50 CREIGHTON ROAD

DUNDAS, ONTARIO

PEDESTRIAN WIND ASSESSMENT

PROJECT #2304221
OCTOBER 17, 2023

SUBMITTED TO

Performance Investments GP Inc.
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50 Creighton Road
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1. INTRODUCTION

Rowan Williams Davies & Irwin Inc. (RWDI) was retained to conduct a qualitative assessment of the pedestrian wind conditions expected around the proposed project at 50 Creighton Road in Dundas, Hamilton, Ontario. This effort is intended to inform good design and has been conducted in support of Zoning By-Law Amendment (ZBA) Application with the City of Hamilton.

The proposed site is located on the west side of Creighton Road, between Mill Street and Cloverhill Avenue (Image 1). The site is currently occupied by a one-storey seniors housing and surrounded by low-rise suburban developments.

The project consists of a 12-storey residential condominium, with 2-storey massing extending to the south and west sides (Image 2). There is also an 8-storey and 9-storey stepped massing on the east side of the proposed building. Areas of interest include entrances, sidewalks, walkways and trails (Image 3).

Image 1: Aerial View of the Existing Site and Surroundings (Credit: Google Maps)

1. INTRODUCTION

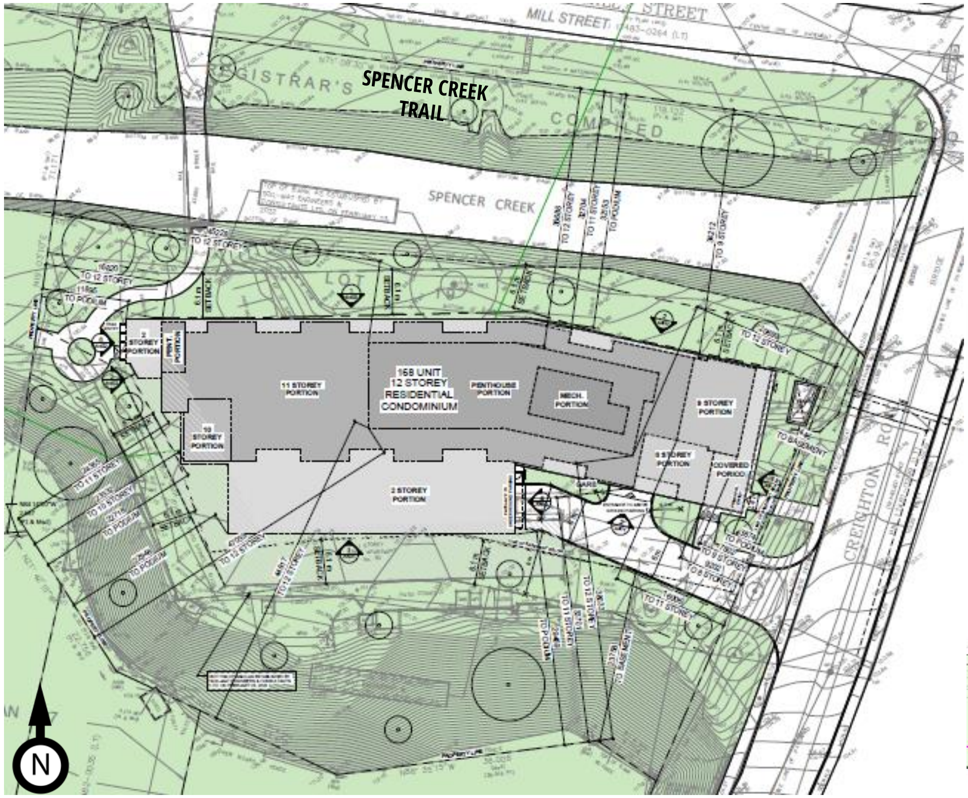
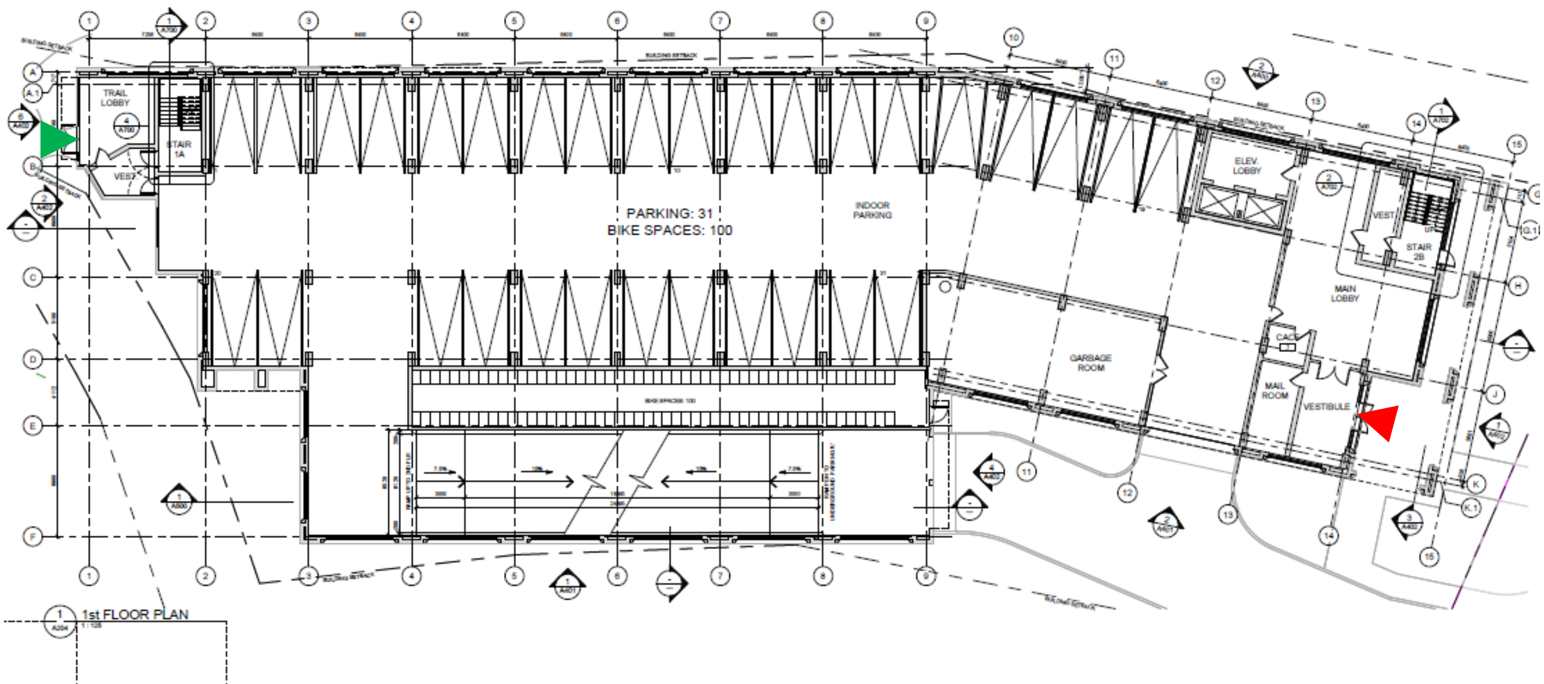


