REPORT

3056 NEYAGAWA BOULEVARD

OAKVILLE, ONTARIO

PEDESTRIAN WIND COMFORT ASSESSMENT

PROJECT #2402704
November 18, 2024

SUBMITTED TO

Evan Kernaghan
Senior Development Manager
Evan.Kernaghan@neattcommunities.com

Neatt Communities
775 Main Street East
Milton, ON L9T 3Z3
T: 647.206.2534

SUBMITTED BY

Neetha Vasan, M.A.Sc., LEED AP
Senior Specialist / Associate
Neetha.Vasan@rwdi.com

Kathryn Kim, P.Eng.
Senior Project Manager
Kathryn.Kim@rwdi.com

RWDI
625 Queen Street West
Toronto, ON M5V 2B7
T: 647.475.1048 x2031

rwdi.com

1. INTRODUCTION

Rowan Williams Davies & Irwin Inc. (RWDI) was retained to conduct a pedestrian wind assessment for the proposed project located at 3056 Neyagawa Boulevard in Oakville, Ontario. The objective of this assessment is to provide an evaluation of the potential wind impact of the proposed development in support of the OPA/DPoC/ZBA application to the Town of Oakville.

The project site is located west of the intersection of Neyagawa Boulevard and Dundas Street West (Image 1). The surroundings comprise low-rise residential neighborhoods to the north, east and south and woods, parks and similar open lands to the west.

We understand that the proposed project is a mixed-use development, that would include proposes seven residential towers ranging in height from 5- to 28-storeys, providing a total of 2,278 units (Image 2). We also understand that the site will be densely landscaped with trees surrounding several outdoor amenity areas (image 3).

At this time, phasing has not been identified and the assessment has been completed based on a full build-out of the proposed development. Key areas of interest for this assessment include sidewalks and properties near the site and on-site outdoor areas at the ground level.

Image 1: Aerial view of the existing site and surroundings
Source: Google Maps

1. INTRODUCTION

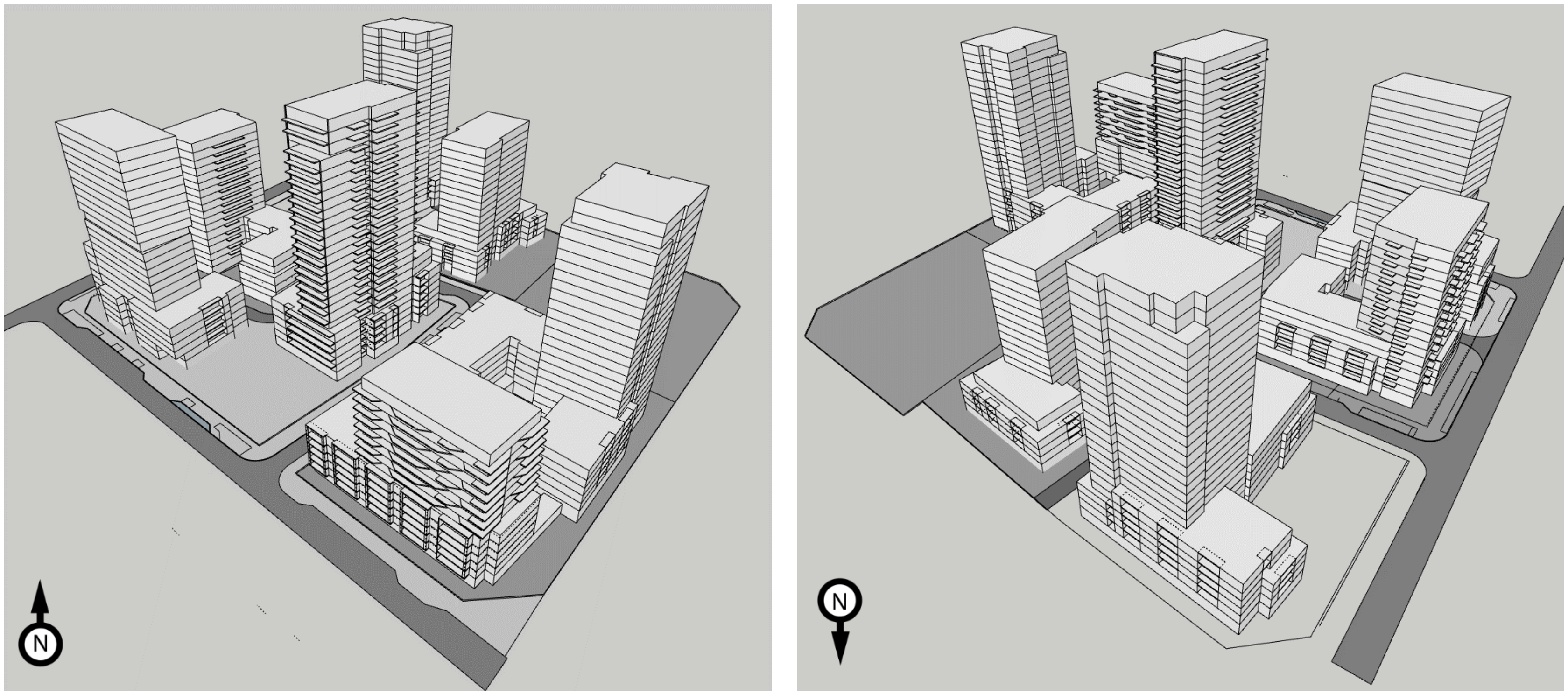


Image 2: Proposed Massing of the Project

1. INTRODUCTION

Image 3: Proposed building plan and tree layout.

