NATURAL VENTILATION STATEMENT

LOTS 3, 4 AND 5 ANDALUSIAN WAY, CASTLE HILL

WI084-04F01(REV0)- NVS REPORT

JANUARY 24, 2024

Prepared for:

Deicorp Projects (Showground East) Pty Ltd

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AT THE LEADING EDGE

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DOCUMENT CONTROL

Date	Revision History	Issued Revision	Prepared By (initials)	Instructed By (initials)	Reviewed & Authorised by (initials)
January 24, 2023	Update of natural ventilation statement (ref: WI084-01F04(rev0)-NVS Report - dated, 21 December, 2023) to reflected changes to building design.	0	ALD	SWR	MLO

EXECUTIVE SUMMARY

This report presents an opinion on the natural ventilation performance of the various residential apartments of the proposed development located at Hills Showground Precinct East, 3 Andalusian Way, Castle Hill, based on the architectural drawings prepared by the architects GSA (Lots 3 and 4) and Turner (Lot 5) received 22 January 2024. The results of the assessment are based on our extensive experience in modelling of natural ventilation in buildings and our understanding of the guidelines for wind-driven natural cross ventilation provided in the Apartment Design Guide (ADG) within the State Environmental Planning Policy No. 65 (SEPP65).

Results (Based of SEPP65):

The results of the assessment indicate that a total of 56% (297 out of 530) of the residential apartments across the development will achieve adequate levels of natural cross ventilation as per SEPP65, which is less than the required minimum of 60%. Per building: 64% (45 of 70) of the apartments in Building A, 59% (57 of 97) of the apartments in Building B, 60% (49 of 81) of the apartments in Building C, 58% (101 of 173) of the apartments in Building D, and 42% (46 of 109) of the apartments in Building E will achieve adequate levels of natural cross ventilation. Natural cross ventilation has been achieved through openings on orthogonal or opposite aspects (for example corner or through apartments), with direct exposure to prevailing winds or windows located in significantly different pressure regions as defined within Section 4B of the ADG.

This has been achieved within corner and cross-through apartments with the proposed openings in the form of operable windows and doors located in significantly different pressure regions along the adjacent aspects. This will be effective in generating pressure driven air flow through the apartment as the incident wind travels from the positively pressurised windward opening and exhausted to the negative or neutrally pressurised sideward opening.

Further Assessment:

A further assessment of the current design has been undertaken to determine additional apartments that could be considered as adequately naturally ventilated based on the inclusion of various treatments. It has been determined that for:

Building B:

- Apartments 303 and 304 – Incorporation of a horizontal plenum leading to the eastern aspect.
- **Note:** Apartments 404, 407, 504, 507, 604, 607, 704, and 707 have been considered to be naturally ventilated as part of this assessment due to the alcove protruding in the direction of the Level 4 communal terrace. The combination of the alcove's significant offset from the main building façade and Windtech's analysis of the prevailing winds indicates that it is likely that the alcove will be in a significantly different pressure region to that of the main building façade, allowing pressure-driven cross-ventilation.

Building D

- Apartments 810, 818, 824 – Incorporation of a horizontal plenum leading to the south-eastern aspect.

Building E

- Apartments 210 to 213, 308 to 310, 405, 409 to 411, 505, 509 to 511, 605, 609 to 611, and 705 – Incorporation of a horizontal plenum leading to the south-eastern aspect.

With the considerations of the above listed apartments, a total of 61% (323 out of 530) of the residential apartments across the entire development are expected to satisfy the ADG requirements for cross-ventilation. Per building: 64% (45 of 70) of the apartments in Building A, 61% (59 of 97) of the apartments in Building B, 60% (49 of 81) of the apartments in Building C, 60% (104 of 173) of the apartments in Building D, and 60% (66 of 109) of the apartments in Building E are expected to satisfy the ADG requirements for natural cross-ventilation.

Important Note: It is important that the naturally cross ventilated flow path does not flow through a bathroom in order to avoid issues with odours. Additionally, each habitable room should have an unobstructed opening size of at least of 5% of the floor area served by the opening, in accordance with Objective 4B-1 of the ADG and have a minimum free area of 0.4m^2 in order to provide effective natural ventilation.

CONTENTS

1 INTRODUCTION

This report presents an opinion on the natural ventilation performance of the various residential apartments of the proposed development. The analysis was conducted based on the based on the architectural drawings prepared by the architects GSA (Lots 3 and 4) and Turner (Lot 5) both received 22 January 2024 (refer to Table 1 below). The results of the assessment are based on our extensive experience in modelling of natural ventilation in buildings and our understanding of the guidelines for wind-driven natural cross ventilation provided in the Apartment Design Guide (ADG) within the State Environmental Planning Policy No. 65 (SEPP65).

If required, a further assessment is undertaken to determine additional apartments that could be considered as adequately naturally ventilated with the inclusion of various treatments.

Table 1: List of Architectural Drawings Referenced

Drawing No. and Title	Revision Number	Date
DA-0000 - DRAWING LIST	E	19/12/2023
DA-0001 - LOCATION PLAN	C	19/12/2023
DA-0002 - PROPOSED SITE PLAN	C	19/12/2023
DA-0004 - BUILDING ENVELOPE	C	19/12/2023
DA-2003 - LOWER GROUND FLOOR PLAN	H	19/12/2023
DA-2004 - GROUND FLOOR PLAN	G	19/12/2023
DA-2005 - LEVEL 1-2 FLOOR PLAN (Typical)	F	19/12/2023
DA-2006 - LEVEL 3 FLOOR PLAN	F	19/12/2023
DA-2007 - LEVEL 4 FLOOR PLAN	F	19/12/2023
DA-2007 - LEVEL 4 FLOOR PLAN	G	19/12/2023
DA-2008 - LEVEL 5-9 FLOOR PLAN (Typical)	E	19/12/2023
DA-2101 - A - GROUND FLOOR PLAN	G	19/12/2023
DA-2102 - A - LEVEL 1-3 PLAN (Typical)	G	19/12/2023
DA-2103 - A - LEVEL 4 FLOOR PLAN	G	19/12/2023
DA-2104 - A - LEVEL 5-12 PLAN (Typical)	F	19/12/2023
DA-2110 - B - LOWER GROUND FLOOR PLAN	F	19/12/2023
DA-2111 - B - GROUND FLOOR PLAN	F	19/12/2023
DA-2112 - B - LEVEL 1-2 FLOOR PLAN (Typical)	F	19/12/2023
DA-2113 - B - LEVEL 3 FLOOR PLAN	F	19/12/2023
DA-2114 - B - LEVEL 4 FLOOR PLAN	G	19/12/2023
DA-2115 - B - LEVEL 5-9 FLOOR PLAN (Typical)	E	19/12/2023
DA-2120 - C - LOWER GROUND FLOOR PLAN	H	19/12/2023
DA-2121 - C - GROUND FLOOR PLAN	H	19/12/2023
DA-2122 - C - LEVEL 1-2 FLOOR PLAN (Typical)	G	19/12/2023
DA-2123 - C - LEVEL 3 FLOOR PLAN	G	19/12/2023
DA-2124 - C - LEVEL 4 FLOOR PLAN	G	19/12/2023

