PROPOSED MIXED-USE DEVELOPMENT - SSDA

2A Gregory Place, Harris Park, NSW
Desktop Environmental Wind Study

Prepared for:

2A Gregory Place Pty Ltd
2A Gregory Place
Harris Park NSW 2150

SLR Ref: 610.30838-R01
Version No: -v1.0
July 2022

PREPARED BY

SLR Consulting Australia Pty Ltd
ABN 29 001 584 612
Tenancy 202 Submarine School, Sub Base Platypus, 120 High Street
North Sydney NSW 2060 Australia

T: +61 2 9427 8100
E: sydney@slrconsulting.com www.slrconsulting.com

BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with 2A Gregory Place Pty Ltd (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.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
610.30838-R01-v1.0	12 July 2022	Mark Hobday	Dr Neihad Al-Khalidy	Dr Neihad Al-Khalidy

EXECUTIVE SUMMARY

SLR Consulting Australia Pty Ltd (SLR) has been engaged by 2A Gregory Place Pty Ltd to assess the wind impact on the immediate surrounds of a proposed Mixed-Use Development (herein the Project) located at 2A Gregory Place, Harris Park– refer **Figure 1**.

The present study is a qualitative (expert opinion) study of potential wind impacts.

This initial assessment has been made on the basis of our best engineering judgment and on the experience gained from (decades of) scale-model Wind Tunnel Testing and CFD Simulation Modelling of a range of similar scale developments.

This assessment is submitted to the Department of Planning, Industry and Environment (DPIE) in support of a State Significant Development Application for the development of the Project for the purposes of a mixed-use precinct with open space, retail, and residential uses, for a Build to Rent and Affordable Housing residential development.

Local Wind Climate

On the basis of long-term wind records obtained from the Bureau of Meteorology stations weather at Bankstown Airport, SLR has determined that key prevailing wind directions of interest are the northeast and south/southeast for summer/early autumn and west quadrant winds for winter/early spring.

Future Wind Environment

In terms of the *future* wind environment with the proposed Development, the following features are noted as being of most significance:

- The proposed Development's main residential blocks are set back from its street frontage with extensive landscaping (large trees) planned.
- Areas potentially requiring wind mitigation are largely within the site, especially the elevated Roof Terraces, Link Terraces and through site links.
- Windbreak recommendations, all of which will be implemented in the design of the development, have been made to assist in ameliorating potentially adverse winds identified in this study. Accordingly, all affected areas should be able to comply with the recommended wind acceptability criteria – refer **Section 7** and **Figures 8** for details.
- During the Detailed Design phase of the project, once the design of the various building facades is finalised, further modelling could be carried out to confirm zones of the building, by height and by plan view location (eg which building corners), where wind mitigation (ie beyond the standard balustrade height) may be beneficial IF it is intended for balconies and terraces to be used all-year-round, also noting that the strongest westerly winds occur during winter. It is recommended to complete a detailed 3D CFD Simulation Modelling rather than Wind Tunnel Testing, given the issue of balcony scaling at typical 1:400 wind tunnel test scales.

This initial assessment has been made on the basis of our best engineering judgment and on the experience gained from (decades of) scale-model Wind Tunnel Testing and CFD Simulation Modelling of a range of similar scale developments.

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1 INTRODUCTION

SLR Consulting Australia Pty Ltd (SLR) has been engaged by 2A Gregory Place Pty Ltd to assess the wind impact on the immediate surrounds of a proposed Mixed-Use Development (herein the Project) located at 2A Gregory Place, Harris Park.

The present study is a qualitative (expert opinion) study of potential wind impacts. It is intended to follow this up with a model-scale Wind Tunnel Environmental Test to reliably quantify these impacts and confirm the efficacy of recommended wind mitigation treatments.

This initial assessment has been made on the basis of our best engineering judgment and on the experience gained from (decades of) scale-model Wind Tunnel Testing and CFD Simulation Modelling of a range of similar scale developments.

Objective of the Study

This assessment is submitted to the Department of Planning, Industry and Environment (DPIE) in support of a State Significant Development Application (SSDA) for the development of the Project for the purposes of a mixed-use precinct with open space, retail, and residential uses, for a Build to Rent and Affordable Housing residential development.

2 PROPOSED DEVELOPMENT OVERVIEW

2.1 Development Site Location

The proposed Development is bounded by Gregory Place to the east and Parkland to the north and south- refer **Figure 1**.

Figure 1 Proposed Development Site Location

2.2 Proposed Development Description

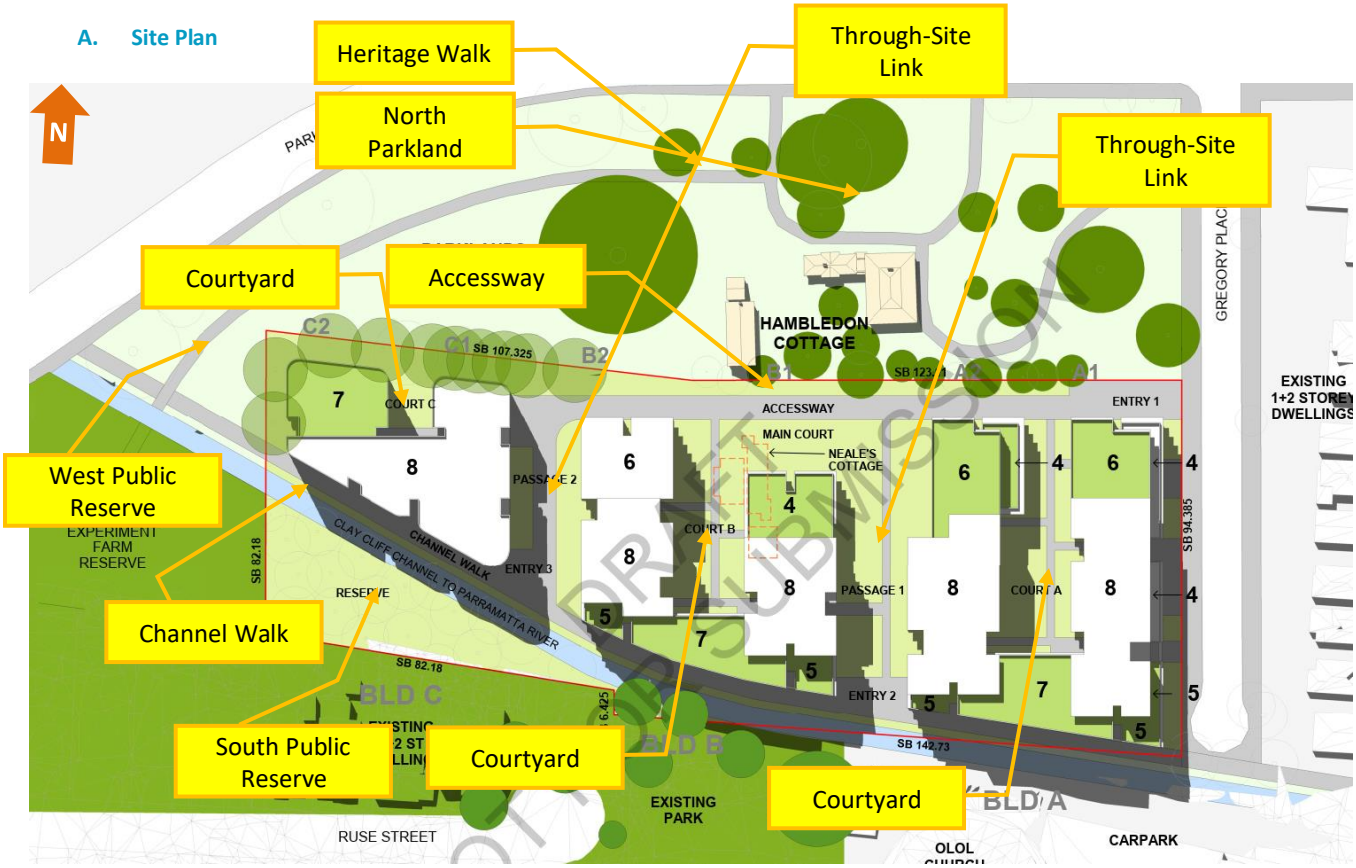
SSDA seeks approval for the following mixed-use development:

- Demolition of all existing buildings and structures on the site, site preparation works, excavation and tree removal;
- The construction of a mixed-use development comprising:
  - 483 apartments across (3) buildings "A", "B", "C", between 6-8 storeys in height;
  - 13,210 m^2 of publicly accessible open space on the ground level including a 1530m^2 park, 7737 m^2 of courtyards, passages and accessways, and through site walkways between the buildings and from Gregory place to Parkes Street.
  - There will be roof terraces and green roof links between or above all buildings, with a total of 3133m^2 landscaped area above ground level.

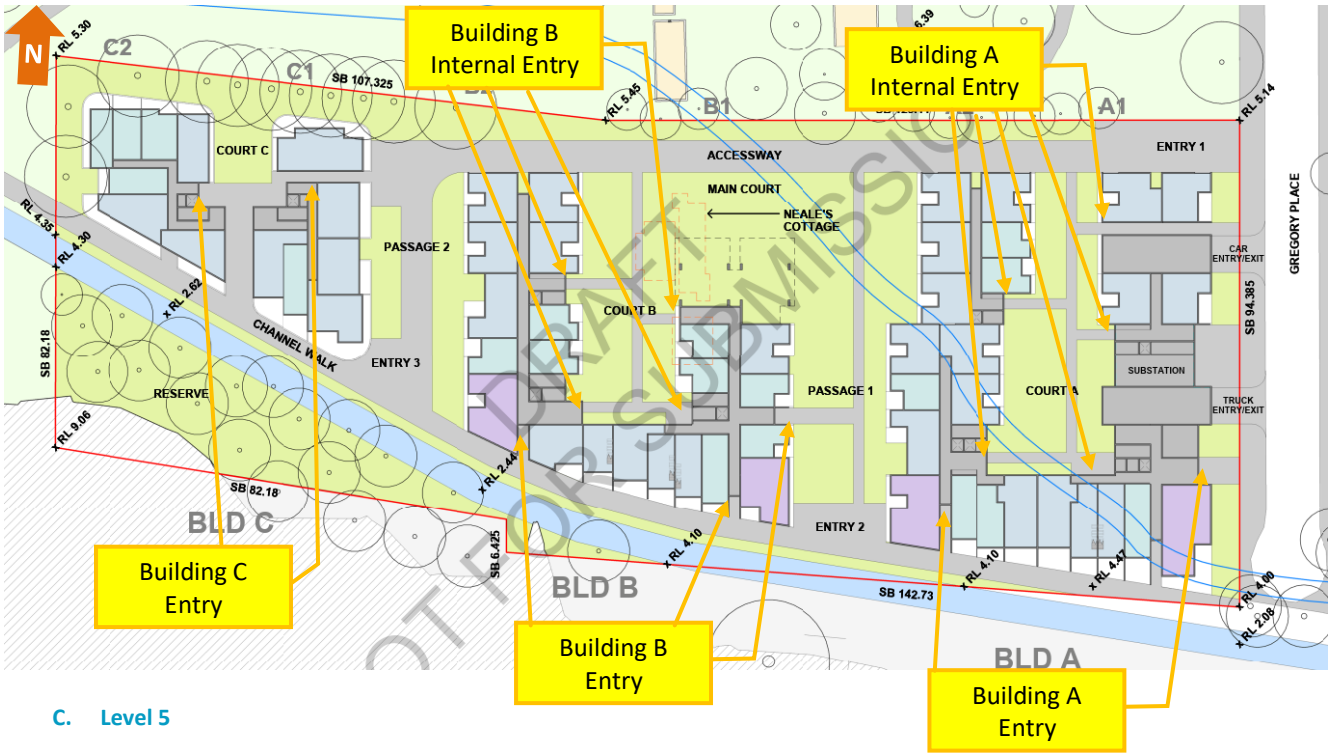
Representative Floor Plans and Development Images are shown in **Figure 2**.

