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- To: Hanseatic Holdings Limited 16 Esna Park Drive Suite 200 Markham, ON L3R 5X1
- Re: Pedestrian Wind Study 600-620 Lolita Gardens Mississauga, ON Novus Project #18-0333

#### Novus Team:

Jenny Vesely, P. Eng. Bill Waechter, C.E.T.





Senior Engineer Senior Microclimate Specialist

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# **1.0 INTRODUCTION**

Novus Environmental Inc. (Novus) was retained by Hanseatic Holdings Limited to conduct a pedestrian wind study for the proposed development at 600-620 Lolita Gardens in Mississauga, Ontario. This report is in connection with of the Official Plan Amendment/Zoning By-Law Amendment (OPA/ZBA) applications for the project.

#### **1.1 Existing Development**

The proposed development is located at the northwest corner of Dundas Street East and Cawthra Road. The site is currently occupied by two Lshaped residential buildings, 600 Lolita Gardens at 17-storeys and 620 Lolita Gardens at 21-storeys in height. These buildings will remain with the addition of the proposed building. **Figure 1** provides an aerial view of the immediate study area. A virtual site visit was conducted by Novus using Google Earth images dated September 2018 and images are included in **Figures 2a** through **2d**.

Immediately surrounding the proposed development is the Cawthra Gardens Long Term Care Residence to the southwest, Cedarbrae Park to the west, low-rise residential properties to the northwest and north, with low-rise commercial buildings to the northeast through east to south. Beyond the immediate surroundings are low-rise residential properties to the southwest through north to northeast, and low-rise commercial properties to the east through south.

Typically, developments currently under construction and Site Plan Approval (SPA) approved developments in the surrounding 500m radius are included as part of the existing surroundings. For this particular project, no such developments were identified.



Figure 1: Aerial view of existing surroundings Credit: Google Earth<sup>™</sup> dated May 7, 2018





Figure 2a: Existing site, looking southeast from Lolita Gardens



Figure 2b: Existing site, looking west from Cawthra Road



Figure 2c: Cawthra Gardens Long Term Care Residence, looking south from Lolita Gardens



Figure 2d: Cedarbrae Park, looking east



#### **1.2 Proposed Development**

The proposed residential building is 25-storeys, for a total height of approximately 83m to the top of the mechanical penthouse. The building is L-shaped, with a footprint of approximately 48m by 32m. The main entrance is located on the north façade (referencing true north), with secondary entrances and/or exits on the west, south and east facades. A model of the proposed development is shown **Figure 3**.

#### **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 amenity spaces. There are several transit stops along Cawthra Road and Dundas Street East. There are also various walkways in some areas around the proposed and existing buildings. An existing playground west of 600 Lolita Gardens was relocated to the west of the proposed building. The areas of interest from a pedestrian wind perspective for building access are highlighted on the site plan in **Figure 4**. Additional outdoor amenity spaces at grade-level are discussed in **Section 5.0**.



Figure 3: Model of proposed development







Figure 4: Areas of interest (building access)



# 2.0 APPROACH

The objective of the wind tunnel study is to assist the design team and City Planning officials in making informed decisions about the building form considered and its influence on pedestrian comfort. This quantitative analysis involves the construction of a physical model of the development and surrounding features that influence wind flow. The physical model is instrumented with probes and tested in a wind tunnel. Afterwards, the wind tunnel data are combined with regional meteorological data; this analysis is then compared to the relevant wind criteria and standards in order to determine how appropriate the wind conditions on site are for the intended pedestrian usage.

#### 2.1 Scale Model Construction

A 1:400 scale model of the 600-620 Lolita Gardens Development was constructed based on drawing information received by Novus on February 26, 2019, and a revised site plan dated June 10, 2019.

The proximity model of the surrounding area was built in block form for a radius of approximately 480m from the site centre. As existing buildings surrounding the site will influence wind characteristics, existing buildings, those under construction and approved buildings (i.e., developments having an approved Site Plan in the past five years) were included in the model for both the Existing and Proposed Configurations. For this particular project, no such developments were identified. Although the grade difference across the study area is approximately 12m, this slope (approximately 2.5%) is minor and nowhere is the change in terrain abrupt. Thus, the site was modelled as flat.