2. METHODOLOGY

2.1 Objective

The objective of this assessment is to provide an evaluation of the potential wind impact of the proposed development on wind conditions in pedestrian areas on and around it based on Computational Fluid Dynamics (CFD) modelling. The assessment is based on the following:

- A review of the regional long-term meteorological data from Billy Bishop Toronto City Airport;
- 3D e-model of the proposed project received on June 26, 2024;
- The use of *Orbital Stack*, an in-house CFD tool;
- RWDI's engineering judgment, experience, and expert knowledge of wind flows around buildings[1-3]; and,
- The RWDI wind comfort and safety criteria.

Note that other microclimate issues such as those relating to cladding and structural wind loads, door operability, air quality, snow impact, etc. are not part of the scope of this assessment

2.2 CFD for Wind Simulation

CFD is a numerical technique that can be used for simulating wind flows in complex environments. For this analysis, CFD techniques were used to generate a virtual wind tunnel where flows around the site and its surroundings were simulated in full scale. The computational domain that covered the site and its surroundings was divided into millions of small cells where calculations were performed, yielding a prediction of wind conditions across the entire study domain. CFD excels as a tool for wind modelling, presenting early design advice, comparing different design and site scenarios, resolving complex flow physics, and helping diagnose problematic wind conditions.

While the computational modelling method used in the current assessment does not explicitly simulate the transient behaviour of turbulent wind, its effects were estimated based on other calculated quantities. RWDI has found this approach to be appropriate for the assessment of typical wind comfort conditions. Wind safety issues, which relate to transient, higher-speed gusts, are discussed qualitatively, based on the CFD predictions and our extensive wind-tunnel experience for similar projects.

In order to quantify the transient behaviour of wind and refine any conceptual mitigation measures, a more detailed assessment would be required using either boundary-layer wind tunnel or transient computational modelling.

2. METHODOLOGY

2.3 Simulation Model

CFD simulations were completed for two scenarios:

- Existing: Existing site and surroundings, and
- Proposed: Proposed development with the existing surroundings.

The computer model of the proposed building is shown in Image 4, and the Existing and Proposed configurations with the surroundings are shown in Images 5a and 5b, respectively. The 3D models were simplified to include only the necessary building and terrain details that would affect the local wind flows in the area and around the site. **Landscaping and other smaller architectural and accessory features were not included in the computer model in order to provide more conservative wind conditions (as is the norm for this level of assessment).**

The wind approaching the modelled area were simulated for 16 directions (starting at 0°, at 22.5° increments around the compass), accounting for the effects of the atmospheric boundary layer and terrain impacts. Wind data were obtained in the form of ratios of wind speeds at approximately 1.5m above concerned levels, to the mean wind speed at a reference height. The data was then combined with meteorological records obtained from Billy Bishop Toronto City Airport to determine the wind speeds and frequencies in the simulated areas.

