ATTACHMENTS.

Special Council Meeting

13 June 2018

Attachment C

City of South Perth

HILLAM
ARCHITECTS

DA RESUBMISSION
POST JDAP DEFERRAL

50-52 MELVILLE PDE
SOUTH PERTH
4th MAY 2018

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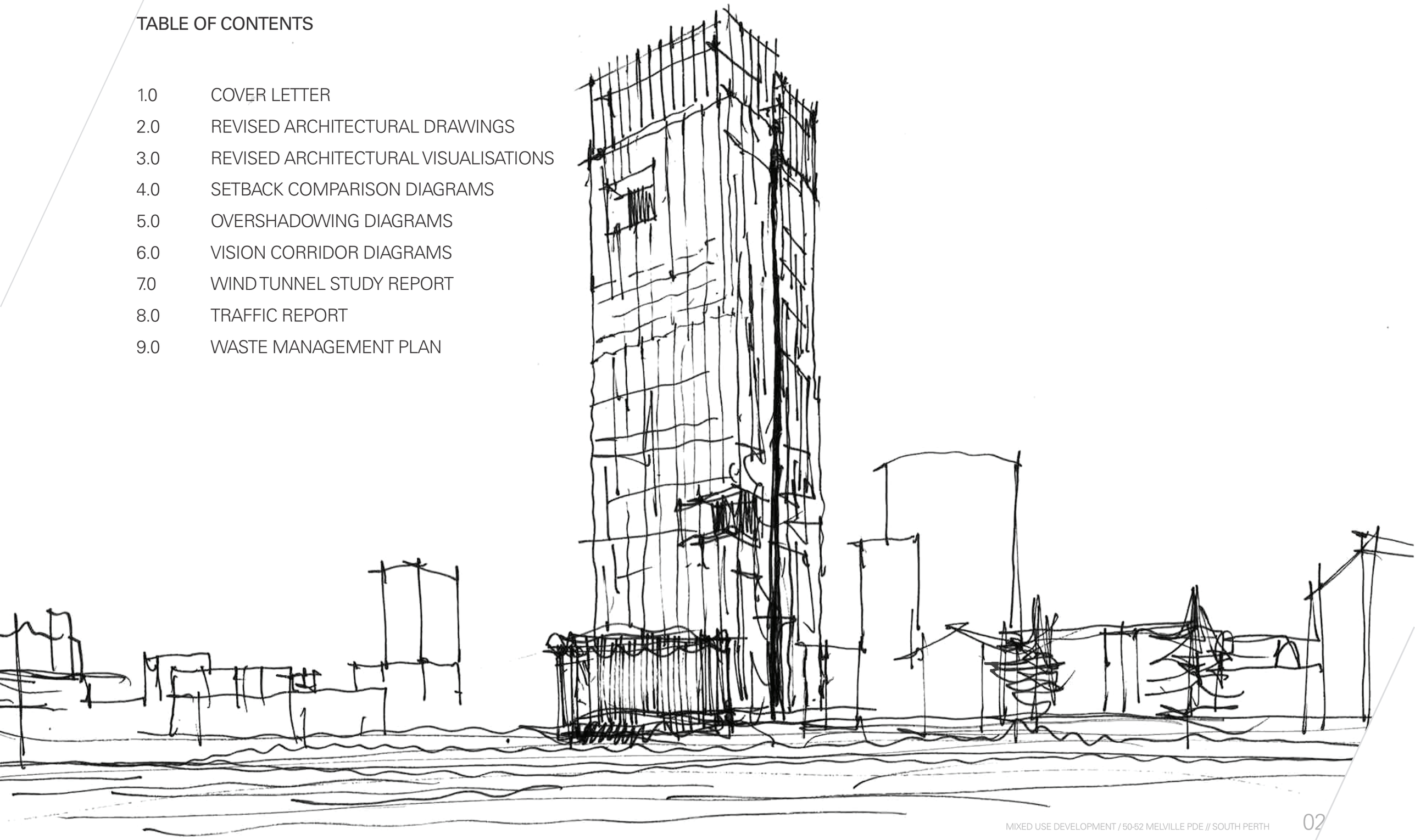

1.0 COVER LETTER

HILLAM ARCHITECTS

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ABN 83 115 057 371 / ACN 115 057 371

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04 May 2018

Our Ref: 1705
Your Ref: ME3/50 11.2017.326.1

Mr Erik Dybdahl
Statutory Planning Officer
City of South Perth
Cnr Sandgate St & South Tce
South Perth WA 6151

Dear Erik,

RE: POST JDAP DEFERRAL RESUBMISSION
PROPOSED 36 STOREY MIXED-USE DEVELOPMENT
LOT 29 (#50-52) MELVILLE PARADE, SOUTH PERTH

Further to the JDAP deferral comments dated 9th February on the above mentioned Development Application, we have revised the design and provide a response to the issue raised, as follows.

1. The potential to make modifications to the podium on the eastern side of the property, such as to significantly reduce its impact on the adjoining property. Such consideration could involve a reduction in height and scale of the podium and setback from Bowman Street and inclusion of an underground parking component that would reduce the need for a podium of the nature.

The following revisions address the core concerns raised by the owners of the neighbouring property to the east, such that there is not considered to be any unreasonable adverse amenity impact. A basement car parking level has also been incorporated in response to the DAP's request that this be given consideration.

In short, the inclusion of the basement car parking level has resulted in the desired reduction in the bulk and scale of the podium, by one level, as detailed below. This has also enabled the provision of the desired additional podium setback to the eastern boundary, further assisting to reduce the bulk and scale of this element. Whilst the podium maintains a nil setback boundary wall component, located towards Bowman Street, this has been aligned with the non-active side wall and open-air car parking area on the neighbouring property. The setback portion of the podium is located to the rear, aligned with the balconies and windows of the apartments on the neighbouring property, thereby ensuring the provision of access to natural light and ventilation, along with the opportunity for an outlook to a landscaped setback area on the subject site, from the habitable areas of the neighbouring building.

The revised podium, with a nil setback boundary wall portion, and a setback portion increasing from nil to 5.37m, is considered appropriate having regard to the requirements of Element 8.1(a) and (b) of Schedule 9A, in that this design recognises the location of the habitable areas of the neighbouring apartment building, and provides a setback accordingly. The extent of the setback, increasing from nil to 5.37m, and resulting in a total building to building separation distance of 9 metres for the habitable areas of the neighbouring apartment building, reflects the desired setback of 3.0 metres as noted at Element 8.1(b)(ii)(B). In this regard the revisions are considered to represent a significant reduction in the impact on the adjoining property, and therefore represent a considered and appropriate response to the aforementioned DAP reason for deferral.

The individual changes proposed are outlined as follows.

A. Basement parking

The revised design includes one basement parking housing 48 car bays. The basement parking helps to reduce the bulk and scale of the podium. Please refer to the attached drawings for detail.

B. Reduction to podium height and scale

The revised design incorporated a number of approaches to reduce the bulk and scale of the podium.

Firstly, the upper podium height is reduced by one storey. The new upper podium height is now 18.865m. The upper podium is setback 3.2m from the northern boundary and 3.3m to 9.75m from the eastern boundary. Deep root planting are proposed in the upper podium setback zone to further soften the upper podium transition. The overall building is reduced to 32 levels (103m) which further improves visual and overshadowing impact to the precinct.

Secondly, the eastern lower podium wall is setback to improve the amenity of 3 Bowman Street. We analysed the property in 3 Bowman Street and believe that the amenity of the south facing block is not impacted by the new development as the apartments in the south block are facing Bowman Street. There is no window facing west in the south block and the setback area is currently used as a carpark. The north block of 3 Bowman will be impacted by the new development as the apartments is directly facing the new development. To improve amenity, the lower podium is setback 0.9m to 5.37m at the north east corner, creating a consistent 9m space parallel to the north block. The additional setback significantly improve the overshadowing impact to 3 Bowman. On 21st June, the north block of 3 Bowman still have sun access at 5pm. Please refer to the attached overshadowing diagrams for detail.

Thirdly, the lower podium wall along the north and east boundaries also reduced from 13.5m to 13m. The reduction in wall height together with the additional setback significantly improves overshadowing and sight impact to 3 Bowman Street. Please refer to the attached overshadowing diagram and vision study for detail.

C. Addition setback along Bowman

The revised design increases the podium setback at the south east corner from 1.5m to 2m to improve the neighbour's sightline. It also provides a better transition to 3 Bowman and reduce the bulk and scale of the podium. Please refer to the attached setback comparison for detail.

D. Overshadowing improvement

The revised design significantly improve the overshadowing impact to the adjoining neighbour. We have conducted several overshadowing studies at various time of the year. All the studies demonstrate that the new design provides addition of 1.5 to 2 hours sun access to 3 Bowman. Please refer to the attached overshadowing diagrams for detail.

E. Design Treatment to eastern podium wall

We are proposing an 80sqm garden at the north east corner of the boundary facing 3 Bowman. 3 Bowman will be the sole beneficiary of the garden. The garden will be maintained by 52 Melville Parade.

To soften the building envelope, we are proposing metal blade fins and some metal mesh screens which allow planting to grow on the wall. The 80sqm garden will be a deep root planting area which further soften the building façade. Please refer to the attached east elevation drawings for detail.

F. Relocation of carpark entrance to Melville Parade

We met the owner representatives of 3 Bowman twice after the JDAP meeting and discussed their concerns in relation to the development. Even though it is not considered as an issue by JDAP, we take a step further and relocated the carpark entrance to Melville Parade to reduce the noise and traffic impact to 3 Bowman.

We also liaised with the City of South Perth for an alternative waste collection solution to improve safety in operation. The City allows the use of smaller waste collection vehicle which is easier to operate and safer for the pedestrian.

2. The modification of the existing wind impact assessment to include the specific assessment of the impact on the adjoining properties.

We have conducted a detailed wind tunnel study on the development and its adjoining neighbours. The study concludes that the new development will not propose wind condition exceeding acceptable standard to its adjoining neighbours. The design has incorporated all mitigation suggestions recommended in the report. Please refer to the attached wind report for detail.

3. Miscellaneous Revisions

A. Apartment mix

The total number of apartment remains at 123 units over 32 levels (30 storey + 2 mezzanine levels). There are 16 serviced apartments and 3 commercial tenancies provided in the development. Please refer to the table below for the mix.

	Commercial - Plot ratio area	Serviced Apartment (Plot Ratio)	Residential - plot ratio area	1x1 bed	2x2 bed	3x2 bed	4x3 bed	Total
Basement								
Ground Floor	641							
Level 1		375						
Level 2		377						
Level 3		374						
Level 3 Mezz								
Level 4		359						
Level 5								
Level 5 Mezz								
Level 6			692	1	3	2		6
Level 7			692	1	3	2		6
Level 8			692	1	3	2		6
Level 9			694	2	2	2		6
Level 10			694	2	2	2		6
Level 11			694	2	2	2		6
Level 12			694	2	2	2		6
Level 13			692	1	3	2		6
Level 14			692	1	3	2		6
Level 15			692	1	3	2		6
Level 16			692	1	3	2		6
Level 17			692	1	3	2		6
Level 18			694	2	2	2		6
Level 19			561	2	1	2		5
Level 20			689	2	2	2		6
Level 21			554	2	1	2		5
Level 22			564	1	3	1		5
Level 23			695		5	1		6
Level 24			578		4	1		5
Level 25			707				3	3
Level 26			707				3	3
Level 27			707				3	3
Level 28			735				2	2
Level 29			735				2	2
TOTAL	***641***	***1485***	***16238***	***25***	***50***	***35***	***13***	***123***
Council requires								
TOTAL PERCENTAGE (%)				***20.3%***	***40.7%***	***28%***	***11%***	***100%***
Plot Ratio Area								
Com Plot Ratio	*1.02*							
Res Plot Ratio	7.77							
SITE AREA	2091							

B. Car Parking

There are 214 car bays provided in the development from basement to level 4. Please refer to the table below and the traffic report attached for detail.

	Car allocations provided	Wide Bay	Tandem Bay	Car bay provided (Council)
Basement	33	3	6	48
Ground Floor	4	0	0	4
Level 1	18	0	13	44
Level 2	10	4	13	40
Level 3	10	4	13	40
Level 3 Mezz	8	9	0	17
Level 4	16	5	0	21
TOTAL	***99***	***25***	***45***	***214***
Council requires		*24.60*		*214*

C. Waste Management Plan

Please refer to the attached waste management plan for the revised waste management strategy.

The design is revised to address the JDAP comments. We also take a step further to address neighbour comments over and beyond what is not considered as an issue at JDAP. The revisions demonstrate significant improvement to the neighbour's amenity and reduction to the overall building bulk and scale. We believe that the revised design has adequately addressed all the concerns raised. We appreciate the JDAP to grant DA approval for the development.

In addition to the above information, the following supporting documents have also been provided in relation to Hillam Architects response;

Summary of Attachments;

A Revised Architectural Drawings (transmittal included)
B Revised Architectural Visualisations
C Setback comparison diagrams
D Overshadowing Diagrams
E Vision corridor Diagrams
F Traffic Report
H Waste Management Plan

Please do not hesitate to contact the undersigned should you have any queries or require further information.

Yours sincerely,

Mandy Leung
Director

2.0 REVISED ARCHITECTURAL DRAWINGS

HILLAM ARCHITECTS

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DOCUMENT TRANSMITTAL		Rev	B
Discipline	Architectural		
Project name	50-52 Melville Parade, South Perth		
Client	NL Homes Melville Pty Ltd		
Project No	1705		
Project Leader	ML		
Status	DA Re-Submission		

				insert new column, previous revisions move right→								
Document No.	**Document name**	**paper size**	**scale**	**04.05.18**								
A1-00	Site Survey Plan	A3	1:250	**L**								
A1-01	Site Plan	A3	1:250	**L**								
A2-00	Basement Plan	A3	1:200	**L**								
A2-01	Ground Floor Plan	A3	1:200	**L**								
A2-02	Level 1 Plan	A3	1:200	**L**								
A2-03	Level 2 Plan	A3	1:200	**L**								
A2-04	Level 3 Plan	A3	1:200	**L**								
A2-05	Level 3 Mezzanine Plan	A3	1:200	**L**								
A2-06	Level 4 Plan	A3	1:200	**L**								
A2-07	Level 5 Plan	A3	1:200	**L**								
A2-08	Level 5 Mezzanine Plan	A3	1:200	**L**								
A2-09	Level 6 -8 13-17	A3	1:200	**L**								
A2-10	Level 9-12, 18 Plan	A3	1:200	**L**								
A2-11	Level 19 Plan	A3	1:200	**L**								
A2-12	Level 20 Plan	A3	1:200	**L**								
A2-13	Level 21 Plan	A3	1:200	**L**								
A2-14	Level 22 Plan	A3	1:200	**L**								
A2-15	Level 23 Plan	A3	1:200	**L**								
A2-16	Level 24 Plan	A3	1:200	**L**								
A2-17	Level 25-27 Plan	A3	1:200	**L**								
A2-18	Level 28-29 Plan	A3	1:200	**L**								
A2-19	Roof Plan	A3	1:200	**L**								
A3-01	West Elevation	A3	1:400	**L**								
A3-02	East Elevation	A3	1:400	**L**								
A3-03	South Elevation	A3	1:400	**L**								
A3-04	North Elevation	A3	1:400	**L**								
	Visual 01	A3	-	**L**								
	Visual 02	A3	-	**L**								
	Visual 03	A3	-	**L**								
Medium	E-Email / M-Post / H-Hand / C-Courier			**E**								
Format	H - Hardcopy / P - PDF / D - DWG, REVIT			**P**								
Chargeable	YES or NO			**N**								
Reason for issue	[I] Information, [A] Approval, [T] Tender, [C] Construction, [QA] Internal, [CO] Coordination, [BP] Building permit			**A**								

3.0 REVISED ARCHITECTURAL VISUALISATIONS

VIEW FROM RIVER

3.0 REVISED ARCHITECTURAL VISUALISATIONS

VIEW FROM MELVILLE PARADE

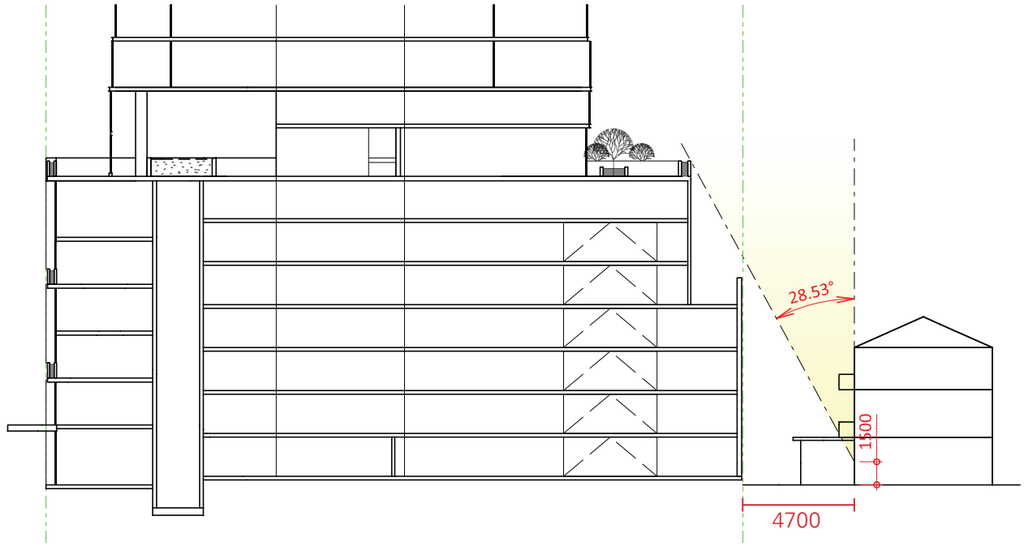
3.0 REVISED ARCHITECTURAL VISUALISATIONS

STREET VIEW

4.0 SETBACK COMPARISON DIAGRAMS

4.1 SETBACK - SECTIONAL COMPARISON

The lower podium has been setback and then reduced to 13m to improve sightlines and amenity of 3 Bowman Street.



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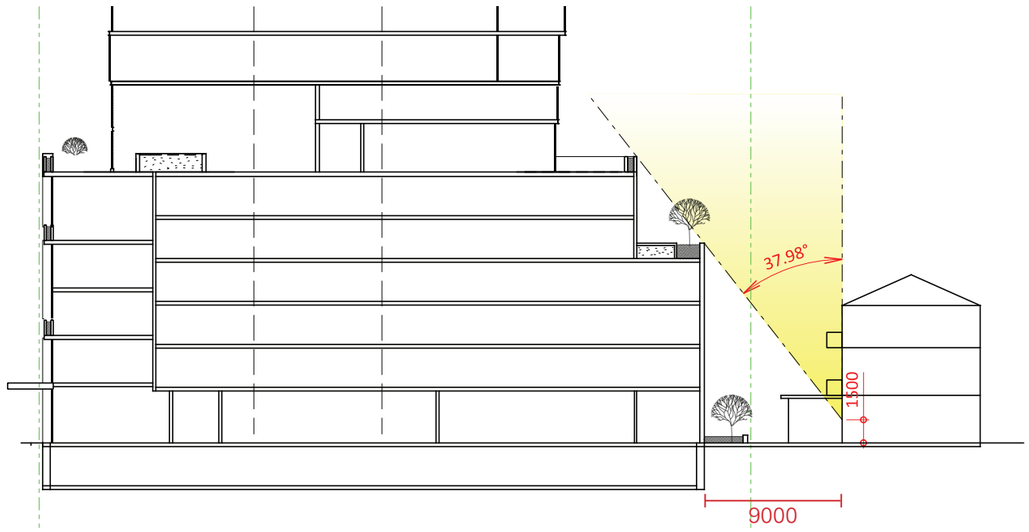


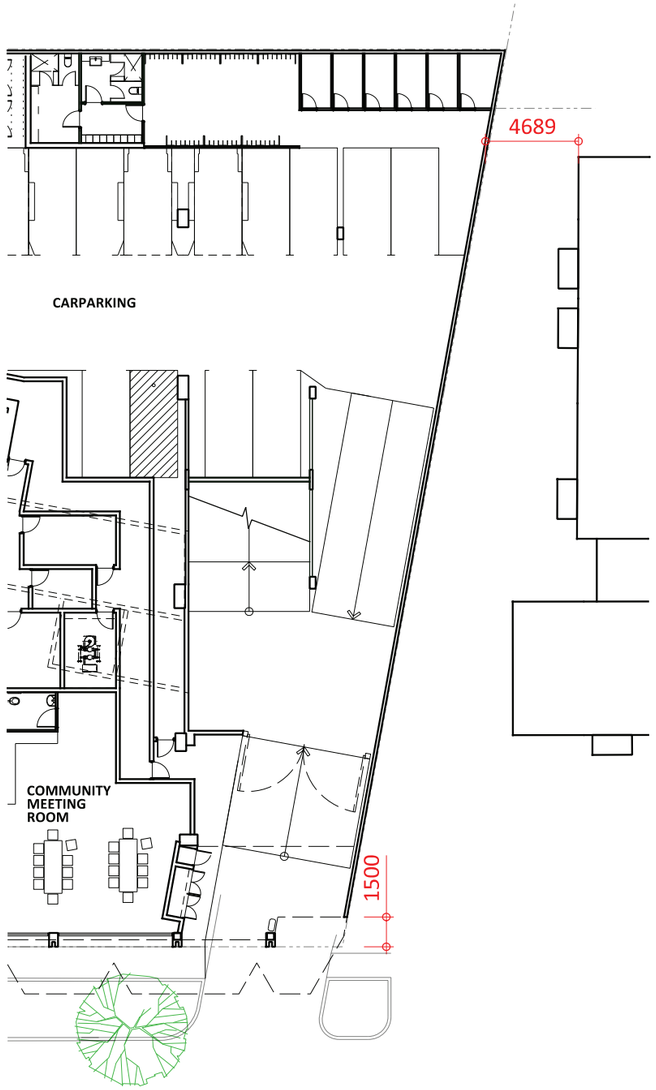
REVISED PROPOSAL

4.0 SETBACK COMPARISON DIAGRAMS

4.2 SETBACK - PLAN COMPARISON

The lower podium has been setback at the northeastern corner to create a consistent 9m setbcak area, parallel to 3 Bownman Street.

The southeastern corner has also been setback to further improve sightlines.



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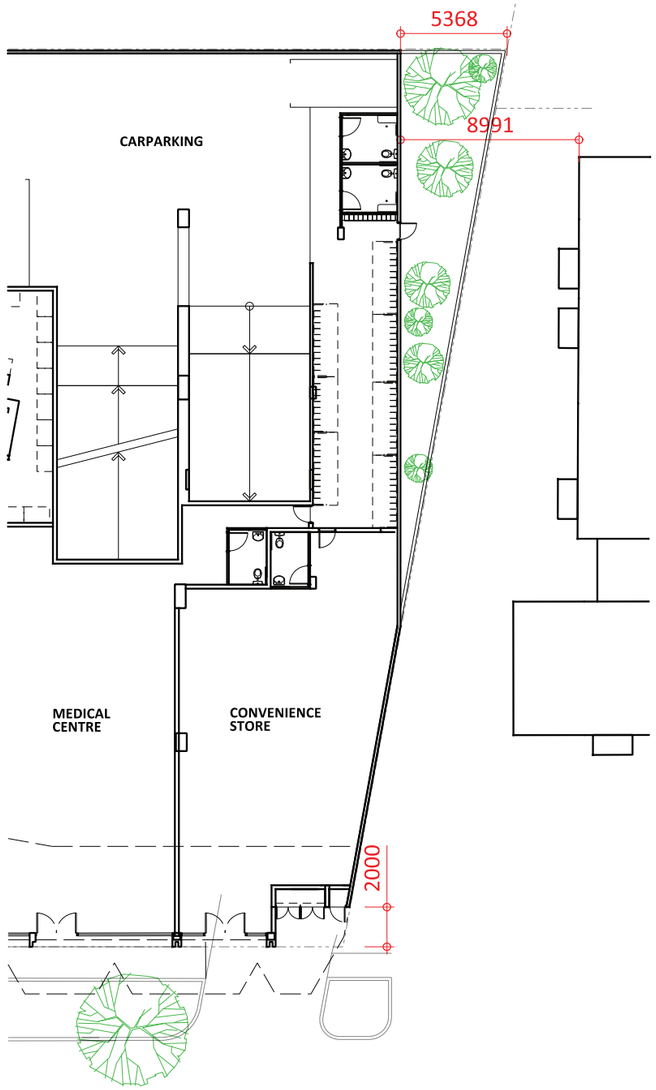
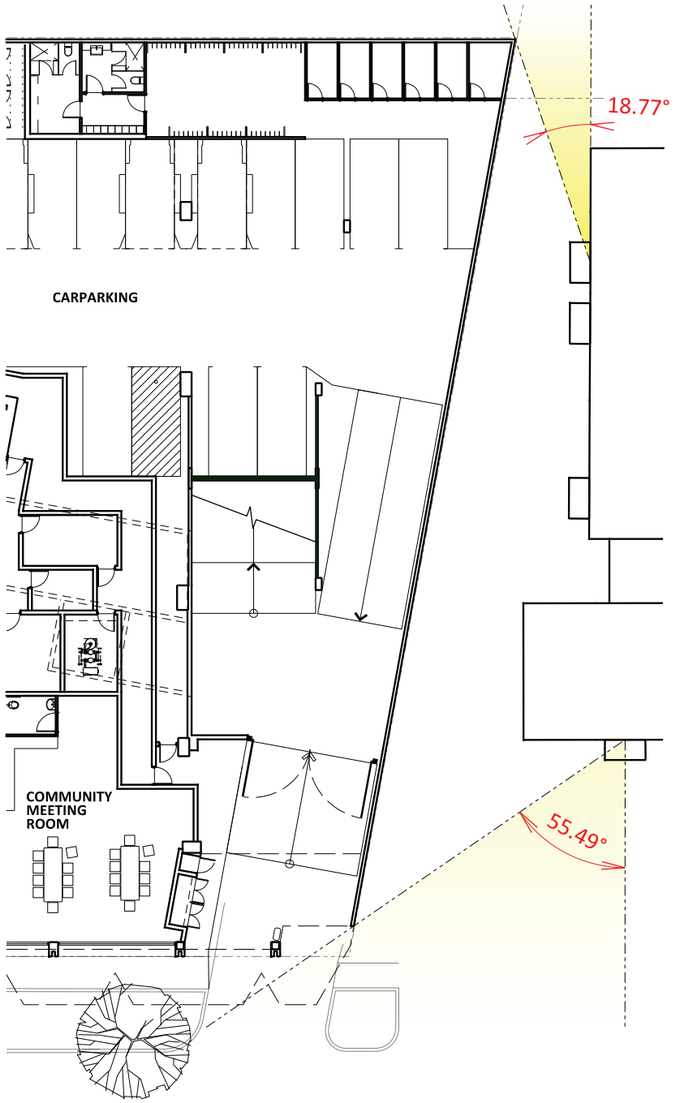


REVISED PROPOSAL

4.0 SETBACK COMPARISON DIAGRAMS

4.3 SETBACK - PLAN COMPARISON

The additional podium setback improves sightline vision from 3 Bownman Street.



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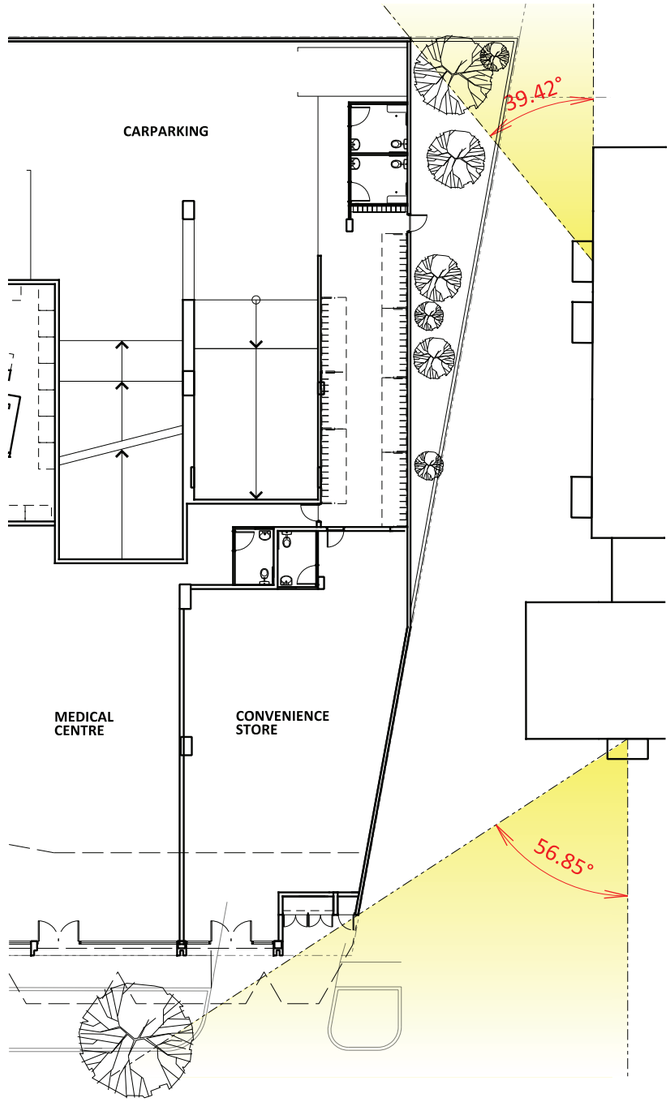
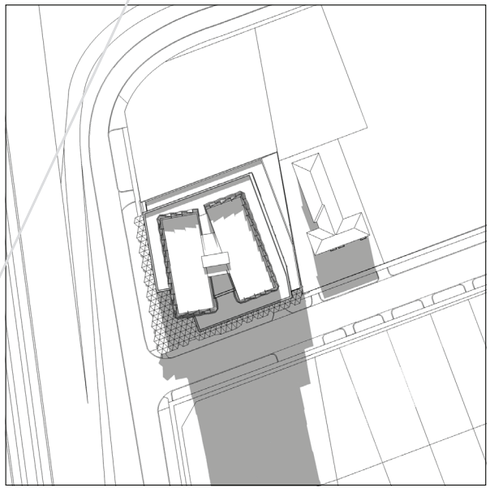


REVISED PROPOSAL

5.0 OVERSHADOWING DIAGRAMS

5.1 SHADOWS ON *21ST JUNE* - REVISED SCHEME



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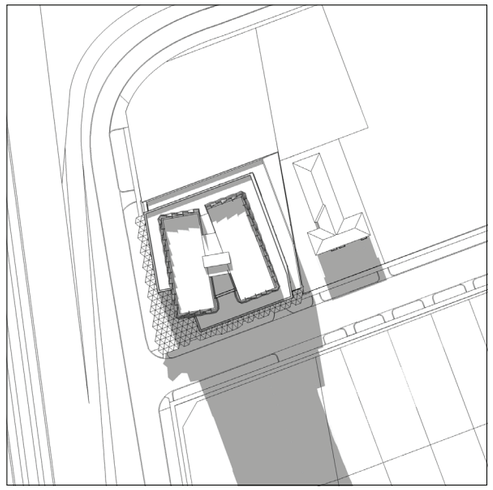

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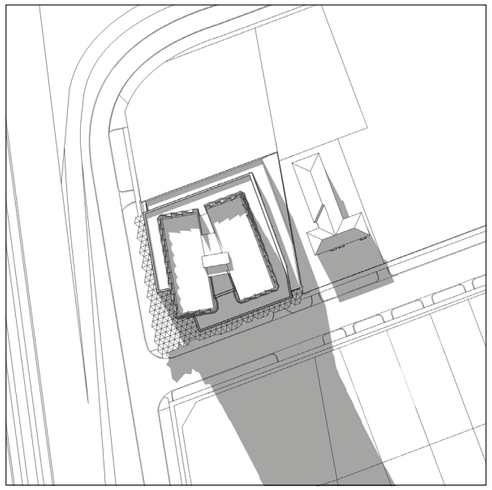

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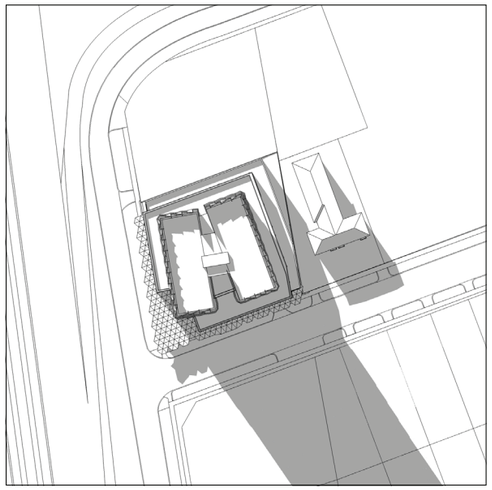

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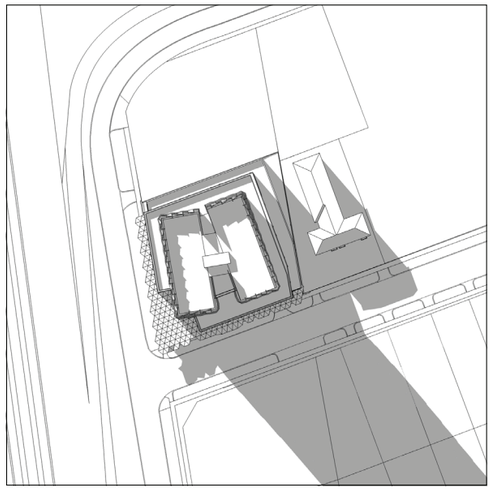

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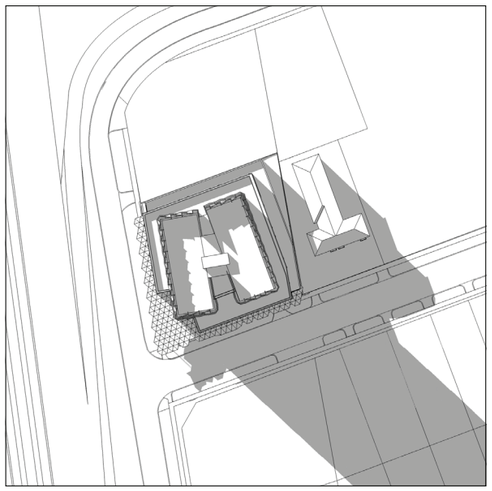

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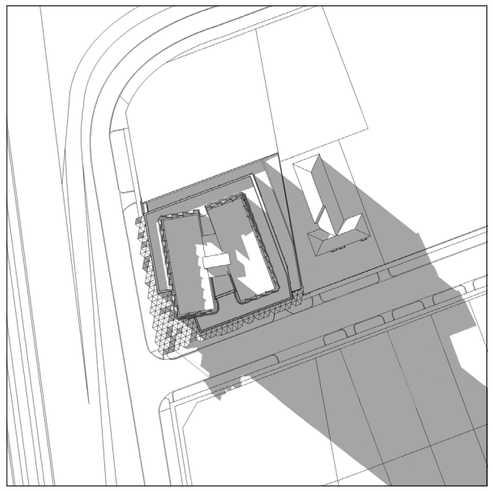

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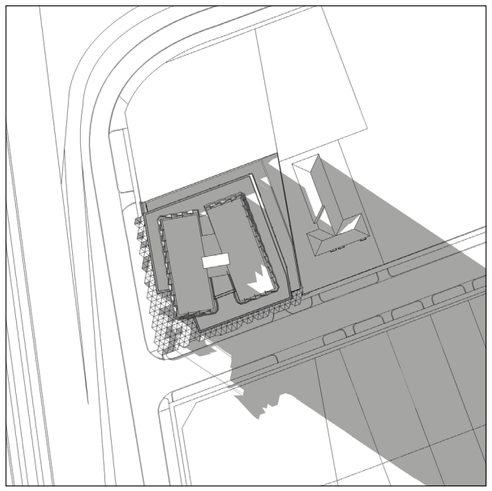

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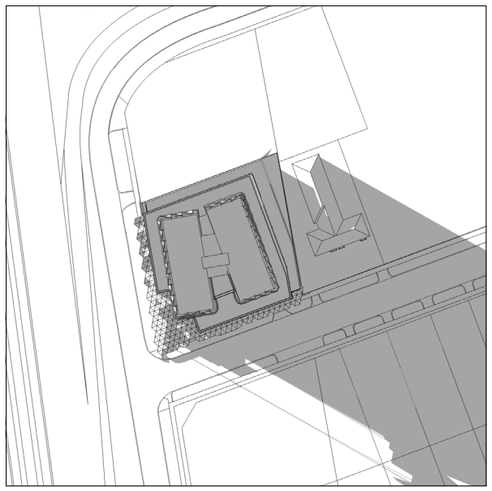

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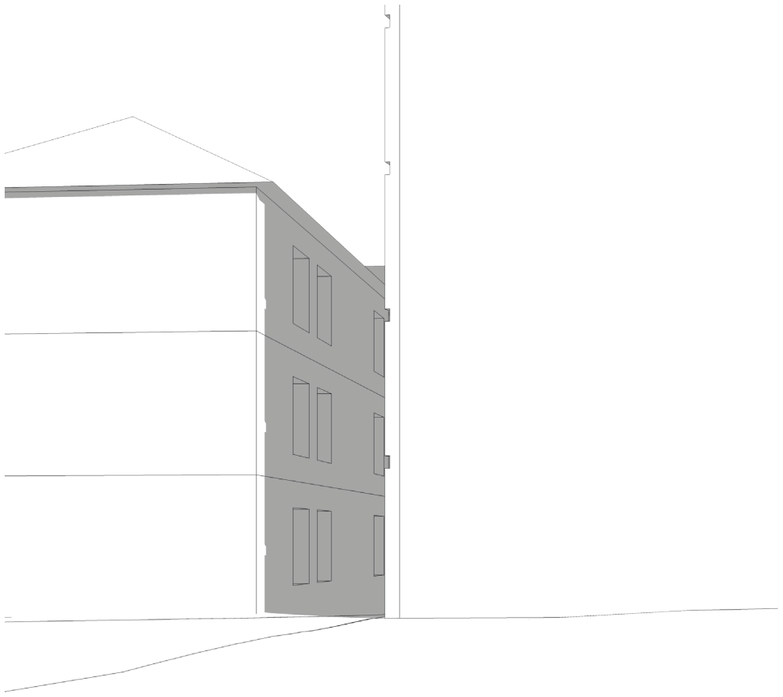
5.0 OVERSHADOWING DIAGRAMS

5.2 SHADOWS ON *21ST JUNE* - COMPARISON



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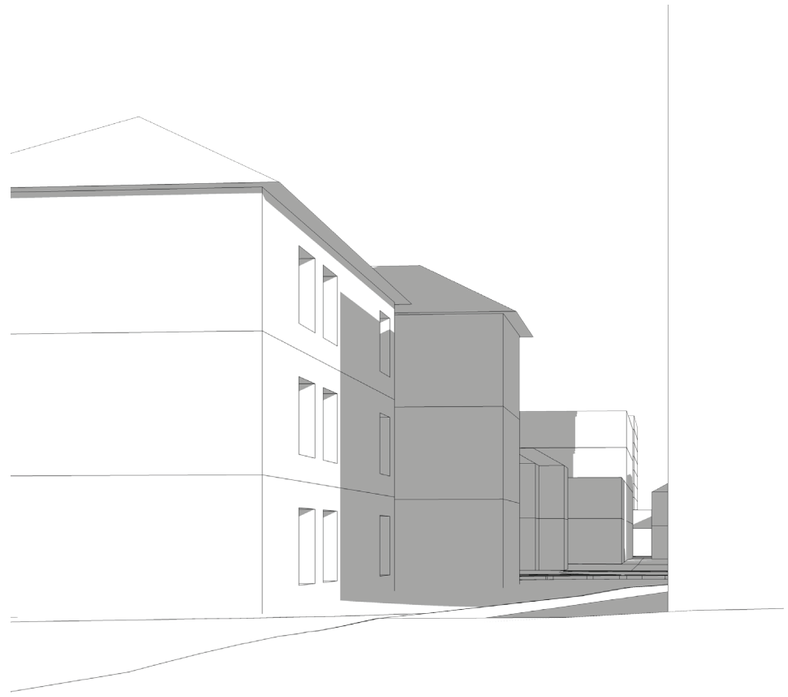
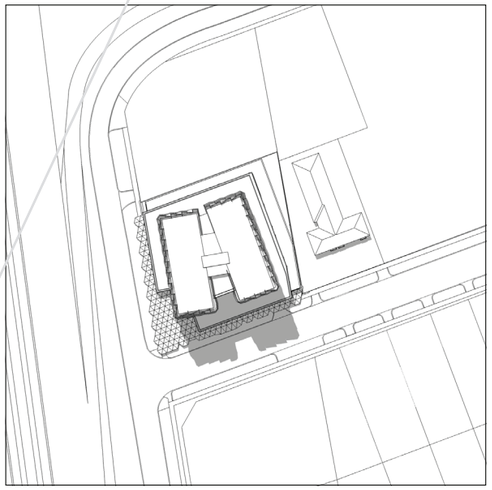


REVISED PROPOSAL
OVERSHADOWING AT 4:00PM

5.0 OVERSHADOWING DIAGRAMS

5.3 SHADOWS ON *22ND DECEMBER* - REVISED SCHEME



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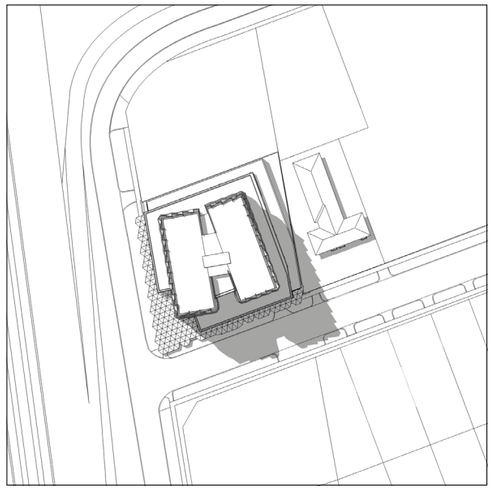

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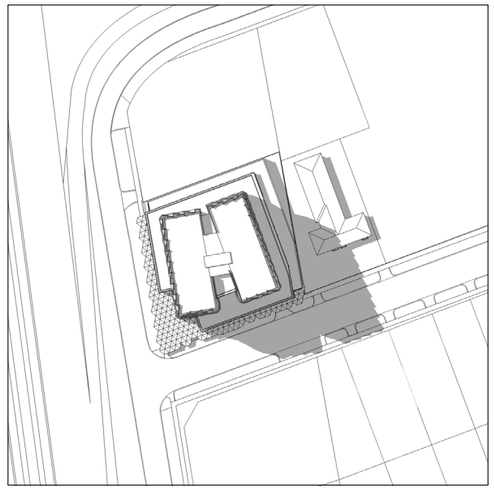

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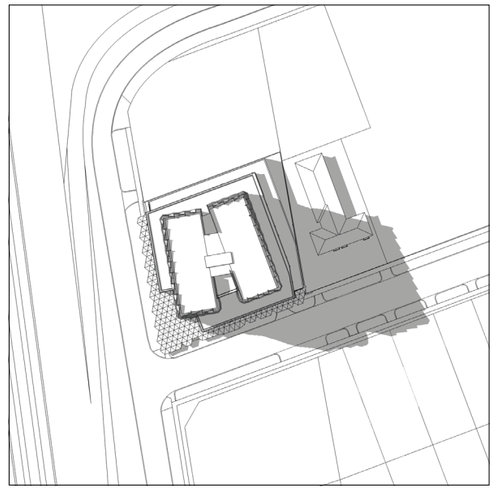

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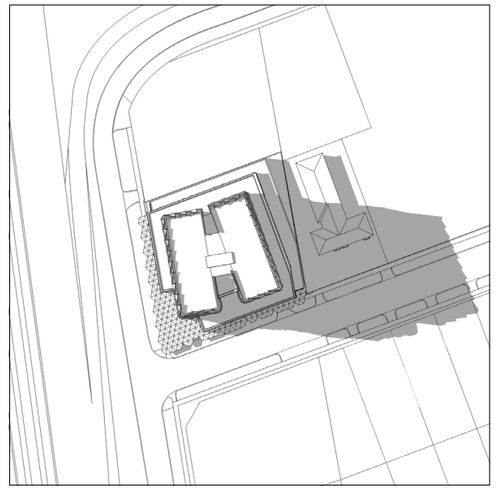

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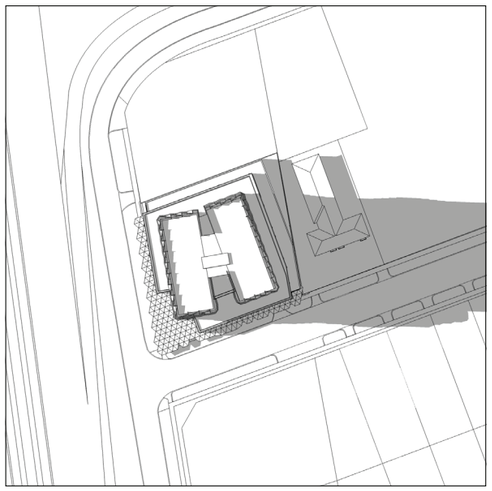

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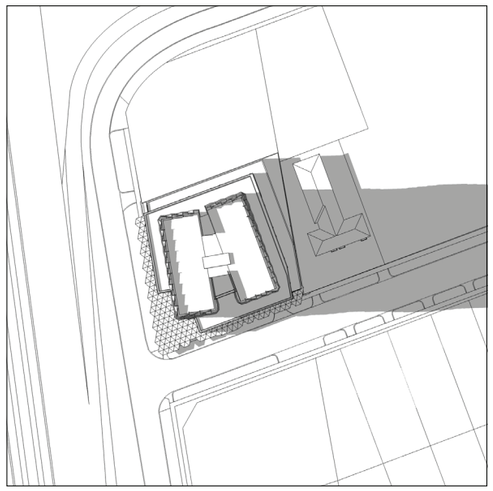

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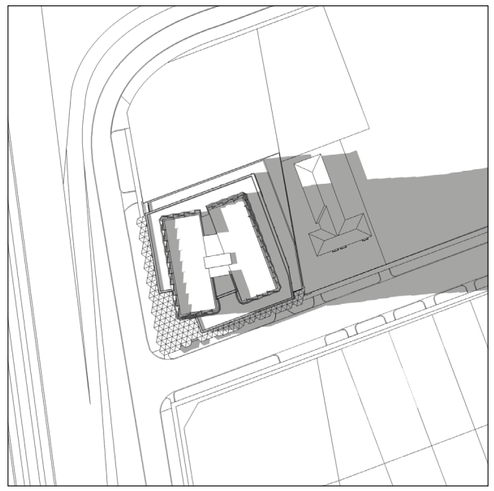