Drawing No. and Title	Revision Number	Date
DA-2125 - C - LEVEL 5-12 FLOOR PLAN (Typical)	F	19/12/2023
DA-3000 - OVERALL ELEVATION A	E	19/12/2023
DA-3001 - OVERALL ELEVATION B	E	19/12/2023
DA-3002 - BUILDING A- NORTH & SOUTH ELEVATION	E	19/12/2023
DA-3003 - BUILDING A&B - EAST ELEVATION	E	19/12/2023
DA-3004 - BUILDING A&B - WEST ELEVATION	E	19/12/2023
DA-3005 - BUILDING B- SOUTH ELEVATION	E	19/12/2023
DA-3006 - BUILDING B- NORTH ELEVATION	E	19/12/2023
DA-3007 - BUILDING C - NORTH & EAST ELEVATIONS	F	19/12/2023
DA-3008 - BUILDING C - SOUTH & WEST ELEVATIONS	F	19/12/2023
DA-3012 - BUILDING A- NORTH & SOUTH ELEVATION RENDER	A	19/12/2023
DA-3013 - BUILDING A&B - EAST ELEVATION RENDER	A	19/12/2023
DA-3014 - BUILDING A&B - WEST ELEVATION RENDER	A	19/12/2023
DA-3015 - BUILDING B- SOUTH ELEVATION RENDER	A	19/12/2023
DA-3016 - BUILDING B- NORTH ELEVATION RENDER	A	19/12/2023
DA-3017- BUILDING C - NORTH & EAST ELEVATIONS RENDER	A	19/12/2023
DA-3018 - BUILDING C - SOUTH & WEST ELEVATIONS RENDER	A	19/12/2023
DA-3200 - SECTION A-A	F	19/12/2023
DA-3201 - SECTION B-B	E	19/12/2023
DA-3202 - SECTION C-C	E	19/12/2023
DA-3203 - SECTION D-D	E	19/12/2023
DA-3204 - SECTION E-E	F	19/12/2023
DA-000-002 - Title Sheet	S1	17/01/2024
DA-010-010 - Context Plan	S1	17/01/2024
DA-110-007 - 110 GA Plans Overall Lower Ground Level	S1	17/01/2024
DA-110-008 - 110 GA Plans Overall Ground Level	S1	17/01/2024
DA-110-010 - 110 GA Plans Overall Level 01	S1	17/01/2024
DA-110-020 - 110 GA Plans Overall Level 02	S1	17/01/2024
DA-110-030 - 110 GA Plans Overall Level 03	S1	17/01/2024
DA-110-040 - 110 GA Plans Overall Level 04	S1	17/01/2024
DA-110-050 - 110 GA Plans Overall Level 05	S1	17/01/2024
DA-110-060 - 110 GA Plans Overall Level 06	S1	17/01/2024
DA-110-070 - 110 GA Plans Overall Level 07	S1	17/01/2024
DA-110-080 - 110 GA Plans Overall Level 08	S1	17/01/2024
DA-110-160 - 110 GA Plans Overall Roof Level	S1	17/01/2024
DA-111-008 - 111 GA Plans Building D Lower Ground Level	S1	17/01/2024
DA-111-009 - 111 GA Plans Building D Ground Level	S1	17/01/2024
DA-111-010 - 111 GA Plans Building D Level 01	S1	17/01/2024

Drawing No. and Title	Revision Number	Date
DA-111-020 - 111 GA Plans Building D Level 02	S1	17/01/2024
DA-111-030 - 111 GA Plans Building D Level 03	S1	17/01/2024
DA-111-040 - 111 GA Plans Building D Level 04	S1	17/01/2024
DA-111-050 - 111 GA Plans Building D Level 05	S1	17/01/2024
DA-111-060 - 111 GA Plans Building D Level 06	S1	17/01/2024
DA-111-070 - 111 GA Plans Building D Level 07	S1	17/01/2024
DA-111-080 - 111 GA Plans Building D Level 08	S1	17/01/2024
DA-112-008 - 112 GA Plans Building E Lower Ground Level	S1	17/01/2024
DA-112-009 - 112 GA Plans Building E Ground Level	S1	17/01/2024
DA-112-010 - 112 GA Plans Building E Level 01	S1	17/01/2024
DA-112-020 - 112 GA Plans Building E Level 02	S1	17/01/2024
DA-112-030 - 112 GA Plans Building E Level 03	S1	17/01/2024
DA-112-040 - 112 GA Plans Building E Level 04	S1	17/01/2024
DA-112-050 - 112 GA Plans Building E Level 05	S1	17/01/2024
DA-112-060 - 112 GA Plans Building E Level 06	S1	17/01/2024
DA-112-070 - 112 GA Plans Building E Level 07	S1	17/01/2024
DA-210-101 - 210 GA Elevations Building D1 North Elevation	S1	17/01/2024
DA-210-102 - 210 GA Elevations Building D1 South Elevation	S1	17/01/2024
DA-210-201 - 210 GA Elevations Building D2 North Elevation	S1	17/01/2024
DA-210-202 - 210 GA Elevations Building D2 South Elevation	S1	17/01/2024
DA-210-301 - 210 GA Elevations Building E1 North Elevation	S1	17/01/2024
DA-210-302 - 210 GA Elevations Building E1 South Elevation	S1	17/01/2024
DA-210-401 - 210 GA Elevations Building E2 North Elevation	S1	17/01/2024
DA-210-402 - 210 GA Elevations Building E2 South Elevations	S1	17/01/2024
DA-210-501 - 210 GA Elevations Building E East Elevation	S1	17/01/2024
DA-210-502 - 210 GA Elevations Building D East Elevation	S1	17/01/2024
DA-210-503 - 210 GA Elevations Building D West Elevation	S1	17/01/2024
DA-210-504 - 210 GA Elevations Building E West Elevation	S1	17/01/2024
DA-210-601 - 210 GA Elevations Building D Internal Courtyard East Elevation	S1	17/01/2024
DA-210-602 - 210 GA Elevations Building E Internal Courtyard East Elevation	S1	17/01/2024
DA-310-101 - 310 GA Sections Section AA	S1	17/01/2024

2 REGIONAL WIND CLIMATE

The Castle Hill region is governed by three principal wind directions, and these can potentially affect the subject development. These winds prevail from the north-east, south to south-east, and west. This summary is based on an analysis of wind rose data obtained by the Bureau of Meteorology from Bankstown Airport between 1993 and 2016. Directional plots of the daily average winds when temperatures are between 20-29.5°C; which is the thermal comfort range for this region is shown in Figure 1 below (when occupants tend to open windows for ventilation). These plots have been produced The Castle Hill region is governed by three principal wind directions, and these can potentially affect the subject development. These winds prevail from the north-east, south to south-east, and west. This summary is based on an analysis of wind rose data obtained by the Bureau of Meteorology from Bankstown Airport between 1993 and 2016. Directional plots of the daily average winds when temperatures are between 20-29.5°C; which is the thermal comfort range for this region is shown in Figure 1 below (when occupants tend to open windows for ventilation). These plots have been produced based on an analysis of recorded wind speed data obtained from Bankstown Airport from 1993 to 2016.

Natural ventilation for a residential apartment is most beneficial during the warmer times of the year, when the occupants of the apartment are most likely to open the windows and/or doors and also when the cooling effect of airflow through the apartment is most effective. An analysis of the Castle Hill wind climate data within the thermal comfort zone range indicates that more than half of the wind events occur from the 'NNE' to 'S' sector, where the 'NNE' to 'NE' and 'SE' to 'S' sector winds are the most dominant.