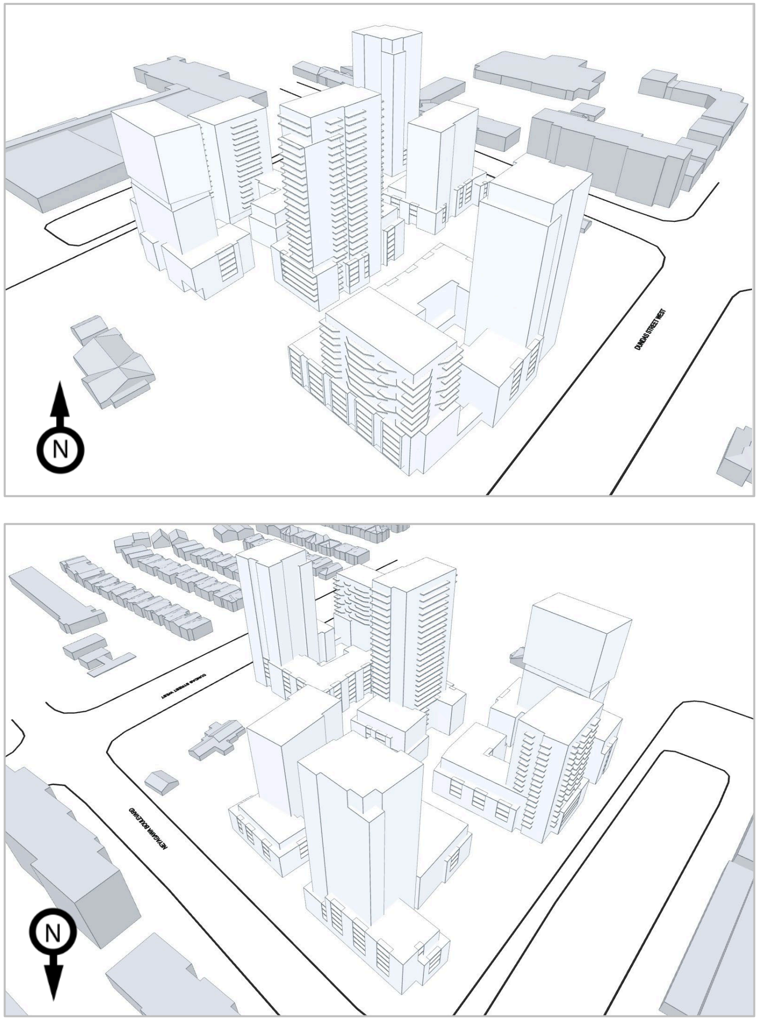


Image 4: Computer model of the proposed project

2. METHODOLOGY

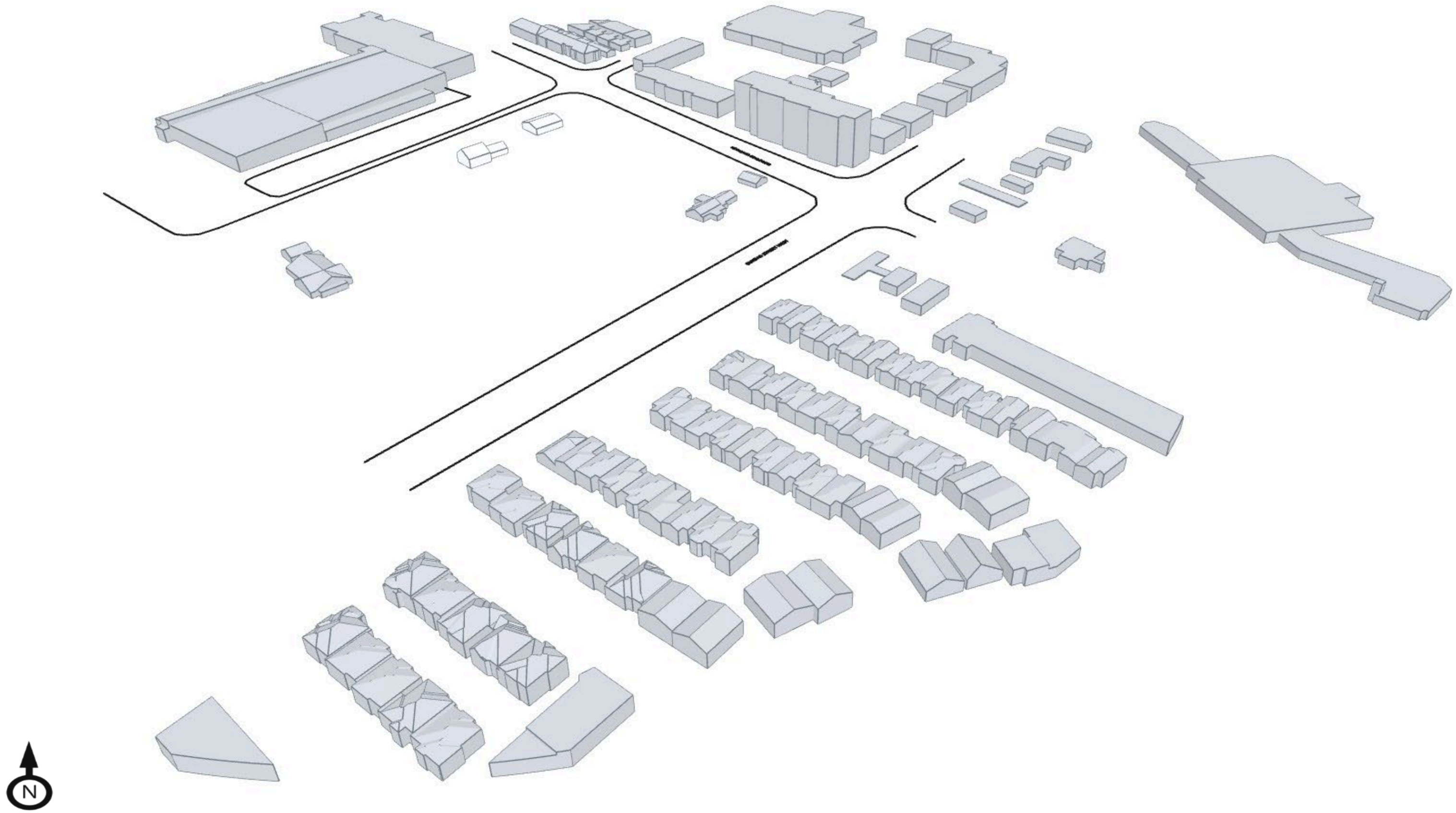


Image 5a: Computer model of the existing site and extended surroundings

2. METHODOLOGY

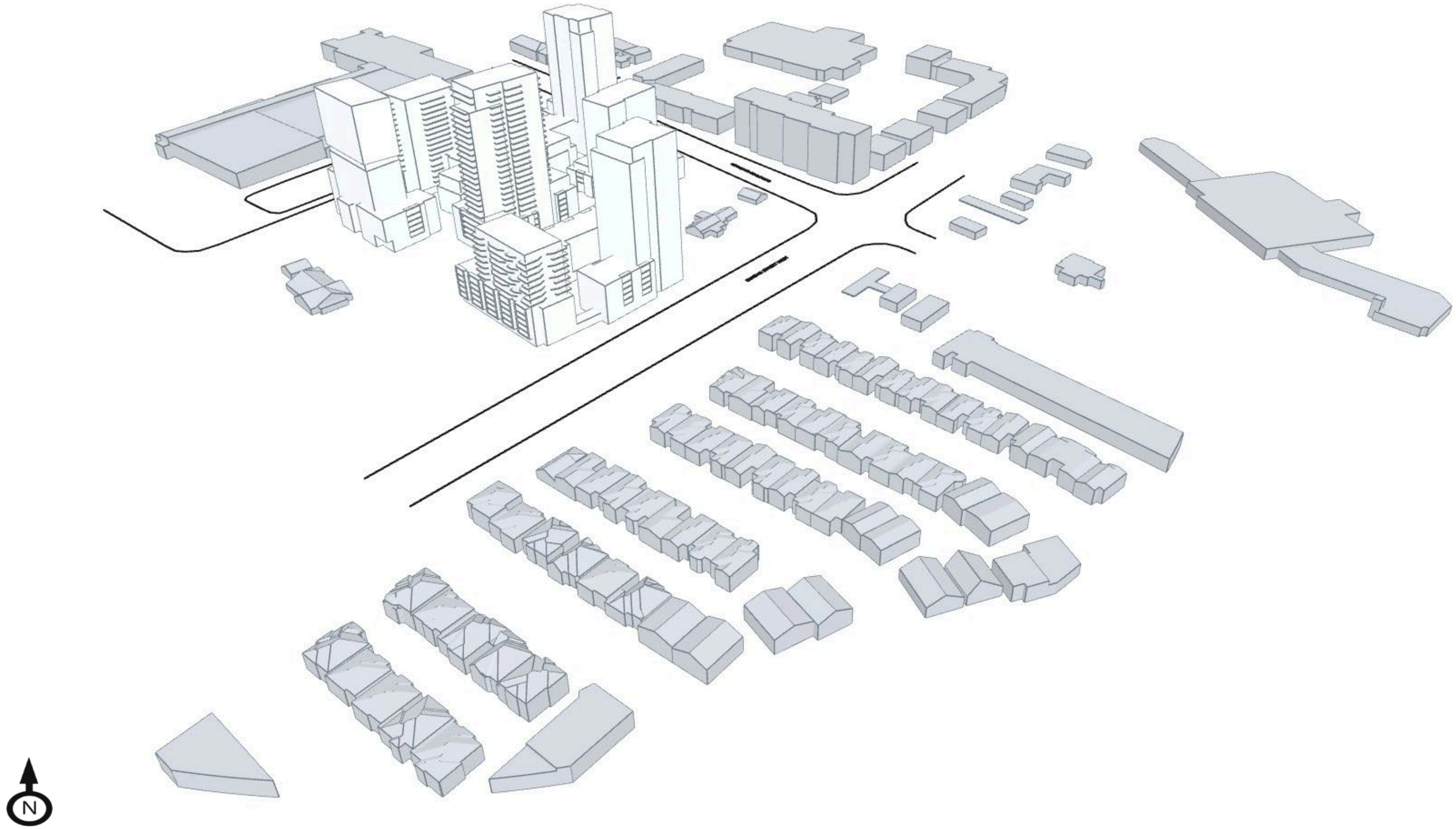


Image 5b: Computer model of the Proposed Project and extended surroundings

2.4 Meteorological Data

Long-term wind data recorded at Billy Bishop Toronto City Airport between 1992 and 2022, inclusive, were analyzed for the summer (May to October) and winter (November to April) months. Image 6 graphically depicts the directional distributions of wind frequencies and speeds for these periods.

In the summer, winds from the easterly directions are predominant, with winds also approaching from the southwest and northwest quadrants. In the winter, winds from the west, southwest and northwest are significantly more frequent in addition to winds from the easterly directions.

