WINDTECH

Direct Solar Access Analysis

for the proposed development known as

Macquarie Place, Parramatta

July 13, 2011

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Document Control

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1.0 Executive Summary

This report presents the results of a detailed assessment of the amount of direct solar access to the living areas and associated private open spaces for each residential apartment of the proposed development known as Macquarie Place, located in Parramatta. The analysis has been undertaken based on architectural drawings of the subject buildings prepared by the project architect Allen Jack + Cottier, received 7 July 2011.

The study has taken into account any overshadowing effects caused by neighbouring buildings, eaves, overhead protruding balcony slabs, blade walls, and any other façade features that may affect direct solar access.

The amount of solar access been calculated onto the glass-line of the window(s) of the living area, and onto the floor-slab of the associated private open space, of each residential unit of the subject development, and the results are compared against the criteria for direct solar access described in the State Environmental Planning Policy No. 65 (SEPP 65) and Parramatta DCP. The results presented in this report are based between the hours of 9am and 3pm on the Winter Solstice (June 21), as required by SEPP 65 and the Parramatta DCP.

For a multi-dwelling residential development, SEPP 65 requires that at least 70% of the residential apartments achieve at least 3 hours of direct solar access between 9am and 3pm on June 21. For dense urban areas however, a minimum of 2 hours of direct solar access may be acceptable. Note also that SEPP 65 requires that the number of south-facing single-aspect units within a development should be less than 10% of the total number of residential dwellings.

The analysis of direct solar access is carried out based on the shadow diagram analysis of the proposed development and its adjacent surroundings in a 3D CAD environment. Visual representations of the direct solar access onto the proposed development are attached in the Appendix of this report. The results presented in this report for the number of hours of direct solar access for each residential dwelling are accurate to within 10 minute.

The results of the analysis are summarised as follows.

- 9% (32 out of 367) of the residential apartments have the living room window(s) facing towards the south, which is within the 10% limit.
- 74% (270 of the total 367) of the residential apartments receive at least 2 hours of direct solar access to the glass-line of the window(s) of the living areas between 9am and 3pm.
- 84% (309 out of 367) of the residential apartments receive at least 2 hours of direct solar access to the floor of the private open spaces between 9am and 3pm.

The results of the analysis indicate that the development will comply with solar access requirements stipulated in SEPP 65 and the Parramatta DCP of more than 70% of the residential apartments achieving direct solar access for more than 2 hours.

2.0 Description of the Proposed Development

The proposed development site is located on an existing car park site bounded by Macquarie Street to the north, Marsden Street to the east, Hunter Street to the south, and low to mid rise developments to the west. Figure 1 shows an aerial image of the proposed development site. Directly north of the site is the high rise development known as the Jessie Street Centre. Surrounding the site to the east, south and west are low to mid rise business and commercial development of varying heights. The landform in the local vicinity of the site has a general rise towards the north.

The proposed development consists of a mixed use building in a mirrored "L'" shape design. The proposed development has a total of 25 floors above ground, with 6 basement levels for car parking, a 2 level podium for commercial and retail interests, and 23 residential floors atop of the podium.

Figure 1: Aerial Image of the Site

3.0 Criteria for Direct Solar Access

The number of hours of direct solar access that each residential apartment of the proposed development achieves is compared to criteria from the State Environmental Planning Policy No. 65 (SEPP 65) and the Parramatta City Council Development Control Plan (DCP) requirements. The criteria stipulated under each criterion are detailed in the sections below.

3.1 State Environmental Planning Policy No. 65 (SEPP65)

The State Environmental Planning Policy No. 65 (SEPP65) for the design of quality residential flat development requires that a residential development should be designed in such a way as to optimise the amount of available solar access.

The Residential Flat Design Code has the following guidelines, listed as "Rules of Thumb":

- *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."*

3.2 Parramatta City Council DCP 2005, Part 4.3.4

The development is located in the Parramatta Town Centre precinct located within the Parramatta City Council. The planning regulations pertaining to this site are bound by the Parramatta City Council Development Control Plan 2005, Part 4.3.4, which states the following:

- *Dwellings within the development site and adjoining properties are to receive a minimum of 3 hours sunlight in habitable rooms and in at least 50% of the private open space between 9am and 3am on 21 June.*

As the proposed development is located in a high density urban area, the requirement for two hours of solar access between the 9am and 3pm on the Winter Solstice for SEPP65 is applicable.