Image 2: Site Plan (Left) and View from Southeast (Right)



PRINCIPAL ENTRANCE (COVERED PORTICO)

TRAIL LOBBY ENTRANCE

Image 3: First Floor Plan

2. METHODOLOGY

Predicting wind speeds and occurrence frequencies is complex. It involves a combined assessment of building geometry, orientation, position and height of surrounding buildings, upstream terrain and the local wind climate.

Over the years, RWDI has conducted thousands of wind-tunnel model studies on pedestrian wind conditions around buildings, yielding a broad knowledge base. In some situations, this knowledge and experience, together with literature, allow for a reliable, consistent and efficient desktop estimation of pedestrian wind conditions without wind-tunnel testing. This approach provides a screening-level estimation of potential wind conditions and offers conceptual wind control measures for improved wind comfort, where necessary.

In order to quantify and confirm the predicted conditions or refine any of the suggested conceptual wind control measures, physical scale model tests in a boundary-layer wind tunnel would be required.

RWDI's assessment is based on the following:

- Design drawings received from KNYMH Architecture Solutions on October 10, 2023;
- A review of the regional long-term meteorological data from Hamilton International Airport;
- Use of RWDI's proprietary software (*WindEstimator*[1]) for providing a screening-level numerical estimation of potential wind conditions around generalized building forms;
- Wind-tunnel studies and desktop assessments undertaken by RWDI for projects in the Hamilton area;
- RWDI's engineering judgement and knowledge of wind flows around buildings[2, 3]; and,
- RWDI Criteria for pedestrian wind comfort and safety.

