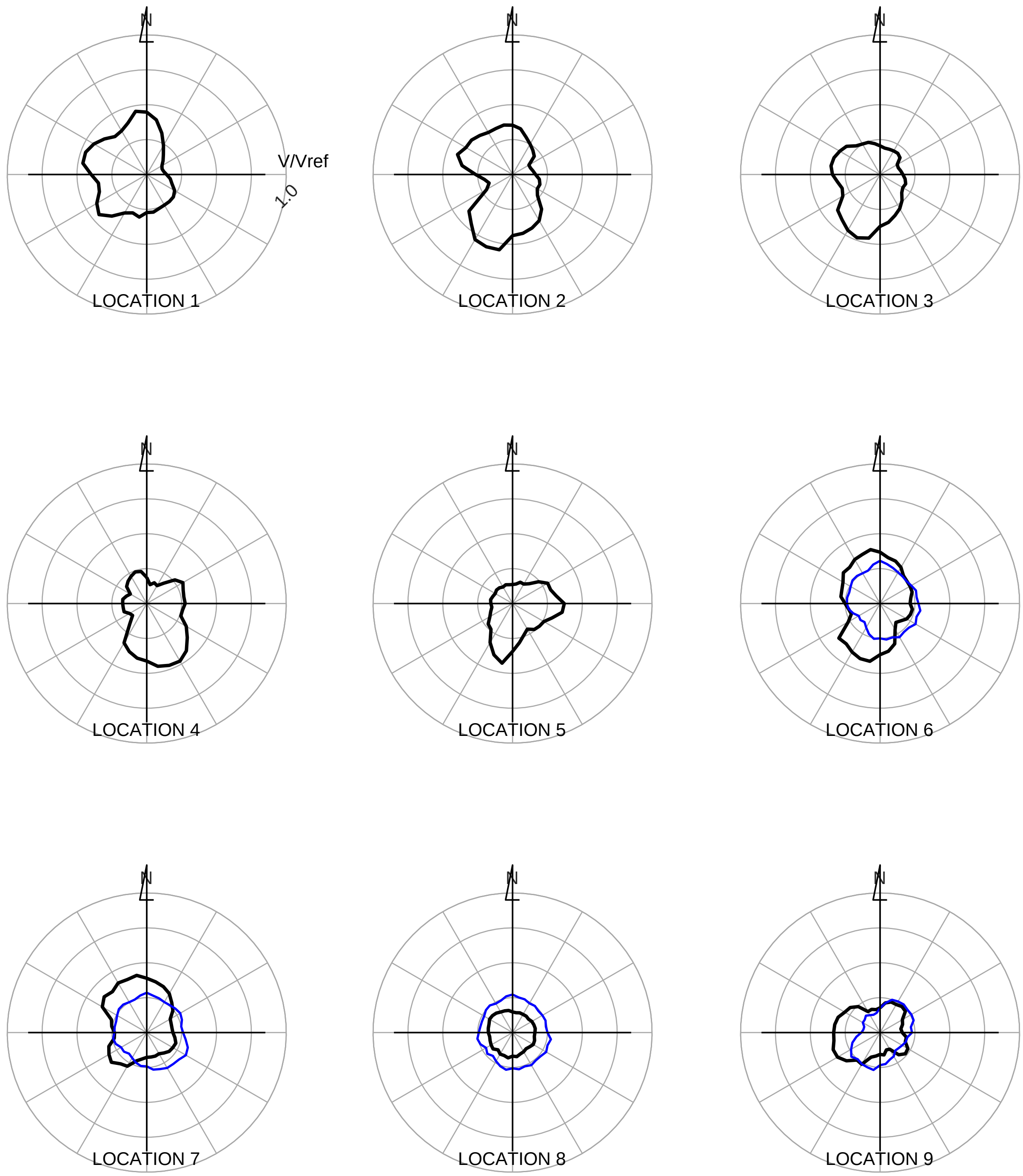
Mississauga, ON (Pearson) - Pedestrian Comfort