Following an initial set of tests with the proposed development in place, existing on-site conifers and wind mitigation features (including conifers, porous wind screens, and Columnar English Oak trees) were added to the model to enhance wind comfort. In no instances were proposed trees placed in areas where wind conditions did not meet the safety criterion. These wind mitigation features were included in the Proposed Configuration; and are shown in the landscape plan dated June 10, 2019.

Photographs of the wind tunnel model showing both the Existing and Proposed Configurations are included in **Figures 5a** and **5b**.

#### 2.2 Wind Tunnel

Wind tunnel tests were conducted in the Alan G. Davenport Wind Engineering Group Boundary-Layer Wind Tunnel Laboratory at the University of Western Ontario. The upstream test section of the wind tunnel included generic roughness blocks and turbulence-generating spires to modify the wind flow approaching the model. These features develop characteristics of the wind flow that are similar to the actual site. The test model is rotated on a turn-table to simulate different wind directions with the upstream terrain being changed as appropriate to reflect the various upwind conditions encountered around the site.

The test model was equipped with 93 omni-directional probes to record wind speed at the pedestrian-level (approximately 1.5m above grade). The model orientation was rotated in 10° intervals on the turn-table to permit measurement of wind speed at each probe for 36 wind directions. The wind tunnel data were then combined with the wind climate model for this region to predict the occurrence of wind speeds in the pedestrian realm and compare against wind criteria for comfort and safety.



#### 600-620 Lolita Gardens Mississauga, ON







#### Figure 5a: Existing Configuration







These images are examples of landscape concepts tested to achieve the final Proposed Configuration, as per the landscape plan of June 10, 2019.



#### Figure 5b: Proposed Configuration



#### 2.3 Wind Climate

Wind data recorded at Pearson International Airport in Toronto for the period of 1986-2015 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 northerly through westerly directions 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 northwesterly and westerly sectors. All wind speeds and directions were included in the wind climate model.

The seasonal wind roses show daytime hours only from 6:00am to 11:00pm, while the annual wind rose shows all hours.



Figure 6: Wind roses for Toronto Pearson International Airport (1986-2015)



## **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 criteria utilized for this analysis is provided by the City of Mississauga, in the document *Urban Design Terms of Reference – Pedestrian Wind Comfort and Safety Studies* (June 2014). The comfort criteria, which is based on certain predicted hourly gust-equivalent mean (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 comfort able 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) assuming a 24 hour day. When more than one event is predicted annually, wind mitigation measures are then advised. The wind safety criterion is shown in **Table 2**.

Activity	Comfort Ranges for GEM Wind Speed Exceeded 20% of the Time		Description of Wind Effects			
Sitting	0 to 10 km/h	0 to 2.8 m/s	Calm or light breezes desired for outdoor restaurants and seating areas where one can read a paper without having it blown away.			
Standing	0 to 15 km/h	0 to 4.2 m/s	Gentle breezes suitable for main building entrances and bus stops.			
Walking	0 to 20 km/h	0 to 5.6 m/s	Relatively high speeds that can be tolerated if one's objective is to walk, run or cycle without lingering.			
Uncomfortable	> 20 km/h	> 5.6 m/s	Strong winds of this magnitude are considered a nuisance for most activities, and wind mitigation is typically recommended.			

#### **Table 2: Wind Safety Criterion**

Table 1: Wind Comfort Criteria

Activity	Safety Criterion Gust Wind Speed Exceeded Once Per Year (0.1%)		Description of Wind Effects
Any	90 km/h	25 m/s	Excessive gust speeds that can adversely affect a pedestrian's balance and footing. Wind mitigation is typically required.



# 4.0 **RESULTS**

Results are presented through discussion of the wind conditions on the site, and along nearby major streets. Note the comfort criterion are based on wind force alone, thus climate issues that influence a person's overall "thermal" comfort (e.g., temperature, humidity, wind chill, shade, etc.) are not considered in this analysis. The results for the summer and winter seasons are displayed on plans. Full detailed results for the summer and winter can be found in **Appendix A**, while results for wind safety are provided in **Appendix B**. Note that project north is approximately 50 degrees from true north. Wind directions are referenced to true north, while building and site locations are discussed in reference to project north.