Strong winds of a mean speed greater than 30 km/h measured at the airport (at an anemometer height of 10 m) are more frequent in the winter (red and yellow bands in Image 6). These winds potentially could be the source of uncomfortable or severe wind conditions, depending on the site exposure and development design.

Wind statistics were combined with the simulated data to predict the wind conditions at the project site and assessed against the wind criteria for pedestrian comfort.

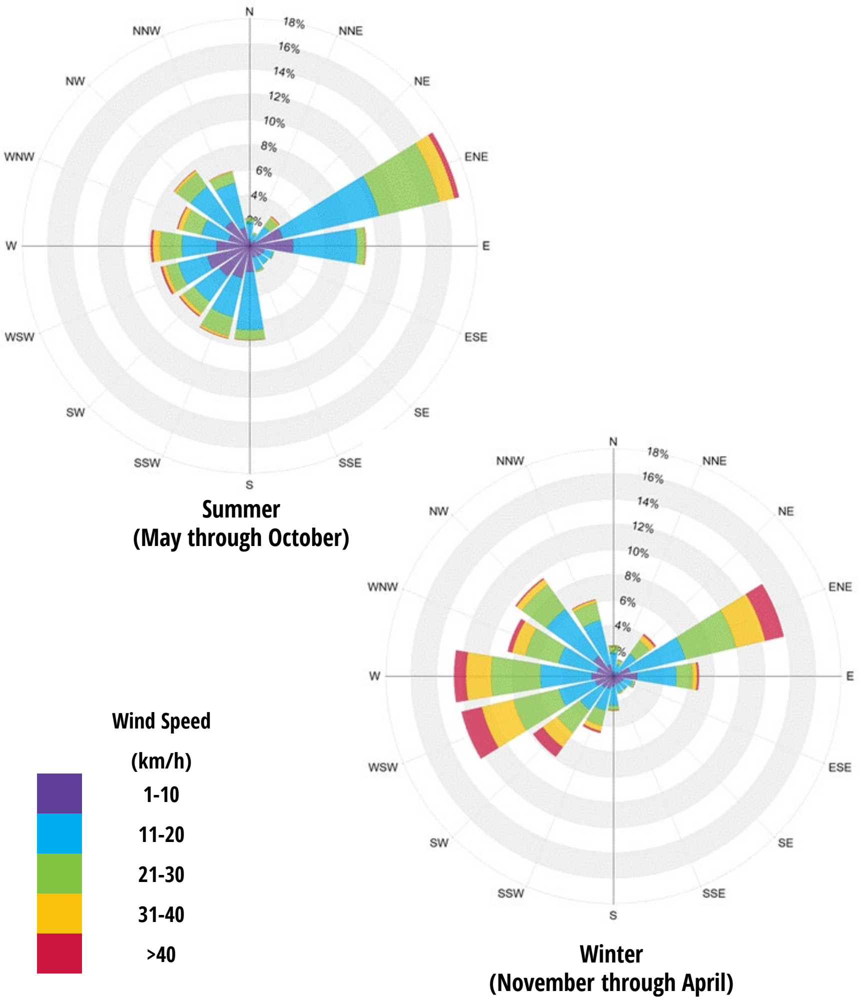


Image 6: Directional distribution of wind approaching Billy Bishop Toronto City Airport (1992 to 2022)

3. WIND CRITERIA

The RWDI pedestrian wind criteria are used in the current study; the criteria presented in the table below, addresses pedestrian safety and comfort. These criteria have been developed by RWDI through research and consulting practice since 1974. They have also been widely accepted by municipal authorities, building designers and the city planning community.

