29-53 VICTORIA ROAD, BELLEVUE HILL

Scots College Stevenson Library (SSD 8922)
Environmental Wind Impact Assessment

Prepared for:

Impact Group
PO Box 1002
NORTH SYDNEY NSW 2059

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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Impact Group (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

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DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
610.17857-R02-v1.0	19 April 2018	Dr Peter Georgiou	Dr Neihad Al-Khalidy	Dr Neihad Al-Khalidy

EXECUTIVE SUMMARY

SLR Consulting Australia Pty Ltd (SLR) has been engaged by Impact Group, on behalf of the Presbyterian Church (NSW) Property Trust, to carry out a qualitative Environmental Wind Impact Assessment covering the proposed Scots College Stevenson Library Redevelopment, located within the college grounds at 29-53 Victoria Road, Bellevue Hill. The assessment is to support a State Significant Development application, SSD 8922.

Redevelopment of the Stevenson Library Building (the Project) is understood to comprise partial demolition of the five existing library levels, then alteration and addition works to construct a total of six floors with a bulk envelope, from a wind engineering point of view, only slightly larger than the current building envelope. Details of the redevelopment are provided in **Section 2**.

SLR's study comprises the following:

- Identify local prevailing wind conditions impacting the site;
- Examine ground level wind impacts and identify wind "hot spots" around the redevelopment; and
- Recommend wind mitigation options to ameliorate any potentially adverse conditions.

The above addresses the relevant "Environmental Amenity" SEARs requirements for the redevelopment, namely:

5. Environmental Amenity

- Detail amenity impacts including solar access, acoustic impacts, visual privacy, view loss, overshadowing and **wind impacts**. A high level of environmental amenity for any surrounding residential land uses must be demonstrated.
- Detail any proposed use of the school grounds out of school hours (including weekends) and any resultant amenity impacts on the immediate locality and proposed mitigation measures.

In summary, the low-rise nature of the redevelopment, occupying only a slightly greater building envelope compared to the current library building, will result in no impact on environmental winds at surrounding public access locations, including all surrounding pedestrian footpaths.

Recommendations have been made with respect to "internal" areas (ie within the redevelopment building itself) that may be subject to potentially elevated wind conditions.

CONTENTS

TABLES

FIGURES

1 INTRODUCTION

SLR Consulting Australia Pty Ltd (SLR) has been engaged by Impact Group, on behalf of the Presbyterian Church (NSW) Property Trust, to carry out a qualitative Environmental Wind Impact Assessment covering the proposed Scots College Stevenson Library Redevelopment, located within the college grounds at 29-53 Victoria Road, Bellevue Hill. The assessment is to support a State Significant Development application, SSD 8922.

1.1 Site Location

The Stevenson Library Building is located within the Victoria Road East Precinct of The Scots College - refer **Figure 1**. The College lies within the local government area of Woollahra Municipal Council.

Figure 1 Redevelopment Site

Aerial View from the South

Aerial View from the East

2 PROPOSED REDEVELOPMENT SITE AND SURROUNDS

The existing Stevenson Library comprises five levels and a metal deck roof.

The proposed remodelling of the library will involve:

- Partial demolition of the ground, first, second, third, fourth and roof levels;
- Extensions to existing floor slabs;
- Construction of an atrium void;
- Construction of a sixth level and new roof;
- Complete interior refitting;
- Complete recladding of the exterior in a Scottish Baronial architectural style;
- Construction of a new main entrance from the College Quadrangle; and
- Construction of new, secondary entrances from the College Oval.

The refurbished library will provide:

- Ground Floor: Canteen/Café;
- First Floor: Reception desk, student meeting area, student services and teaching/learning areas;
- Second Floor: Student counselling, teaching and learning areas;
- Third Floor: Seminar rooms and learning spaces;
- Fourth Floor: Library, teaching/learning areas, student services and counselling staff;
- Fifth Floor: Teaching/learning areas, multi-use space and outdoor terrace.