APPENDIX B

POLAR PLOTS OF SPEED COEFFICIENTS

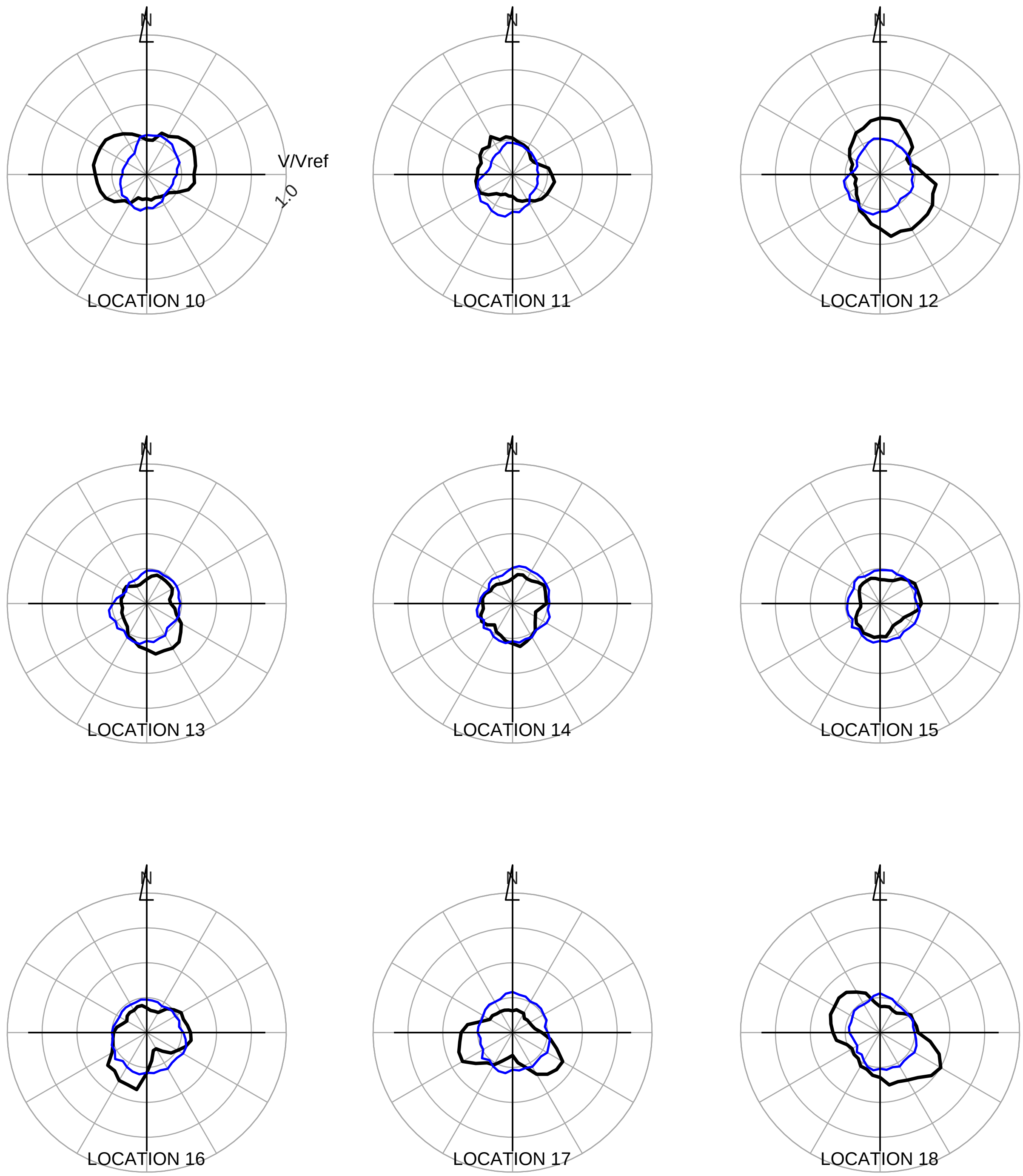
Speed ratios are the speed at the probe height divided by the speed at reference height (see Figure 3).

The azimuth indicated refers to the direction of the oncoming reference-height wind flow, measured from true North. Surface wind directions may vary considerably from these.