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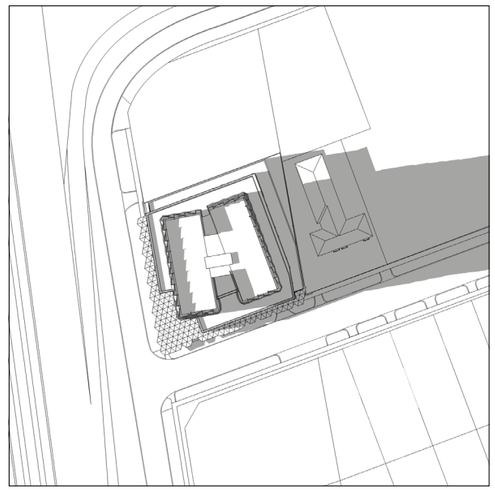

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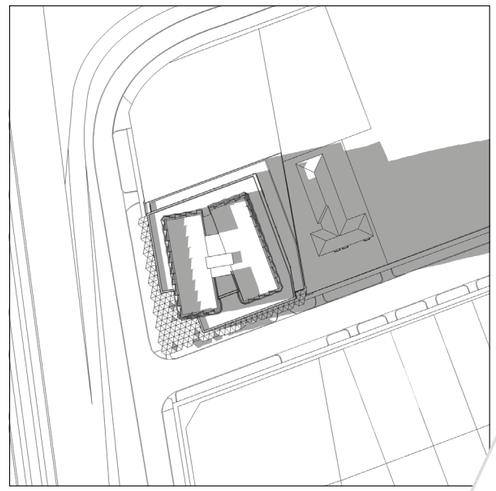

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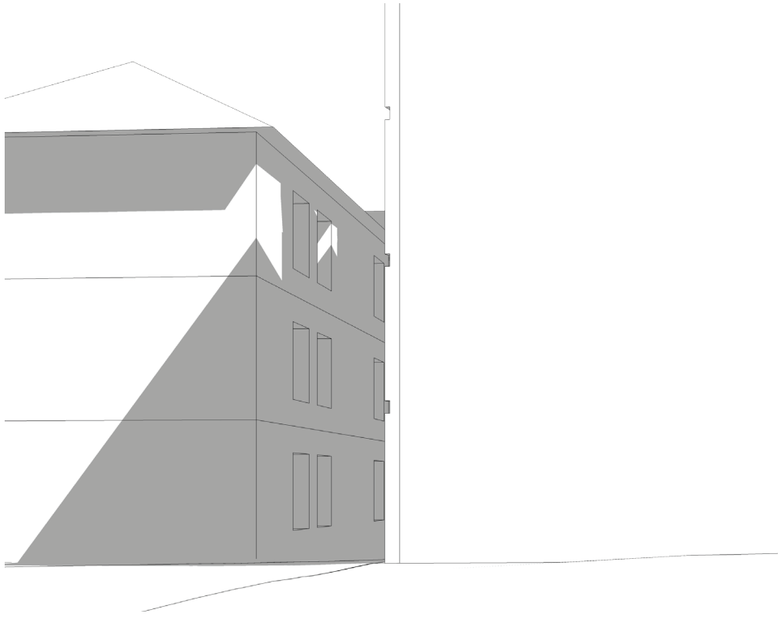
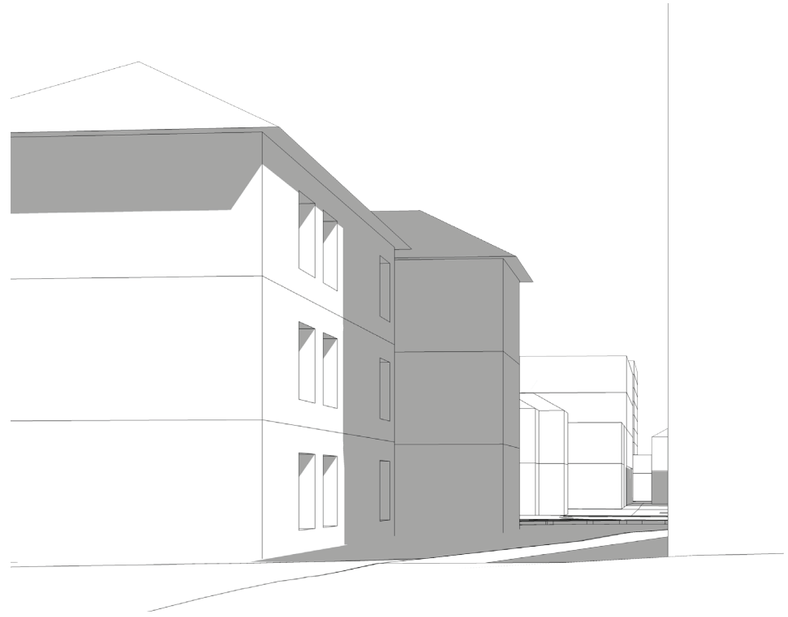
5.0 OVERSHADOWING DIAGRAMS

5.4 SHADOWS ON *22ND DECEMBER* - COMPARISON



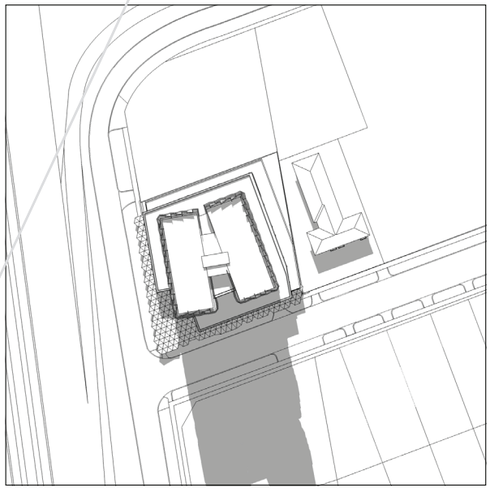
PREVIOUS
OVERSHADOWING AT 3:00PM



REVISED PROPOSAL
OVERSHADOWING AT 3:00PM

5.0 OVERSHADOWING DIAGRAMS

5.5 SHADOWS ON *21ST MARCH / 23RD SEPTEMBER* - REVISED SCHEME



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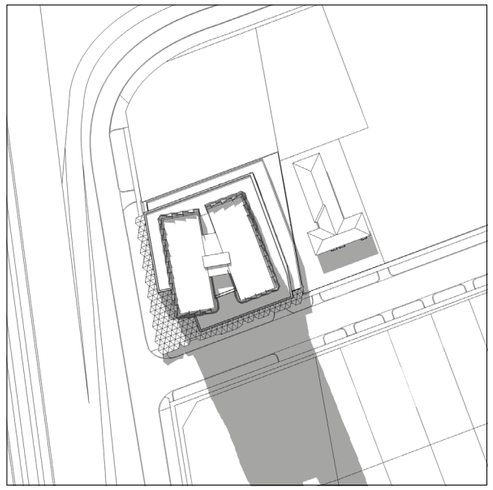

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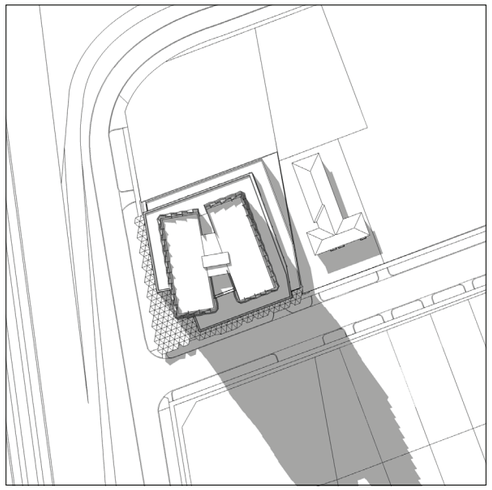

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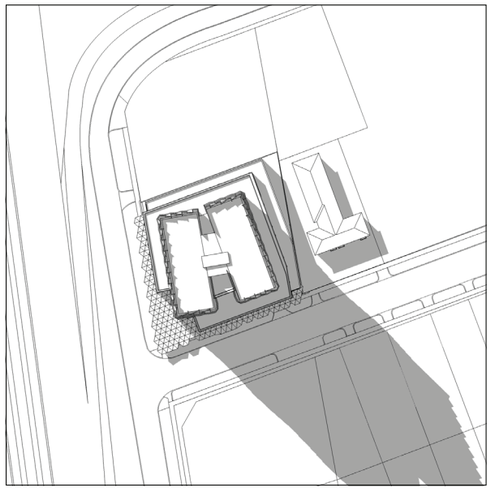

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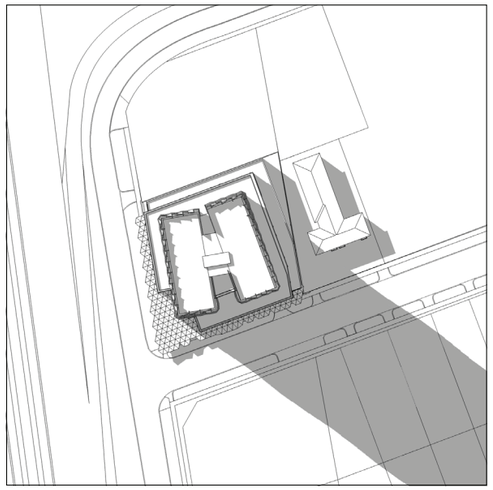

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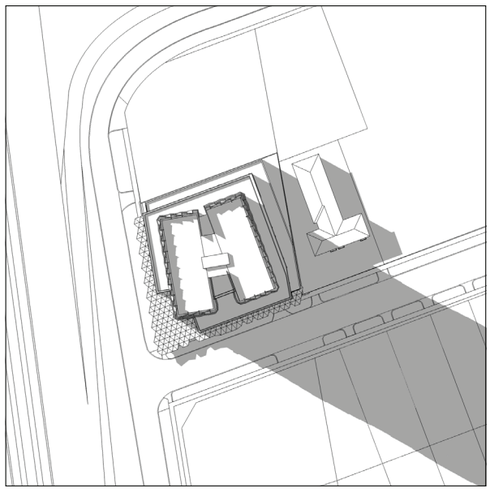

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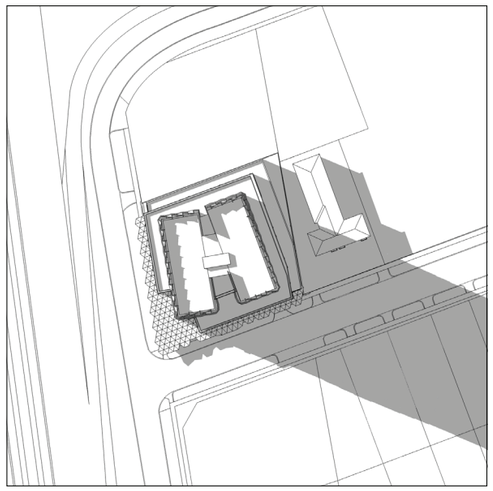

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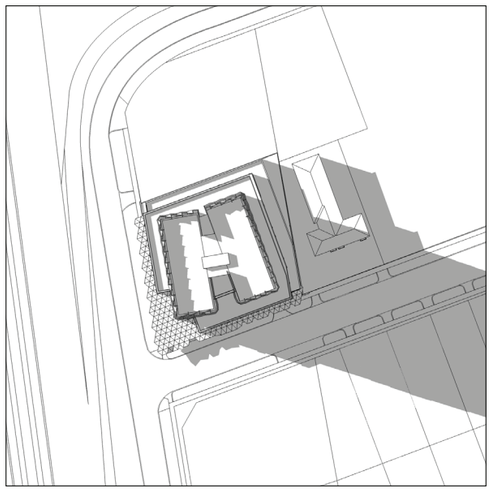

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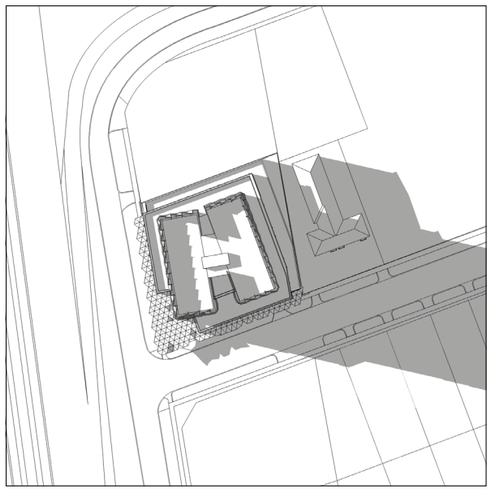

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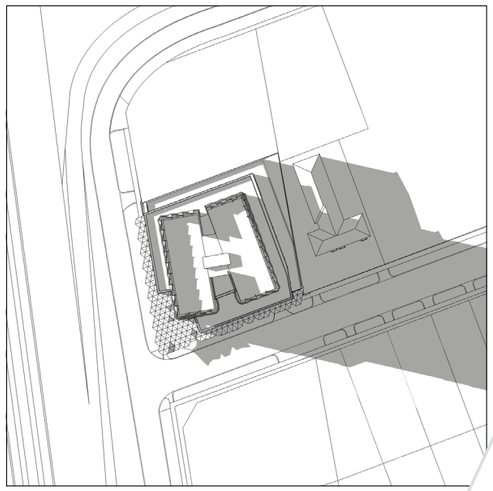

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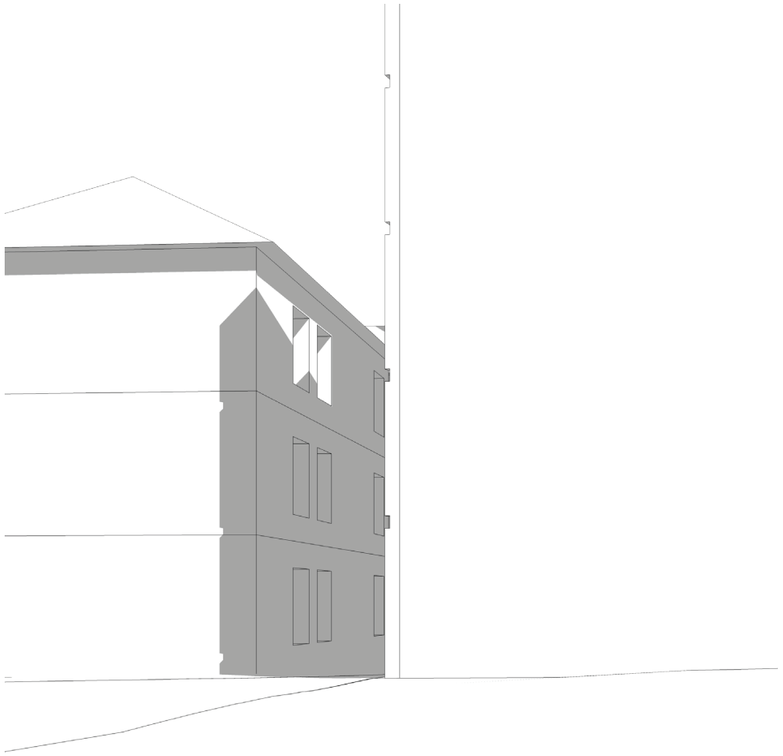
5.0 OVERSHADOWING DIAGRAMS

5.5 SHADOWS ON *21ST MARCH / 23RD SEPTEMBER* - REVISED SCHEME



PREVIOUS
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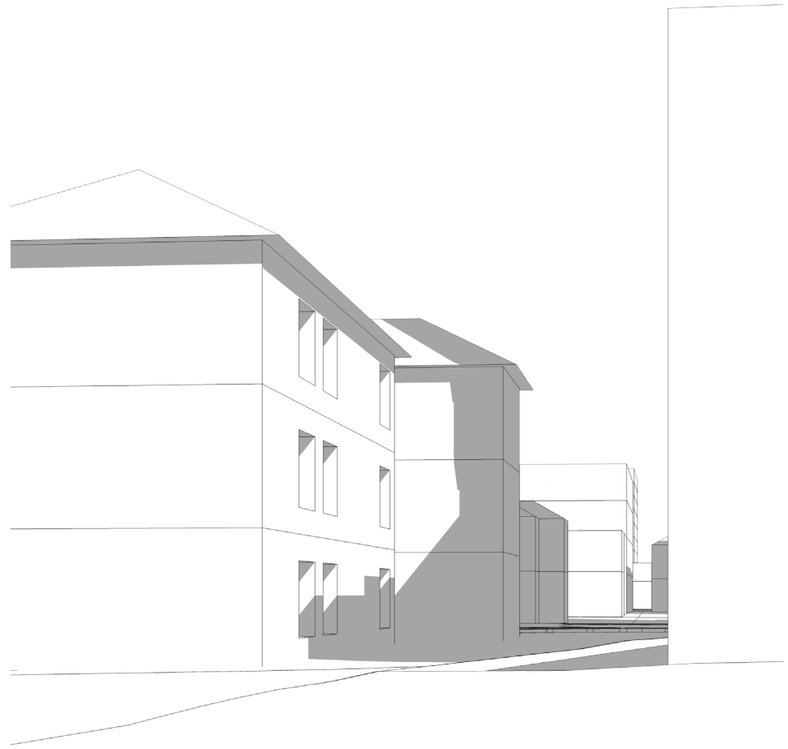
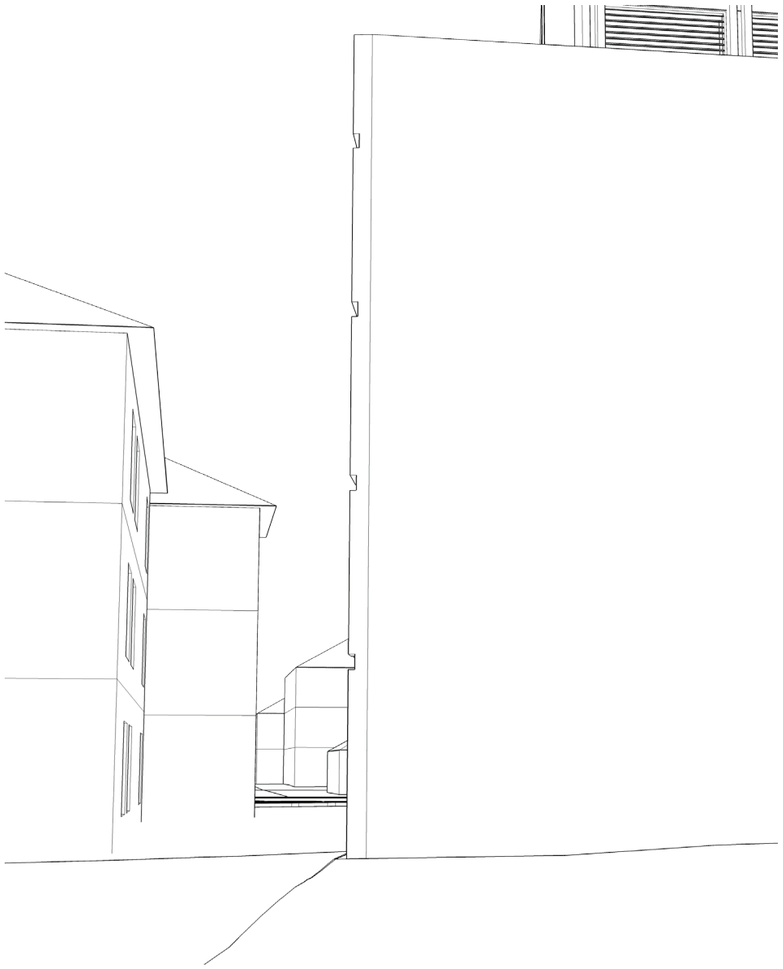


REVISED PROPOSAL
OVERSHADOWING AT 3:00PM

6.0 VISION CORRIDOR DIAGRAMS

6.1 AMENITY IMPROVEMENT - COMPARISON

The additional podium setback significantly improves the amenity of 3 Bowman Street.



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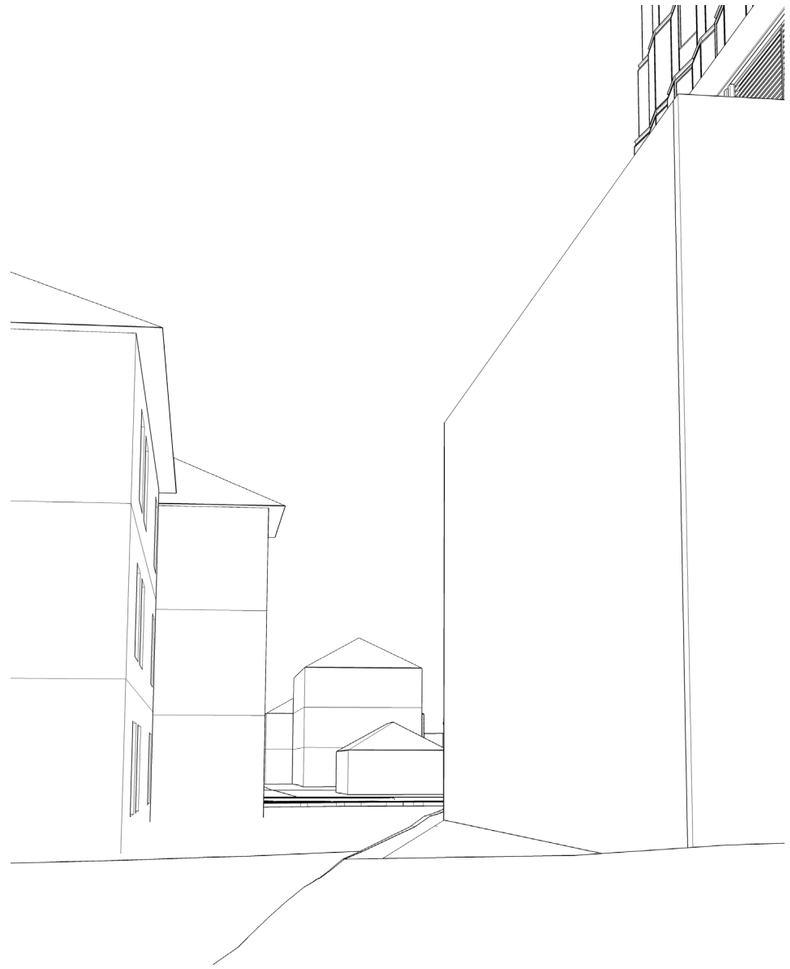
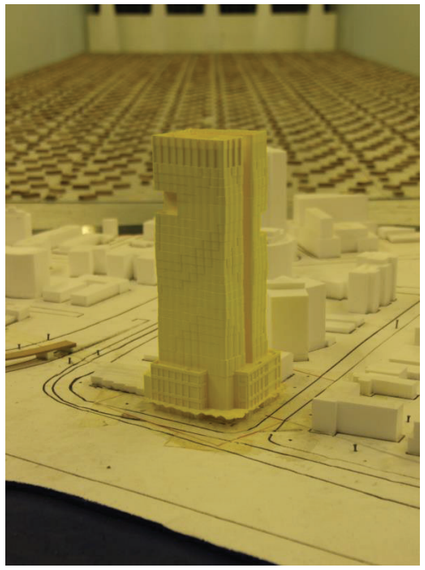
VIEW CORRIDOR



REVISED PROPOSAL
VIEW CORRIDOR

7.0 WIND TUNNEL STUDY REPORT

WINDTECH



PEDESTRIAN WIND ENVIRONMENT STUDY

50-52 MELVILLE PARADE, SOUTH PERTH

WD702-02F01(REV0)- WE REPORT

MAY 2, 2018

Prepared for:

NL Homes Melville Pty Ltd
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Subiaco WA 6008

DOCUMENT CONTROL

Date	Revision History	Issued Revision	Prepared By (initials)	Instructed By (initials)	Reviewed & Authorised by (initials)
May 2, 2018	Initial.	0	JG	SWR	HK

The work presented in this document was carried out in accordance with the Windtech Consultants Quality Assurance System, which is based on International Standard ISO 9001.

This document is issued subject to review and authorisation by the Team Leader noted by the initials printed in the last column above. If no initials appear, this document shall be considered as preliminary or draft only and no reliance shall be placed upon it other than for information to be verified later.

7.0

EXECUTIVE SUMMARY

This report presents the results of a detailed investigation into the wind environment impact on the outdoor trafficable areas of the development located at 50-52 Melville Parade, South Perth. Testing was performed using Windtech's boundary layer wind tunnel, which has a 3.0m wide working section and has a fetch length of 14m. Measurements were made in the wind tunnel at selected critical trafficable outdoor locations within and around the development from 16 wind directions at 22.5 degree increments using a 1:300 scale detailed model. The scale model was constructed based on the available architectural drawing package (Date Issued 19/3/2018) prepared by Hillam Architects received March, 2018. Since the time of the study model fabrication an updated drawing package from the project architect (Date Issued 19/4/2018) has been received April, 2018. The effect of the design changes to the development are not expected to have a significant impact on the wind conditions measured. The effects of nearby buildings and land topography have been accounted for through the use of a proximity model, which represents an area with a radius of 375m.

Peak gust and mean wind speeds were measured at selected critical outdoor trafficable locations within and around the subject development. Wind velocity coefficients representing the local wind speeds are derived from the wind tunnel and are combined with a statistical model of the regional wind climate (which accounts for the directional strength and frequency of occurrence of the prevailing regional winds) to provide the equivalent full-scale wind speeds at the site. These wind speed measurements are compared with criteria for pedestrian comfort and safety, based on gust wind speeds and Gust-Equivalent Mean (GEM) wind speeds.

The model of the development was tested in the wind tunnel without the effect of any forms of wind ameliorating devices such as screens, balustrades, etc, which are not already shown in the architectural drawings. The effect of vegetation was also excluded from the initial testing. The existing wind conditions along the pedestrian footpaths and within the neighbouring sites around the proposed site have also been tested to determine the impact of the proposed development.

The results of the study indicate that the majority of trafficable outdoor locations within and around the development will experience suitable wind conditions. Results indicate that with the inclusion of the proposed development there are no adverse wind conditions measured within the eastern neighbouring development

With the inclusion of the proposed development, the results of the study indicate that some treatments are necessary to be implemented to achieve the desired wind speed criteria for pedestrian comfort and/or safety. The suggested treatments, which have been tested in the wind tunnel to verify their effectiveness, are summarised as follows:

Ground Level:

- Recommended inclusion of the proposed densely foliating evergreen trees (as indicated in the Ground Floor architectural drawing) capable of growing to a height of 3-5 metres with a 3-5 metre wide canopy.
- Recommended inclusion of densely foliating evergreen shrubs along the south-western aspect, in front of the public plaza areas. These shrubs should be capable of growing to a height of 1.0 metre above a 0.5 metre planter box.

Level 5:

- Recommended inclusion of densely foliating evergreen shrubs located along the perimeter of the podium, as shown in Figure 7b. These shrubs should be capable of growing to a height of 1.0 metre above a 0.5-1.2 metre planter box.
- Recommended inclusion of a screen divider (minimum height of 3.0 metres to full height) at the north-east corner of the terrace. Treatment recommended in-principle based on results of alternative designs implemented and tested during treatment testing.
- Recommended inclusion of a screen divider (minimum height of 3.0 metres to full height) with return screens at the south-east corner of the terrace. Treatment recommended in-principle based on results of alternative designs implemented and tested during treatment testing.

It should be noted that for the south-eastern corner area that exceeds the safety limit (Annual Peak), the treatment solution recommended in-principle does not rely solely on any form of planting or vegetation. The recommendation is made in combination with solid elements, such that the planting/vegetation assists with the comfort levels and the solid element mitigates the annual peak winds.

7.0

CONTENTS

1 WIND CLIMATE FOR THE PERTH REGION

The regional wind climate model used in this study is based on an analysis of 63 years of recorded mean wind speed data (recorded from 1944 to 2006) obtained at the meteorological recording station located within Perth Airport. A plot of the regional wind speeds is presented in Figure 1, which are referenced to a height of 10m above ground in standard open terrain and converted to hourly means. This data is also presented in Table 1. The frequency of occurrence of the regional winds is also shown in Figure 1 for each wind direction. Note that the recurrence intervals examined in this study are for exceedances of 5% per 90 degree sector and 0.1% per 22.5 degree sector. The data indicates that the maximum wind speeds for the region are governed primarily by easterly and south-westerly winds.

Table 1: Directional Mean and Gust Wind Speeds for the Perth Region (referenced to 10m height above ground in standard open terrain)

Wind Direction	Reference Hourly Mean Wind Speeds (m/s)	
	5% Exceedance per 90deg sector	0.1% Exceedance per 22.5deg sector
N	5.6	10.0
NNE	5.7	10.0
NE	6.5	10.2
ENE	8.1	11.5
E	11.1	14.8
ESE	8.3	13.2
SE	5.9	9.6
SSE	4.1	8.1
S	7.0	9.8
SSW	7.6	10.0
SW	8.9	11.5
WSW	8.6	11.8
W	8.1	11.7
WNW	6.0	11.1
NW	4.6	11.1
NNW	1.0	9.9

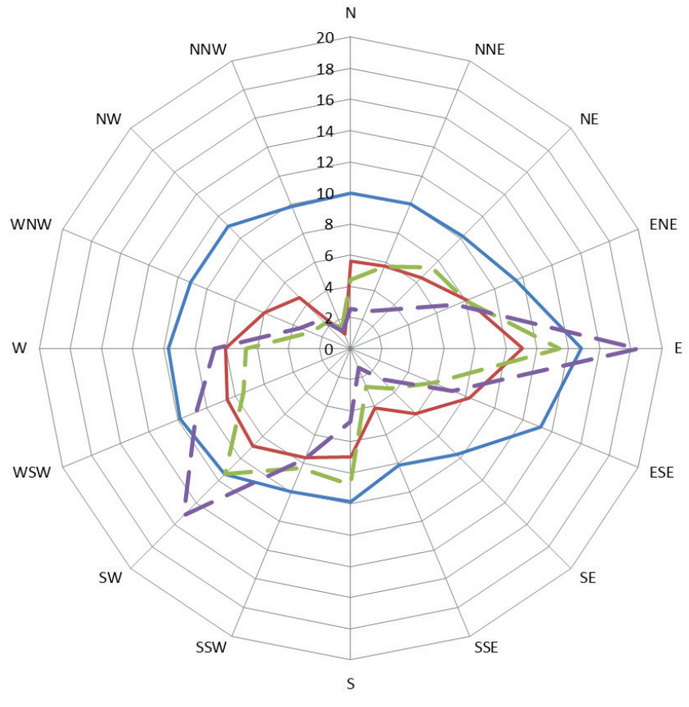

Figure 1: Directional Hourly Mean Wind Speeds, and Frequencies of Occurrence, for the Perth Region (for probabilities of exceedance of 0.1% and 5%, referenced to standard open terrain at a height of 10m above ground)

2 THE WIND TUNNEL MODEL

Wind tunnel testing was undertaken to obtain accurate wind speed measurements at selected critical outdoor locations within and around the development using a 1:300 scale model. The study model incorporates all necessary architectural features on the development to ensure an accurate wind flow is achieved around the model. The study model incorporates all necessary architectural features on the development to ensure an accurate wind flow is achieved around the model, and has been constructed based on the available architectural drawing package (Date Issued 19/3/2018) prepared by Hillam Architects received March, 2018. Since the time of the study model fabrication an updated drawing package from the project architect (Date Issued 19/4/2018) has been received April, 2018. The most significant change to the development was for the Level 5 podium terrace. The effect of the design changes to the development are not expected to have a significant impact on the wind conditions measured.

A proximity model has also been constructed and represents the surrounding buildings and significant topographical effects within a radius of 375m, centred on the development site. The model is reconfigurable to represent the existing site conditions. Photographs of the wind tunnel model and plan view image of the proximity model are presented in Figures 2a to 2g on the following pages.

The model of the development was tested in the wind tunnel without the effect of any forms of wind ameliorating devices such as screens, balustrades, etc, which are not already shown in the architectural drawings. The effect of vegetation was also excluded from the initial testing. If the results of the study indicate that any area is exposed to strong winds, in-principle treatments have been recommended. The existing site conditions were also tested, for comparison.

7.0

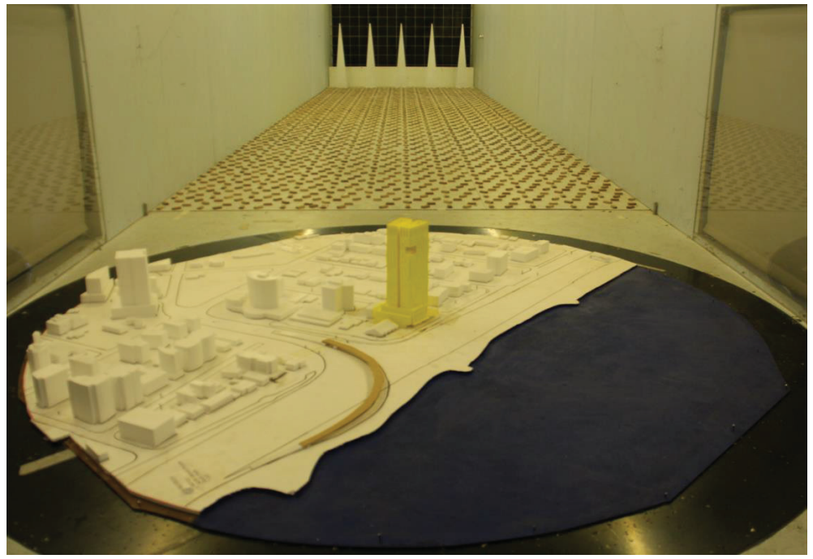

Figure 2a: Photograph of the Wind Tunnel Model – Proposed Scenario (view from the north-west)

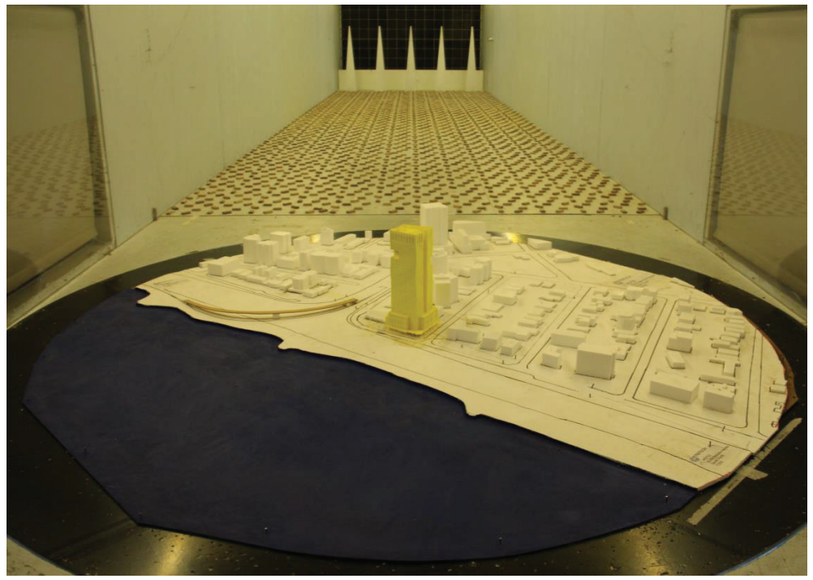

Figure 2b: Photograph of the Wind Tunnel Model – Proposed Scenario (view from the south-west)

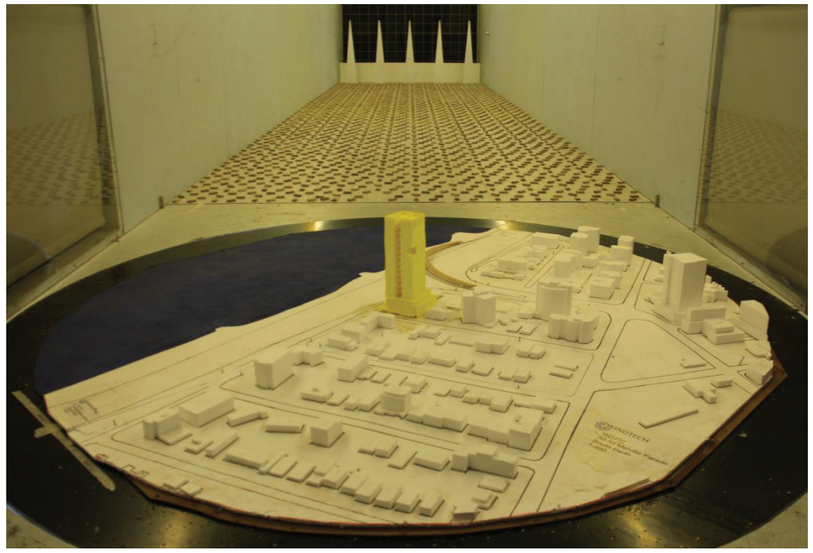

Figure 2c: Photograph of the Wind Tunnel Model – Proposed Scenario (view from the south-east)

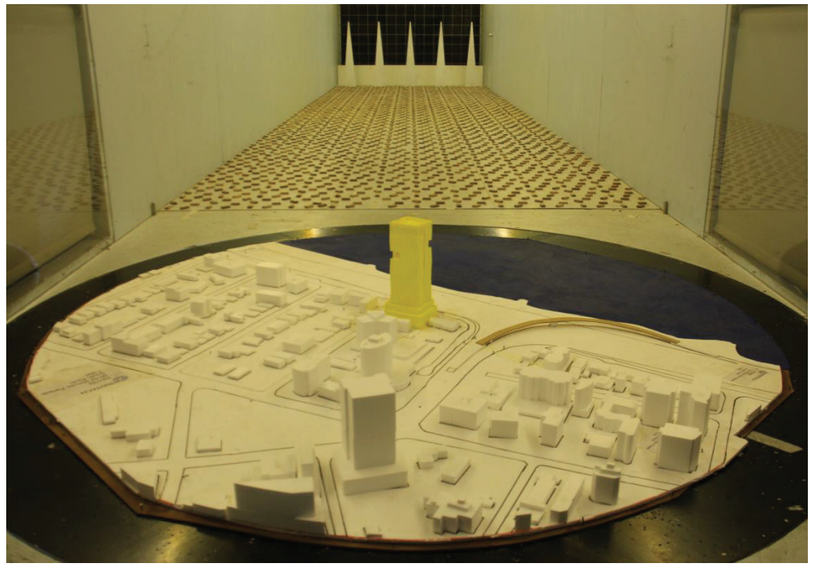

Figure 2d: Close up photograph of the Wind Tunnel Model– Proposed Scenario (view from the north-east)

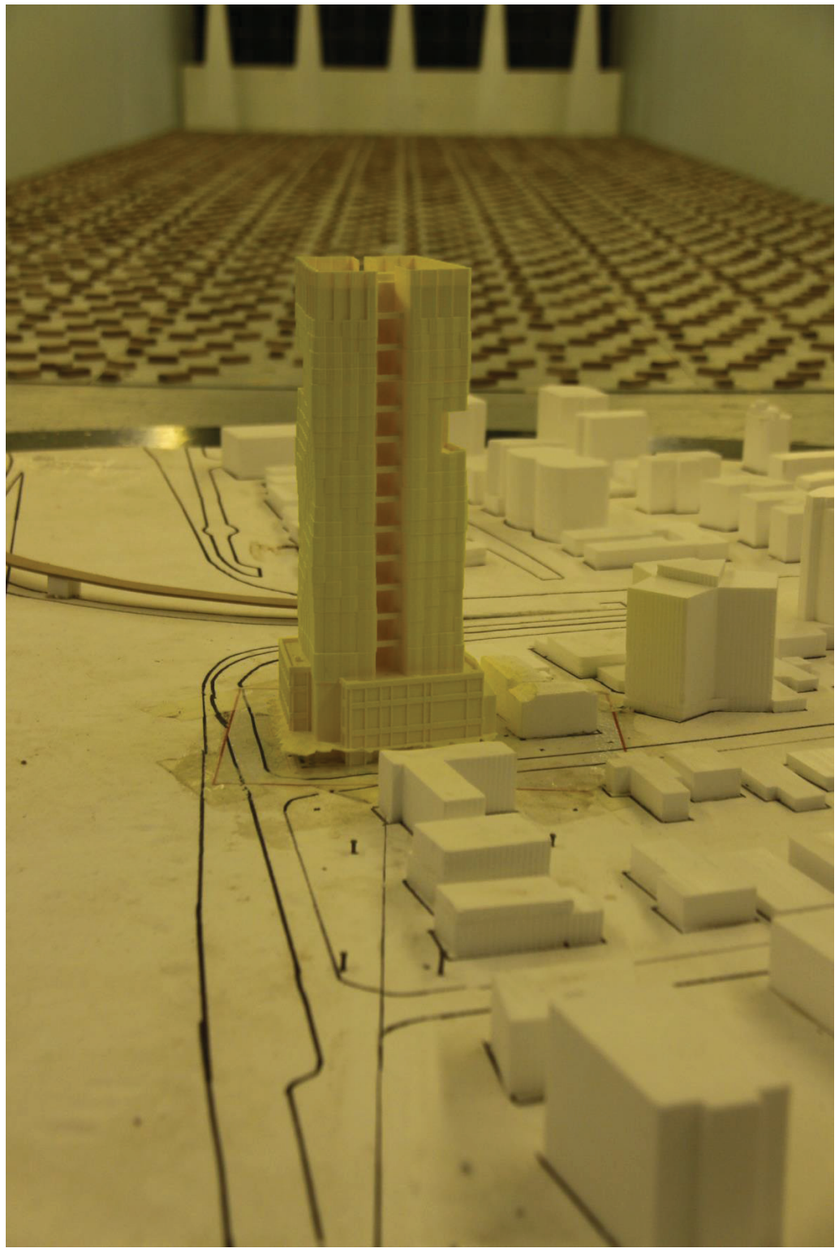

Figure 2e: Close up photograph of the Wind Tunnel Model– Proposed Scenario (view from the south)

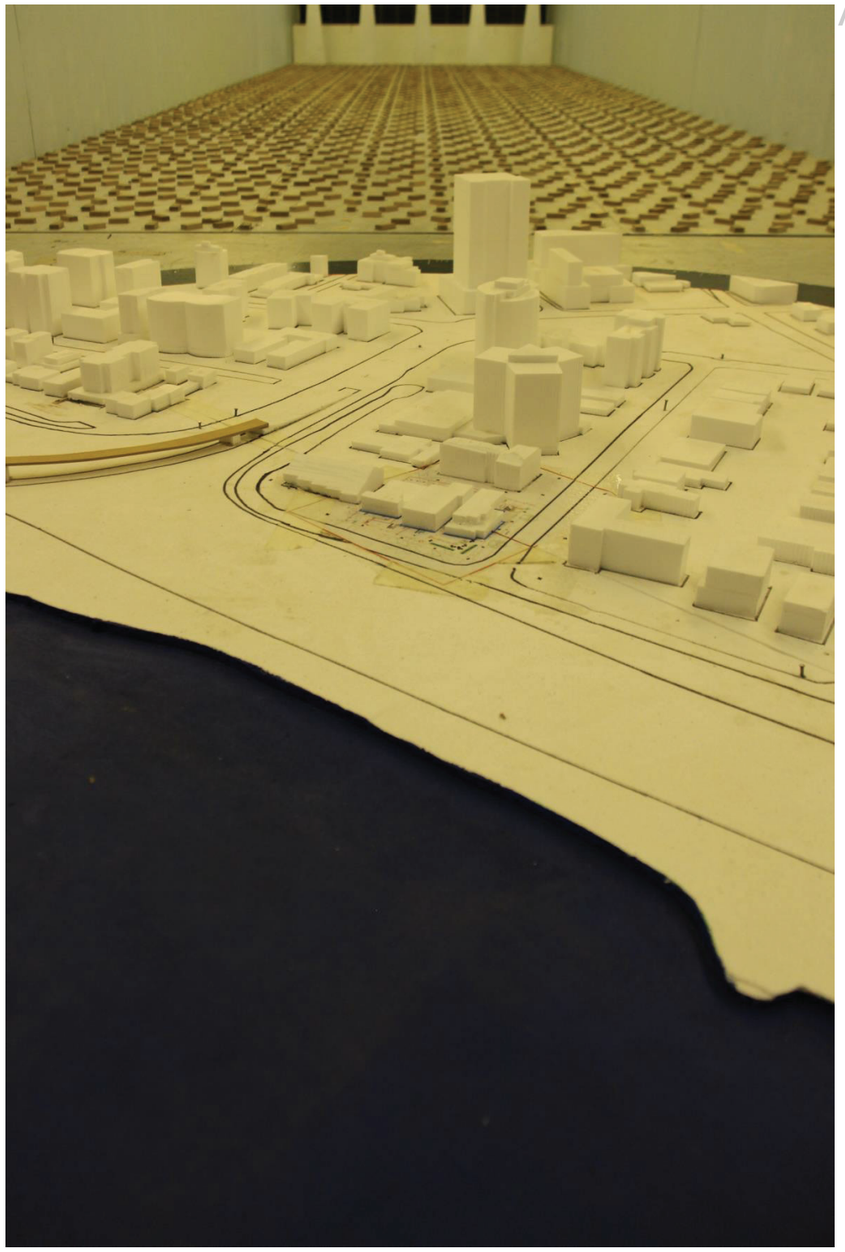

Figure 2f: Photograph of the Wind Tunnel Model – Existing Scenario (view from the south-west)

Figure 2g: Image of the Existing Proximity Model (Plan View)

3 BOUNDARY LAYER WIND FLOW MODEL

Testing was performed using Windtech's boundary layer wind tunnel, which has a 3.0m wide working section and has a fetch length of 14m. The model was placed in the appropriate standard boundary layer wind flow for each of the prevailing wind directions for the wind tunnel testing. The type of wind flow used in a wind tunnel study is determined by a detailed analysis of the surrounding terrain types around the subject site. Details of the analysis of the surrounding terrain for this study are provided in the following pages of this report.

The roughness of the earth's surface has the effect of slowing down the prevailing wind near the ground. This effect is observed up to what is known as the *boundary layer height*, which can range between 500m to 3km above the earth's surface depending on the roughness of the surface (i.e. oceans, open farmland, dense urban cities, etc.). Within this range, the prevailing wind forms what is known as a *boundary layer wind profile*.