Figure 2 Proposed Redevelopment – Representative Views

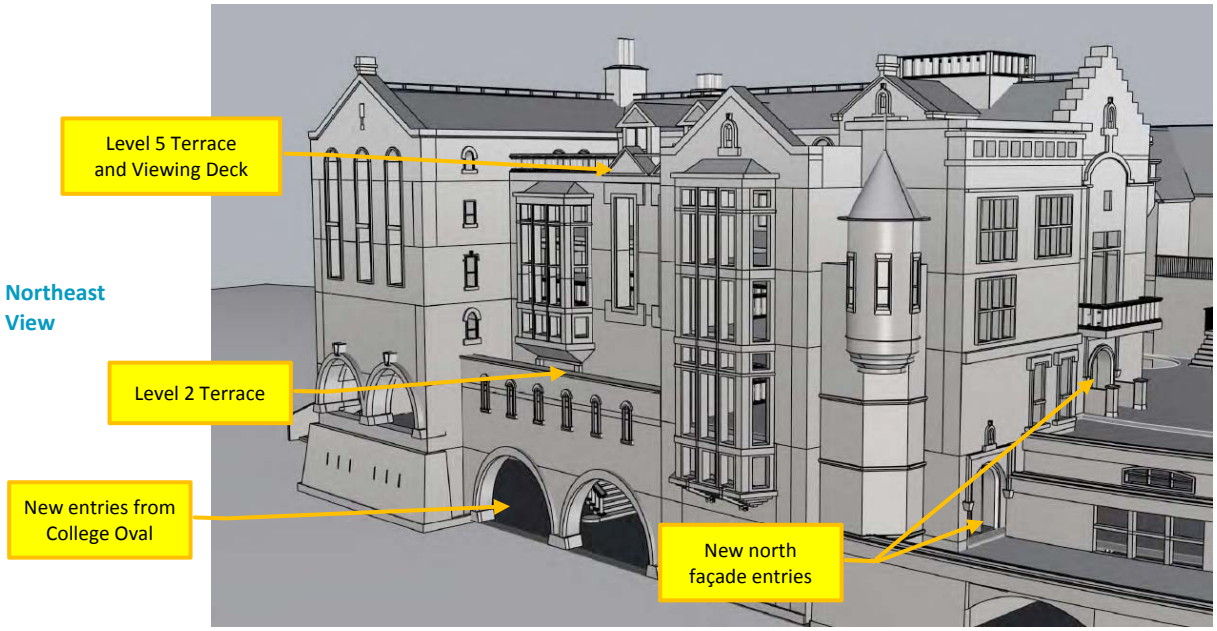
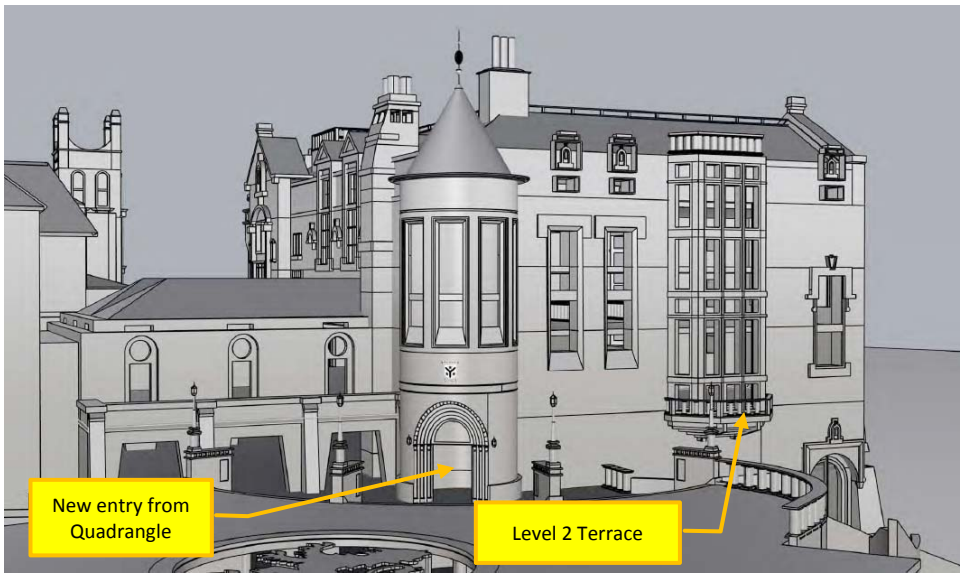
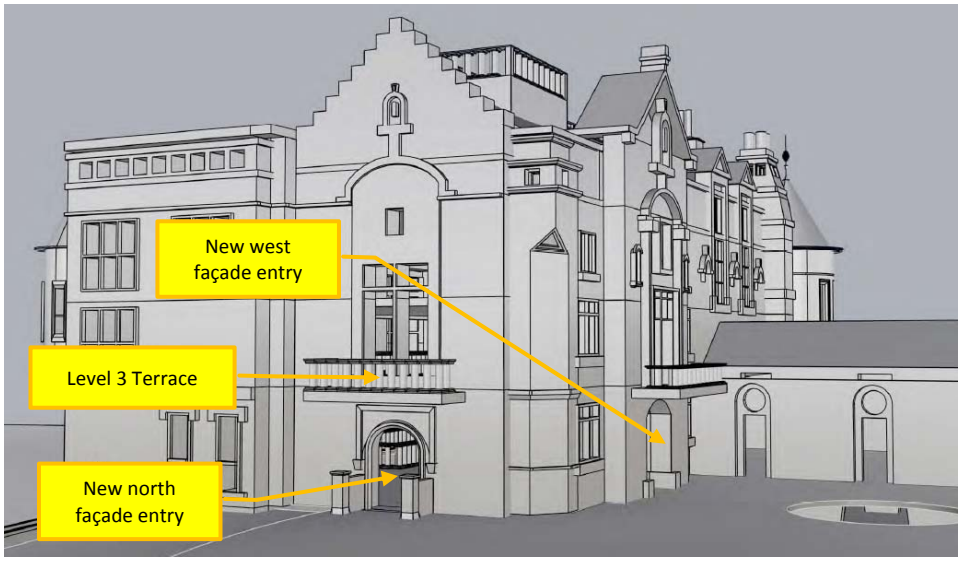


Fig 2 (cont'd)

Southern View



Northwest View



2.1 Surrounding Built Environment

The built environment and terrain surrounding the site comprises …

- Residential areas with one and two-storey buildings in all directions with reasonably copious trees and landscaping – refer **Figure 1**.
- Reasonably significant changes in elevation in all directions: dropping to the north (towards Sydney Harbour, Rose Bay) and east (Woollahra Oval, playing fields, golf course, etc); increasing to the south (in the direction of Bondi Junction) and west (the ridgeline between Bellevue Hill and Double Bay).

