

**Shadow Study Report**

**Proposed Hotel Development**

**144 & 176 John Street  
Niagara-on-the-Lake  
Ontario**

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144 & 176 John Street

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# 1.0 Introduction

## Purpose of the Report:

The purpose of this report is to demonstrate the effect of the proposed development of a 6- storey Hotel and Conference Building upon the current location and upon adjacent properties. This is done by using a computer generated Shadow Diagram, which generates the Shadow Pattern which is cast upon the ground by buildings upon adjacent properties. The study conforms to the Dates and Times set out typically for Shadow studies in Southwestern Ontario Municipalities. These can be found in Site Plan Standard “Design Reference Notes” or in “Standards for Shadow Studies.”

## Description of the Proposed Development:

The existing land parcel is an established former estate property of approximately 53,806m<sup>2</sup> (13.29 acres) of area coverage. 300 metres (984 feet) of its frontage is onto municipally-owned John Street and 122 metres (400 feet) extends along municipally-owned Charlotte Street. Of the site area approximately 30,736m<sup>2</sup> (7.59 acres) of the land will remain in an “Open Space” use as defined by Town by-law 4511-11 where it was identified as a heritage conservation space. A substantial percentage of the “Open Space” consists of treed areas with a variety of deciduous and coniferous species, some trees of measured height in excess of 24 metres (78 feet). Combined with environmental conservation mapping areas that follow the path of the One-Mile Creek and also contain mature tree stock, well over 60% of the site is covered by a canopy of trees that have a conservative average height of 13 metres (43 feet) above a proposed finished floor height datum elevation used for this study. This canopy is well established at the boundaries of the property adjacent to neighbouring residential properties. The shading created thereby from a pre-existing natural condition shall be noted later in the evaluation for the reader.

There are three existing buildings on the site occupying approximately 1,605 m<sup>2</sup> of land coverage or approximately 3 percent of the land parcel area. A summary of existing building massing is provided in the following chart:

Existing Building Name	Footprint Area		Maximum Bldg. Height		Average Height of Building Mass	
	sq. metres	sq. feet	metres	feet	metres	feet
1 Randwood Mansion Building	1037.59	11168.56	13.00	42.65	10.00	32.81
2 Devonian House	404.31	4351.96	11.50	37.65	9.60	31.50
3 Coach House	162.80	1752.39	7.00	23.00	5.00	16.40

New building that will have a shadow impact will include the proposed hotel and conference centre and a new grounds maintenance building.



New Building Name	Footprint Area		Maximum Bldg. Height		Average Height of Building Mass	
	sq. metres	sq. feet	metres	feet	metres	feet
	1 Maintenance Bldg.	307.42	3309.04	5.50	16.40	5.20
2 Hotel & Conference Bldg.	2563.78	27596.29	11.50	75.45	22.00	72.18
3 Linked Covered Walkway	92.14	991.78	5.50	18.04	4.60	15.09
4 u/g parking facility	5706.67	61426.08	2.80	9.18	0.01	0.03

For purpose of clarity, please note the following summary of new building area and heights. The limitations of shadows cast on other low height building mass discounts further study. This applies to the linked covered walkway (#1) and the u/g parking facility (#4) when factoring in the position or the average height of building mass in each instance. Therefore, the study will present in greater detail only the shadow data pertaining to the new hotel / conference building and the new maintenance building as relevant to the study objectives.

The proposed hotel/conference building will be located in a central clearing within the site between the existing Randwood mansion and the coach house although slightly set back from John Street by comparison to the mansion house.

### Neighbouring Properties:

Although our study will use accurate coordinates for Sun study, in order to simplify general reference the report will consider the John Street frontage as the north boundary of the property, and Charlotte Street frontage as the west boundary of the property.

To the East:

The immediate adjacent property is owned by the applicant and known as 200 John Street. The 20 metre wide portion of 200 John Street extends along the entire 195 metre depth of the subject property and has no buildings within it, though heavily treed consistent with the same levels of canopy height found on the subject site.