3.1 Pedestrian Comfort

Pedestrian comfort is associated with common wind speeds conducive to different levels of human activity. Wind conditions are considered suitable for sitting, standing, strolling or walking if the associated mean wind speeds (see table) are expected for at least four out of five days (80% of the time). The assessment considers winds occurring between 6 AM and midnight. Limited usage of outdoor spaces is anticipated in the excluded period. Speeds that exceed the criterion for Walking are categorized Uncomfortable. These criteria for wind forces represent average wind tolerance. They are sometimes subjective and regional differences in wind climate and thermal conditions as well as variations in age, health, clothing, etc. can also affect people's perception of the wind climate.

Comfort Category	GEM Speed (km/h)	Description (Based on seasonal compliance of 80%)
Sitting	**≤ 10**	**Calm or light breezes desired for outdoor seating areas where one can read a paper without having it blown away**
Standing	**≤ 14**	**Gentle breezes suitable for main building entrances, bus stops, and other places where pedestrians may linger**
Strolling	**≤ 17**	**Moderate winds appropriate for window shopping and strolling along a downtown street, plaza or park**
Walking	**≤ 20**	**Relatively high speeds that can be tolerated if one's objective is to walk, run or cycle without lingering**
Uncomfortable	**> 20**	**Strong winds considered a nuisance for all pedestrian activities. Wind mitigation is typically recommended**

3.2 Pedestrian Safety

Pedestrian safety is associated with excessive Gust Speeds that can adversely affect a person's balance and footing. These are usually infrequent events but deserve special attention due to the potential impact on pedestrian safety.

Safety Criterion	Gust Speed (km/h)	Description (Based on annual exceedance of 9 hrs or 0.1% of time)
Exceeded	**> 90**	**Excessive gusts that can adversely affect one's balance and footing. Wind mitigation is typically required**

4. RESULTS AND DISCUSSION

4.1 Wind Flow around Buildings

Wind generally tends to flow over buildings of uniform height, without disruption and accelerate in large open areas. Buildings that are taller than the surroundings intercept and redirect winds around them. Wind is directed down the height of the building (*Downwashing)*, and the flow subsequently moves around windward building corners, causing a localized increase in wind activity (*Corner Acceleration)*. Wind also accelerates through the relatively narrow space between tall buildings (*Channelling Effect)*. Large horizontal platforms like podium roofs and low roofs of adjacent buildings disrupt downwash and reduce the potential wind impact on the ground level. These flow patterns are illustrated in Image 7.

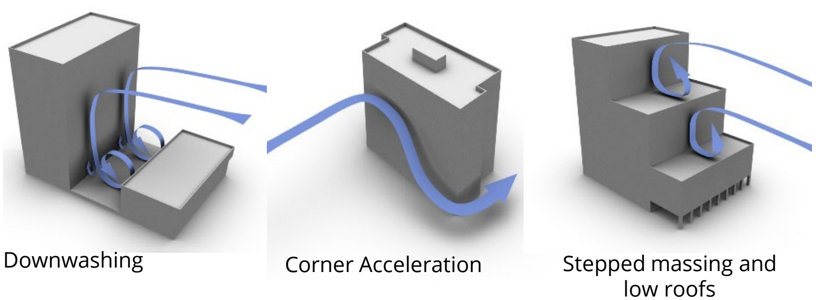


Image 7: General wind flow mechanisms

4.2 Presentation of Results

The results of the assessment are presented and discussed in detail in Sections 4.3 and 4.4. Images 8 and 9 show the predicted seasonal wind conditions at grade for the Existing and Proposed configurations. The graphical presentation is in the form of colour contours of wind speeds calculated based on the wind comfort criteria (Section 3.1), approximately 1.5 m above the concerned levels. The assessment against the safety criterion (Section 3.2) was conducted qualitatively based on the predicted wind conditions and our extensive experience with wind tunnel assessments. The discussion also includes recommendations for wind control, where necessary, to reduce the potential for high wind speeds for the design team's consideration.

Target Conditions

For the current development, wind speeds comfortable for walking or strolling are appropriate for sidewalks and walkways where pedestrians are likely to be active and moving intentionally. Lower wind speeds comfortable for standing are required for entrances and areas where people are expected to be engaged in passive activities. Calm wind speeds suitable for sitting are desired in areas where prolonged periods of passive activities are anticipated, such as outdoor amenity areas, seating areas etc., especially during the summer when these areas are typically in use.

4.3 Existing Scenario

The existing site is mostly unbuilt, with two low-rise buildings at the north end. The nearfield surroundings are similarly open or low-rise neighbourhoods, beyond which are open fields. The low/open surroundings expose the site to the predominant winds, which accelerate uninterrupted through the fairly open site. Wind conditions at most areas in the existing scenario are considered comfortable for strolling in the summer (green regions in Image 8a) and uncomfortable in the winter (orange regions in Image 9a), with lower speeds around the existing buildings. Wind conditions at all areas near the project site are expected to meet the safety criterion.