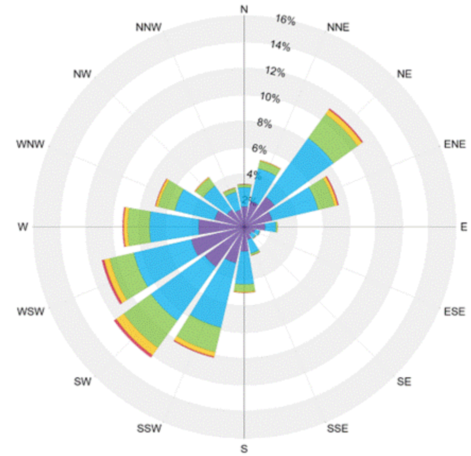
Note that other microclimate issues such as those relating to cladding and structural wind loads, door operability, etc., are not part of the scope of this assessment.

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.

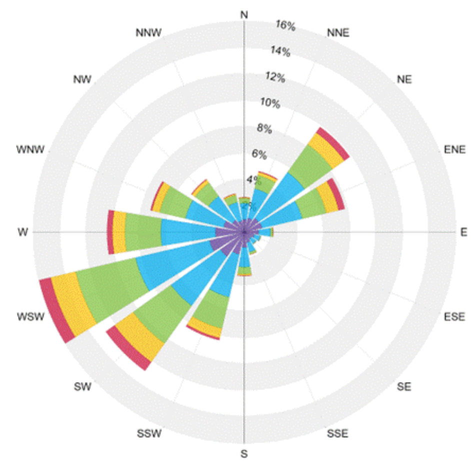
3. METEOROLOGICAL DATA

Long-term wind data recorded at Hamilton International Airport between 1991 and 2021, inclusive, used as a reference for wind conditions in the area. The distributions of wind frequency and directionality for the summer (May - October) and winter (November - April) seasons are shown in the wind roses in Image 4.

In both the summer and winter seasons, winds from the southwest and northeast are predominant, as shown in Image 4. 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 4). These winds potentially could be the source of uncomfortable or severe wind conditions, depending on the site exposure and development design.



Summer (May through October)



Winter (November through April)

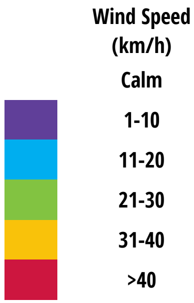


Image 4: Directional Distribution of Winds Approaching Hamilton International Airport (1991 to 2021)

4. WIND CRITERIA

The RWDI pedestrian wind criteria are used in the current study. 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 including the City of Hamilton. The criteria are as follows:

4.1 Safety Criterion

Pedestrian safety is associate with excessive gust that can adversely affect a pedestrian's balance and footing. If strong winds that can affect a person's balance (**90 km/h**) occur more than **0.1%** of the time or 9 hours per year, the wind conditions are considered severe.

4.2 Pedestrian Comfort Criteria

Wind comfort can be categorized by typical pedestrian activities:

Sitting (≤ 10 km/h): Calm or light breezes desired for outdoor seating areas where one can read a paper without having it blown away.

Standing (≤ 14 km/h): Gentle breezes suitable for main building entrances and bus stops.

Strolling (≤ 17 km/h): Moderate winds that would be appropriate for window shopping and strolling along a downtown street, plaza or park.

Walking (≤ 20 km/h): Relatively high speeds that can be tolerated if one's objective is to walk, run or cycle without lingering.

Uncomfortable: The comfort category for walking is not met.

Wind conditions are considered suitable for sitting, standing, strolling or walking if the associated mean wind speeds are expected for at least four out of five days (**80% of the time**). Wind control measures are typically required at locations where winds are rated as uncomfortable, or they exceed the wind safety criterion.

Note that these wind speeds are assessed at the pedestrian height (i.e., 1.5 m above grade or the concerned floor level), typically lower than those recorded in the airport (10 m height and open terrain).

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.

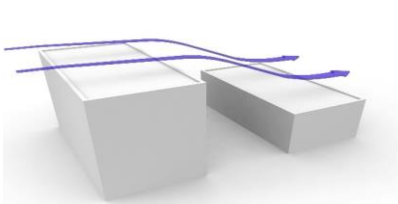
For the current development, wind speeds comfortable for walking or strolling are appropriate for sidewalks, walkways and trails; lower wind speeds comfortable for standing are required for building entrances where pedestrians may linger.

5. RESULTS AND DISCUSSION

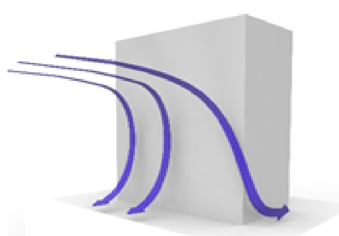
5.1 Wind Flow Around Buildings

Short buildings do not redirect winds significantly to cause adverse wind conditions at pedestrian areas (Image 5a). Tall buildings tend to intercept the stronger winds at higher elevations and redirect them to the ground level (Downwashing). These winds subsequently move around exposed building corners, causing a localized increase in wind activity due to Corner Acceleration (Images 5b). If these building / wind combinations occur for prevailing winds, there is a greater potential for increased wind activity and *uncomfortable* conditions.