There are generally accepted wind comfort levels that are desired for various pedestrian uses. For example, for public sidewalks, wind comfort suitable for **walking** would be desirable year-round. For main entrances and transit stops, wind conditions conducive to **standing** would be preferred throughout the year, but can be difficult to achieve in regions where winter winds are inherently harsh. For amenity spaces, wind conditions suitable for **sitting** and/or **standing** are generally desirable during the summer months. The most stringent category of **sitting** is considered appropriate for cafes and dedicated seating areas, while for public parks **sitting** and/or **standing** would be appropriate in the summer. The numerous deciduous trees both on-site and off were not included on the model, thus the summer comfort levels in a majority of areas will be better than those presented.

Overall, the wind conditions with the proposed development in place are generally suitable for the intended usage. The exception is in a nondesignated pedestrian area immediately north of 620 Lolita Gardens.

# 4.1 Proposed Building Entrances & Walkways (Locations 1–10 & 90)

In the Existing Configuration, wind conditions in the area of he proposed building are comfortable for walking or better throughout the year (**Figures 7a** and **7b**, **Appendix A**).

In the Proposed Configuration, wind conditions at the main entrance are comfortable for standing in the summer and winter (Location 2, **Figures 7a** and **7b**). There is a canopy above this entrance, as well as a 50% porous wind screen along the north edge of the canopy, that extends from grade to the underside of the canopy. Wind conditions at the drop-off area (Location 90) are suitable for sitting in the summer and standing in the winter.

Wind conditions at the entrance sidewalk to the relocated play area, are suitable for standing throughout the year (Location 1).

In the general vicinity of exits (Locations 4, 7 and 8), summer winds are comfortable for sitting or standing, and winter winds are comfortable for walking or better.

On the walkways surrounding the proposed building, wind conditions are comfortable for walking or better throughout the year, which includes the sidewalk on the east side of the driveway (Locations 9 and 10).





Figure 7a: Wind Conditions at Proposed Site – Summer





## 4.2 Building Entrances & Walkways – 620 Lolita Gardens (Locations 11–24)

The main entrance to 620 Lolita Gardens was relocated to the inset building corner (Location 22), is covered with a canopy and includes a full height wind screen along a portion of the south side of the canopy. Wind conditions at this new entrance location are comfortable for sitting throughout the year in the Proposed Configuration (**Figures 8a** and **8b**). The entrance was previously at Location 23 where uncomfortable winds occur in the Existing Configuration. Location 23 is now a drop-off where winds are suitable standing in the summer and walking in the winter.

Existing wind conditions around 620 Lolita Gardens are generally comfortable for walking or better year-round. The exceptions are at the northwest, northeast and southwest corners where wind conditions are uncomfortable in the winter (Locations 12, 16, 21 and 23, **Figure 8b**). In the Proposed Configuration, wind conditions improve in three of these areas; however, wind conditions remain uncomfortable in the winter at the northwest corner (Location 12). This is not a designated pedestrian use area. However, if desired at the time of site plan approval, a 1.5m tall by 4m long dense hedgerow could be proposed from the building's northwest corner and following westward along the northern edge of the underground parking structure. This would provide local wind protection.

Wind conditions at the northern end of the traffic island (Locations 11) are suitable for walking throughout the year for both the Existing and Proposed Configurations.

On the remain walkways around 620 Lolita Gardens, summer and winter wind conditions are comfortable for walking or better throughout the year.

## 4.3 Building Entrances & Walkways – 600 Lolita Gardens (Locations 25–33 & 89)

In the Existing Configuration, wind conditions at the main entrance to 600 Lolita Gardens (Location 25) are considered uncomfortable throughout the year (**Figures 8a** and **8b**). The safety criterion is also exceeded at this location in the Existing Configuration (**Appendix B**). On the walkways surrounding the existing building and in the nearby parking lot, wind conditions are comfortable for walking or better throughout the year.

In the Proposed Configuration, the main entrance to 600 Lolita Gardens was moved from the north facade to the inset building corner, and is covered with a canopy. Wind conditions in the entrance area improved to be suitable for standing in the summer and walking during the winter (**Figures 8a** and **8b**). In addition, the safety criterion is no longer exceeded at this location in the Proposed Configuration (Location 25). Wind conditions at the remaining exits and walkways around the building are comfortable for walking or better throughout the year.





