

STEVE KING

CONSULTANT

Appropriate design and alternative technologies for environmental control in buildings

25 June 2015

Mount Pritchard & District Community Club

c/ CERNO MANAGEMENT

GPO Box 2594, Sydney NSW 2001

Re: EXPERT OPINION VERIFICATION SEPP 65 AMENITY COMPLIANCE

I have prepared a revised report with respect to my expert opinion report of 1 August 2014 which formed part of the Development Application.

The purpose of the revised report is to confirm that the s.96 proposal continues to comply with the relevant local controls, and the Residential Flat Design Code (RFDC) as it gives effect to the Amenity provisions of SEPP65, as they apply to **solar access and natural ventilation** for the seniors living residential component of the proposed Harbord Diggers Club Redevelopment at Lot 12 DP 1197725, 80 Evans Street Freshwater.

Solar access

66 apartments receive over three hours and four a minimum of 2 hours between 9am and 3pm, being altogether 70 (72.9%) out of a total of 96 dwelling fully comply with the controls. The RFDC Rules of Thumb suggests a minimum 70%.

In my view, the applicable DCP and the performance objectives of the RFDC Rules of Thumb are fully satisfied.

Natural ventilation

The requirements of the FFDC with respect to natural ventilation are fully satisfied, with 68 (70.8%) of the 96 dwellings being simply cross ventilated. RFDC Rules of Thumb suggests a minimum 60%.

I warrant that the solar access and natural ventilation compliances of the approved DA are maintained with the proposed design changes described in the s.96 application documents.

Yours sincerely,



Steve King

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s.96 APPLICATION
EXPERT OPINION
VERIFICATION SEPP 65 AMENITY COMPLIANCE
SENIORS LIVING
SOLAR ACCESS
NATURAL VENTILATION

Harbord Diggers Club Redevelopment
80 Evans Street Freshwater
Lot 12 DP 1197725
24 June 2015

Signed,

A handwritten signature in dark ink, appearing to read "Steve King", with a large, stylized flourish at the end.

.....
Steve King

STEVE KING
CONSULTANT
11 Clovelly Road Randwick NSW 2031 Australia
PHONE 0414385485

1.0 PRELIMINARIES/SUMMARY

1.1 This report is a *revision* of my expert opinion report of 1 August 2014 which formed part of the Development Application.

The purpose of this report is to confirm that the s.96 proposal continues to comply with the relevant local controls and the Residential Flat Design Code (RFDC) as it gives effect to the Amenity provisions of SEPP65, with respect to **solar access** and **natural ventilation** for the **seniors living residential component** of the proposed Harbord Diggers Club Redevelopment at Lot 12 DP 1197725, 80 Evans Street Freshwater.

1.2 My qualifications and experience are included at 2.0 *Credentials*.

1.3 The documentation on which I rely is set out in 3.0 *Documents*.

1.4 **Solar access.**

66 apartments receive over three hours and four a minimum of 2 hours between 9am and 3pm, being altogether 70 (72.9%) out of a total of 96 dwelling fully comply with the controls. The RFDC *Rules of Thumb* suggests a minimum 70%.

In my view, the applicable DCP and the performance objectives of the RFDC *Rules of Thumb* are fully satisfied.

On this site, unobstructed solar access is available to some apartments from dawn. For dwellings that are oriented towards the ocean view, I consider it reasonable to take account of this additional effective direct sun. On that basis, an additional five apartments will also receive over three hours of effective sun on June 21.

1.5 **Natural ventilation**

The requirements of the RFDC with respect to natural ventilation are fully satisfied, with 68 (70.8%) of the 96 dwellings being simply cross ventilated. RFDC *Rules of Thumb* suggests a minimum 60%.

2.0 CREDENTIALS

I taught teaching architectural design, thermal comfort and building services at the Universities of Sydney, Canberra and New South Wales since 1971. From 1992, I was a Research Project Leader in SOLARCH, the National Solar Architecture Research Unit at the University of NSW. Until its disestablishment in December 2006 I was the Associate Director, Centre for Sustainable Built Environments (SOLARCH), UNSW.

My research and consultancy includes work in solar access, energy simulation and assessment for houses and multi-dwelling developments. I am the principal author of *SITE PLANNING IN AUSTRALIA: Strategies for energy efficient residential planning*, published by AGPS, and of the BDP Environment Design Guides on the same topic. Through Linarch Pty Ltd, I conduct training in solar access and overshadowing assessment for Local Councils. I have delivered professional development courses on topics relating to energy efficient design both in Australia and internationally.

I taught the wind and ventilation components of environmental control in the undergraduate course in architecture at UNSW, and am the author of internationally referenced, web accessed coursework materials on the subject. I have supervised PhD research specifically on the problem of single sided ventilation of multi-storey apartments.

Of particular relevance, I have delivered the key papers in the general area of assessment of *ventilation and solar access performance and compliance* at the NEERG Seminars and other professional development settings. Senior Commissioner Moore cited my assistance in reframing of the Land and Environment Court Planning Principle related to solar access (formerly known as the Parsonage Principle) in *The Benevolent Society v Waverley Council [2010] NSWLEC 1082*.

I practised as a Registered Architect from 1971 to 2014, and now maintain a specialist consultancy practice in passive environmental performance of buildings. I regularly assist the Land and Environment Court as an expert witness in related matters.

3.0 DOCUMENTS

3.1 I base my report on

- Development Application drawings issued to me by Architectus Architects digitally 5 June 2015:
 - DA000 - Cover Sheet & Drawing List_Rev A
 - DA001 - Location Plan_Rev A
 - DA002 - Site Plan_Rev A
 - DA003 - Site Photographic Analysis_Rev A
 - DA004 - Site Analysis_Rev A
 - DA100 - Basement 3_Rev A
 - DA101 - Basement 2_Rev A
 - DA102 - Basement 1_Rev A
 - DA103 - Lower Ground_Rev A
 - DA104 - Upper Ground_Rev A
 - DA105 - Level 1_Rev A
 - DA106 - Level 2_Rev A
 - DA107 - Level 3_Rev A
 - DA108 - Level 4_Rev A
 - DA109 - Roof_Rev A
 - DA111 Elevation 1 - Evans Street_Rev A
 - DA112 Elevation 2 - Carrington Parade_Rev A
 - DA113 Elevation 3 - Lumsdaine Drive_Rev A
 - DA114 Elevation 4 - McKillop Park_Rev A
 - DA115 Courtyard Elevations - Sheet 1_Rev A
 - DA116 Courtyard Elevations - Sheet 2_Rev A
 - DA117 Courtyard Elevations - Sheet 3_Rev A
 - DA120 - Section A_Rev A
 - DA121 - Section B_Rev A
 - DA122 - Section C_Rev A
 - DA123 - Section D_Rev A
 - DA124 - Section E_Rev A
 - DA125 - Section F_Rev A
 - DA126 - Section G_Rev A
 - DA130 Detailed Elevations - Street_Rev A
 - DA131 Detailed Elevations - Courtyard Screen_Rev A
 - DA132 Detailed Elevations – Headland Buildings_Rev A
 - DA136 - Staging Plan - Existing Structure_Rev A
 - DA137 - Staging Plan - Proposed Buildings_Rev A
 - DA138 - Demolition Plan_Rev A
 - DA139 - Driveway Details_Rev A
 - DA140 - Typical Hoarding Fence Details_Rev A
 - DA150 - Materials Board_Rev A
 - DA151 - Shadow Diagrams - Existing_Rev A
 - DA152 - Shadow Diagrams - Proposed_Rev A
 - DA155 - 3D Stage 1 and Existing building comparison_Rev A
 - DA156 - 3D Building Envelope and height plane comparison_Rev A
 - DA157 - 3D Building & Height plane comparison_Rev A
 - DA159 - Setback Compliance Diagrams_Rev A
- 3D digital model file 140729_HarbordDiggers_R2.dwg issued on the same day.