Various wind codes and standards classify various types of boundary layer wind flows depending on the surface roughness. However, it should be noted that the wind profile does not change instantly due to changes in the terrain roughness. It can take many kilometres (at least 100km) of a constant surface roughness for the boundary layer profile to achieve a state of equilibrium. Descriptions of the standard boundary layer profiles for various terrain types are summarised as follows (in accordance with AS/NZS1170.2:2011):

- **Terrain Category 1.0:** Extremely flat terrain. Examples include enclosed water bodies such as lakes, dams, rivers, bays, etc.
- **Terrain Category 1.5:** Relatively flat terrain. Examples include the open ocean, deserts, and very flat open plains.
- **Terrain Category 2.0:** Open terrain. Examples include grassy fields and plains and open farmland (without buildings or trees).
- **Terrain Category 2.5:** Relatively open terrain. Examples include farmland with scattered trees and buildings and very low-density suburban areas.
- **Terrain Category 3.0:** Suburban and forest terrain. Examples include suburban areas of towns and areas with dense vegetation such as forests, bushland, etc.
- **Terrain Category 3.5:** Relatively dense suburban terrain. Examples include centres of small cities, industrial parks, etc.
- **Terrain Category 4.0:** Dense urban terrain. Examples include CBD's of large cities with many high-rise towers, and areas with many closely-spaced mid-rise buildings.

For this study, the shape of the boundary layer wind flows over standard terrain types is defined as per Deaves and Harris (1978). These are summarised in Table 2, referenced to the study reference height of 50m above ground.

7.0

Table 2: Terrain and Height Multipliers, Turbulence Intensities and Corresponding Roughness Lengths, for Standard Boundary Layer Profiles (at study reference height)

Terrain Category	Terrain and Height Multipliers			Turbulence Intensity	Roughness Length (m)
	$k_{tr,T=3600s}$ *(hourly)*	$k_{tr,T=600s}$ *(10-minute)*	$k_{tr,T=3s}$ *(3-second)*	I_v	$z_{0,r}$
1.0	0.96	0.99	1.28	0.112	0.003
1.5	0.90	0.93	1.25	0.128	0.01
2.0	0.84	0.88	1.21	0.147	0.03
2.5	0.77	0.81	1.17	0.174	0.1
3.0	0.69	0.73	1.12	0.208	0.3
3.5	0.58	0.62	1.04	0.265	1
4.0	0.46	0.51	0.96	0.355	3

An analysis of the effect of changes in the upwind terrain roughness was carried out for each of the wind directions studied. This has been undertaken based on the method given in ESDU-82026:2002 and ESDU-83045:2002, and detailed analysis of the surrounding terrain roughness for each directional sector. Aerial images showing the surrounding terrain are shown in Figures 3a and 3b for ranges of 5km and 50km respectively. The resulting mean and gust terrain and height multipliers are presented in Table 3, referenced to the study reference height.

For each of the 16 wind directions tested in this study, the approaching boundary layer wind profiles modelled in the wind tunnel matched the model scale and the overall surrounding terrain characteristics beyond the 375m radius of the proximity model. Plots of the wind tunnel boundary layer wind profiles are presented in Appendix B of this report.

Table 3: Terrain and Height Multipliers for Each Directional Sector (at the study reference height)

Wind Sector (degrees)	$k_{tr,T=3600s}$ *(hourly mean)*	$k_{tr,T=600s}$ *(10-minute mean)*	$k_{tr,T=3s}$ *(3-second gust)*
0	0.72	0.76	1.13
30	0.76	0.79	1.13
60	0.80	0.83	1.17
90	0.75	0.79	1.14
120	0.70	0.74	1.12
150	0.72	0.76	1.12
180	0.80	0.83	1.17
210	0.83	0.86	1.18
240	0.86	0.89	1.21
270	0.83	0.85	1.19
300	0.83	0.86	1.20
330	0.75	0.79	1.14

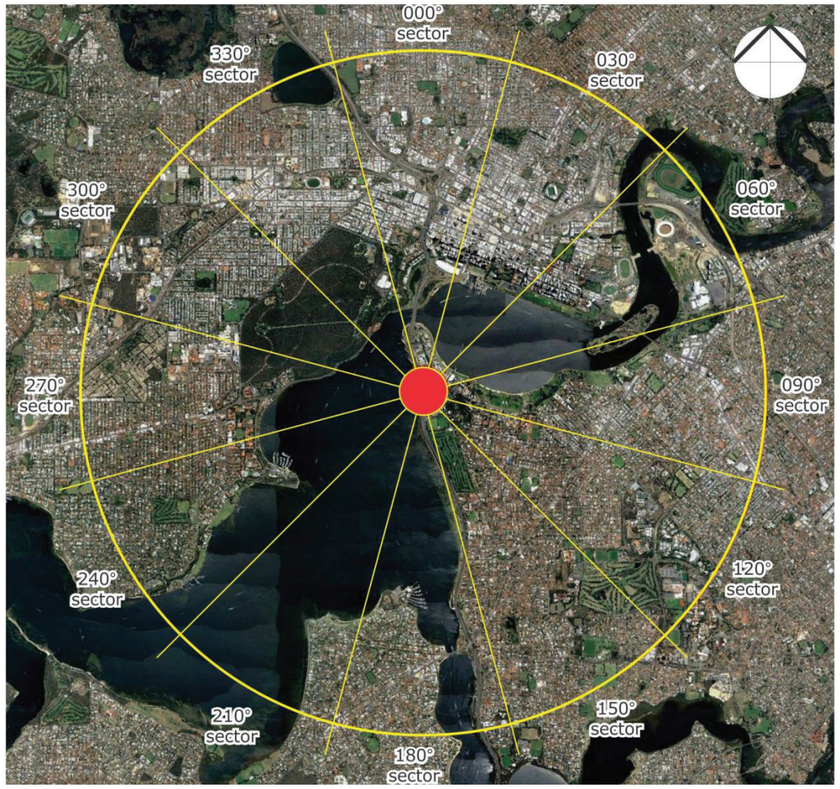

Figure 3a: Aerial Image showing the Surrounding Terrain (radius of 5km from the edge of the proximity model, which is coloured red)

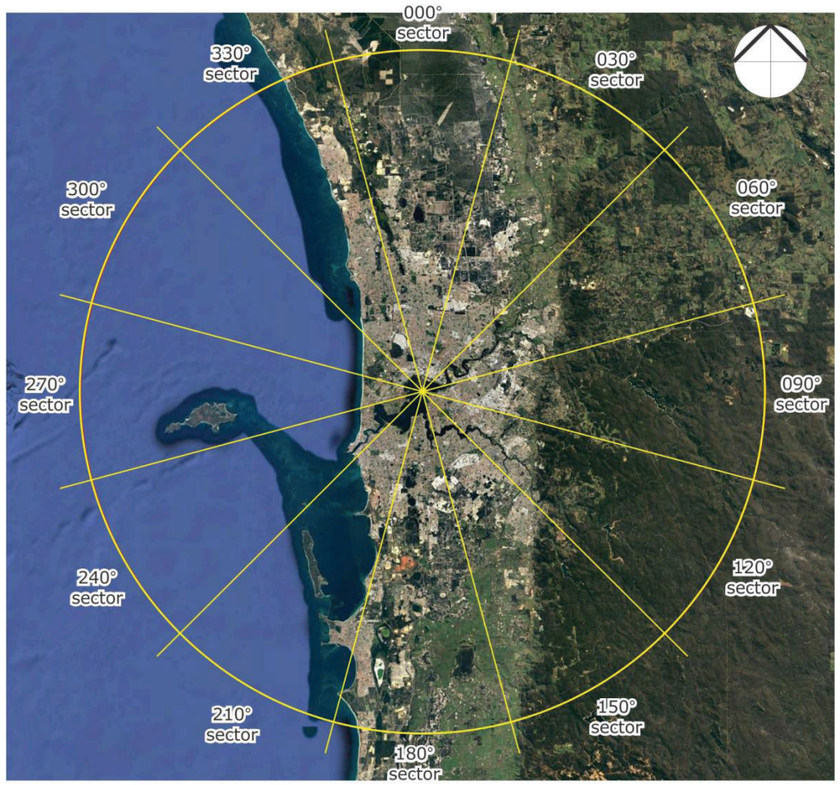

Figure 3b: Aerial Image of the Surrounding Terrain (radius of 50km)

4 ENVIRONMENTAL WIND SPEED CRITERIA

4.1 Wind Effects on People

The acceptability of wind in any area is dependent upon its use. For example, people walking or window-shopping will tolerate higher wind speeds than those seated at an outdoor restaurant. Various other researchers, such as A.G. Davenport, T.V. Lawson, W.H. Melbourne, A.D. Penwarden, etc, have published criteria for pedestrian comfort for pedestrians in outdoor spaces for various types of activities. These are discussed in the following sub-sections of this report.

4.1.1 A.D. Penwarden (1975) Criteria for Gust Wind Speeds

The following table developed by A.D. Penwarden (1975) is a modified version of the Beaufort Scale, and describes the effects of various wind intensities on people. Note that the applicability column related to wind conditions occurring frequently (a probability of exceedance of 5%). Higher ranges of wind speeds can be tolerated for rarer events.

Table 4: Summary of Wind Effects on People (after A.D. Penwarden, 1975)

Type of Winds	Beaufort Number	Mean Wind Speed (m/s)	Effects
Calm, light air	1	0 - 1.5	Calm, no noticeable wind
Light breeze	2	1.6 - 3.3	Wind felt on face
Gentle breeze	3	3.4 - 5.4	Hair is disturbed, Clothing flaps
Moderate breeze	4	5.5 - 7.9	Raises dust, dry soil and loose paper - Hair disarranged
Fresh breeze	5	8.0 – 10.7	Force of wind felt on body
Strong breeze	6	10.8 – 13.8	Umbrellas used with difficulty, Hair blown straight, Difficult to walk steadily, Wind noise on ears unpleasant.
Near gale	7	13.9 – 17.1	Inconvenience felt when walking.
Gale	8	17.2 - 20.7	Generally impedes progress, Great difficulty with balance.
Strong gale	9	20.8 – 24.4	People blown over by gusts.

4.1.2 A.G. Davenport (1972) Criteria for Mean Wind Speeds

A.G. Davenport (1972) had also determined a set of criteria in terms of the Beaufort Scale and for various return periods. The values presented in Table 5 below are based on a probability of exceedance of 5%.

Table 5: Criteria by A.G. Davenport (1972)

Classification	Activities	Maximum Mean (5% exceedance)
Walking Fast	Acceptable for walking, main public accessways.	7.5 m/s < $\overline{V}$ < 10.0 m/s
Strolling, Skating	Slow walking, etc.	5.5 m/s < $\overline{V}$ < 7.5 m/s
Short Exposure Activities	Generally acceptable for walking & short duration stationary activities such as window-shopping, standing or sitting in plazas.	3.5 m/s < $\overline{V}$ < 5.5 m/s
Long Exposure Activities	Generally acceptable for long duration stationary activities such as in outdoor restaurants & theatres and in parks.	$\overline{V}$ < 3.5 m/s

4.1.3 T.V. Lawson (1975) Criteria for Mean Wind Speeds

In 1973, T.V. Lawson quotes that A.D. Penwarden's Beaufort 4 wind speeds (as listed in Table 3) would be acceptable if it is not exceeded for more than 4% of the time; and a Beaufort 6 as being unacceptable if it is exceeded more than 2% of the time. Later, in 1975, T.V. Lawson presented a set of criteria very similar to those of A.G. Davenport's. These are presented in Tables 6 and 7.

Table 6: Safety Criteria by T.V. Lawson (1975)

Classification	Activities	Maximum Mean (0.1% exceedance)
Safety (all weather areas)	Accessible by the general public.	15 m/s
Safety (fair weather areas)	Private outdoor areas (balconies, terraces, etc.)	20 m/s

Table 7: Comfort Criteria by T.V. Lawson (1975)

Classification	Activities	95 Percentile Maximum Mean
Business Walking	Objective Walking from A to B.	8 m/s < $\overline{V}$ < 10m/s
Pedestrian Walking	Slow walking, etc.	6 m/s < $\overline{V}$ < 8 m/s
Short Exposure Activities	Pedestrian standing or sitting for short times.	4 m/s < $\overline{V}$ < 6 m/s
Long Exposure Activities	Pedestrian sitting for a long duration.	$\overline{V}$ < 4 m/s

4.1.4 W.H. Melbourne (1978) Criteria for Gust Wind Speeds

W.H. Melbourne (1978) introduced a set of criteria for the assessment of environmental wind conditions, which were developed for a temperature range of 10°C to 30°C and for people suitably dressed for outdoor conditions. These criteria are based on maximum gust wind speeds with a 0.1% probability of exceedance, and are outlined in Table 8 below. It should be noted that this criteria tends to be more conservative than criteria suggested by other researchers.

Table 8: Criteria by W.H. Melbourne (1978)

Classification	Human Activities	Maximum Gust (0.1% exceedance)
Limit for safety	Completely unacceptable: people likely to get blown over.	$\hat{V}$ > 23m/s
Marginal	Unacceptable as main public accessways.	23 m/s > $\hat{V}$ > 16 m/s
Comfortable Walking	Acceptable for walking, main public accessways	16 m/s > $\hat{V}$ > 13 m/s
Short Exposure Activities	Generally acceptable for walking & short duration stationary activities such as window-shopping, standing or sitting in plazas.	13 m/s > $\hat{V}$ > 10 m/s
Long Exposure Activities	Generally acceptable for long duration stationary activities such as in outdoor restaurants & theatres and in parks.	10 m/s > $\hat{V}$

4.2 Comparison of the Various Wind Speed Criteria

The criteria by W.H. Melbourne (1978) mentioned in Table 8, and criteria from other researchers, are compared on a probabilistic basis in Figure 4. This indicates that the criteria by W.H. Melbourne (1978) are quite conservative. This was also observed by A.W. Rofail (2007) when undertaking on-site remedial studies, who concluded that the criteria by W.H. Melbourne (1978) generally overstates the wind effects in a typical urban setting, which is caused by the assumption by W.H. Melbourne of a fixed 15% turbulence intensity for all areas. This value tends to be at the lower end of the range of turbulence intensities, and the A.W. Rofail (2007) study found that, in an urban setting, the range of the *minimum* turbulence intensities is typically in the range of 20% to 60%.

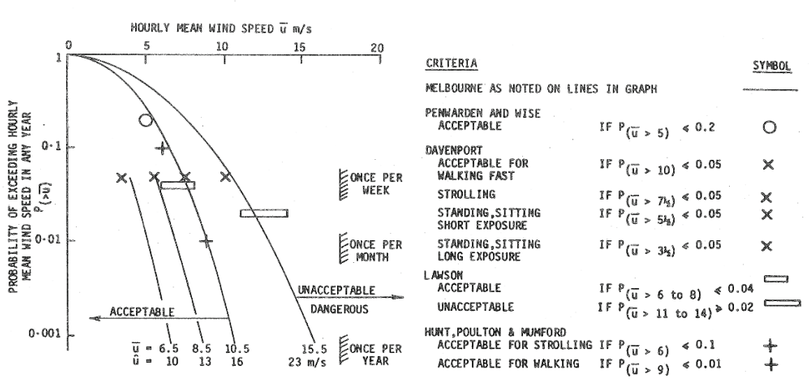

Figure 4: Comparison of Various Mean and Gust Wind Environment Criteria, assuming 15% turbulence and a Gust Factor of 1.5 (after W.H. Melbourne, 1978)

7.0

4.3 Wind Speed Criteria Used for This Study

For this study, the measured wind conditions for the various critical outdoor trafficable areas within and around the subject development are compared against two sets of criteria. For comfort, the A.G. Davenport (1972) criteria are used in conjunction with a maximum Gust-Equivalent Mean (GEM) wind speed (defined below), which are representative of a 5% probability of exceedance. The safety limit criterion by W.H. Melbourne (1978) of 23m/s for the maximum gust wind speeds with a 0.1% probability of exceedance is also used. Note that the A.G. Davenport (1972) criteria, used in conjunction with a GEM wind speed (defined below), has proven over time, and through field observations, to be the most reliable indicator of pedestrian comfort (Rofail, 2007). Note also that the safety limit criterion by W.H. Melbourne (1978) of 23m/s for maximum peak gust wind speeds is also applied to all areas. Existing site wind conditions were tested as part of this study to determine the impact of the subject development. The basic criteria for a range of outdoor activities are described as follows:

- **Short Exposure:** 5.5m/s maximum GEM wind speeds (5% probability of exceedance).
- **Comfortable Walking:** 7.5m/s maximum GEM wind speeds (5% probability of exceedance).
- **Safety Limit:** 23.0m/s maximum gust wind speeds (0.1% probability of exceedance).
- **Existing Site Conditions:** Where relevant, if the existing site conditions exceed the above-mentioned wind comfort criterion, then the target wind speed for that area with the inclusion of the proposed development is to at least match the existing site conditions.

The results of the wind tunnel study are summarised in the following section, and presented in the form of directional plots attached in Appendix A of this report. Each study point has 2 plots (one comparing to the modified version of the A.G. Davenport (1972) criteria for the maximum GEM wind speeds, and the other comparing to the W.H. Melbourne (1978) criteria for the maximum gust wind speeds).

Notes:

- The GEM is defined as the maximum of the mean wind speed and the gust wind speed divided by a gust factor of 1.85.
- The gust wind speed is defined as 3.0 standard deviations from the mean for a 3 second gust duration, or 3.4 standard deviations from the mean for a 0.5 second gust duration.
- Short Exposure applies typically to areas where short duration stationary activities are involved (less than 1 hour). This includes window shopping, waiting areas, etc.
- Comfortable Walking applies typically to areas used mainly for pedestrian thoroughfares. This also includes private swimming pools, communal areas, and private balconies and terraces.
- In all areas, the wind conditions are also checked against the safety limit.

5 TEST PROCEDURE AND METHODOLOGY

5.1 Measurement of the Velocity Coefficients

Testing was performed using Windtech's boundary layer wind tunnel facility, which has a 3.0m wide working section and has a fetch length of 14m. The test procedures followed for the wind tunnel testing performed for this study generally adhere to the guidelines set out in the Australasian Wind Engineering Society Quality Assurance Manual (AWES-QAM-1-2017) and AWES 2014, ASCE 7-10 (Chapter C31), and CTBUH (2013) guidelines.

The model of the subject development was setup within the wind tunnel, and the wind velocity measurements were monitored using Dantec hot-wire probe anemometers at selected critical outdoor locations at a full-scale height of approximately 1.5m above ground/slab level. The probe support for each study location was mounted such that the probe wire was vertical as much as possible, which ensures that the measured wind speeds are independent of wind direction along the horizontal plane. In addition, care was taken in the alignment of the probe wire and in avoiding wall-heating effects. Wind speed measurements are made in the wind tunnel for 16 wind directions, at 22.5° increments. The output from the hot-wire probes was obtained using a National Instruments 12-bit data acquisition card. A sample rate of 1024Hz was used, which is more than adequate for he given frequency band. The signal was low pass filtered at 32Hz, which results in the peak gust being the equivalent of a 2 to 3 second gust (which is what the criteria for pedestrian comfort and safety are based upon).

The mean and the maximum 3-second duration peak gust velocity coefficients are derived from the wind tunnel test by the following relation:

$$\hat{C}_V = \overline{C}_V + g.\sigma_V \qquad (5.1)$$

where: $\hat{C}_V$ is the 3-second gust velocity coefficient.

$\overline{C}_V$ is the mean velocity coefficient.

g is the gust factor, which is taken to be 3.0 for a 3-second gust duration, or 3.4 for a 0.5-second gust duration.

σ_V is the standard deviation of the velocity measurement.

The mean free-stream wind speed measured in the wind tunnel for this study was approximately 10.9m/s. Note that the measurement location for the mean free-stream wind speed is at a height of 200m at the upwind edge of the proximity model. A sampling time of 14 seconds was used for each wind direction tested, which is equivalent to a minimum sample time of approximately 36 minutes in full-scale for the maximum gust wind speeds, which is suitable for this type of study.

5.2 Calculation of the Full-Scale Results

To determine if the wind conditions at each study point location will satisfy the relevant criteria for pedestrian comfort and safety, the measured velocity coefficients need to be combined with information about the local wind climate. The aim of combining the wind tunnel measurements with wind climate information is to determine the probability of exceedance of a given wind speed at the site. The local wind climate is normally described using a statistical model, which relates wind speed to a probability of exceedance. Details of the wind climate model used in this study are outlined in Section 1.

A feature of this process is to include the impact of wind directionality, which includes any local variations in wind speed or frequency with wind direction. This is important as the wind directions that produce the highest wind speed events for a region may not coincide with the most wind exposed direction of the site.

The methodology adopted for the derivation of the full-scale results for the maximum gust and GEM wind speeds are outlined in the following sub-sections.

5.2.1 Maximum Gust Wind Speeds

The full-scale maximum gust wind speed at each study point location is derived from the measured velocity coefficient using the following relationship:

$$V_{study} = V_{ref,RH}\left(\frac{k_{200m,tr,T=3600s}}{k_{RH,tr,T=3600s}}\right)C_V \qquad (5.2)$$

V_{study} is the full-scale wind velocity at the study point location, in m/s.

$V_{ref,RH}$ is the full-scale reference wind speed at the upwind edge of the proximity model at the study reference height. This value is determined by combining the directional wind speed data for the region (detailed in Section 1) and the upwind terrain and height multipliers for the site (detailed in Section 3).

$k_{200m,tr,T=3600s}$ is the hourly mean terrain and height multiplier at 200m for the standard terrain category setup used in the wind tunnel tests.

$k_{RH,tr,T=3600s}$ is the hourly mean terrain and height multiplier at the study reference height (see Table 3).

C_V is the velocity coefficient measurement obtained from the hot-wire anemometer, which is derived from the following relationship:

$$C_V = \frac{C_{V,study}}{C_{V,200m}} \qquad (5.3)$$

$C_{V,study}$ is the velocity coefficient measurement obtained from the hot-wire anemometer at the study point location.

$C_{V,200m}$ is the measurement obtained from the hot-wire anemometer at the free-stream reference location at 200m height upwind of the model in the wind tunnel.

The value of $V_{ref,RH}$ varies with each prevailing wind direction. Wind directions where there is a high probability that a strong wind will occur will have a higher directional wind speed than other directions. To determine the directional wind speeds, a probability level must be assigned for each wind direction. These probability levels are set following the approach used in AS/NZS1170.2:2011, which assumes that the major contributions to the combined probability of exceedance of a typical load effect comes from only two 45 degree sectors.

5.2.2 Maximum Gust-Equivalent Mean Wind Speeds

The contribution to the probability of exceedance of a specified wind speed (i.e. the desired wind speed for pedestrian comfort, as per the criteria) is calculated for each wind direction. These contributions are then combined over all wind directions to calculate the total probability of exceedance of the specified wind speed. To calculate the probability of exceedance for a specified wind speed a statistical wind climate model was used to describe the relationship between directional wind speeds and the probability of exceedance. A detailed description of the methodology is given by Lawson (1980).

The criteria of Davenport (1972), which is used in this study, is referenced to a probability of exceedance of 5% of a specified wind speed.

5.3 Layout of Study Points

For this study, a total of 39 study point locations have been selected for analysis in the wind tunnel. The locations of the various study points tested for this study are presented in Figures 5a to 5g in the form of marked-up plan drawings, along with the wind criteria each point is required to meet. It should be noted that only the most critical outdoor locations of the development have been selected for analysis. A total of 10 study points located in surrounding areas around the development site were tested to determine the impact of the development on the surrounding conditions.

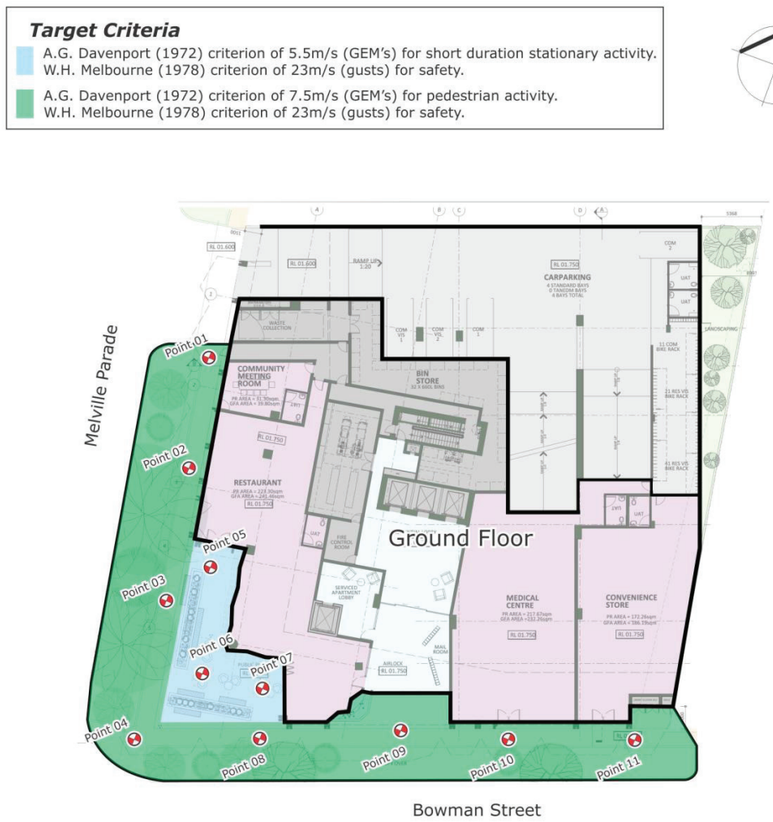

Figure 5a: Study Point Locations and Wind Speed Criteria – Ground Floor Plan

7.0

Target Criteria

A.G. Davenport (1972) criterion of 5.5m/s (GEM's) for short duration stationary activity.
W.H. Melbourne (1978) criterion of 23m/s (gusts) for safety.

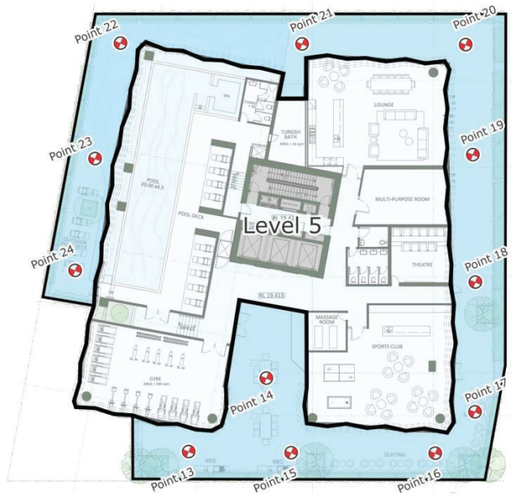

Figure 5b: Study Point Locations and Wind Speed Criteria – Level 5 Plan

Target Criteria

A.G. Davenport (1972) criterion of 5.5m/s (GEM's) for short duration stationary activity.
W.H. Melbourne (1978) criterion of 23m/s (gusts) for safety.

Figure 5c: Study Point Locations and Wind Speed Criteria – General Floor Plan Lower Level

7.0

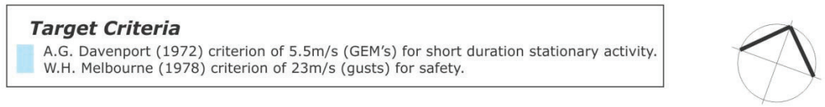

Figure 5d: Study Point Locations and Wind Speed Criteria – General Floor Plan Mid Level including Sky Garden

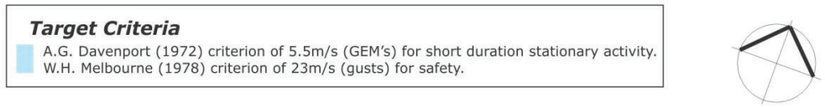

Figure 5e: Study Point Locations and Wind Speed Criteria – Upper Level Sky Garden

Target Criteria

A.G. Davenport (1972) criterion of 5.5m/s (GEM's) for short duration stationary activity.
W.H. Melbourne (1978) criterion of 23m/s (gusts) for safety.

Figure 5f: Study Point Locations and Wind Speed Criteria – General Floor Plan Upper Level

Target Criteria

A.G. Davenport (1972) criterion of 7.5m/s (GEM's) for pedestrian activity.
W.H. Melbourne (1978) criterion of 23m/s (gusts) for safety.

Figure 5g: Study Point Locations and Wind Speed Criteria – Surrounding Areas

7.0

6 RESULTS AND DISCUSSION

The results for all study point locations are presented in the form of directional plots in Appendix A, and are summarised in Table 9a and 9b below and also in Figures 6a to 6g. The wind speed criteria that the wind conditions should achieve are also listed in Table 9a and 9b for each study point location, as well as in Figures 5a to 5g. The existing wind conditions along the pedestrian footpaths and within the neighbouring sites around the proposed site have also been tested to determine the impact of the proposed development.

The results of the study indicate that the majority of trafficable outdoor locations within and around the development will experience suitable wind conditions. However, strong winds were observed along the pedestrian footpath areas on Melville Parade and Bowman Street due to the impact of the prevailing easterly and south-westerly winds. Although these winds satisfied the criteria for safety, an exceedance of the criteria for comfort is exceeded.

Results indicate that strong localised winds are experienced at both the north-east and south-east corners of the Level 5 Podium. These conditions are driven by the prevailing easterly winds interacting with the eastern façade and accelerating around the corner.

Results indicate that with the inclusion of the proposed development there are no adverse wind conditions measured within the eastern neighbouring development. With the inclusion of the development the wind conditions measured north of the site along Melville Parade are seen to exceed the comfort criteria due to the south-westerly winds. With the inclusion of the recommended Ground Level treatments as outlined below the wind comfort levels are seen to meet the recommended criteria. All other surrounding areas meet the recommended criteria.

With the inclusion of the proposed development, the results of the study indicate that some treatments are necessary to be implemented to achieve the desired wind speed criteria for pedestrian comfort and/or safety. The suggested treatments, which have been tested in the wind tunnel to verify their effectiveness, are summarised as follows:

Ground Level:

- Recommended inclusion of the proposed densely foliating evergreen trees (as indicated in the Ground Floor architectural drawing) capable of growing to a height of 3-5 metres with a 3-5 metre wide canopy, as shown in Figure 7a.
- Recommended inclusion of densely foliating evergreen shrubs along the south-western aspect, in front of the public plaza areas. These shrubs should be capable of growing to a height of 1.0 metre above a 0.5 metre planter box, as shown in Figure 7a.

Level 5:

- Recommended inclusion of densely foliating evergreen shrubs located along the perimeter of the podium, as shown in Figure 7b. These shrubs should be capable of growing to a height of 1.0 metre above a 0.5-1.2 metre planter box.
- Recommended inclusion of a screen divider (minimum height of 3.0 metres to full height) at the north-east corner of the terrace, as shown in Figure 7b. Treatment recommended in-principle based on results of alternative designs implemented and tested during treatment testing.
- Recommended inclusion of a screen divider (minimum height of 3.0 metres to full height) with return screens at the south-east corner of the terrace, as shown in Figure 7b. Treatment recommended in-principle based on results of alternative designs implemented and tested during treatment testing.

It should be noted that for the south-eastern corner point that exceeds the safety limit (Annual Peak) as shown in Table 9a, the treatment solution recommended in-principle does not rely solely on any form of planting or vegetation. The recommendations is made in combination with solid elements, such that the planting/vegetation assists with the comfort levels and the solid element mitigates the annual peak winds.

The inclusion of additional landscaping and densely foliating evergreen trees and shrubs within and around the development will further enhance the wind comfort conditions.

With the inclusion of the abovementioned treatments to the final design, suitable wind conditions are expected to be achieved for all trafficable areas within and around the subject development site.

Table 9a: Proposed Development Wind Tunnel Results Summary

Point Name	Desired Criterion (m/s)		Treatment Necessary to Pass GEM?	Treatment Necessary to Pass Gust?	Description of Treatment
	GEM (with 5% exceedance)	Gust (with 0.1% exceedance)			
Point 01	7.5	23.0	YES	NO	Refer to Figure 7a
Point 02	7.5	23.0	NO	NO	
Point 03	7.5	23.0	YES	NO	Refer to Figure 7a
Point 04	7.5	23.0	NO	NO	
Point 05	7.5	23.0	NO	NO	
Point 06	5.5	23.0	YES	NO	Refer to Figure 7a
Point 07	5.5	23.0	NO	NO	
Point 08	7.5	23.0	YES	NO	Refer to Figure 7a
Point 09	7.5	23.0	NO	NO	
Point 10	7.5	23.0	NO	NO	
Point 11	7.5	23.0	YES	NO	Refer to Figure 7a
Point 12	7.5	23.0	NO	NO	
Point 13	5.5	23.0	NO	NO	
Point 14	5.5	23.0	NO	NO	
Point 15	5.5	23.0	YES	NO	Refer to Figure 7b
Point 16	5.5	23.0	YES	YES	Refer to Figure 7b
Point 17	5.5	23.0	NO	NO	
Point 18	5.5	23.0	NO	NO	
Point 19	5.5	23.0	NO	NO	
Point 20	5.5	23.0	YES	NO	Refer to Figure 7b
Point 21	5.5	23.0	NO	NO	
Point 22	5.5	23.0	NO	NO	
Point 23	5.5	23.0	NO	NO	
Point 24	5.5	23.0	NO	NO	
Point 25	5.5	23.0	NO	NO	
Point 26	5.5	23.0	NO	NO	
Point 27	5.5	23.0	NO	NO	
Point 28	5.5	23.0	NO	NO	
Point 29	5.5	23.0	NO	NO	

Table 9b: Proposed Development Wind Tunnel Results Summary - Surrounding Areas

Point Name	Desired Criterion (m/s)		Treatment Necessary to Pass GEM?	Treatment Necessary to Pass Gust?	Description of Treatment
	GEM (with 5% exceedance)	Gust (with 0.1% exceedance)			
Point 101	7.5	23.0	NO	NO	
Point 102	7.5	23.0	NO	NO	
Point 103	7.5	23.0	NO	NO	
Point 104	7.5	23.0	NO	NO	
Point 105	7.5	23.0	NO	NO	
Point 106	7.5	23.0	NO	NO	
Point 107	7.5	23.0	NO	NO	
Point 108	7.5	23.0	NO	NO	
Point 109	7.5	23.0	YES	NO	Refer to Figure 7a
Point 110	7.5	23.0	YES	NO	Refer to Figure 7a

Figure 6a: Wind Directionality Plots – Ground Level Plan
(results shown without treatments applied)

Figure 6b: Wind Directionality Plots – Level 5 Plan
(results shown without treatments applied)

Figure 6c: Wind Directionality Plots – General Floor Plan Lower Level (results shown without treatments applied)

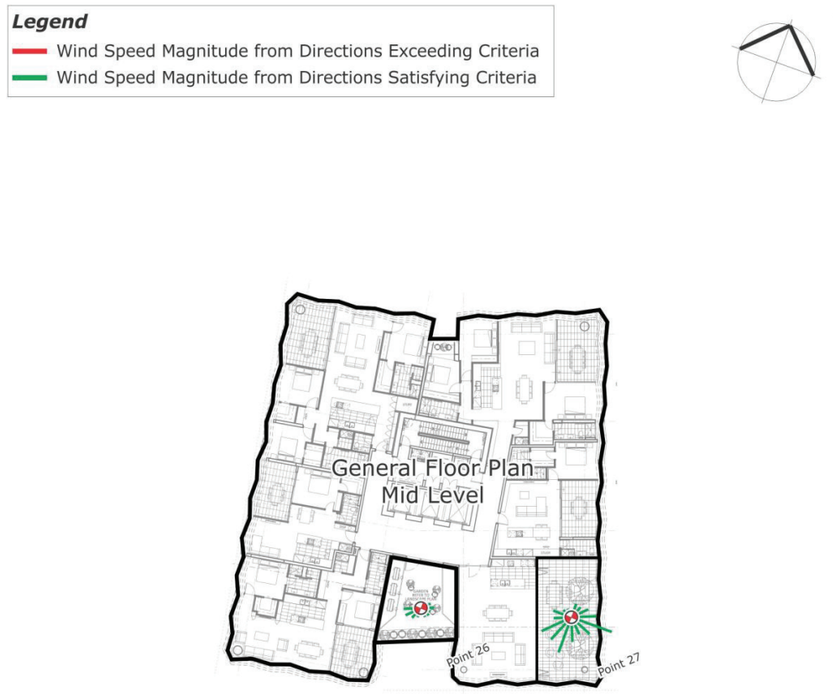

Figure 6d: Wind Directionality Plots – General Floor Plan Mid Level including Sky Garden (results shown without treatments applied)

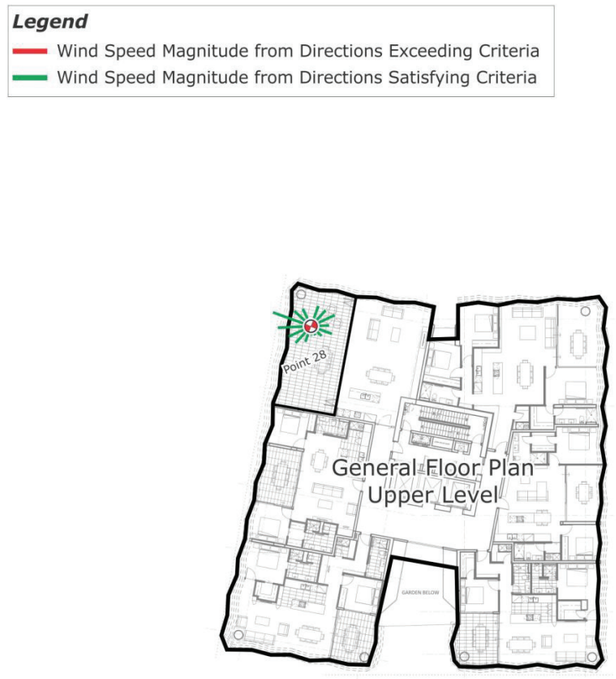

Figure 6e: Wind Directionality Plots – Upper Level Sky Garden
(results shown without treatments applied)

Figure 6f: Wind Directionality Plots – General Floor Plan Upper Level
(results shown without treatments applied)

Legend

Wind Speed Magnitude from Directions Exceeding Criteria

Wind Speed Magnitude from Directions Satisfying Criteria

Figure 6g: Wind Directionality Plots – Surrounding Areas (results shown without treatments applied)

Legend

Recommended retention of proposed tree planting, capable of growing to a height of 3-5m, with a 3-5m wide canopy. The trees should be of a dense evergreen species.

Proposed inclusion of densely foliating evergreen shrubs capable of growing to a height of 1.0m above a 0.5m planter box.

Figure 7a: Recommended Treatments – Ground Level Plan

Figure 7b: Recommended Treatments – Level 5 Plan

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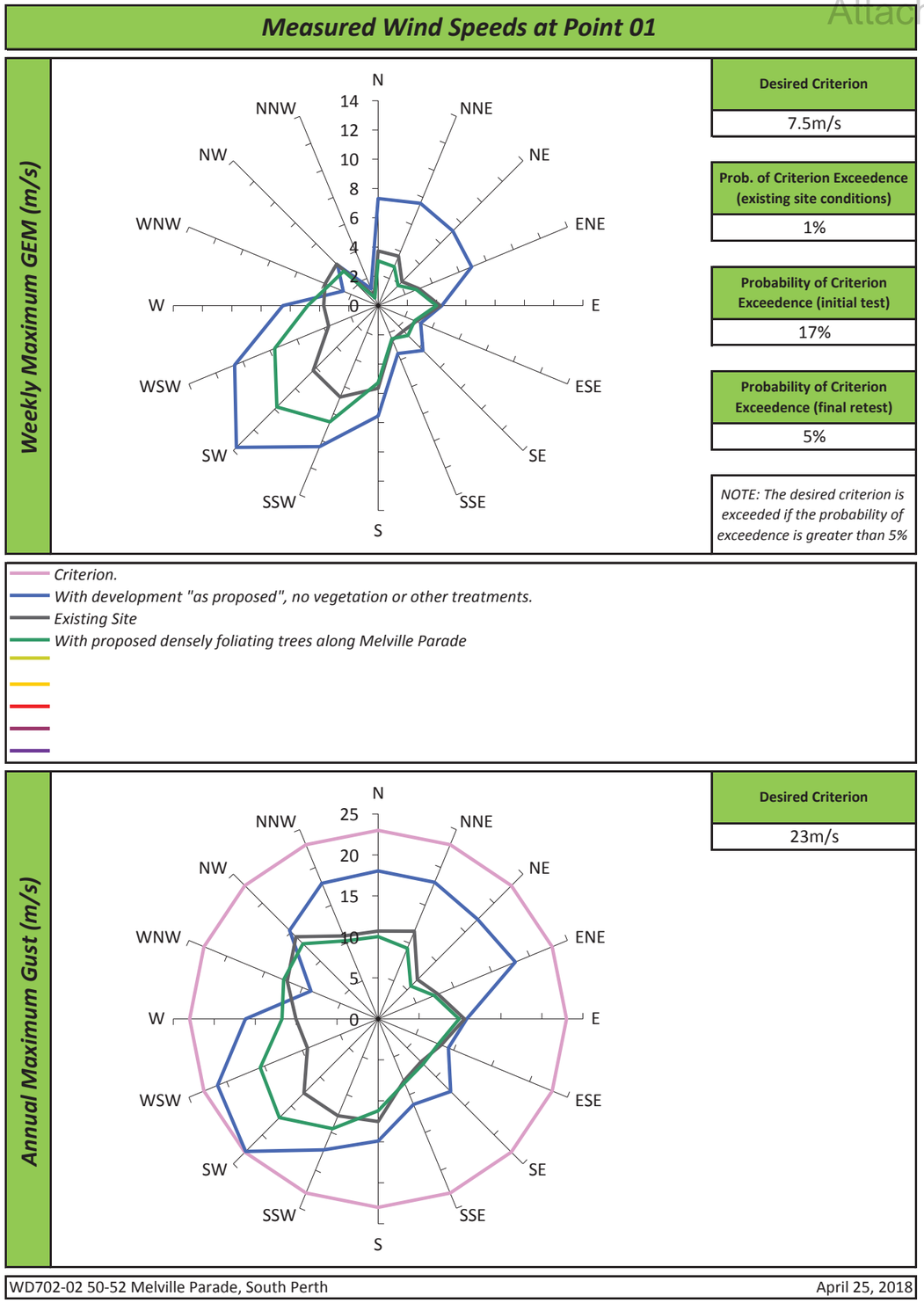
7.0

APPENDIX A - DIRECTIONAL PLOTS OF THE WIND TUNNEL RESULTS



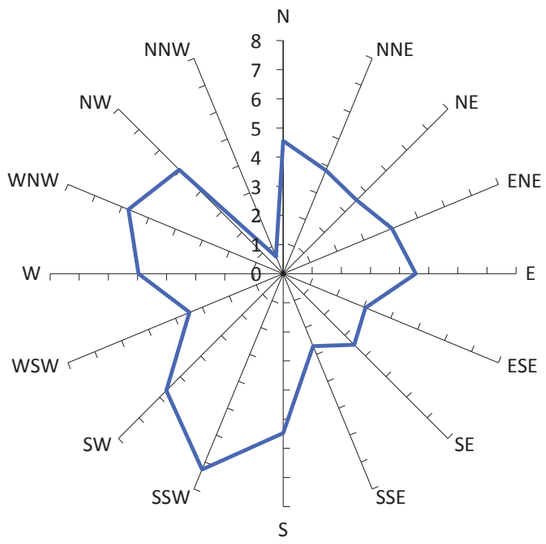
Sydney Office
WD702-02F01(rev0)- WE Report
May 2, 2018

Pedestrian Wind Environment Study
50-52 Melville Parade, South Perth
NL Homes Melville Pty Ltd

7.0

Measured Wind Speeds at Point 02

Weekly Maximum GEM (m/s)



Desired Criterion
7.5m/s

Prob. of Criterion Exceedence (existing site conditions)
Not Tested

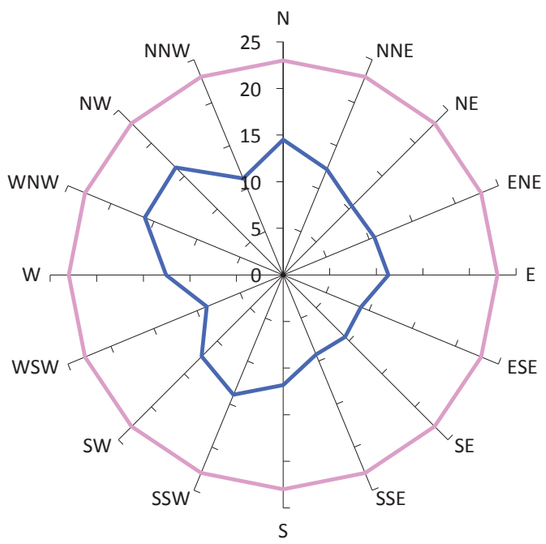
Probability of Criterion Exceedence (initial test)
2%

Probability of Criterion Exceedence (final retest)
N/A

NOTE: The desired criterion is exceeded if the probability of exceedence is greater than 5%

- *Criterion.*
- *With development "as proposed", no vegetation or other treatments.*

Annual Maximum Gust (m/s)

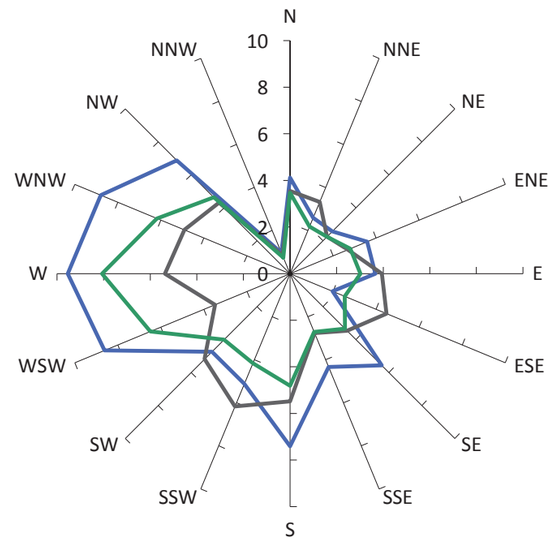


Desired Criterion
23m/s

WD702-02 50-52 Melville Parade, South Perth — April 25, 2018

Measured Wind Speeds at Point 03

Weekly Maximum GEM (m/s)



Desired Criterion
7.5m/s

Prob. of Criterion Exceedence (existing site conditions)
1%

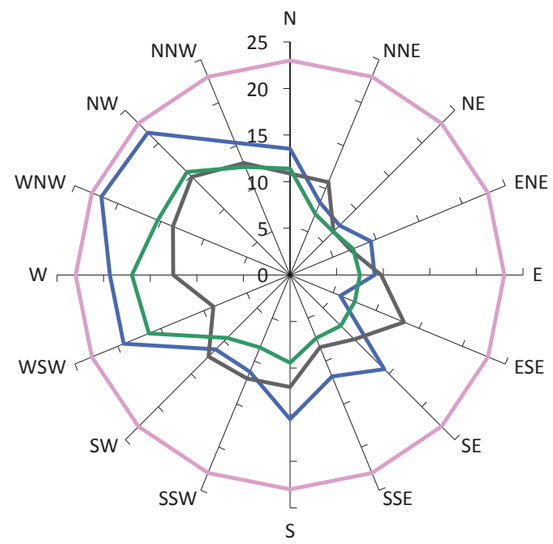
Probability of Criterion Exceedence (initial test)
7%