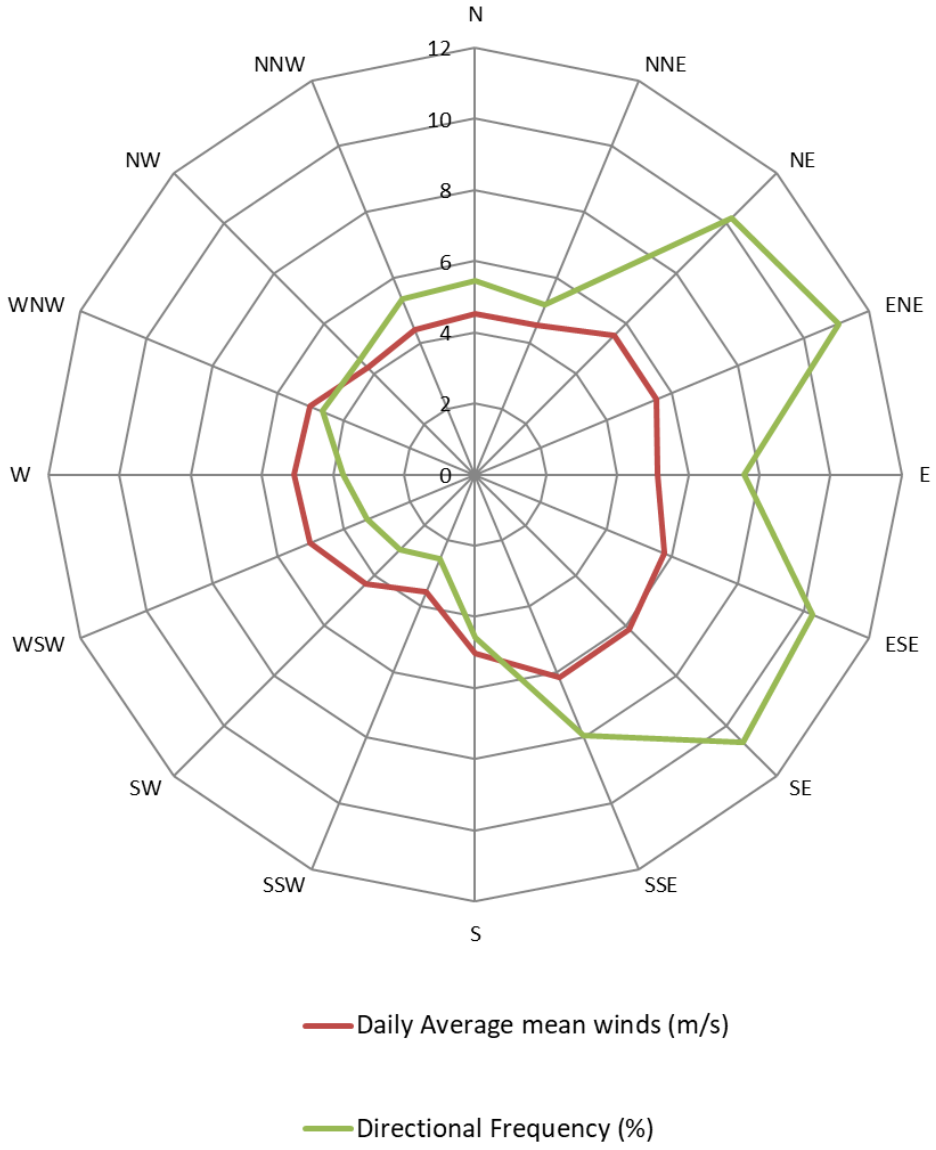

Figure 1: Daily Average Hourly Mean Wind Speeds, and Frequencies Occurrences,
for the Castle Hill Region for Outdoor Temperatures between 20-29.5°C
(based on observations from Bankstown Airport from 1995 to 2016, corrected to open terrain at 10m)

3 NATURAL CROSS VENTILATION OF DEEMED TO SATISFY APARTMENTS

Natural ventilation of indoor areas can be used to improve both the level of occupant comfort and the air quality of an internal space. Natural ventilation is beneficial in improving occupant comfort during the warmer months of the year when the occupants will generally have windows and doors open, while during the winter months it is considered primarily beneficial for air quality purposes only.

The predominant wind directions for the region have been analysed in Section 1 of this report, and from this analysis only the north-easterly and southerly winds should be considered as contributors to natural ventilation for occupant comfort purposes, since these are the predominant wind directions during the warmer months of the year. The westerly winds are predominant during the cooler winter months and would be beneficial for air quality purposes only.

The NSW State Environmental Planning Policy No. 65 (SEPP65) states that, for a development to be considered naturally ventilated, at least 60% of the individual apartments in the first nine storeys of the building must be considered to be naturally cross ventilated. Apartments at ten storeys or greater are deemed to be cross ventilated only if any enclosure of the balconies at these levels allows adequate natural ventilation and cannot be fully enclosed. To be considered to be naturally cross ventilated, the overall depth of a cross-over or cross-through apartment must not exceed 18m, measured glass line to glass line. Examples of apartments which are classified as being naturally ventilated by SEPP65 are shown in Figures 2 below, which also show the flow paths for natural cross ventilation through the apartments.

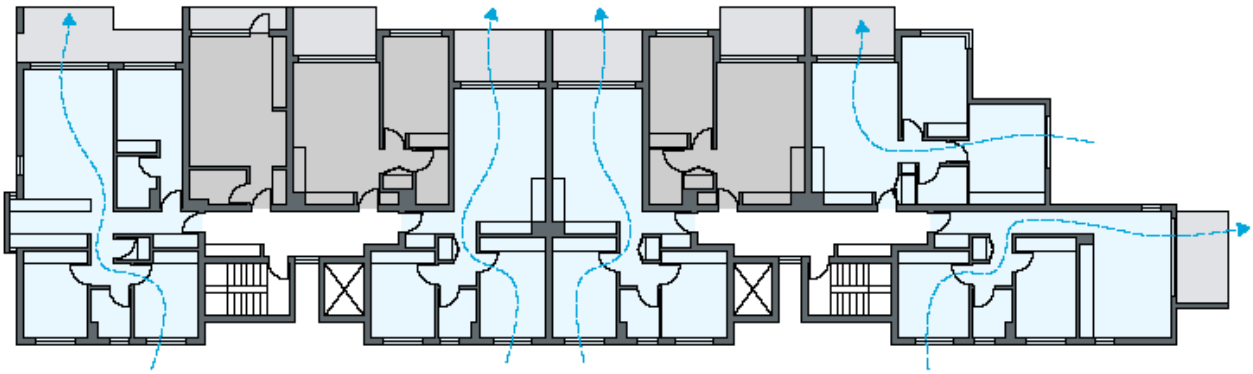

Figure 2a: Examples of Apartments Achieving Effective Natural Cross Ventilation
(from Apartment Design Guide, floor plan of a typical residential building)