3.2 I have visited the site.

4.0 SITE CONSTRAINTS AND BUILDING MASSING

This section of the report is not edited.

4.1 The proposal is for Seniors Living buildings offering a mix of bedroom types generating 97 apartments, in association with future Club comprising the Hospitality Venue and Fitness Centre, and with ancillary services including:

- Community Day Care Facility providing respite care for aged persons;
- Long Day Care Child Care Centre providing a minimum 90 places;
- Members Services comprising 3 minor outlets alongside the Future Club; and
- Community Facility.

The seniors living apartments component consists effectively of six discrete buildings over common car parking.

4.2 The site is an irregular trapezoidal shape, bounded on the north-west by Carrington Parade, on the north-east by Lumsdale Drive, and of the south-west by Evans Street. To the south-east is the landscape setting of the Harbord headland.

4.3 The siting of the seniors living residential component of the project was determined by the relationship to the club redevelopment, including the adaptive reuse of extensive portions of the existing club building. Logically, the majority of the residential component of the project relates to the two principal bounding streets which form the interface with the adjacent residential suburb. These relationships, including stringent height controls, were adopted as design constraints through a preliminary development application and subsequent design competition.

4.4 Detailed planning of the individual residential block further constrained by the way they are used to define appropriate semi-public common open space. In my considered opinion, the overall design responds effectively to the constraints of the highly desirable outlook, generally to the east and south, and the adverse orientation to Evans Street.

4.5 I note the use of 'wintergardens' as private open space for a proportion of apartments. This has tangible benefits in the additional protection against the potentially extreme wind exposure for the apartments facing in an easterly direction towards the ocean. The judicious use of wintergardens is also supported where they optimises winter performance as 'attached sunspaces' with extended sunlit glazing, while retaining the flexibility for well ventilated summer use.

5.0 SOLAR ACCESS

I have employed the same methodology as previously employed in my DA report.

5.1 Methodology

5.1.1 The analysis of solar access has been carried out by use of the 3D digital model in the *Trimble SketchUp* software package.

5.1.2 The model was prepared by the architects in the *Autodesk Revit* commercial CAD application. I note that in *Revit*, the 2D drawings are produced from the digital 3D model and for that reason guarantee coincidence between the model and the drawings.

For my analysis, the model was exported as a .3ds format file and imported into the *Trimble SketchUp* software package. I have undertaken a summary check of the topographical and building dimensions of the 3D digital model by reference to figured dimensions, where found in the plans and sections. I feel confident to rely on the general accuracy of the modelling.

5.1.3 I have independently geolocated the model, and verified the direction of True North by reference to the cadastral grid north.

5.1.4 The SketchUp software prepares the shadow projections by reference to accurate solar geometry. The model has been used to examine the projected solar access for the glazing and private open space for each individual apartment, including the overshadowing impacts of mutual shading by adjacent residential blocks and self shading by verandas and other features.

Because of the complexity of demonstrating the quantification of solar access to glazing and private open space of various orientations, my detailed analysis was performed primarily by using projections known as 'View from the Sun'. A view from the sun shows all sunlit surfaces at a given time and date. It therefore allows a very precise count of sunlight hours on any glazing or horizontal surface, with little or no requirement for secondary calculations or interpolation. The technique is illustrated in Figure 1.

Note that the views from the sun do not show any shadows. Shadows are those areas exactly coinciding with objects in the foreground.

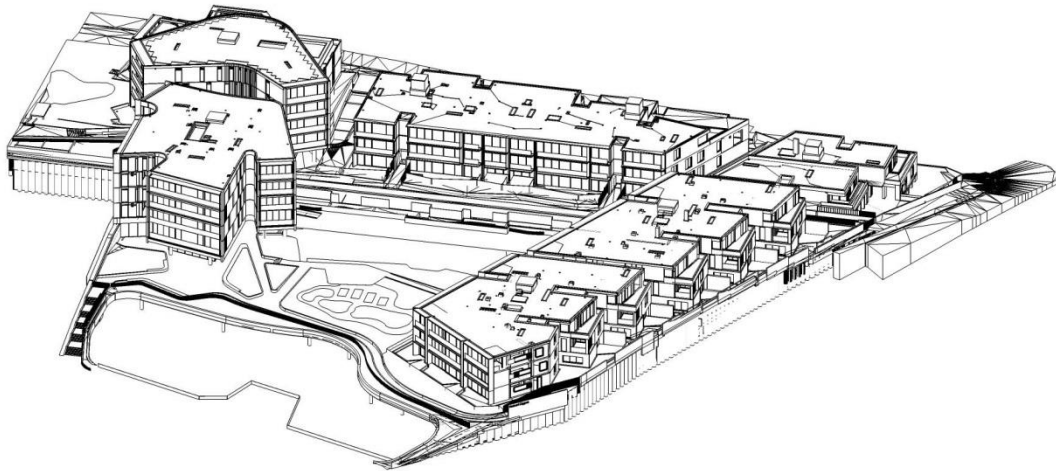


Figure 1: View from the sun 10am June 21.
Updated.

5.2 Characterisation of solar access compliance

5.2.1 For the purpose of calculating the compliance with the control, I have examined sun patches on the relevant glazing line and for the private open space of each apartment.

For the apartments facing in an easterly direction to the ocean views, I have taken account of sun before 9am, which is demonstrably unlikely to be obstructed now or in the future. I note that such earlier sun is actually the *most* effective sun access for apartments with these orientations, because it penetrates more deeply into the interior of the respective dwellings.