4.0 Methodology

The amount of direct solar access to the living areas and associated private open spaces of the proposed development known as Macquarie Place has been assessed. The analysis has been undertaken based on architectural drawings of the subject buildings prepared by the project architect Allen Jack + Cottier, received 7 July 2011.

The amount of solar access been calculated onto the glass-line of the window(s) of the living area, and onto the floor-slab of the associated private open space, of each residential unit of the subject development, and the results are compared against the criteria for direct solar access described in the State Environmental Planning Policy No. 65 (SEPP 65) and Parramatta DCP. The results presented in this report are based between the hours of 9am and 3pm on the Winter Solstice (June 21), as required by SEPP 65 and the Parramatta DCP.

The analysis of direct solar access is carried out based on the shadow diagram analysis of the proposed development and its adjacent surroundings in a 3D CAD environment. Visual representations of the direct solar access onto the proposed development are attached in the Appendix of this report. The results presented in this report for the number of hours of direct solar access for each residential dwelling are accurate to within 10 minutes.

The study has taken into account any overshadowing effects caused by neighbouring buildings, eaves, overhead protruding balcony slabs, blade walls, and any other façade features that may affect direct solar access. Figures 2a to 2e illustrates the 3D CAD model used for the solar access study.

Figure 2a: 3D CAD model used for the Direct Solar Access Study

Figure 2b: 3D CAD model used for the Direct Solar Access Study

Figure 2c: 3D CAD model used for the Direct Solar Access Study

Figure 2d: 3D CAD model used for the Direct Solar Access Study

Figure 2e: 3D CAD model used for the Direct Solar Access Study

5.0 Results and Recommendations

5.1 Results

The amount of direct solar access, presented as the total number of hours, to the glass-line of the window(s) of the living area, and to the floor slabs of the associated private open space, has been calculated for each residential apartment of the subject development. The results are presented in the following Tables 1 and 2. Also presented in these tables are the times of occurrence when direct solar access is achieved.

Table 1 presents the number of hours and times of occurrence of direct solar access into living areas and private open spaces between 9am and 3pm on the Winter Solstice (June 21).

The unit numbers referenced in the following tables match those shown in the architectural drawings.

Table 1: Direct Solar Access to the Living Areas and Private Open Space of each Residential Unit between 9am and 3pm

Unit Number	Living Area		Private Open Space	
	Number of Hours	Times of Occurrence	Number of Hours	Times of Occurrence
2.01	0.8	12:30 - 13:20	0.7	12:40 - 13:20
2.02	0.0	No Solar Access	0.2	13:50 - 14:00
2.03	1.0	14:00 - 15:00	1.0	14:00 - 15:00
2.04	0.0	No Solar Access	0.0	No Solar Access
2.05	0.0	No Solar Access	0.0	No Solar Access
2.06	0.0	No Solar Access	0.0	No Solar Access
2.07	0.0	No Solar Access	0.0	No Solar Access
2.08	1.5	9:40 - 10:10, 10:30 - 11:10 and 14:40 - 15:00	1.7	9:40 - 10:20, 10:40 - 11:20 and 14:40 - 15:00
2.09	1.5	10:30 - 12:00	1.7	10:40 - 12:20
2.10	1.8	11:00 - 12:50	1.7	11:00 - 12:40
2.11	0.5	12:10 - 12:40	1.2	11:30 - 12:40
2.12	0.3	12:30 - 12:50	1.2	11:30 - 12:10 and 12:20 - 12:50
3.01	0.8	12:30 - 13:20	1.2	11:50 - 12:10 and 12:30 - 13:20
3.02	0.5	13:30 - 14:00	0.2	13:50 - 14:00
3.03	1.0	14:00 - 15:00	1.0	14:00 - 15:00

Table 1: Direct Solar Access to the Living Areas and Private Open Space of each Residential Unit between 9am and 3pm (Cont...)