3033 Dundas St. W, Mississauga - Proposed Configuration DunPCplz/GEMean

3033 Dundas St. W, Mississauga - Existing Configuration DunECplz/GEMean



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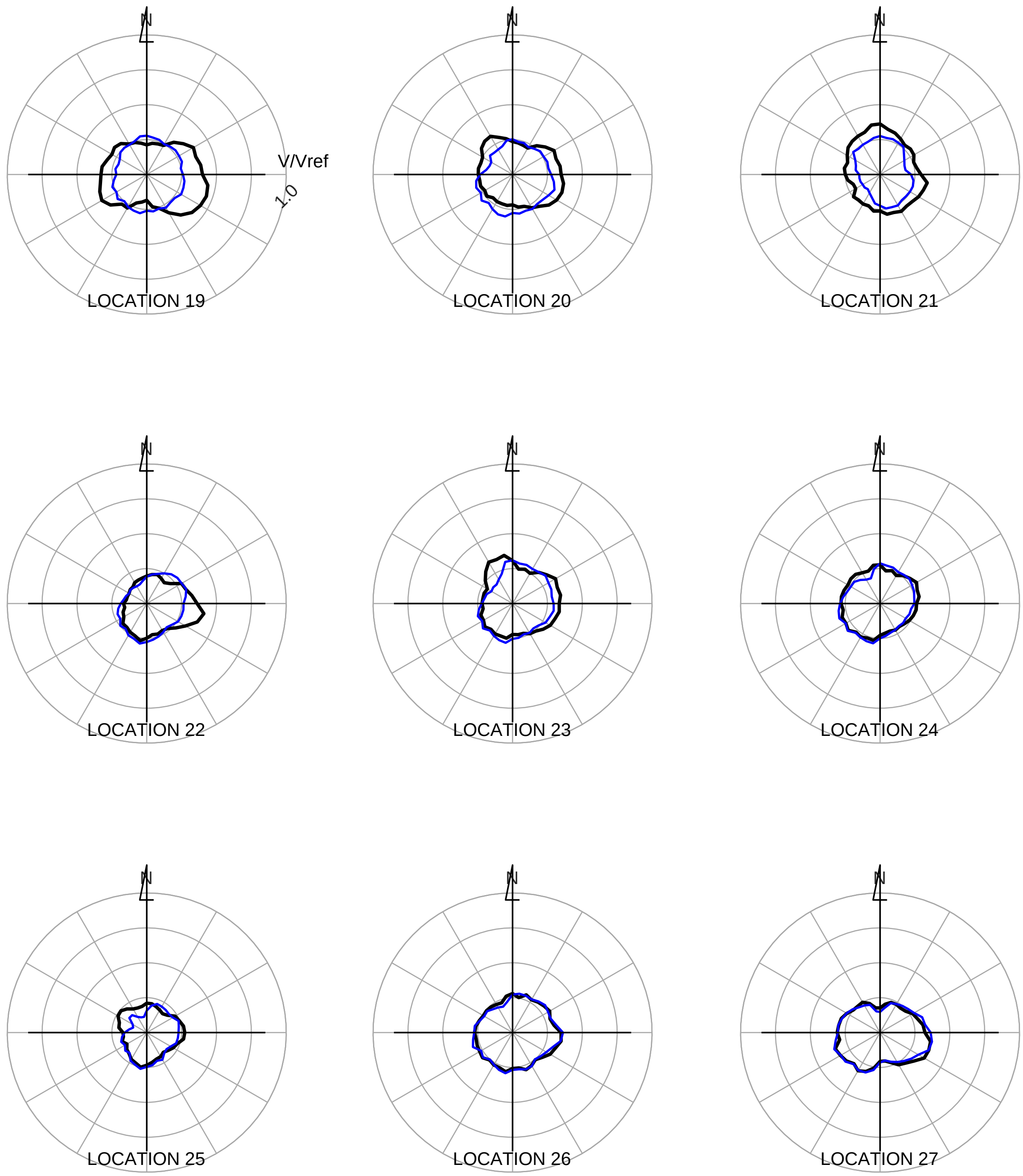
3033 Dundas St. W, Mississauga - Existing Configuration DunECplz/GEMean