5.2.2 Because of its key importance in the determination of what is 'effective sunlight' for characterisation of compliance, for both glazing and private open space, I refer specifically to the relevant *L+EC Planning Principle (The Benevolent Society v Waverley Council [2010] NSWLEC 1082)*:

- I ignore very large angles of incidence to the glazing surface, and unusably small areas of sunlit glazing;
- I quantify as complying all sun patches of 'reasonable size';
- Where a wintergarden is used, the relevant glazing line for solar access is the outer glazing, on the basis that for winter amenity the wintergarden functions as an 'attached sunspace'.

There is no accepted standard for the absolute limit of acceptable area of the sunpatch on partly shaded glazing. In accordance with the Court's *Planning Principle*, I consider this to be approximately 1m² (on the basis that it exceeds 50% of the area of a standard window 1500 x 1200 high which would normally be accepted as complying).

5.2.3 Morning and afternoon sun

'Views from the Sun' also allow rapid and accurate assessment of the likely overshadowing impact of developments adjacent to and remote from the site. This is critical in taking account of effective direct sun which may be available to glazing and private open space in the early morning or late afternoon in midwinter. On this site of particular relevance is the early morning sun available over the ocean from the time of sunrise.

My table in Appendix B therefore includes views from the sun from 8am to 4pm, showing likely unobstructed direct sun to relevant glazing and POS. Note that on easterly or westerly orientations, unobstructed lower angle winter sun is actually more effective in penetrating the interior of the apartments than higher angle sun during the middle of the day.

In relation to this interpretation of the RFDC performance objectives, I refer specifically to the judgement by Brown C. in the matter of Botany Development Pty Ltd v Botany Council LEC 10360 of 2013, at paras 79 through 87.

5.3 Applicable controls

5.3.1 Residential Flat Design Code

The Residential Flat Design Code gives the following quantified recommendations:

- Living rooms and private open spaces for at least 70 percent of apartments in a development should receive a minimum of three hours direct sunlight between 9am and 3pm in mid winter. In dense urban areas a minimum of two hours may be acceptable.
- Limit the number of single-aspect apartments with a southerly aspect (SW-SE) to a maximum of 10 percent of the total units proposed.
- Developments which seek to vary from the minimum standards must demonstrate how site constraints and orientation prohibit the achievement of these standards and how energy efficiency is addressed (see Orientation and Energy Efficiency).
(Rules of Thumb: Daylight Access p. 84)

5.3.2 Local controls

The local control is the solar access requirements of *Part D6 Access to Sunlight* of the Warringah DCP. The control generally aligns with the Residential Flat Design Code, therefore compliance with the RFDC will be taken as satisfying the local control.

5.4 Projected solar access

5.4.1 I have independently generated my own quantification and compliance table. Table 1 summarises the projected levels of compliance for the individual dwellings.

Table 1: Summary of solar access compliance

| | | |
|---|-----------|--------------|
| Number of units | 96 | |
| Units which achieve 3 hours or more sunlight to Living and POS 9am – 3pm | 66 | |
| Additional units which achieve 2 hours or more sunlight to Living and POS 9am – 3pm | (4) | |
| Total units which achieve 3 hours or more sunlight to Living and POS 9am – 3pm | 70 | 72.9% |
| Additional units which achieve 3 hours or more sunlight to Living and POS 8am – 4pm | 5 | |
| Total units which achieve 3 hours or more sunlight to Living and POS 8am – 4pm | 75 | 78.1% |

Table 3 in Appendix A sets out the solar access for each individual dwelling. Table 4 in Appendix B reproduces at a reduced scale of half hourly views from the sun, from 8pm to 3pm.

6.0 NATURAL VENTILATION

6.1 Performance Objectives

The Residential Flat Design Code (RFDC) gives rules of thumb for interpreting SEPP 65 with respect to natural ventilation:

- Building depths, which support natural ventilation typically range from 10 to 18 metres.
- Sixty percent (60%) of residential units should be naturally cross ventilated.
- Twenty five percent (25%) of kitchens within a development should have access to natural ventilation.
- Developments, which seek to vary from the minimum standards, must demonstrate how natural ventilation can be satisfactorily achieved, particularly in relation to habitable rooms.
(Rules of Thumb: Natural Ventilation p.87)

6.2 Ventilation compliance

6.2.1 Table 2 summarises the compliance achieved for natural ventilation.

| | | |
|-------------------------|-----------|--------------|
| Number of units | 96 | |
| Cross ventilated | 68 | 70.8% |

Table 2: Ventilation compliance

6.2.2 The RFDC *Rules of Thumb* require a minimum of 60% of the apartments to be cross ventilated. The proposed development fully complies with the controls for cross ventilation.

6.0 CONCLUSIONS

6.1 Solar access

Notwithstanding that the site constraints are such that it is relatively onerous to meet the RFDC *Rule of Thumb* for solar access, **the proportion of dwellings which achieve projected solar access of minimum 3 hours between 9am and 3pm June 21 to living areas of apartments is 70 from a total of 96 (72.9%).**

I note that through the process of s.96 amendment, the proportion of apartments complying has actually been slightly improved. The RFDC *Rules of Thumb* nominate as a minimum 70%.

The proposed development fully complies with the controls for solar access.

6.2 Natural ventilation

A total of 78 apartments out of a total of 68 (70.8%) may be regarded as simply cross ventilated. I note that this is a slightly lower figure than I reported with respect to the development application. This outcome is primarily a function of the review of some previous opening locations in order to improve privacy considerations in the apartment layouts.

The proportion required by the RFDC is a minimum of 60%.

The proposed development therefore still fully complies with the relevant control for natural ventilation.

I have included in my characterisation of cross ventilation only those units which have conventional openings to two principal facades. It is worth noting that due to the exposure of this site to higher wind speeds, all other single aspect units can be considered to be naturally ventilated equivalent to cross ventilation in other, more sheltered locations.

A.0 APPENDIX: DETAILED COMPLIANCE TABLE

Note:

In the table below skylights and wintergardens are noted only where solar access compliance relies on solar access provided by those elements. All skylights are understood to be fixed, and are not relied on for cross ventilation.