Unit Number	Living Area		Private Open Space	
	Number of Hours	Times of Occurrence	Number of Hours	Times of Occurrence
3.04	2.0	9:00 - 11:00	2.2	9:00 - 11:00 and 14:50 - 15:00
3.05	2.2	9:00 - 11:10	2.3	9:00 - 11:20
3.06	2.5	9:00 - 11:30	2.7	9:00 - 11:40
3.07	0.0	No Solar Access	0.0	No Solar Access
3.08	0.0	No Solar Access	0.0	No Solar Access
3.09	0.0	No Solar Access	0.0	No Solar Access
3.10	0.0	No Solar Access	0.0	No Solar Access
3.11	1.8	9:40 - 11:10 and 14:40 - 15:00	1.7	9:40 - 10:20, 10:40 - 11:20 and 14:40 - 15:00
3.12	1.7	10:30 - 12:10	1.7	10:40 - 12:20
3.13	2.0	11:00 - 13:00	1.7	11:00 - 12:40
3.14	0.8	12:10 - 13:00	1.2	11:30 - 12:40
3.15	0.7	12:10 - 12:50	1.2	11:30 - 12:10 and 12:20 - 12:50
4.01	0.8	12:30 - 13:20	1.8	11:20 - 12:10 and 12:30 - 13:30
4.02	1.3	12:40 - 14:00	0.5	13:50 - 14:20
4.03	1.0	14:00 - 15:00	1.0	14:00 - 15:00
4.04	2.0	9:00 - 11:00	2.2	9:00 - 11:00 and 14:50 - 15:00
4.05	2.2	9:00 - 11:10	2.3	9:00 - 11:20
4.06	2.5	9:00 - 11:30	2.7	9:00 - 11:40
4.07	1.8	9:00 - 10:50	2.7	9:00 - 11:40
4.08	2.0	9:00 - 11:00	2.5	9:00 - 11:30
4.09	2.0	9:00 - 11:00	2.3	9:00 - 11:20
4.10	2.0	9:00 - 11:00	2.3	9:00 - 11:20
4.11	2.0	9:00 - 11:00	2.3	9:00 - 11:20
4.12	2.0	9:00 - 11:00	2.3	9:00 - 11:20
4.13	0.0	No Solar Access	0.0	No Solar Access
4.14	0.0	No Solar Access	0.0	No Solar Access

Table 1: Direct Solar Access to the Living Areas and Private Open Space of each Residential Unit between 9am and 3pm (Cont...)

Unit Number	Living Area		Private Open Space	
	Number of Hours	Times of Occurrence	Number of Hours	Times of Occurrence
4.15	0.0	No Solar Access	0.0	No Solar Access
4.16	0.0	No Solar Access	0.0	No Solar Access
4.17	1.8	9:40 - 11:10 and 14:40 - 15:00	2.2	9:40 - 11:30 and 14:40 - 15:00
4.18	1.8	10:30 - 12:20	2.0	10:30 - 12:30
4.19	2.2	11:00 - 13:10	2.0	11:00 - 13:00
4.20	1.0	12:10 - 13:10	1.5	11:30 - 13:00
4.21	1.0	12:10 - 13:10	1.5	11:30 - 13:00
5.01	1.2	12:10 - 13:20	0.8	11:20 - 12:10
5.02	1.3	12:40 - 14:00	3.0	11:20 - 14:20
5.03	1.5	13:30 - 15:00	1.0	14:00 - 15:00
5.04	2.0	9:00 - 11:00	2.2	9:00 - 11:00 and 14:50 - 15:00
5.05	2.2	9:00 - 11:10	2.3	9:00 - 11:20
5.06	2.5	9:00 - 11:30	2.7	9:00 - 11:40
5.07	1.8	9:00 - 10:50	2.0	9:00 - 11:00
5.08	2.0	9:00 - 11:00	2.0	9:00 - 11:00
5.09	2.0	9:00 - 11:00	2.0	9:00 - 11:00
5.10	2.0	9:00 - 11:00	2.0	9:00 - 11:00
5.11	2.0	9:00 - 11:00	2.0	9:00 - 11:00
5.12	2.0	9:00 - 11:00	2.0	9:00 - 11:00
5.13	0.0	No Solar Access	0.0	No Solar Access
5.14	0.0	No Solar Access	0.0	No Solar Access
5.15	0.0	No Solar Access	0.0	No Solar Access
5.16	0.0	No Solar Access	0.0	No Solar Access
5.17	1.8	9:40 - 11:10 and 14:40 - 15:00	2.2	9:40 - 11:30 and 14:40 - 15:00
5.18	2.0	10:30 - 12:30	2.3	10:30 - 12:50
5.19	2.3	11:00 - 13:20	2.2	11:00 - 13:10
5.20	1.2	12:10 - 13:20	1.7	11:30 - 13:10
5.21	1.2	12:10 - 13:20	1.8	11:30 - 13:20

Table 1: Direct Solar Access to the Living Areas and Private Open Space of each Residential Unit between 9am and 3pm (Cont...)