Figure 2 Representative Plans of the Proposed Development

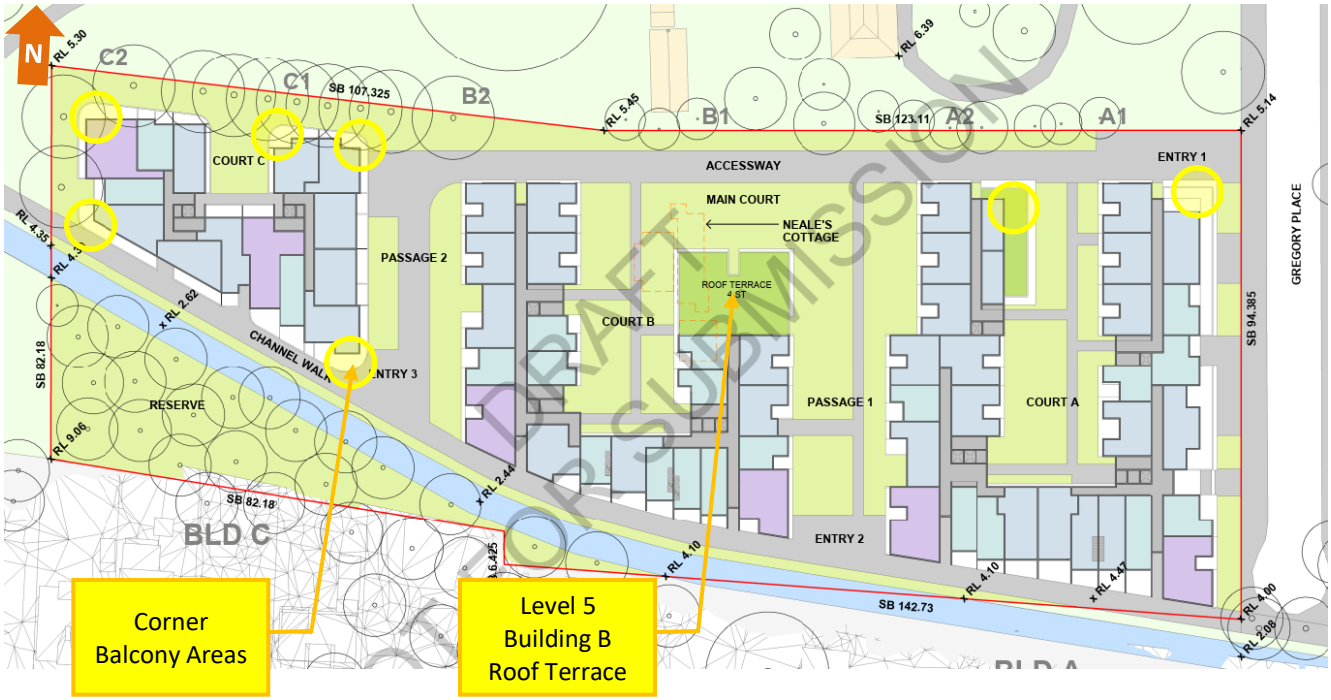
A. Site Plan



B. Ground Level

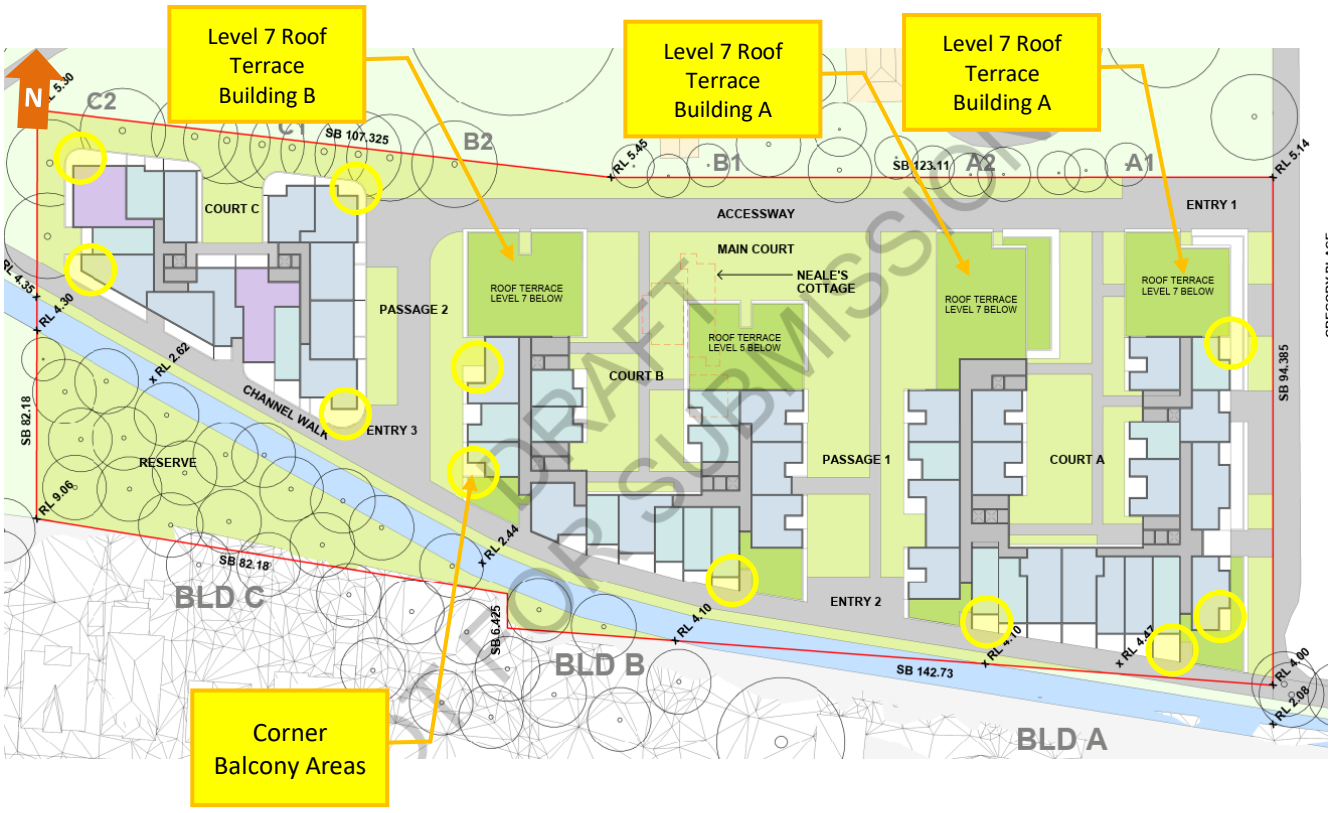


C. Level 5

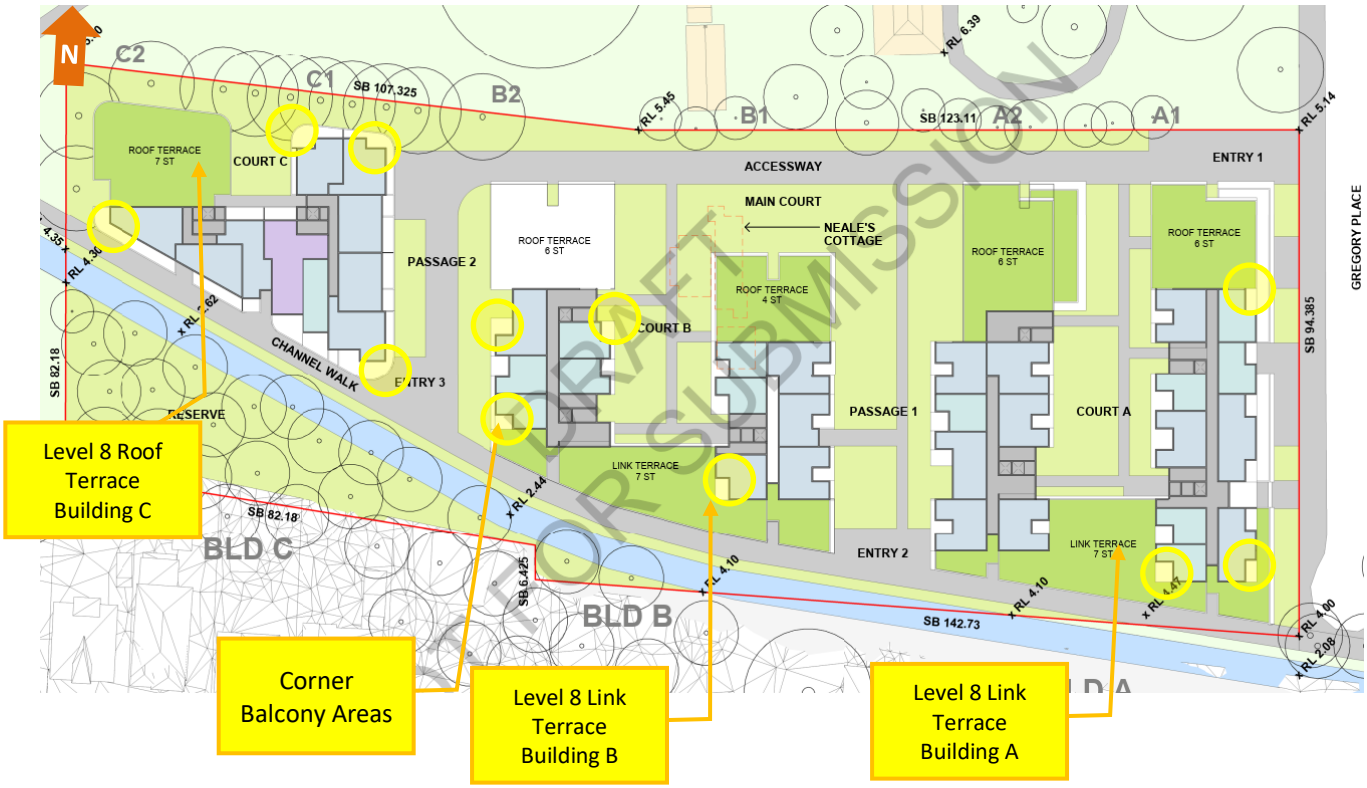


D. Level 6

E. Level 7



F. Level 8


N
C2
C1
SB 107.325
B2
B1
A2
A1
ROOF TERRACE 7 ST
COURT C
ACCESSWAY
ENTRY 1
MAIN COURT
NEALE'S COTTAGE
ROOF TERRACE 6 ST
PASSAGE 2
ROOF TERRACE 4 ST
COURT B
CHANNEL WALK
ENTRY 3
RESERVE
PASSAGE 1
COURT A
LINK TERRACE 7 ST
ENTRY 2
BLD C
BLD B
SB 142.73
SB 123.11
SB 94.385
SB 82.18
GREGORY PLACE
DRAFT FOR SUBMISSION
Level 8 Roof Terrace Building C
Corner Balcony Areas
Level 8 Link Terrace Building B
Level 8 Link Terrace Building A

2.3 Surrounding Built Environment

"Near Field"