3 SYDNEY'S WIND CLIMATE

3.1 Seasonal Variations of Sydney's Regional Wind Climate

Key characteristics of Sydney's "regional" wind climate relevant to the redevelopment site are shown in the **Figure 3** annual wind rose and **Figure 4** seasonal wind roses, taken from Bureau of Meteorology met data recorded at Sydney Airport. These indicate that Sydney is affected by two primary wind seasons:

- Summer winds occur mainly from the northeast, southeast, and south. While northeast winds are the more common prevailing wind direction (occurring typically as offshore land-sea breezes), southeast and southerly winds generally provide the strongest gusts during summer.
- Winter/Early Spring winds occur mainly from the west-northwest, with only a small contribution from southerly winds. West quadrant winds provide the strongest winds during winter and in fact for the whole year.

Figure 3 Sydney Airport (Bureau of Meteorology Station) Annual Wind Rose

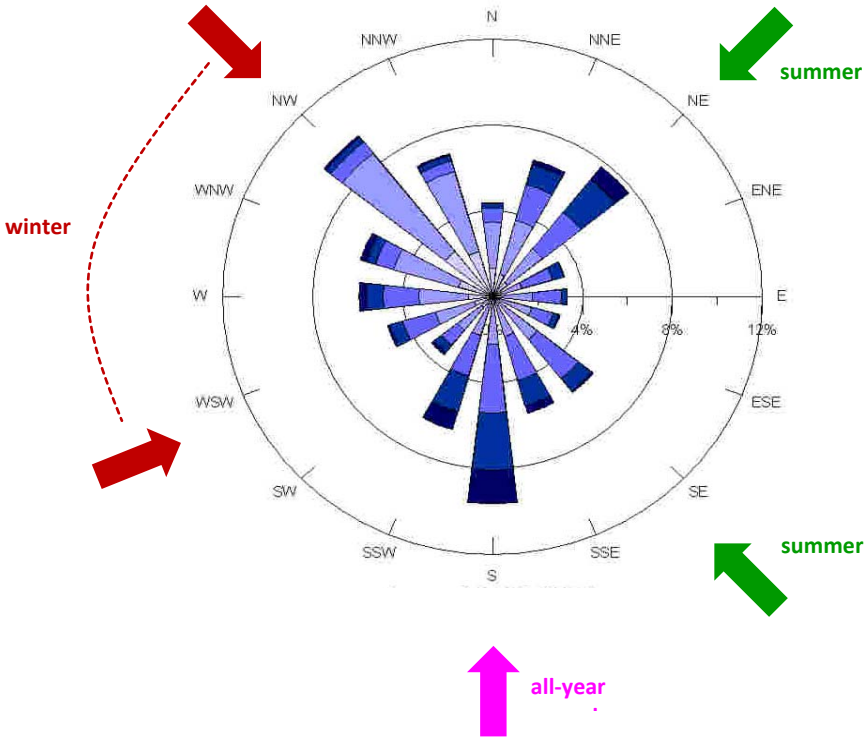
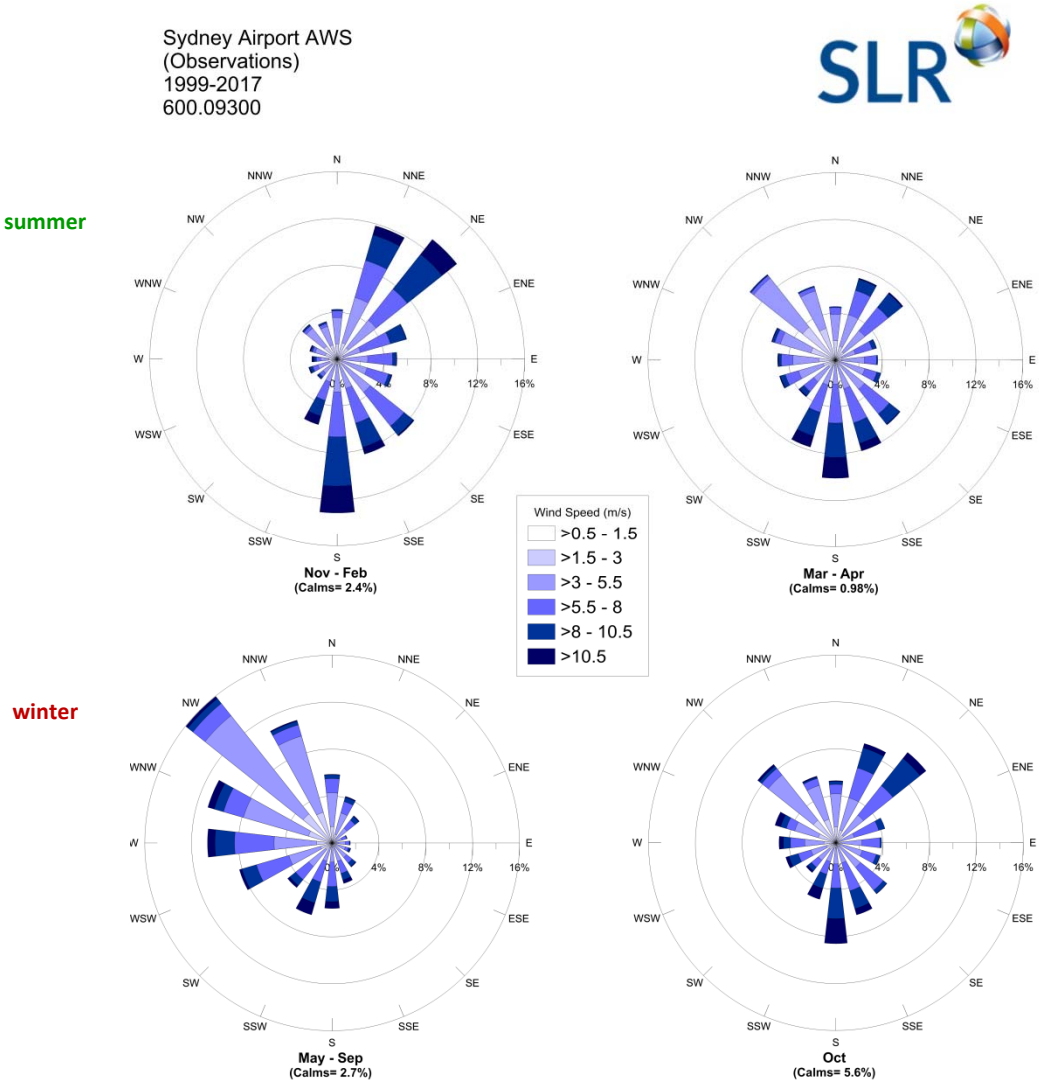