Design details such as stepped massing, tower step-back from a podium edge, deep canopies close to ground level, wind screens / tall trees with dense underplanting, etc. (Image 6) can help reduce wind speeds. The choice and effectiveness of these measures would depend on the exposure and orientation of the site with respect to the prevailing wind directions and the size and massing of the proposed buildings.

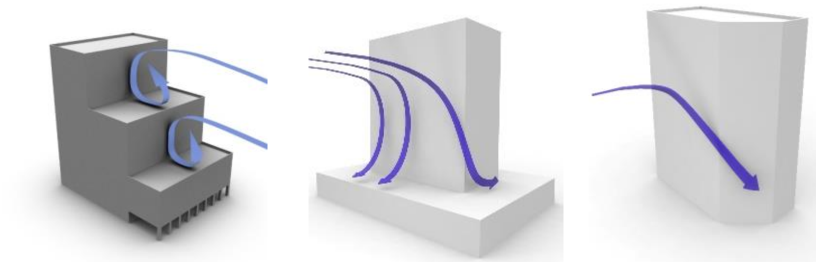


a) Wind flow over built terrain of uniform height

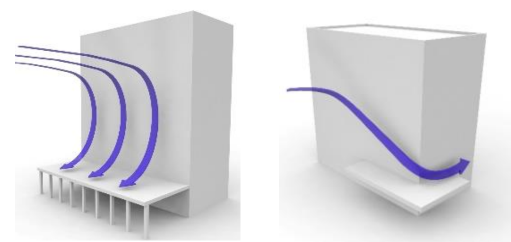


b) Downwashing and Corner Acceleration

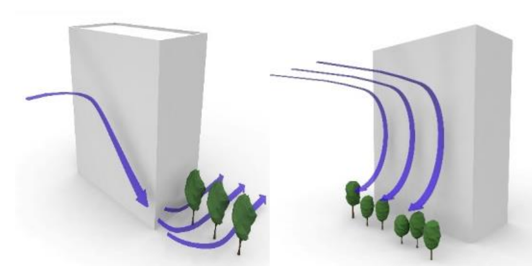
Image 5: Generalized Wind Flows



Stepped Massing ***Podium*** ***Chamfered Corner***



Canopy



Trees help reduce wind impact at ground level

Image 6: Examples of Common Wind Control Measures

5.2 Existing Scenario

The existing site is occupied by a low-rise building similar to the surrounding low-rise suburban neighbourhood. As such, there are no significant structures that would deflect ambient winds to ground to cause adverse wind impacts. The surrounding deciduous woods are expected to offer some wind protection in the summer when they are in full foliage.

Currently, wind conditions on and around the site are considered comfortable for standing in the summer and for strolling in the winter. Wind conditions exceeding the safety criterion are not expected.

5.3 Proposed Scenario: Wind Flow

The proposed 12-storey building will be taller than buildings in the surrounding area and therefore, is expected to be exposed to the prevailing winds and result in downwashing and corner acceleration flows. The proposed building is oriented with the wide facades facing the predominant northeast and southwest winds (Image 7). Positively, the proposed development incorporates several wind-responsive design features that are anticipated to moderate its wind impact:

- The two-storey stepped massing is on the windward side of the building; this feature is expected to help disrupt wind flow moving around the building at the west end, and thereby reduce the potential severity of downwashing and corner accelerations.
- Similarly, the two-storey massing step at the northwest corner is also anticipated to disrupt corner acceleration flows.
- The articulated (re-entrant) southwest corner of the 11-storey portion is favourable as it would disrupt corner wind accelerations.
- The principal entrance is recessed into the façade and covered by a portico, which is expected to provide protection from ambient wind flows.
- In addition, both the principle and trail lobby entrances are designed with vestibules that can provide a temporary transition space during windy days.

The proposed project is expected to cause an increase in wind activity around it owing to its height, orientation and exposure; however, the wind-responsive features described above would help moderate wind impacts to some extent. The following sections provide a discussion of the potential wind conditions around the project, taking these features into account. The anticipated wind flow pattern are illustrated in Images 7 and 8, and the expected wind conditions are shown in Image 9.