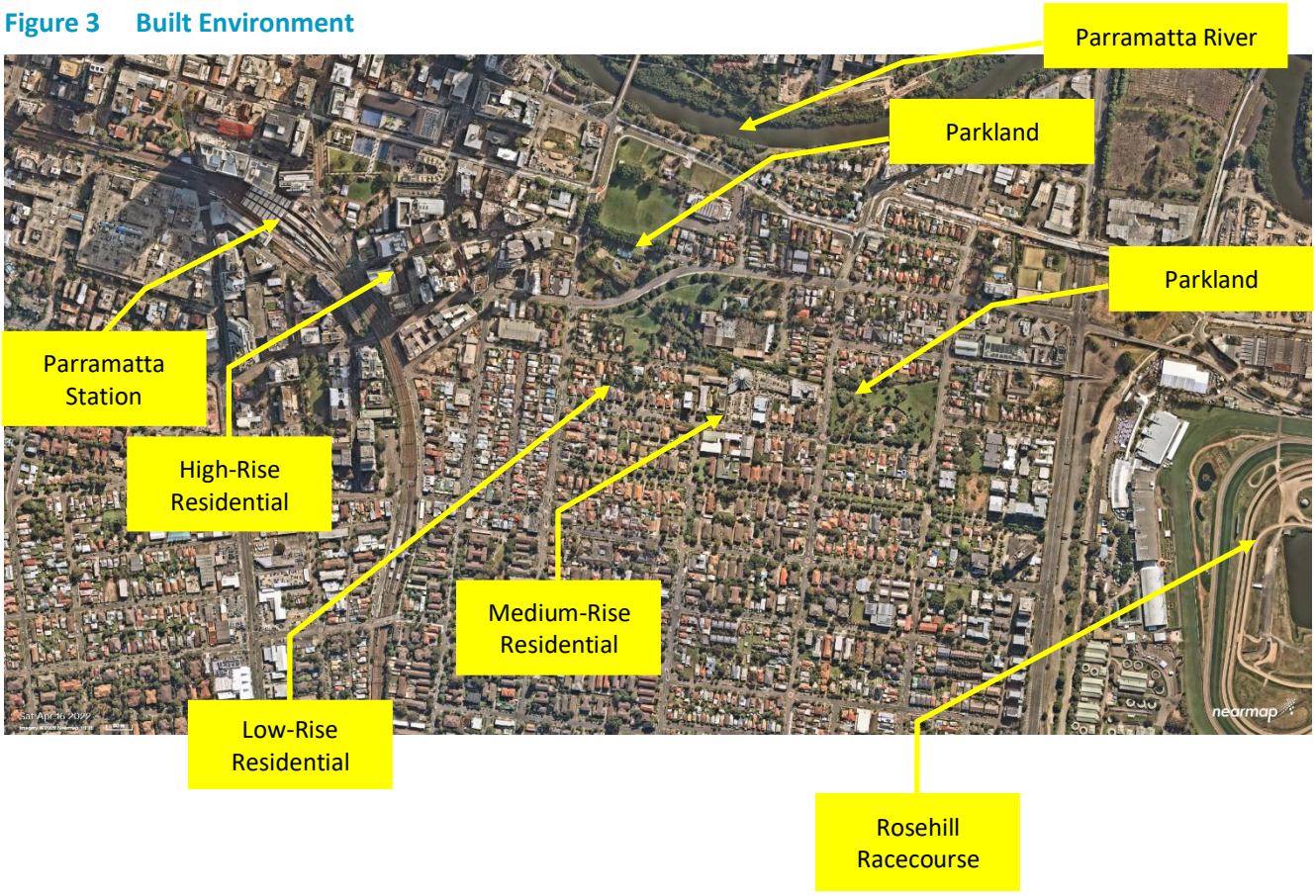
The "near-field" built environment comprises mainly low-rise residential, commercial and industrial in all directions, with the exception of several medium rise residential south and southeast – refer **Figure 3**. These buildings will influence the winds arriving at the site, especially from the southeast.

"Far Field"

The "far-field" built environment comprises the same mix of typically low to mid rise residential areas and commercial/industrial buildings, with scattered similar height residential buildings towards the northwest. To the northwest and southwest lies some parkland, with Parramatta station to the west and Parramatta River to the north.

The surrounding topography is generally flat with no significant features (hills, ridges, escarpments, etc) influencing local wind speeds.

Figure 3 Built Environment



3 SYDNEY'S WIND CLIMATE

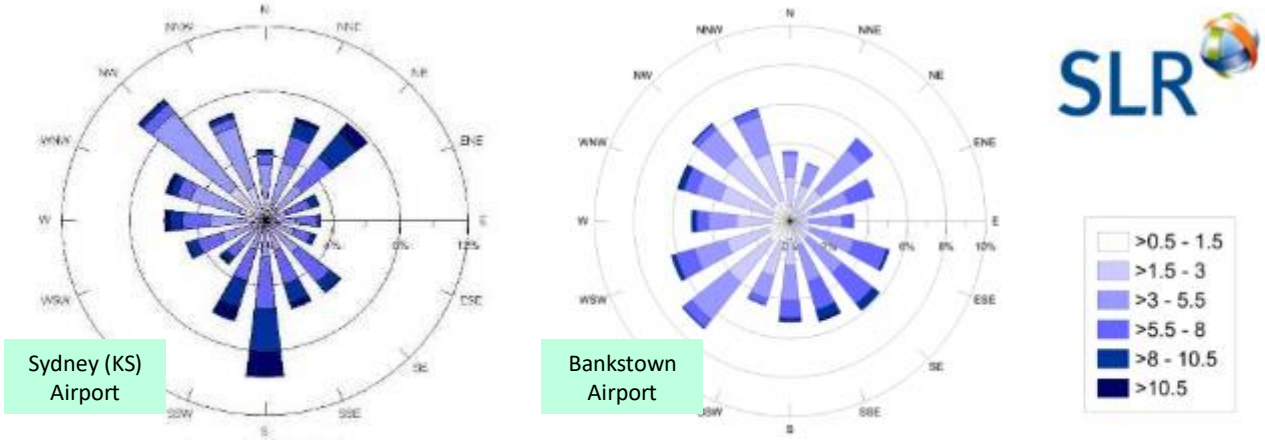
The data of interest in this study are the mean hourly wind speeds and largest gusts experienced throughout the year (especially higher, less frequent winds), how these winds vary with azimuth, and the seasonal break-up of winds into the primary Sydney Region wind seasons.

3.1 Annual and Seasonal Regional Variations

Key characteristics of Sydney's Regional Wind Climate are illustrated in two representative wind roses shown in **Figure 4**, taken from Bureau of Meteorology (BoM) data recorded during the period 1999-2017 at Sydney (Kingsford Smith) Airport and Bankstown Airport. A review of the associated seasonal wind roses (refer **Appendix A**) shows that Sydney is affected by two primary wind seasons with relatively short (1-2 month) transition periods in between:

- 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. Northeast winds (as sea breezes) and stronger southerly winds (eg "East Coast Lows" and "Southerly Busters") have a greater impact along the coastline. Inland, these systems lose strength and have altered wind direction characteristics.
- Winter/Early Spring winds occur mainly from west quadrants and to a lesser extent from the south. West quadrant winds provide the strongest winds during winter and in fact for the whole year, particularly at locations away from the coast.

Figure 4 Annual Wind Roses for Sydney (KS) Airport and Bankstown Airport (BoM Data)



3.2 Representative Winds for Harris Park

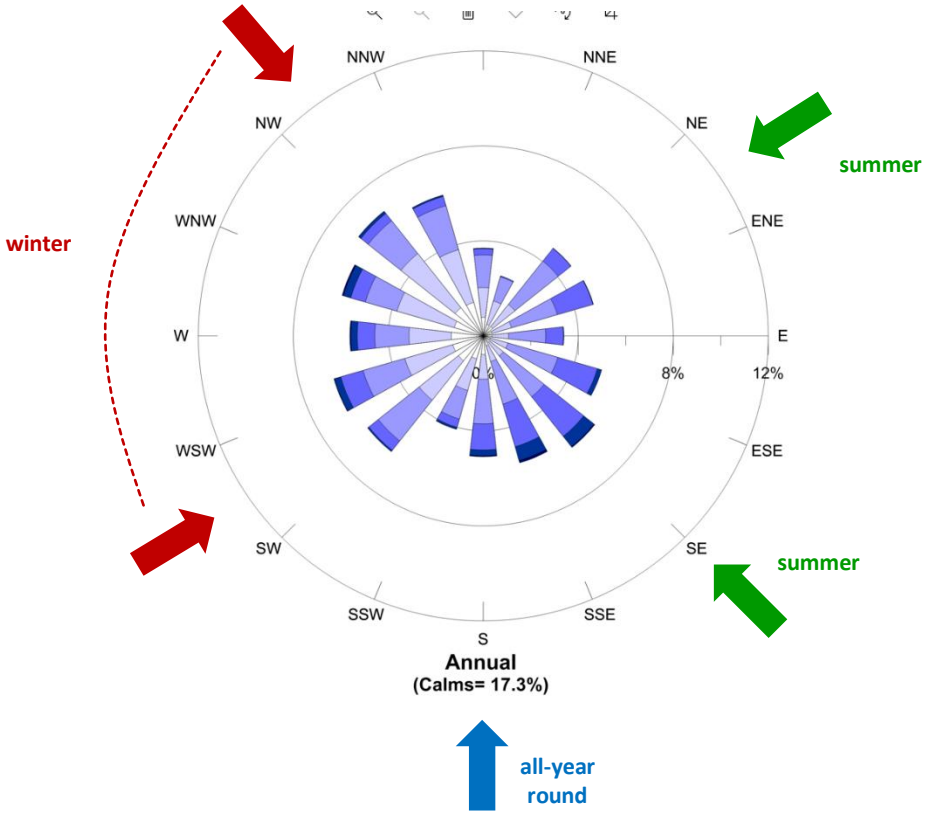
SLR has carried out a detailed study of Sydney Basin wind speeds using continuous records of wind speed and direction measured at the Bureau of Meteorology's (BoM) Sydney weather stations. Particular emphasis was given to weather stations with a "clean" surrounding exposure, ie stations such as Sydney (Kingsford Smith) Airport and Bankstown Airport Details can be found in …

- SLR Technical Note: *"9300-TN-CW&E-v2.0 Sydney Region Design Winds"*, March 2018.

For Harris Park, SLR has determined that local upper level winds reflective of the weather systems experienced at the site would have characteristics closer to Bankstown Airport compared to Sydney (KS) Airport, given Carlingford's distance (22 km) inland from the coast compared to Bankstown Airport (25 km) and Sydney (KS) Airport (5 km).

Accordingly, Harris Park wind speeds – refer **Figure 5** - would have slightly lower strength characteristics from the northeast and south compared to Sydney (Kingsford Smith) Airport and higher strengths from the southeast and southwest/northwest relative to Sydney (KS) Airport.

Figure 5 Seasonal Variation of Wind Speeds Expected at Harris Park



3.3 Wind Exposure at the Site – the "Local"' Wind Environment

Close to the ground, the "regional" wind patterns described above are affected by the local terrain, topography and built environment, all of which influence the "local" wind environment.

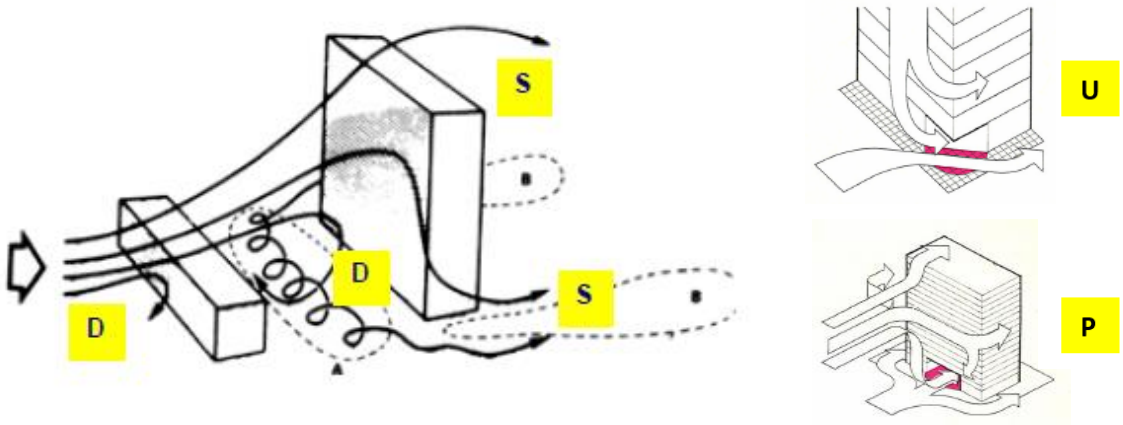
- As noted in **Section 1.3**, the far field environment currently comprises of a mix of typically low to medium rise residential areas and commercial/industrial buildings to all direction, except to north and southeast direction where there are large parkland areas.
- The site will therefore receive only modest wind shielding from most of the wind directions with increased sheltering (especially at lower levels) from west direction.