Table 3: Solar access for individual dwellings

| LEVEL | UNIT | Solar access | | | | | | | | | | Solar compliance | | | | | | | | | | Cross Vent | Notes |
|------------------------|-------|--------------|-----|---|-----|----|------|----|------|----|------|------------------|------|----|------|----|------|----|-----------------------------|-----------------------------|--------------|------------|-------|
| | | 8 | 830 | 9 | 930 | 10 | 1030 | 11 | 1130 | 12 | 1230 | 13 | 1330 | 14 | 1430 | 15 | 1530 | 16 | >3 hrs 9-15 (>3hrs 8-16) | >2 hrs 9-15 (>3hrs 8-16) | >2hrs (8-16) | | |
| Upper Ground (A) | A_001 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | YES | | YES | | |
| | A_002 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | YES | | NO | | |
| | A_003 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | YES | | YES | | |
| | A_004 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | YES | NO | | |
| | A_005 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | YES | | |
| Level 1 (A) | A_006 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | | | YES | | |
| | A_101 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | YES | | YES | | |
| | A_102 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | YES | | NO | | |
| | A_103 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | YES | | YES | | |
| | A_104 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | YES | NO | | |
| Level 2 (A) | A_105 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | YES | | |
| | A_106 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | | | YES | | |
| | A_201 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | YES | | YES | | |
| | A_202 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | YES | | NO | | |
| | A_203 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | YES | | YES | | |
| Upper Ground (B) | A_204 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | YES | | NO | | |
| | A_205 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | YES | | YES | | |
| | A_206 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | YES | | YES | | |
| | | | | | | | | | | | | | | | | | | | | | | | |
| | B_001 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | YES | | YES | | |
| | B_002 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | YES | | NO | | |
| | B_003 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | YES | | YES | | |
| | B_004 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | | | YES | | |
| | B_005 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | NO | | |

| | | Solar access | | | | | | | | | | | | | | | | Solar compliance | | | | | | |
|------------------------|-------|--------------|-----|---|-----|----|------|----|------|----|------|----|------|----|------|----|------|------------------|----------------|-----------------------------|--------------|------------|----------|--|
| LEVEL | UNIT | 8 | 830 | 9 | 930 | 10 | 1030 | 11 | 1130 | 12 | 1230 | 13 | 1330 | 14 | 1430 | 15 | 1530 | 16 | >3 hrs 9-15 | >2 hrs 9-15 (>3hrs 8-16) | >2hrs (8-16) | Cross Vent | Notes | |
| Level 1 (B) | B_006 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | YES | | |
| | B_101 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | YES | | | YES | | |
| | B_102 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | YES | | | NO | | |
| | B_103 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | YES | | | YES | | |
| | B_104 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | | | | YES | | |
| | B_105 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | NO | | |
| Level 2 (B) | B_106 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | B | | | | YES | | |
| | B_201 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | YES | | | YES | SKYLIGHT | |
| | B_202 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | YES | | | NO | SKYLIGHT | |
| | B_203 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | YES | | | YES | SKYLIGHT | |
| | B_204 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | YES | | | YES | SKYLIGHT | |
| | B_205 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | YES | | | NO | SKYLIGHT | |
| Level 1 (C) | B_206 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | YES | | | YES | SKYLIGHT | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| | C_101 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | YES | | | YES | SKYLIGHT | |
| Upper Ground (D) | C_102 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | YES | | | YES | SKYLIGHT | |
| | C_103 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | YES | | | YES | SKYLIGHT | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| Level 1 | D_001 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | NO | | |
| | D_002 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | YES | | | YES | | |
| | D_003 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | YES | | | NO | | |
| | D_004 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | YES | | | YES | | |
| | D_005 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | YES | | | YES | | |
| | D_006 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | YES | | | NO | | |
| | D_007 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | YES | | | YES | | |
| Level 1 | D_008 | 0 | 0 | 0 | B | B | B | B | B | B | B | B | B | B | 0 | 0 | 0 | 0 | | | | YES | | |
| | D_009 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | NO | | |
| | D_101 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | | | | NO | | |

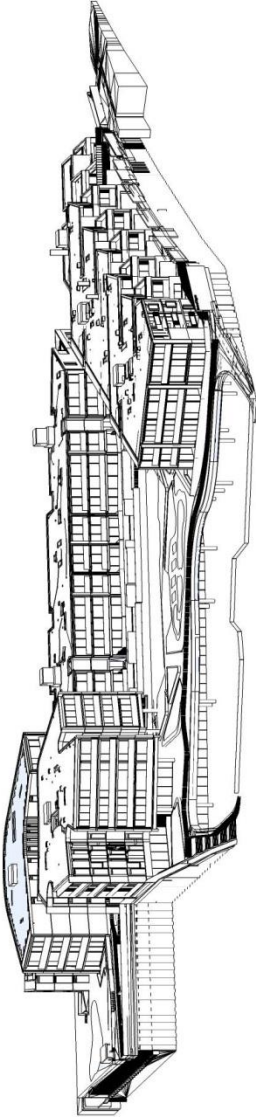
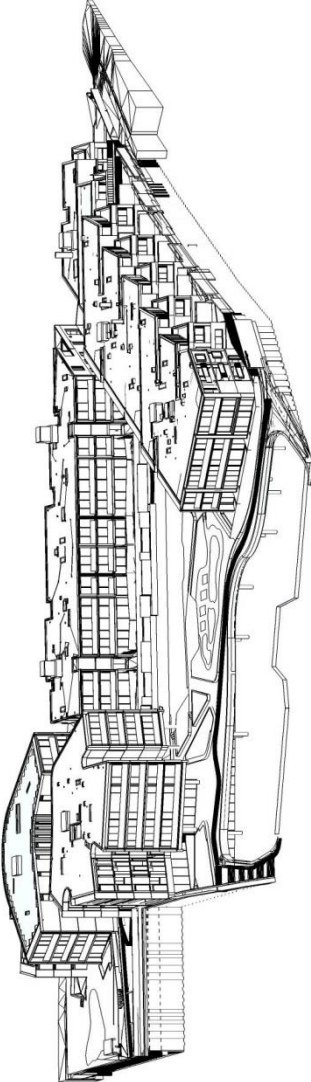
| | | Solar access | | | | | | | | | | | | | | | | Solar compliance | | | | | | | |
|----------------|-------|--------------|-----|---|-----|----|------|----|------|----|------|----|------|----|------|----|------|------------------|---------------------------|--------------|------------|-------|--|--|--|
| LEVEL | UNIT | 8 | 830 | 9 | 930 | 10 | 1030 | 11 | 1130 | 12 | 1230 | 13 | 1330 | 14 | 1430 | 15 | 1530 | 16 | >3 hrs 9-15 >3hrs 8-16 | >2hrs (8-16) | Cross Vent | Notes | | | |
| (D) | D_102 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | YES | | YES | | | | |
| | D_103 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | YES | | NO | | | | |
| | D_104 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | YES | | YES | | | | |
| | D_105 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | YES | | YES | | | | |
| | D_106 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | YES | | NO | | | | |
| | D_107 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | YES | | YES | | | | |
| | D_108 | 0 | B | B | B | B | B | B | B | B | B | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | YES | YES | | | | |
| | D_109 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | | | NO | | | | |
| LEVEL 2 (D) | D_202 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | YES | | YES | | | | |
| | D_203 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | YES | | NO | | | | |
| | D_204 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | YES | | YES | | | | |
| | D_205 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | YES | | YES | | | | |
| | D_206 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | YES | | NO | | | | |
| | D_207 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | YES | | YES | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| LEVEL 1 (E) | E_101 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | YES | | YES | | | | |
| | E_102 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | B | B | B | B | 0 | 0 | 0 | 0 | | YES | YES | | | | |
| | E_103 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | YES | | | | |
| | E_104 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | NO | | | | |
| LEVEL 2 (E) | E_105 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | YES | | YES | | | | |
| | E_201 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | YES | | YES | | | | |
| | E_202 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | B | B | B | B | B | B | 0 | 0 | 0 | 0 | | YES | YES | | | | |
| | E_203 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | YES | | | | |
| | E_204 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | NO | | | | |
| | E_205 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | YES | | YES | | | | |
| | E_301 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | YES | | YES | | | | |
| LEVEL 3 (E) | E_302 | 1 | 1 | 1 | 1 | 1 | B | B | B | B | B | B | B | B | B | B | 0 | 0 | | YES | YES | | | | |
| | E_303 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | YES | | | | |