5. RESULTS AND DISCUSSION

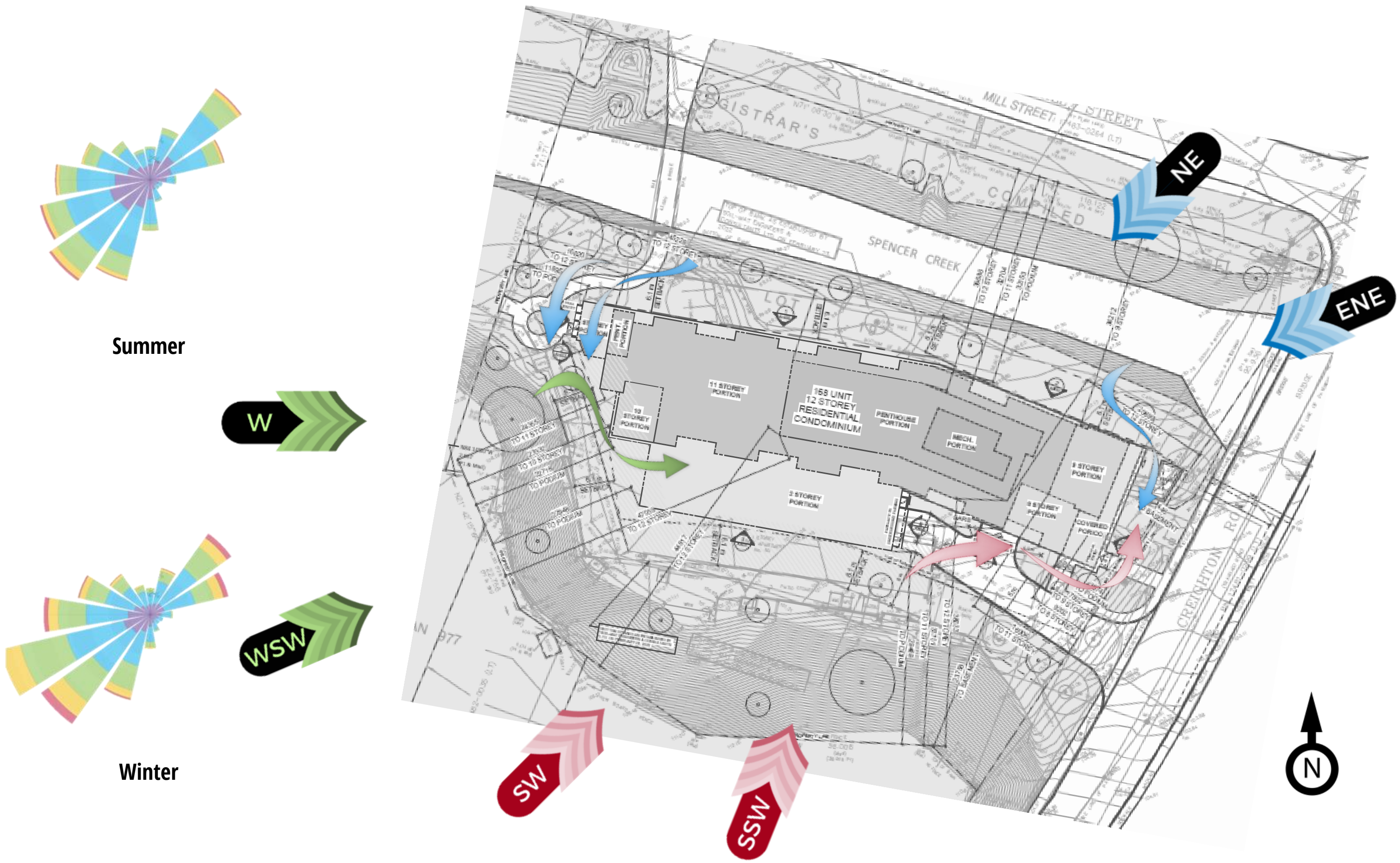