4 BUILDING-WIND INTERACTION – GENERAL OBSERVATIONS

The impact of wind flowing past buildings has well understood general impacts at ground level - refer **Figure 6**. 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
- Concentrated adverse windflow can also be created when winds are accelerated by the negative pressure area at an undercroft (**"U"**) or through passages (**"P"**) at the base of buildings.

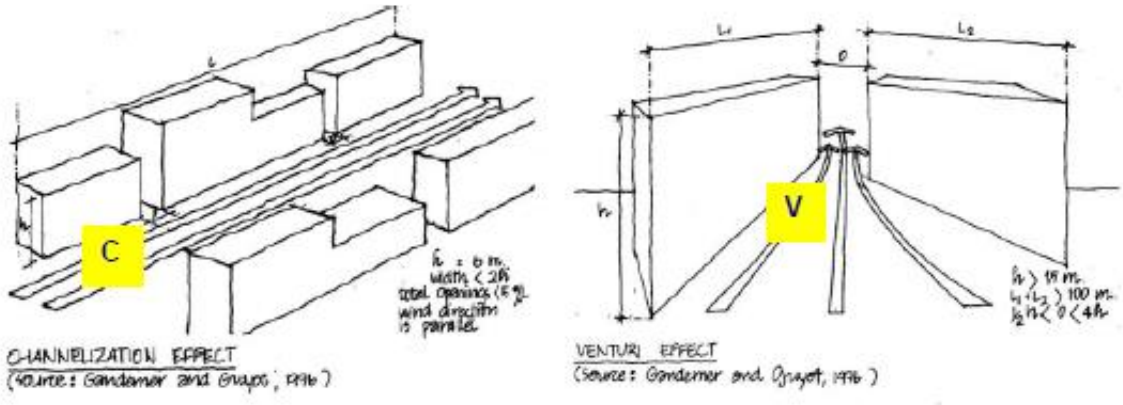
Figure 6 Wind Flow Patterns Past Regular Shaped Buildings



The grouping of buildings can also have an impact on surrounding pedestrian winds – refer **Figure 7**.

- **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 7 Wind Flow Patterns Past Groups of Buildings



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**. The limiting wind speed criteria in **Table 1** are based on the maximum wind gust occurring (on average) once per year.

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 (ie more stringent) than for "walking comfort".

5.2 Application of Wind Criteria

The criteria provided in **Table 1** (especially in relation to Comfort) 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.

6 WIND IMPACTS OF THE PROPOSED REDEVELOPMENT

6.1 Areas of Interest in Relation to Wind Impact

Areas of interest in relation to the expected wind impact of the proposed Development on surrounding footpaths, primary building entry points, communal open spaces, balconies, etc, are identified in **Figure 2**.

- Gregory Place Pedestrian Walkway — refer **Figure 2-A**
- Parkland Heritage Walkway — refer **Figure 2-A**
- The Public Park, to the north of the site — refer **Figure 2-A**
- The Public Reserve, to the southwest of the site — refer **Figure 2-A**
- The Public Park, to the east of the site — refer **Figure 2-A**
- The Accessway, at the north of the site — refer **Figure 2-A**
- The Channel Walk, at the north of the site — refer **Figure 2-A**
- The Building Lobby Entrances, on Ground level — refer **Figure 2-B**
- Courtyard A, on Ground level — refer **Figure 2-A**
- Courtyard B, on Ground level — refer **Figure 2-A**
- Courtyard C, on Ground level — refer **Figure 2-A**
- Passage 1, on Ground level — refer **Figure 2-A**
- Passage 2, on Ground level — refer **Figure 2-A**
- Private Corner Balconies — refer **Figure 2-C to F**
- Level 5 Roof Terrace Building B — refer **Figure 2-C**
- Level 7 Roof Terrace Building B — refer **Figure 2-E**
- Level 7 Roof Terrace Building A — refer **Figure 2-E**
- Level 8 Roof Terrace Building C — refer **Figure 2-F**
- Level 8 Link Terrace Building A — refer **Figure 2-F**
- Level 8 Link Terrace Building A — refer **Figure 2-F**

6.2 Future Wind Impact at All Areas of Interest

The wind impact of the proposed Development is described by examining the impact of key prevailing wind conditions on areas of interest within and external to the development. The key directions analysed are:

- NE and S/SE winds for spring-summer-autumn months and
- W winds (ranging from SW to NW) for winter months.

The predicted wind environment at the site is examined in terms of both:

- Existing Winds, and
- Future Winds with the addition of the proposed development.

The above predictions are made on the basis of our best engineering judgement and (decades of) experience in carrying out Environmental Wind Tunnel Testing and CFD Simulation Studies.

The above predictions are made without necessarily assuming any benefit from the already planned landscaping for the proposed development.

Prevailing Wind Direction:
NORTHEAST Winds

Period of Annual Cycle:
Summer (October to March)

Location	Existing Compliance	Future Compliance	Key Factors
Gregory Place Pedestrian Walkway	**Likely comply**	**Moderate Increase Likely comply**	NE winds are generally mild. The proposed development's Gregory Place façades are set back from the footpath. It is likely higher NE winds could potentially be directed downwards off Building A's east facing façade and impacting the Gregory Place pedestrian walkways.
Parkland Heritage Walkway	**Likely comply**	**Moderate Increase Likely comply**	NE winds are generally mild. The proposed development's Northern façades are set back from the Parkland Heritage Walkway. Higher NE winds could potentially be directed downwards off Building C's north facing façade and impacting the western sections of the Parkland Heritage Walkway. The landscaping to the north of the development is expected to reduce the impact of this wind condition.
The North Public Park	**Likely comply**	**Moderate Increase Likely comply**	NE winds are generally mild. The proposed development's northern façades are set back from the North Public Park. The development may create some blockage of the northeastern winds and may redirect some winds towards the western sections of the North Park. The landscaping to the north of the development is expected to reduce the impact of this wind condition.
The South Public Reserve	**Likely comply**	**Moderate Increase Likely comply**	NE winds are generally mild. The proposed development's façades are set back from the South Public Reserve. The development may create channelling effect between building B and C and may redirect some winds towards the South Public Reserve. The landscaping to the south of the development is expected to reduce the impact of this wind condition.
The West Public Park	**Likely comply**	**Moderate Increase Likely comply**	NE winds are generally mild. The proposed development's façades are set back from the West Public Park. Higher NE winds could potentially be directed downwards off Building C's north facing façade and impacting the West Public Park. The landscaping to the north and west of the development is expected to reduce the impact of this wind condition.
The Accessway	Locations not relevant to "existing" built environment	**May just comply**	NE winds are generally mild. The proposed development has a broken façade design along the Accessway. The development may create side streaming effect along the Accessway. The landscaping to the north of the development is expected to reduce the impact of this wind condition.
The Channel Walk		**May just comply**	NE winds are generally mild. The proposed development's will create a large amount of shielding along the Channel Walk. The development may create channelling effect between the buildings which may impact specific areas of the Channel Walk. The landscaping to the north and east of the development is expected to reduce the impact of this wind condition.
Building A External Lobby Entry		**May not comply without appropriate mitigation**	Although NE winds are generally mild, there will be infrequent occasions where higher NE winds are directed downwards off Building A's George Place façade onto the area in front of the Building A's Lobby. The broken façade along building A's east façade is expected to limit the impact of this wind condition. Other entrances are expected to be largely shielded by the development from the northeastern winds.

Location	Existing Compliance	Future Compliance	Key Factors
Building A Courtyard Lobby Entry	Locations not relevant to "existing" built environment	**Likely comply**	Sheltering from the proposed development's Building A will limit northeast winds at this Lobby entry. It is expected building shape around the courtyard will stagnate any winds entering the courtyard area.
Building B External Lobby Entry		**May not comply without appropriate mitigation**	Although NE winds are generally mild, there will be infrequent occasions where higher NE winds are directed downwards off Building B's Eastern façade onto the area in front of the Building B's Lobby. Furthermore, there may be a channelling effect between building A and B which may impact the Lobby entrance area. The broken façade along building B's east façade is expected to limit the impact of this wind condition. Other entrances are expected to be largely shielded by the development from the northeastern winds.
Building B Courtyard Lobby Entry		**Likely comply**	Sheltering from the proposed development's Building B will limit northeast winds at this Lobby entry. It is expected building shape around the courtyard will stagnate any winds entering the courtyard area.
Building C External Lobby Entry		**May not comply without appropriate mitigation**	Although NE winds are generally mild, there will be infrequent occasions where higher NE winds are directed downwards off Building C's Eastern façade onto the area in front of the Building C's Lobby. Furthermore, there may be a channelling effect between building B and C which may impact the Lobby entrance area. Other entrances are expected to be largely shielded by the development from the northeastern winds.
Building C Courtyard Lobby Entry		**Likely comply**	Sheltering from the proposed development's Building C will limit northeast winds at this Lobby entry. It is expected that specific entrances around the corners of the building C will be impacted by the S to SE significantly.
Courtyard A		**Likely comply**	Sheltering from the proposed development's Building A will limit northeast around the Courtyard A area. It is expected building shape around the courtyard will stagnate any winds entering the courtyard area.
Courtyard B		**Likely comply**	Sheltering from the proposed development's Building B will limit northeast around the Courtyard B area. It is expected building shape around the courtyard will stagnate any winds entering the courtyard area.
Courtyard C		**Likely comply**	Sheltering from the proposed development's Building C will limit northeast around the Courtyard C area. It is expected building shape around the courtyard will stagnate any winds entering the courtyard area.
Passage 1		**May not comply without appropriate mitigation**	Although NE winds are generally mild, there will be infrequent occasions where higher NE winds are directed downwards off Building B's Eastern façade onto the Passage 1 area between building A and B. Furthermore, there may be a channelling effect between building A and B which may impact the Passage 1 area between building A and B.
Passage 2		**May not comply without appropriate mitigation**	Although NE winds are generally mild, there will be infrequent occasions where higher NE winds are directed downwards off Building C's Eastern façade onto the Passage 2 area between building B and C. Furthermore, there may be a channelling effect between building B and C which may impact the Passage 2 area between building B and C.