Probability of Criterion Exceedence (final retest)
2%

NOTE: The desired criterion is exceeded if the probability of exceedence is greater than 5%

- *Criterion.*
- *With development "as proposed", no vegetation or other treatments.*
- *Existing Site*
- *With proposed densely foliating trees along Melville Parade*

Annual Maximum Gust (m/s)

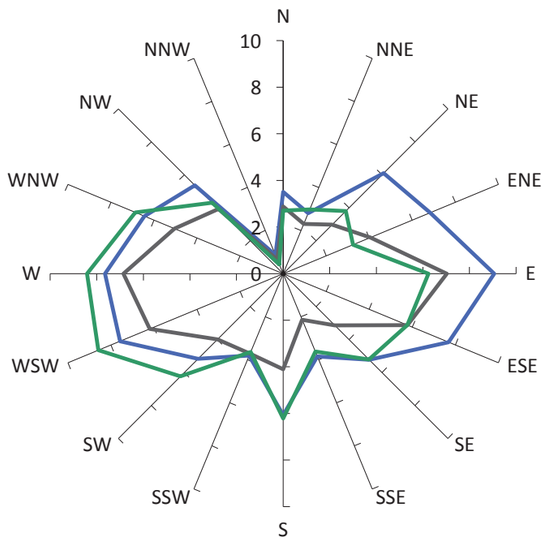


Desired Criterion
23m/s

WD702-02 50-52 Melville Parade, South Perth — April 25, 2018

Measured Wind Speeds at Point 04

Weekly Maximum GEM (m/s)



Desired Criterion
7.5m/s

Prob. of Criterion Exceedence (existing site conditions)
1%

Probability of Criterion Exceedence (initial test)
5%

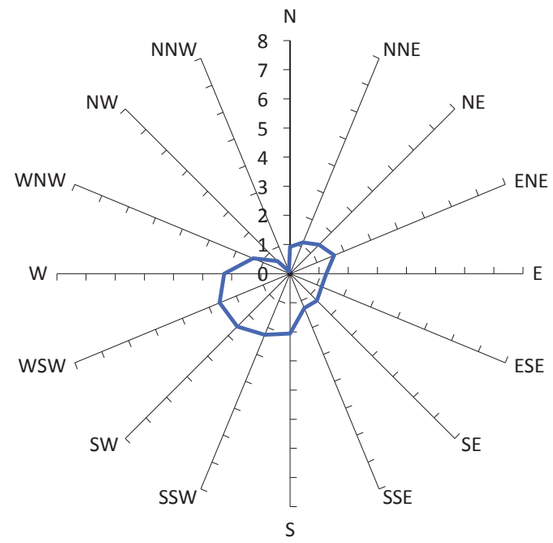
Probability of Criterion Exceedence (final retest)
N/A

NOTE: The desired criterion is exceeded if the probability of exceedence is greater than 5%

- *Criterion.*
- *With development "as proposed", no vegetation or other treatments.*
- *Existing Site*
- *With proposed densely foliating trees along Melville Parade and Bowman Street*

Measured Wind Speeds at Point 05

Weekly Maximum GEM (m/s)



Desired Criterion
7.5m/s

Prob. of Criterion Exceedence (existing site conditions)
Not Tested

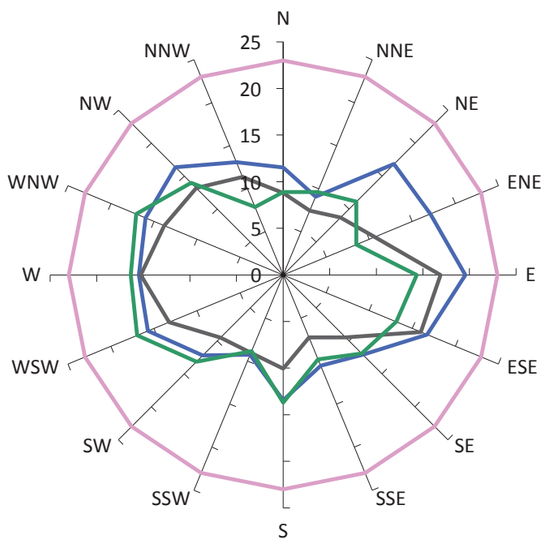
Probability of Criterion Exceedence (initial test)
0%

Probability of Criterion Exceedence (final retest)
N/A

NOTE: The desired criterion is exceeded if the probability of exceedence is greater than 5%

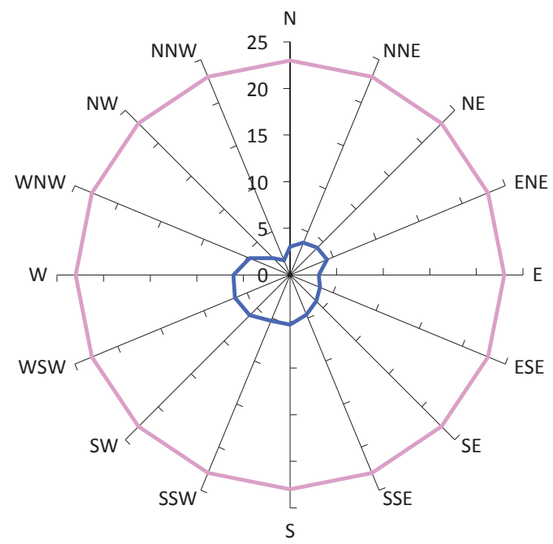
- *Criterion.*
- *With development "as proposed", no vegetation or other treatments.*

Annual Maximum Gust (m/s)



Desired Criterion
23m/s

Annual Maximum Gust (m/s)



Desired Criterion
23m/s

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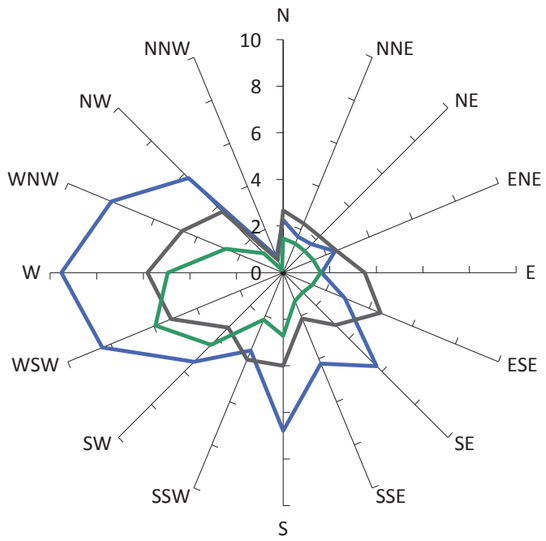
Measured Wind Speeds at Point 06

Weekly Maximum GEM (m/s)



Desired Criterion
5.5m/s

Prob. of Criterion Exceedence (existing site conditions)
3%

Probability of Criterion Exceedence (initial test)
15%

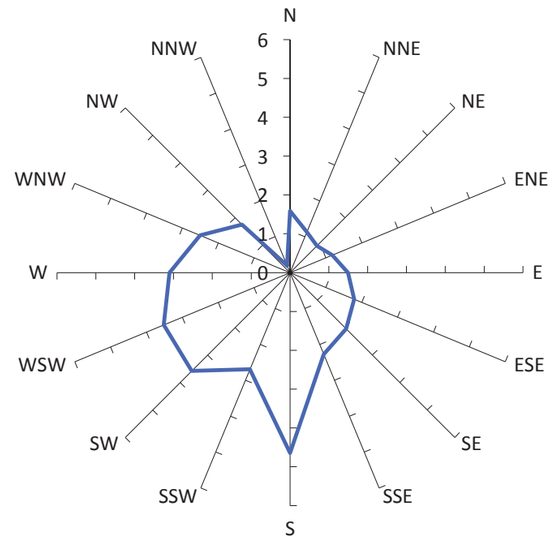
Probability of Criterion Exceedence (final retest)
1%

NOTE: The desired criterion is exceeded if the probability of exceedence is greater than 5%

- *Criterion.*
- *With development "as proposed", no vegetation or other treatments.*
- *Existing Site*
- *With proposed densely foliating trees and shrubs along planter areas*

Measured Wind Speeds at Point 07

Weekly Maximum GEM (m/s)



Desired Criterion
5.5m/s

Prob. of Criterion Exceedence (existing site conditions)
Not Tested

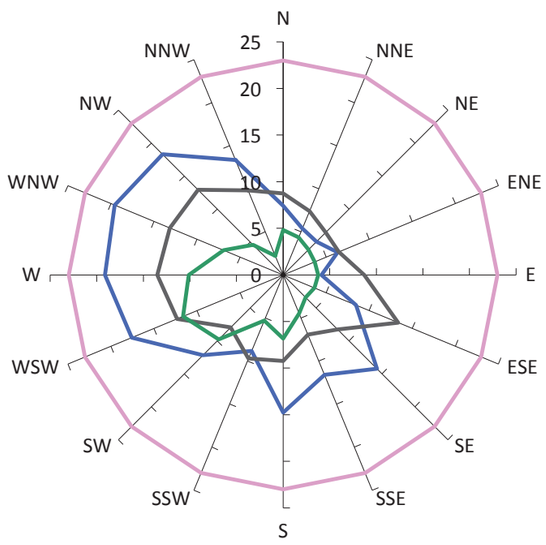
Probability of Criterion Exceedence (initial test)
0%

Probability of Criterion Exceedence (final retest)
N/A

NOTE: The desired criterion is exceeded if the probability of exceedence is greater than 5%

- *Criterion.*
- *With development "as proposed", no vegetation or other treatments.*

Annual Maximum Gust (m/s)



Desired Criterion
23m/s

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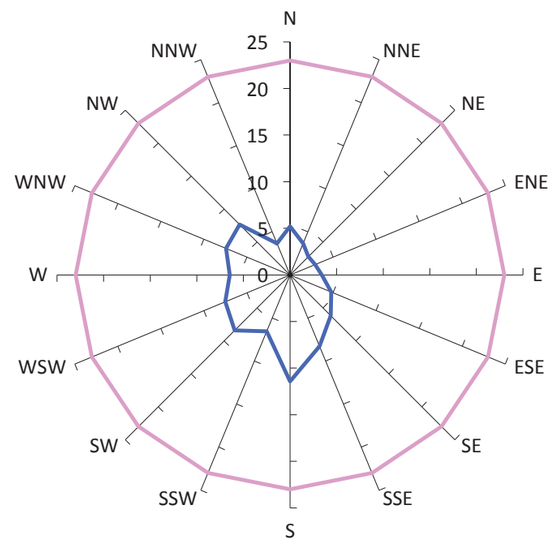
Annual Maximum Gust (m/s)



Desired Criterion
23m/s

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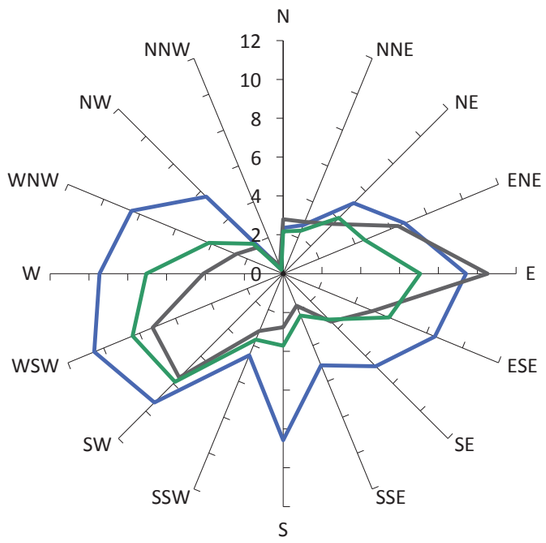
Measured Wind Speeds at Point 08

Weekly Maximum GEM (m/s)



Desired Criterion
7.5m/s

Prob. of Criterion Exceedence (existing site conditions)
3%

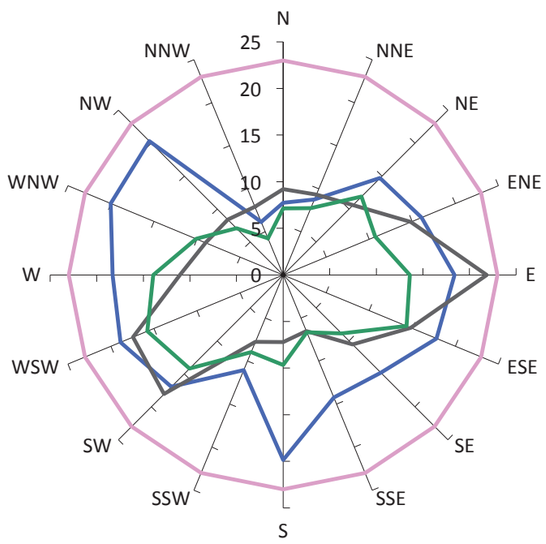
Probability of Criterion Exceedence (initial test)
14%

Probability of Criterion Exceedence (final retest)
3%

NOTE: The desired criterion is exceeded if the probability of exceedence is greater than 5%

- *Criterion.*
- *With development "as proposed", no vegetation or other treatments.*
- *Existing Site*
- *With proposed densely foliating trees along Melville Parade and Bowman Street*

Annual Maximum Gust (m/s)



Desired Criterion
23m/s

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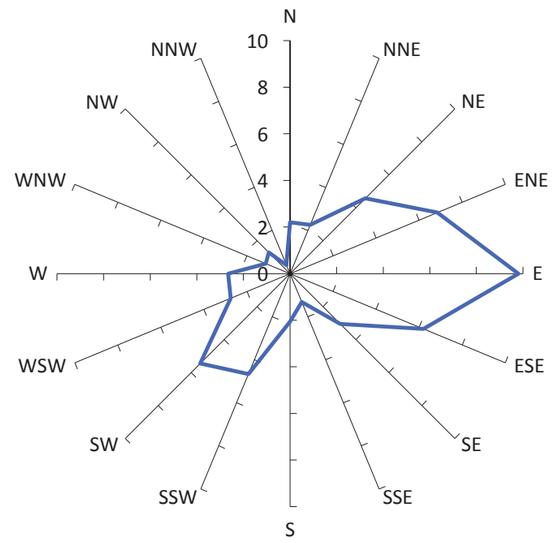
Measured Wind Speeds at Point 09

Weekly Maximum GEM (m/s)



Desired Criterion
7.5m/s

Prob. of Criterion Exceedence (existing site conditions)
Not Tested

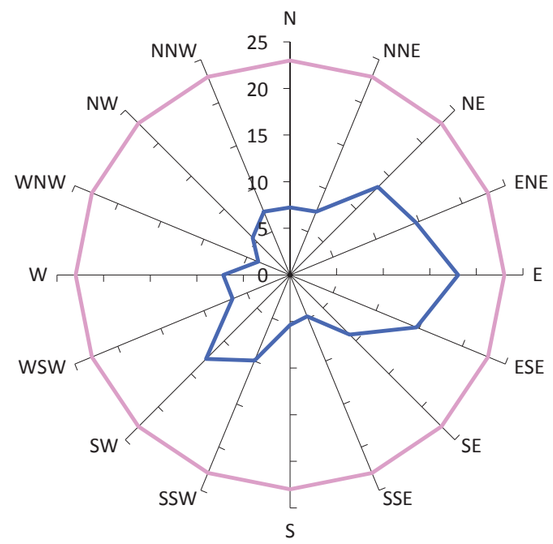
Probability of Criterion Exceedence (initial test)
2%

Probability of Criterion Exceedence (final retest)
N/A

NOTE: The desired criterion is exceeded if the probability of exceedence is greater than 5%

- *Criterion.*
- *With development "as proposed", no vegetation or other treatments.*

Annual Maximum Gust (m/s)



Desired Criterion
23m/s

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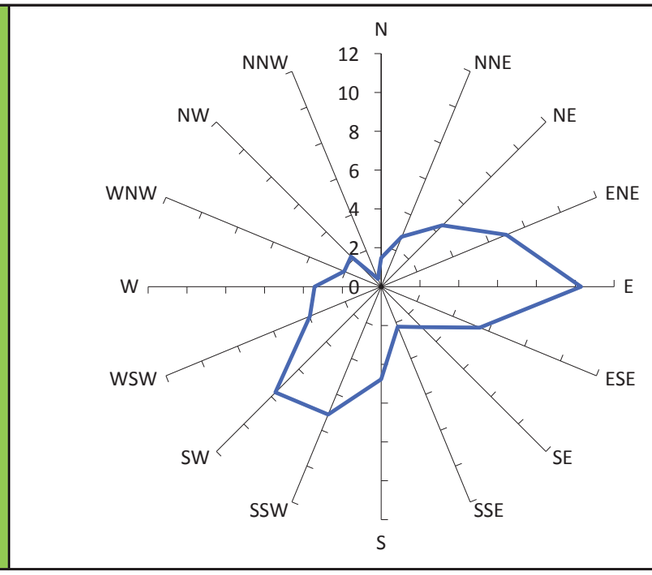
7.0

Measured Wind Speeds at Point 10

Weekly Maximum GEM (m/s)



Desired Criterion
7.5m/s

Prob. of Criterion Exceedence (existing site conditions)
Not Tested

Probability of Criterion Exceedence (initial test)
3%

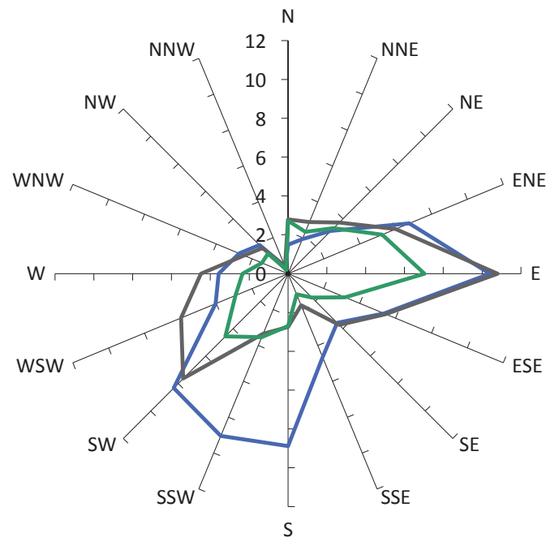
Probability of Criterion Exceedence (final retest)
N/A

NOTE: The desired criterion is exceeded if the probability of exceedence is greater than 5%

- *Criterion.*
- *With development "as proposed", no vegetation or other treatments.*

Measured Wind Speeds at Point 11

Weekly Maximum GEM (m/s)



Desired Criterion
7.5m/s

Prob. of Criterion Exceedence (existing site conditions)
3%

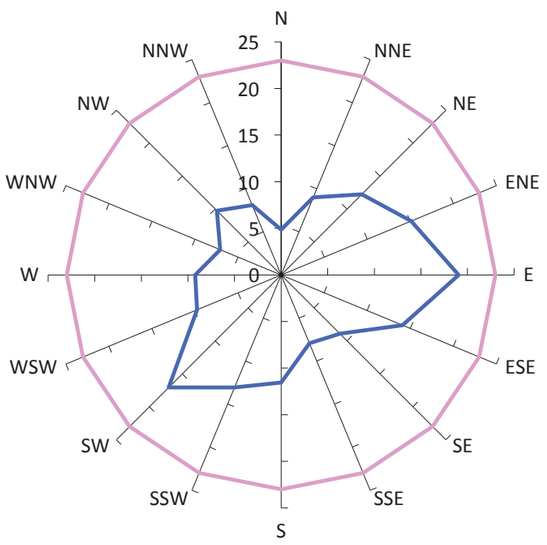
Probability of Criterion Exceedence (initial test)
7%

Probability of Criterion Exceedence (final retest)
0%

NOTE: The desired criterion is exceeded if the probability of exceedence is greater than 5%

- *Criterion.*
- *With development "as proposed", no vegetation or other treatments.*
- *Existing Site*
- *With proposed densely foliating trees along Bowman Street*

Annual Maximum Gust (m/s)



Desired Criterion
23m/s

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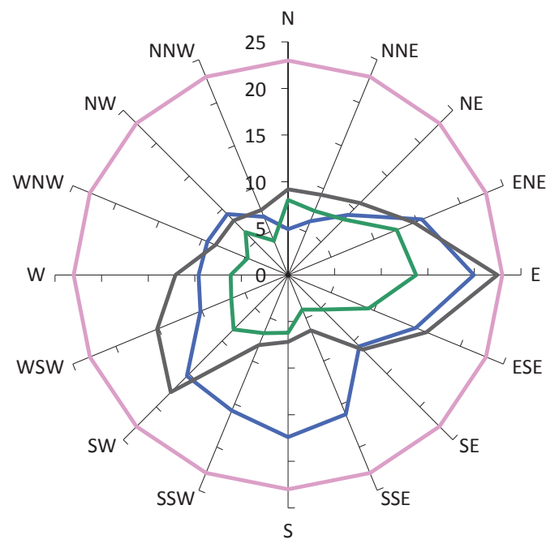
Annual Maximum Gust (m/s)



Desired Criterion
23m/s

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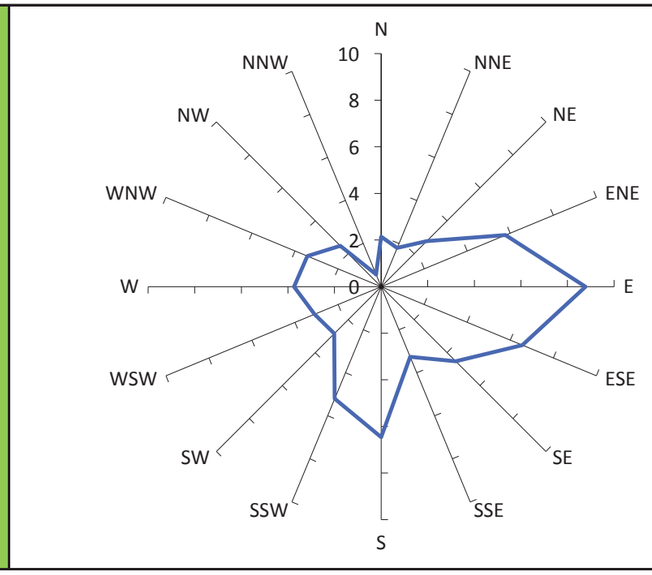
7.0

Measured Wind Speeds at Point 12

Weekly Maximum GEM (m/s)



Desired Criterion
7.5m/s

Prob. of Criterion Exceedence (existing site conditions)
Not Tested

Probability of Criterion Exceedence (initial test)
2%

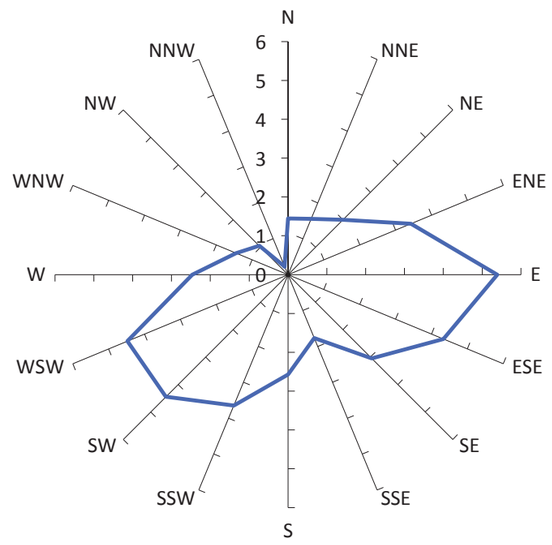
Probability of Criterion Exceedence (final retest)
N/A

NOTE: The desired criterion is exceeded if the probability of exceedence is greater than 5%

Criterion.
With development "as proposed", no vegetation or other treatments.

Measured Wind Speeds at Point 13

Weekly Maximum GEM (m/s)



Desired Criterion
5.5m/s

Prob. of Criterion Exceedence (existing site conditions)
Not Tested

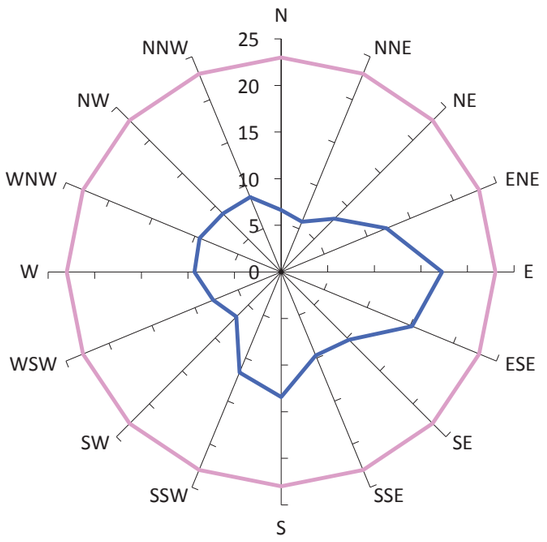
Probability of Criterion Exceedence (initial test)
1%

Probability of Criterion Exceedence (final retest)
N/A

NOTE: The desired criterion is exceeded if the probability of exceedence is greater than 5%

Criterion.
With development "as proposed", no vegetation or other treatments.

Annual Maximum Gust (m/s)



Desired Criterion
23m/s

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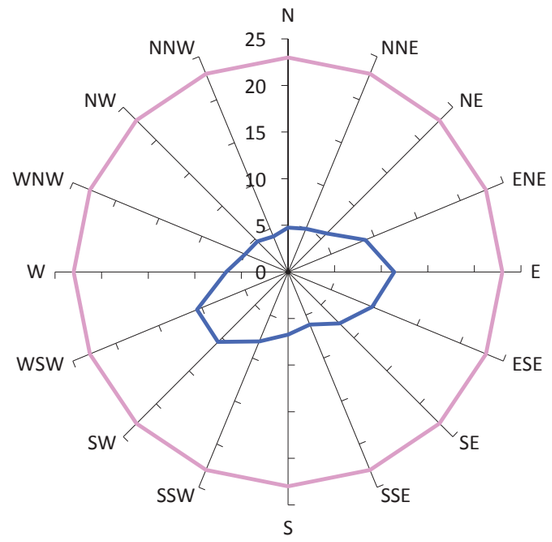
Annual Maximum Gust (m/s)



Desired Criterion
23m/s

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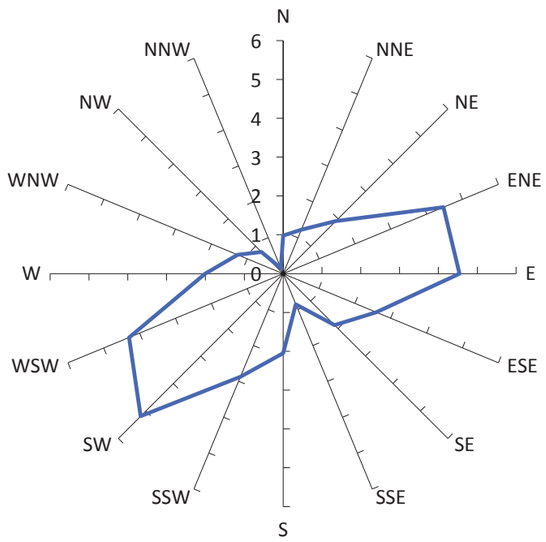
Measured Wind Speeds at Point 14

Weekly Maximum GEM (m/s)



Desired Criterion
5.5m/s

Prob. of Criterion Exceedence (existing site conditions)
Not Tested

Probability of Criterion Exceedence (initial test)
1%

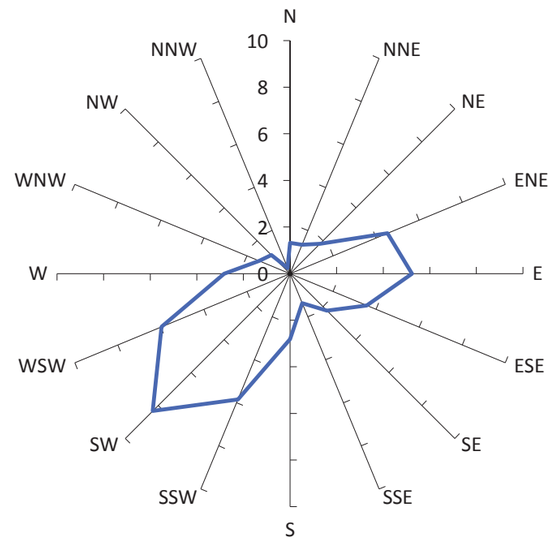
Probability of Criterion Exceedence (final retest)
N/A

NOTE: The desired criterion is exceeded if the probability of exceedence is greater than 5%

Criterion.
With development "as proposed", no vegetation or other treatments.

Measured Wind Speeds at Point 15

Weekly Maximum GEM (m/s)



Desired Criterion
5.5m/s

Prob. of Criterion Exceedence (existing site conditions)
Not Tested

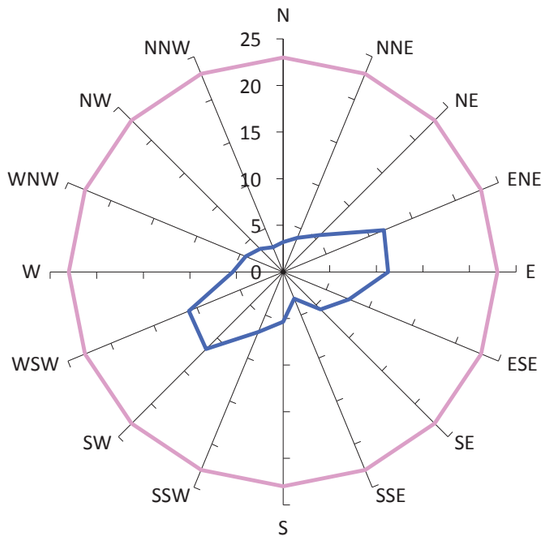
Probability of Criterion Exceedence (initial test)
8%

Probability of Criterion Exceedence (final retest)
N/A

NOTE: The desired criterion is exceeded if the probability of exceedence is greater than 5%

Criterion.
With development "as proposed", no vegetation or other treatments.

Annual Maximum Gust (m/s)



Desired Criterion
23m/s

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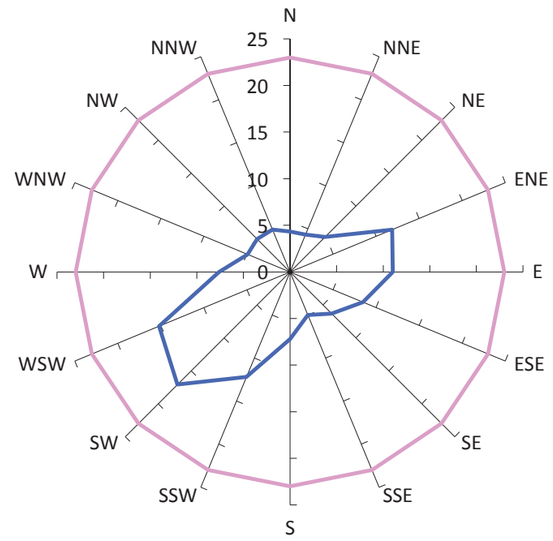
Annual Maximum Gust (m/s)



Desired Criterion
23m/s

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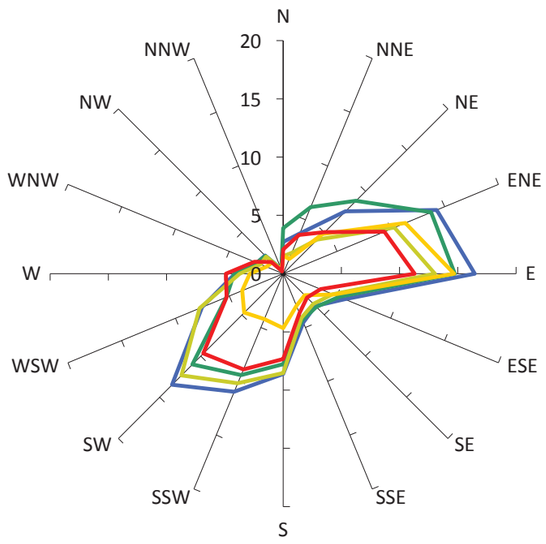
Measured Wind Speeds at Point 16

Weekly Maximum GEM (m/s)



Desired Criterion
5.5m/s

Prob. of Criterion Exceedence (existing site conditions)
Not Tested

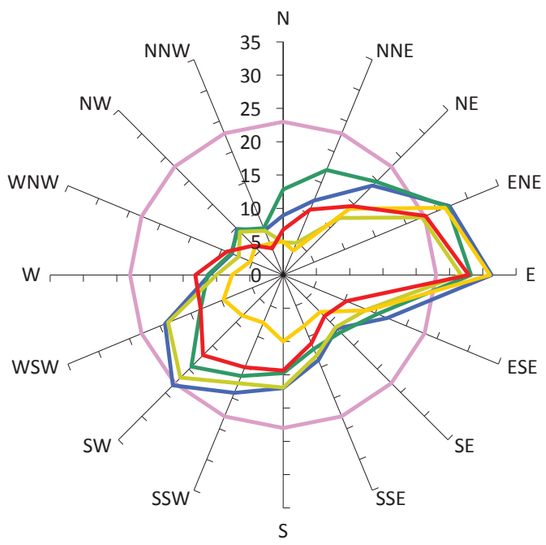
Probability of Criterion Exceedence (initial test)
33%

Probability of Criterion Exceedence (final retest)
26%

NOTE: The desired criterion is exceeded if the probability of exceedence is greater than 5%

- *Criterion.*
- *With development "as proposed", no vegetation or other treatments.*
- *With 2m high screen along eastern and southern perimeter*
- *With wrap around Canopy at south-east corner*
- *With wrap around Canopy at south-east corner and 2m screen along east and south*
- *With wrap around Canopy at south-east corner and full-height porous screen along east and south*

Annual Maximum Gust (m/s)



Desired Criterion
23m/s

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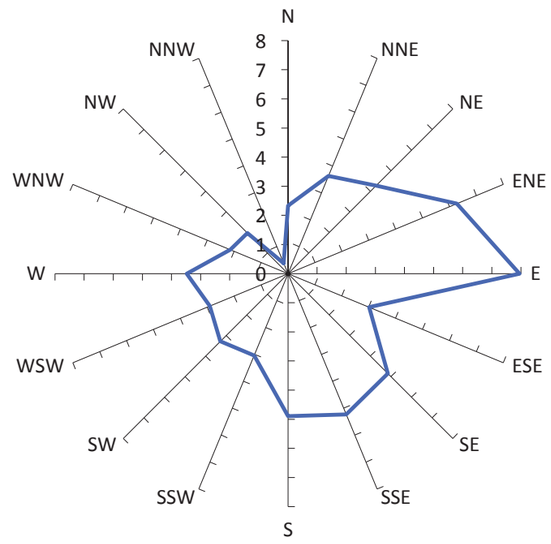
Measured Wind Speeds at Point 17

Weekly Maximum GEM (m/s)



Desired Criterion
5.5m/s

Prob. of Criterion Exceedence (existing site conditions)
Not Tested

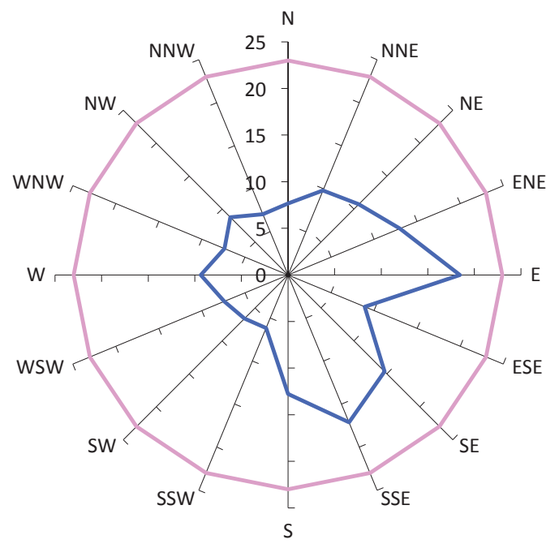
Probability of Criterion Exceedence (initial test)
5%

Probability of Criterion Exceedence (final retest)
N/A

NOTE: The desired criterion is exceeded if the probability of exceedence is greater than 5%

- *Criterion.*
- *With development "as proposed", no vegetation or other treatments.*

Annual Maximum Gust (m/s)



Desired Criterion
23m/s

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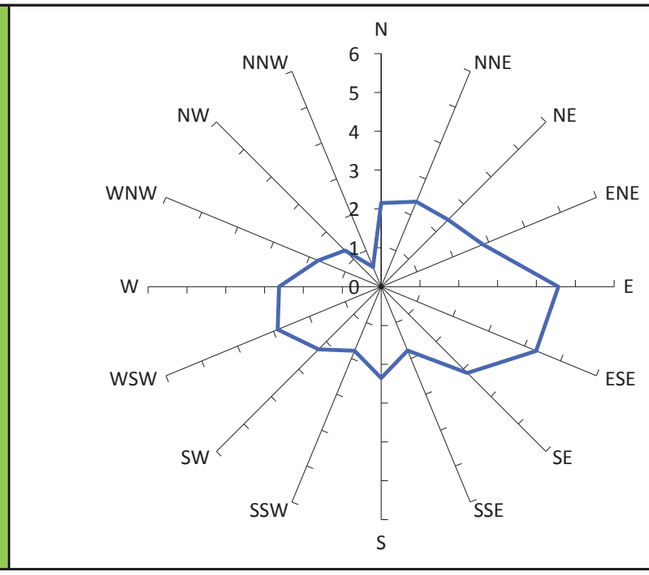
7.0

Measured Wind Speeds at Point 18

Weekly Maximum GEM (m/s)



Desired Criterion
5.5m/s

Prob. of Criterion Exceedence (existing site conditions)
Not Tested

Probability of Criterion Exceedence (initial test)
0%

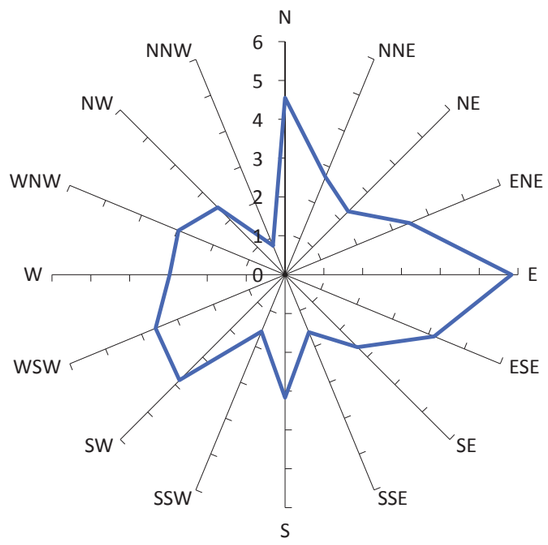
Probability of Criterion Exceedence (final retest)
N/A

NOTE: The desired criterion is exceeded if the probability of exceedence is greater than 5%

Criterion.
With development "as proposed", no vegetation or other treatments.

Measured Wind Speeds at Point 19

Weekly Maximum GEM (m/s)



Desired Criterion
5.5m/s

Prob. of Criterion Exceedence (existing site conditions)
Not Tested

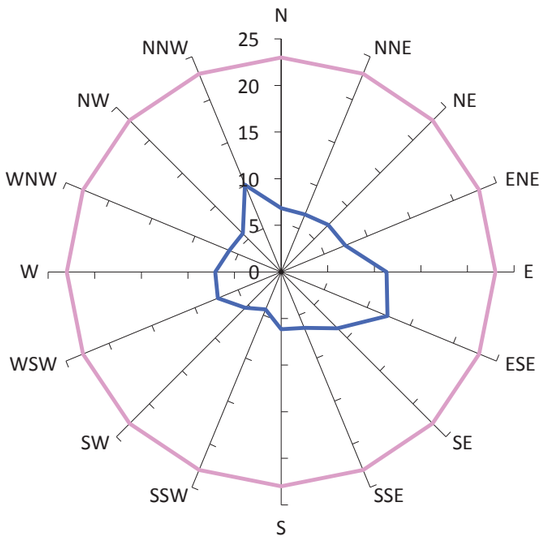
Probability of Criterion Exceedence (initial test)
1%

Probability of Criterion Exceedence (final retest)
N/A

NOTE: The desired criterion is exceeded if the probability of exceedence is greater than 5%

Criterion.
With development "as proposed", no vegetation or other treatments.

Annual Maximum Gust (m/s)



Desired Criterion
23m/s

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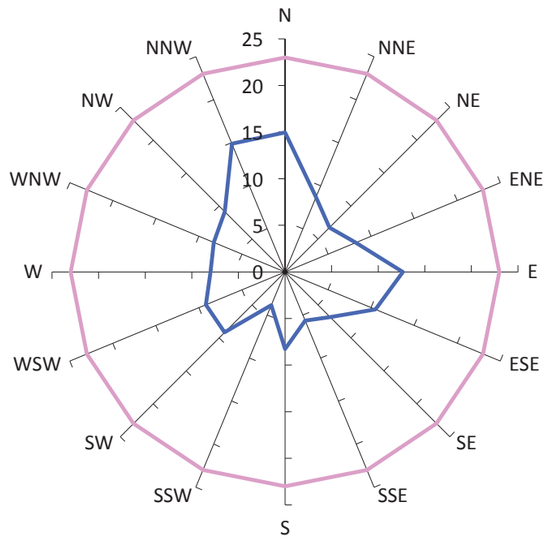
Annual Maximum Gust (m/s)



Desired Criterion
23m/s

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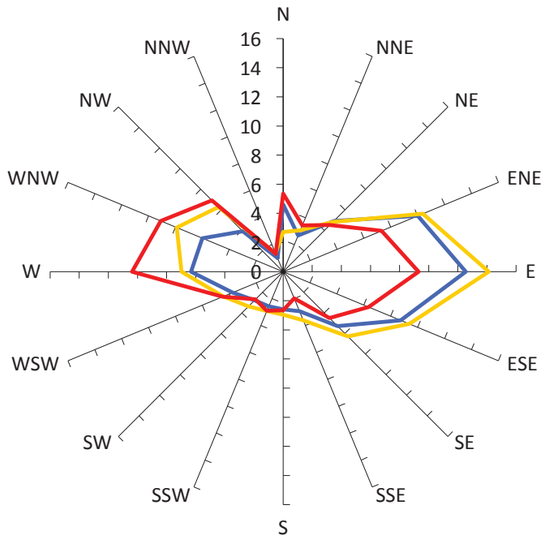
Measured Wind Speeds at Point 20

Weekly Maximum GEM (m/s)



Desired Criterion
5.5m/s

Prob. of Criterion Exceedence (existing site conditions)
Not Tested

Probability of Criterion Exceedence (initial test)
20%

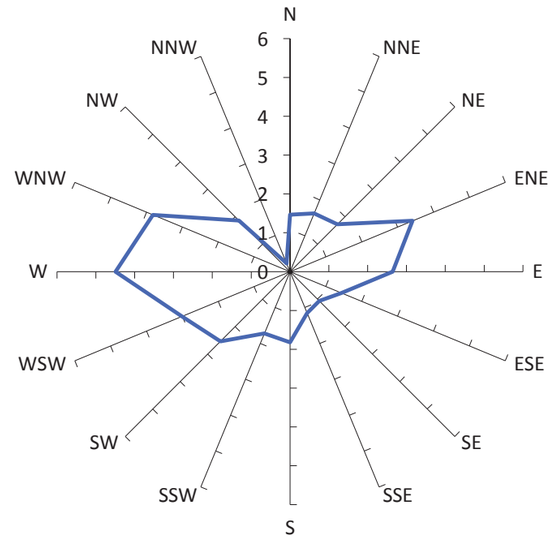
Probability of Criterion Exceedence (final retest)
17%

NOTE: The desired criterion is exceeded if the probability of exceedence is greater than 5%

Criterion.
With development "as proposed", no vegetation or other treatments.
With wrap around Canopy at south-east corner and 2m screen along east and south
With wrap around Canopy at south-east corner and full-height porous screen along east and south

Measured Wind Speeds at Point 21

Weekly Maximum GEM (m/s)



Desired Criterion
5.5m/s

Prob. of Criterion Exceedence (existing site conditions)
Not Tested

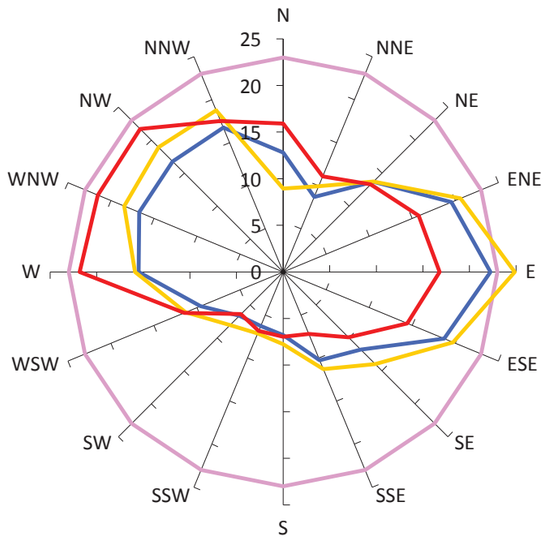
Probability of Criterion Exceedence (initial test)
0%

Probability of Criterion Exceedence (final retest)
N/A

NOTE: The desired criterion is exceeded if the probability of exceedence is greater than 5%

Criterion.
With development "as proposed", no vegetation or other treatments.