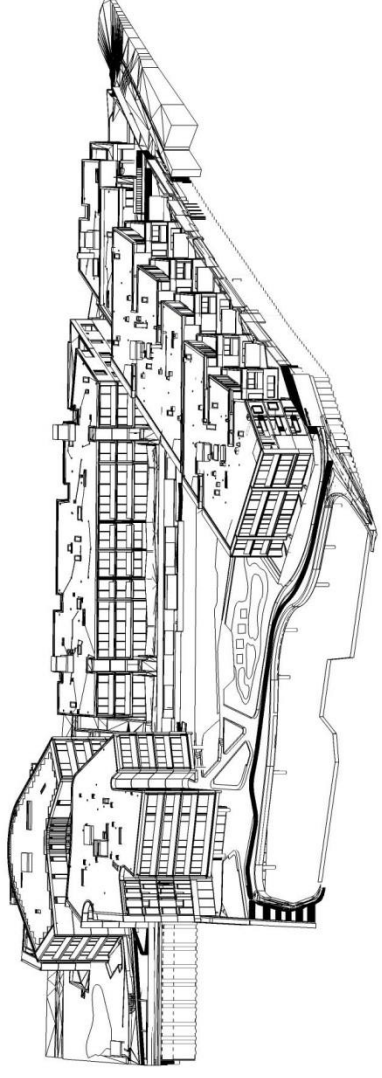

| | | Solar access | | | | | | | | | | | | | | | | Solar compliance | | | | | | |
|----------------|-------|--------------|-----|---|-----|----|------|----|------|----|------|----|------|----|------|----|------|------------------|----------------|---------------------------|--------------|------------|----------|--|
| LEVEL | UNIT | 8 | 830 | 9 | 930 | 10 | 1030 | 11 | 1130 | 12 | 1230 | 13 | 1330 | 14 | 1430 | 15 | 1530 | 16 | >3 hrs 9-15 | >2 hrs 9-15 >3hrs 8-16 | >2hrs (8-16) | Cross Vent | Notes | |
| LEVEL 4 (E) | E_304 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | YES | | YES | | |
| | E_401 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | YES | | | YES | SKYLIGHT | |
| | E_402 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | YES | | | YES | SKYLIGHT | |
| | E_403 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | YES | | | YES | SKYLIGHT | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| LEVEL 1 (F) | F_101 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | YES | | | YES | | |
| | F_102 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | B | B | B | B | B | B | B | YES | | | YES | | |
| | F_103 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | YES | | | NO | | |
| | F_104 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | | | | YES | | |
| LEVEL 2 (F) | F_201 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | YES | | | YES | | |
| | F_202 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | B | B | B | B | B | B | B | YES | | | YES | | |
| | F_203 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | YES | | | NO | | |
| | F_204 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | | | | YES | | |
| LEVEL 3 (F) | F_301 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | YES | | | YES | | |
| | F_302 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | B | B | B | B | B | B | B | YES | | | YES | | |
| | F_303 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | YES | | | NO | | |
| | F_304 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | | | | YES | | |
| LEVEL 4 (F) | F_301 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | YES | | | YES | SKYLIGHT | |
| | F_302 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | YES | | | YES | SKYLIGHT | |
| | F_303 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | YES | | | NO | SKYLIGHT | |
| | F_304 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | YES | | | YES | SKYLIGHT | |