Figure 8a: Wind Conditions at Existing Buildings – Summer

Figure 8b: Wind Conditions at Existing Buildings – Winter



#### 4.4 Adjacent Buildings (Locations 34-46 & 88)

At the main entrance to the Cawthra Gardens Long Term Care Residence (Location 37), wind conditions are comfortable for standing or better throughout the year in the Existing Configuration (**Figures 9a** and **9b**, **Appendix A**). At the entrance to the adjacent condominiums (Location 43), wind conditions are comfortable for standing throughout the year. On the walkways surrounding both buildings, wind conditions are comfortable for walking or better throughout the year.

In the Proposed Configuration, wind conditions at the entrances to both the Cawthra Gardens Long Term Care Residence and the adjacent condominium building are comfortable for standing throughout the year (**Figures 9a** and 9**b**). In other areas around both buildings, wind conditions remain comfortable for walking or better throughout the year.

Note, the results presented for Location 88 in the Proposed Configuration are without landscaping in place (from a previous test) due to technical issues in the final test. Similar or improved results are expected with the landscaping in place.

#### 4.5 Surrounding Sidewalks (Locations 47-87)

On the surrounding sidewalks of Lolita Gardens, Dundas Street East and Cawthra Road, wind conditions in the Existing Configuration are comfortable for walking or better throughout the year (**Figures 10a** and **10b Appendix A**). At the transit stops on the south side of Dundas Street East (Location 75) and on the west side of Cawthra Road (Location 81) wind conditions are comfortable for standing in the summer and walking in the winter.

In the Proposed Configuration, wind conditions remain comfortable for walking or better year-round on the surrounding sidewalks (**Figures 10a** and **10b**). At the two nearby transit stops, wind conditions are suitable standing in the summer and walking (Location 75) or standing (Location 81) in the winter season.

These wind conditions are appropriate for the intended usage.





Figure 9a: Wind Conditions around adjacent buildings – Summer



Figure 9b: Wind Conditions around adjacent buildings -

Winter



Figure 10a: Wind Conditions on surrounding sidewalks – Summer

Winter

#### 4.6 Wind Safety

In the Existing Configuration, the wind safety criterion is exceeded at the northeast corner of the 600 Lolita Gardens, where the main entrance is located (Location 25, **Figure 11**). In the Proposed Configuration, the conditions are improved, and the wind safety criterion is no longer exceeded.



🔅 Existing Configuration





### 5.0 UPDATED SITE PLAN

The site plan received by Novus on June 10, 2019 identifies several new outdoor amenity spaces associated with the existing and proposed buildings at grade. The site plan identifying the outdoor amenity spaces is shown in **Figure 12**.

Provided below are comments on the wind conditions in these amenity spaces. The comments are based on the wind tunnel results at the various sensor locations within or near these amenity spaces.

#### 5.1 Relocated Play Space & Outdoor Fitness Space

The relocated play space is located north of the proposed building (or east, when referencing true north) at Location 91 (**Figures 7a** and **7b**). In this area, wind conditions are comfortable for standing in the summer and walking in the winter.

In the outdoor fitness space on the west side of the building, wind conditions are expected to be comfortable for sitting or standing throughout the year (Location 7, **Figure 7a** and **7b**).

## 5.2 Proposed Community Gardens and Dog Run / Open Lawn Area

The proposed community gardens (Location 92), as well as the dog run and open lawn area (Location 93, **Figures 10a** and **10b**) are located to the west of the existing 600 Lolita Gardens. In these areas, wind conditions are suitable for standing in the summer and walking in the winter. These wind conditions are suitable for the anticipated usage of the spaces.

### 5.3 Proposed Lounge Area

The proposed lounge area is located to the east of the indoor pool for 620 Lolita Gardens. Wind conditions in this area are comfortable for standing in the summer and walking in the winter (Location 18, **Figures 8a** and **8b**). The landscaping plan shows a screen and acoustic barrier to the west and east of the lounge area, which will provide some wind shelter for the space.