Figure 4 Sydney Airport (Bureau of Meteorology Station) Seasonal Wind Roses



3.2 Wind Exposure at the Site – the 'Local' Wind Environment

Close to the ground, the "regional" wind patterns described above are modified by the local terrain, topography and built environment, creating the "local" wind environment. At the redevelopment site, the following influences are present:

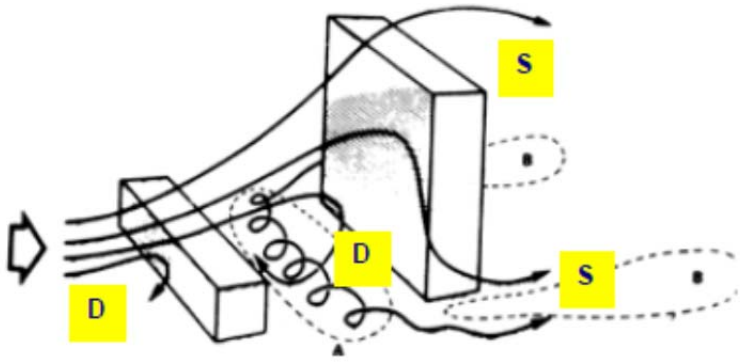
- The residential and landscape environment surrounding the site in all directions will generate a typical "suburban" type exposure, ie moderate sheltering of oncoming winds at ground level only.
- To the north and east, the drop in elevation will allow a moderate topographic-induced "speed-up" of winds approaching the site from these directions – this would apply to northeast winds.

4 BUILDING-WIND INTERACTION – GENERAL OBSERVATIONS

The impact of wind flowing past buildings has well understood general impacts at ground level - refer **Figure 5**. In general, the taller the building, the more pronounced the impact on ground level winds.

- **Downwash winds "D"** are the winds which impact on the windward face of a building and are then deflected downwards to Ground Level in a vertical direction
- Accelerating **Shearflow winds "S"** are the winds which experience an acceleration as they pass by the building edges and roof as the wind flow moves around and past the building

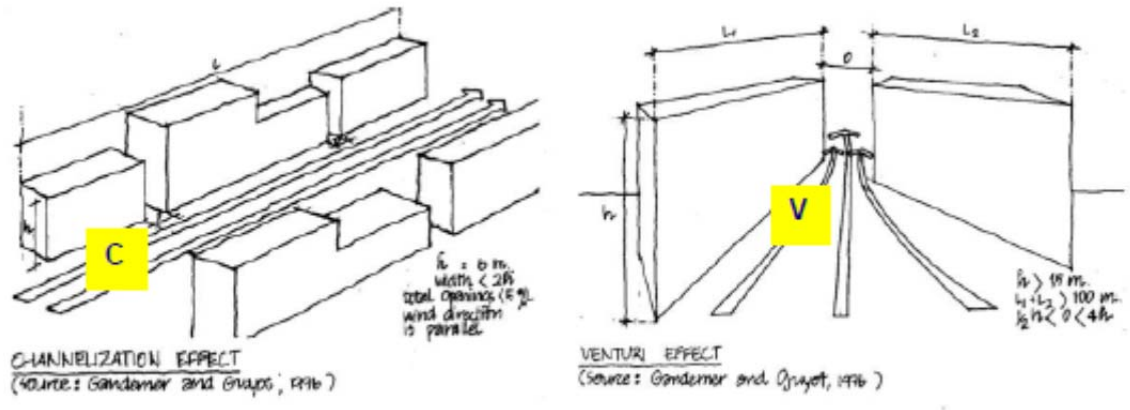
Figure 5 Wind Flow Patterns Past Regular Shaped Buildings



The grouping of buildings can also have an impact on surrounding pedestrian winds – refer **Figure 6**.

- **Channelling Effect winds "C"** result when there are rows of parallel buildings (especially taller ones) where the gaps in between the buildings line up with prevailing wind directions.
- **Venturi Effect winds "V"** result when wind flow is forced to pass between two converging buildings or groups of buildings with a resulting increase in flow.