Location	Existing Compliance	Future Compliance	Key Factors
Private Corner Balconies		**May not comply without appropriate mitigation**	Although NE winds are generally mild, as the building heights rising, the higher-level balconies are exposed to higher speed wind profiles. There will be infrequent occasions where higher accelerating NE winds will impact the balconies located in building corners, creating high winds that are not safe or comfortable for stationary type activities (e.g., long-exposure sitting, dining, etc.).
Level 5 Roof Terrace Building B		**May not comply without appropriate mitigation**	Although NE winds are generally mild, there will be infrequent occasions the upper-level winds will have a higher impact on elevated areas. The northeast winds are expected to directly impact the Level 5 Roof Terrace Building B. Higher NE winds may be directed downwards off Building B's Northern façade onto the Level 5 Roof Terrace on Building B. Furthermore, there may be some acceleration around the corners of building B creating some areas of adverse wind conditions.
Level 7 Roof Terrace Building B		**May not comply without appropriate mitigation**	Although NE winds are generally mild, the upper-level winds will have a higher impact on elevated areas. The northeast winds are expected to directly impact the Level 7 Roof Terrace Building B. Higher NE winds may be directed downwards off Building B's Northern façade onto the Level 7 Roof Terrace on Building B. Furthermore, there may be some acceleration around the corners of building B creating some areas of adverse wind conditions.
Level 7 Roof Terrace Building A		**May not comply without appropriate mitigation**	Although NE winds are generally mild, the upper-level winds will have a higher impact on elevated areas. The northeast winds are expected to directly impact the Level 7 Roof Terrace Building A. Higher NE winds may be directed downwards off Building A's Northern façade onto the Level 7 Roof Terrace on Building A. Furthermore, there may be some acceleration around the corners of building B creating some areas of adverse wind conditions.
Level 8 Roof Terrace Building C		**May not comply without appropriate mitigation**	Although NE winds are generally mild, the upper-level winds will have a higher impact on elevated areas. The northeast winds are expected to directly impact the Level 8 Roof Terrace Building C. Higher NE winds may be directed downwards off Building C's Northern façade onto the Level 8 Roof Terrace on Building C. Furthermore, there may be some acceleration around the corners of building C creating some areas of adverse wind conditions.
Level 8 Link Terrace Building A		**May not comply without appropriate mitigation**	Although NE winds are generally mild, the upper-level winds will have a higher impact on elevated areas. The northeast winds are expected to channel between the upper facades of building A and directly impact the link terrace area. Furthermore, there may be some acceleration around the corners of building A creating some areas of adverse wind conditions.
Level 8 Link Terrace Building B		**May not comply without appropriate mitigation**	Although NE winds are generally mild, the upper-level winds will have a higher impact on elevated areas. The northeast winds are expected to channel between the upper facades of building B and directly impact the link terrace area. Furthermore, there may be some acceleration around the corners of building B creating some areas of adverse wind conditions.

Prevailing Wind Direction:
SOUTH & SOUTHEAST Winds

Period of Annual Cycle:
All-Year-Round (South) Summer (Southeast)

Location	Existing Compliance	Future Compliance	Key Factors
Gregory Place Pedestrian Walkway	**Likely comply**	**Moderate Increase Likely comply**	The proposed development's Gregory Place façades are set back from the footpath. It is likely SE winds could potentially be directed downwards off Building A's east facing façade and impacting the Gregory Place pedestrian walkways. Furthermore, the S winds are expected to side stream along building A's east Façade and impact the Gregory Place pedestrian walkways.
Parkland Heritage Walkway	**Likely comply**	**Moderate Increase Likely comply**	The proposed development's façades are set back from the footpath Parkland Heritage walkway. S to SE winds are expected to side stream and channel between the buildings which is expected to impact some areas of the Parkland Heritage Walkway. Furthermore, it is expected the S winds will side stream along Building C's western façade and impact the Heritage walkway directly. The landscaping to the north, west and south of the development is expected to reduce the impact of this wind condition.
The North Public Park	**Likely comply**	**Moderate Increase Likely comply**	The proposed development's façades are set back from the North Public Park. S to SE winds are expected to side stream and channel between the buildings which is expected to impact the North Public Park directly. Furthermore, it is expected the S winds will side stream along Building C's western façade and impact the North Public Park directly. The landscaping to the north, west and south of the development is expected to reduce the impact of this wind condition.
The South Public Reserve	**Likely comply**	**Moderate Increase Likely comply**	The proposed development's façades are set back from the South Public Reserve. The development may create side streaming effect along the southern facades of the development towards the South Public Reserve. S to SE winds could potentially be directed downwards off Building C's south facing façade and impacting the South Public Reserve. The landscaping to the south of the development is expected to reduce the impact of this wind condition.
The West Public Park	**Likely comply**	**Moderate Increase Likely comply**	The proposed development's façades are set back from the West Public Park. The development may create side streaming effect along the southern façade of building C towards the West Public Park. The landscaping to the south and east of the development is expected to reduce the impact of this wind condition.
The Accessway	Locations not relevant to "existing" built environment	**May not comply without appropriate mitigation**	The development may create channelling effect between the buildings which may impact specific areas of the Accessway. The landscaping to the north and south of the development is expected to reduce the impact of this wind condition.
The Channel Walk		**May not comply without appropriate mitigation**	The proposed development has a partially broken façade design along the Channel Walk. The development may create side streaming effect along the Channel Walk. Furthermore, it is expected the S to SE winds will be directed downwards off the developments south facing façades impacting the Channel Walk. The landscaping to the south of the development is expected to reduce the impact of this wind condition.

Location	Existing Compliance	Future Compliance	Key Factors
Building A External Lobby Entry	Locations not relevant to "existing" built environment	**May not comply without appropriate mitigation**	It is expected the SE winds are directed downwards off Building A's George Place façade onto the area in front of the Building A's Lobby. Furthermore, it is expected the S winds will side stream along the eastern façade of building A directly impacting the area in front of Building A's Lobby. The broken façade along building A's east façade is expected to limit the impact of this wind condition. Other entrances are expected to be largely shielded by the development from the S to SE winds.
Building A Courtyard Lobby Entry		**Likely comply**	Sheltering from the proposed development's Building A will limit south to southeast winds at this Lobby entry.
Building B External Lobby Entry		**May not comply without appropriate mitigation**	It is expected the SE winds are directed downwards off Building B's eastern façade onto the area in front of the Building B's Lobby. Furthermore, it is expected the S winds will side stream along the eastern façade of building B directly impacting the area in front of Building B's Lobby. The broken façade along building B's east façade is expected to limit the impact of this wind condition. Other entrances are expected to be largely shielded by the development from the S to SE winds.
Building B Courtyard Lobby Entry		**Likely comply**	Sheltering from the proposed development's Building A will limit south to southeast winds at this Lobby entry.
Building C External Lobby Entry		**May not comply without appropriate mitigation**	It is expected the SE winds are directed downwards off Building C's eastern façade onto the area in front of the Building C's Lobby. Furthermore, it is expected the S winds will side stream along the eastern façade of building C directly impacting the area in front of Building C's Lobby. Other entrances are expected to be largely shielded by the development from the S to SE winds.
Building C Courtyard Lobby Entry		**Likely comply**	Sheltering from the proposed development's Building A will limit south to southeast winds at this Lobby entry.
Courtyard A		**Likely comply**	Sheltering from the proposed development's Building A will limit northeast around the Courtyard A area.
Courtyard B		**Likely comply**	Sheltering from the proposed development's Building B will limit northeast around the Courtyard B area.
Courtyard C		**Likely comply**	Sheltering from the proposed development's Building C will limit northeast around the Courtyard C area.
Passage 1		**May not comply without appropriate mitigation**	It is expected that SE winds are directed downwards off Building B's Eastern façade onto the Passage 1 area between building A and B. Furthermore, it is expected the S to SE winds will create channelling effect between building A and B which may impact the Passage 1 area between building A and B.
Passage 2		**May not comply without appropriate mitigation**	It is expected that SE winds are directed downwards off Building C's Eastern façade onto the Passage 2 area between building B and C. Furthermore, it is expected the S to SE winds will create channelling effect between building B and C which may impact the Passage 2 area between building B and C.

Location	Existing Compliance	Future Compliance	Key Factors
Private Corner Balconies		**May not comply without appropriate mitigation**	As the building heights rising, the higher-level balconies are exposed to higher speed wind profiles. The S to SE winds are expected to impact the balconies located in building corners adversely, creating high winds that are not safe or comfortable for stationary type activities (e.g., long-exposure sitting, dining, etc.).
Level 5 Roof Terrace Building B		**May not comply without appropriate mitigation**	As the building heights rising, the higher-level terraces are exposed to higher speed wind profiles. The S to SE winds are expected to channel between building A and building B which may create some acceleration around the corners of building B creating some areas of adverse wind conditions within the Level 5 Roof Terrace Building B.
Level 7 Roof Terrace Building B		**May not comply without appropriate mitigation**	As the building heights rising, the higher-level terraces are exposed to higher speed wind profiles. The S to SE winds are expected to channel between the upper levels of building B and also between building B and C which may create some acceleration around the corners of building B creating some areas of adverse wind conditions within the Level 7 Roof Terrace Building B.
Level 7 Roof Terrace Building A		**May not comply without appropriate mitigation**	As the building heights rising, the higher-level terraces are exposed to higher speed wind profiles. The S to SE winds are expected to channel between the upper levels of building A and also between building A and B which may create some acceleration around the corners of building B creating some areas of adverse wind conditions within the Level 7 Roof Terrace Building A.
Level 8 Roof Terrace Building C		**May not comply without appropriate mitigation**	As the building heights rising, the higher-level terraces are exposed to higher speed wind profiles. The S winds are expected to side stream along the western façade of building C which may create some acceleration around the corners of building C creating some areas of adverse wind conditions within the Level 8 Roof Terrace Building C.
Level 8 Link Terrace Building A		**May not comply without appropriate mitigation**	As the building heights rising, the higher-level terraces are exposed to higher speed wind profiles. The S to SE winds are expected to directly impact the Level 8 Link Terrace Building A. Higher S to SE winds may be directed downwards off Building A's southern façade onto the Level 8 Link Terrace Building A. Furthermore, there may be some acceleration around the corners of building A creating some areas of adverse wind conditions.
Level 8 Link Terrace Building B		**May not comply without appropriate mitigation**	As the building heights rising, the higher-level terraces are exposed to higher speed wind profiles. The S to SE winds are expected to directly impact the Level 8 Link Terrace Building B. Higher S to SE winds may be directed downwards off Building B's southern façade onto the Level 8 Link Terrace Building B. Furthermore, there may be some acceleration around the corners of building B creating some areas of adverse wind conditions.

Prevailing Wind Direction:
WESTERLY Winds (SW-NW)

Period of Annual Cycle:
Winter (May to October)

Location	Existing Compliance	Future Compliance	Key Factors
Gregory Place Pedestrian Walkway	**Likely comply**	**Likely comply**	Sheltering from the proposed development's Building A will limit western winds on the Gregory Place Pedestrian Walkway. Some areas around the southeastern corner and northeastern corner may experience corner accelerating winds.
Parkland Heritage Walkway	**Likely comply**	**Moderate Increase** **Likely comply**	The proposed development's façades are set back from the footpath Parkland Heritage walkway. The western winds are expected to downwash off the western façade of building C which will impact the western section of the Parkland Heritage Walkway. The landscaping to the west of the development is expected to reduce the impact of this wind condition.
The North Public Park	**Likely comply**	**Likely comply**	The proposed development's façades are set back from the North Public Park. The development may create some blockage of the westerly winds and may redirect some winds towards sections of the North Park. It is expected the overall impact on the North Public Park due to the development will be limited.
The South Public Reserve	**Likely comply**	**Moderate Increase** **Likely comply**	The proposed development's façades are set back from the South Public Reserve. The development may create side streaming effect along the southern facades of the development towards the South Public Reserve. The landscaping to the south of the development is expected to reduce the impact of this wind condition.
The West Public Park	**Likely comply**	**Moderate Increase** **Likely comply**	The proposed development's façades are set back from the West Public Park. The western winds are expected to downwash off the western façade of building C which will impact the West Public Park. The landscaping to the west of the development is expected to reduce the impact of this wind condition.
The Accessway	Locations not relevant to "existing" built environment	**May not comply without appropriate mitigation**	The development may create side streaming effect along the buildings northern facades which will impact the Accessway. The landscaping to the north of the development is expected to reduce the impact of this wind condition.
The Channel Walk		**May not comply without appropriate mitigation**	The proposed development has a partially broken façade design along the Channel Walk. The development may create side streaming effect along the Channel Walk. The landscaping to the west and south of the development is expected to reduce the impact of this wind condition.
Building A External Lobby Entry		**Likely comply**	Sheltering from the proposed development's Building A will limit western winds at this Lobby entry.
Building A Courtyard Lobby Entry		**Likely comply**	Sheltering from the proposed development's Building A will limit western winds at this Lobby entry.
Building B External Lobby Entry		**Likely comply**	Sheltering from the proposed development's Building B will limit western winds at this Lobby entry.
Building B Courtyard Lobby Entry		**Likely comply**	Sheltering from the proposed development's Building B will limit western winds at this Lobby entry.