Annual Maximum Gust (m/s)



Desired Criterion
23m/s

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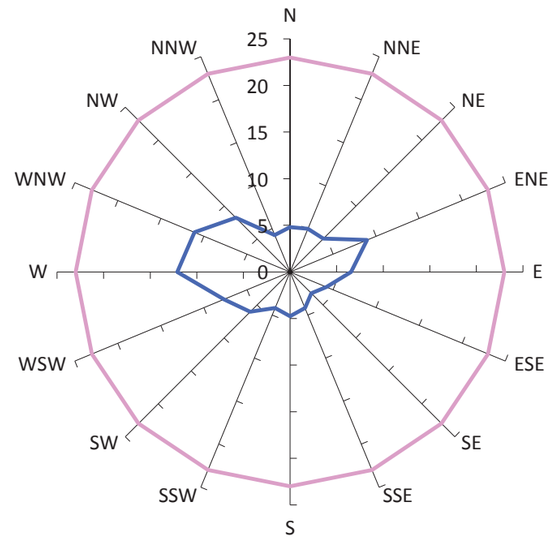
Annual Maximum Gust (m/s)



Desired Criterion
23m/s

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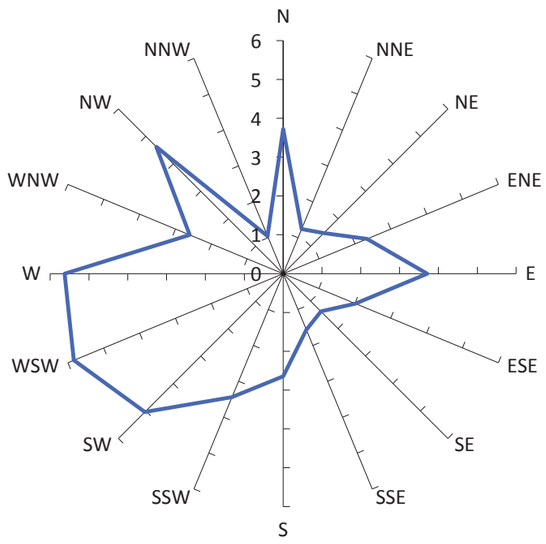
Measured Wind Speeds at Point 22

Weekly Maximum GEM (m/s)



Desired Criterion
5.5m/s

Prob. of Criterion Exceedence (existing site conditions)
Not Tested

Probability of Criterion Exceedence (initial test)
4%

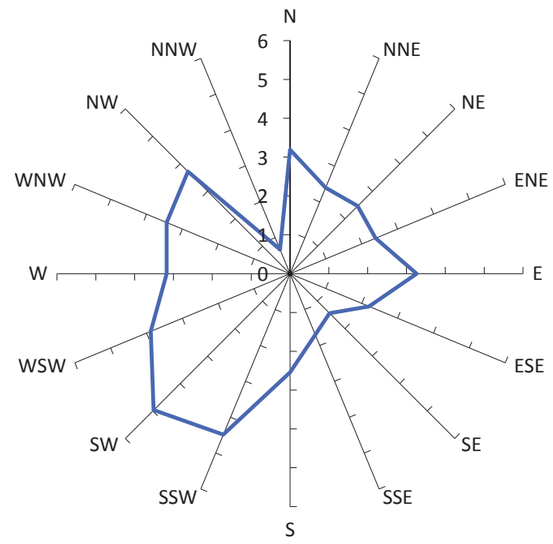
Probability of Criterion Exceedence (final retest)
N/A

NOTE: The desired criterion is exceeded if the probability of exceedence is greater than 5%

Criterion.
With development "as proposed", no vegetation or other treatments.

Measured Wind Speeds at Point 23

Weekly Maximum GEM (m/s)



Desired Criterion
5.5m/s

Prob. of Criterion Exceedence (existing site conditions)
Not Tested

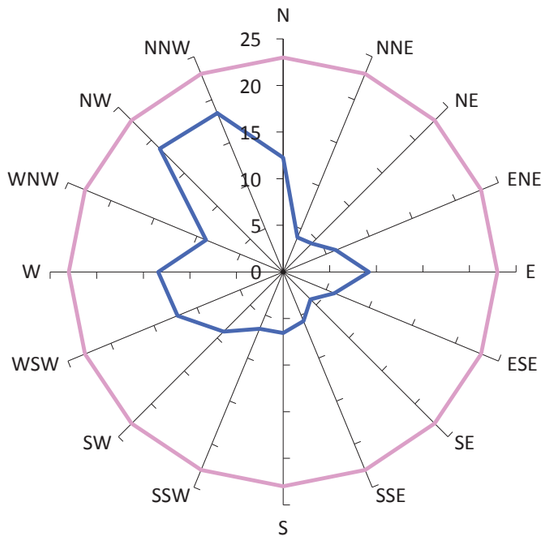
Probability of Criterion Exceedence (initial test)
1%

Probability of Criterion Exceedence (final retest)
N/A

NOTE: The desired criterion is exceeded if the probability of exceedence is greater than 5%

Criterion.
With development "as proposed", no vegetation or other treatments.

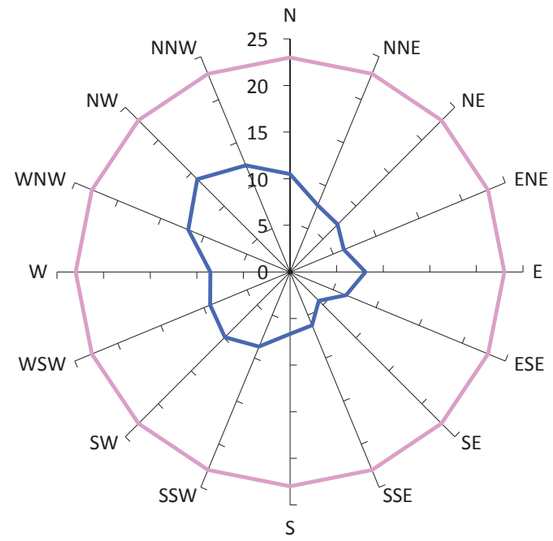
Annual Maximum Gust (m/s)



Desired Criterion
23m/s

WD702-02 50-52 Melville Parade, South Perth — April 25, 2018

Annual Maximum Gust (m/s)



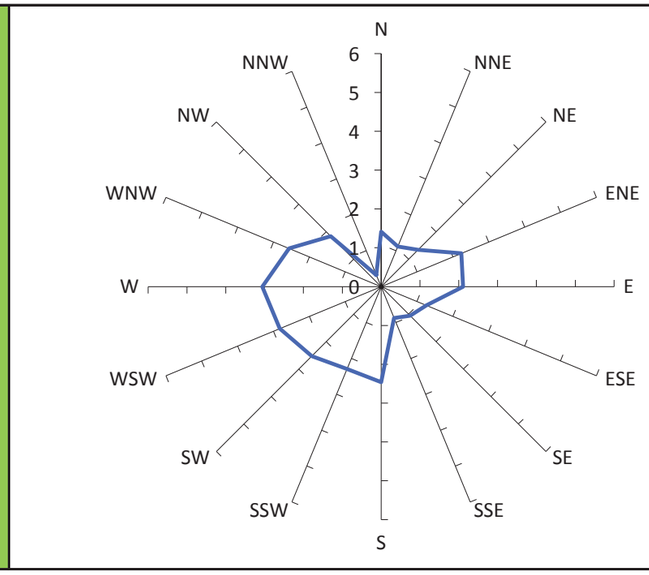
Desired Criterion
23m/s

WD702-02 50-52 Melville Parade, South Perth — April 25, 2018

7.0

Measured Wind Speeds at Point 24

Weekly Maximum GEM (m/s)



Desired Criterion
5.5m/s

Prob. of Criterion Exceedence (existing site conditions)
Not Tested

Probability of Criterion Exceedence (initial test)
0%

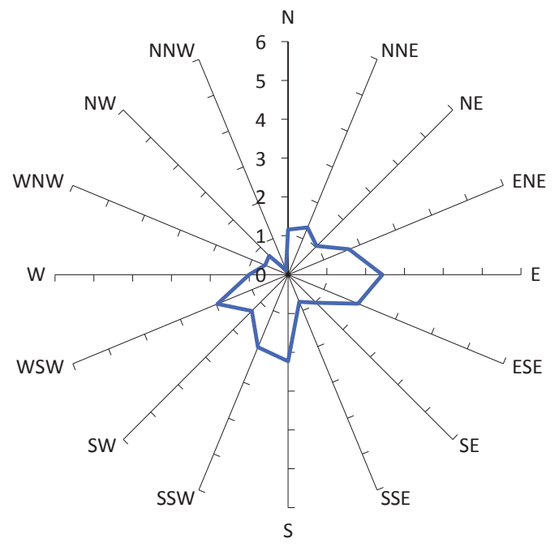
Probability of Criterion Exceedence (final retest)
N/A

NOTE: The desired criterion is exceeded if the probability of exceedence is greater than 5%

Criterion.
With development "as proposed", no vegetation or other treatments.

Measured Wind Speeds at Point 25

Weekly Maximum GEM (m/s)



Desired Criterion
5.5m/s

Prob. of Criterion Exceedence (existing site conditions)
Not Tested

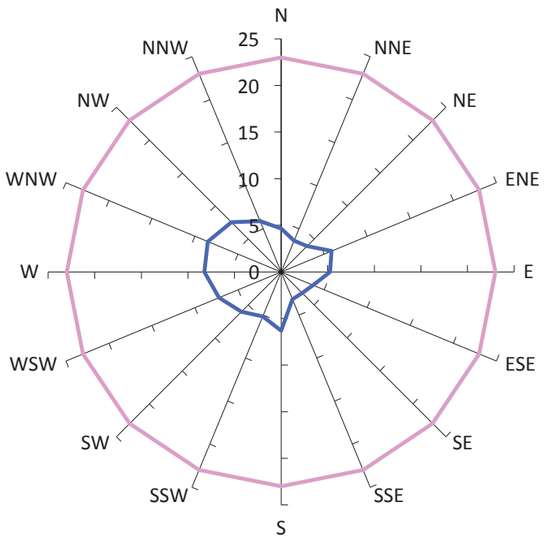
Probability of Criterion Exceedence (initial test)
0%

Probability of Criterion Exceedence (final retest)
N/A

NOTE: The desired criterion is exceeded if the probability of exceedence is greater than 5%

Criterion.
With development "as proposed", no vegetation or other treatments.

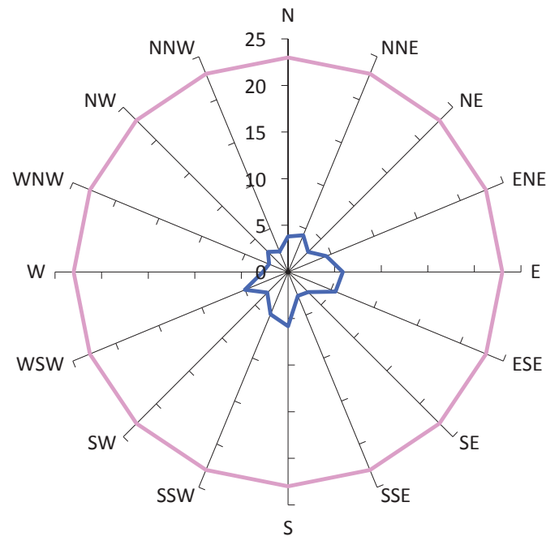
Annual Maximum Gust (m/s)



Desired Criterion
23m/s

WD702-02 50-52 Melville Parade, South Perth — April 25, 2018

Annual Maximum Gust (m/s)



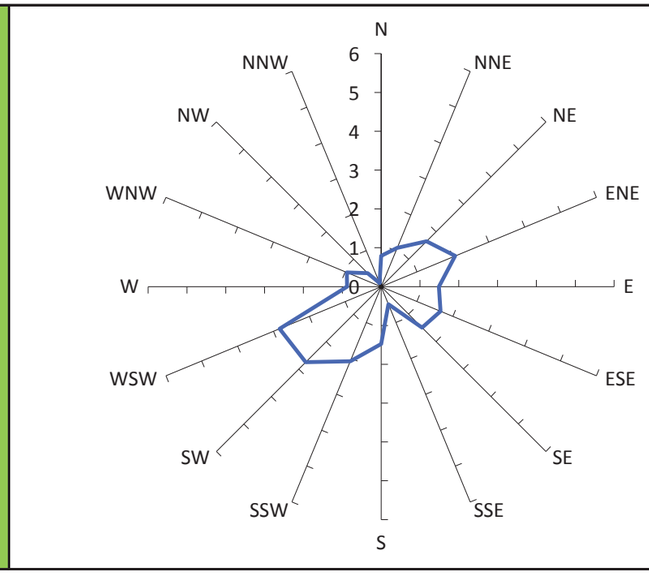
Desired Criterion
23m/s

WD702-02 50-52 Melville Parade, South Perth — April 25, 2018

7.0

Measured Wind Speeds at Point 26

Weekly Maximum GEM (m/s)



Desired Criterion
5.5m/s

Prob. of Criterion Exceedence (existing site conditions)
Not Tested

Probability of Criterion Exceedence (initial test)
0%

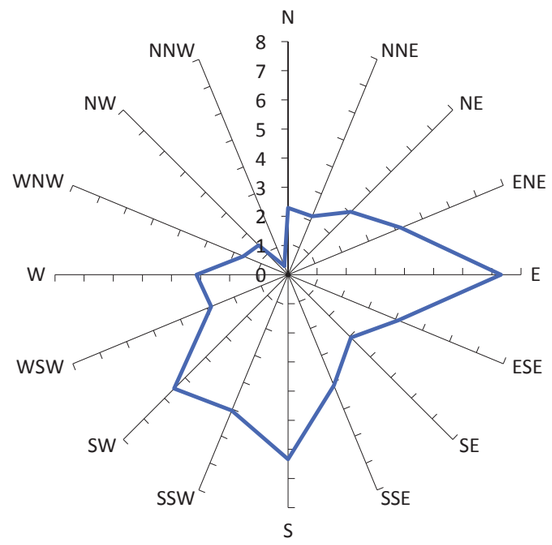
Probability of Criterion Exceedence (final retest)
N/A

NOTE: The desired criterion is exceeded if the probability of exceedence is greater than 5%

- *Criterion.*
- *With development "as proposed", no vegetation or other treatments.*

Measured Wind Speeds at Point 27

Weekly Maximum GEM (m/s)



Desired Criterion
5.5m/s

Prob. of Criterion Exceedence (existing site conditions)
Not Tested

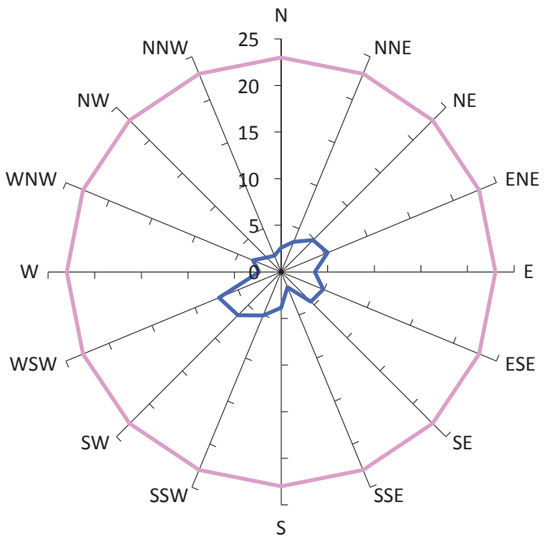
Probability of Criterion Exceedence (initial test)
4%

Probability of Criterion Exceedence (final retest)
N/A

NOTE: The desired criterion is exceeded if the probability of exceedence is greater than 5%

- *Criterion.*
- *With development "as proposed", no vegetation or other treatments.*

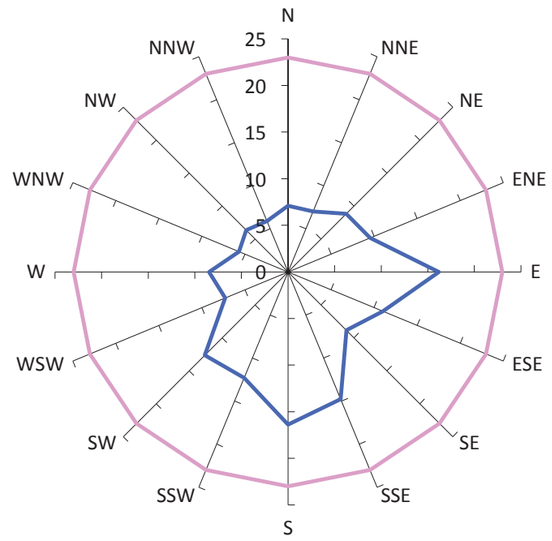
Annual Maximum Gust (m/s)



Desired Criterion
23m/s

WD702-02 50-52 Melville Parade, South Perth — April 25, 2018

Annual Maximum Gust (m/s)



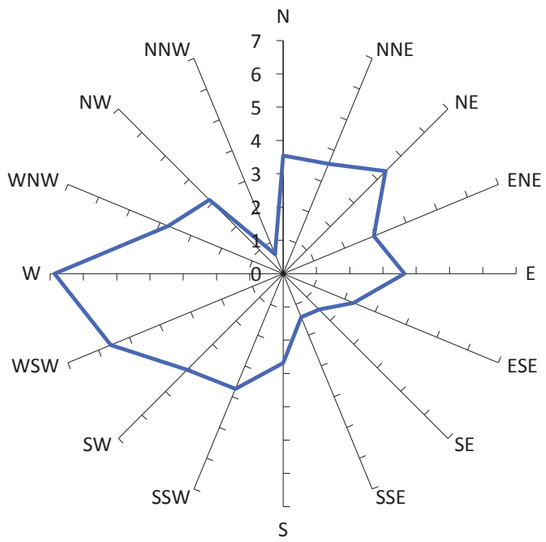
Desired Criterion
23m/s

WD702-02 50-52 Melville Parade, South Perth — April 25, 2018

7.0

Measured Wind Speeds at Point 28

Weekly Maximum GEM (m/s)



Desired Criterion
5.5m/s

Prob. of Criterion Exceedence (existing site conditions)
Not Tested

Probability of Criterion Exceedence (initial test)
4%

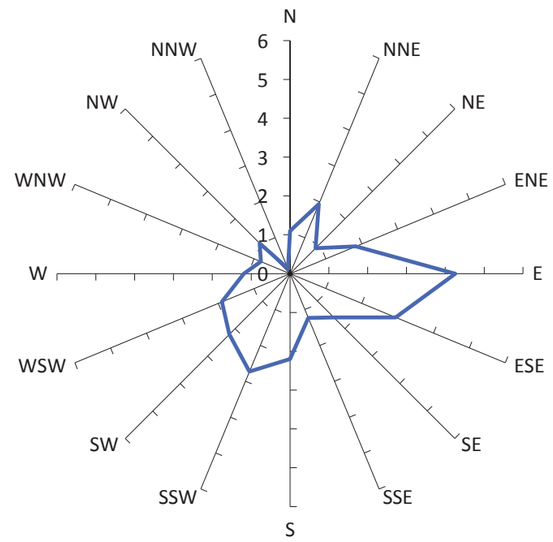
Probability of Criterion Exceedence (final retest)
N/A

NOTE: The desired criterion is exceeded if the probability of exceedence is greater than 5%

Criterion.
With development "as proposed", no vegetation or other treatments.

Measured Wind Speeds at Point 29

Weekly Maximum GEM (m/s)



Desired Criterion
5.5m/s

Prob. of Criterion Exceedence (existing site conditions)
Not Tested

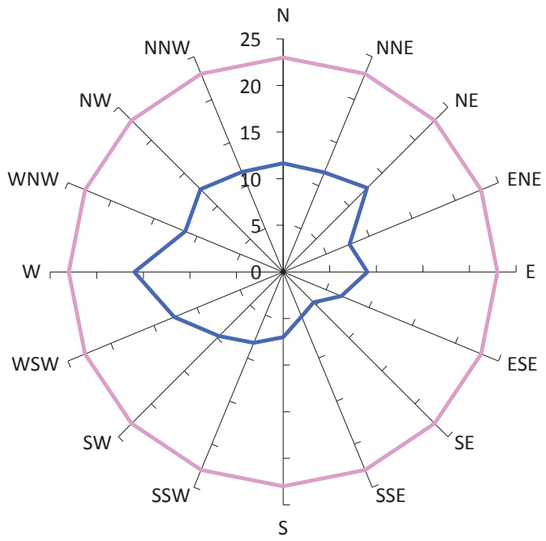
Probability of Criterion Exceedence (initial test)
0%

Probability of Criterion Exceedence (final retest)
N/A

NOTE: The desired criterion is exceeded if the probability of exceedence is greater than 5%

Criterion.
With development "as proposed", no vegetation or other treatments.

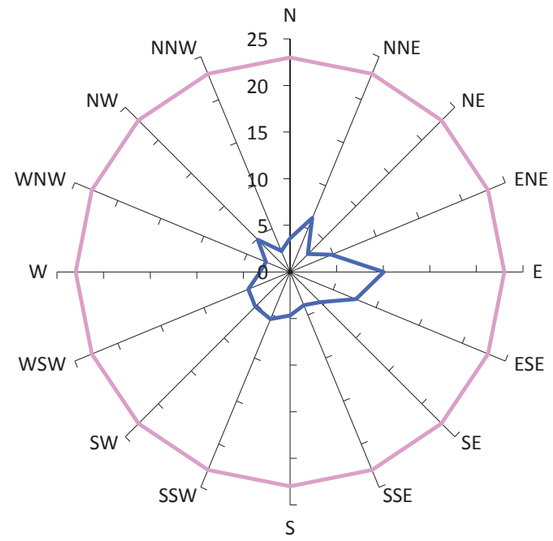
Annual Maximum Gust (m/s)



Desired Criterion
23m/s

WD702-02 50-52 Melville Parade, South Perth — April 25, 2018

Annual Maximum Gust (m/s)



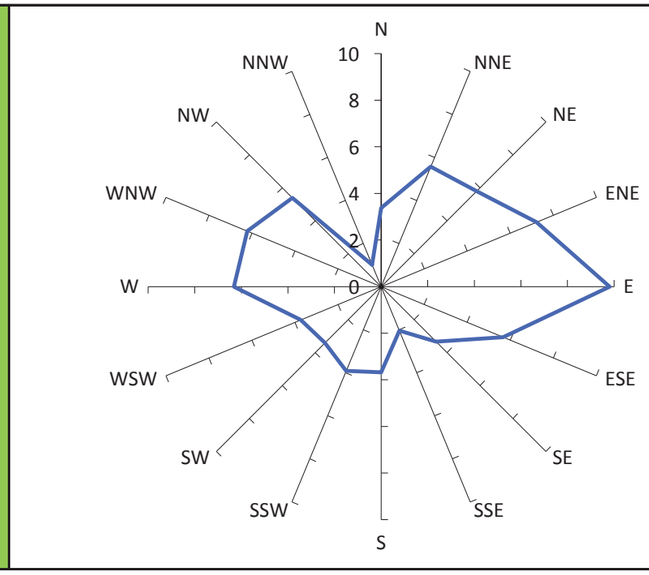
Desired Criterion
23m/s

WD702-02 50-52 Melville Parade, South Perth — April 25, 2018

7.0

Measured Wind Speeds at Point 101

Weekly Maximum GEM (m/s)



Desired Criterion
7.5m/s

Prob. of Criterion Exceedence (existing site conditions)
Not Tested

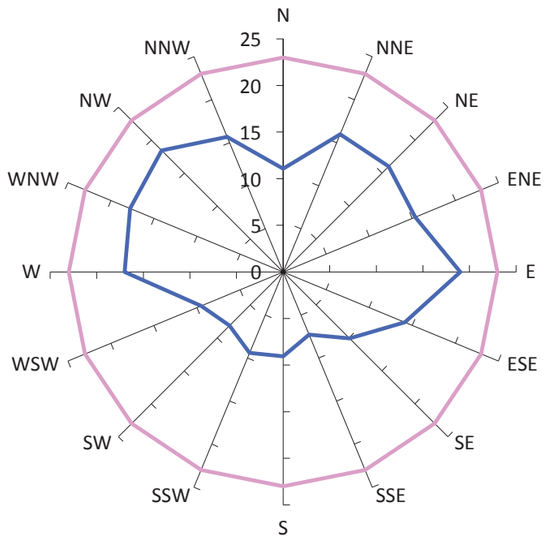
Probability of Criterion Exceedence (initial test)
4%

Probability of Criterion Exceedence (final retest)
N/A

NOTE: The desired criterion is exceeded if the probability of exceedence is greater than 5%

- *Criterion.*
- *Surrounding Areas*

Annual Maximum Gust (m/s)

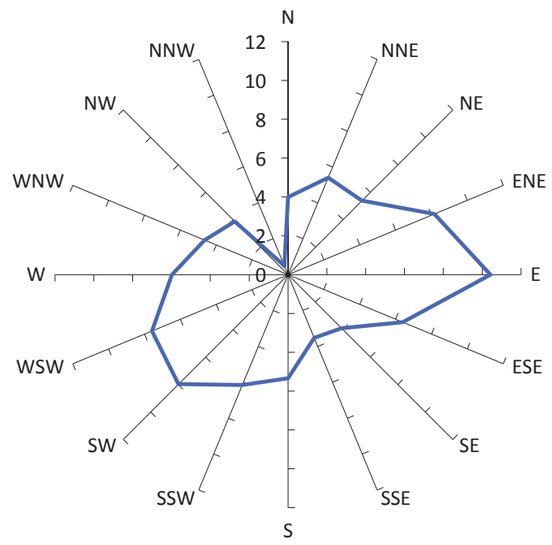


Desired Criterion
23m/s

WD702-02 50-52 Melville Parade, South Perth — April 25, 2018

Measured Wind Speeds at Point 102

Weekly Maximum GEM (m/s)



Desired Criterion
7.5m/s

Prob. of Criterion Exceedence (existing site conditions)
Not Tested

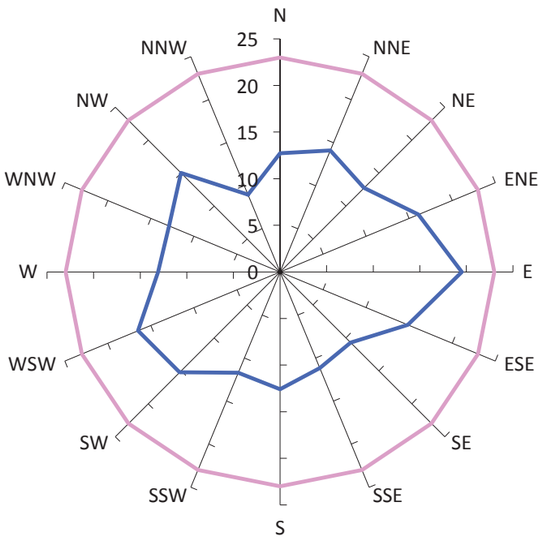
Probability of Criterion Exceedence (initial test)
5%

Probability of Criterion Exceedence (final retest)
N/A

NOTE: The desired criterion is exceeded if the probability of exceedence is greater than 5%

- *Criterion.*
- *Surrounding Areas*

Annual Maximum Gust (m/s)



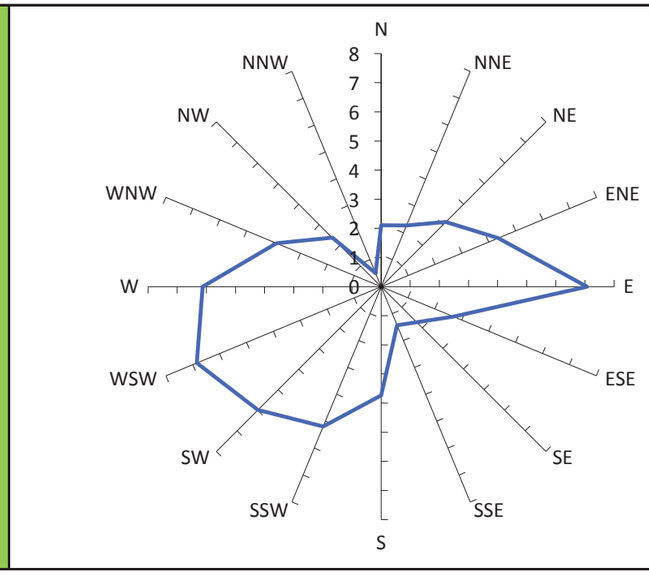
Desired Criterion
23m/s

WD702-02 50-52 Melville Parade, South Perth — April 25, 2018

7.0

Measured Wind Speeds at Point 103

Weekly Maximum GEM (m/s)



Desired Criterion
7.5m/s

Prob. of Criterion Exceedence (existing site conditions)
Not Tested

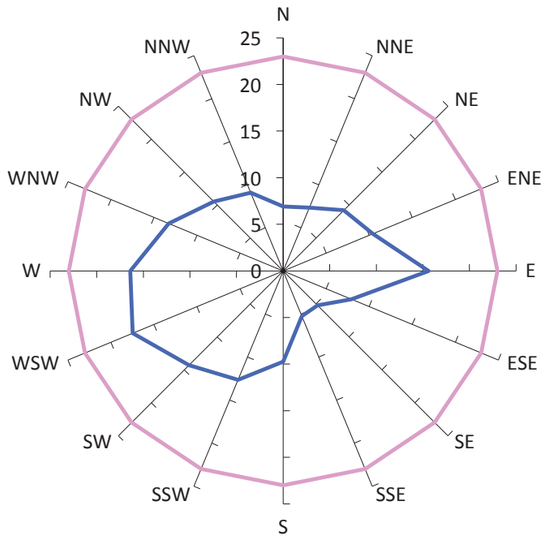
Probability of Criterion Exceedence (initial test)
1%

Probability of Criterion Exceedence (final retest)
N/A

NOTE: The desired criterion is exceeded if the probability of exceedence is greater than 5%

- *Criterion.*
- *Surrounding Areas*

Annual Maximum Gust (m/s)

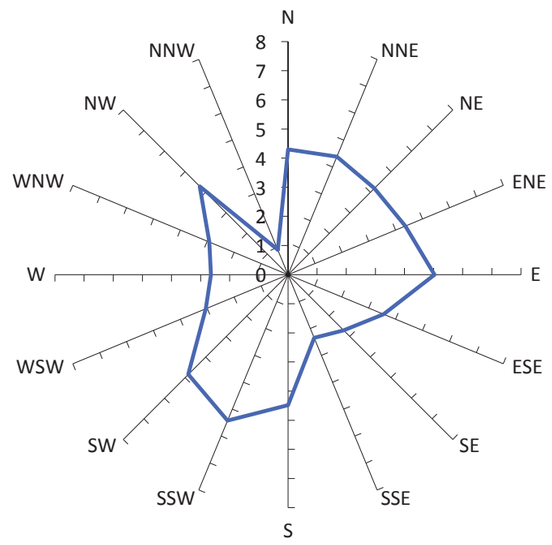


Desired Criterion
23m/s

WD702-02 50-52 Melville Parade, South Perth — April 25, 2018

Measured Wind Speeds at Point 104

Weekly Maximum GEM (m/s)



Desired Criterion
7.5m/s

Prob. of Criterion Exceedence (existing site conditions)
Not Tested

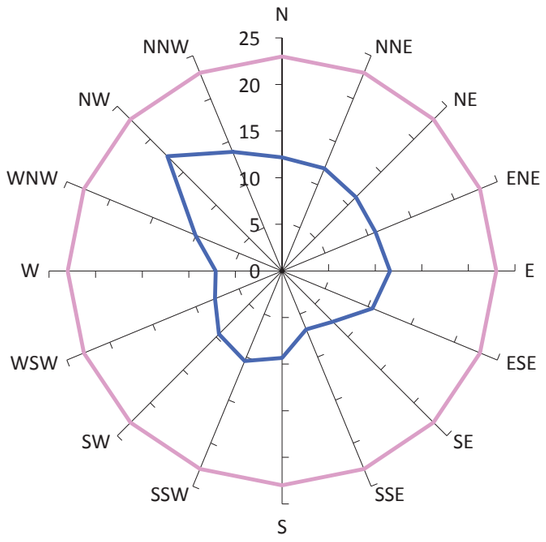
Probability of Criterion Exceedence (initial test)
1%

Probability of Criterion Exceedence (final retest)
N/A

NOTE: The desired criterion is exceeded if the probability of exceedence is greater than 5%

- *Criterion.*
- *Surrounding Areas*

Annual Maximum Gust (m/s)



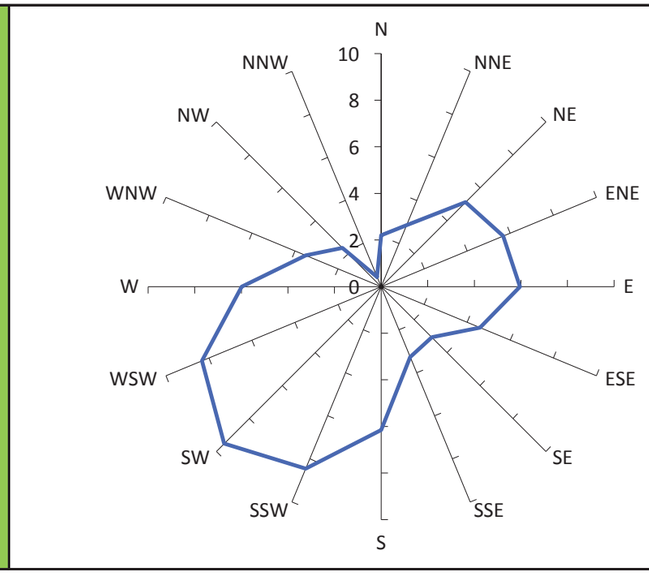
Desired Criterion
23m/s

WD702-02 50-52 Melville Parade, South Perth — April 25, 2018

7.0

Measured Wind Speeds at Point 105

Weekly Maximum GEM (m/s)



Desired Criterion
7.5m/s

Prob. of Criterion Exceedence (existing site conditions)
Not Tested

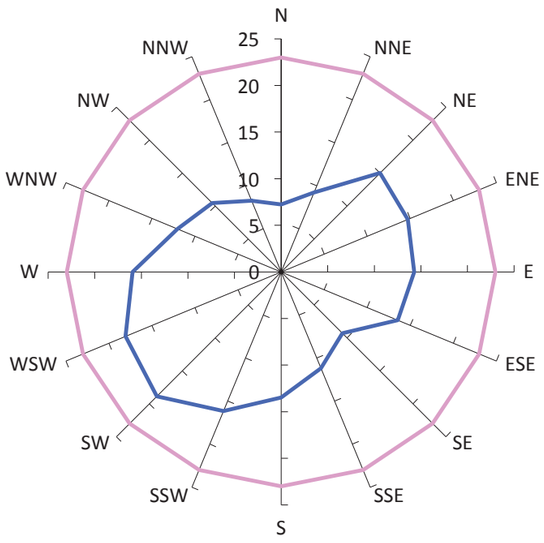
Probability of Criterion Exceedence (initial test)
5%

Probability of Criterion Exceedence (final retest)
N/A

NOTE: The desired criterion is exceeded if the probability of exceedence is greater than 5%

- *Criterion.*
- *Surrounding Areas*

Annual Maximum Gust (m/s)

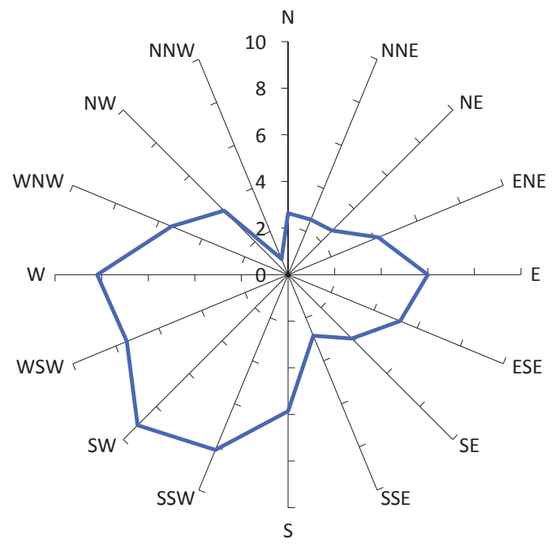


Desired Criterion
23m/s

WD702-02 50-52 Melville Parade, South Perth — April 25, 2018

Measured Wind Speeds at Point 106

Weekly Maximum GEM (m/s)



Desired Criterion
7.5m/s

Prob. of Criterion Exceedence (existing site conditions)
Not Tested

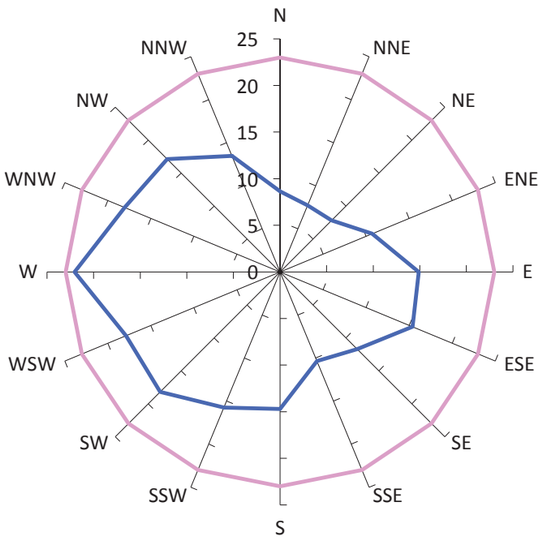
Probability of Criterion Exceedence (initial test)
5%

Probability of Criterion Exceedence (final retest)
N/A

NOTE: The desired criterion is exceeded if the probability of exceedence is greater than 5%

- *Criterion.*
- *Surrounding Areas*

Annual Maximum Gust (m/s)



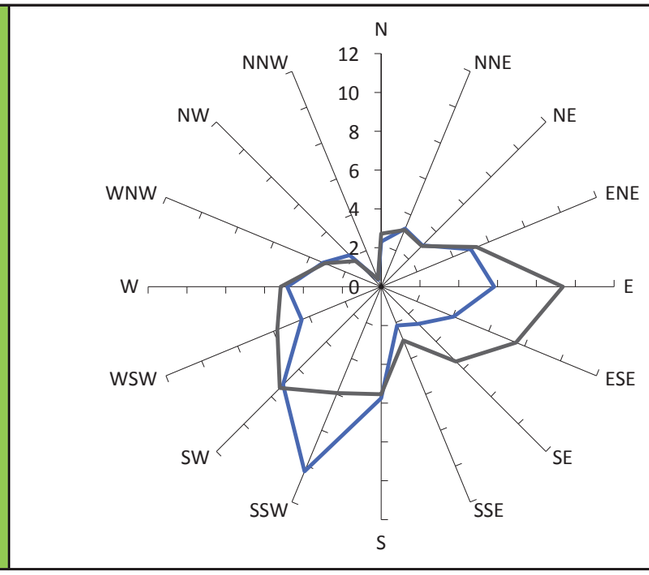
Desired Criterion
23m/s

WD702-02 50-52 Melville Parade, South Perth — April 25, 2018

7.0

Measured Wind Speeds at Point 107

Weekly Maximum GEM (m/s)



Desired Criterion
7.5m/s

Prob. of Criterion Exceedence (existing site conditions)
3%

Probability of Criterion Exceedence (initial test)
5%

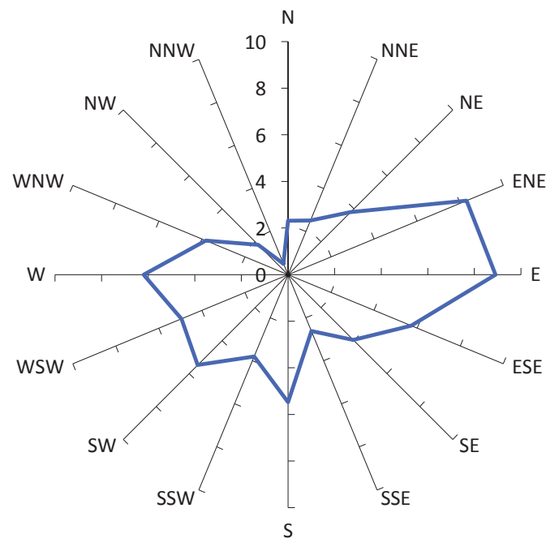
Probability of Criterion Exceedence (final retest)
N/A

NOTE: The desired criterion is exceeded if the probability of exceedence is greater than 5%

- *Criterion.*
- *Surrounding Areas*
- *Existing Site*

Measured Wind Speeds at Point 108

Weekly Maximum GEM (m/s)



Desired Criterion
7.5m/s

Prob. of Criterion Exceedence (existing site conditions)
Not Tested

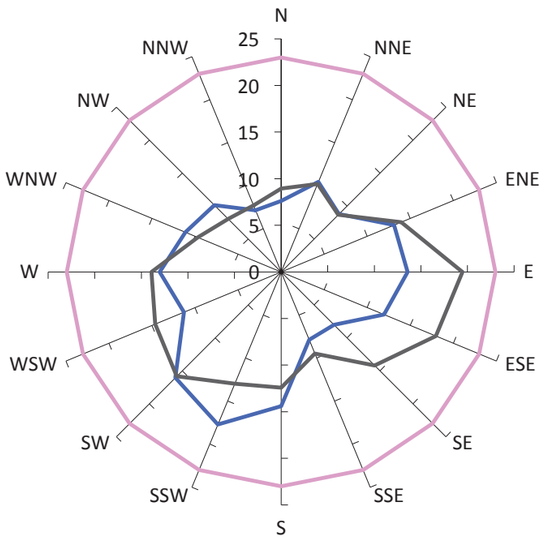
Probability of Criterion Exceedence (initial test)
2%

Probability of Criterion Exceedence (final retest)
N/A

NOTE: The desired criterion is exceeded if the probability of exceedence is greater than 5%

- *Criterion.*
- *Surrounding Areas*

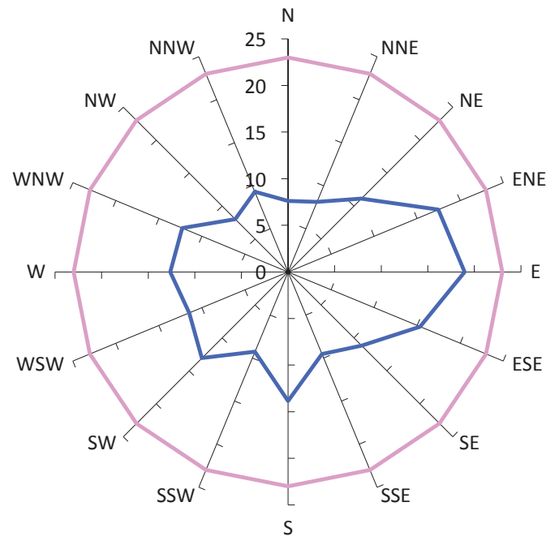
Annual Maximum Gust (m/s)



Desired Criterion
23m/s

WD702-02 50-52 Melville Parade, South Perth — April 25, 2018

Annual Maximum Gust (m/s)



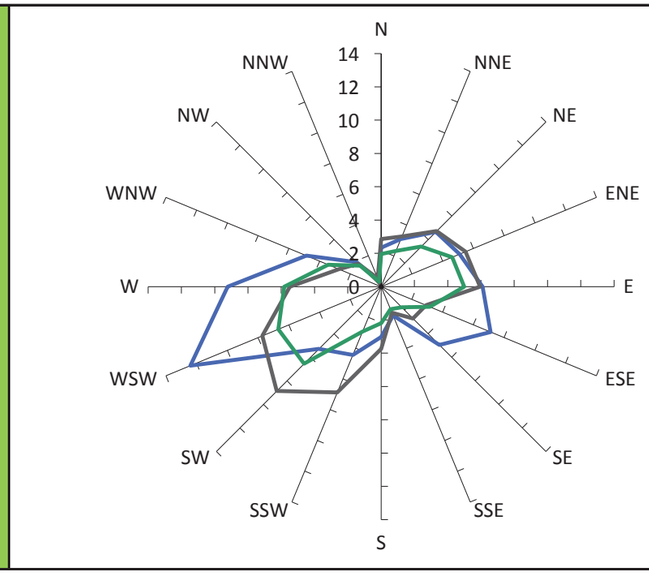
Desired Criterion
23m/s

WD702-02 50-52 Melville Parade, South Perth — April 25, 2018

7.0

Measured Wind Speeds at Point 109

Weekly Maximum GEM (m/s)



Desired Criterion
7.5m/s

Prob. of Criterion Exceedence (existing site conditions)
3%

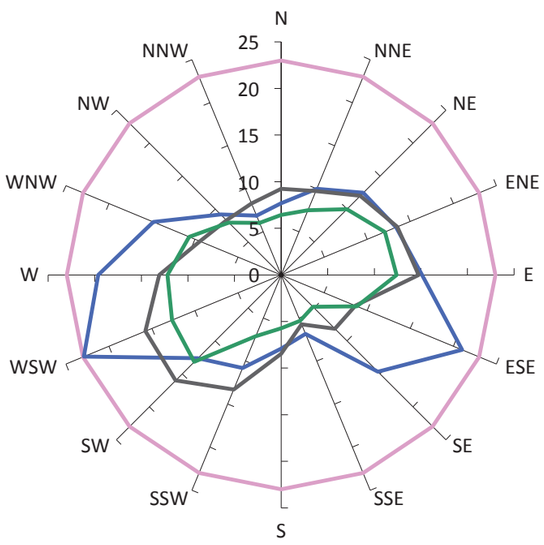
Probability of Criterion Exceedence (initial test)
8%

Probability of Criterion Exceedence (final retest)
1%

NOTE: The desired criterion is exceeded if the probability of exceedence is greater than 5%

- *Criterion.*
- *Surrounding Areas*
- *Existing Site*
- *With proposed densely foliating trees along Melville Parade*

Annual Maximum Gust (m/s)

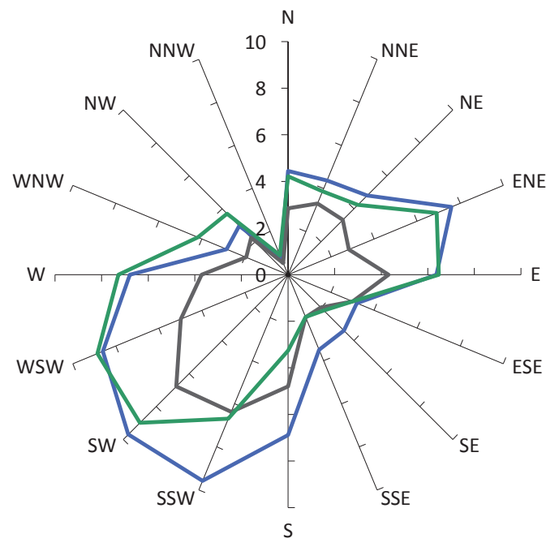


Desired Criterion
23m/s

WD702-02 50-52 Melville Parade, South Perth — April 25, 2018

Measured Wind Speeds at Point 110

Weekly Maximum GEM (m/s)



Desired Criterion
7.5m/s

Prob. of Criterion Exceedence (existing site conditions)
0%

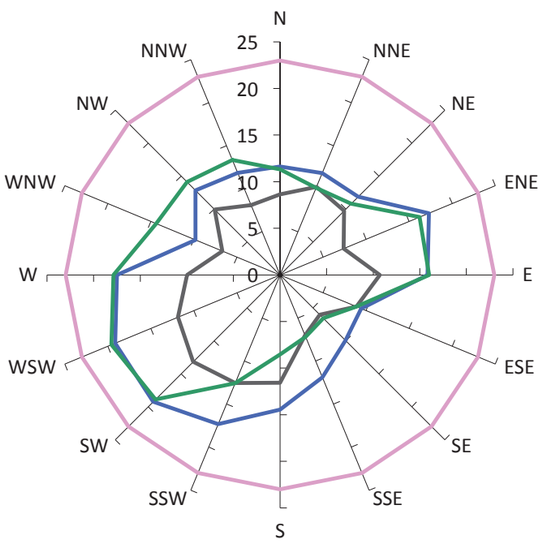
Probability of Criterion Exceedence (initial test)
8%

Probability of Criterion Exceedence (final retest)
4%

NOTE: The desired criterion is exceeded if the probability of exceedence is greater than 5%

- *Criterion.*
- *Surrounding Areas*
- *Existing Site*
- *With proposed densely foliating trees along Melville Parade*

Annual Maximum Gust (m/s)

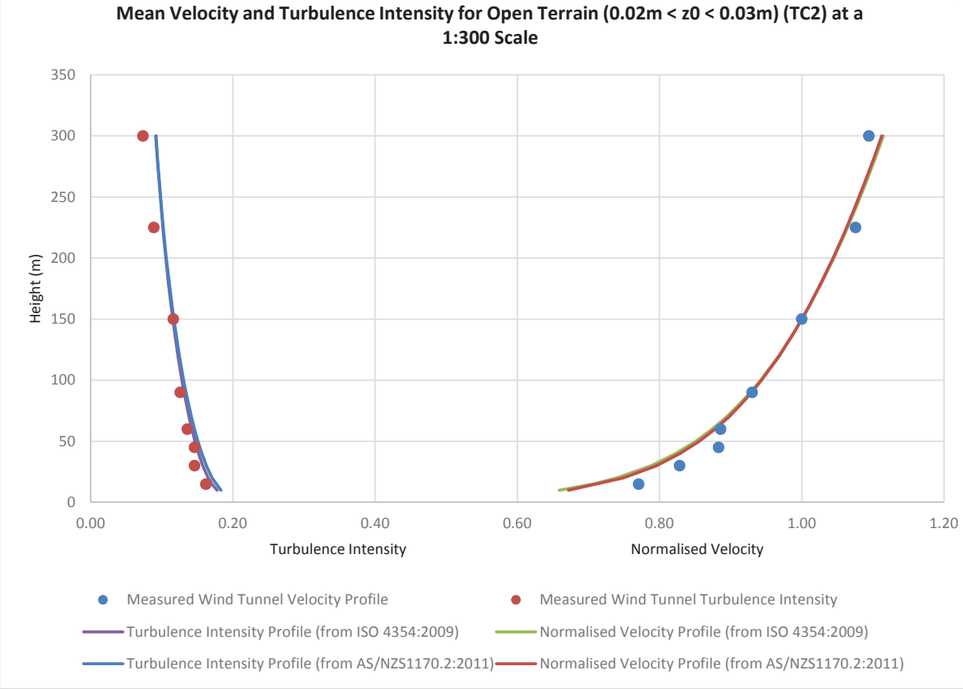


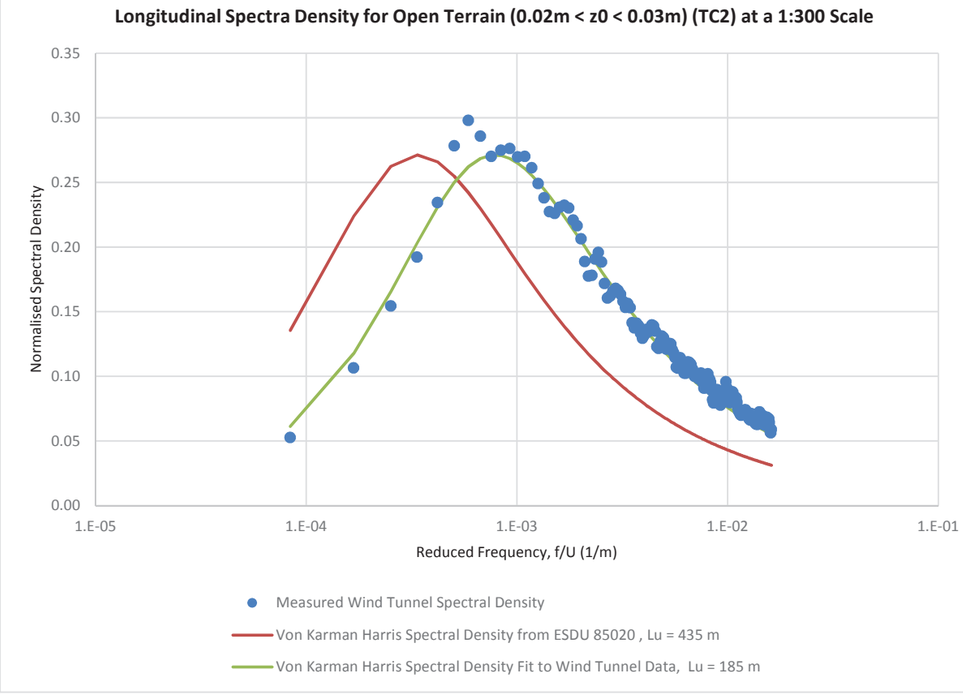
Desired Criterion
23m/s

WD702-02 50-52 Melville Parade, South Perth — April 25, 2018

7.0

APPENDIX B - VELOCITY AND TURBULENCE INTENSITY PROFILES





Windtech Consultants

8.0 TRAFFIC REPORT

Project:	Proposed Mixed Use Development 50-52 Melville Parade, South Perth
Client:	NL Homes Melville Pty Ltd c/o Hillam Architects
Author:	Leigh Dawson
Date:	01/05/2018
Document #	1708008-001

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Contents

1. Introduction and Background

Shawmac Pty Ltd has been commissioned by NL Homes Melville on behalf of Hillam Architects to prepare a Transport Assessment for a proposed mixed use development in the South Perth Station Precinct (SPSP) of the City of South Perth. The development comprises a multi storey building with a mix of commercial tenancies, apartments and serviced apartments.