Figure 6 Wind Flow Patterns Past Groups of Buildings

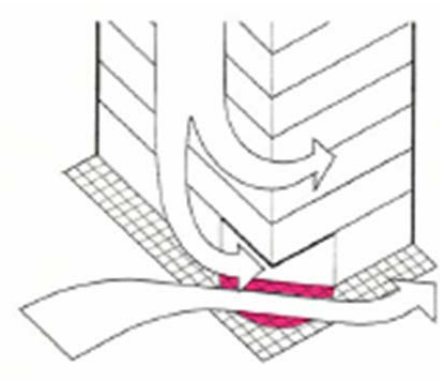


Local building details can also influence winds in the immediate vicinity – refer **Figure 7**.

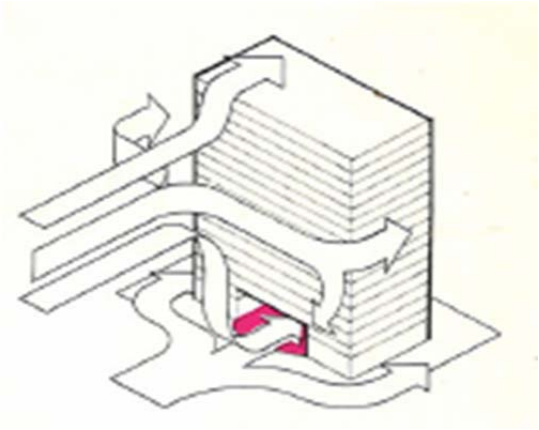
- The **"Undercroft"** effect is a well-known adverse building-wind characteristic as depicted in the generic building wind effect diagrams shown below**.** The winds are induced towards the negative pressure area within the undercroft, creating concentrated adverse wind flow through undercrofts and through-passages at the base of buildings.

Figure 7 Undercroft Winds and Through-Passage Winds

Undercroft Winds



Through-Passage Winds



5 WIND ACCEPTABILITY CRITERIA

5.1 Standard Local Government Criteria

The choice of suitable criteria for evaluating the acceptability of particular ground level conditions has been the subject of international research over the past few decades. One of the commonly accepted set of acceptability criteria developed from this research, currently referenced by many Australian Local Government Development Control Plans, is summarised in **Table 1**.

Table 1 Standard Local Government Wind Acceptability Criteria

Type of Criteria	Limiting Gust Wind Speed Occurring Once Per Year	Activity Concerned
Safety	24 m/s	Knockdown in Isolated Areas
	23 m/s	Knockdown in Public Access Areas
Comfort	16 m/s	Comfortable Walking
	13 m/s	Standing, Waiting, Window Shopping
	10 m/s	Dining in Outdoor Restaurant

The primary objectives relating to the above wind impact criteria are as follows:

- The general objective is for annual 3-second gust wind speeds to remain at or below the so-called 16 m/s "Walking Comfort" criterion. Whilst this magnitude may appear somewhat arbitrary, its value represents a level of wind intensity above which the majority of the population would find unacceptable for comfortable walking on a regular basis at any particular location.
- In many urban locations, either because of exposure to open water conditions or because of street "canyon" effects, etc, the 16 m/s "Walking Comfort" level may already be currently exceeded. In such instances a new development should ideally not exacerbate existing adverse wind conditions and, wherever feasible and reasonable, ameliorate such conditions.
- It can be seen in **Table 1** that the recommended limiting wind speeds for spaces designed for activities such as seating, outdoor dining, etc., are lower than for "walking comfort".

5.2 Application of Wind Criteria

The criteria provided in **Table 1** should not be viewed as *"hard"* numbers as the limiting values were generally derived from subjective assessments of wind acceptability. Such assessments have been found to vary considerably with the height, strength, age, etc., of the pedestrian concerned. A further factor for consideration is the extent of windy conditions, and some relaxation of the above criteria may be acceptable for small areas under investigation provided the general site satisfies the relevant criteria.

Finally, it is noted that the limiting wind speed criteria in **Table 1** are based on the maximum wind gust occurring (on average) once per year. Winds at all other times, ie monthly winds, weekly winds, etc, would be of lesser magnitude. So for example, a location with a maximum annual gust of 10 m/s would experience winds throughout the year of a generally very mild nature, conducive to stationary activities (seating, dining, etc)