Location	Existing Compliance	Future Compliance	Key Factors
Building C External Lobby Entry	Locations not relevant to "existing" built environment	**Likely comply**	Sheltering from the proposed development's Building C will limit western winds at this Lobby entry. It is expected that specific entrances around the corners of the building C will be impacted by the western winds significantly.
Building C Courtyard Lobby Entry		**Likely comply**	Sheltering from the proposed development's Building C will limit western winds at this Lobby entry.
Courtyard A		**Likely comply**	Sheltering from the proposed development's Building A will limit northeast around the Courtyard A area.
Courtyard B		**Likely comply**	Sheltering from the proposed development's Building B will limit northeast around the Courtyard B area.
Courtyard C		**Likely comply**	Sheltering from the proposed development's Building C will limit northeast around the Courtyard C area.
Passage 1		**Likely comply**	Sheltering from the proposed development's Building C will limit western winds at Passage 1. It is expected that specific areas within passage 1 around the corners of the building B will be impacted by the western winds significantly.
Passage 2		**Likely comply**	Sheltering from the proposed development's Building C will limit western winds at Passage 1. It is expected that specific areas within passage 1 around the corners of the building C will be impacted by the western winds significantly.
Private Corner Balconies		**May not comply without appropriate mitigation**	As the building heights rising, the higher-level balconies are exposed to higher speed wind profiles. The western winds are expected to impact the balconies located in building corners adversely, creating high winds that are not safe or comfortable for stationary type activities (e.g., long-exposure sitting, dining, etc.).
Level 5 Roof Terrace Building B		**May not comply without appropriate mitigation**	As the building heights rising, the higher-level terraces are exposed to higher speed wind profiles. Sheltering from the proposed development's Building B will limit western winds. The western winds are expected to directly impact the Level 5 Roof Terrace Building B.
Level 7 Roof Terrace Building B		**May not comply without appropriate mitigation**	As the building heights rising, the higher-level terraces are exposed to higher speed wind profiles. Sheltering from the proposed development's Building C will limit western winds. The western winds are expected to directly impact the Level 7 Roof Terrace Building B. It is expected the western winds will side stream along the northern façade of building C impacting the Level 7 Roof Terrace Building B.
Level 7 Roof Terrace Building A		**May not comply without appropriate mitigation**	As the building heights rising, the higher-level terraces are exposed to higher speed wind profiles. Sheltering from the proposed development's Building C and B will limit western winds. The western winds are expected to directly impact the Level 7 Roof Terrace Building A. It is expected the western winds could side stream along the northern façade of building B and C impacting the Level 7 Roof Terrace Building A.
Level 8 Roof Terrace Building C		**May not comply without appropriate mitigation**	As the building heights rising, the higher-level terraces are exposed to higher speed wind profiles. The western winds are expected to directly impact the Level 8 Roof Terrace Building C.

Location	Existing Compliance	Future Compliance	Key Factors
Level 8 Link Terrace Building A		**May not comply without appropriate mitigation**	As the building heights rising, the higher-level terraces are exposed to higher speed wind profiles. The western winds are expected to directly impact the Level 8 Link Terrace Building A. It is expected the western winds could side stream along the southern façade of building B and C impacting the Level 8 Link Terrace Building A. Furthermore, there may be some acceleration around the corners of building A creating some areas of adverse wind conditions.
Level 8 Link Terrace Building B		**May not comply without appropriate mitigation**	As the building heights rising, the higher-level terraces are exposed to higher speed wind profiles. The western winds are expected to directly impact the Level 8 Link Terrace Building BA. It is expected the western winds could side stream along the southern façade of building C impacting the Level 8 Link Terrace Building B. Furthermore, there may be some acceleration around the corners of building B creating some areas of adverse wind conditions.

7 WIND MITIGATION RECOMMENDATIONS

Section 6 provided guidance as to the areas where the adopted wind acceptability criteria had the potential to be exceeded and an indication as to the likely local optimum wind treatment strategy, eg whether the wind condition of interest is likely to arise from accelerating winds which require vertical windbreaks (such as landscaping) or downwash winds which require horizontal windbreaks (such as awnings, canopies).

The wind conditions of potential concern in relation to the proposed development include:

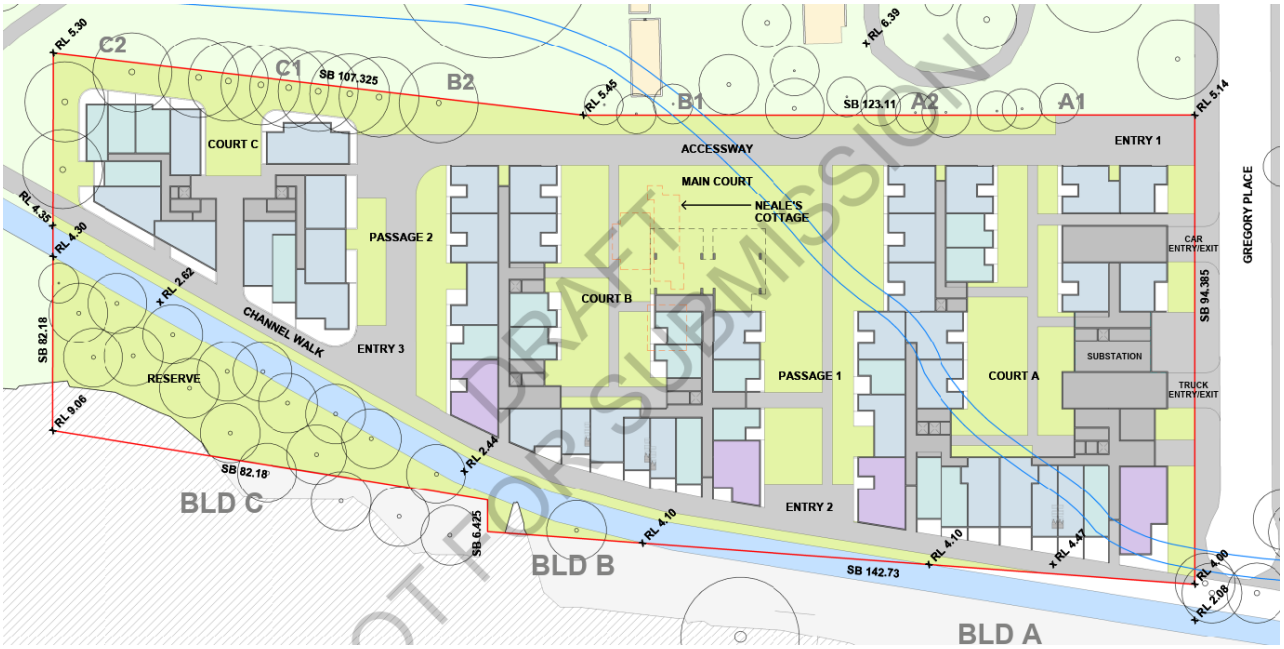
- Gregory Place Pedestrian Walkway;
- Parkland Heritage Walkway;
- The Accessway
- The Channel Walk
- Main Lobby Entries;
- Passage 1 and 2 Through-Site Links
- All elevated Roof Terrace Spaces; and
- All elevated Link Terrace Spaces;
- All elevated Private Corner Balconies;

7.1 Already Planned Wind Mitigation

The following features, already planned for the development, will have an ameliorating impact on local wind conditions:

- Extensive landscaping along the Accessway and to the south of the development. -refer **Figure 7.**
- Note that some of the footpath landscaping involves retention of existing trees, etc.

Figure 8 Planned Landscaping at Ground Level.



7.2 Additional Wind Mitigation Recommendations

On the basis of the expected wind impacts outlined in **Section 6**, the following recommendations for wind amelioration features are made in areas where winds have the potential, without suitable wind mitigation, to approach or exceed the relevant 10 m/s, 13 m/s or 16 m/s criterion depending on the designated use for that area.

The recommendations shown in **Figure 8** are designed to mitigate adverse wind conditions.

George Place Pedestrian Pathways

- Retain or replace the existing trees along the footpath, especially adjacent to the Public Park areas.
- Additional trees along the George Place Pedestrian Pathways of the site. Landscaping is recommended to have a canopy height of 3m, densely foliating vegetation with high concentration around building corners and site perimeter.

The Accessway

- Retain or replace the existing trees along the accessway, especially adjacent to the Public Park areas.
- Additional trees along the accessway of the site. Landscaping is recommended to have a canopy height of 3m, densely foliating vegetation with high concentration around building corners and site perimeter.

The Channel Walk

- Retain or replace the existing trees along the Channel Walk, especially adjacent to the Public Park areas.
- Additional trees along the Channel Walk to the southeastern section of the site. Landscaping is recommended to have a canopy height of 3m, densely foliating vegetation with high concentration around building corners and site perimeter.

External Main Lobby Entries

- Retain the recessed design of the lobby entrance areas.
- Provide a solid proposed overhang (canopy, awning, etc) protecting the main entry areas into Buildings A, B, C protecting these areas from downwashed winds.

Passage 1 and 2 Through-Site Links

- Retain or replace the existing trees along the accessway, especially adjacent to the Public Park areas.
- Additional trees along at both entrances into the through site link. Landscaping is recommended to have a canopy height of 3m, densely foliating vegetation with high concentration around building corners and site perimeter.

Courtyard Areas

- Retain tree planting along the northern entrances into courtyard areas.
- Add horizontal wind mitigation (awnings, pergolas, shade cloths, etc) above the extended use areas such as playgrounds or seating areas.

Elevated Roof Terrace Spaces

- Provide minimum 1.8 m height balustrade or equivalent (eg wall plus planter of same height) along the Roof Terrace garden perimeters.