A Transport Impact Assessment (TIA) in accordance with the Western Australian Planning Commission's *Transport Impact Assessment Guidelines* is the standard of assessment with the following key objectives:

- To assess the proposed access arrangements for all modes, that is, vehicle, public transport, pedestrian and cyclists.
- To assess the level of transport integration between the development and the surrounding land uses
- To determine the impacts of the traffic generated by the development on the surrounding land uses.
- To determine the impacts of the traffic generated by the development on the surrounding transport networks.

This assessment refers to several other documents including:

- GHD *Report for South Perth Station Precinct - Transport and Access Strategy FINAL*, August 2016 ("GHD report")
- City of South Perth *Local Planning Scheme No. 6* ("LPS6")
- Cardno *South Perth Micro Simulation Model*, October 2016 ("Cardno Report")
- Cardno *South Perth Station Precinct Trip Rate Policy*, November 2016 (Cardno Trip Rate Policy)
- Cardno *50-52 Melville Parade Development Investigation Micro Simulation Modelling Results* (Cardno Technical Memo) included in Appendix D.

1.1. Location

The site is located east of the Kwinana Freeway in the north-east corner of the intersection of Melville Parade and Bowman Street, South Perth as shown in **Figure 1** and **Figure 2**. The site address is 50-52 Melville Parade.

Figure 1: General site location

Figure 2: Site location

2. Development Proposal

2.1. Regional Context

According to the City of South Perth LPS6, the site is within *Special Control Area 1 (SCA1) - South Perth Station Precinct* and is zoned *Mixed Use Commercial*. The residential zoning is R60/R80.

2.2. Proposed Land Use

The proposed development consists of a mixed use building with the following components:

- 123 apartments (25 one-bedroom apartments, 50 two-bedroom apartments, 35 three-bedroom apartments and 13 four bed apartments);
- 16 serviced apartments (13 two-bedroom apartments and 3 three-bedroom apartments);
- A restaurant on the ground floor with approximately 244m^2 GFA;
- A convenience store on the ground floor with approximately 186.45m^2 GFA;
- A medical centre on the ground floor with approximately 227m^2 GFA; and
- A community meeting room on the ground floor for use by tenants and the shared accommodation areas.

The proposed site plan and floor plans are attached in **Appendix A**.

2.3. Access Arrangement

The development proposes a single vehicle access point and service loading bay from Melville Parade. There will be one main point of pedestrian access from Bowman Street to the residential and service apartment lobby.

The proposed access arrangement is shown in **Figure 3**.

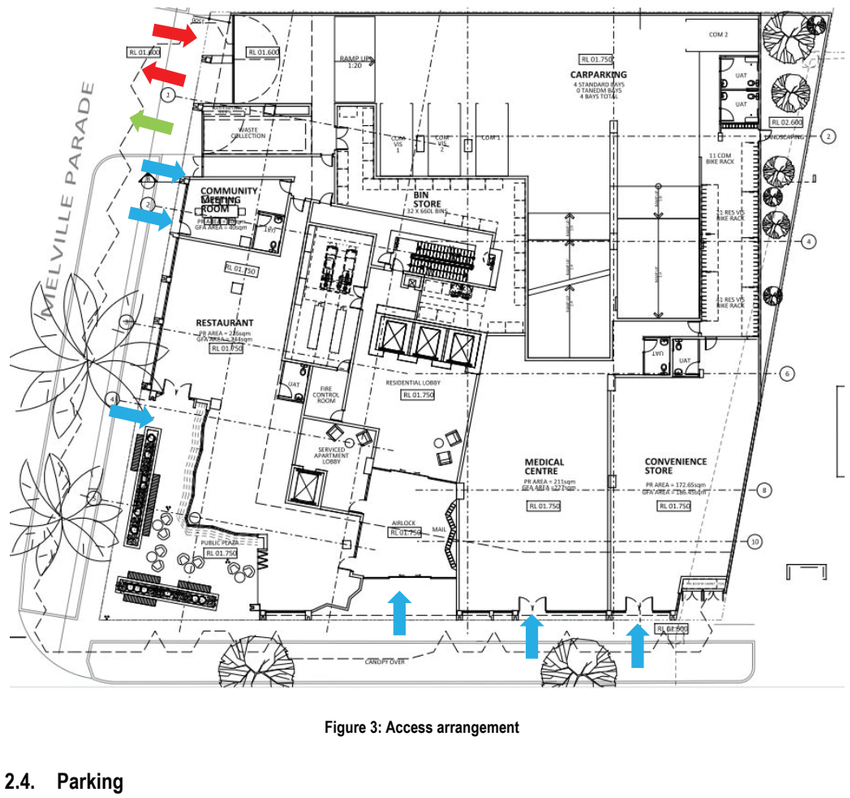


Figure 3: Access arrangement

2.4. Parking

2.4.1. Car Parking

Car parking will be located on the over 7 level from the basement to the ground floor and up to Level 4 (including level 3 mezzanine).

A total of 214 car bays will be provided including:

- 14 bays for commercial use (including visitors)
- 8 bays for serviced apartment tenants
- 171 bays for residents
- 21 bays for resident visitors

2.4.2. Bicycle Parking and End of Trip Facilities

End of trip facilities for the ground floor uses are located along the eastern side of the ground floor car park with

11 bike racks for commercial, 21 racks for residential visitors and 41 racks for residents. There are also 14 bike racks within the residential parking area as well as secured storage areas.

3. Existing Situation

3.1. Site and Surrounding Land Uses

The site has a total area of 2091m² and currently has three single dwellings which are currently used for commercial purposes. Surrounding development comprises a mixture of commercial development and residential development of varying density. Perth Zoo is located approximately 500m south-east of the site and the Royal Perth Golf Club is located approximately 1km south of the site.

Whilst the site is currently generating 20 trips in the peak hour to be conservative these trips have been disregarded.

3.2. Surrounding Road Network

3.2.1. Mid-block

The hierarchy of the surrounding road network is shown in **Figure 4** and the geometry and characteristics of the roads adjacent to the site are detailed in **Table 1**.

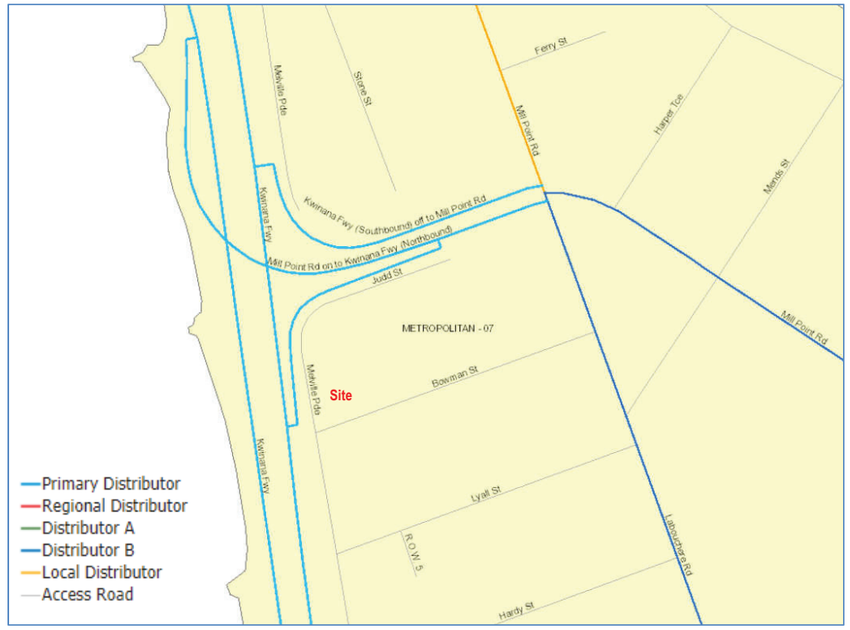


Figure 4: Road hierarchy (Main Roads WA Road Information Mapping)

Table 1: Road network details

Road and Location	Classification	Number of lanes	Speed Limit (km/h)
Kwinana Freeway	Primary Distributor	6 lanes divided	80
Labouchere Road	Distributor B	4 lanes divided	60
Mill Point Road (east of Labouchere)	Distributor B	4 lanes divided	60
Mill Point Road (north of Labouchere)	Local Distributor	2 lanes undivided	50
Bowman Street	Access Road	2 lanes undivided	50
Melville Parade	Access Road	2 lanes undivided	50
Lyall Street	Access Road	2 lanes undivided	50
Hardy Street	Access Road	2 lanes undivided	50
Mends Street	Access Road	2 lanes undivided	50

3.2.2. Intersections

The Mill Point Road / Labouchere Road / Freeway Ramp intersection is a four-way signalised intersection and is the most significant intersection near the site and in the surrounding area. The layout of the intersection is shown in **Figure 5**.

Figure 5: Mill Point Road / Labouchere Road signalised intersection

Labouchere Road intersects with Bowman Street, Lyall Street, Hardy Street and Mends Street via priority T-intersections with no turning restrictions. Bowman Street and Hardy Street are under stop sign control, Mends Street is under give-way control and Lyall Street is unsigned.

Melville Parade intersects with Bowman Street, Lyall Street and Hardy Street via unsigned T-intersections with no turning restrictions.

3.3. Traffic Counts

The latest available traffic data for the surrounding road network was obtained from the City of South Perth and Main Roads WA. The average weekday daily traffic volumes on the road network are shown in **Figure 6**. The data is primarily from 2016 and 2017. Note City of South Perth data provided weekday volumes and the AM and PM peaks are assumed to be 10% of the weekday traffic volumes.

Figure 6: Existing weekday daily traffic

3.3.1. Major Intersections

The existing peak hour traffic volumes at the Mill Point Road / Labouchere Road / Freeway Ramp intersection were obtained from Main Roads WA SCATS data as shown in **Figure 7**. For lanes with shared movements, the propotion of each movement was derived from manual peak hour traffic counts undertaken in previous transport assessments. The peak hours on the road network were identified as:

- Weekday AM peak hour: 07:30 - 08:30
- Weekday PM peak hour: 16:30 - 17:30

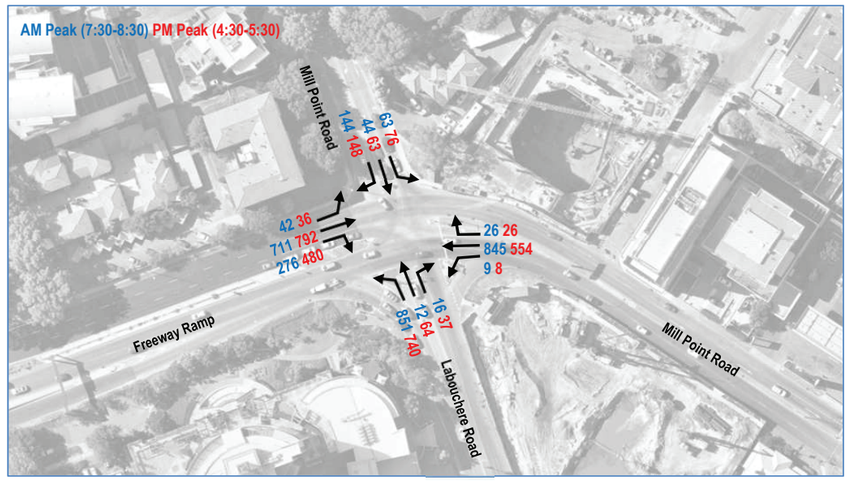


Figure 7: Peak hour traffic volumes - Mill Point Road / Labouchere Road / Freeway Ramp intersection

3.4. Pedestrian / Cyclist Network

The existing pedestrian and cyclist network is shown in **Figure 8**.

Figure 8: Pedestrian / cyclist network, Department of Transport

3.5. Existing Public Transport

The existing public transport services operating within the vicinity of the site is shown in **Figure 9**. Transperth bus routes 30 (Perth - Curtin University), 31 (Perth - Salter Point) and 34 (Perth - Cannington Station) are classified as 'high frequency bus routes' as defined by the WAPC *Residential Design Codes* (RDC). It is noted that these routes meet the high frequency criteria in the peak direction of travel for each peak period (generally northbound in the AM peak hour and southbound in the PM peak hour).

The closest bus stops are located on Labouchere Road between Bowman Street and Mends Street approximately 240m walking distance from the site as shown in **Figure 10**.

Figure 9: Public transport network, Transperth

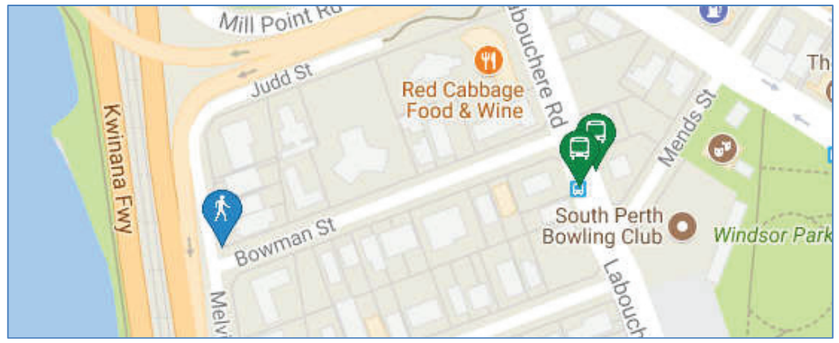


Figure 10: Closest bus stops, Transperth

3.6. Crash History

The crash history of the surrounding road network at mid-block locations and intersections for the five year period from January 2012 to December 2016 was sourced from the MRWA *Reporting Centre*. The occurrence of crashes is summarised in **Figure 11**. Medical Attention was required for 26 of the 157 recorded crashes resulted in medical attention. The intersection of Mends Street and Mill Point is included in the Crash Analysis Reporting System as a prequalified blackspot intersection.

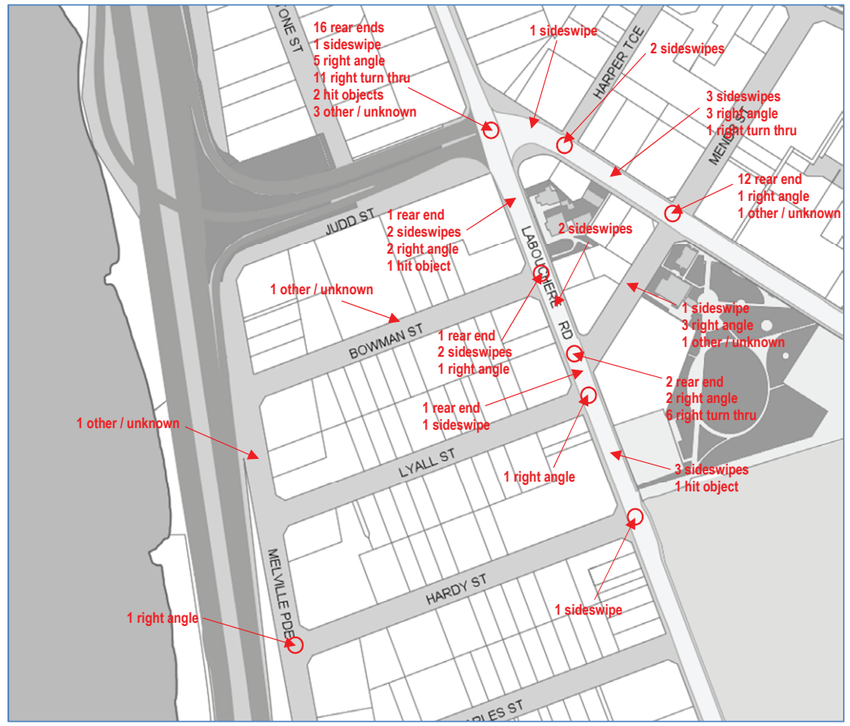


Figure 11: Summary of crash types - January 2012 to December 2016

4. Changes to Surrounding Transport Networks

GHD finalised the *South Perth Station Precinct - Transport and Access Strategy* in August 2016 which recommended a number of changes to the transport network to improve access within the precinct. Relevant changes in the short term (1 to 3 years) include the following:

- Restricting the Labouchere Road / Bowman Street intersection to left-in / left-out only.
- Restricting the Labouchere Road / Mends Street intersection to left-in / left-out / right-in only.
- Upgrading of the cycling network in line with the South Perth Bike Plan including cycle lanes on Labouchere Road

Although these recommended changes have not been confirmed, it is assumed that they will have been implemented by the time the development would have been completed.

4.1. Integration with Surrounding Area

External generators of traffic to the non-residential uses in the development will be the residential development in the surrounding areas.

Major attractors external to the site include the Perth CBD, the South Perth Esplanade, shopping and activity centres (Garden City, Victoria Park café strip, Angelo Street shops) and nearby education institutions (Wesley College, Penrhos College, UWA, Curtin University).

The main desire lines between the development and the external generators and attractors of traffic would be along Kwinana Freeway, Mill Point Road, Labouchere Road and Canning Highway. The existing transport infrastructure along these routes are considered to be adequate and no major deficiencies were identified.

4.2. Committed Developments and Other Transport Proposals

Cardno was commissioned by the City of South Perth to develop a micro-simulation traffic model of the South Perth Station Precinct which could be used to evaluate the impact of development proposals within the precinct. The model included numerous 'approved developments' which are yet to be completed in order to determine the cumulative effect of the ongoing development in the precinct. The traffic model included the following approved developments:

- 12-16 Charles Street
- 7 Lyall Street
- One Richardson (1-3 Richardson Street)
- 6 Lyall Street

8.0

- Pinnacles South Perth (30-34 Charles Street)
- South Bank (98 Mill Point Road)
- Southstone Apartments (1 Stone Street)
- Aurelia (96 Mill Point Road)
- 14-18 Hardy Street
- Glasshouse (31 Labouchere Road and 24 Lyall Street)
- 13 Stone Street
- Civic Heart
- Echelon (77-79 South Perth Esplanade)
- 5-7 Harper Terrace
- 26-28A Charles Street
- 2 Harper Terrace
- 152B Mill Point Road
- 21-22 Mends St
- 19 Labouchere Rd
- 11 Melville Parade

The locations of the most of the approved developments are shown in **Figure 12** as extracted from the Cardno report.

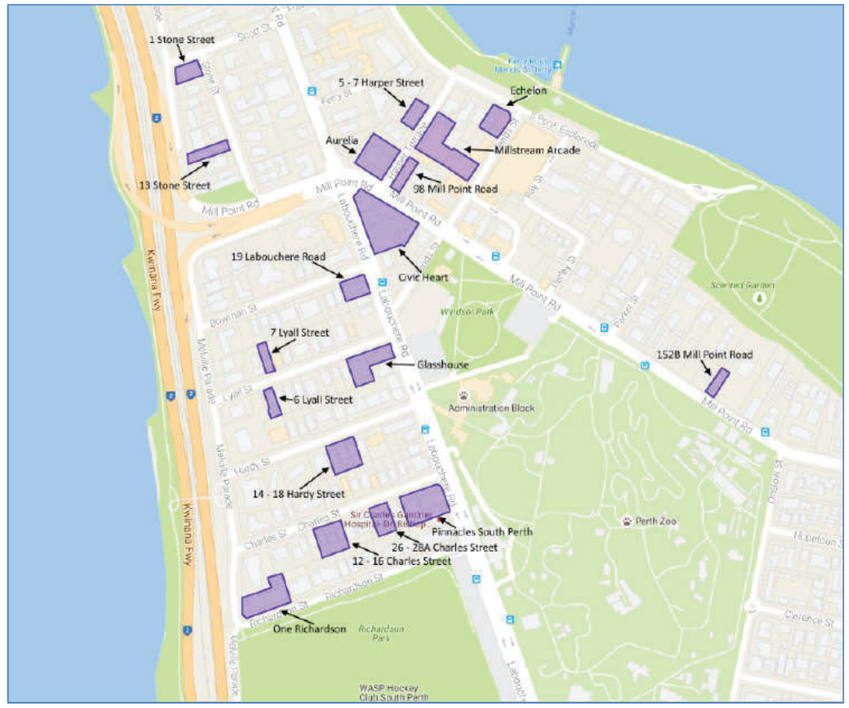


Figure 12: Approved developments within South Perth Station Precinct, Cardno 2016

The traffic model was updated by Cardno (Appendix E) to include both 50-52 Melville Parade and the proposed development at 1-3 Lyall Street.

5. Development Generation and Distribution

5.1. Assessment Years

The assessment has been based on the year that the proposed development is complete and occupied which is assumed to be the year 2021. The analysis of 2021 includes the traffic generate by the approved and planned developments as outlined in the Cardno report. An analysis of the existing traffic data from Main Roads WA on Labouchere Road and Mill Point Road (7 years of data) indicates that traffic on these roads is stable. The growth in traffic on Labouchere Road and Mill Point Road will be due to the committed development and therefore the 2021 modelling also represents 10 years from opening.

5.2. Time Periods for Assessment

The time periods used for assessment were the morning and afternoon peak hours on the road network (from 7:30 to 8:30 in the morning and from 4:30 to 5:30 in the afternoon) which are expected to coincide with the peak period of traffic generated by the development.

5.3. Vehicle Trip Generation

Peak hour vehicle trip generation rates for the proposed land uses in the development have been obtained from the Cardno Technical Memorandum *South Perth Station Precinct Trip Rate Policy* which was produced to guide assessment of proposed developments within the precinct. The daily vehicle trip generation rates were obtained from the Institute of Transportation Engineers *Trip Generation* 9th Edition (2012) as the Cardno Trip Rate Policy did not include daily generation rates.

The traffic generation potential of the overall site is predicted as follows:

- Weekday Daily 1,278 vpd (639 in / out)
- Weekday AM Peak Hour 66 vph (25 in / 41 out)
- Weekday PM Peak Hour 84 vph (49 in / 35 out)

The existing commercial development on the site would currently generate a relatively low volume of traffic (10 vph in peak hour and daily traffic of 84vpd). For simplicity, the traffic generated from the existing uses has not been subtracted from the future traffic generation which is considered conservative.

The detailed trip generation is attached in **Appendix B**.

5.4. Traffic Distribution

The distribution of traffic generated by the site has been assumed based on the layout of the road network and the most logical route to and from external locations as follows:

- 60% is travelling to / from Kwinana Freeway via Labouchere Road and Lyall Street
- 20% of traffic is travelling to / from the south via Labouchere Road
- 20% of traffic is travelling to / from Mill Point Road.

It is assumed that there is little demand for vehicular travel to and from Richardson Street as the drivers will be able to right turn out at Lyall Street. All traffic will exit the site onto Melville Parade and then choose to travel along Bowman Street to left turn out onto Labouchere Road or continue on Melville Parade to Lyall Street to right turn out onto Labouchere Road. For traffic entering the site the traffic from the north will right turn from Labouchere Road into Lyall Street then Melville Parade to access the site. Traffic entering the site from Labouchere Road south will left turn into Bowman Street then Melville Parade to access the site.

5.5. Predicted Traffic Flows

Based on the assumed distribution, the increase in daily traffic volumes and peak hour traffic flows on the adjacent road network are as shown in **Figure 13**.

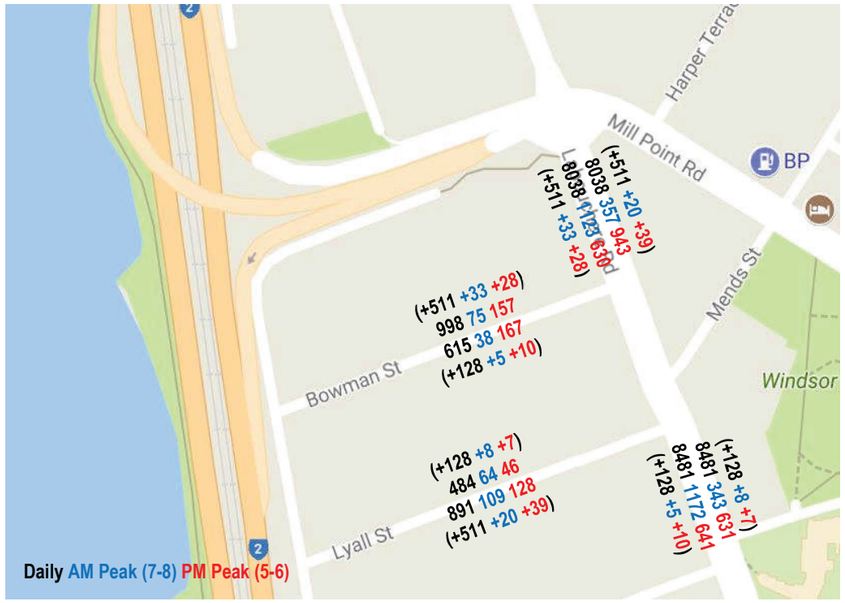


Figure 13: Post-development traffic – Weekday

The traffic generation and distribution shows that the development will have minimal impact on the surrounding network. As the development is with the South Perth Station Precinct Cardno have added it, along with 1-3 Lyall

Street, into the Station Precinct microsimulation model to determine the impact of the development when considering all the other approved developments as outlined in Section 6. The Technical Memorandum is attached in Appendix C and further discussed in Section 10.

6. Impact on Surrounding Roads

Austroads *Guide to Traffic Management Part 3: Traffic Studies and Analysis* (AGTM06) provides the following advice on the typical lane capacity of different road types:

- Two-lane two-way rural roads and highways — 1,700 passenger cars / hour
- Urban roads with interrupted flow — 900 - 1,000 passenger cars / hour / lane

The resulting peak hour traffic flows on the road network as shown in **Figure 13** are shown to be within the practical capacity of the existing roads. It should be noted that the weekday peak hour traffic flows are currently well within the mid-block capacity based on the current number of lanes.

7. Impact on Intersections

The peak hour operation of the intersections adjacent to the intersection has been modelled within the microsimulation modelling undertaken by Cardno and summarised in Appendix C.

The traffic modelling indicates that based on all committed developments and both 50-52 Melville Parade and 1-3 Lyall Street result in a maximum increase in delay of 22 seconds and indicates that all intersection operate with an average delay increase of only 11 seconds. The Cardno report summarises that the impact of the traffic generated by the development of 50-52 Melville Parade is acceptable base on the traffic being distributed to a number of streets rather than concentrated at the intersection of Bowman Street / Labouchere Road. The increase in the delay is minimal and results in additional queuing on the side roads rather than Labouchere Road.

Sidra modelling was also undertaken at the intersection of Labouchere Road and Mill Point Road based on the existing traffic and the 2021 with the committed developments (outlined in the Cardno report and Section 6) and the proposed development traffic.

The Sidra modelling (Figure 14 and 15) indicates that based on the microsimulation traffic volumes determined by Cardno and the development generated traffic the intersection is predicted to operate satisfactorily.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Labouchere Road											
1	L2	773	3.0	0.602	36.7	LOS D	19.6	140.9	0.84	0.82	35.5
2	T1	64	3.0	0.739	65.0	LOS E	6.5	46.4	1.00	0.86	21.1
3	R2	40	3.0	0.739	69.3	LOS E	6.5	46.4	1.00	0.86	19.7
Approach		877	3.0	0.739	40.2	LOS D	19.6	140.9	0.86	0.82	33.5
East: Mill Point Road											
4	L2	50	3.0	0.763	48.2	LOS D	25.7	184.2	0.96	0.88	25.8
5	T1	797	3.0	0.763	40.4	LOS D	25.7	184.2	0.92	0.85	29.8
6	R2	50	3.0	0.325	39.7	LOS D	2.3	16.7	0.79	0.76	21.0
Approach		897	3.0	0.763	40.8	LOS D	25.7	184.2	0.92	0.84	29.2
North: Mill Point Road											
7	L2	98	3.0	0.722	61.4	LOS E	10.6	76.1	1.00	0.87	16.0
8	T1	81	3.0	0.722	56.9	LOS E	10.6	76.1	1.00	0.87	22.8
9	R2	185	3.0	0.763	63.0	LOS E	11.2	80.3	1.00	0.89	23.8
Approach		364	3.0	0.763	61.2	LOS E	11.2	80.3	1.00	0.88	21.8
West: Freeway Ramp											
10	L2	180	3.0	0.422	16.7	LOS B	14.4	103.6	0.53	0.57	43.7
11	T1	860	3.0	0.422	11.1	LOS B	14.9	107.0	0.53	0.51	46.3
12	R2	351	3.0	0.747	51.4	LOS D	19.5	139.9	0.98	0.87	30.6
Approach		1391	3.0	0.747	22.0	LOS C	19.5	139.9	0.64	0.61	39.7
All Vehicles		3529	3.0	0.763	35.4	LOS D	25.7	184.2	0.80	0.75	32.9

Figure 14: SIDRA Analysis of Labouchere Road / Mill Point Road Intersection PM Peak 2021 with development

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Labouchere Road											
1	L2	983	3.0	0.775	42.5	LOS D	27.3	196.2	0.93	0.88	33.4
2	T1	31	3.0	0.664	64.6	LOS E	5.0	36.2	1.00	0.81	21.0
3	R2	51	3.0	0.664	69.0	LOS E	5.0	36.2	1.00	0.81	19.6
Approach		1065	3.0	0.775	44.5	LOS D	27.3	196.2	0.94	0.87	32.3
East: Mill Point Road											
4	L2	63	3.0	0.767	43.6	LOS D	28.2	202.2	0.94	0.87	27.4
5	T1	922	3.0	0.767	36.2	LOS D	28.2	202.2	0.91	0.83	31.4
6	R2	55	3.0	0.240	34.3	LOS C	2.3	16.4	0.72	0.74	22.9
Approach		1040	3.0	0.767	36.6	LOS D	28.2	202.2	0.90	0.83	30.8
North: Mill Point Road											
7	L2	91	3.0	0.674	63.0	LOS E	8.0	57.5	1.00	0.84	15.6
8	T1	44	3.0	0.674	58.4	LOS E	8.0	57.5	1.00	0.84	22.3
9	R2	144	3.0	0.731	64.4	LOS E	8.7	62.6	1.00	0.87	23.5
Approach		279	3.0	0.731	63.0	LOS E	8.7	62.6	1.00	0.85	21.1
West: Freeway Ramp											
10	L2	104	3.0	0.287	13.8	LOS B	8.5	60.8	0.43	0.48	46.2
11	T1	641	3.0	0.287	8.3	LOS A	8.7	62.6	0.43	0.42	49.1
12	R2	316	3.0	0.695	50.1	LOS D	17.0	122.0	0.97	0.85	30.9
Approach		1061	3.0	0.695	21.3	LOS C	17.0	122.0	0.59	0.55	40.3
All Vehicles		3445	3.0	0.775	36.4	LOS D	28.2	202.2	0.82	0.76	32.7

Figure 15: SIDRA Analysis of Labouchere Road / Mill Point Road Intersection AM Peak 2021 with development

Further Analysis was undertaken by applying a uniform percentage increase of 10% (approximately 1% growth a year for 10 years noting current growth is approximately 0%) can be accommodated within the existing intersection. Whilst a number of legs would perform with LOS E it shows the intersection has capacity to absorb this development 10 years from opening.

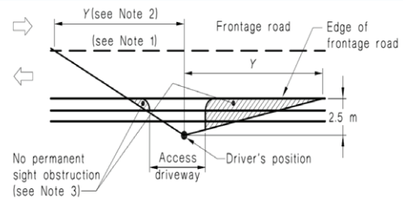
Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Labouchere Road											
1	L2	1077	3.0	0.829	46.2	LOS D	32.1	230.7	0.95	0.91	32.2
2	T1	34	3.0	0.694	65.1	LOS E	5.3	38.1	1.00	0.83	20.9
3	R2	52	3.0	0.694	69.5	LOS E	5.3	38.1	1.00	0.83	19.5
Approach		1163	3.0	0.829	47.8	LOS D	32.1	230.7	0.96	0.91	31.2
East: Mill Point Road											
4	L2	77	3.0	0.825	49.1	LOS D	32.4	232.3	0.98	0.95	25.5
5	T1	1014	3.0	0.825	41.7	LOS D	32.4	232.3	0.95	0.92	29.3
6	R2	61	3.0	0.129	32.7	LOS C	2.4	16.9	0.70	0.72	23.5
Approach		1152	3.0	0.825	41.8	LOS D	32.4	232.3	0.94	0.91	28.8
North: Mill Point Road											
7	L2	100	3.0	0.742	64.7	LOS E	9.0	64.7	1.00	0.88	15.3
8	T1	48	3.0	0.742	60.1	LOS E	9.0	64.7	1.00	0.88	21.9
9	R2	158	3.0	0.804	67.2	LOS E	9.9	71.2	1.00	0.92	22.9
Approach		307	3.0	0.804	65.3	LOS E	9.9	71.2	1.00	0.90	20.6
West: Freeway Ramp											
10	L2	114	3.0	0.316	14.1	LOS B	9.5	68.5	0.44	0.49	46.0
11	T1	705	3.0	0.316	8.5	LOS A	9.8	70.6	0.44	0.43	48.9
12	R2	341	3.0	0.726	50.5	LOS D	18.6	133.7	0.97	0.86	30.8
Approach		1161	3.0	0.726	21.4	LOS C	18.6	133.7	0.60	0.56	40.2
All Vehicles		3782	3.0	0.829	39.3	LOS D	32.4	232.3	0.85	0.80	31.6

Figure 16: SIDRA Analysis of Labouchere Road / Mill Point Road Intersection AM Peak 2021 with development and 10% growth

8. Impact on Development Access

8.1. Access Vehicle Sight Distance

Sight distance from the car park egress along Melville Parade meets the requirements outlined in Figure 3.2 of AS2890.1 which is reproduced in **Figure 17**. A desktop review concluded that the minimum sight distance is achieved.



Frontage road speed	Km/h	Desirable gap (m)	Minimum sight distance (m)
	50	69	45

NOTES:
1 Centre-line or centre of road (undivided road), or right-hand edge of right hand through lane (divided road)
2 A check to the left is not required at a divided road where the median is wide enough to shelter a vehicle leaving the driveway.
3 Parking on this side of the frontage road may need to be restricted on either side of the driveway so that the sight distance required by the above table to an approaching vehicle is not obstructed.

Figure 17 - Sight Distance Requirements

8.2. Access Pedestrian Sight Distance

The Australian Standard AS2890.1:2004 also provides details for sight lines and distances for pedestrian movements across an access to a car park. Those details are shown in the AS2890.1 Figure 3.3 extract on **Figure 18**.

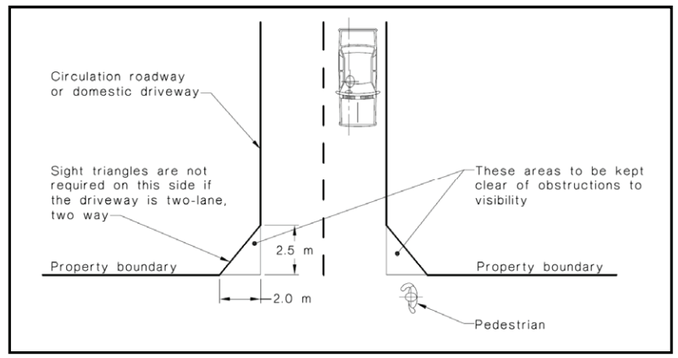


Figure 18 - AS 2890.1 Requirements for Pedestrian Sight Lines

8.0

The plan indicates a two-way crossover with a 6.1m wide ramp which indicate that a sight triangle is not required on the northern side of the crossover. The sight line to the footpath is not achieved on the southern side of the crossover due to the wall of the waste loading bay. The sight triangle for the waste collection loading bay is provided to the south however is not achieved on the northern side due to the wall of the loading bay. To mitigate this a pedestrian warning system should be implemented. Consideration should also be given to relocating the footpath on the verge with additional clearance to the property boundary.

The crossover combines the car parking access and waste collection which consolidates access and will conflict with less pedestrian traffic compared to being on Bowman Street. As the waste collection loading bay will only be used 3 to 4 times a week the consolidation with the car park access is considered acceptable

9. Road Safety

The crash history for the adjacent road network at mid-block locations and at intersections has been outlined in Section 3.6.

The main location where there is a potential for crashes to occur is at the intersection of Labouchere Road / Lyall Street due to the additional right turn into and out of Lyall Street. Whilst there is an increase in traffic through the intersection there is good sight distance and sufficient gap to minimise the increased risk for crashes. Also with Bowman Street becoming left in / left out at Labouchere Road this will reduce the conflict and consolidate the risk to the Lyall Street / Labouchere Road. The severity of existing crashes in the area indicates that the majority of the crashes are property damage with less than 17% requiring medical attention and no fatalities.

Although the proposed uses will slightly increase the volume of traffic on the surrounding road network, the magnitude of increase in traffic is very low and the modifications to the road network will reduce conflict therefore the increased risk of crashes is considered minimal and acceptable.

8.0

10. Public Transport Access

The site is located within the vicinity of Transperth Bus Route 30/31 which is considered a high frequency bus route as it operates at 4 to 5 minute intervals during the peak hour and every 15 minutes throughout the week between Curtin University and the Perth Busport The nearest stops are located approximately 240 metres walking distance from the site. Further the proposed South Perth Railway Station would be located 350 metres walking distance from the development and the Mends Street ferry is within 750m. PTA have not indicated any upgrades to the network at this stage. The area is considered to be well supported by the existing public transport and no upgrades to public transport are proposed.

11. Pedestrian and Cycle Access

There is a PSP along Kwinana Freeway and the Swan River as well as pedestrian footpath along both sides of Bowman Street and one side of Melville Parade. There is pedestrian access into the development from both Melville Parade and Bowman Street that provides access to both the Serviced Apartments and Residential lobbies. The South Perth Bike Plan also proposes cycle lanes on Labouchere Road.

There existing path network is adequate to meet the needs of pedestrians and cyclists travelling to and from the proposed development. The commercial bike users and residential visitor will either access the bike racks through the car park access or through the residential lobby access. Signage advising these users how to access the bike racks shown be included within the wayfinding signage strategy.

The existing pedestrian and cycling network is considered sufficient to support this development.

12. Parking

The parking requirements for the development have been calculated in accordance with the development requirements outlined in Table 6 of City of South Perth Town Planning Scheme as shown in **Table 2**.

Table 2: Car parking requirements

Land Use	Quantum	Standard Minimum	Standard Maximum	Bays Required Minimum	Bays Required Maximum
1 Bedroom Apartment	25	0.75 bays / dwelling	1 bay / dwelling	19	25
2 Bedroom Apartment	34	1.0 bay / dwelling	2 bay /dwelling	34	68
3+ Bedroom Apartment	64	1.0 bay / dwelling	2 bay /dwelling	64	128
Apartments	123	Visitors: 1 per 6 dwellings	NA	21	NA
Tourist Accommodation / Serviced Apartments	16	0.5 bays / dwelling	NA	8	NA
Commercial	657 m^2	1 bay per 50m^2 NLA	NA	14	NA
			Total Required	160	264
			Total Provided	**214**	

Based on the above, the minimum required car parking supply of the development is 160 bays. The maximum allowable parking supply is 264 bays based on the maximum amount of parking for residents and the minimum requirement for the other uses.

The proposed car parking supply is therefore within the minimum and maximum requirements for the development with 214 bays which has been allocated as follows:

- 171 bays for residents
- 21 resident visitor bays
- 14 bays for the commercial tenancies including 1 disabled
- 8 for Serviced Apartments

It is reasonable to assume that the disabled bay can be shared between residential visitors and the commercial tenancy.

It is understood that the provision of a variety of residential parking including long bays and wide bays is essential for the commercial viability of the development.

The car park will require priority control at the intersection of the ramps to the basement and level 1 levels. A pedestrian warning system should be provided at the property boundary. The security gate and card reader will need to be located allow the vehicle to queue clear of the footpath whilst the security gate opens.

The car parking dimensions have been reviewed and are in accordance with AS/NZS 2890.1 Class 1A requirements. Note some bays are noted as wide bays / long bays and exceed the minimum requirements of AS/NZS 2890.1. The review of the car park indicates that appropriate clearance to the walls has been achieved and the ramp gradients are considered to satisfy the standard. A car parking management plan should be developed for use by the building management.

12.1. Bicycle Parking

The bicycle parking requirements according to the *Special Control Area SCA1 – South Perth Station Precinct* are 1 per 3 dwelling for residents and 1 per 10 dwellings for residential visitors. The scheme also requires 1 bicycle park per 200m2 of commercial area. This results in the need for 41 residential bicycle racks, 13 bicycle racks for residential visitors and 4 racks for commercial users.

Based on the above, the bicycle parking provision of 55 residential bike racks, 21 residential visitors and 11 commercial bike racks is considered sufficient. There is a need to demarcate the location of the commercial and residential visitor bike racks to increase their potential usage. There is also an End of Trip facility located adjacent to the commercial use bike racks satisfying this requirement.

13. Service Vehicle Access

Service Vehicle access has been provided via the single crossover on Melville Parade that also supports the access to the car parking. The waste truck will be required to reverse into the waste collection area and then drive forward out back onto Melville Parade. The Waste Collection has been sized based on the Small Rear Loader Collection as outlined in the City of South Perth's Waste Guidelines for New Developments (July 2017) and the waste loading bay has been designed to accommodate this vehicle and the clearance outlined in the report. The vehicle is able to reverse into the loading bay and stand clear of the pedestrian footpath which is on the boundary.