Further to the east (not adjacent) is 210 John Street, which an estate property containing a heritage mansion and a collection of accessory buildings on approximately 10 acres of area and of similar lot depth as the subject property. The 2 ½ storey house is centred on the property more than 60 metres away from its west boundary. This property contains heavily treed areas along its west boundary. This house would be at most 150 metres from the proposed 6-storey hotel block with respect to the distance from the highest potential shadow projecting mass.

To the West:

Approximately 204 metres of West boundary is adjacent to private single family homes or town homes while the balance of the lands front on Charlotte Street. While 1, 2, 3,4,5,6 & 7 Christopher Street have rear yards that fully, or partially, back onto the subject property, 5 Christopher Street and 6 Christopher Street are closest to the new development buildings. 5 Christopher Street is a one-storey home with attached garage and is approximately 3 metres (10 feet) away from the rear property to the house at its closest point. The house would be, at most, 72 metres from the proposed 6 storey hotel block with respect to the distance from the highest potential shadow projecting mass. 6 Christopher Street is a 2-storey home with attached garage and is approximately 17 (56 feet) metres away from the rear property to the house at its closest point. Though higher in building height than their neighbour, this house would be at most 73 metres from the proposed 6-storey hotel block with respect to the distance from the highest potential shadow projecting mass. It is approximately 43 metres from the proposed one-storey maintenance building with respect to the distance from the highest potential shadow projecting mass.



Figure 2: 5 & 6 Christopher Street single-family homes. Note Existing Trees on subject property and rear yards



Figure 1 : Aerial View of Christopher Street with No Deciduous Foliage

To the West cont'd.....

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Rear yards of town home units 44 and 40 on Weather stone Court are not directly adjacent to the subject property and are positioned south of the proposed location of the maintenance building.

To the North:

John Street, across from the subject property is has no private lands or buildings that could be impacted by shadows. The most adjacent lands are owned by Parks Canada and form part of the area known as the “Commons”. The lands are randomly treed at the boundary along John Street with mostly mature deciduous stock and there is a diverging laneway more than 140 metres from the Street that is lined with mature deciduous trees. The remaining land is long cut grass. It is 120 metres from the proposed 6-storey hotel block with respect to the distance from the highest potential shadow projecting mass to the edge of John Street.

To the South:

The immediate adjacent property to the south is owned by the applicant and known as 200 John Street. This property is under a separate development application that is intended for residential development.

## 2.0 Methodology

The Town of Niagara on the Lake has bylaws, which govern property development. One of the criteria being analysed under the broader application is the requirement that the proposed development address the bylaw requirements and that the development proponent make materials available to the Municipality for evaluating development applications.

Specifically this study is addressing the issue of new building height and effect of the shadows created upon neighbouring properties and the subject property itself as a result.

This shadow study also provides shadow diagrams for 3 periods of the day which is representative of different shadow patterns cast over the course of the day as the sun arcs through the sky.

Because the Sun changes its angle of arc, our study also analyses the typical shadow patterns, which reflect the solar solstice periods over the course of the year, and represent the highest, the mid and lowest points of the sun over the year.

The findings of a computer generated simulation provides data as to building height, shadow length, solar angle and solar rotation over the course of the typical day over the periods of study and presents this data in comparative chart form.

### Location Factors

In Appendix “A” the shadow diagrams contained within that section illustrate the maximum shadows to be created at specific times and dates and the chart in Appendix “B” provides the technical data. The analysis was conducted based upon a geodetic location of 43 degrees, 14 minutes and 39.29 seconds North and 79 degrees, 4 minutes and 20.28 seconds west, which is central to the subject property and specifically in the area of the land parcel where the proposed new buildings would be located.

### Building Height Assumption

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At the time of the study, the proposed buildings The analysis will base the shadow correlation of a building with a maximum height of 23 metres above the geodetic ground level set for the finished ground floor level, established at 91 metres above sea level for the purpose of the Study. The study takes into account the general terrain of the site and surrounding lands relative to the geodetic ground level as this will vary the shadow correlation.

The diagrams provided illustrate shadow patterns for 3-4 times at 3 specific dates of the year. The analysis of the shadow diagrams identify the typical shadows, which are cast in spring, summer and winter periods. On each shadow plan the report will discuss the surface pattern for each of the dates and times and will identify characteristics of those shadows and the anticipated impact upon the immediate site and neighbouring sites.