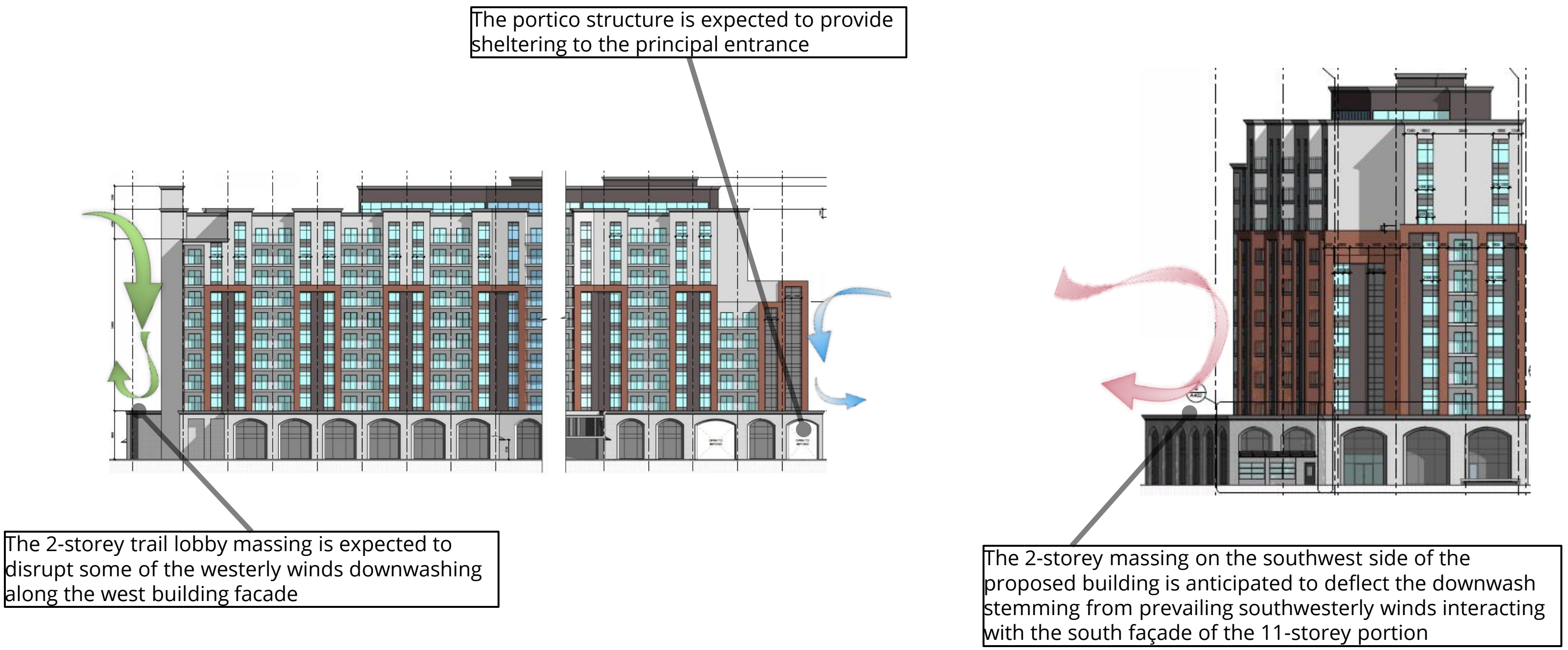