Given that Melville Parade is a no through road (north of Bowman Street) with low traffic volumes and waste collection will occur outside of peak hours the reverse in is considered acceptable. The driveway crossover will need to be modified to allow for the service vehicle turn path. A swept path has been included in **Figure 19** showing that the requirements to comply with AS2890.2. noting the driveway will need to be modified to suit the swept path and consideration given to banning parking adjacent to the reversing manoeuvre.

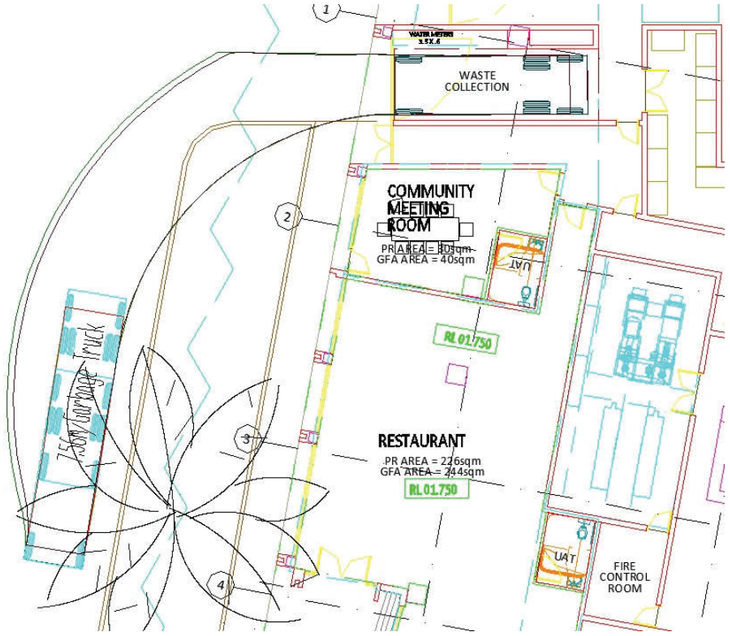


Figure 19: Service Vehicle Swept Path reversing into waste collection

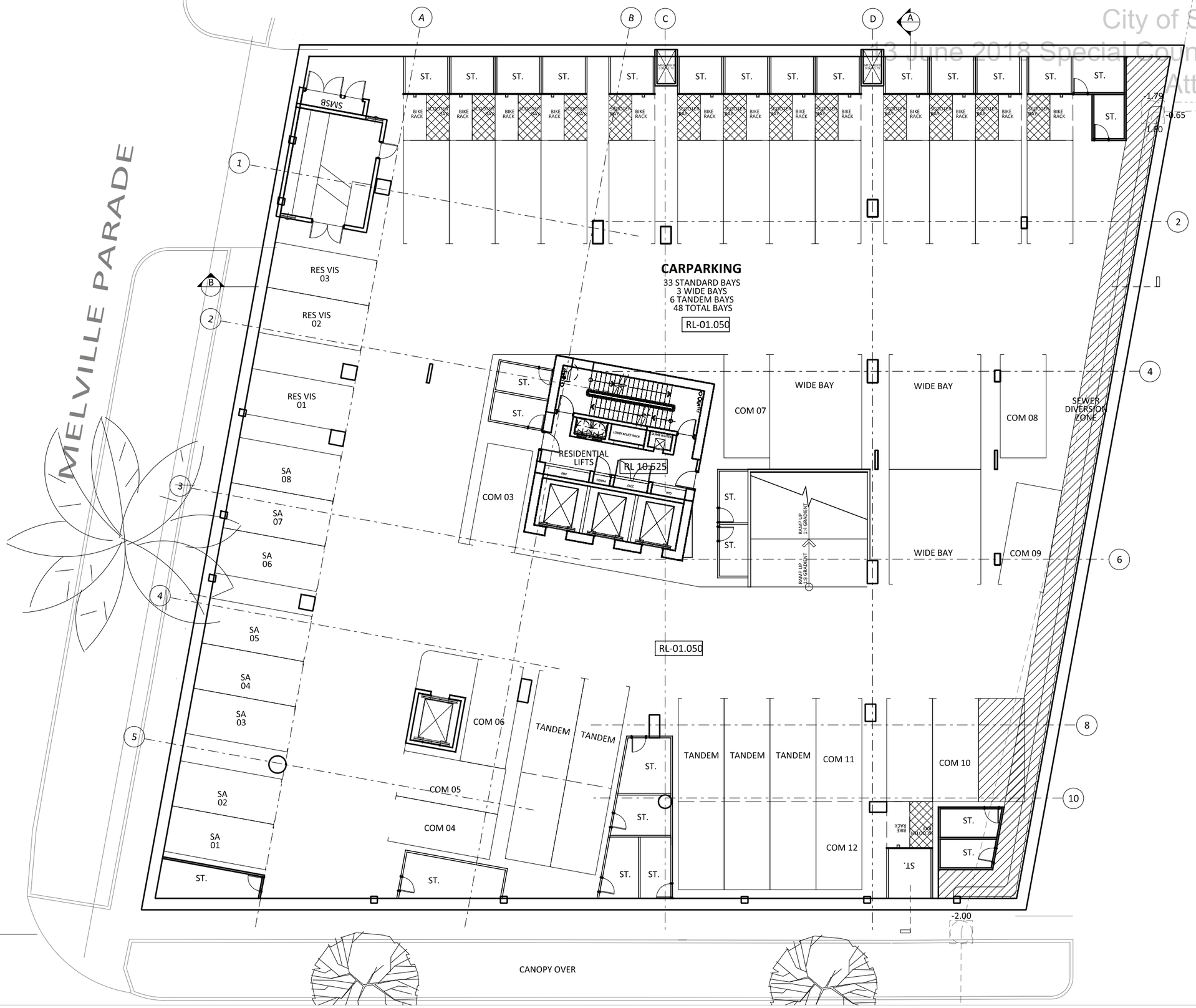
14. Conclusion

A Transport Impact Assessment of the proposed mixed use development at 50-52 Melville Parade has concluded the following:

- The volume of traffic generated by the proposed development can be accommodated within the capacity of the existing road network. The impact on the adjacent road network at mid-block and intersections locations was demonstrated to be within acceptable levels.
- The intersection of Labouchere Road and Mill Point Road can accommodate the proposed development in 2021 along with the other committed developments
- The proposed site crossovers were assessed as being compliant with Austroads guidelines
- The car and bicycle parking supply were assessed in accordance with the requirements
- The existing public transport services are considered to be adequate. The existing path network is also adequate to meet the needs of any pedestrian and cyclist demand of the site.
- Driveway crossover to the service vehicle access to be modified to suit the truck swept path
- Pedestrian warning system required for car park / waste collection access.
- Car park management plan to be developed for use by building management

8.0

Appendix A: Site and Floor Plans



BASEMENT PLAN

SCALE 1:200 @ A3

MIXED-USE DEVELOPMENT

50-52 MELVILLE PARADE SOUTH PERTH

NL HOMES MELVILLE PTY LTD

HILLAM ARCHITECTS

SCALE 1:200 @ A3

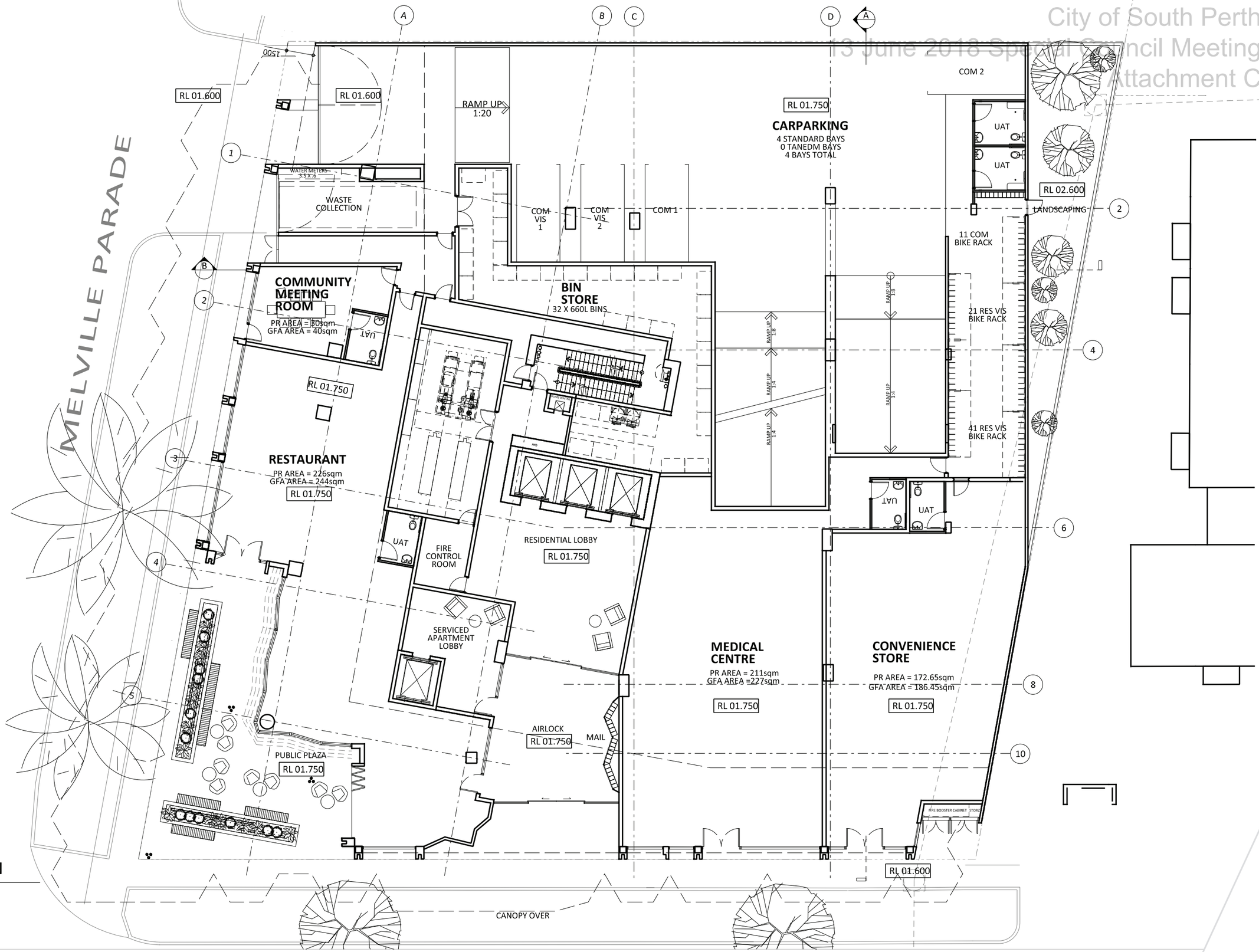
NP

DATE ISSUED 27.04.18

DWG. NAME BASEMENT

DWG No. A2-00

REV 0107



GROUND FLOOR PLAN

SCALE 1:200 @ A3

MIXED-USE DEVELOPMENT
50-52 MELVILLE PARADE SOUTH PERTH
NL HOMES MELVILLE PTY LTD

HILLAM ARCHITECTS

SCALE
1:200 @ A3

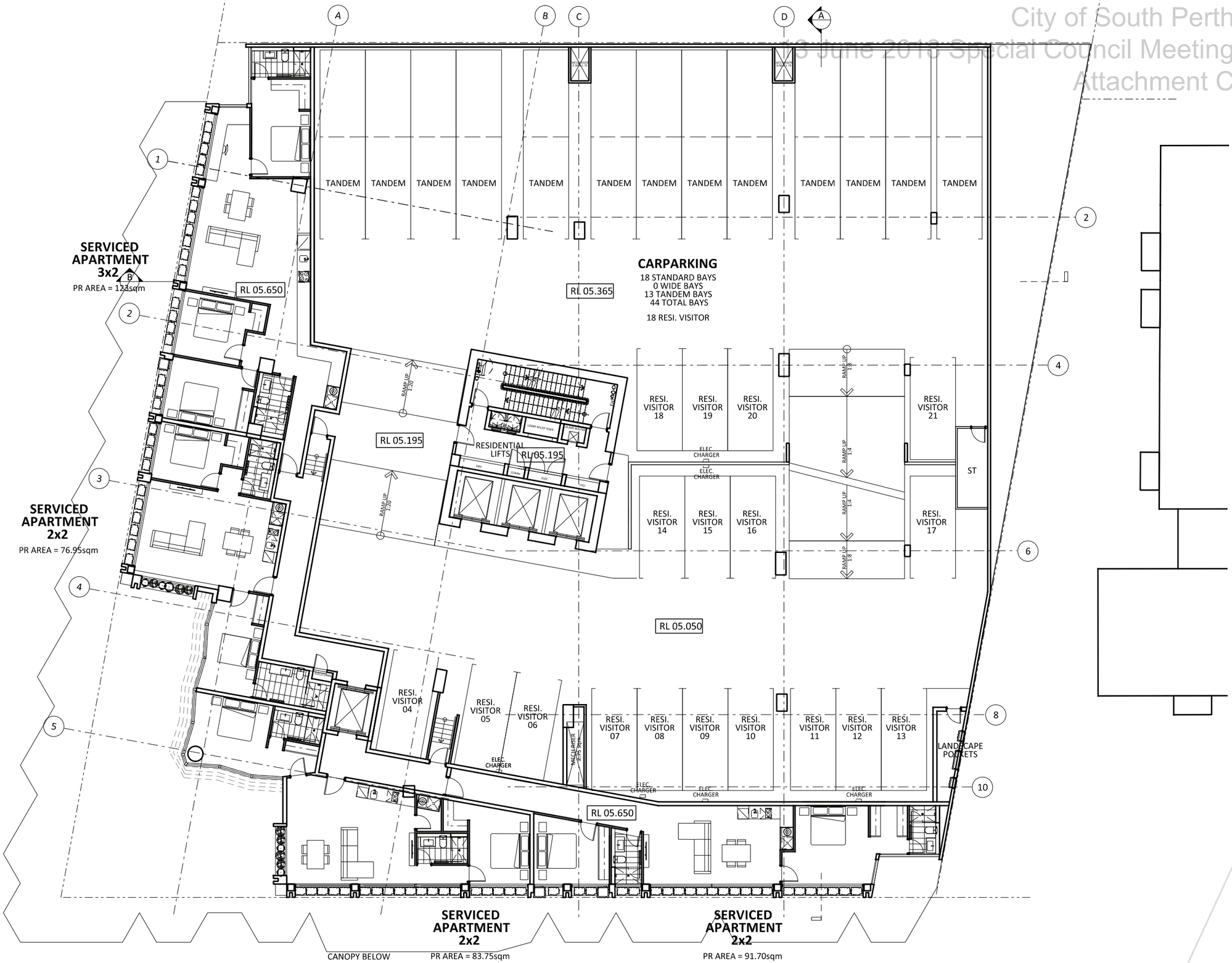
NP

DATE ISSUED
27.04.18

DWG. NAME
GROUND FLOOR PLAN

DWG No.
A2-01

REV
0108



LEVEL 1 FLOOR PLAN

SCALE 1:200 @ A3

MIXED-USE DEVELOPMENT
50-52 MELVILLE PARADE SOUTH PERTH
NL HOMES MELVILLE PTY LTD

HILLAM ARCHITECTS

SCALE
1:200 @ A3

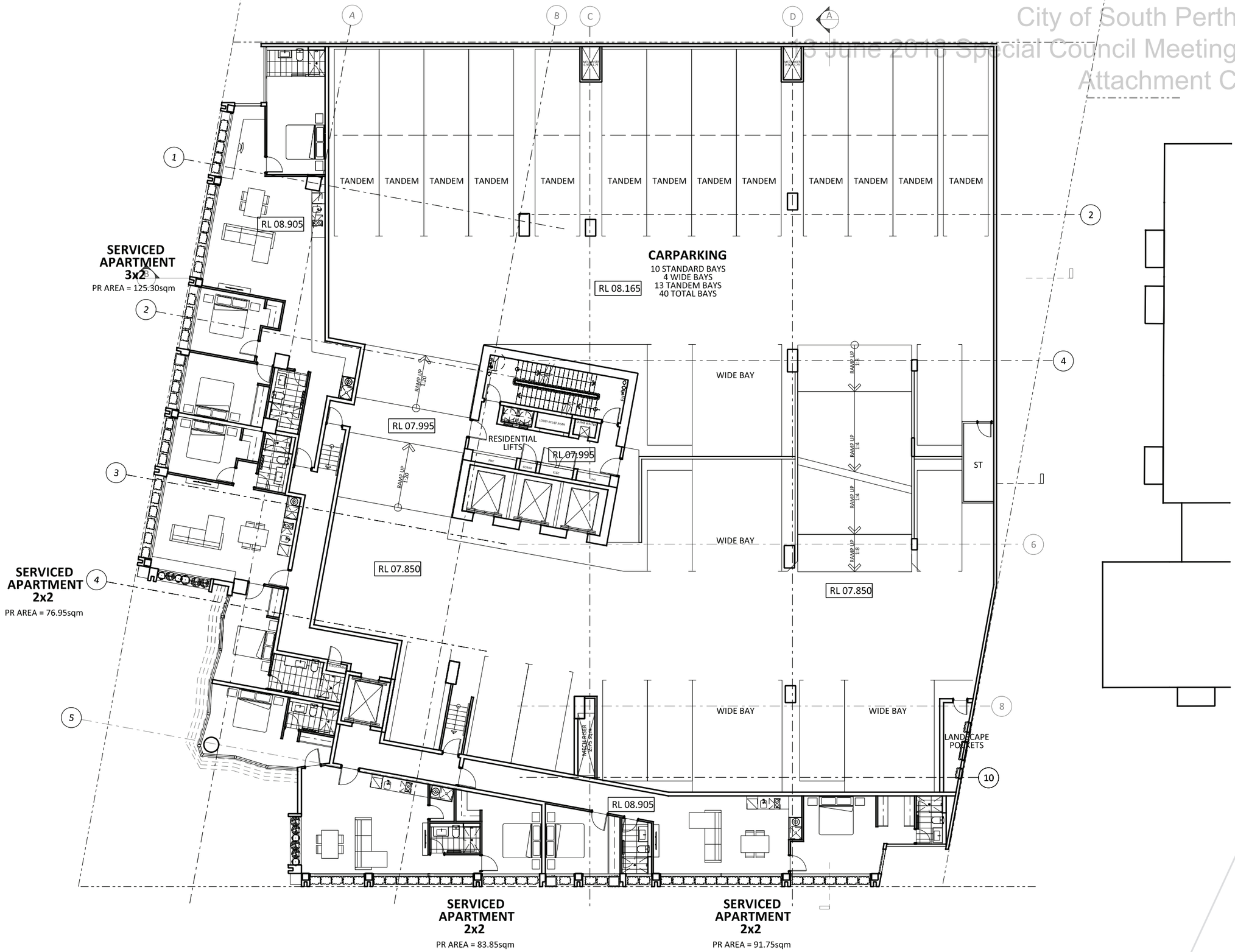
NP

DATE ISSUED
27.04.18

DWG. NAME
LEVEL 1 PLAN

DWG No.
A2-02

REV
0109



LEVEL 2 FLOOR PLAN

SCALE 1:200 @ A3

MIXED-USE DEVELOPMENT
50-52 MELVILLE PARADE SOUTH PERTH
NL HOMES MELVILLE PTY LTD

HILLAM ARCHITECTS

SCALE
0 1 2.5 5
1:200 @ A3

NP

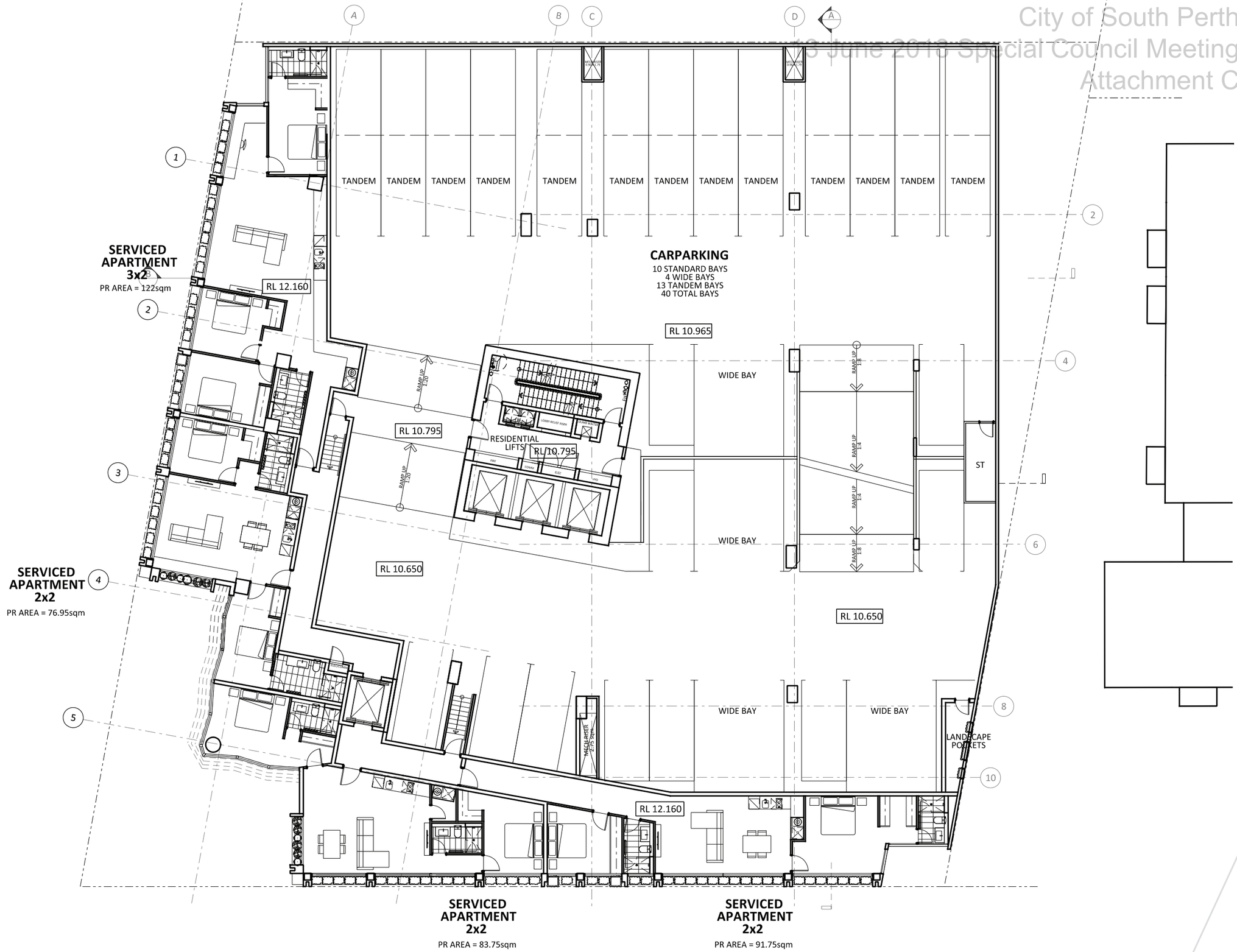
DATE ISSUED
27.04.18

DWG. NAME
LEVEL 2 PLAN

DWG No.
A2-03

REV
01

8.0



LEVEL 3 FLOOR PLAN

SCALE 1:200 @ A3

MIXED-USE DEVELOPMENT
50-52 MELVILLE PARADE SOUTH PERTH
NL HOMES MELVILLE PTY LTD

HILLAM ARCHITECTS

SCALE
0 1 2.5 5
1:200 @ A3

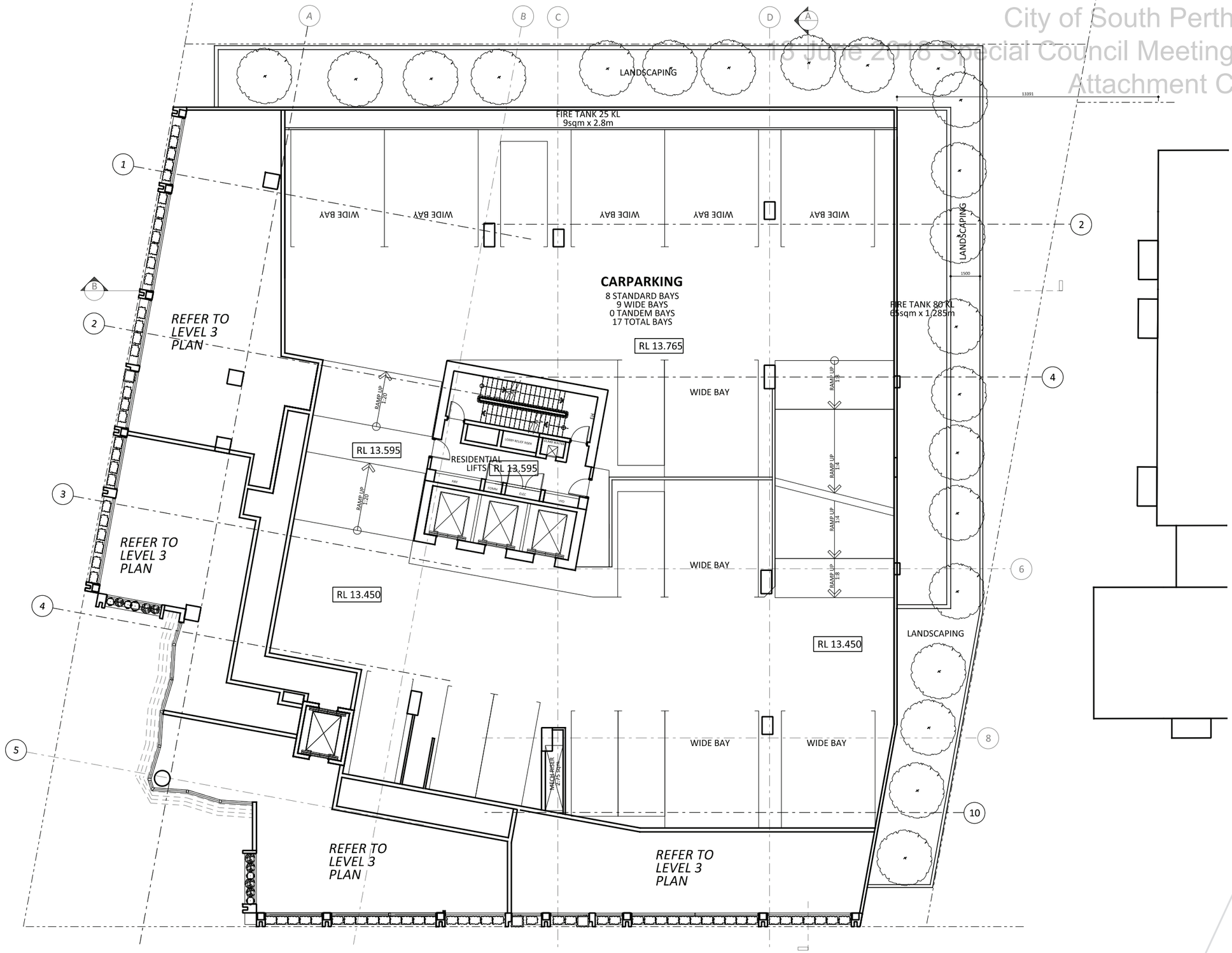
NP

DATE ISSUED
27.04.18

DWG. NAME
LEVEL 3

DWG No.
A2-04

REV
01



LEVEL 3 MEZZANINE FLOOR PLAN

SCALE 1:200 @ A3

MIXED-USE DEVELOPMENT
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NL HOMES MELVILLE PTY LTD

HILLAM ARCHITECTS

SCALE
0 1 2.5 5
1:200 @ A3

NP

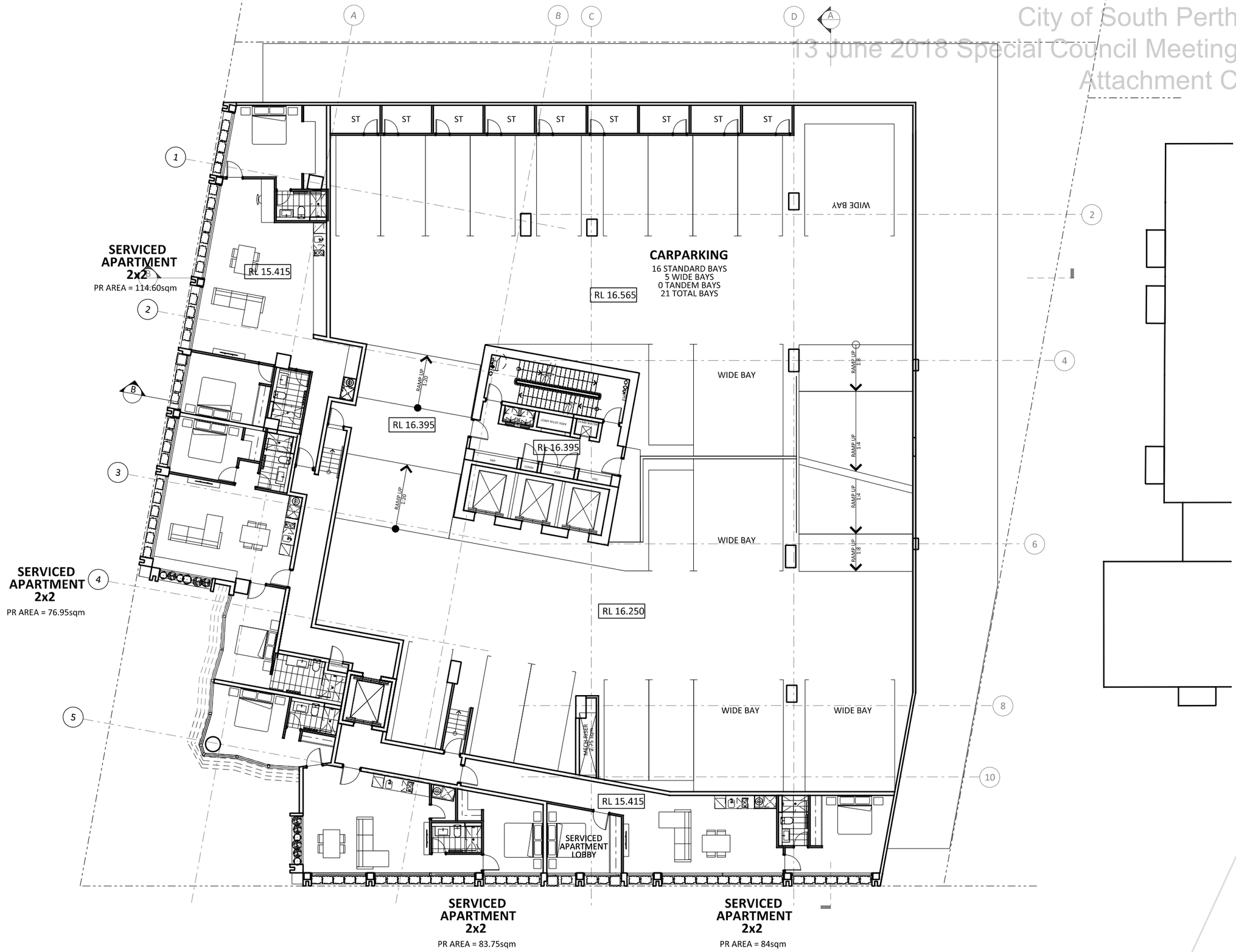
DATE ISSUED
27.04.18

DWG. NAME
LEVEL 3 MEZZANINE

DWG No.
A2-05

REV
0112

8.0



LEVEL 4 FLOOR PLAN

SCALE 1:200 @ A3

MIXED-USE DEVELOPMENT
50-52 MELVILLE PARADE SOUTH PERTH
NL HOMES MELVILLE PTY LTD

HILLAM ARCHITECTS

SCALE
0 1 2.5 5
1:200 @ A3

NP

DATE ISSUED
27.04.18

DWG. NAME
LEVEL 4 PLAN

DWG No.
A2-06

REV
0113

Appendix B: Detailed Traffic Generation

Weekday

Land Use	Units	Quantity	Daily Trip Rate	Directional Split		Total Trips		
				Daily In	Daily Out	Daily In	Daily Out	Daily Total
Apartments	Dwelling	123	6.65	50%	50%	409	409	818
Serviced Apartments (All Suites Hotel)	Dwelling	16	4.90	50%	50%	39	39	78
Café / Restaurant (High Turnover Restaurant)	Per 100m2 GFA	244	136.86	50%	50%	167	167	334
Convenience Store	Per 100m2 GFA	186	11.87	50%	50%	11	11	22
Office - Medical	Per 100m2 GFA	227	11.87	50%	50%	13	13	26
						639	639	1278

Land Use	Units	Quantity	AM Peak Trip Rate	Directional Split		Total Trips		
				AM Peak In	AM Peak Out	AM Peak In	AM Peak Out	AM Peak Total
Apartments	Dwelling	123	0.28	22%	78%	8	27	35
Serviced Apartments (All Suites Hotel)	Dwelling	16	0.30	39%	61%	2	3	5
Café / Restaurant (High Turnover Restaurant)	Per 100m2 GFA	244	8.68	52%	48%	11	10	21
Convenience Store	Per 100m2 GFA	186	1.25	61%	39%	1	1	2
Office - Medical	Per 100m2 GFA	227	1.38	88%	12%	3	0	3
						25	41	66

Land Use	Units	Quantity	PM Peak Trip Rate	Directional Split		Total Trips		
				PM Peak In	PM Peak Out	PM Peak In	PM Peak Out	PM Peak Total
Apartments	Dwelling	123	0.39	62%	38%	30	18	48
Serviced Apartments (All Suites Hotel)	Dwelling	16	0.30	54%	46%	3	2	5
Café / Restaurant (High Turnover Restaurant)	Per 100m2 GFA	244	8.23	61%	39%	12	8	20
Convenience Store	Per 100m2 GFA	186	3.73	48%	52%	3	4	7
Office - Medical	Per 100m2 GFA	227	1.33	17%	83%	1	3	4
						49	35	84

8.0

Appendix C: Cardno Technical Memorandum

Technical Memorandum

Title	**50-52 Melville Parade Development Investigation Micro Simulation Modelling Results**		
Client	City of South Perth	**Project No**	CW1009000
Date	11/09/2017	**Status**	Rev B
Author	Andreas Wang	**Discipline**	Traffic and Transport
Reviewer	Ray Cook	**Office**	Perth

Introduction

Cardno have been engaged by the City of South Perth to utilise and update the existing 2021 Station Precinct Micro-simulation Model (version 1.3) to evaluate intersection delay at the intersection of Mill Point Road / Labouchere Road and the intersections along Labouchere Road (to the south of Mill Point Road) as a result of the potential development at 50-52 Melville Parade, South Perth

The models have previously been developed for the AM and PM peak hour periods, defined as:

- Weekday AM peak hour: 07:30 – 08:30
- Weekday PM peak hour: 16:30 – 17:30

50 – 52 Melville Parade

As described in correspondence dated 28/8/2017, the potential 50-52 Melville Parade development is to include the following yields:

- 241 m^2 Restaurant
- 142 m^2 Retail
- 315 m^2 Office (commercial)
- 140 Residential apartments
- 20 Serviced apartments

Traffic Generation

Based on surveys and research undertaken for similar developments in similar locations, the following trip generation rates summarised in **Table 1** have been adopted for the purpose of this study.

8.0

Table 1 Adopted Trip Generation Rates

Land Use	AM Generation Rate	PM Generation Rate
Café	8.68 trips / 100 m^2	8.23 trips / 100 m^2
Commercial / Office	1.38 trips / 100 m^2 GFA	1.33 trips / 100 m^2 GFA
Residential Apartments (1-2 bedrooms)	0.28 trips / apartment	0.39 trips / apartment
Residential Apartments (2-3 bedrooms)		
Serviced Apartments	0.30 trips / apartment	0.30 trips / apartment
High Quality Restaurant	0.60 trips / 100 m^2 GFA	5.39 trips / 100 m^2 GFA
Retail	0.00 trips / 100 m^2 GFA (based on the assumption that the retail will not open until after 8:30 AM)	3.73 trips / 100 m^2 GFA

Model Scenarios

As part of this modelling exercise, the following scenarios have been modelled:

- Scenario 1 - Base 2021 (including all approved / committed developments, excluding 50 – 52 Melville Parade and 1 - 3 Lyall Street)
- Scenario 2 – 2021 with development at 50 – 52 Melville Parade (but not at 1 - 3 Lyall Street)
- Scenario 3 – 2021 with development at both 50 – 52 Melville Parade and 1 – 3 Lyall Street

Approved / Committed Developments

The following committed or approved developments have been accounted for in the Base 2021 model demands:

- Lumiere (74 Mill Point Road)
- 12-16 Charles Street
- 7 Lyall Street
- One Richardson (1-3 Richardson Street)
- 6 Lyall Street
- Pinnacles South Perth (30-34 Charles Street)
- South Bank (98 Mill Point Road)
- Southstone Apartments (1 Stone Street)
- Aurelia (96 Mill Point Road)
- 14-18 Hardy Street
- Glasshouse (31 Labouchere Road and 24 Lyall Street)
- 13 Stone Street
- Civic Heart
- Echelon (77-79 South Perth Esplanade)

- 5-7 Harper Terrace
- 26-28A Charles Street
- 2 Harper Terrace
- 152B Mill Point Road
- Millstream Arcade (21-23 Mends Street)
- 19 Labouchere Road
- 11 Melville Parade

Model Results

Link Delay Plots (LDPs) have been extracted from the model and are shown in **Figure 1** - **Figure 3** for the 2021 AM scenarios and in **Figure 4** - **Figure 6** for the 2021 PM scenarios.

8.0

Figure 1 Scenario 1 - 2021 AM Link Delay Plot (seconds) – Committed Developments Only (Excluding 50 – 52 Melville Parade and 1 - 3 Lyall Street)

Figure 2 Scenario 2 – 2021 AM Link Delay Plot (seconds) – Committed Developments and 50 – 52 Melville Parade (Excluding 1 - 3 Lyall Street)

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Figure 3 Scenario 2 – 2021 AM Link Delay Plot (seconds) – Committed Developments, Including Both 50 – 52 Melville Parade and 1 - 3 Lyall Street

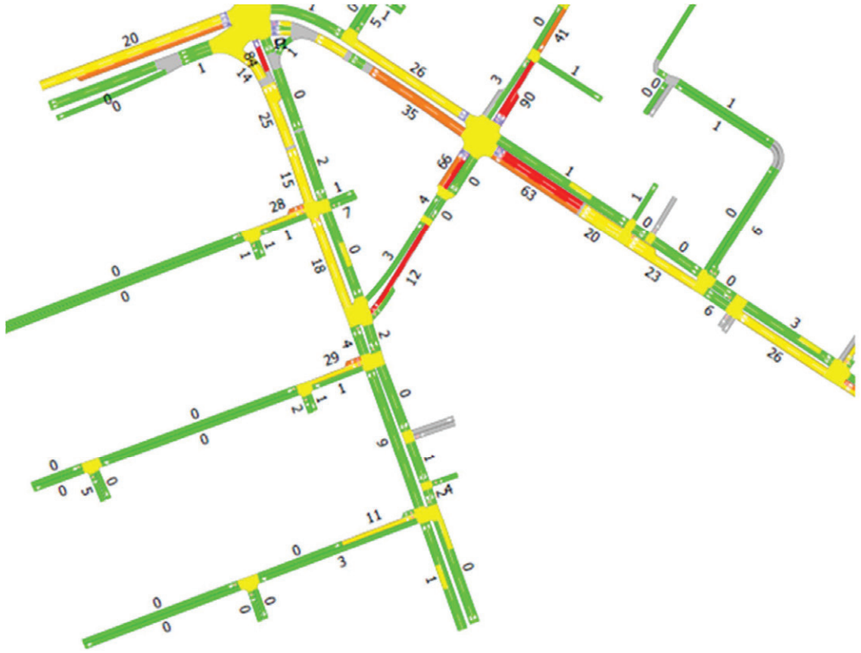

Figure 4 Scenario 1 - 2021 PM Link Delay Plot (seconds) – Committed Developments Only (Excluding 50 – 52 Melville Parade and 1 - 3 Lyall Street)

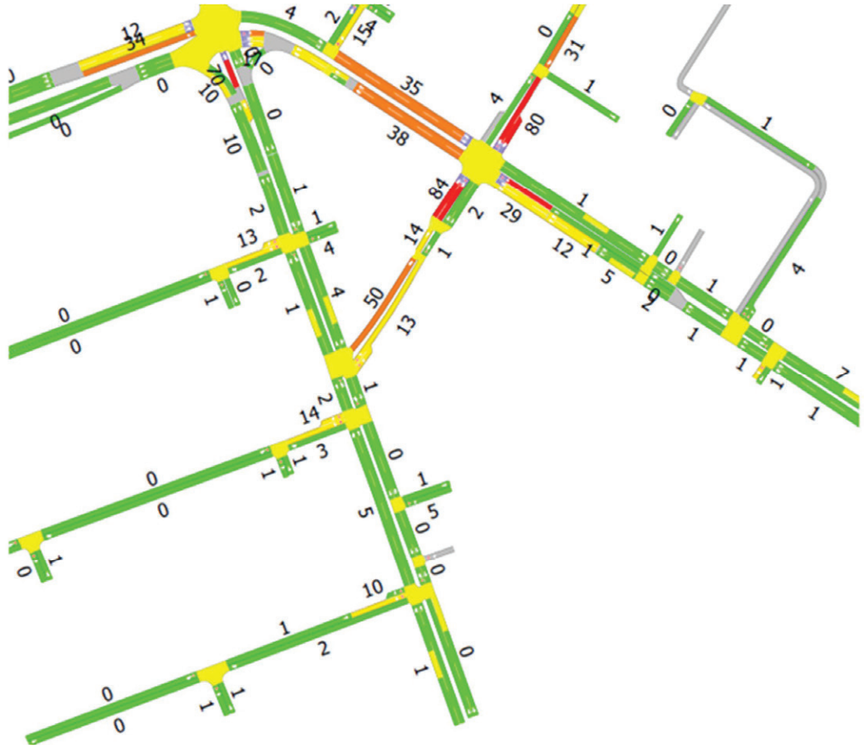

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Figure 5 Scenario 2 – 2021 PM Link Delay Plot (seconds) – Committed Developments and 50 – 52 Melville Parade (Excluding 1 - 3 Lyall Street)

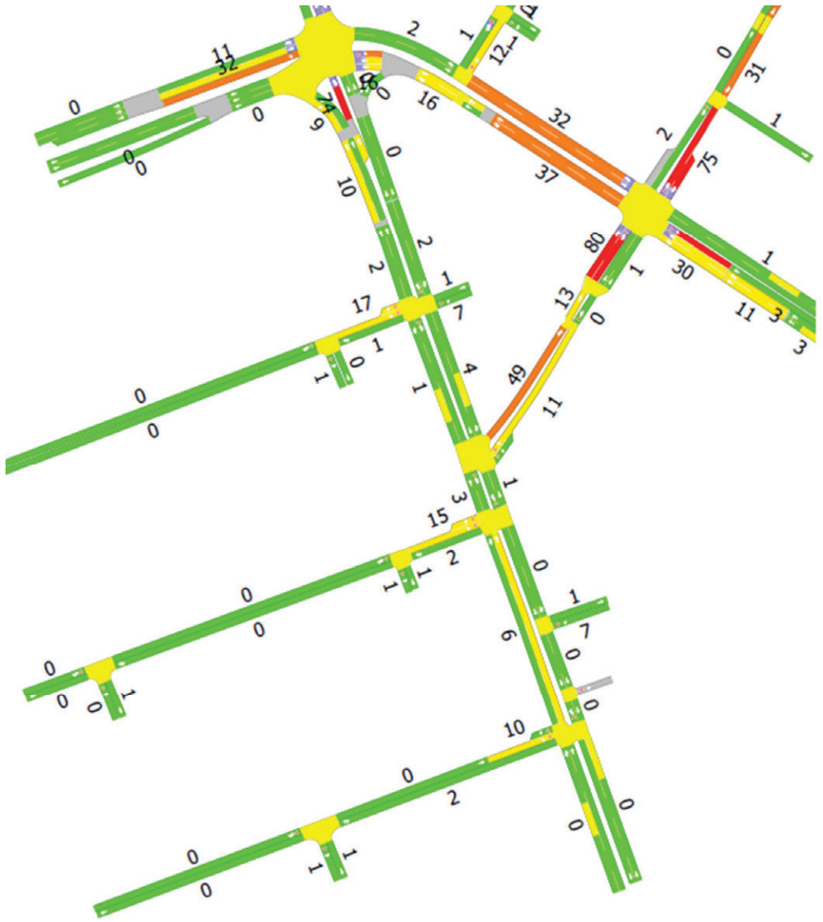
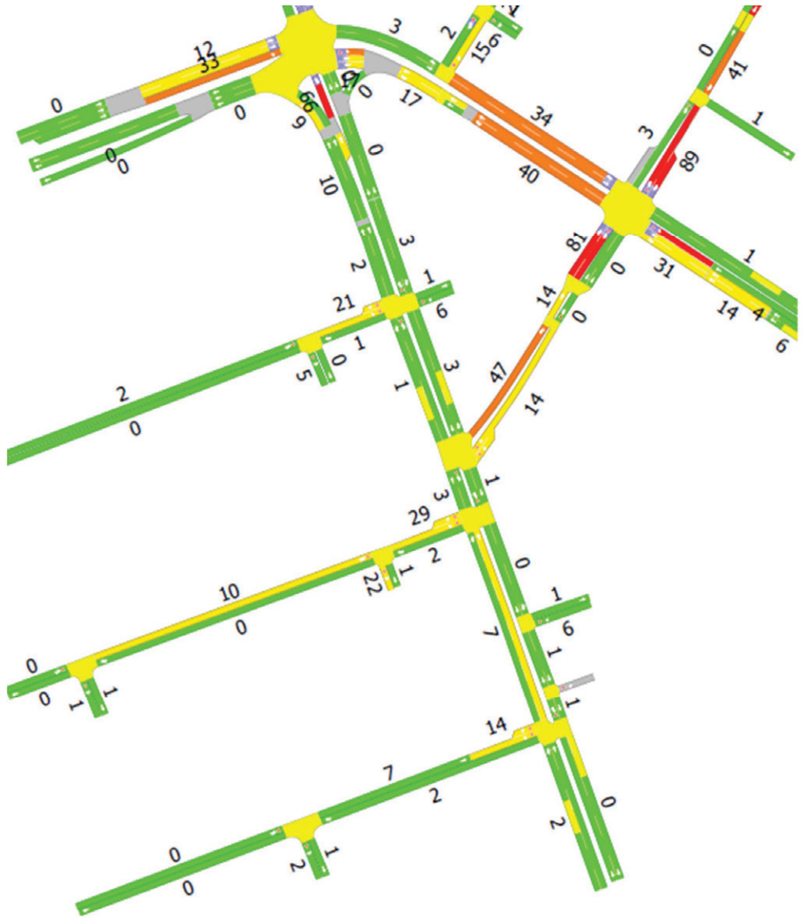


Figure 6 Scenario 3 – 2021 PM Link Delay Plot (seconds) – Committed Developments, Including Both 50 – 52 Melville Parade and 1 - 3 Lyall Street



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Overall, the delays on these streets are comparable for each of the scenarios. The results for Scenario 3 suggest a moderate increase in intersection delays as a result of both proposed developments, although the increase in delays are still considered manageable when distributed throughout the network.