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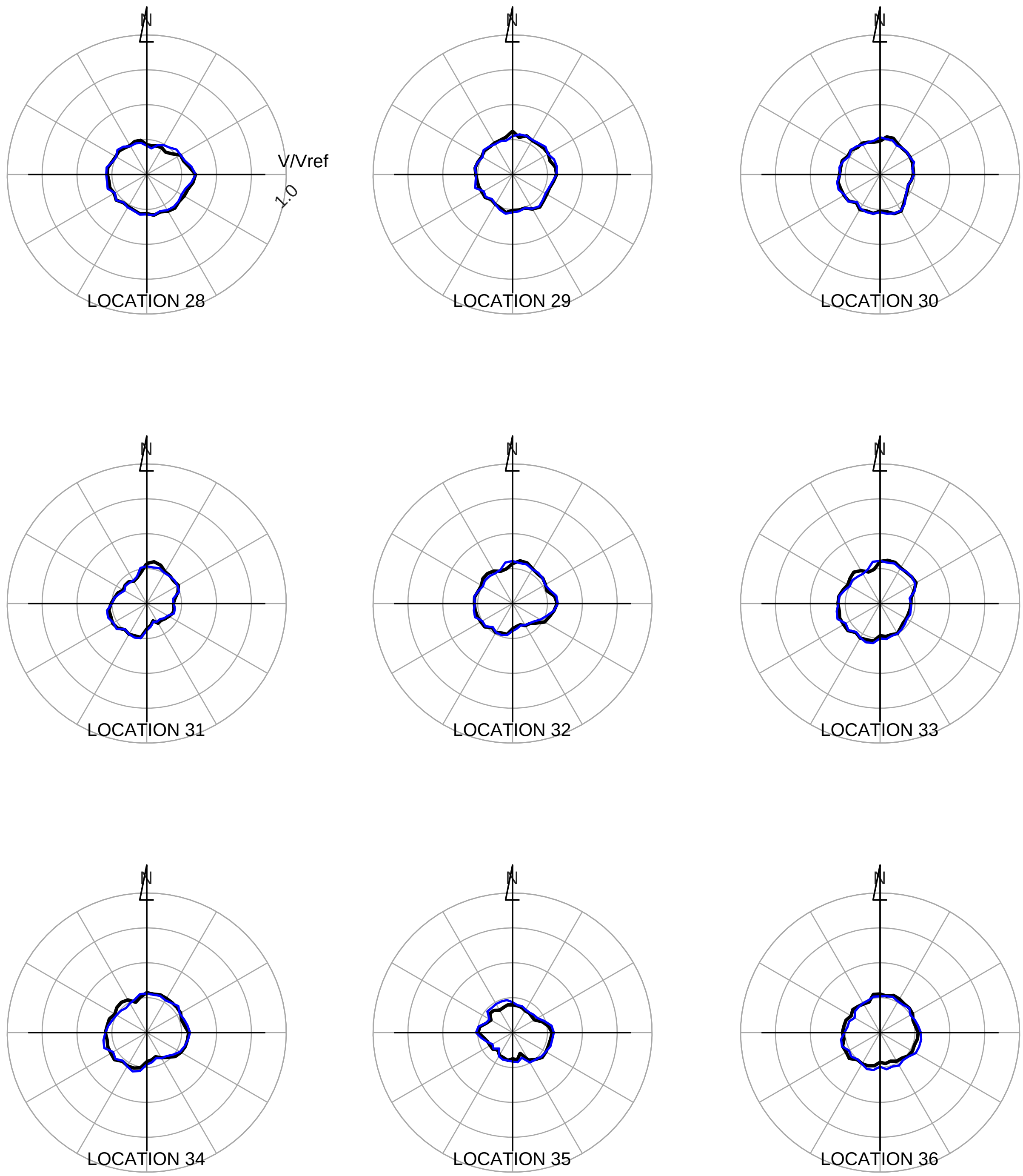
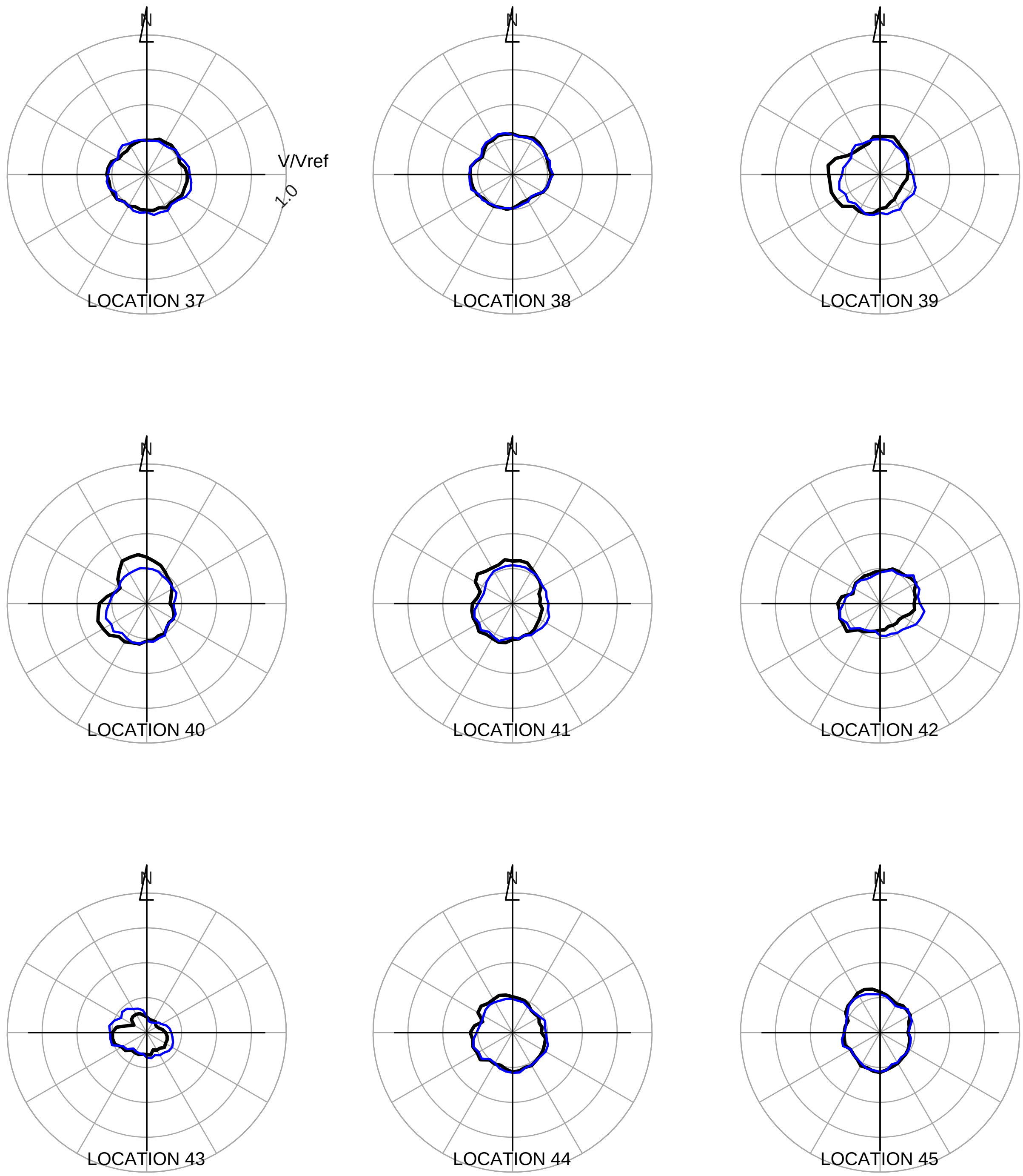
3033 Dundas St. W, Mississauga - Existing Configuration DunECplz/GEMean