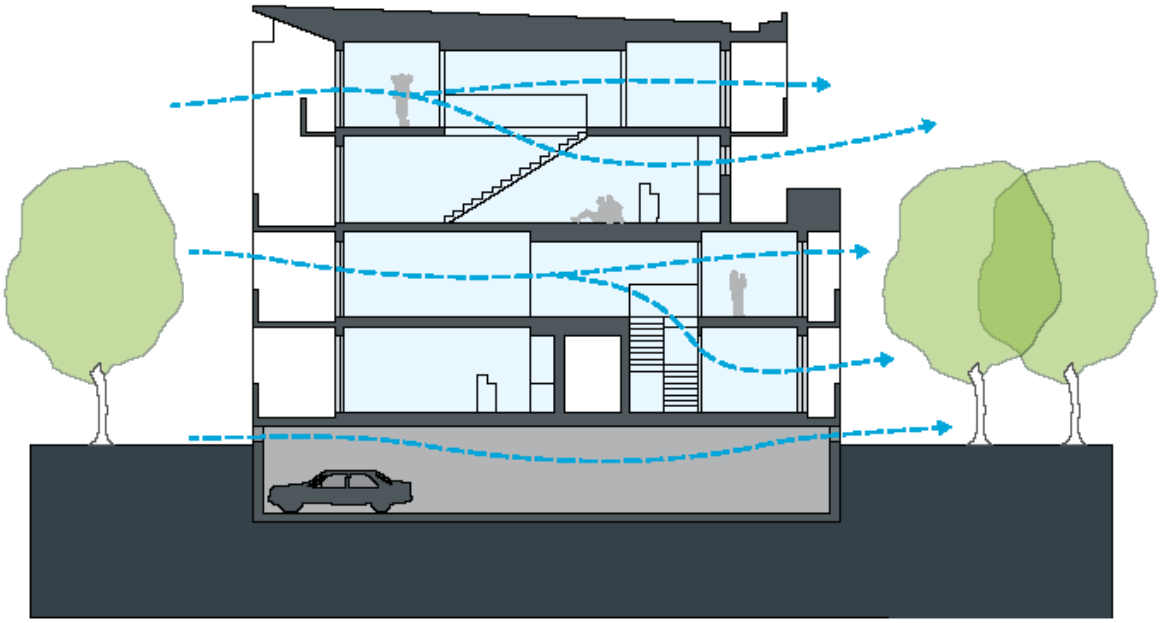

Figure 2b: Examples of Apartments Achieving Effective Natural Cross Ventilation
(from Apartment Design Guide, section elevation of a typical residential building)

Apartments have been considered to have dual aspects if the two openings are able to be located on aspects which are less than 135° in plan orientation from each other. Openings which are located on aspect orientations greater than this are more likely to have similar pressures at the opening, and their performance cannot be considered to satisfy based on the SEPP65 guidelines. These apartments may still be considered to be naturally ventilated, but will require further analysis, as outlined in Section 4.

The Apartment Design Guide does provide design guidance for the layout and design of single aspect apartments to maximise natural ventilation. While these are not considered naturally cross ventilated, they allow for site restraints for design excellence in single aspect apartments. The design allows for the inclusion of plenums, vertical ventilation shafts and building indentations with a width to depth ratio of 2:1 or 3:1 to ensure effective air circulation and avoid trapped smells.

It is important that the naturally cross ventilated flow path does not flow through a bathroom in order to avoid issues with odours.

It should be noted that deviations in the apartment layout shown in SEPP65 can have the potential to provide effective natural ventilation through the apartment. However, due to the complicated nature of flow paths driven by pressure differentials at different openings of an apartment, the effectiveness of natural ventilation for apartments which are outside of those presented in Figures 2 should be demonstrated by means of a detailed wind tunnel study. A comparison between the predicted natural ventilation characteristics of an apartment obtained from wind tunnel testing with the observed full-scale characteristics of the same apartment have been published in the paper titled 'Designing for Natural Ventilation for Tall Residential Buildings' by Peddie and Rofail (2011), which demonstrates close agreement.

4 RESULTS AND DISCUSSION

4.1 Results (Based on SEPP65)

The results of the assessment indicate that a total of 56% (297 out of 530) of the residential apartments across the development will achieve adequate levels of natural cross ventilation as per SEPP65, which is less than the required minimum of 60%. Per building: 64% (45 of 70) of the apartments in Building A, 59% (57 of 97) of the apartments in Building B, 60% (49 of 81) of the apartments in Building C, 58% (101 of 173) of the apartments in Building D, and 42% (46 of 109) of the apartments in Building E will achieve adequate levels of natural cross ventilation. Natural cross ventilation has been achieved through openings on orthogonal or opposite aspects (for example corner or through apartments), with direct exposure to prevailing winds or windows located in significantly different pressure regions as defined within Section 4B of the ADG.

This has been achieved within corner and cross-through apartments with the proposed openings in the form of operable windows and doors located in significantly different pressure regions along the adjacent aspects. This will be effective in generating pressure driven air flow through the apartment as the incident wind travels from the positively pressurised windward opening and exhausted to the negative or neutrally pressurised sideward opening.

The natural ventilation performance of the various residential apartments of the subject development is summarised in Table 2.

4.2 Further Assessment

A further assessment of the current design has been undertaken to determine additional apartments that could be considered as adequately naturally ventilated based on the inclusion of various treatments. It has been determined that for:

Building B

- Apartments 303 and 304 – Incorporation of a horizontal plenum leading to the eastern aspect. (As shown in Figure 3a)
- **Note:** Apartments 404, 407, 504, 507, 604, 607, 704, and 707 have been considered to be naturally ventilated as part of this assessment due to the alcove protruding in the direction of the Level 4 communal terrace. The combination of the alcove's significant offset from the main building façade and Windtech's analysis of the prevailing winds indicates that it is likely that the alcove will be in a significantly different pressure region to that of the main building façade, allowing pressure-driven cross-ventilation.

Building D

- Apartments 810, 818, 824 – Incorporation of a horizontal plenum leading to the south-eastern aspect. (As shown in Figure 3b)

Building E

- Apartments 210 to 213, 308 to 310, 405, 409 to 411, 505, 509 to 511, 605, 609 to 611, and 705 – Incorporation of a horizontal plenum leading to the south-eastern aspect. (As shown in Figures 3c-f)

With the considerations of the above listed apartments, a total of 61% (323 out of 530) of the residential apartments across the entire development are expected to satisfy the ADG requirements for cross-ventilation. Per building: 64% (45 of 70) of the apartments in Building A, 61% (59 of 97) of the apartments in Building B, 60% (49 of 81) of the apartments in Building C, 60% (104 of 173) of the apartments in Building D, and 60% (66 of 109) of the apartments in Building E are expected to satisfy the ADG requirements for natural cross-ventilation.

Important Note: It is important that the naturally cross ventilated flow path does not flow through a bathroom in order to avoid issues with odours. Additionally, each habitable room should have an unobstructed opening size of at least of 5% of the floor area served by the opening, in accordance with Objective 4B-1 of the ADG and have a minimum free area of 0.4m^2 in order to provide effective natural ventilation.