4.4 Proposed Scenario

The proposed project includes several towers that would be substantially taller than the existing built context. The proposed buildings would be exposed to the predominant winds and create the flows described in Section 4.1. Overall, the conditions on the site would be largely governed by the ambient existing wind microclimate as well as the height and exposure of the proposed buildings. Potential wind impacts are expected to be moderated to some extent by positive built form design elements such as the proposed stepped podiums and the low roofs. The addition of the development will also positively disrupt the preexisting open and uninterrupted wind flow through the site and reduce wind speeds in some areas to the east and west of the site.

The addition of the full buildout of the proposed development is expected to result in an overall reduction in wind speeds immediately around the site. Wind conditions in a large area are expected to be comfortable for standing in the summer and walking in the winter (Image 8b and 9b).

Higher wind activity is expected around the corners of and channels between the proposed buildings – conditions in these areas are expected to be comfortable for strolling or walking in the summer. In the winter, when the ambient approach winds are stronger, conditions in these areas are expected to be uncomfortable, similar to the existing conditions, and likely exceed the annual safety criterion.

Conditions predicted in the summer are appropriate for most pedestrian activities, including the use of entry areas where relaxed patron behavior is expected, necessitating low wind speeds comfortable for standing. These conditions would be enhanced with the addition of the proposed trees with large and wide canopies combined with dense underplanting. In the winter, the predicted conditions may be higher than desired for most pedestrian activities. As a result, the wind activity on the project site would need to be improved with cold-tolerant/perennial vegetation or architectural interventions.

4. RESULTS AND DISCUSSION

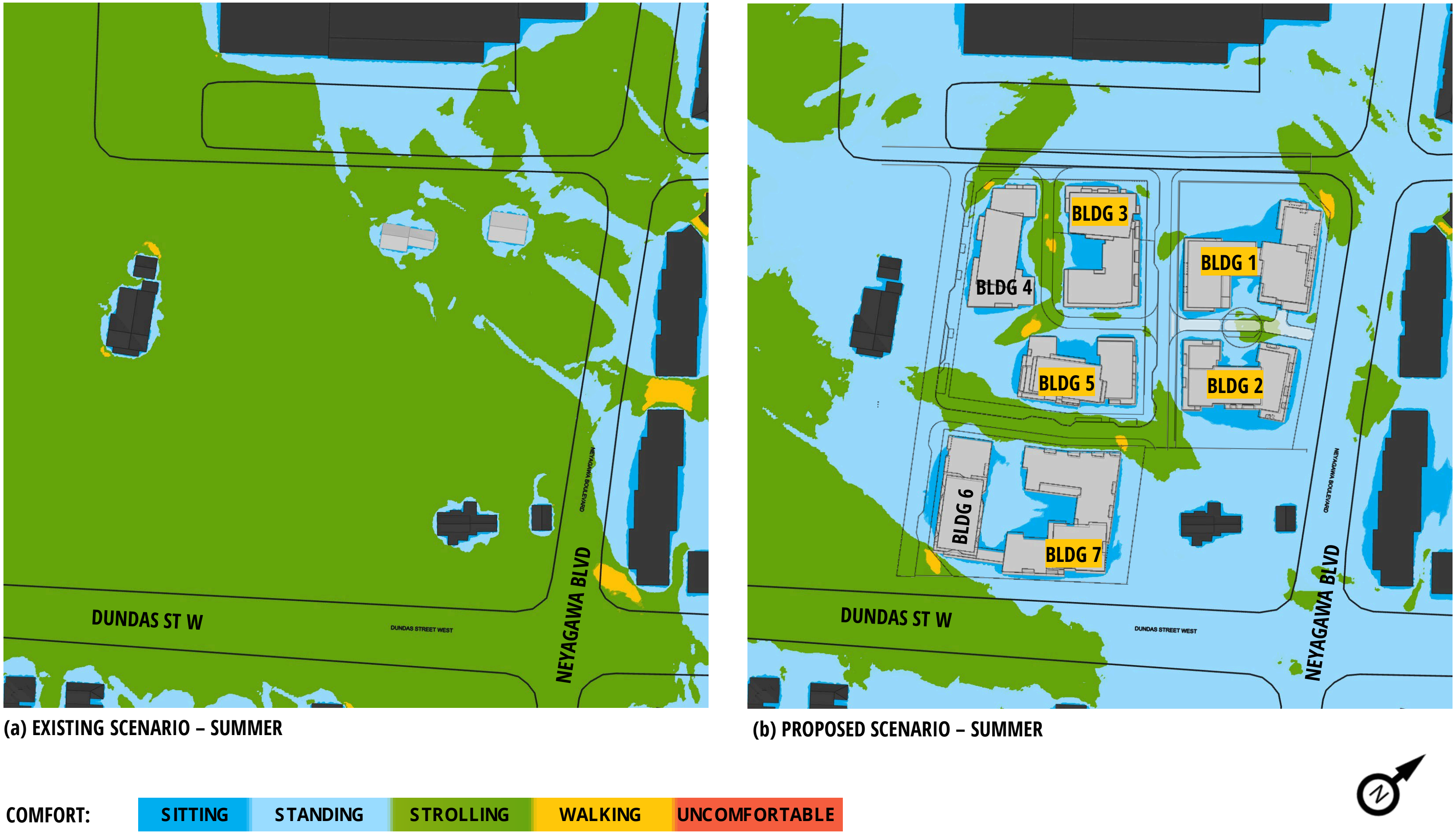
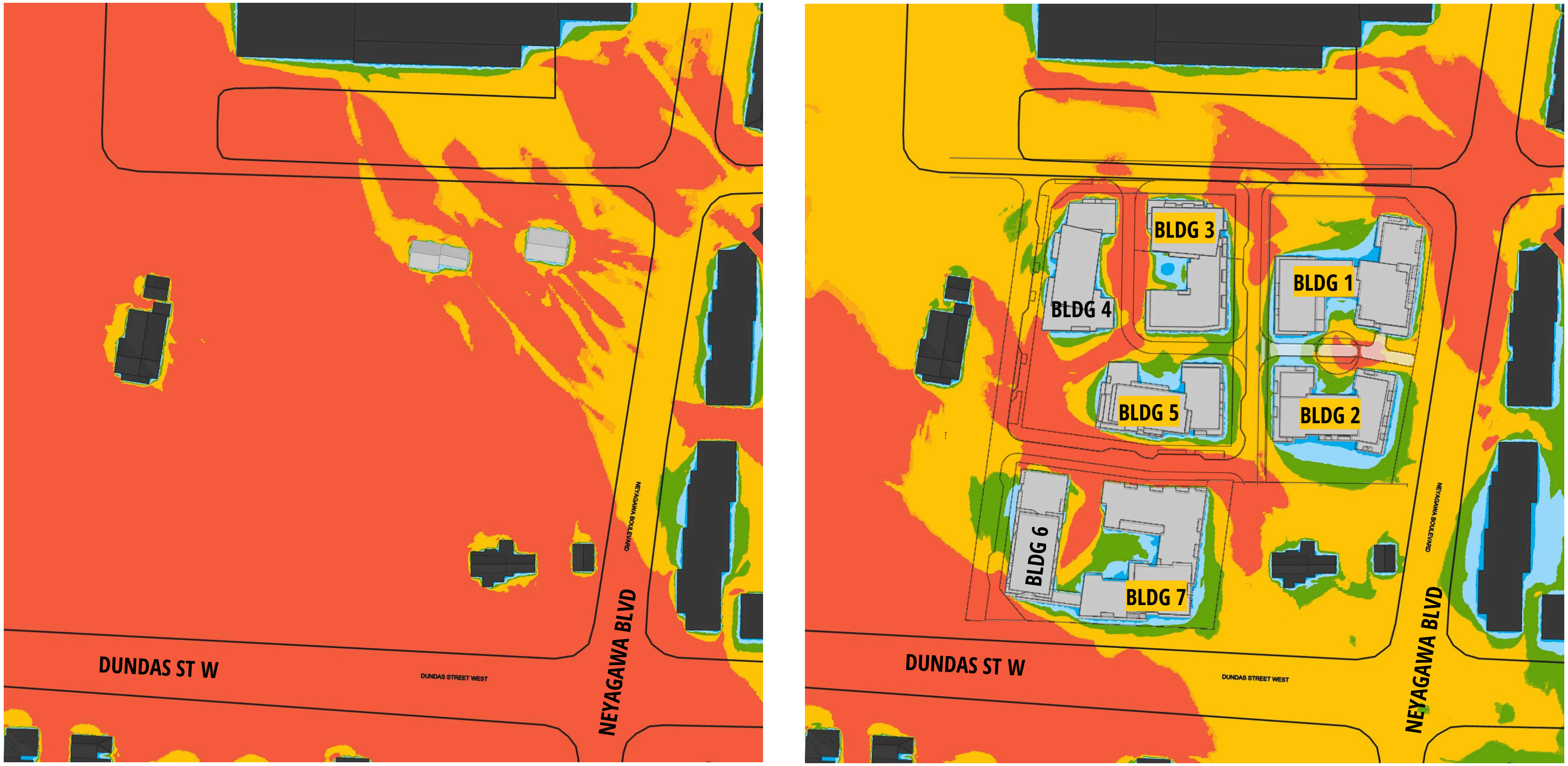