3033 Dundas St. W, Mississauga - Proposed Configuration DunPCplz/GEMean

3033 Dundas St. W, Mississauga - Existing Configuration DunECplz/GEMean



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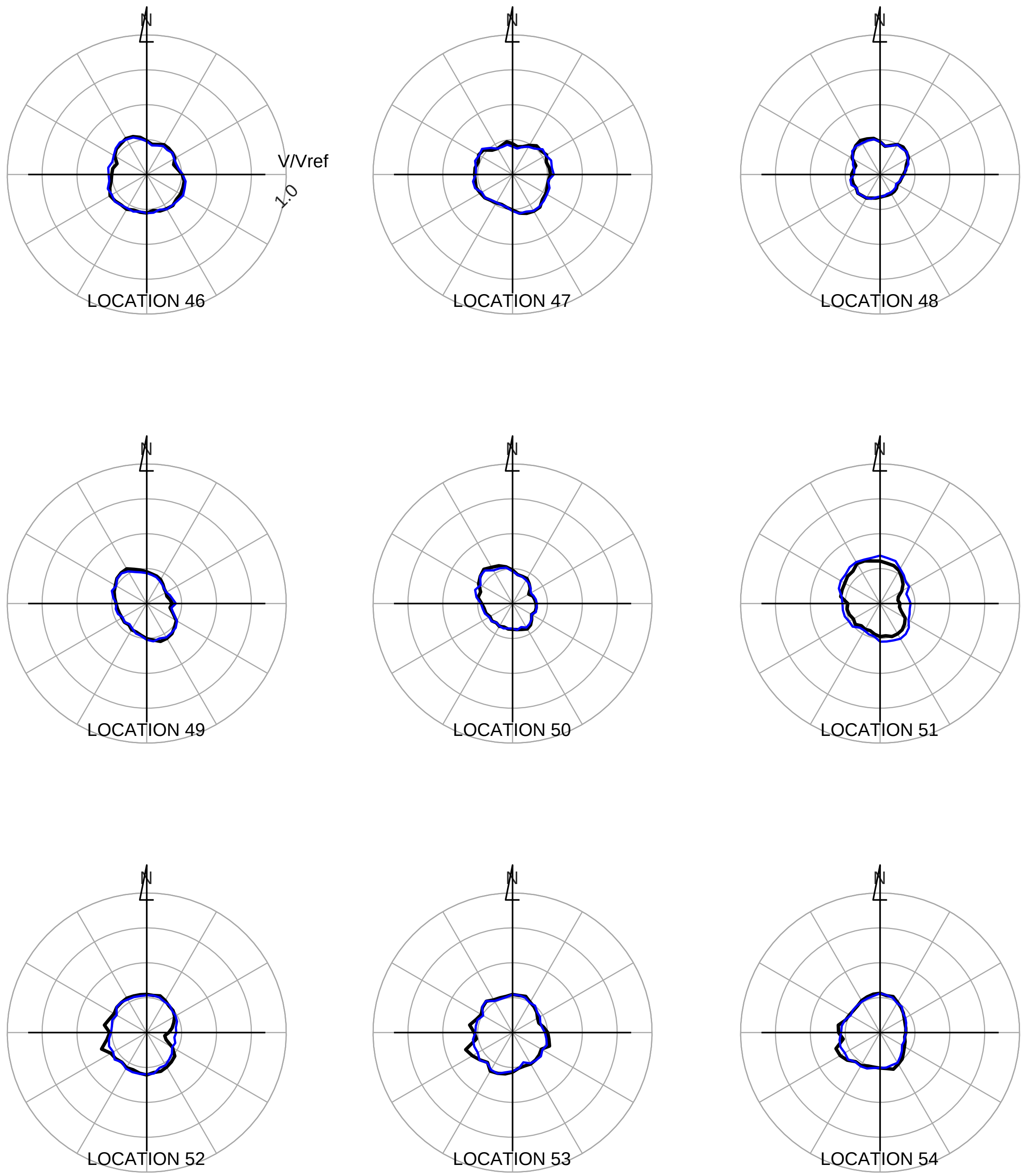
3033 Dundas St. W, Mississauga - Existing Configuration DunECplz/GEMean