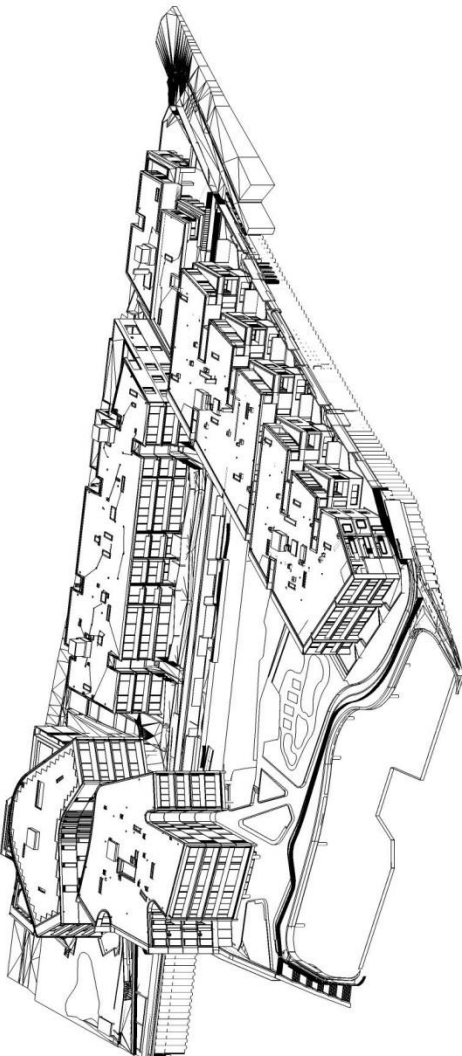
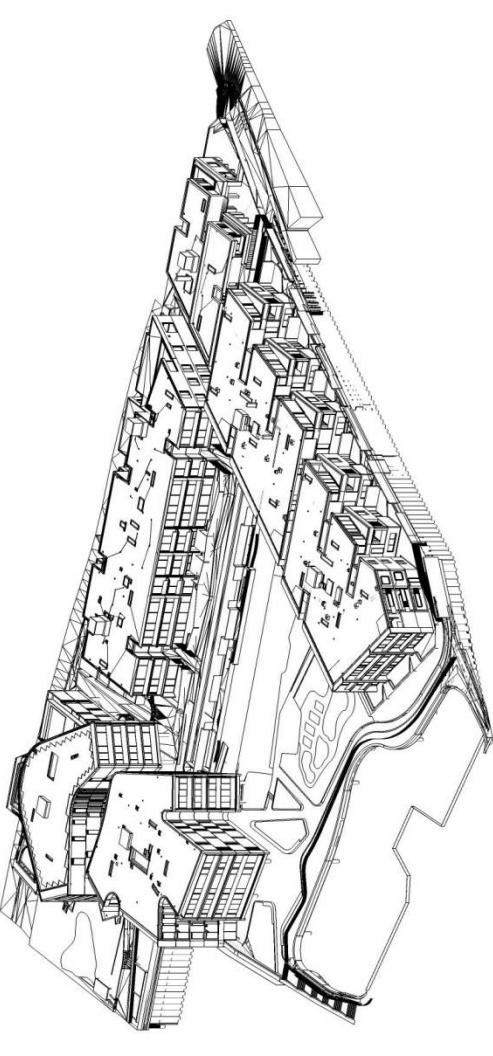
| | | | | | | | | |
|------------|-------|----------------|-----------------------------|--------------|------------|-------|--|--|
| COMBINED | | | | | | | | |
| 96 | Units | >3 hrs 9-15 | >2 hrs 9-15 (>3hrs 8-16) | >2hrs (8-16) | Cross vent | | | |
| | | 66 | 4 | 5 | 68 | | | |
| | | 68.8% | 4.2% | 5.2% | 70.8% | | | |
| | | 72.9% | | | | 75 | | |
| | | | | | | 78.1% | | |
| BUILDING A | | | | | | | | |
| 18 | Units | >3 hrs 9-15 | >2 hrs 9-15 (>3hrs 8-16) | >2hrs (8-16) | Cross vent | | | |
| | | 12 | 2 | 2 | 12 | | | |
| | | 66.7% | 11.1% | 11.1% | 66.7% | | | |
| | | 77.8% | | | | 16 | | |
| | | 88.9% | | | | | | |
| BUILDING B | | | | | | | | |
| 18 | Units | >3 hrs 9-15 | >2 hrs 9-15 (>3hrs 8-16) | >2hrs (8-16) | Cross vent | | | |
| | | 12 | 0 | 0 | 12 | | | |
| | | 66.7% | 0.0% | 0.0% | 66.7% | | | |
| | | 66.7% | | | | 12 | | |
| | | 66.7% | | | | | | |
| BUILDING C | | | | | | | | |
| 3 | Units | >3 hrs 9-15 | >2 hrs 9-15 (>3hrs 8-16) | >2hrs (8-16) | Cross vent | | | |
| | | 3 | 0 | 0 | 3 | | | |
| | | 100.0% | 0.0% | 0.0% | 100.0% | | | |
| | | 100.0% | | | | 3 | | |
| | | 100.0% | | | | | | |
| BUILDING D | | | | | | | | |
| 24 | Units | >3 hrs 9-15 | >2 hrs 9-15 (>3hrs 8-16) | >2hrs (8-16) | Cross vent | | | |
| | | 18 | 1 | 0 | 14 | | | |
| | | 75.0% | 4.2% | 0.0% | 58.3% | | | |
| | | 79.2% | | | | 19 | | |
| | | 79.2% | | | | | | |
| BUILDING E | | | | | | | | |
| 17 | Units | >3 hrs 9-15 | >2 hrs 9-15 (>3hrs 8-16) | >2hrs (8-16) | Cross vent | | | |
| | | 8 | 1 | 3 | 15 | | | |
| | | 47.1% | 5.9% | 17.6% | 88.2% | | | |
| | | 52.9% | | | | 12 | | |
| | | 70.6% | | | | | | |
| BUILDING F | | | | | | | | |
| 16 | Units | >3 hrs 9-15 | >2 hrs 9-15 (>3hrs 8-16) | >2hrs (8-16) | Cross vent | | | |
| | | 13 | 0 | 0 | 12 | | | |
| | | 81.3% | 0.0% | 0.0% | 75.0% | | | |
| | | 81.3% | | | | 13 | | |
| | | 81.3% | | | | | | |

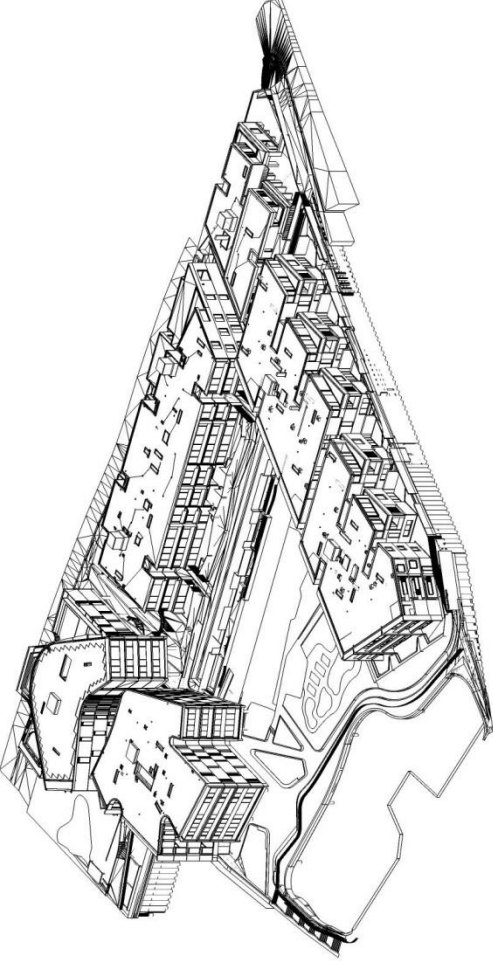
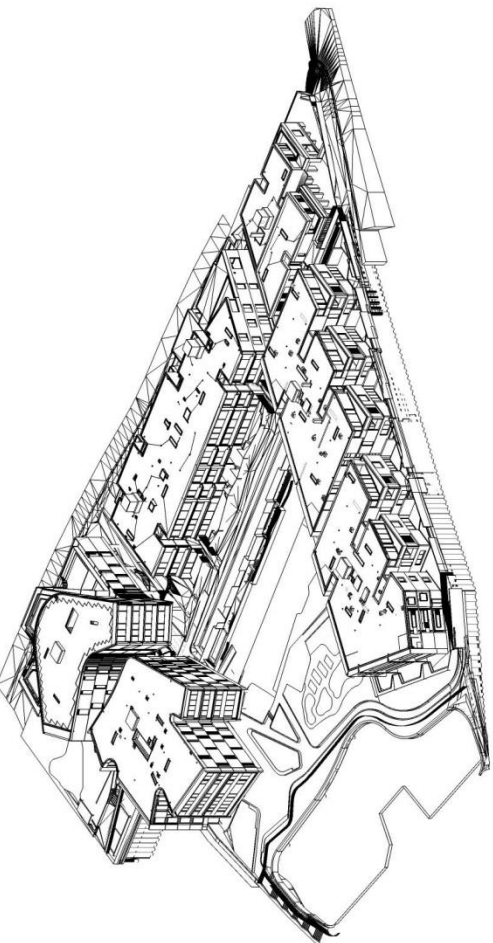
A.0 APPENDIX: VIEWS FROM THE SUN