Table 2: Natural Ventilation Performance

Unit Number	Meets ADG Guidelines for Natural Cross Ventilation
A.116	YES
A.117	YES
A.118	YES
A.119	NO
A.120	NO
A.121	NO
A.122	YES
A.123	YES
A.124	NO
A.216	YES
A.217	YES
A.218	YES
A.219	NO
A.220	NO
A.221	NO
A.222	YES
A.223	YES
A.224	NO
A.314	YES
A.315	YES

Unit Number	Meets ADG Guidelines for Natural Cross Ventilation
A.316	YES
A.317	NO
A.318	NO
A.319	NO
A.320	YES
A.321	YES
A.322	NO
A.411	YES
A.412	YES
A.413	YES
A.414	NO
A.415	NO
A.416	YES
A.417	YES
A.511	YES
A.512	YES
A.513	YES
A.514	NO
A.515	NO
A.516	YES
A.517	YES
A.611	YES
A.612	YES
A.613	YES
A.614	NO
A.615	NO
A.616	YES
A.617	YES
A.711	YES
A.712	YES
A.713	YES
A.714	NO
A.715	NO
A.716	YES
A.717	YES

Unit Number	Meets ADG Guidelines for Natural Cross Ventilation
A.811	YES
A.812	YES
A.813	YES
A.814	NO
A.815	NO
A.816	YES
A.817	YES
A.G13	YES
A.G14	YES
A.G15	YES
A.G16	NO
A.G17	NO
A.G18	YES
A.G19	YES
A.G20	NO
B.101	NO
B.102	YES
B.103	YES
B.104	NO
B.105	NO
B.106	NO
B.107	NO
B.108	YES
B.109	YES
B.110	NO
B.111	NO
B.112	NO
B.113	YES
B.114	YES
B.115	NO
B.201	NO
B.202	YES
B.203	YES
B.204	NO
B.205	NO

Unit Number	Meets ADG Guidelines for Natural Cross Ventilation
B.206	NO
B.207	NO
B.208	YES
B.209	YES
B.210	NO
B.211	NO
B.212	NO
B.213	YES
B.214	YES
B.215	NO
B.301	YES
B.302	YES
B.303	NO
B.304	NO
B.305	NO
B.306	YES
B.307	YES
B.308	NO
B.309	NO
B.310	NO
B.311	YES
B.312	YES
B.313	NO
B.401	YES
B.402	YES
B.403	NO
B.404	YES
B.405	YES
B.406	NO
B.407	YES
B.408	NO
B.409	YES
B.410	YES
B.501	YES
B.502	YES

Unit Number	Meets ADG Guidelines for Natural Cross Ventilation
B.503	NO
B.504	YES
B.505	YES
B.506	YES
B.507	YES
B.508	NO
B.509	YES
B.510	YES
B.601	YES
B.602	YES
B.603	NO
B.604	YES
B.605	YES
B.606	YES
B.607	YES
B.608	NO
B.609	YES
B.610	YES
B.701	YES
B.702	YES
B.703	NO
B.704	YES
B.705	YES
B.706	YES
B.707	YES
B.708	NO
B.709	YES
B.710	YES
B.G01	YES
B.G02	YES
B.G03	NO
B.G04	NO
B.G05	NO
B.G06	NO
B.G07	NO

Unit Number	Meets ADG Guidelines for Natural Cross Ventilation
B.G08	YES
B.G09	YES
B.G10	NO
B.G11	YES
B.G12	YES
B.LG01	YES
B.LG02	YES
C.101	NO
C.102	YES
C.103	YES
C.104	NO
C.105	NO
C.106	YES
C.107	YES
C.108	NO
C.109	YES
C.110	NO
C.111	YES
C.201	NO
C.202	YES
C.203	YES
C.204	NO
C.205	NO
C.206	YES
C.207	YES
C.208	NO
C.209	YES
C.210	NO
C.211	YES
C.301	NO
C.302	YES
C.303	YES
C.304	NO
C.305	NO
C.306	YES

Unit Number	Meets ADG Guidelines for Natural Cross Ventilation
C.307	YES
C.308	NO
C.309	YES
C.310	NO
C.311	YES
C.401	NO
C.402	YES
C.403	YES
C.404	NO
C.405	YES
C.406	YES
C.407	NO
C.408	YES
C.409	YES
C.501	NO
C.502	YES
C.503	YES
C.504	NO
C.505	YES
C.506	YES
C.507	NO
C.508	YES
C.509	YES
C.601	NO
C.602	YES
C.603	YES
C.604	NO
C.605	YES
C.606	YES
C.607	NO
C.608	YES
C.609	YES
C.701	NO
C.702	YES
C.703	YES

Unit Number	Meets ADG Guidelines for Natural Cross Ventilation
C.704	NO
C.705	YES
C.706	YES
C.707	NO
C.708	YES
C.709	YES
C.G01	NO
C.G02	YES
C.G03	YES
C.G04	YES
C.G05	YES
C.G06	NO
C.G07	YES
C.G08	NO
C.G09	YES
C.LG01	YES
C.LG02	NO
C.LG03	NO
D.116	NO
D.117	YES
D.118	NO
D.120	YES
D.121	YES
D.122	NO
D.123	YES
D.124	NO
D.125	YES
D.126	YES
D.127	NO
D.128	YES
D.129	NO
D.130	NO
D.131	NO
D.132	YES
D.133	YES

Unit Number	Meets ADG Guidelines for Natural Cross Ventilation
D.134	NO
D.135	NO
D.136	NO
D.216	NO
D.217	YES
D.218	YES
D.219	NO
D.220	NO
D.221	YES
D.222	YES
D.223	NO
D.224	YES
D.225	NO
D.226	YES
D.227	YES
D.228	NO
D.229	YES
D.230	NO
D.231	NO
D.232	NO
D.233	YES
D.234	YES
D.235	NO
D.236	NO
D.237	NO
D.312	NO
D.313	YES
D.314	NO
D.315	YES
D.316	YES
D.317	NO
D.318	YES
D.319	NO
D.320	YES
D.321	YES

Unit Number	Meets ADG Guidelines for Natural Cross Ventilation
D.322	NO
D.323	YES
D.324	NO
D.325	NO
D.326	YES
D.328	YES
D.329	YES
D.330	NO
D.331	YES
D.413	YES
D.414	YES
D.415	NO
D.416	YES
D.417	YES
D.418	NO
D.419	YES
D.420	NO
D.421	YES
D.422	YES
D.423	NO
D.424	YES
D.425	YES
D.426	YES
D.427	NO
D.428	YES
D.429	NO
D.430	NO
D.513	YES
D.514	YES
D.515	NO
D.516	YES
D.517	YES
D.518	NO
D.519	YES
D.520	NO

Unit Number	Meets ADG Guidelines for Natural Cross Ventilation
D.521	YES
D.522	YES
D.523	NO
D.524	YES
D.525	YES
D.526	YES
D.527	NO
D.528	YES
D.529	NO
D.530	YES
D.613	YES
D.614	YES
D.615	NO
D.616	YES
D.617	YES
D.618	NO
D.619	YES
D.620	NO
D.621	YES
D.622	YES
D.623	NO
D.624	YES
D.625	YES
D.626	YES
D.627	NO
D.628	YES
D.629	NO
D.630	YES
D.708	YES
D.709	YES
D.710	NO
D.711	YES
D.712	YES
D.713	NO
D.714	YES

Unit Number	Meets ADG Guidelines for Natural Cross Ventilation
D.715	NO
D.716	YES
D.717	YES
D.718	NO
D.719	YES
D.720	YES
D.721	YES
D.722	NO
D.723	YES
D.724	NO
D.725	YES
D.808	YES
D.809	YES
D.810	NO
D.811	YES
D.812	YES
D.813	NO
D.814	YES
D.815	NO
D.816	YES
D.817	YES
D.818	NO
D.819	YES
D.820	YES
D.821	YES
D.822	NO
D.823	YES
D.824	NO
D.825	YES
D.G20	NO
D.G21	NO
D.G22	NO
D.G23	YES
D.G24	NO
D.G25	YES

Unit Number	Meets ADG Guidelines for Natural Cross Ventilation
D.G26	YES
D.G27	NO
D.G28	YES
D.G29	NO
D.G30	NO
D.G31	YES
D.G32	NO
D.G33	NO
D.G34	YES
D.G35	NO
D.G36	NO
D.G37	YES
D.G38	YES
D.G39	YES
D.G40	YES
D.G41	YES
E.101	NO
E.102	NO
E.103	NO
E.104	NO
E.105	NO
E.106	YES
E.107	YES
E.108	NO
E.109	YES
E.110	NO
E.111	NO
E.112	NO
E.113	NO
E.114	YES
E.115	YES
E.201	NO
E.202	NO
E.203	NO
E.204	NO