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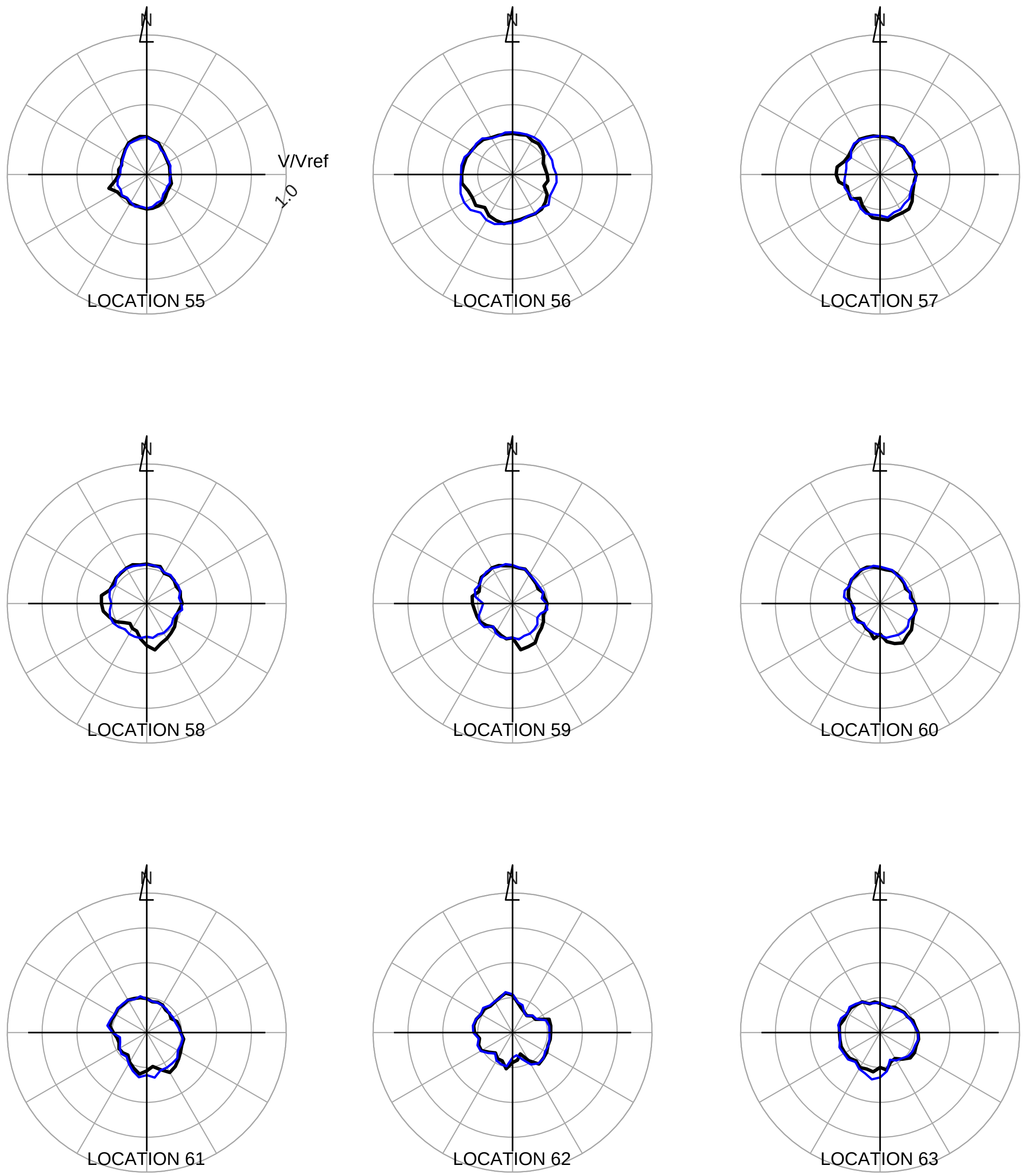
3033 Dundas St. W, Mississauga - Existing Configuration DunECplz/GEMean



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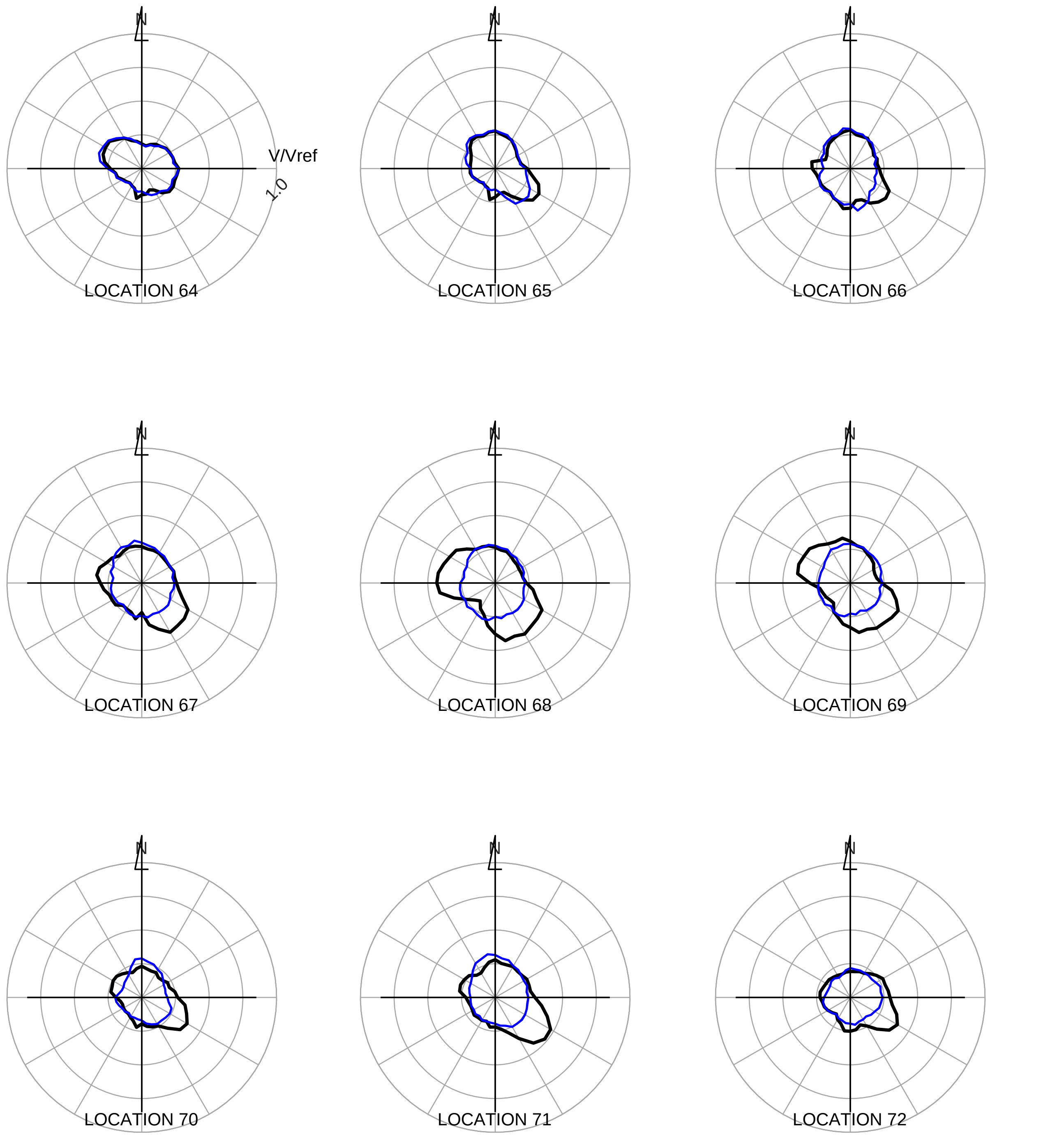