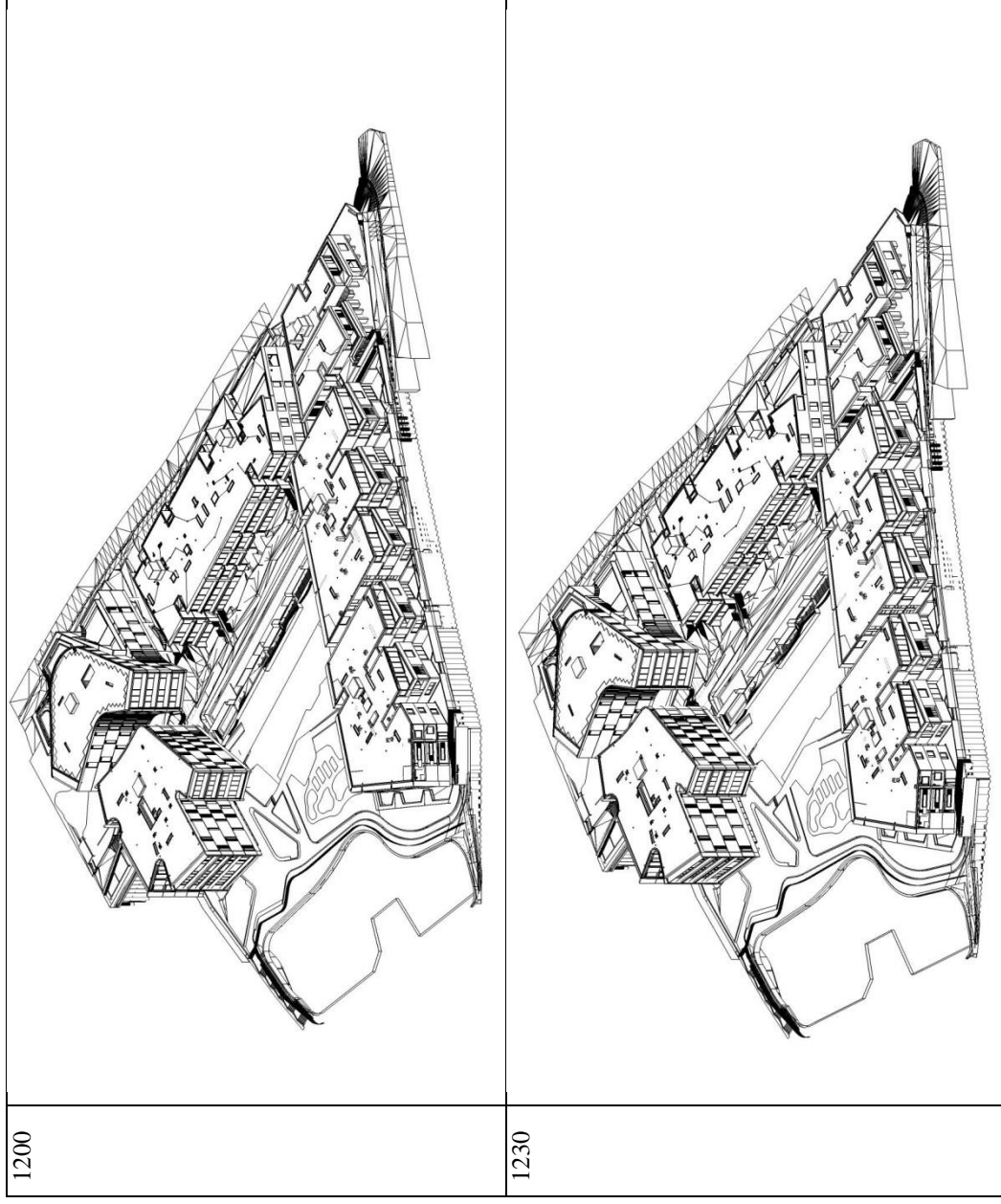
The attached table reproduces for reference in reduced form the hourly views of solar access projections for June 21. The projections were prepared by me from a 3D digital model in Trimble SketchUp v8.

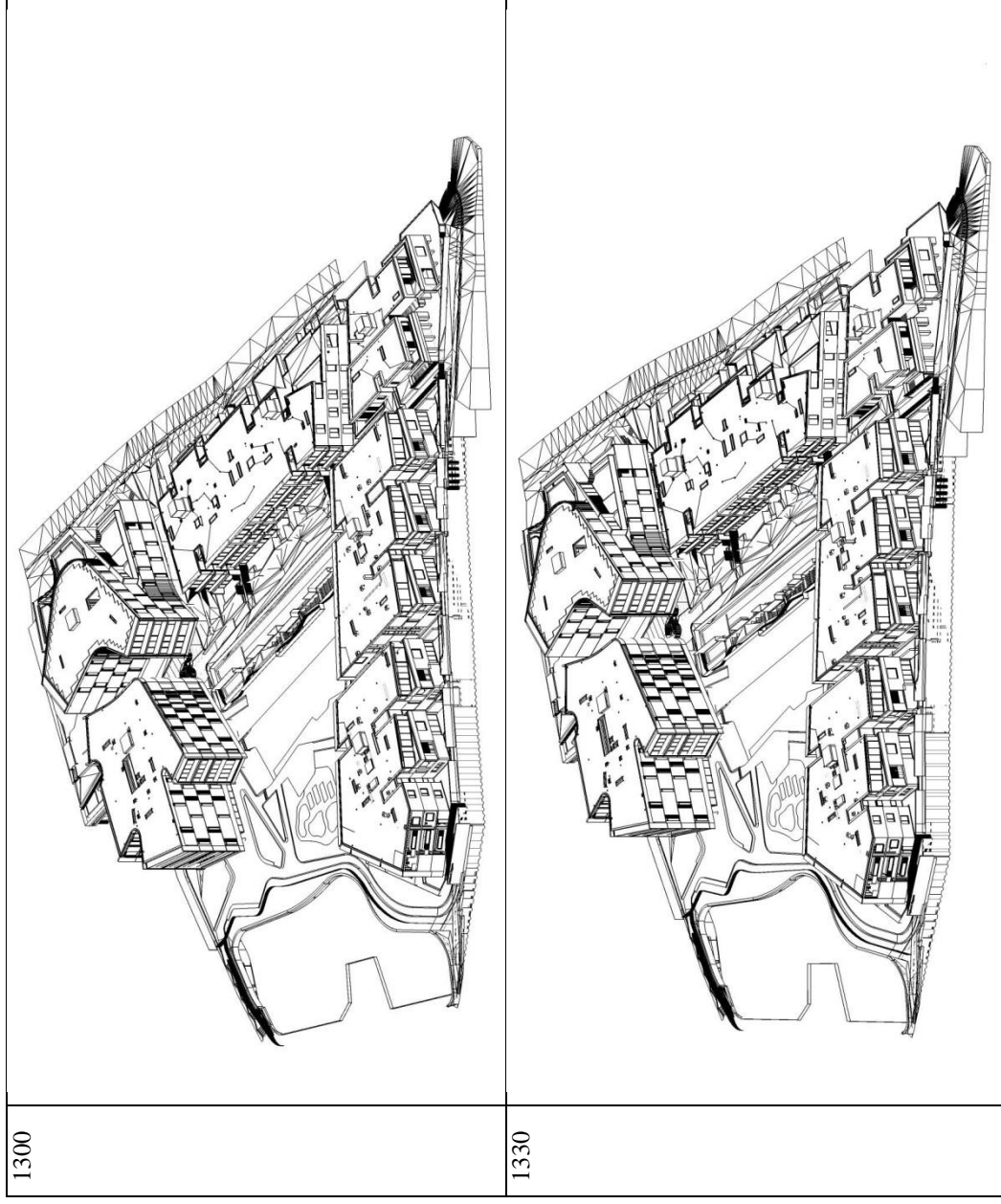
| | |
|------|---|
| 0800 |  |
| 0830 |  |