Unit Number	Meets ADG Guidelines for Natural Cross Ventilation
E.205	NO
E.206	YES
E.207	YES
E.208	NO
E.209	YES
E.210	NO
E.211	NO
E.212	NO
E.213	NO
E.214	YES
E.215	YES
E.301	YES
E.302	YES
E.303	NO
E.304	NO
E.305	YES
E.306	NO
E.307	YES
E.308	NO
E.309	NO
E.310	NO
E.311	YES
E.401	NO
E.402	YES
E.403	YES
E.404	NO
E.405	NO
E.406	YES
E.407	YES
E.408	YES
E.409	NO
E.410	NO
E.411	NO
E.412	YES
E.501	NO

Unit Number	Meets ADG Guidelines for Natural Cross Ventilation
E.502	YES
E.503	YES
E.504	NO
E.505	NO
E.506	YES
E.507	YES
E.508	YES
E.509	NO
E.510	NO
E.511	NO
E.512	YES
E.601	NO
E.602	YES
E.603	YES
E.604	NO
E.605	NO
E.606	YES
E.607	YES
E.608	YES
E.609	NO
E.610	NO
E.611	NO
E.612	YES
E.701	NO
E.702	YES
E.703	YES
E.704	NO
E.705	NO
E.706	YES
E.707	YES
E.G01	NO
E.G02	YES
E.G03	NO
E.G04	NO
E.G05	NO

Unit Number	Meets ADG Guidelines for Natural Cross Ventilation
E.G06	YES
E.G07	YES
E.G08	NO
E.G09	NO
E.G10	NO
E.G11	YES
E.G12	YES
E.G13	NO
E.G14	NO
E.G15	NO
E.G16	NO
E.G17	NO
E.G18	YES
E.G19	YES
E.LG01	YES
E.LG02	NO
E.LG03	NO
E.LG04	YES
E.LG05	NO
E.LG06	NO

5 REFERENCES

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Peddie K.M. and Rofail A.W., 2011, 'Designing for Natural Ventilation for Tall Residential Buildings', 2011 CTBUH World Conference, Seoul, Korea, October 10-12, 2011.

Peddie K.M. and Rofail A.W., 2010, 'Application of Natural Ventilation for Commercial Developments' 14th Australasian Wind Engineering Society Workshop, Canberra, August 5-6, 2010.

APPENDIX A

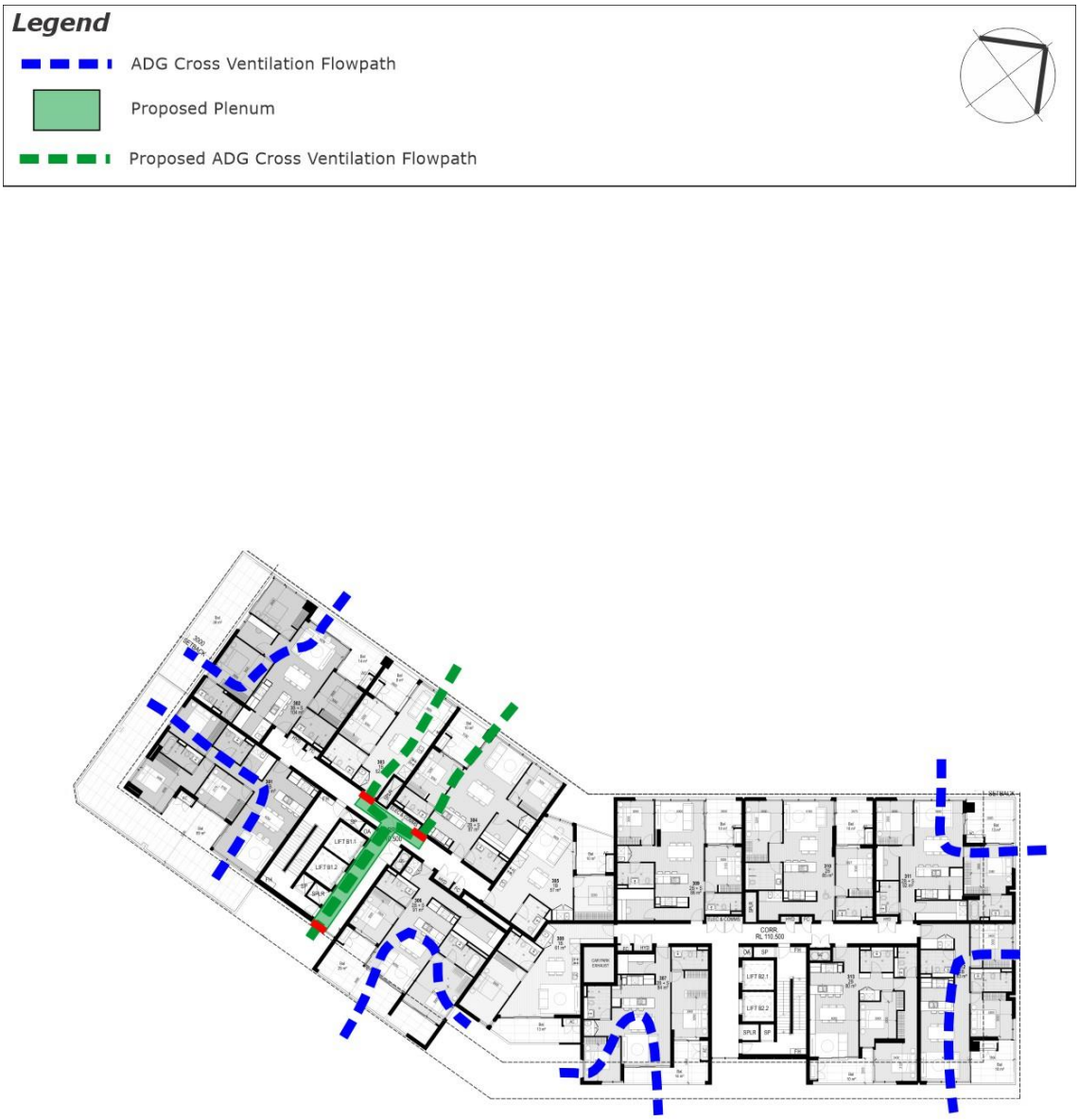

Figure 3a: Layout of Flow Paths and Treatments – Level 3 (Building B)

Figure 3b: Layout of Flow Paths and Treatments – Level 8 (Building D)