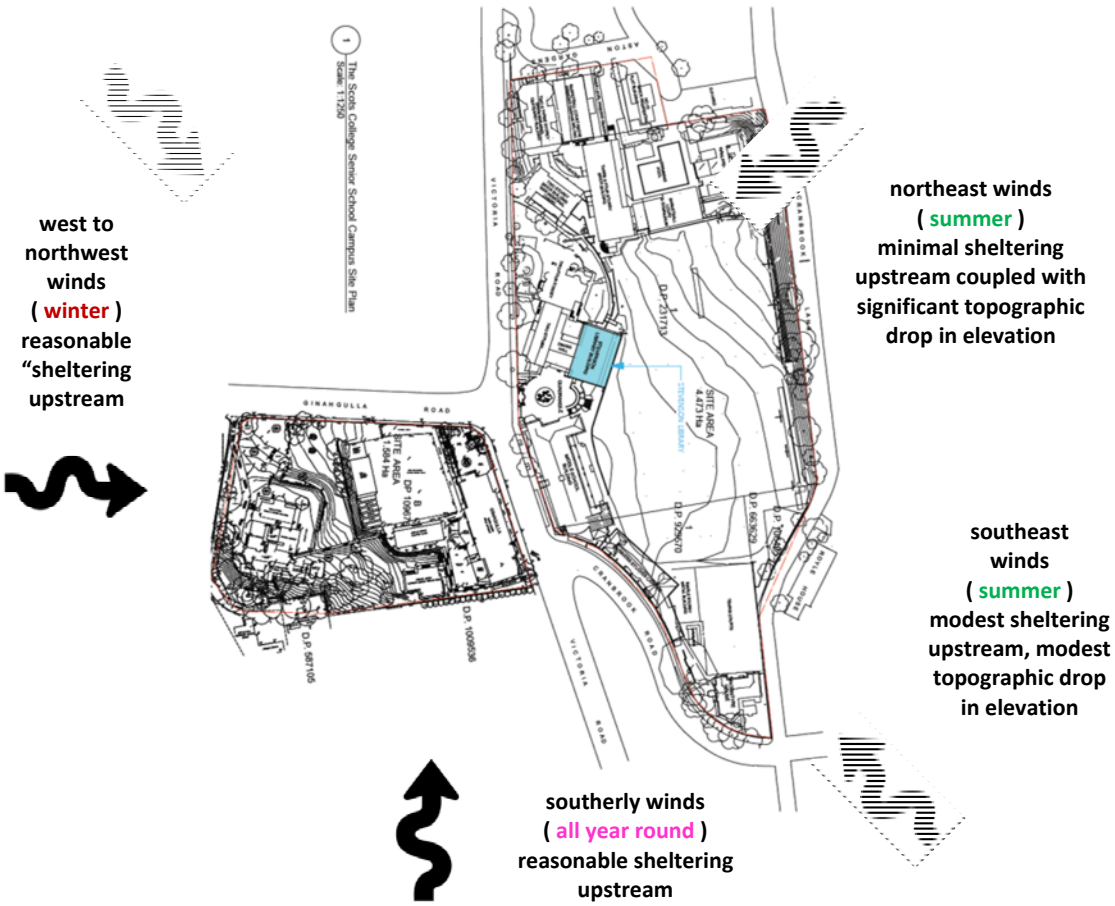
6 WIND IMPACTS OF THE PROPOSED REDEVELOPMENT

6.1 Wind Exposure

The exposure of the site to key prevailing wind directions is shown in **Figure 8**.

- Exposure will be relatively high for northeast and southeast winds.
- Exposure will be lower for southerly and westerly winds.

Figure 8 Exposure of the Site to Prevailing Winds

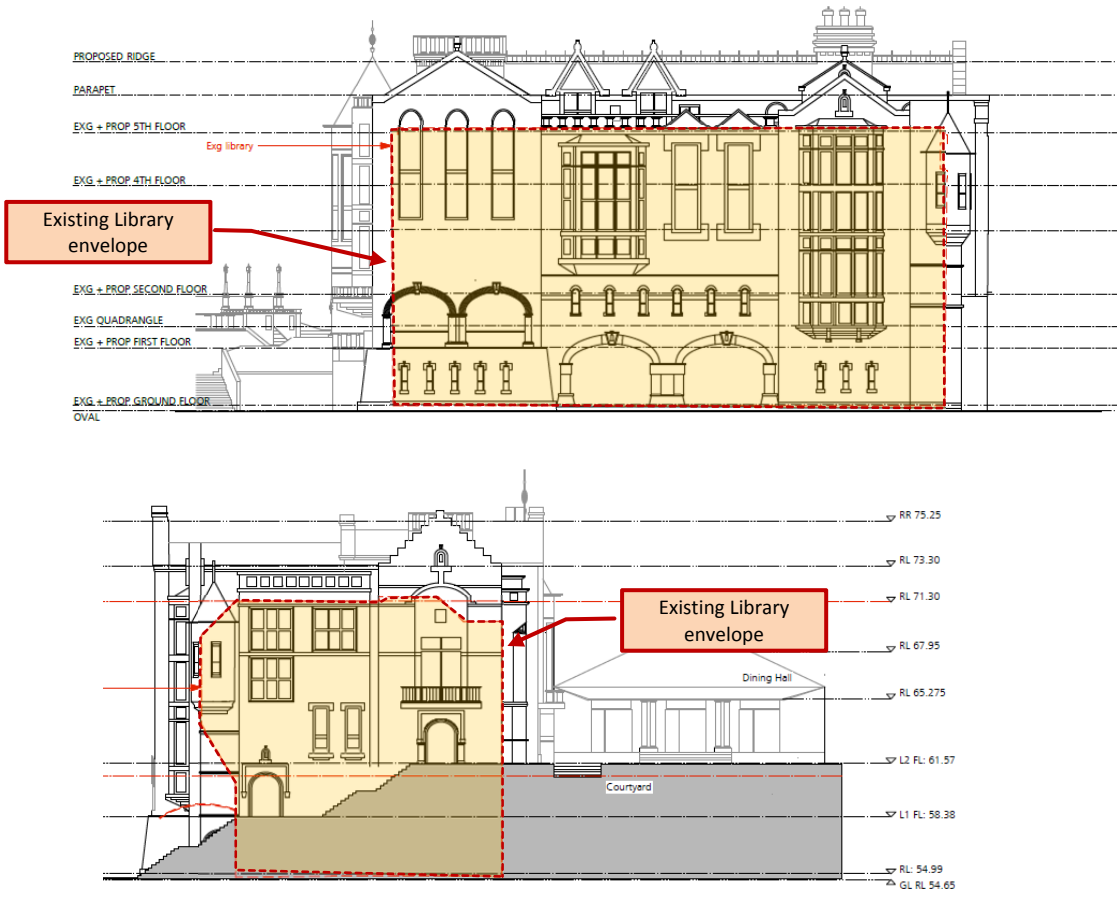


6.2 Bulk Building Envelope Changes

The wind impact of the redevelopment will be closely related to the change in its bulk envelope, which is illustrated in the east and north façade view shown in **Figure 8**.