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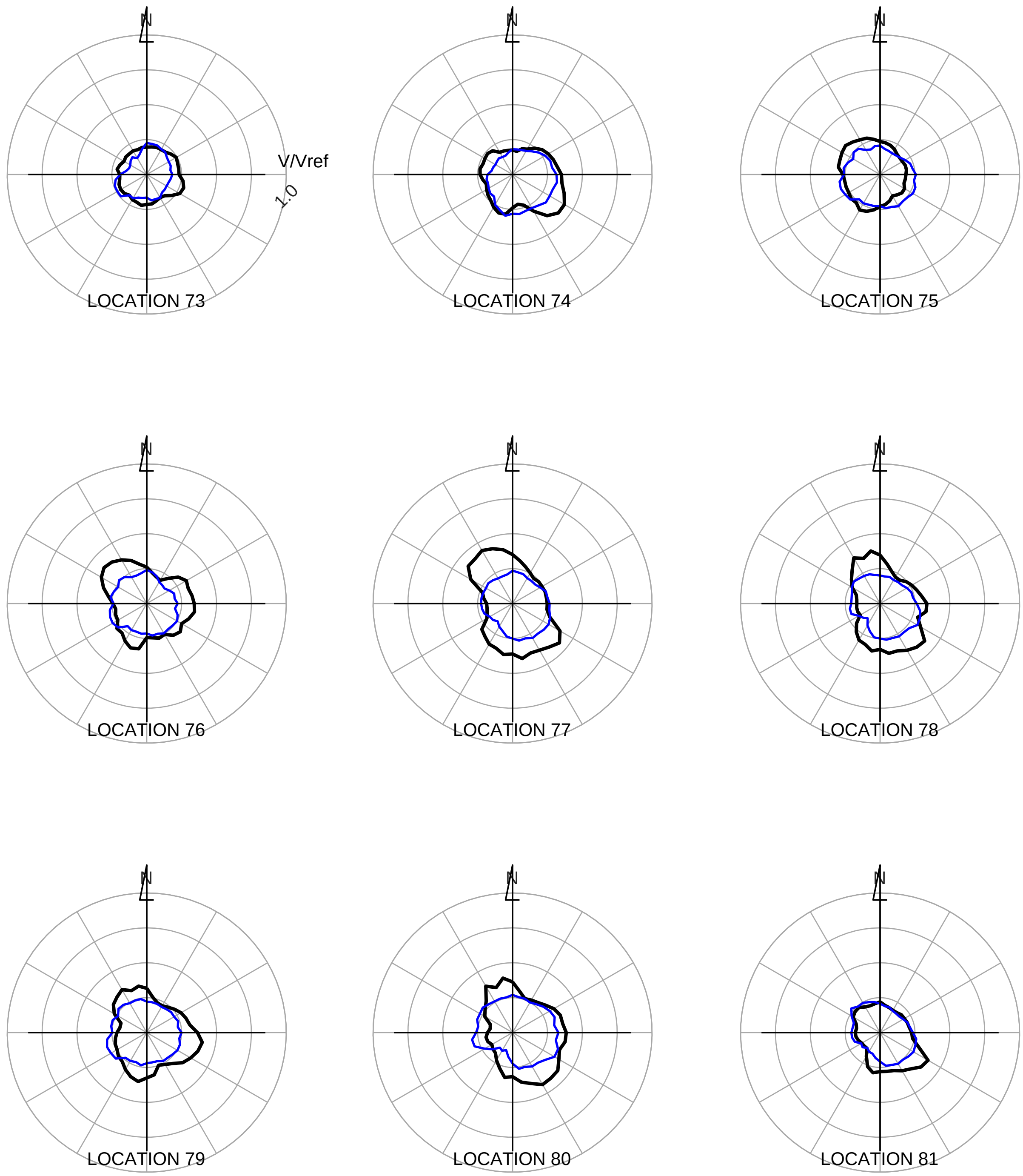