Image 7: Site Plan with Wind Rose Overlay and Anticipated Wind Flow around the Proposed Building

5. RESULTS AND DISCUSSION



a) Section View from South

b) Section View from East

Image 8: Anticipated Wind Flow around the Proposed Building

5. RESULTS AND DISCUSSION

5.4 Proposed Scenario: Predicted Wind Conditions

WIND CATEGORIES

- Sitting / Standing
- Strolling
- Walking
- Uncomfortable

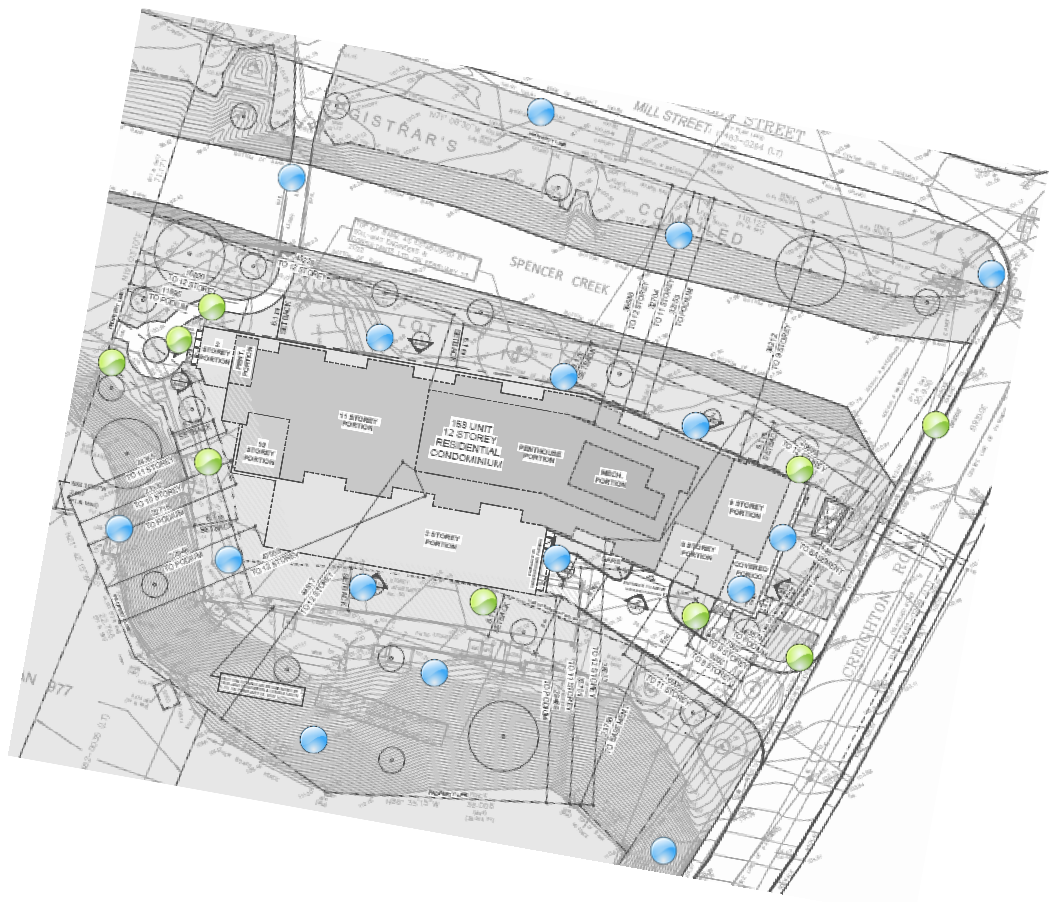


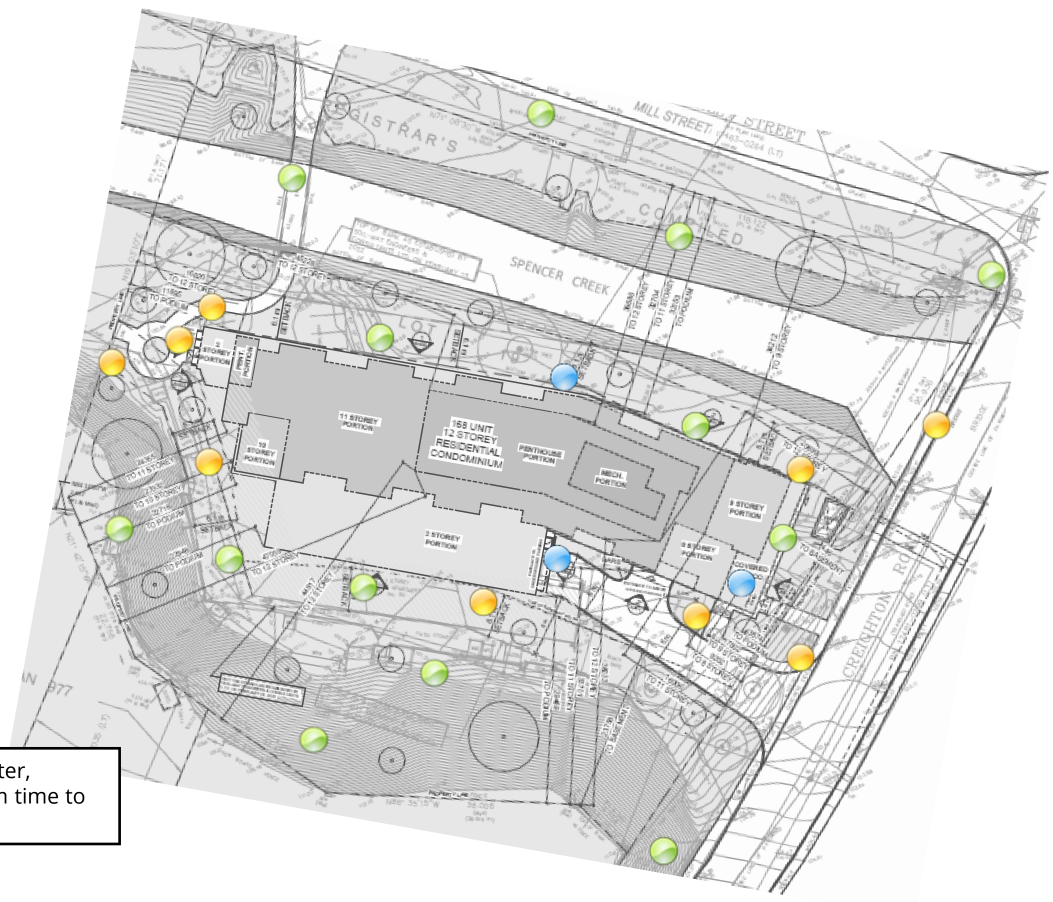
Image 9a: Predicted Wind Conditions - Summer

5. RESULTS AND DISCUSSION

5.4 Proposed Scenario: Predicted Wind Conditions

WIND CATEGORIES

- Sitting / Standing
- Strolling
- Walking
- Uncomfortable



Note that on particularly windy days in the winter, uncomfortable wind conditions may occur from time to time at the northern and western corners.