- The redevelopment extends the height of the current overall envelope by approximately 4 m and the lateral extent by slightly lower distances.
- From a wind perspective, the overall bulk envelope of the redevelopment is only marginally greater than the current library building on the site.
- There will be potential for changes to local wind conditions in the immediate vicinity of the redevelopment, eg at library building corners, etc, but wind conditions further afield are unlikely to be affected.

Figure 9 Change in Redevelopment Bulk Envelope Compared to Existing Building



6.3 External Public Areas

The relevant wind acceptability criterion (refer **Section 5**) would be the 16 m/sec walking comfort criterion.

The nearest "external" public areas to the proposal with the potential to be impacted (in terms of local wind conditions) are the pedestrian areas along Victoria Road to the west of the redevelopment site and Cranbrook Lane to the east.

Pedestrian areas along Aston Garden and Aston Place (to the north) and Cranbrook Road (to the south) are too far away to experience any change in local wind conditions arising from the new library building, given the modest overall bulk envelope of the redevelopment and the distances involved.

Victoria Road:

- The highest winds along Victoria Road will likely arise from southerly winds given the orientation of the street and surrounding sheltering from residences and school buildings, vegetation and landscaping.
- Elevated winds may also be experienced at the intersection of Victoria Road and Ginahgulla Road for westerly wind conditions.
- The library redevelopment is set well back from Victoria Road and will occupy only a slightly larger bulk envelope compared to the existing library building.
- Furthermore, the redevelopment is not positioned in a way that will influence southerly or westerly winds along Victoria Road.

As a result, local Victoria Road footpaths will not experience any change in all-year-round wind conditions with the addition of the proposed redevelopment.

Cranbrook Lane:

- The highest winds along Cranbrook Lane will likely also arise from southerly winds given the orientation of the street and surrounding sheltering from residences to the east and the elevated school grounds to the west, combined with surrounding vegetation and landscaping.
- The library redevelopment is set well back from Cranbrook Lane and will occupy only a slightly larger bulk envelope comparted to the existing library building.
- Furthermore, the redevelopment is not positioned in a way that will influence southerly winds along Cranbrook Lane.

As a result, local Cranbrook Lane footpaths will not experience any change in all-year-round wind conditions with the addition of the proposed redevelopment.

On the basis of the above, it is concluded that the redevelopment will result in no impact on environmental winds at surrounding public access locations, including all surrounding pedestrian footpaths.

6.4 Redevelopment Building Entry Points

The redevelopment features several new entry points as shown in **Figure 2**.

East Façade (to College Oval)

- The new east façade (College Oval) entry points will likely be impacted by elevated northeast and southeast winds; these are summer wind conditions, with northeast (sea breeze) winds in particular being generally milder in nature.
- The expected relatively higher winds arising from the southeast will cause downwash at the two building entry points.

North Façade

- The two new north façade entry points (at Ground Floor and Level 2) will likely be impacted by elevated northeast (summer) winds, being generally milder in nature;
- The impact of northeast winds will be generally horizontal in nature, given the orientation of the façade;
- They will also be impacted by northwest winds, but receive significant sheltering from the adjacent Aspinall House for this wind direction.

West Façade

- The new west façade entry point (close to the northwest corner of the redevelopment) will also be impacted by northwest winds, but receive significant sheltering from the adjacent Aspinall House for this wind direction.

Southwest Corner (to College Quadrangle)

- The new semi-circular southwest corner entry point (from the College Quadrangle) will likely be impacted by elevated southeast (summer) winds and southwest (winter) winds;
- There will only be moderate sheltering for southeast winds; winds here will be accelerating around the circular entry point in a horizontal fashion;
- There will be slightly better sheltering or southwest winds, eg from the trees at the southwest corner of Victoria Road and Ginahgulla Road as well as buildings further upstream to the southwest;
- The impact of southerly winds at this entry will be ameliorate by sheltering from the nearby Middle School Building.