Figure 12: Amenity spaces on updated site plan



# 6.0 CONCLUSIONS & RECOMMENDATIONS

The pedestrian wind conditions for the proposed development at 600-620 Lolita Gardens have been assessed through wind tunnel modelling techniques. Based on the results of our study, the following conclusions and recommendations have been reached:

- An existing exceedance of the wind safety criterion was eliminated under the Proposed Configuration. All locations tested met the wind safety criterion in the Proposed Configuration.
- Wind conditions at the main entrance to the proposed building are satisfactory throughout the year. A windscreen and canopy at this entrance have been incorporated into the design.
- Wind conditions in the outdoor amenity spaces are generally suitable for the intended usage.
- Existing wind conditions at the main entrances to the existing buildings are improved in the Proposed Configuration. On the walkways surrounding the two buildings, wind conditions are generally similar to, or better than, the Proposed Configuration.
- Existing uncomfortable wind conditions have been eliminated at three of four areas in the Proposed Configuration. The remaining uncomfortable area is in a non-designated pedestrian-use area. Mitigation features are described.
- Along the surrounding sidewalks and properties, wind conditions are comfortable for walking or better throughout the year in both the Existing and Proposed Configurations.

# 7.0 STUDY APPLICABILITY

This study is based on wind tunnel testing and provides a quantitative analysis of the pedestrian wind comfort conditions on and around the proposed development. Any subsequent alterations to the design may influence these findings. Novus should be contacted to provide additional comments and/or recommendations for additional analysis of the design revisions.

Should you have any questions or concerns, please do not hesitate to contact the undersigned.

Sincerely, Novus Environmental Inc.

Henry Vesely

Jenny Vesely, P.Eng. Senior Engineer

Bill Jacoli

Bill Waechter, C.E.T. Specialist – Microclimate



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# **Appendix A**

# Pedestrian Wind Comfort Summer (July – September) & Winter (January – March)



#### **Interpretation of Results**

In the graphs, the vertical bars represent the GEM wind speed (in km/h) exceeded 20% of the time for the test configurations at each location. The dashed horizontal lines represent wind speed thresholds for the wind comfort criteria (left figure). At the right side of each graph are white bars that represent ambient wind conditions for typical suburban and rural areas of this region.



Example Results - Comfort Criteria (20% GEM Wind Speeds)

The blue bars represent wind conditions in the Existing Configuration, while the green bars represent the Proposed Configuration. For example, wind conditions at Sensor #3 were suitable for walking in the Existing Configuration and standing in the Proposed Configuration. The figure below illustrates the safety criteria.



Example Results – Safety Criteria (Annual 0.1% Gust Wind Speeds)





Figure A1a: Pedestrian Wind Conditions – Summer Season – Proposed Site and 620 Lolita Gardens





Figure A1b: Pedestrian Wind Conditions – Summer Season – 600 Lolita Gardens, Cawthra Gardens Residence and 500 Lolita Gardens





Figure A1c: Pedestrian Wind Conditions - Summer Season - Lolita Gardens and Silver Creek Boulevard





Figure A1d: Pedestrian Wind Conditions – Summer Season – Dundas Street East and Cawthra Road





Figure A2a: Pedestrian Wind Conditions – Winter Season – Proposed Site and 620 Lolita Gardens





Figure A2b: Pedestrian Wind Conditions – Winter Season – 600 Lolita Gardens, Cawthra Gardens Residence and 500 Lolita Gardens





Figure A2c: Pedestrian Wind Conditions - Winter Season - Lolita Gardens and Silver Creek Boulevard





Figure A2d: Pedestrian Wind Conditions – Winter Season – Dundas Street East and Cawthra Road



# **Appendix B**

# Pedestrian Wind Safety Results Annual





Figure B1a: Pedestrian Wind Safety – Annual – Proposed Site and 620 Lolita Gardens





Figure B1b: Pedestrian Wind Safety – Annual – 600 Lolita Gardens, Cawthra Gardens Residence and 500 Lolita Gardens





Figure B1c: Pedestrian Wind Safety – Annual – Lolita Gardens and Silver Creek Boulevard





Figure B1d: Pedestrian Wind Safety – Annual – Dundas Street East and Cawthra Road