#### Criteria for determining an Impact

By way of priority, the report would weigh adverse impact of shadows as whether they firstly cast onto neighbouring private lands or public spaces. If there are new shadows created in the initial findings, secondary analysis will compare the change caused by the development against the background of existing shading conditions and by what extent or region of the neighbouring site being impacted. Specific concern would be identified for amenity spaces or predominantly pedestrian-utilized areas affected.

### **3.1 Shadow Study: Pre-Development**

#### 3.1.1 Winter Shadows: December 21st

Assumptions of shadows cast upon the site or from the site of the subject property are as follows:

- Single family homes including 5 and 6 Christopher Street to the west of the subject property will be cast in partial shadow from existing trees that bound the One-Mile Creek on both the subject property and rear yards of the same neighbouring properties. In addition to tree canopy shading the existing coach house casts a shadow only in December and only in early hours on 5 Christopher Street within the backyard.
- As the property is very large is because the other existing buildings are located north, or east, and in the widest east-west cross section, no other pre-existing shading condition is noted.

#### 3.1.2 Spring Shadows: April 21st & Fall Shadows: – September 21st

Assumptions of shadows cast upon the site or from the site of the subject property are as follows:

- As encountered in winter conditions but with more foliage, Christopher Street to the west of the subject property will be cast in partial shadow from existing trees in early morning.
- No other shadows generated in spring or fall sun positions extend beyond the property boundaries.

#### 3.1.3 Summer Shadows: June 21st

Assumptions of shadows cast upon the site or from the site of the subject property are as follows:

- No shadows generated in summer sun positions that extend beyond the property boundaries.

## **3.2 Shadow Study: Post-Development**

*POST DEVELOPMENT: (6-STOREY MODEL) ANALYSING THE IMPACT OF THE SHADOW OF NEW HOTEL BUILDING AND MAINTENANCE BUILDING" ON THE PROPERTIES SURROUNDING THE PROPOSED DEVELOPMENT.*

### 3.2.1 Winter Shadows: (as at December 21st.)

A summary of the winter shadow impact of the proposed development upon the subject property and surrounding area is as follows:

**3.2.1A 9:30am (see Appendix 1 Page 1)** The shadow length is approximately 110 metres. The morning sun in winter rotates only 116 degrees from east to west in approximately 9 hours. At this time of day it is low in the sky (12.89 degrees altitude and 320.1 azimuths) and rises in the sky over vineyards and heavy treed areas whereby general shading factors are high and overlapping. Sunrise will be approximately 7:30 am and will arc 16 degrees by 9:30. No building shading on neighbouring lands from the hotel building by 9:30am and the maintenance building will extend a 15 metre long shadow beyond the west property line of the subject where there are no buildings affected.

**3.2.1B 12:30pm (see Appendix 1 Page 2)** The shadow length is approximately 54 metres. At this time of day it is highest in the sky (23.20 degrees altitude and 267.03 azimuths) and above background obstacles. All shading cast by subject property buildings including the new buildings falls well within the property lines. No building shading impact occurs on neighbouring lands.

**3.2.1C 3:30pm (see Appendix 1 Page 3)** The shadow length is approximately 123 metres. At this time of day it is descending below mid-way point in the sky (10.02 degrees altitude and 226.23 azimuths). Although lower on the horizon than the 9:30 interval, all shading cast by subject property buildings, including the new buildings, falls well within the property lines. No building shading impact occurs on neighbouring lands.

### 3.2.2 Spring Shadows (as at March 21st) & Fall Shadows (as at September 21st.)



A summary of the Spring/Fall shadow impact of the proposed development upon the subject property and surrounding area is as follows:

**3.2.2A 9:30am (see Appendix 1 Page 4)** The shadow length is approximately 41 metres  
The morning sun rises at approximately 6:15am and evening sunset occurs at approximately 6:30pm. At this time of day it is reaching a mid-point in the sky (31.66 degrees altitude and 324.91 azimuths) above the horizon clear of heavy treed areas. No building shading on neighbouring lands from the hotel building or the maintenance building will occur.