Cross-Flow Winds between Entry Points

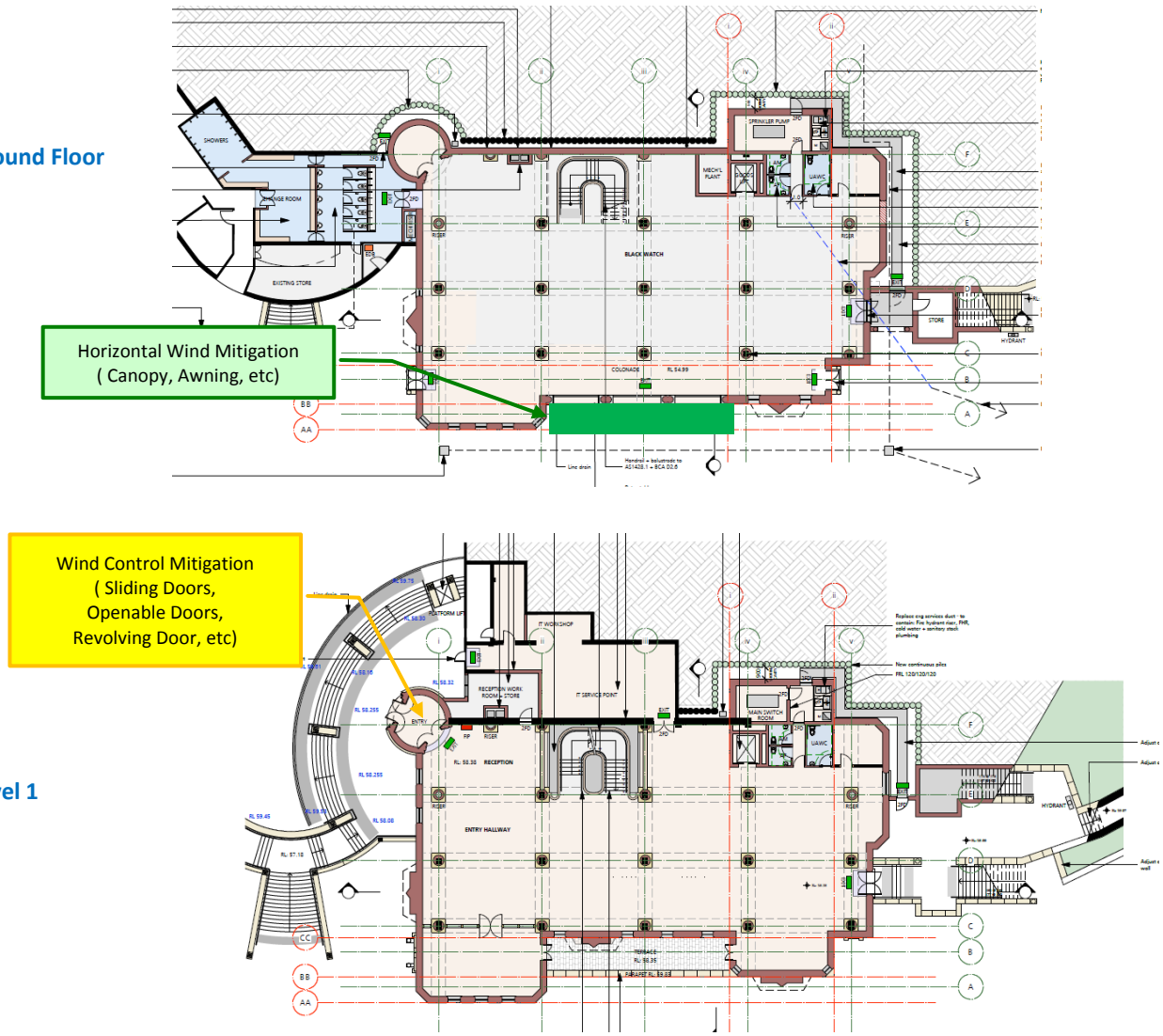
- It will be possible for airflow to move internally within the building between several entry points. East quadrant winds for example will enter the building at the Ground floor entry points and move via the U-shaped stairwell along the western wall to Level 1 exiting through the new southwest corner circular entry. The opposite airflow will occur for southwest winds.
- This airflow has the potential to create elevated internal wind conditions as well as elevated entry points wind conditions under high-wind, and associated strong pressure difference conditions across the building envelope.

On the basis of the above, and in relation to the wind acceptability criteria outlined in **Section 5**, areas likely to benefit from some form of wind mitigation are:

- The two east façade entry points leading to the College Oval; and
- The southwest corner entry point leading to the College Quadrangle.

The suggested wind mitigation for the entry areas of interest is shown in **Figure 10**.

Figure 10 Main Entry Wind Mitigation Recommendations



In the latest design iteration of the redevelopment (refer **Figure 10**), the southwest corner entry has been equipped with a double door design, which will create an effective airlock, thereby eliminating the potential for adverse cross-airflow within the redevelopment identified above.

6.5 Redevelopment Terraces

The redevelopment features several new terraces as shown in **Figure 2**.

East Façade

- The new east façade terraces on Level 2 and Level 5 will be impacted by elevated northeast and southeast winds; these are summer wind conditions, with northeast (sea breeze) winds in particular being generally milder in nature.

North Façade

- The new north façade terrace on Level 3 will likely be impacted by elevated northeast (summer) winds, being generally milder in nature, and northwest winds, although the latter will receive significant sheltering from the adjacent Aspinall House for this wind direction.

West Façade

- The new west façade terrace on Level 3 (close to the northwest corner of the redevelopment) will also be impacted by northwest winds, but receive significant sheltering from the adjacent Aspinall House for this wind direction.

South Facade

- The new south façade terrace on Level 1 will likely be impacted by elevated southeast (summer) winds and southwest (winter) winds.

For all of the above, any instances of potential elevated wind conditions will likely be horizontal in nature, ie wind accelerating across the facades of the redevelopment as opposed to downwash type windflow.

Accordingly, if it is intended to use these terrace areas on an all-year-round basis, with frequent public access usage expected, the relevant wind mitigation would involve having a reasonable balustrade height (say 1.2 m minimum) to protect the terrace areas.

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