Image 9a: Predicted Wind Conditions - Winter

5.5 Proposed Scenario: Wind Safety

The 12-storey building height is considered moderate from a wind impact perspective. In addition, as discussed in section 5.3, the wind-responsive features of the proposed development would help reduce the intensity of building-wind interactions to some degree. Severe wind gusts are not anticipated; however, it should be noted that wind speeds at the northeast and northwest corners may be close to the criterion on particularly windy days in the winter. Wind conditions around the project are expected to meet the annual wind safety criterion.

5.6 Proposed Scenario: Wind Comfort

5.6.1 Entrances

The principal entrance is proposed on the east side of the building, in a recessed area and under a portico structure (Image 3). As such, this entrance area will be protected from ambient winds to a large extent. Wind conditions are expected to be comfortable for sitting or standing in the summer and winter, which is appropriate (Images 9a and 9b).

The trail lobby entrance is proposed at the northwest corner of the building, where it may be exposed to corner acceleration flows. Wind conditions are expected to be comfortable for standing or strolling in the summer (Image 9a). Due to seasonally stronger winds, slightly elevated wind speeds, comfortable for walking are anticipated at the trail lobby entrance in the winter (Image 9b). Higher wind speeds in the winter may be acceptable, as patrons are less likely to linger outside the entrance in the cold.

The design team may consider adding tall (approximately 2 m) coniferous/marcescent landscaping or screens on both sides of the entrance. For the trail lobby entrance, the design team may alternatively consider recessing the entrance. Examples are shown in Image 10. If feasible, we recommend relocating the entrances farther away from the building corners. The closed vestibule of both entrances will serve as conditioned areas for people to wait or transition between the indoor and outdoor on windy days.

5.6 Proposed Scenario: Wind Comfort

5.6.2 Sidewalks, Walkways and Trails

Wind conditions at most grade-level areas around the project, including sidewalks, walkways and trails, are expected to be comfortable for standing or strolling in the summer, and for walking, strolling or standing in the winter. These conditions are suitable for the intended pedestrian use.

The highest wind speeds are expected at the northeast corner of the proposed building, where conditions are anticipated to be comfortable for strolling or walking throughout the year. Wind conditions at the northern and eastern corners may be uncomfortable from time to time in the winter, on particularly windy days.

5.6.3 Neighbouring Properties

The wind-responsive designs of the proposed development are expected to reduce high wind activity and limit the potential impact of the proposed project to the immediate vicinity of project site. The neighbouring properties are not anticipated to be affected negatively by the proposed building.

5. RESULTS AND DISCUSSION

Image 10: Examples of Wind Control Strategies for Trail Lobby Entrance

6. SUMMARY

RWDI was retained to provide an assessment of the potential pedestrian level wind impact of the proposed project at 50 Creighton Road in Dundas, Hamilton, Ontario. Our assessment was based on the local wind climate, the current design of the proposed development, the existing surrounding buildings, our experience with wind tunnel testing of similar buildings, and screening-level modelling.

Our findings are summarized as follows:

- The proposed building is taller than buildings in the existing surroundings, and therefore will cause an increase in wind speeds around it.
- The building design incorporates several wind-responsive features, including stepped massing, large massing extending out from the main tower, articulated tower corners, covered portico and vestibules. These features are expected to moderate the potential wind impacts on the surroundings.
- Wind conditions on and around the proposed project are not expected to exceed the recommended criteria for pedestrian safety.
- Wind speeds at the principal entrance are expected to be appropriate for the expected use in the summer and winter.
- Wind conditions at the trail lobby entrance are expected to be higher than desired from time to time in the summer, and for most of the time in the winter. Wind control strategies are discussed in the report.
- Wind conditions on sidewalks, walkways and trails are expected to be suitable for the intended pedestrian use throughout the year.
- The impact of the proposed building is expected to be limited to the immediate vicinity of the site. The neighbouring properties are not anticipated to be affected negatively.

7. DESIGN ASSUMPTION

The findings/recommendations in this report are based on the architectural drawings communicated to RWDI on October 10, 2023, 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)
22024 - 50 Creighton Rd_compressed	PDF	10/10/2023

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.

8. STATEMENT OF LIMITATIONS

This report was prepared by Rowan Williams Davies & Irwin Inc. for Performance Investments GP Inc. and Arcadis Professional Services (Canada) Inc. ("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.