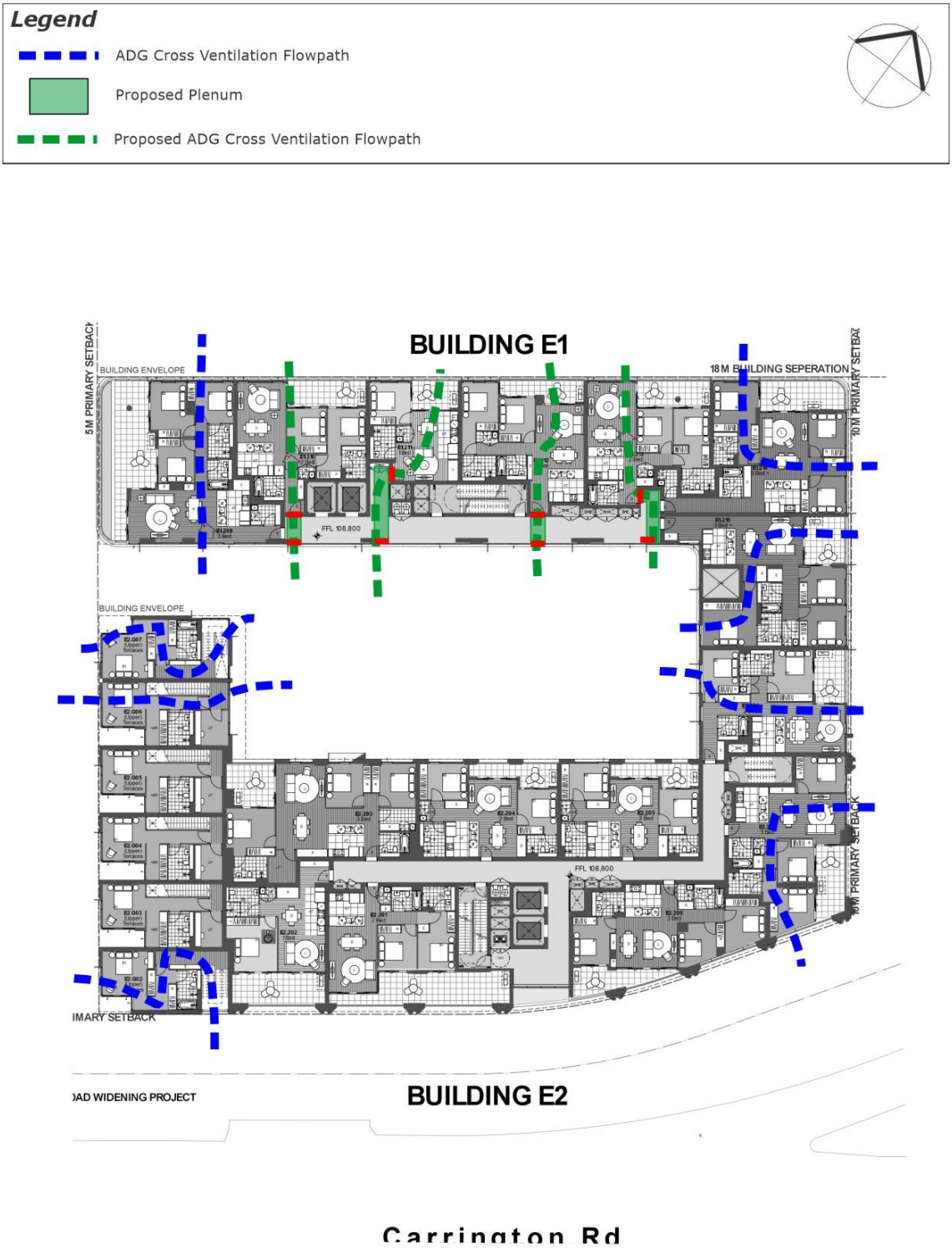

Figure 3c: Layout of Flow Paths and Treatments – Level 2 (Building E)

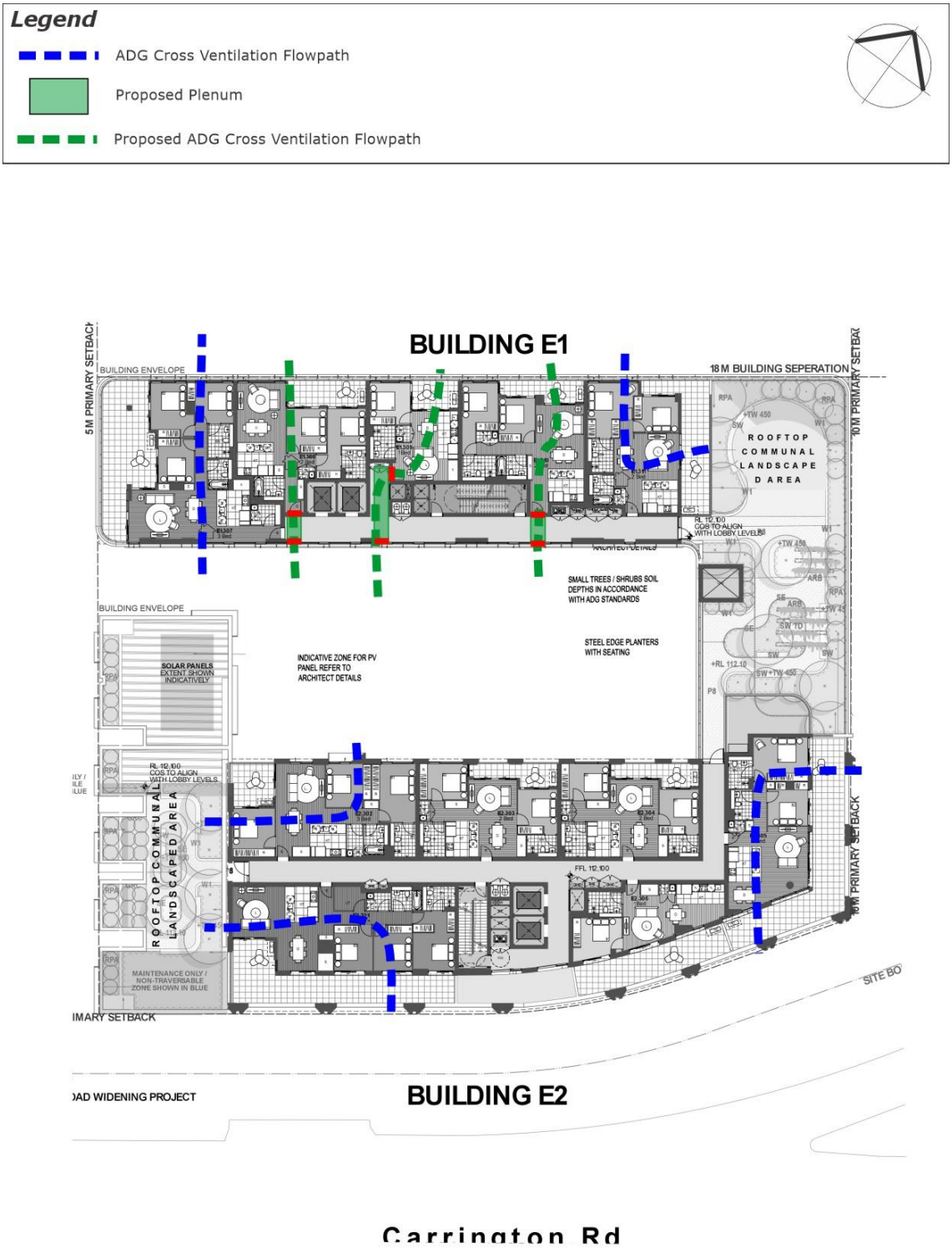

Figure 3d: Layout of Flow Paths and Treatments – Level 3 (Building E)