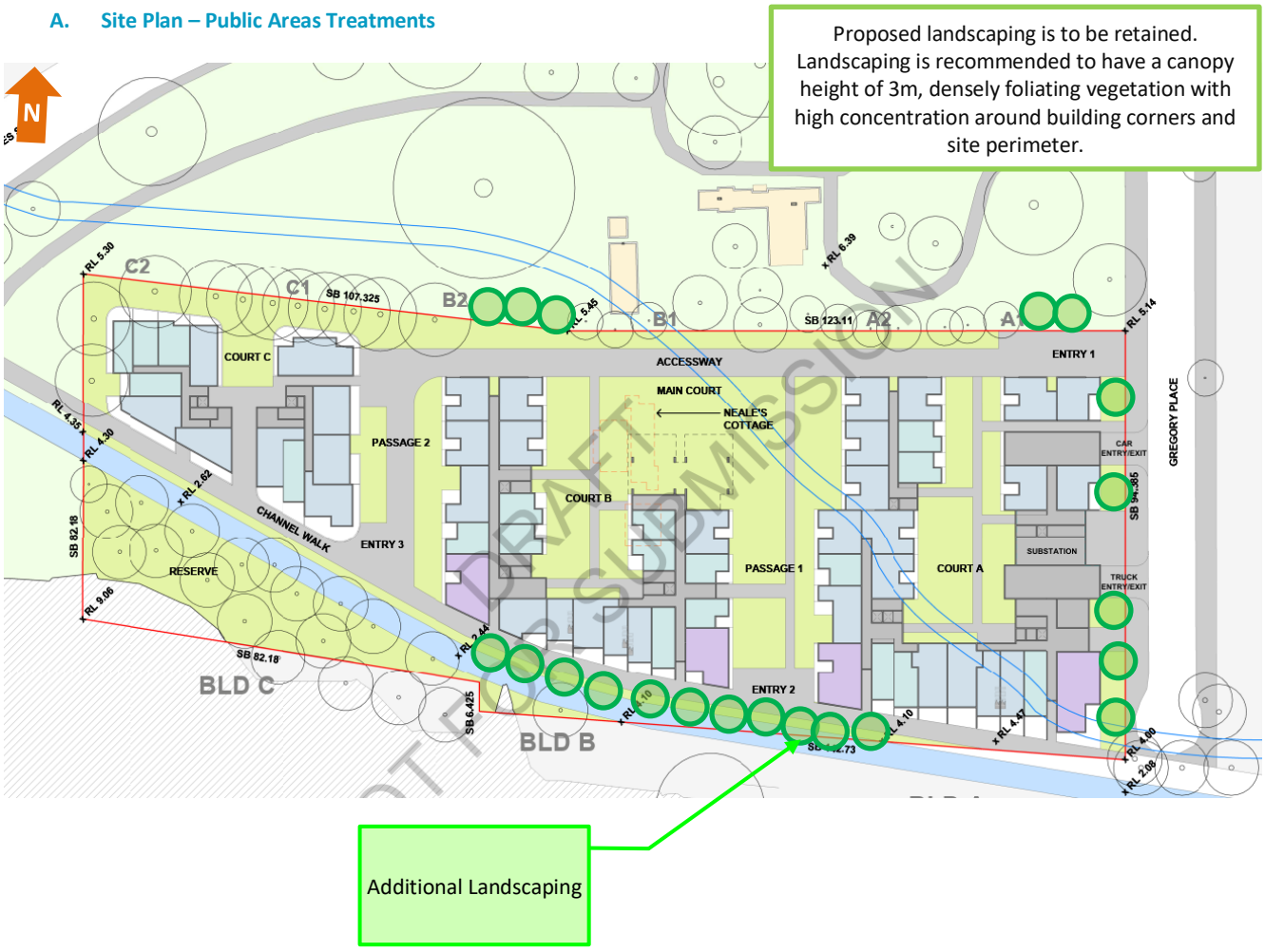
- Add horizontal wind mitigation (awnings, pergolas, shade cloths, etc) above the extended use areas such as playgrounds or seating areas.

Elevated Link Terrace Spaces

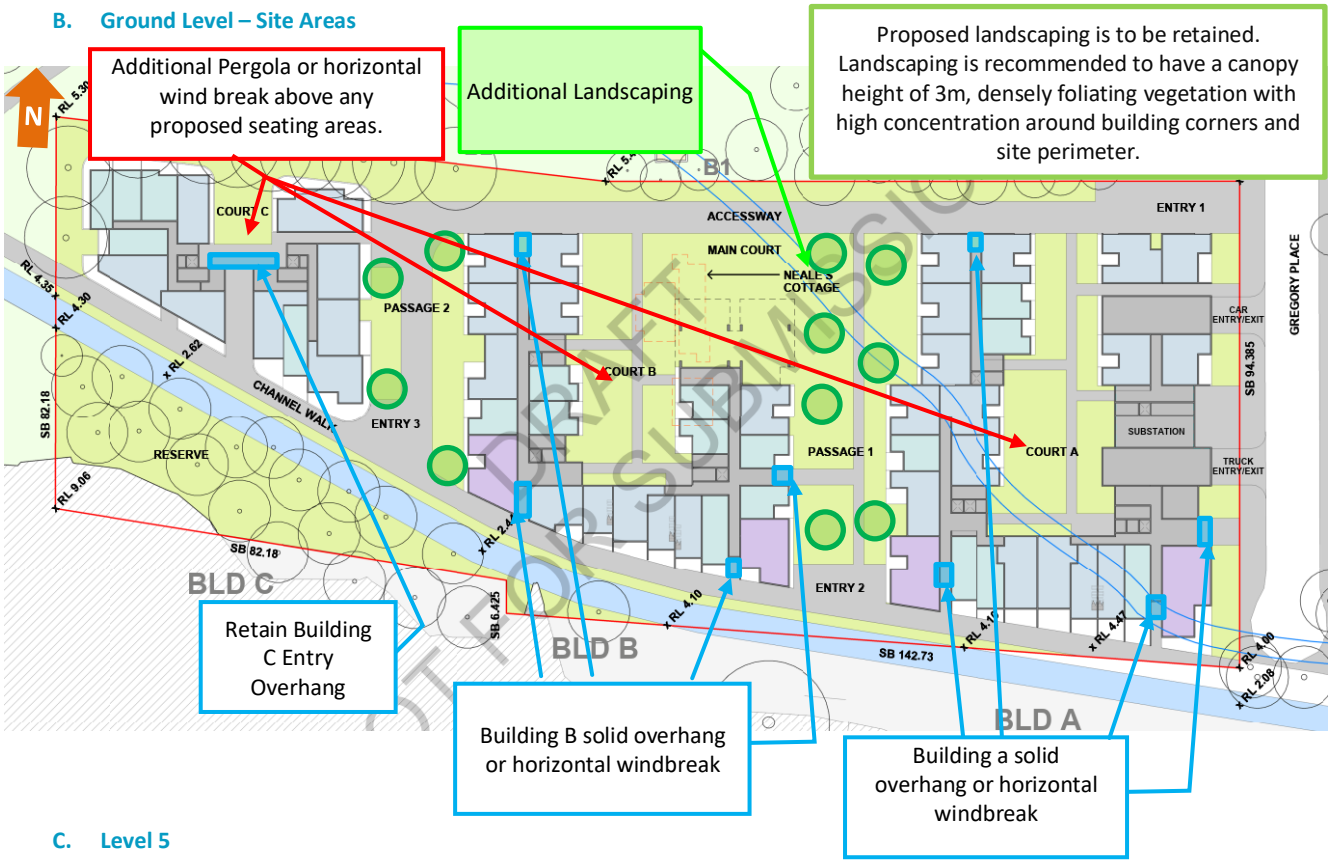
- Provide minimum 1.8 m height balustrade or equivalent (eg wall plus planter of same height) along the Link Terrace garden perimeters.
- Add horizontal wind mitigation (awnings, pergolas, shade cloths, etc) above the extended use areas such as playgrounds or seating areas.