A summary of the average intersection delays is shown in **Table 2**.

Table 2 Intersection Average Delays – 2021

Scenario		Mill Point Road / Labouchere Road (northbound)	Labouchere Road / Lyall Street (eastbound)	Labouchere Road / Bowman Street (eastbound)	Labouchere Road / Hardy Street (eastbound)
Scenario 1	AM	47	15	16	6
	PM	22	14	13	10
Scenario 2	AM	54	18	20	8
	PM	25	15	17	10
Scenario 3	AM	62	29	28	11
	PM	32	29	23	14

Discussion of Results

Scenario 2 was found to result in minor delays on the northbound intersection approach for the intersection of Mill Point Road / Labouchere Road and on the eastbound approach delays were found to somewhat increase for the Labouchere Road intersections of Lyall Street, Bowman Street and Hardy Street, while Scenario 3 was found to result in moderate increases to delays at the intersections. For each of the scenarios, the increases are considered manageable due to the development generated traffic being able to 'spread' its impact over a number of intersections e.g. not concentrated at a single intersection.

Conclusion

The combined impact of the proposed 50 – 52 Melville Parade and 1 – 3 Lyall Street developments was found to be manageable as the development generated traffic is shown to 'spread' its impact over a number of intersections instead of being concentrated at a single intersection.

Due to the cumulative traffic impacts by the proposed developments in the 2021 Scenarios on the key intersections within the study area and the constrained nature of the area, it is recommended that the development of an area-wide Development Contribution Plan (DCP) be undertaken to include funding for the following (but not limited to) potential items:

- Promotion of alternate transport modes and provision of additional pedestrian and cycling infrastructure
- Increase frequencies of key public transport services within the study area (including ferries)
- Undertake a parking study to ensure appropriate (reduced) parking requirements are promoted for the area
- Undertake area-wide transport and safety study to maximise connectivity and safety for local residents and visitors to pass through and walk/cycle around the Precinct.
- Capital works as required in the immediate area, including modifications to intersections along Labouchere Road

Bowman & Associates Pty Ltd

Waste Management Specialists

Tel: 0402 373 582
www.bowmanassociates.com.au

PO Box 2059, ROSSMOYNE WA 6148

WASTE MANAGEMENT PLAN FOR MIXED-USE COMPLEX AT 50-52 MELVILLE PARADE, SOUTH PERTH

DISCLAIMER

In order to provide structure to the conclusions derived in this document certain assumptions have been made. These assumptions are based on the Consultants informal enquiries, knowledge and experience from working in the waste management industry. The content contained herewith has been compiled in good faith using normal industry practices employed by Environmental Engineers and Environmental Scientists. Bowman & Associates Pty Ltd accepts no liability for loss or damages incurred by any individual or organisation due to reliance on the included content. This document and its contents cannot be used for any other purpose or reasons other than those agreed between the Client and Bowman & Associates Pty Ltd without first obtaining written consent from Bowman & Associates Pty Ltd.

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1	18.09.2017	B. Bowman	B. Bowman	
2	05.12.2017	B. Bowman	B. Bowman	
3	11.12.2017	B. Bowman	B. Bowman	
4	4.05.2018	B. Bowman	B. Bowman	

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FILE NAME

180504 50-52 MELVILLE PARADE WMP.DOCX

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FIGURES

DRAWINGS

1 Introduction

NL Homes Melville Pty Ltd is proposing to develop the site, 50-52 Melville Parade, South Perth, by constructing a thirty (30) storey residential complex which will include three commercial premises on the ground floor level. Bowman & Associates has been engaged by NL Homes Melville Pty Ltd to prepare a waste management plan for the complex.

The preparation of this Waste Management Plan involved the following:

a) Liaison with the City of South Perth and a review of background data to determine site specific requirements.
b) Carrying out waste generation modelling to calculate anticipated quantities of waste generated and determine types and number of bins required.
c) Reviewing design of the bin storage area allowing for appropriate size, location and layout.
d) Reviewing access for appropriate waste collection vehicles.
e) Verifying waste collection access requirements, frequency and procedure and development of waste collection processes in accordance with the City of South Perth requirements.
f) Developing methodology for handling different waste types.
g) Advising on appropriate transport of waste within the building.
h) Drafting the waste management responsibilities for strata/caretaker and resident waste management.
i) Proposing alternative waste management solutions where appropriate.
j) Providing advice on compaction and bin chutes.
k) Preparing a Waste Management Plan to the satisfaction of the City of South Perth.

The complex will consist of a ground level with a convenience store, restaurant, medical suite and a bin store with thirty one (31) levels housing carparks, serviced apartments and residential units. A summary of the configurations on each level is shown in **Table 1**.

Table 1: Floor configuration

Level	Aspect			
Ground	Commercial	Convenience Store, Restaurant, Medical Suite		
1 - 4	Serviced Apartments	16 apartments		
5	Amenities			
7 - 29	Residential Units	25 (1x1)	50 (2x2)	48 (3x2)

This Waste Management Plan has been developed in consultation with the Waste Management Division of the City of South Perth (City), Hillam Architects and NL Homes Melville. This Waste Management Plan describes the responsibilities of complex's management and occupants. This Waste Management Plan also describes the spatial allocation and management of waste services for the complex.

2 City of South Perth Waste Management Requirements

2.1 Waste Guideline for New Developments

The City of South Perth has provided a guideline for waste management, *Waste Guideline for New Developments,* February 2015, (Guideline), as the reference document for the preparation of this Waste Management Plan.

The requirements of the Guideline have been considered and acknowledged at **Section 10** within this Waste Management Plan. The critical requirements within the Guideline are:

2.1.1 Waste Receptacles

a) Grouped dwellings, multi-unit and commercial developments may store waste in bins larger than 240 L with the City's approval.

2.1.2 Waste Storage

a) Receptacles must not be visible from the property boundary except when presented for collection.
b) Bin rooms and compounds must have a smooth impervious floor sloped to a drain connected to the sewer system of not less than 75 millimetres in thickness subject to the City's approval.
c) The bin room or compound must be undercover and be designed to not permit storm water to enter into the drain.
d) The bin room or compound must have enough space to facilitate the cleaning of receptacles inside the bin storage area.
e) Walls and floors of bin storage areas must be constructed of a material which facilitates the cleaning of the bin storage area.
f) Bin rooms or compounds must be fitted with a self-closing gate.
g) Enclosed bin rooms or compounds must be ventilated to a suitable standard as approved by the City.
h) Where mechanical ventilation is used, the outlet for vented air must be in a location which will not adversely impact residents.
i) Bin stores shall be provided with artificial lighting, sensor or switch controlled both internal/external to the room or area. All lighting in open areas to comply with AS4282-1997 (Control of Obtrusive Outdoor Lighting).
j) Sufficient space must be provided to allow the easy passage of receptacles in and out of the bin storage area.
k) Bin stores require the following signs and/or information to be displayed:
    I. A Sign stating "NO STANDING" at the entrance to the room/area.
    II. A clearly visible "DANGER" sign in the vicinity of the entrance to the room/area.
l) Refuse may be compacted to a maximum compaction ratio of 2 to 1. Recycling material must not be compacted unless it is clean cardboard in a separate collection to co-mingled recycling material.
m) Where applicable in the case of non-residential use or development, it is recommended that waste contract provisions should require the collection and recycling of low/high grade office paper and other office equipment including: batteries, smoke detectors, fluorescent tubes, computers and televisions from the waste stream.
n) Residential and commercial waste storage, management and collection in mixed use developments and/or buildings are recommended to be separate (with separate access arrangements).
o) The provision of a minimum of 0.5 m^2 per dwelling 'bulky' storage space in residential development.

2.1.3 Waste Collection

a) With the approval of the City, receptacles stored in a bin storage area may be collected either from an onsite location within the property or inside the bin storage area at group dwellings, multi-unit and commercial developments.
b) Where receptacles are presented outside of the storage area for collections, the surfaces which are traversed must be designed to allow easy transportation of the receptacles and be finished in a way which reduces the noise of the receptacles as they are manoeuvred.
c) Gradients must not exceed 1 in 14 for two wheeled receptacles and 1 in 20 for four wheeled receptacles on the path used to transfer the receptacles from their storage location to the collection point or vehicle collection location.
d) Where onsite collections occur, roadways and infrastructure traversed by the collection vehicle must be constructed to accommodate an 18 tonne Gross Vehicle Mass.
e) Where private collections are employed the collections must comply with all local, state and federal laws and regulations.
f) Where bin rooms are secured, a compatible key system is necessary to enable access by collecting personnel/contractors. This includes the City of South Perth where the City is the collector. The City's Waste Services Units is to be consulted regarding the system prior to installation. All costs associated with the system are the responsibility of the developer, property owner/s and/or the strata managers.
g) A caretaker or strata management representative is to manage waste and recycling to ensure bins are filled consecutively, with only full bins to be presented on collection day.

2.1.4 Waste Collection Basement/Underground

a) Where onsite collections are to occur from in the basement, part basement or undercroft level of a development, or all of these levels sufficient clearance and conditions must be catered for.
b) Where waste and recyclables are to be collected in the basement level or similar, collection is to take place in the vicinity of the bin store. The bin presentation area or collection point is to be flat, with the travel path between the bin store and collection point/vehicle clear of steps or kerbs. The distance between the bin store and the presentation should be ideally no great than ten (10) metres.
c) Minimum clearance required in the basement, part basement or undercroft levels of a development is 2.4 metres. This includes clearance to all structural beams, pipe work, services or similar. The City's Waste Services shall be notified prior to any modification to the basement clearances.
d) Minimum driveway width is four (4) metres. On-site manoeuvring (turning circles etc) is to provide for ease of collection and vehicle egress in a forward manner. Where a turn-table is to be installed to facilitate forward egress, the turn-table requires a minimum 20 tonne capacity. Basement must be designed such that the service of waste bins can occur without

the requirement to reverse the waste vehicle. A 12.8 m diameter minimum turning circle is required for the low profile waste truck.

e) Access ramps and driveway gradient serving basements, part basements or undercroft areas are to cater for long wheel base vehicles 7.2 metres in length with a maximum gradient of 1:4.5.

2.2 Service Days and Frequency

The City of South Perth provides the following waste and recycling collection services:

- Waste service (residential) – one (1) day per week, Monday to Friday;
- Waste service (commercial) – seven (7) days per week; and
- Co-mingled recycling – one (1) per fortnight on garbage collection day.

2.3 Bin Types

The City of South Perth uses 240 L mobile garbage bins (MGBs) serviced by a side load waste collection truck and 660 L and 1100 L MGBs using a rear load waste collection truck. The 660 L and 1100 L MGBs are used for multi residential and commercial complexes.

This Waste Management Plan proposes the use of 660L MGBs.

The City of South Perth has adopted the following colour combinations for its waste and recycling collection services:

- Waste – green body with dark green lid; and
- Comingled recycling – green body with yellow lid.

Typical 660 L MGBs that is proposed for use in this complex are shown in **Figure 1** and **Figure 2**.

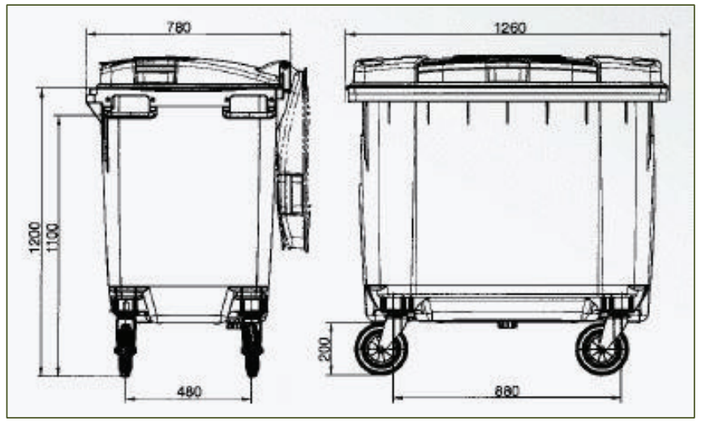

Figure 1: 660 Litre MGB dimensions

Figure 2: Typical 660 Litre MGB used for waste collection

3 Site Location

The development is located at on Lots 50, 51 and 52 Melville Parade, South Perth, refer **Figure 3**. The site is on the corner of Melville Parade and Bowman Street.

Source: City of South Perth

Figure 3: Location of the complex

The bin storage area is located on the ground floor and access will be from Melville Parade, refer **Figure 4**. The waste collection truck will be required to reverse into the dedicated waste service loading bay and travel out of the service loading bay back onto Melville Parade in a forward manner.

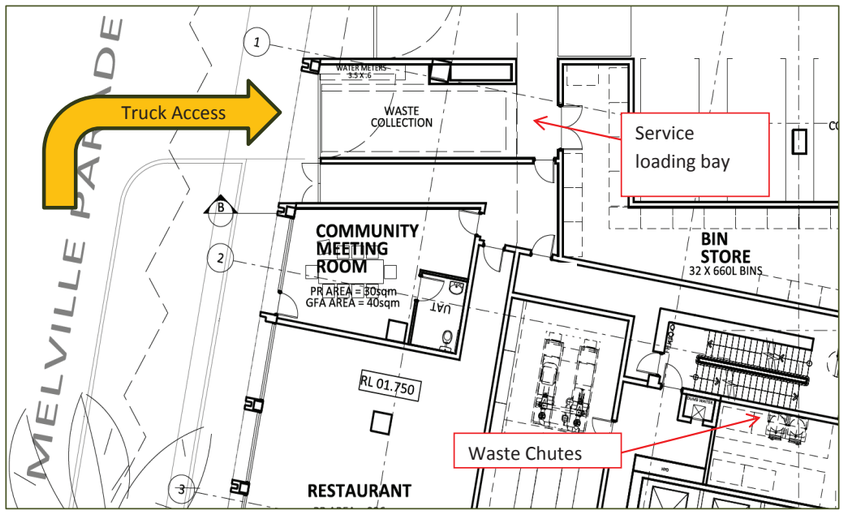

Figure 4: Proposed waste truck access

4 Quantity of Bins Required

The waste generation rates calculated below are taken from the City of South Perth *Waste Guidelines for New Developments*. The applicable waste and recycling generation rates for various types of premises are detailed within these Guidelines.

4.1 Waste and Recycling Generation Rates

The number of garbage and recycling bins required for this development is based on the waste generation rate, the types of bins and the service frequency. The Guideline suggests waste generation rates for multi-residential developments based on the number of bedrooms and commercial areas based on floor area. These waste generation rates for garbage and recycling are displayed in **Table 2**.

Table 2: Waste and recycling generation rates

Waste Stream	Dwelling Size	Waste Generation Rate
General Waste	1 bedroom	80 L/week
	2 bedroom	100 L/week
	3+ bedroom	120 L/week
Comingled recycling	1 bedroom	80 L/week
	2 bedroom	120 L/week
	3+ bedroom	120 L/week

Waste Stream	Dwelling Size	Waste Generation Rate
Commercial Garbage	Convenience Store	660 L/100 m2 floor area/day
	Restaurant	660 L/100 m2 floor area/day
	Medical Suite	10 L per week per apartment
Commercial Recycling	Convenience Store	240 L/100 m2 floor area/day
	Restaurant	200 L/100 m2 floor area/day
	Medical Suite	10 L per week per apartment

There is limited opportunity to collect paper and cardboard due to the waste and recycling chutes that are proposed to deliver waste to the bin store. The paper and cardboard has been allocated in equal proportions to the garbage and recycling stream. One (1) 660 L MGB will be placed in the bin store for the collection opportunistic of paper and cardboard.

The below quantities are associated with the one twenty three (123) residential units, sixteen (16) serviced apartments, convenience store, restaurant and medical suite. It is proposed to use 660 L MGBs for the management of waste and recycling within the complex.

Table 3: Summary of residential 660 L MGB allocation for the proposed development

Type of Premises	General Waste Generation	Recyclables Generation
Number of Units	123	123
Number of serviced Apartments	16	16
Quantity of Garbage	14,440 L per week	15,680 L per week
Service Frequency	3 days per week	2 days per week
MGB Type	660 L	660 L
No of 660 L MGBs required	8	12
Waste Compaction	Yes	No
Compaction Rate	60%	N/A
Revised MGB requirement	5	12
Total number 660 L MGBs in Bin Store	**17**	

Table 4: Summary of commercial 660 L MGB allocation for the proposed development

Type of Premises	General Waste Generation	Recyclables Generation
Convenience Store	186 m^2	186 m^2
Restaurant	244 m^2	244 m^2
Medical Suite	227 m^2	227 m^2
Quantity of Garbage	20,002 L per week	5,784 L per week
Service Frequency	3 days per week	2 days per week
MGB Type	660 L	660 L
No of 660 L MGBs required	11	5
Waste Compaction	Yes	No
Compaction Rate	60%	N/A
Revised MGB requirement	7	5
Total number 660 L MGBs in Bin Store	**12**	

Modelling has included an allowance of 1.96 m^2 for each 660 L MGB. The footprint of an 660 L MGB is 0.98 m^2. Using 1.96 m^2 for each 660 L MGB ensures sufficient room to manoeuvre MGBs within the bin store. The bin store has the capacity to comfortably store the required twelve (12) 660 L MGBs for waste and seventeen (17) MGBs for recycling as determined.

5 Bin Store

One bin store has been proposed; the bin store is located on the ground level, refer **Figure 5** and **Drawing A2-01 Ground Floor Plan**.

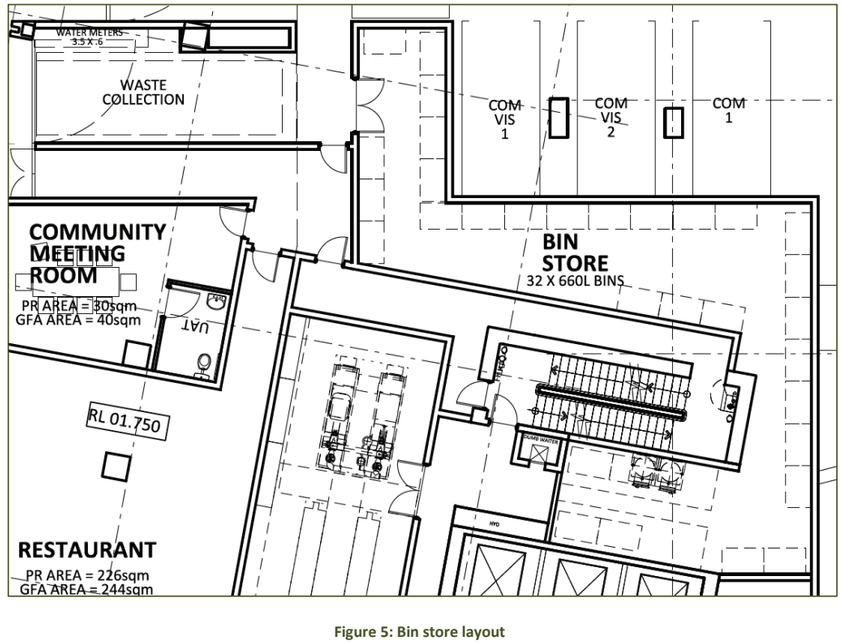

Figure 5: Bin store layout

The area of the bin store is 92 m^2 and capable of easily housing the requisite twenty nine (29), two waste chutes (garbage and recycling), an elephant foot waste compactor and an area for bulk waste storage of 10.0 m^2. Refer **Table 5**.

Table 5: Bin Store Area

Bin Bay Allocation	Area (m^2)
12 x 660 L MGBs (garbage, 0.98 m^2 per MGB)	11.76 m^2
17 x660 L MGBs (recycling, 0.98 m^2 per MGB)	16.66 m^2
Bin Chutes and Compactor	5.0 m^2
Bulk waste storage	10.0 m^2
Area for manoeuvring bins	48.58 m^2
Total area of bin store	**92.0 m^2**

5.1 Wash Bay

The bin wash bay is located at the end of the service loading bay. The wash bay will have:

- Reinforced concrete slab floor with fall to a floor waste trap connected to the sewer of minimum 75 mm diameter;
- Mechanical ventilation through the service loading bay;
- Hose cock to facilitate bin washout; and
- Walls to be sealed and painted in a light colour to facilitate washout.

5.2 Bin Store Specification

The bin store will have the following as a minimum:

- Situated within the ground floor level and not visible from Melville Parade;
- Reinforced concrete slab floor with fall to a floor waste trap connected to the sewer of minimum 75 mm diameter;
- Self-closing gates fitted at the entry to the bin store;
- Mechanical ventilation through the service loading bay ;
- Hose cock to facilitate bin store cleaning;
- Walls to be sealed and painted in a light colour to facilitate washout;
- Artificial lighting with sensor and switch control at the service loading bay and within the bin store;
- Key/swipe card entry to the bin store; and
- All applicable signage.

5.3 Signage

A regularly updated information sheet will be affixed at the entry to the bin store containing the following information to facilitate safe and efficient waste management at the proposed development. The signage will include:

- Caretaker contact details for any waste related issues;
- Bin collection days and times;
- Waste types appropriate for each bin type;
- Link to the waste management section of the City's website;
- Notice that bulk rubbish and other items are not to be stored in the bin store without approval from the Caretaker; and
- Bulk rubbish collection periods.

This information sheet will be maintained as current by the Caretaker. Any changes or amendments shall be passed on to the residents. The same sign will be affixed to the wall in each lobby adjacent to the waste chutes.

In addition to the information sheet the following signs will be displayed at the entry to the bin store:

- A Sign stating "NO STANDING"; and
- A clearly visible "DANGER" sign.

5.4 Waste Chutes

Waste chutes will be used to transfer garbage and recycling to the ground floor level from each floor of the complex. **Figure 5** shows the location of the waste and recycling chutes on each floor. Two waste chutes will be used, one for garbage and one for recycling. All waste on each floor will either be placed in the garbage or recycling chute, or for large garbage items, shall be taken directly to the bin store for placement directly into the 660 L MGBs. There is no capacity to store garbage and recycling at each level as there will be no waste room provided on the floors. The waste chutes will be a custom designed structure and be of similar design as shown in **Figure 6**.

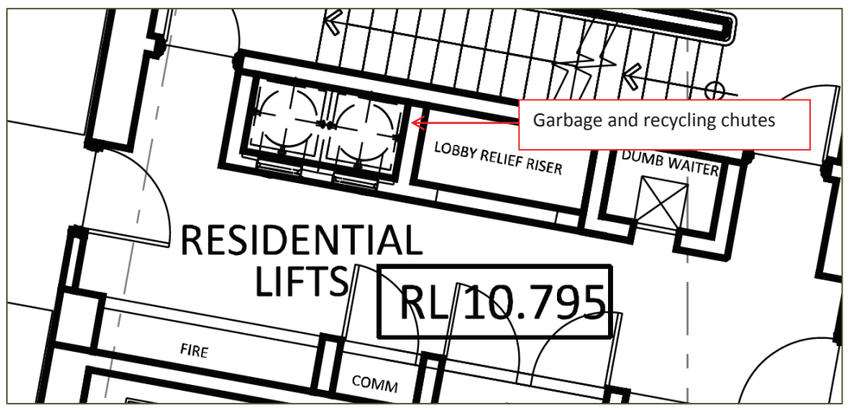

Figure 6: Location of waste chutes on a typical floor

Garbage and recycling drops at a controlled speed down the chutes to rest on flaps fitted to the bottom of the chutes. These flaps can be controlled by a weight mechanism or electronically using an App on a mobile phone.

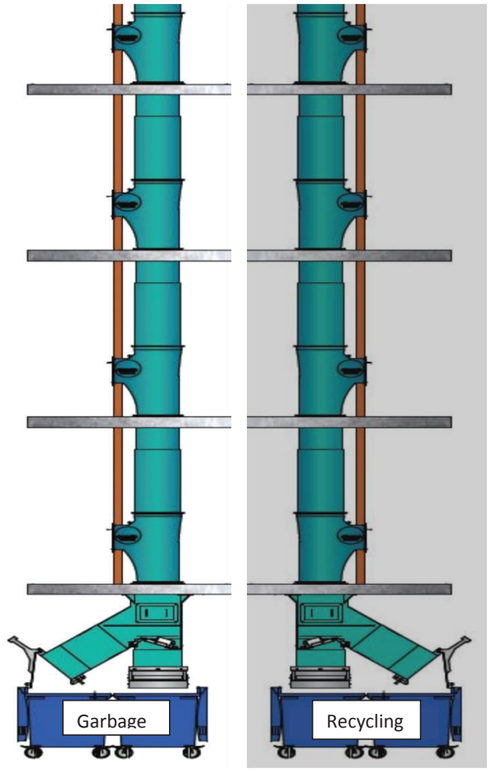

Figure 7: Typical garbage and recycling chute

5.5 Waste Compactor

Adjacent to the outlet of the waste chute will be an elephant foot waste compactor to compress the garbage in the 660 L waste MGB. It is expected that the garbage will be compacted to 60% of its original volume; a compaction rate of 60% is considered conservative. Compaction of the garbage in the MGB allows a reduced number of MGBs to be used. There will be no compaction of recycling materials. A typical elephant foot waste compactor is shown in **Figure 8**.

Figure 8: Typical MGB waste compactor

5.6 Bin Collection Area

Once the MGBs are full the Caretaker shall remove the full MGB from under the bin chute and replace with an empty MGB. The full MGB will be moved to the elephant foot compactor where the contents on the MGB will be compressed. The compacted MGB will then be placed back under the chute to receive further garbage.

Once completely filled the full MGBs will be moved up the bin store towards the service loading bay for collection. Any large items brought to the bin store by residents will be placed in an empty MGB.

The collection vehicle will enter the service loading bay located at ground level by reversing in from Melville Parade, **Figure 9**. Once in the service loading bay the collection vehicle will be clear of all pedestrian traffic. The service loading bay is built with sufficient height clearance and floor area to facilitate the easy access and exit of heavy rigid chassis vehicles.

The waste vehicle operator then empties the required MGBs and exits the service loading bay in a forward motion. The Caretaker will be present to assist the waste collection truck driver to empty the MGBs. It is the responsibility of the caretaker to ensure that the MGBs are ready at the service loading bay for collection on the appropriate days and times of day.

Figure 9: Service loading bay

6 Waste and Recycling Collection

6.1 Service Provider

It is intended that the City of South Perth will provide the garbage and recycling collection services. Waste management company Cleanaway currently provides waste services on behalf of the City. The alternative is for Strata management to engage a private waste collection contractor to provide waste and recycling collection services.

Garbage and recycling will utilise 660 L MGBs requiring rear load collection vehicles to be used.

6.2 Collection Frequency

Multiple collections per week are proposed being three (3) days per week for garbage and two (2) days per week for recycling.

6.3 Collection Process

The servicing of the MGBs from the proposed development is envisaged to proceed as follows:

- The waste collection truck will park in the designated loading bay, refer **Figure 9**;
- MGBs will be brought to the truck from the bin store by the Caretaker;
- The waste collection driver will empty the MGBs into the truck;
- Empty MGBs will be taken back in to the bin store by the Caretaker; and
- Waste collection truck will exit the service loading bay and continue on its collection route.

6.4 Waste Acceptance

Unless otherwise agreed with the City of South Perth and the collection contractor waste placed outside the MGBs will not be collected. The types of waste for placement in the waste and recycling MGBs are outlined below.

6.4.1 Waste MGBs

The following waste will be accepted in the waste MGBs:

- General waste; and
- Organic waste including food waste, grass clippings and small prunings.

Items listed below must NOT be placed in the waste MGBs:

- Asbestos;
- Gas bottles;
- Fire extinguishers;
- Household chemicals;
- Construction and demolition materials;
- Pharmaceuticals and medicines;
- Radioactive materials; or
- Items containing metals such as copper, zinc, cadmium, mercury or lead (i.e. batteries or fluorescent lights).

6.4.2 Recycling MGBs

The following recyclables are normally accepted as loose in the recycling MGBs:

- Glass bottles and jars;
- All plastic containers (types 1 to 7);
- Milk and juice cartons;
- All types of paper;
- Cardboard and cardboard containers; and
- Aluminium and steel cans.

Items not to be placed in the recycling MGBs include:

- Food scraps;
- Clothing;
- Plastic bags;
- Oil containers;
- Ceramics; and
- Fluorescent lights.

6.5 Special Waste Types

6.5.1 Bulk Waste

The City of South Perth provides one (1) bulk waste collection and two (2) bulk greenwaste collections per year. Bulk waste is normally placed at the verge in a tidy and separated manner. The City's bulk waste collection for the location of the proposed development is November.

The City of South Perth in its memorandum dated October 27, 2017, Jason Jenke, advised that there will be no bulk verge collection as the complex is too large. It is proposed that a private contractor will be engaged through Strata Management to collect bulk waste on a scheduled basis. Residents will be encouraged to store bulk waste within their apartments until the scheduled collection time.

An area of 10.0 m^2 has been allocated for bulk waste storage in the bin store. There is a further 48.58 m^2 within the bin store for manoeuvring bins, part of which could be used for temporary storage of bulk waste on collection day. The bulk waste will be collected from within the complex at the service loading bay. Residents and the Caretaker will deliver bulk waste items to the service loading bay on the day of scheduled collection.

The bulk waste collection service will collect the following:

- Household furniture (lounges, mattresses, desks etc.);
- White goods (stoves, dishwashers, washing machines, clothes drivers);
- Fridges and freezers (doors removed);
- General junk, small electrical goods, carpet, linoleum, mattresses and metal items no longer than 1.5m;
- Unwanted pine (untreated pine materials, firewood, logs, timber, furniture); and
- E-Waste items such as computers and televisions.

The bulk waste collection service will not remove the following:

- Garden waste;
- Hazardous waste (oil, pesticides, solvents, chemicals, paint, batteries, asbestos, globes/tubes, machine parts, motor oil, paints/solvents, and tyres);
- Building materials (bricks, rubble, sand, and cement);
- Tyres, batteries, motor vehicle parts;
- Asbestos cement products;
- Household waste;
- Gas cylinders;
- Plate glass such as windows or shower screens; or
- Items longer than 1.5 m.

6.5.2 Household Hazardous Waste

Household hazardous waste includes:

- Flammable liquids;
- Petrol;
- Paints;
- Acids;
- Chemicals;
- Poisons; and
- Gas cylinders.

The City of South Perth promotes the disposal of household hazardous waste at the Canning Waste Transfer Station located at Lot 502 Ranford Road, Canning Vale or the Armadale Landfill and Recycling Facility located at Hopkinson Road, Brookdale. Residents with household hazardous waste can obtain further information regarding disposal from the Caretaker or from the City of South Perth website www.southperth.wa.gov.au

6.5.3 Free Recycling

The City of South Perth offers a free collection service for the following items:

- E-Waste;
- Clean and uncontaminated cardboard;
- Uncontaminated used motor oil;
- All scrap metal including fridges, washing machines and microwaves;
- Fluorescent lighting tubes and globes; and

- Household and vehicle batteries.

Residents are requested to contact the Caretaker to make arrangement for collection or contact the City of South Perth website www.southperth.wa.gov.au

7 Waste Management Responsibilities

7.1 Residents

The residents will be responsible to undertake the following:

- Practice correct waste separation of garbage and recycling;
- Deposit recyclables loose in the recycling chute (not bagged);
- Coordinate with the Caretaker in regards to waste management practices and report any issues;
- Store bulk waste within their apartments until collection day;
- Present bulk waste at the bin store or service loading bay immediately prior to the scheduled bulk waste collection day and advise the Caretaker; and
- Keep updated on the current waste services information displayed at the waste chutes and on the City of South Perth website www.southperth.wa.gov.au

7.2 Commercial Tenants

The commercial tenants will be responsible to undertake the following:

- Practice correct waste separation of garbage and recycling;
- Deposit recyclables loose in the recycling MGBs;
- Coordinate with the Caretaker in regards to waste management practices and report any issues;
- Store bulk waste within their premises until collection day;
- Present bulk waste at the bin store or service loading bay immediately prior to the scheduled bulk waste collection day and advise the Caretaker; and
- Keep updated on the current waste services information displayed at the waste chutes and on the City of South Perth website www.southperth.wa.gov.au

7.3 Caretaker

The Caretaker will be responsible to undertake the following:

- Inspect the waste chutes on each floor of the complex on a daily basis to ensure that there is no accumulation of waste in the lobby areas, that signage is visible, lobby areas are clean and that the waste chutes are functioning correctly;
- Ensure that the doors on the waste chutes at the bin store are functioning correctly and that there is no blockages in the waste chutes;
- Change the 660 L MGBs at the base of the waste chutes in the bin store as the MGBs become full;
- Compact garbage in the 660 L MGBs to increase bin capacity;
- Clean and maintain the MGBs and bin store;
- Washing and deodorising MGBs as required;

- Schedule preventative maintenance on bin chutes and waste compactor in accordance with manufacturers' specifications;
- Liaise with the waste collection contractor to organise a suitable time for garbage and recycling collection to take place;
- Keep up to date with waste collection issues such as public holiday collection schedules, local service disruptions or changes in collection days;
- Keep up to date with the City of South Perth's waste management policies and practices;
- Coordinate with the residents to place the bulk waste in the bin store and service loading bay at the scheduled collection day;
- Schedule with a private waste contractor to collect bulk waste; and
- Keep updated on the current waste services information displayed on City of South Perth's website www.southperth.wa.gov.au

The Caretaker may also be required by Strata Management to perform other duties in addition to those duties included in this Waste Management Plan.

7.4 Strata Management

The Strata Manager will be required to engage a Caretaker to manage the waste collection and the bin store. The engagement of a Caretaker will form part of the Strata Management Agreement for the property, endorsed by all building owners. Provision for the payment of the Caretaker will be included in the annual strata fees.

The Strata Manager's responsibilities are listed below:

- Appoint a Caretaker to manage waste and related activities at the complex;
- Appoint a waste collection contractor to collect bulk waste generated by residents;
- Liaise with the City of South Perth and the City's collection contractor to coordinate the collection day and time for MGB collection;
- Ensure preventative maintenance on bin chutes and waste compactor is carried out in accordance with manufacturers' specifications;
- Remaining aware of changes to collection schedules, the City's waste collection procedures or other issues that may affect the provision of waste collection services;
- Updating information displayed at the bin store and waste chutes as required;
- Coordinating the Caretaker and the private bulk waste contractor for the placement of bulk waste in the bin store and service loading bay on the nominated collection day; and
- Promoting correct waste separation awareness with the residents and tenants.

8 Contingencies

The City of South Perth in its memorandum dated October 27, 2017 expressed concern regarding equipment breakdown and delays in scheduled collections. The Strata Manager will be responsible for ensuring that all equipment is maintained in accordance with equipment manufacturers' recommendations.

The bin store has the capacity to store an additional three (3) MGBs. This provides capacity to store a further 2,000 L of combined garbage and recycling. Along with the surplus space in the bin store the

bin store, plus the 10 m^2 reserved for bulk waste, the bin store can easily store two days' worth of additional garbage and recycling.

The garbage collection schedule is three (3) times per week and the recycling is twice (2) per week. The low frequency in collection rate allows Strata Management to make alternate arrangements should the City of South Perth be experiencing delays in its waste and recycling collection.

9 Waste Management Plan Review

On a regular basis (annually at minimum), the Waste Management Plan will require reviewing and updating to address any performance shortfalls, improvements and/or any changes in waste management operating procedures. Any changes to this Waste Management Plan must be approved by the Strata Management and the City of South Perth.

10 City of South Perth Check List

This section responds to the City of South Perth's requirements detailed in its *Waste Guidelines for New Developments* to confirm compliance of the waste management services proposed to be undertaken at the complex are with the City's requirements.

10.1 Waste Receptacles

i. All refuse and recycling material generated within a development is required to be stored in appropriate waste receptacles as determined by the City.

All waste and recycling will be stored in 660 L MGBs with the exception of small amounts of bulky waste items that will be stored temporarily in the bin store awaiting collection.

ii. Waste other than refuse and recycling material must be stored in appropriate receptacles as approved by the City. This can include, but is not limited to, cooking oil, medical waste and hazardous substances.

Liquid, medical and house hold hazardous waste will not be stored in the bin store.

iii. Single Residential Developments are required to use 240L MGBs for refuse and recycling material.

The complex is a multi-residential building housing 123 residential units and 16 serviced apartments.

iv. Grouped Dwellings, Multi-unit and Commercial Development's may store waste in larger receptacles with the City's approval.

660 L MGBs have been proposed for the collection of garbage, recycling and paper and cardboard.

v. Where Individual Units/Dwellings within Grouped Dwellings and Multi-unit Developments are allocated their own receptacles, these receptacles must be 240L MGBs for refuse and recycling material.

Not applicable.

*vi. The number of receptacles provided must be sufficient to store the anticipated waste generation as derived from **Appendix A – Waste Generation Rates**.*

Garbage and recycling quantities have been determined in accordance with the City's *Waste Guidelines for New Developments.*

10.2 Waste Storage

i. All developments must provide suitable storage for waste receptacles to the satisfaction of the City.

A dedicated bin store has been provided for the storage of 660 L MGBs for the collection of garbage and recycling.

ii. Sufficient space must be provided to store refuse and recycling material in separate receptacles.

The bin store is of sufficient size to store the appropriate number of MGBs and provide room to manoeuvre the MGBs within the bin store.

iii. The storage location of receptacles must be located behind the front building setback.

The bin store is located within the ground level floor and not visible from Melville Parade.

iv. Receptacles must be stored in locations that are reasonably secured from theft and vandalism.

The bin store shall be fitted with self-closing lockable gates.

v. Receptacles must not be visible from the property boundary except when presented for collection.

MGBs will not be visible from Melville Parade except at times of collection when MGBs will be moved to the service loading bay.

vi. Bin rooms or compounds may be required at Grouped Dwellings with 10 or more units, Multi-unit and Commercial Developments subject to the City's approval.

Bin store is provided on the ground level.

vii. Bin rooms and compounds must have a smooth impervious floor sloped to a drain connected to the sewer system of not less than 75 millimetres in think-ness subject to the City's approval.

Floor of bin store will be reinforced concrete and the area under the waste chutes will drain to a sump within the bin store and be connected to the sewer via a pipe of diameter no less than 75 mm.

viii. The bin room or compound must be undercover and be designed to not permit storm water to enter into the drain.

The bin store is undercover and located within the ground level.

ix. The bin room or compound must have enough space to facilitate the cleaning of receptacles inside the bin storage area.

An area of 48.58 m^2 has been allocated in the bin store to manoeuvre MGBs.

x. Walls and floors of bin storage areas must be constructed of a material which facilitates the cleaning of the bin storage area.

Walls will be sealed and painted in a light colour to facilitate washout.

xi. Bin rooms or compounds must be fitted with a self-closing gate.

Self-closing gates shall be fitted to the entry of the bin store.

xii. Enclosed bin rooms or compounds must be ventilated to a suitable standard as approved by the City.

Mechanical ventilation will be provided for the bin store and vented through the service loading bay via the gates.

xiii. Where mechanical ventilation is used, the outlet for vented air must be in a location which will not adversely impact residents.

Ventilation will be into the service loading bay.

xiv. Bin stores shall be provided with artificial lighting, sensor or switch controlled both internal/external to the room or area. All lighting in open areas to comply with AS4282-1997 (control of Obtrusive Outdoor Lighting).

Artificial lighting with sensor and switch control will be provided at the service loading bay and within the bin store.

xv. Vermin must be excluded from the bin storage area.

Vermin control measures shall be employed within the complex, long term storage of waste will not occur.

xvi. Sufficient space must be provided to allow the easy passage of receptacles in and out of the bin storage area.

Additional area of 48.58 m^2 has been provided in the bin store to manoeuvre MGBs.

xvii. Waste other than refuse and recycling material is required to be stored in a suitable manner as approved by the City.

All waste and recycling will be stored in 660 L MGBs with the exception of small amounts of bulky waste items that will be stored temporarily in the bin store awaiting collection.

xviii. Bin stores require the following signs and/or information to be displayed:

i. A Sign stating "NO STANDING" at the entrance to the room/area.

ii. A clearly visible "DANGER" sign in the vicinity of the entrance to the room/area.

The above additional signage will be displayed at the entry to the bin store.

xix. Refuse may be compacted to a maximum compaction ratio of 2 to 1. Recycling material must not be compacted unless it is clean cardboard in a separate collection to co-mingled recycling material.

There will be compaction of garbage with an estimated 60% volume reduction. There will be no compaction of recycling.

Preferred (Recommended)

xx. Where applicable in the case of non-residential use or development, waste contract provisions should require the collection and recycling of low/high grade office paper and other office equipment including: batteries, smoke detectors, fluorescent tubes, computers and televisions from the waste stream.

The commercial premises and residential tenants will be encouraged to separate recyclable materials from their waste stream.

xxi. Residential and Commercial Waste storage, management and collection in mixed use developments and/or buildings is recommended to be separate (with separate access arrangements)

Commercial tenants located at ground level will have dedicated garbage and recycling MGBs. Garbage and recycling from the residents of the tower will have their own 660 L MGBs managed by the Caretaker.

xxii. The provision of a minimum of 0.5 m^2 per dwelling 'bulky' storage space in residential development.

An area of 10.0 m^2 has been allocated in the bin store for the temporary storage of bulky waste. Residents will be encouraged to retain bulk waste items in their apartments until the next scheduled collection day.

10.3 Waste Collection

i. Receptacles must be presented to the verge on the specified collection day for collection.
ii. Receptacles placed on the verge for collection must not be placed on a neighbouring verge.
iii. Receptacles placed for collection on the verge must not obstruct pedestrians, street furniture or bike lanes.
iv. Where four wheeled receptacles or more than 5 x 240L MGBs are to be presented to the verge, an area must be paved to accommodate the receptacles on the verge and allow passage to and from the storage area.
v. The space required for collection from the verge must not exceed one third of the property frontage or 15 receptacles.
vi. Where approval is given for the collection of waste and recyclables from the road (at the pre-application stage, or via the development application process), consideration needs to be given to a 12.5 metre long truck where access and/or manoeuvrability is difficult or limited.

vii. With the approval of the City, receptacles stored in a bin storage area may be collected either from an onsite location within the property or inside the bin storage area at Group Dwellings, Multi-unit and Commercial Developments.

Collection will occur in the service loading bay.

viii. Where receptacles are presented outside of the storage area for collections, the surfaces which are traversed must be designed to allow easy transportation of the receptacles and be finished in a way which reduces the noise of the receptacles as they are manoeuvred.

ix. Gradients must not exceed 1 in 14 for two wheeled receptacles and 1 in 20 for four wheeled receptacles on the path used to transfer the receptacles from their storage location to the collection point or vehicle collection location.

The floor of the service loading bay and bin store will be reinforced concrete with a smooth level surface.

x. Where onsite collections occur, roadways and infrastructure traversed by the collection vehicle must be constructed to accommodate an 18 tonne Gross Vehicle Mass.

Pavements traversed by heavy vehicles will be designed to accommodate a 25 tonne heavy vehicle.

xi. Waste which is likely to become putrid such as wet organic waste must be collected at a frequency which reduces the likelihood of this material causing offence. Alternatively the City may approve at its discretion, storage of this waste in a way which reduces this likelihood, such as refrigerated storage rooms.

Foodwaste from the restaurant will be delivered to the bin store in plastic bags. MGBs will be emptied three (3) times per week. This will stop garbage becoming putrid.

xii. Where private collections are employed the collections must comply with all local, state and federal laws and regulations.

Collections are proposed to be carried out by the City's waste contractor. If collections are carried out by a private contractor all of the City's requirements will be met.

xiii. Where Bin Room are secured, a compatible key system is necessary to enable access by collecting personnel/contractors. This includes the City of South Perth where the City is the collector. The City's Waste Services Units is to be consulted regarding the system prior to installation. All costs associated with the system are the responsibility of the developer, property owner/s and/or the strata managers.

A key lock or swipe card entry will be adopted for entry to the bin store. The collection driver, commercial tenants (offices and café), Strata management and the Caretaker will have access to the bin store.

xiv. A caretaker or strata management representative is to manage waste and recycling to ensure bins are filled consecutively, with only full bins to be presented on collection day.

The day to day management of the bin store will be carried out by the Caretaker under the supervision of Strata management.

10.4 Waste Collection Basement/Underground

Where onsite collections are to occur from in the basement, part basement or undercroft level of a development, or all of these levels sufficient clearance and conditions must be catered for.

i. Where waste and recyclables are to be collected in the basement level or similar, collection is to take place in the vicinity of the bin store. The bin presentation area or collection point is to be flat, with the travel path between the bin store and collection point/vehicle clear of steps or kerbs. The distance between the bin store and the presentation should be ideally no great than ten (10 metres).

The bin store is next to the service loading bay, both have a smooth level surface.

ii. Minimum clearance required in the basement, part basement or undercroft levels of a development is 2.4 metres. ***Appendix C – Collection Vehicle Specifications*** *This includes clearance to all structural beams, pipe work, services or similar. The City's Waste Services shall be notified prior to any modification to the basement clearances.*

The minimum overhead clearance is sufficient for a small rear load waste collection truck.

iii. Minimum driveway width is four (4) metres. On-site manoeuvring (turning circles etc) is to provide for ease of collection and vehicle egress in a forward manner. Where a turn-table is to be installed to facilitate forward egress, the turn-table requires a minimum 20 tonne capacity. Basement must be designed such that the service of waste bins can occur without the requirement to reverse the waste vehicle. An 12.8m diameter minimum turning circle is required for the low profile waste truck.

At its narrowest point the service loading bay is 3.0 m wide. This is considered sufficient to reverse a small rear load truck into the service loading bay. The collection trucks will be required to reverse into the service loading bay.

iv. Access ramps and driveway gradient serving basements, part basements or undercroft areas are to cater for long wheel base vehicles 7.2 metres in length with a maximum gradient of 1:4.5.

The bin store and service loading bay are both at ground level. The service loading bay is of sufficient length to fully house waste collection vehicle up to 9.5 m in length with sufficient area to empty the MGBs.

11 Drawings

Drawing A2-01 Ground Floor Plan