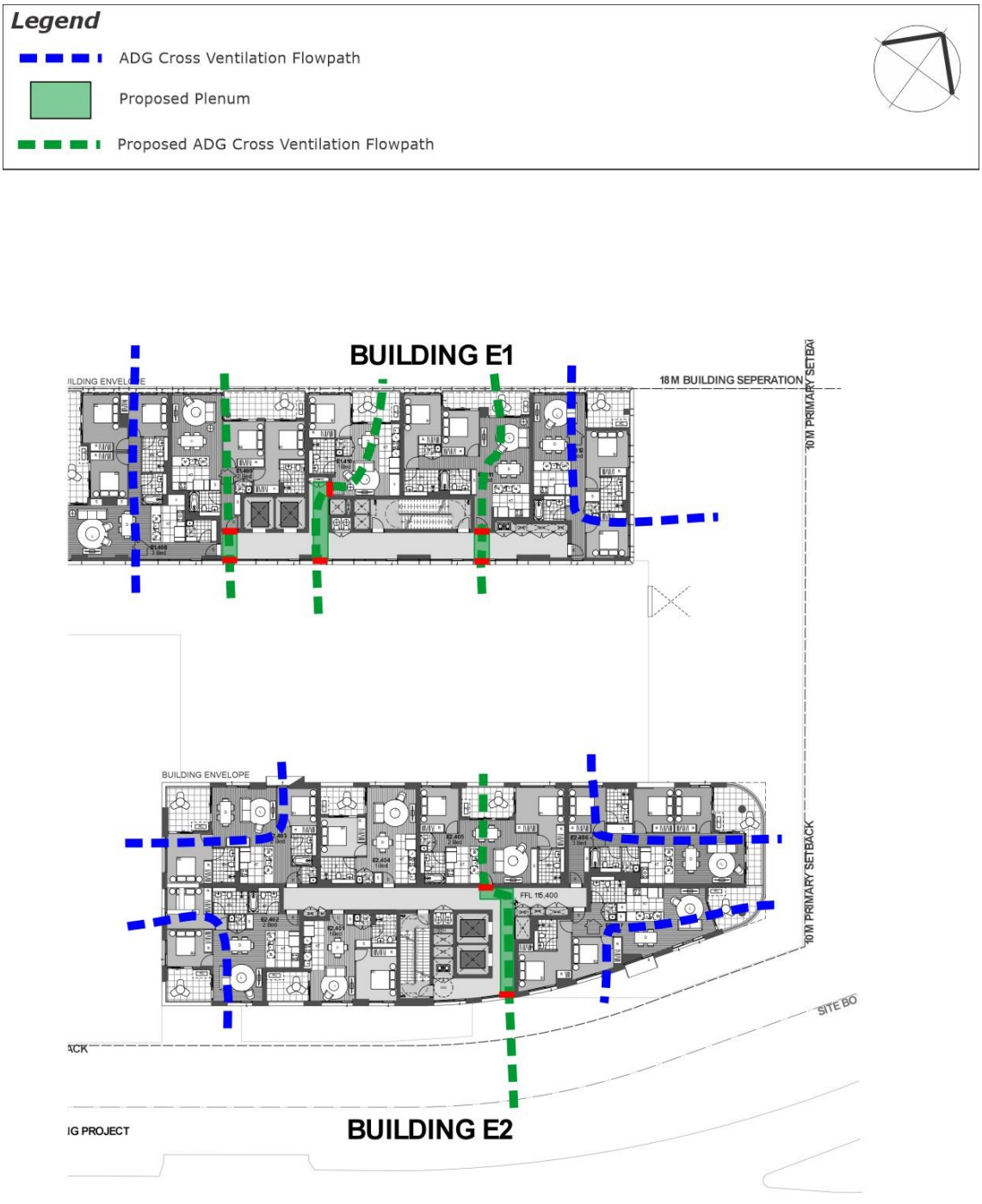

Figure 3e: Layout of Flow Paths and Treatments – Level 4-6 (Building E)

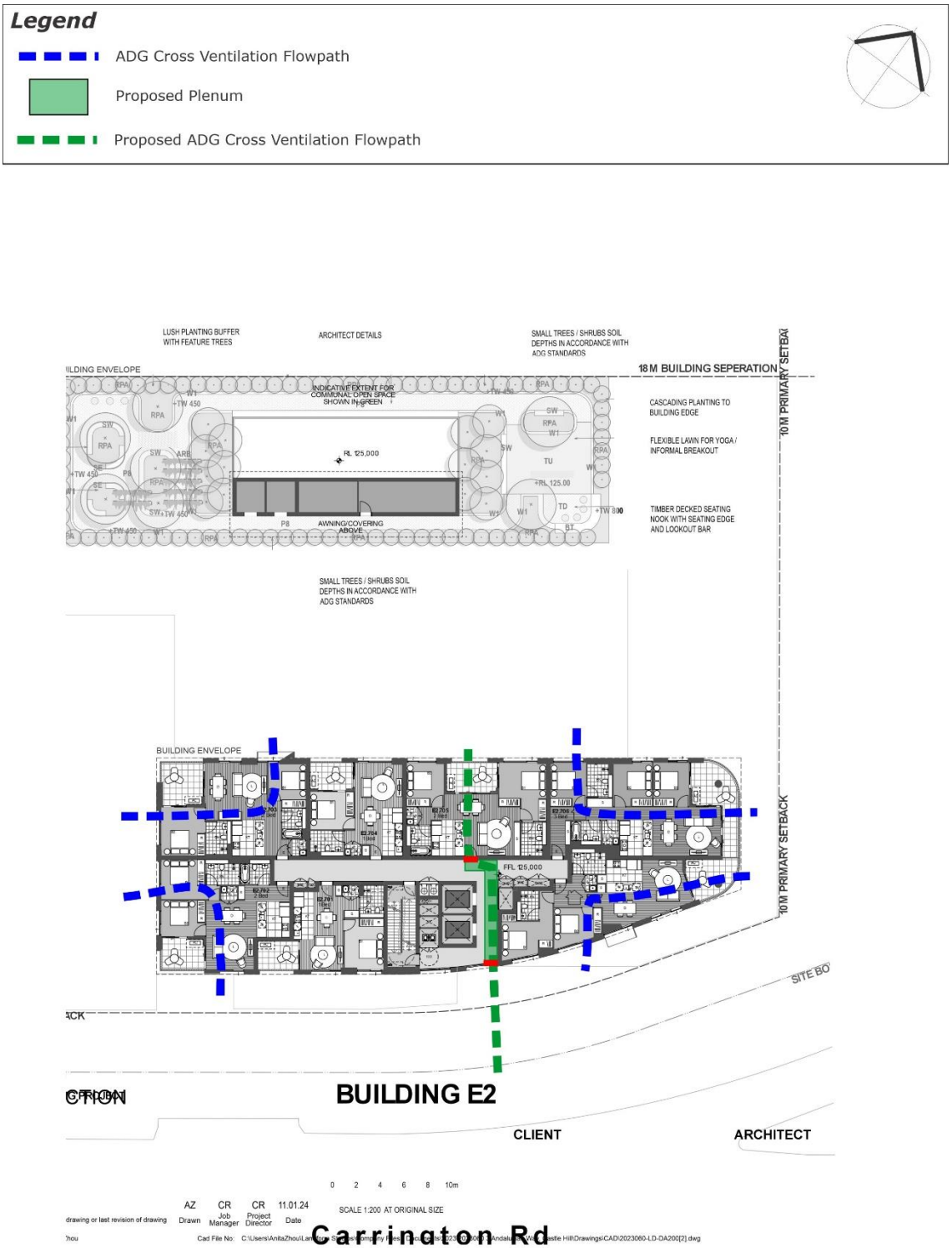

Figure 3f: Layout of Flow Paths and Treatments – Level 7 (Building E)