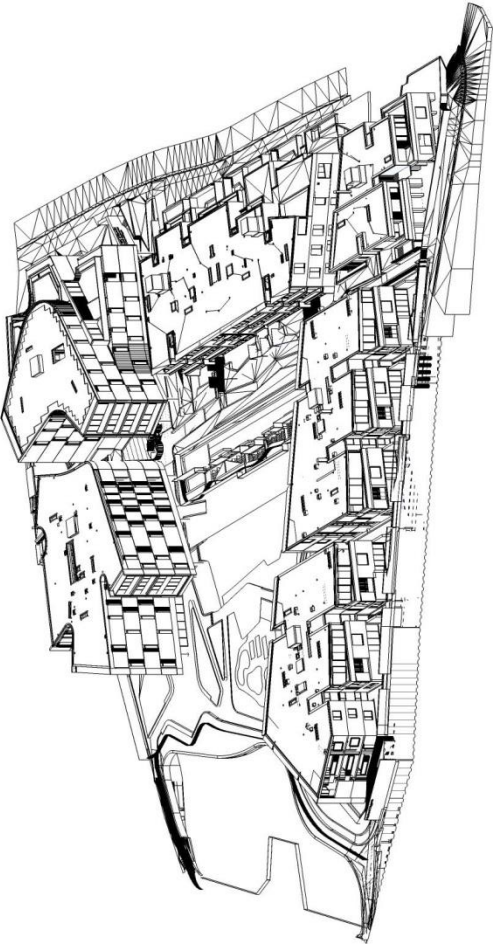

| | |
|--|---|
| <p>0900</p>  | <p>0930</p>  |
|--|---|

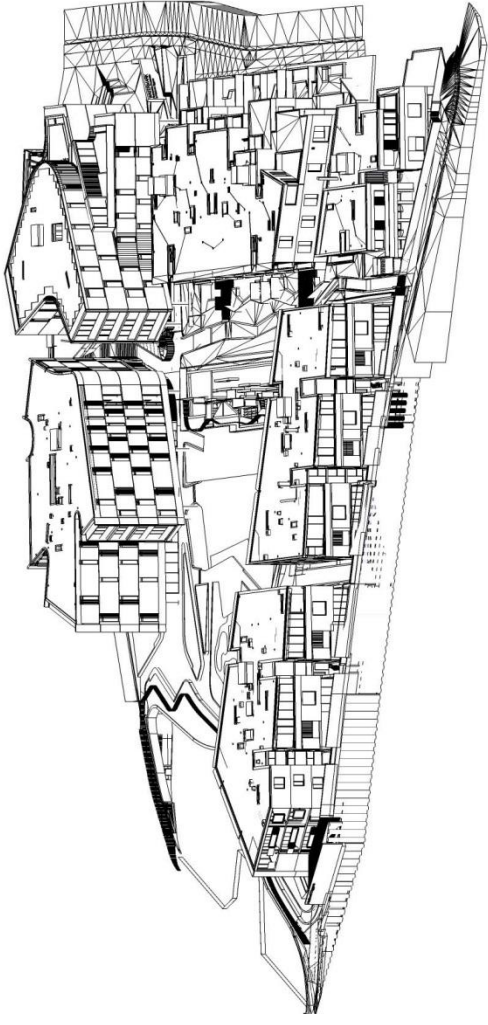
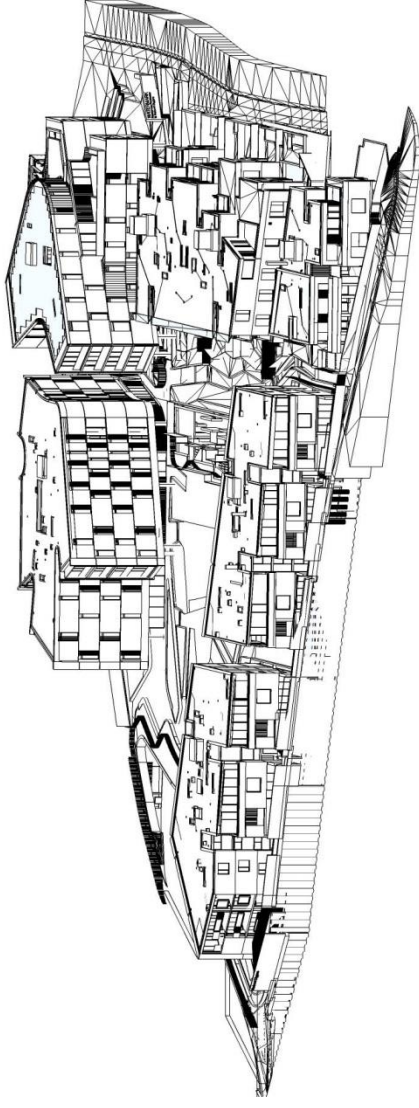
| | |
|--|---|
| <p>1000</p>  |  |
| <p>1030</p> | |

| | |
|--|---|
| <p>1100</p>  |  |
| <p>1130</p> | |





| | |
|------|--|
| 1400 |  |
| 1430 |  |

| | |
|--|---|
| <p>1500</p>  |  |
| <p>1530</p> | |