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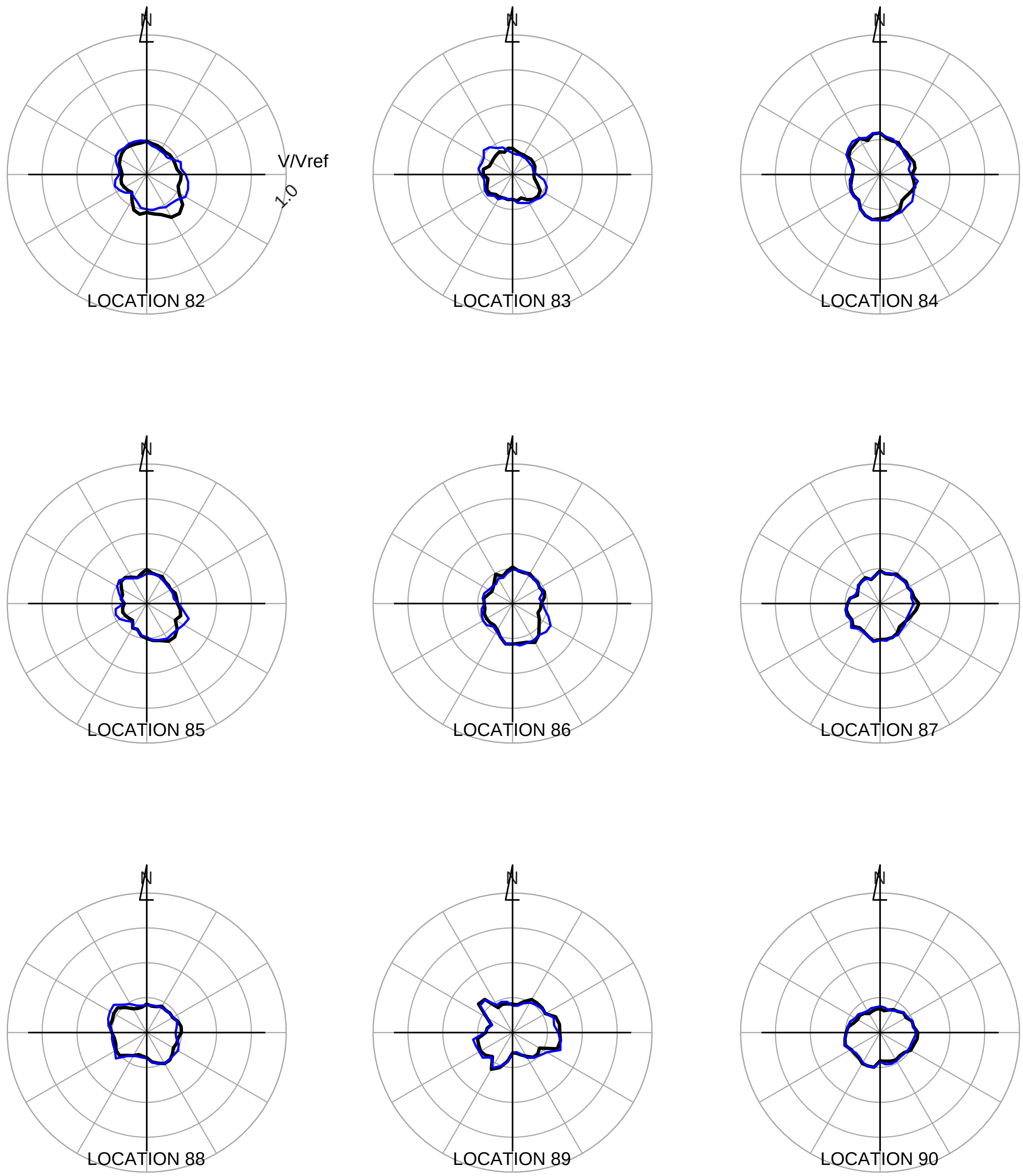

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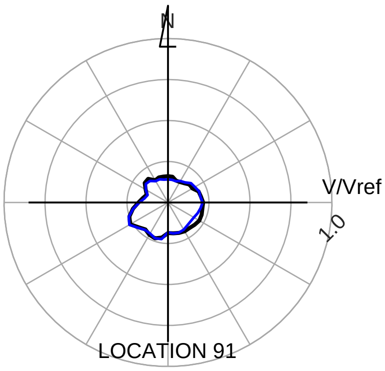

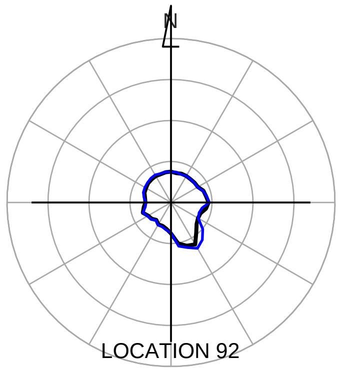

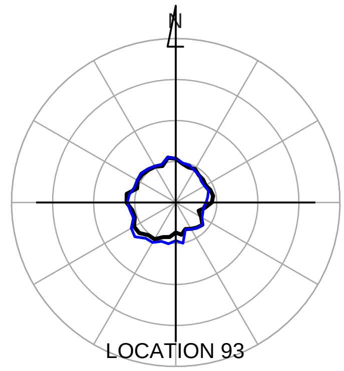

3033 Dundas St. W, Mississauga - Proposed Configuration DunPCplz/GEMean

3033 Dundas St. W, Mississauga - Existing Configuration DunECplz/GEMean