Image 8: Predicted wind conditions – GROUND LEVEL - SUMMER



(a) EXISTING SCENARIO – WINTER

(b) PROPOSED SCENARIO – WINTER

COMFORT:	SITTING	STANDING	STROLLING	WALKING	UNCOMFORTABLE

Image 9: Predicted wind conditions – GROUND LEVEL - WINTER

4.5 Recommendations

The current assessment concludes that the wind conditions in the existing scenario may be be too windy for pedestrian use. In comparison, the addition of the proposed development is expected to reduce wind activity in a large area around it (including the public areas on the adjacent streets and sidewalks) and create localized areas of higher wind activity near the new buildings. At a later design stage, we recommend quantifying and confirming the potential wind conditions through wind tunnel testing to refine this information and develop appropriate wind control measures.

Architectural and massing articulations have the most impact on wind impacts. Some massing features that can be considered to streamline wind flows around tall towers and reduce wind impacts at the ground level include corner articulations (reentrant corners), multiple steps in the podium massing, large offsets of the tower from the edges of the podium, deep canopies on the podium, etc.

We recommend main entrances be located in areas of low wind activity (comfortable for sitting or standing) or that the design team consider placing coniferous landscaping or screens on either sides of main entrances to create a localized protected zone for patrons using the entrances. Alternatively consider recessing the entrances 2 m into the façade for a similar effect.

While wind conditions on-site in the summer may be managed with strategic landscaping, we recommend fences, screens or evergreen trees for wind protection in the winter months and for added comfort in the shoulder seasons when deciduous trees offer little wind control benefit.