**3.2.2B 12:30pm (see Appendix 1 Page 5)** The shadow length is approximately 22 metres  
At this time of day it is highest in the sky (46.13 degrees altitude and 268.75 azimuths) and above background obstacles. All shading cast by subject property buildings including the new buildings falls well within the property lines. No building shading impact occurs on neighbouring lands.

**3.2.2C 3:30pm (see Appendix 1 Page 6)** The shadow length is approximately 37 metres  
At this time of day the sun is descending below mid-way point in the sky (30.63 degrees altitude and 213.50 azimuths). Although lower on the horizon than the 9:30 interval, all shading cast by subject property buildings, including the new buildings, falls well within the property lines. No building shading impact occurs on neighbouring lands.

### 3.2.3 Summer Shadows (as at June 21st.)

A summary of the Summer shadow impact of the proposed development upon the subject property and surrounding area is as follows:

**3.2.3A 9:30am (see Appendix 1 Page 7)** The shadow length is approximately 19 metres  
Daylight savings is observed. The morning sun rises at approximately 4:36am and evening sunset occurs at approximately 8:00pm. At this time of day it is reaching a mid-point in the sky (49.81 degrees altitude and 344.63 azimuths) above the horizon. No building shading on neighbouring lands from the hotel building or the maintenance building will occur.

**3.2.3B 12:30pm (see Appendix 1 Page 8)** The shadow length is approximately 8.5 metres

At this time of day it is highest in the sky (70.17 degrees altitude and 263.34 azimuths) and above background obstacles. All shading cast by subject property buildings including the new buildings falls well within the property lines. No building shading impact occurs on neighbouring lands.

**3.2.3C 3:30pm (see Appendix 1 Page 9)** the shadow length is approximately 21 metres  
At this time of day the sun is descending but above mid-way point in the sky (46.59 degrees altitude and 191.40 azimuth). Although lower on the horizon than the 9:30 interval, all shading cast by subject property buildings, including the new buildings, falls well within the property lines. No building shading impact occurs on neighbouring lands.

## 4.0 Shadow Impact

*Summary of Impact by the proposed 6-storey Hotel/Conference Bldg. and Maintenance bldg.*

4.1 The shadows cast from this proposed development are largest in the winter:

- The affect will be in the morning only.
- For a period of approximately one half hour during the shadow rotation from south to north between sunrise (7:30am) to approximately 8am where is a possibility that the proposed hotel 6-storey mass, in its location, could cast a long shadow onto the side yard of 5 Christopher Street. This cycle of shadow casting would only occur for one week each side of the December 21<sup>st</sup> Solstice date used for our study. This equates to less than 4% of annual event days and approximately 7 hours per year of shadow coverage.
- There is a shadow cast over the south corner of 6 Christopher Street and 7 Christopher Street backyards as a result of the new maintenance building placement. This occurs during the shadow rotation from south to north between sunrise (7:30am) to approximately 10:45am for approximately three and one half hours from the start to the finish. This shadow path would only occur for approximately three weeks in December and equates to 6% on annual event days and approximately 73 hours of daylight reduction.
- There are no shadows falling upon adjacent houses in this study period.
- With the level of vegetation that is screening the shadow path of pre-development and what is proposed in the way of screening for post-development landscaping, the impact of this event is quite low.

4.2 The shadows cast from this proposed development for remaining Spring Summer and Fall:

- There are no shadows falling upon adjacent houses or neighbouring property surfaces in this study period.

#### 4.3 General Comment Regarding Shadow Affect based upon the Shape of a Building:

- The shadow effect of a “thinner” or “stepped” building has less impact than a “wide” building. The shadow of a thinner building falls “upon” a property for a shorter period of time and effectively “passes over” a building and property more quickly than a wider building and therefore has less shadow impact.
- As this proposal is effectively to create tapered building or building with a one storey plinth which is 6-storeys in height at its “core” and wider at its “base” this is considered a “tapered” building with less shadow impact than a lower and wide building.

#### 4.4 General Comment Regarding Buffers surrounding a Building:

- The development to the north is buffered by substantial, mature growth and, as noted in the information section of our report, there is surrounding tree canopy heights at an average of 13 metres (43 feet) contained within the limits of the shadow distances such that the development will receive very little if any shadow impact at any time of the day and only to a very minor extent in the Winter.



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