Figure 9 Wind Mitigation Recommendations

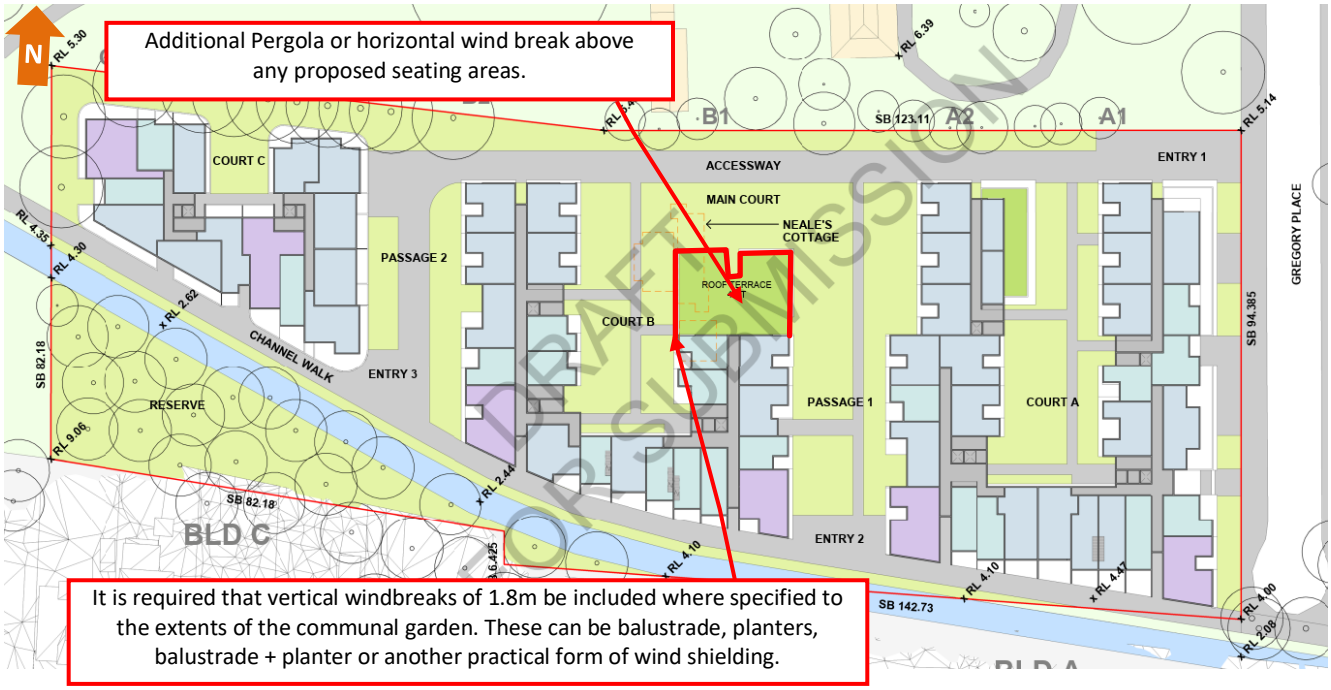
A. Site Plan – Public Areas Treatments



B. Ground Level – Site Areas

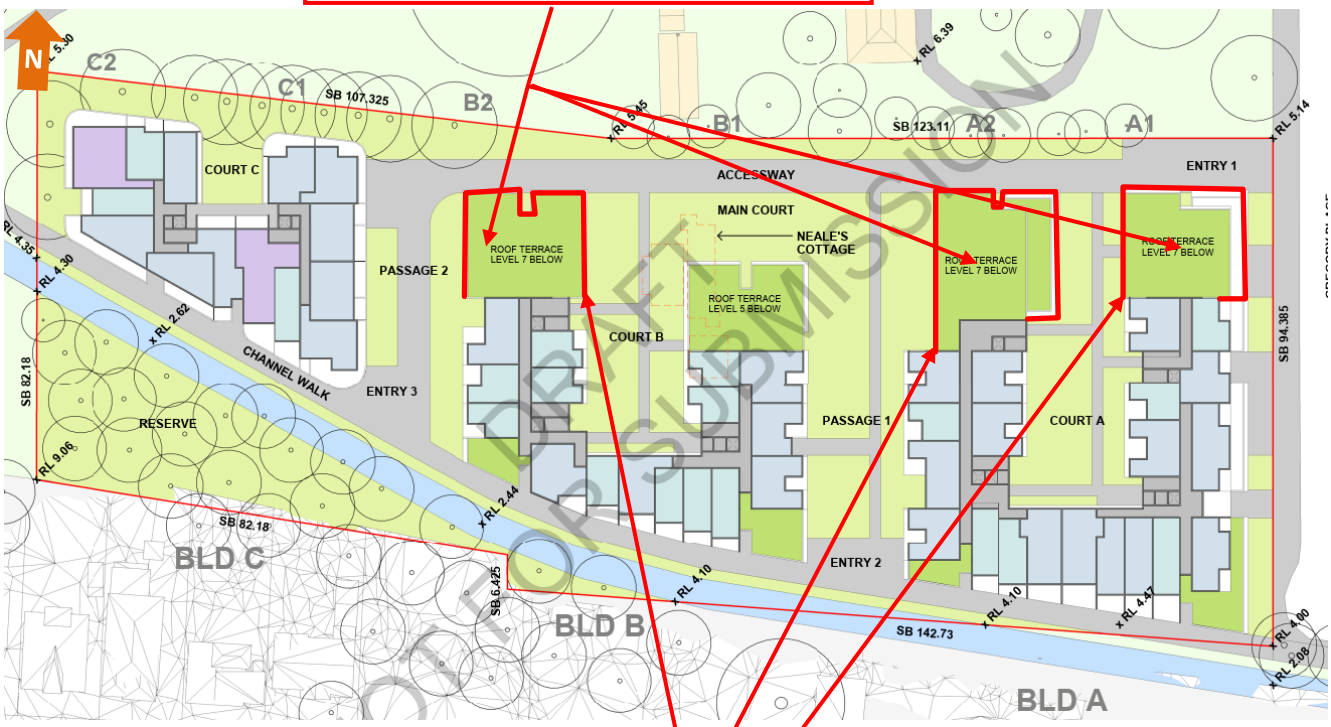


C. Level 5



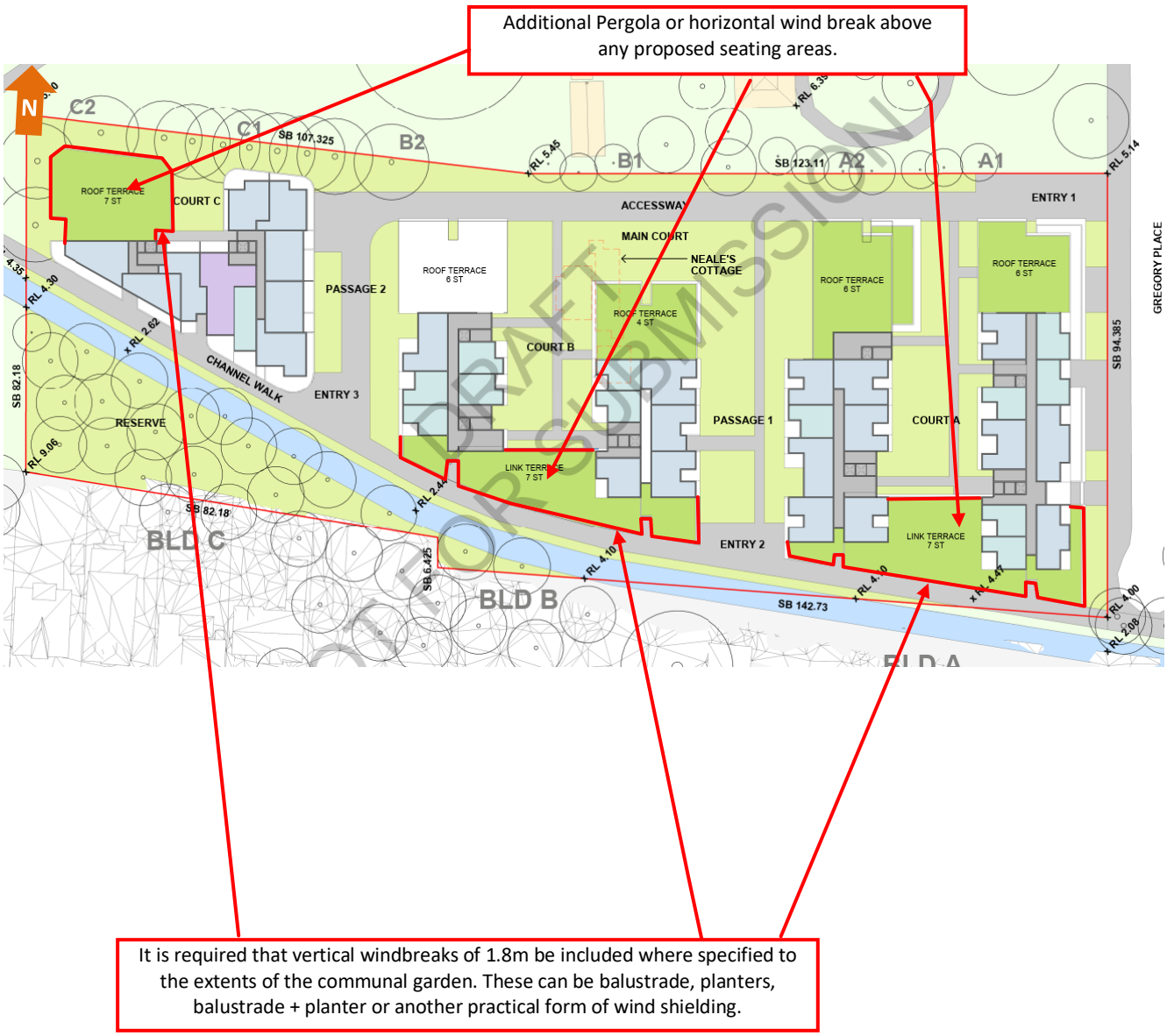
D. Level 7

Additional Pergola or horizontal wind break above any proposed seating areas.



It is required that vertical windbreaks of 1.8m be included where specified to the extents of the communal garden. These can be balustrade, planters, balustrade + planter or another practical form of wind shielding.

E. Level 8


Additional Pergola or horizontal wind break above any proposed seating areas.
N
C2
C1
B2
B1
A2
A1
SB 107.325
SB 123.11
ROOF TERRACE 7 ST
COURT C
ACCESSWAY
ENTRY 1
MAIN COURT
NEALE'S COTTAGE
ROOF TERRACE 6 ST
PASSAGE 2
ROOF TERRACE 4 ST
COURT B
CHANNEL WALK
ENTRY 3
RESERVE
PASSAGE 1
COURT A
LINK TERRACE 7 ST
ENTRY 2
BLD C
BLD B
BLD A
SB 142.73
SB 94.385
SB 82.18
GREGORY PLACE
DRAFT FOR SUBMISSION
It is required that vertical windbreaks of 1.8m be included where specified to the extents of the communal garden. These can be balustrade, planters, balustrade + planter or another practical form of wind shielding.

7.3 Upper Level Balconies

The proposed development's main residential blocks have balconies around all facades. It is almost certain that some of these balconies, especially those at upper levels and near building corners, will experience adverse wind conditions requiring wind treatment beyond standard height (ie code-compliant) balustrades. There may also be interaction between the development's buildings which results in increased balcony winds, eg westerly winds accelerating around the northern edge of Building "B" onto Building "A".

Balconies where such treaments may be considered are shown in **Figure 9**.

Treatments might include increased balustrade height or partial screening via moveable louvres, to take advantage of the beneficial impact of cooler, milder winds during summer, while providing the capacity to limit the impact of colder and potentially much stronger winds during winter. Where balconies have exposure to more than one aspect, partial balcony treatment on the most exposed façade would be a practical means of wind shielding, eg full height balustrade, louvres, pull-down screens, etc, on the most exposed aspect of the balcony. Balconies with predominantly west exposure could also consider winter gardens.

The following is therefore recommended:

- During the Detailed Design phase of the project, once the design of the various building facades is finalised, further modelling could be carried out to confirm zones of the building, by height and by plan view location (eg which building corners), where wind mitigation (ie beyond the standard balustrade height) may be beneficial IF it is intended for balconies and terraces to be used all-year-round, also noting that the strongest westerly winds occur during winter.
- The preference here would be for detailed 3D CFD Simulation Modelling rather than Wind Tunnel Testing, given the issue of balcony scaling at typical 1:400 wind tunnel test scales.

Figure 10 Typical Upper Level Balconies Potentially Exposed to Adverse Wind Conditions

8 CONCLUSIONS

SLR Consulting Australia Pty Ltd (SLR) has been engaged by 2A Gregory Place Pty Ltd to assess the wind impact on the immediate surrounds of a proposed Mixed-Use Development (herein the Project) located at 2A Gregory Place, Harris Park– refer **Figure 1**.

The present study is a qualitative (expert opinion) study of potential wind impacts.

This initial assessment has been made on the basis of our best engineering judgment and on the experience gained from (decades of) scale-model Wind Tunnel Testing and CFD Simulation Modelling of a range of similar scale developments.

This assessment is submitted to the Department of Planning, Industry and Environment (DPIE) in support of a State Significant Development Application for the development of the Project for the purposes of a mixed-use precinct with open space, retail, and residential uses, for a Build to Rent and Affordable Housing residential development.

Local Wind Climate

On the basis of long-term wind records obtained from the Bureau of Meteorology stations weather at Bankstown Airport, SLR has determined that key prevailing wind directions of interest are the northeast and south/southeast for summer/early autumn and west quadrant winds for winter/early spring.

Future Wind Environment

In terms of the *future* wind environment with the proposed Development, the following features are noted as being of most significance:

- The proposed Development's main residential blocks are set back from its street frontage with extensive landscaping (large trees) planned.
- Areas potentially requiring wind mitigation are largely within the site, especially the elevated Roof Terraces, Link Terraces and through site links.
- Windbreak recommendations, all of which will be implemented in the design of the development, have been made to assist in ameliorating potentially adverse winds identified in this study. Accordingly, all affected areas should be able to comply with the recommended wind acceptability criteria – refer **Section 7** and **Figures 8** for details.
- During the Detailed Design phase of the project, once the design of the various building facades is finalised, further modelling could be carried out to confirm zones of the building, by height and by plan view location (eg which building corners), where wind mitigation (ie beyond the standard balustrade height) may be beneficial IF it is intended for balconies and terraces to be used all-year-round, also noting that the strongest westerly winds occur during winter. It is recommended to complete a detailed 3D CFD Simulation Modelling rather than Wind Tunnel Testing, given the issue of balcony scaling at typical 1:400 wind tunnel test scales.

This initial assessment has been made on the basis of our best engineering judgment and on the experience gained from (decades of) scale-model Wind Tunnel Testing and CFD Simulation Modelling of a range of similar scale developments.

ASIA PACIFIC OFFICES

BRISBANE
Level 2, 15 Astor Terrace
Spring Hill QLD 4000
Australia
T: +61 7 3858 4800
F: +61 7 3858 4801

CANBERRA
GPO 410
Canberra ACT 2600
Australia
T: +61 2 6287 0800
F: +61 2 9427 8200

DARWIN
Unit 5, 21 Parap Road
Parap NT 0820
Australia
T: +61 8 8998 0100
F: +61 8 9370 0101

GOLD COAST
Level 2, 194 Varsity Parade
Varsity Lakes QLD 4227
Australia
M: +61 438 763 516

MACKAY
21 River Street
Mackay QLD 4740
Australia
T: +61 7 3181 3300

MELBOURNE
Level 11, 176 Wellington Parade
East Melbourne VIC 3002
Australia
T: +61 3 9249 9400
F: +61 3 9249 9499

NEWCASTLE
10 Kings Road
New Lambton NSW 2305
Australia
T: +61 2 4037 3200
F: +61 2 4037 3201

PERTH
Ground Floor, 503 Murray Street
Perth WA 6000
Australia
T: +61 8 9422 5900
F: +61 8 9422 5901

SYDNEY
Tenancy 202 Submarine School
Sub Base Platypus
120 High Street
North Sydney NSW 2060
Australia
T: +61 2 9427 8100
F: +61 2 9427 8200

TOWNSVILLE
12 Cannan Street
South Townsville QLD 4810
Australia
T: +61 7 4722 8000
F: +61 7 4722 8001

WOLLONGONG
Level 1, The Central Building
UoW Innovation Campus
North Wollongong NSW 2500
Australia
T: +61 2 4249 1000

AUCKLAND
68 Beach Road
Auckland 1010
New Zealand
T: 0800 757 695

NELSON
6/A Cambridge Street
Richmond, Nelson 7020
New Zealand
T: +64 274 898 628