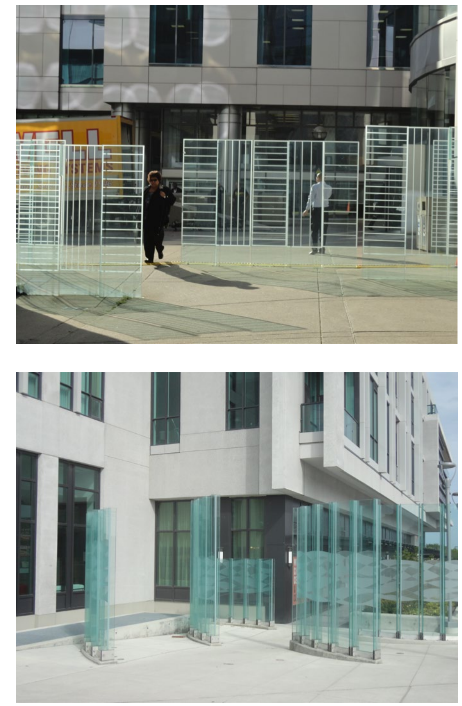
RWDI understands that the proposed landscape design (Image 3) includes a mix of deciduous and evergreen trees. Additionally, we understand that a similar mix of tree species exists to in the surrounding area to the west of the site. Densely wooded areas and large clusters of mature trees with cold-tolerant foliage typically help reduce wind activity immediately downwind. The proposed landscaping beds can be used to incorporate several wind blocking measures to reduce the overall wind activity, and as a result, ameliorate the predicted uncomfortable wind zones on the site. Landscaping features were not included in the computer model for this assessment in order to provide a conservative evaluation of the effect of the project massing (as is the norm for this level of assessment). We recommend that the effect of surrounding and on-site landscaping features be evaluated through detailed quantitative assessments using wind tunnel testing.

Some examples of features discussed herein to be considered for wind control are presented in Image 10. RWDI can advise the design team to aid in this effort as the design progresses.

4. RESULTS AND DISCUSSION

MASSING ARTICULATIONS

RECESSED ENTRY AREAS



TALL SCREENS

Image 10: Design strategies for wind control at the ground level

5. SUMMARY

RWDI was retained to provide an assessment of the potential pedestrian level wind impact of the proposed project at 3056 Neyagawa Boulevard in Oakville, Ontario. Our assessment was based on computational modelling, simulation and analysis of wind conditions for the proposed development design, in conjunction with the local wind climate data and the RWDI wind criteria for pedestrian comfort and safety. Our findings are summarized as follows:

- The proposed building is taller than its surroundings, and therefore will redirect wind to ground level to create notable wind impacts.
- Positively, the addition of the proposed development is expected to disrupt the preexisting uninterrupted wind flow through the site and reduce wind speeds to a lower comfort category in large areas to the east and west of the site.
- Wind conditions at ground level on-site are expected to be appropriate for pedestrian uses in the summer and may be higher than desired for use in many areas in the winter.
- Potentially uncomfortable wind speeds are expected around the corners and areas between the proposed buildings in the winter.
- Strategies for wind control have been discussed.

RWDI recommends that wind tunnel testing be conducted at the detailed design stages in order to refine and validate the predicted wind speeds and mitigation strategies presented herein. RWDI can help guide the placement of wind control features, including landscaping, to achieve appropriate levels of wind comfort based on the programming of the various outdoor spaces.

6. DESIGN ASSUMPTIONS

The findings/recommendations in this report are based on the building geometry and architectural drawings communicated to RWDI listed below. Should the details of the proposed design and/or geometry of the building change significantly, results may vary.

File Name	File Type	Date Received (mm/dd/yyyy)
Neyagawa 2024-06-24.skp	E-model	06/26/2024

Changes to the Design or Environment

It should be noted that wind comfort is subjective and can be sensitive to changes in building design and operation that are possible during the life of a building. These could be, for example: outdoor programming, operation of doors, elevators, and shafts pressurizing the tower, changes in furniture layout, etc.. In the event of changes to the design, construction, or operation of the building in the future, RWDI could provide an assessment of their impact on the discussions included in this report. It is the responsibility of Others to contact RWDI to initiate this process.

7. STATEMENT OF LIMITATIONS

This report was prepared by Rowan Williams Davies & Irwin Inc. for Neatt Communities ("Client"). The findings and conclusions presented in this report have been prepared for the Client and are specific to the project described herein and authorized scope. The conclusions and recommendations contained in this report are based on the information available to RWDI when this report was prepared. Because the contents of this report may not reflect the final design of the Project or subsequent changes made after the date of this report, RWDI recommends that it be retained by Client to verify that the results and recommendations provided in this report have been correctly interpreted in the final design of the Project.

The conclusions and recommendations contained in this report have also been made for the specific purpose(s) set out herein. Should the Client or any other third party utilize the report and/or implement the conclusions and recommendations contained therein for any other purpose or project without the involvement of RWDI, the Client or such third party assumes any and all risk of any and all consequences arising from such use and RWDI accepts no responsibility for any liability, loss, or damage of any kind suffered by Client or any other third party arising therefrom.

Finally, it is imperative that the Client and/or any party relying on the conclusions and recommendations in this report carefully review the stated assumptions contained herein and to understand the different factors which may impact the conclusions and recommendations provided.

8. REFERENCES

1. H. Wu, C.J. Williams, H.A. Baker and W.F. Waechter (2004), “Knowledge-based Desk-Top Analysis of Pedestrian Wind Conditions”, *ASCE Structure Congress 2004,* Nashville, Tennessee.

2. H. Wu and F. Kriksic (2012). “Designing for Pedestrian Comfort in Response to Local Climate”, *Journal of Wind Engineering and Industrial Aerodynamics*, vol.104-106, pp.397-407.

3. C.J. Williams, H. Wu, W.F. Waechter and H.A. Baker (1999), “Experience with Remedial Solutions to Control Pedestrian Wind Problems”, *10th International Conference on Wind Engineering*, Copenhagen, Denmark.