Unit Number	Living Area		Private Open Space	
	Number of Hours	Times of Occurrence	Number of Hours	Times of Occurrence
6.01	0.5	12:10 - 12:40	2.0	11:20 - 13:20
6.02	1.3	12:40 - 14:00	2.2	11:40 - 12:10 and 12:40 - 14:20
6.03	2.2	12:50 - 15:00	2.2	12:50 - 15:00
6.04	2.0	9:00 - 11:00	2.2	9:00 - 11:00 and 14:50 - 15:00
6.05	2.2	9:00 - 11:10	2.3	9:00 - 11:20
6.06	2.5	9:00 - 11:30	2.7	9:00 - 11:40
6.07	1.8	9:00 - 10:50	2.0	9:00 - 11:00
6.08	2.0	9:00 - 11:00	2.0	9:00 - 11:00
6.09	2.0	9:00 - 11:00	2.0	9:00 - 11:00
6.10	2.0	9:00 - 11:00	2.0	9:00 - 11:00
6.11	2.0	9:00 - 11:00	2.0	9:00 - 11:00
6.12	2.0	9:00 - 11:00	2.0	9:00 - 11:00
6.13	0.0	No Solar Access	0.0	No Solar Access
6.14	0.0	No Solar Access	0.0	No Solar Access
6.15	0.0	No Solar Access	0.0	No Solar Access
6.16	0.0	No Solar Access	0.0	No Solar Access
6.17	1.8	9:40 - 11:10 and 14:40 - 15:00	2.3	9:40 - 11:40 and 14:40 - 15:00
6.18	2.3	10:30 - 12:50	2.5	10:30 - 13:00
6.19	2.5	11:00 - 13:30	2.5	11:00 - 13:30
6.20	1.3	12:10 - 13:30	2.0	11:30 - 13:30
6.21	1.3	12:10 - 13:30	2.0	11:30 - 13:30
7.01	1.8	12:10 - 14:00	2.5	11:20 - 13:50
7.02	1.3	12:40 - 14:00	2.7	11:20 - 14:00
7.03	2.2	12:50 - 15:00	2.2	12:50 - 15:00
7.04	2.0	9:00 - 11:00	2.2	9:00 - 11:00 and 14:50 - 15:00
7.05	2.2	9:00 - 11:10	2.3	9:00 - 11:20
7.06	2.7	9:00 - 11:40	2.7	9:00 - 11:40

Table 1: Direct Solar Access to the Living Areas and Private Open Space of each Residential Unit between 9am and 3pm (Cont...)

Unit Number	Living Area		Private Open Space	
	Number of Hours	Times of Occurrence	Number of Hours	Times of Occurrence
7.07	1.8	9:00 - 10:50	2.0	9:00 - 11:00
7.08	2.0	9:00 - 11:00	2.0	9:00 - 11:00
7.09	2.0	9:00 - 11:00	2.0	9:00 - 11:00
7.10	2.0	9:00 - 11:00	2.0	9:00 - 11:00
7.11	2.0	9:00 - 11:00	2.0	9:00 - 11:00
7.12	2.0	9:00 - 11:00	2.0	9:00 - 11:00
7.13	0.0	No Solar Access	0.0	No Solar Access
7.14	0.0	No Solar Access	0.0	No Solar Access
7.15	0.0	No Solar Access	0.0	No Solar Access
7.16	0.0	No Solar Access	0.0	No Solar Access
7.17	4.8	9:40 - 11:40 and 12:10 - 15:00	-11.8	9:40 - 12:00 and 14:10 - 0:00
7.18	3.7	10:30 - 14:10	2.7	10:30 - 13:10
7.19	3.7	11:00 - 14:40	2.8	11:00 - 13:50
7.20	1.7	12:10 - 13:50	2.3	11:30 - 13:50
7.21	1.7	12:10 - 13:50	2.2	11:30 - 13:40
8.01	2.0	12:10 - 14:10	2.7	11:20 - 14:00
8.02	1.8	12:40 - 14:30	3.0	11:20 - 14:20
8.03	2.2	12:50 - 15:00	2.2	12:50 - 15:00
8.04	2.0	9:00 - 11:00	2.2	9:00 - 11:00 and 14:50 - 15:00
8.05	2.2	9:00 - 11:10	2.3	9:00 - 11:20
8.06	2.7	9:00 - 11:40	2.8	9:00 - 11:50
8.07	1.8	9:00 - 10:50	2.0	9:00 - 11:00
8.08	2.0	9:00 - 11:00	2.0	9:00 - 11:00
8.09	2.0	9:00 - 11:00	2.0	9:00 - 11:00
8.10	2.0	9:00 - 11:00	2.0	9:00 - 11:00
8.11	2.0	9:00 - 11:00	2.0	9:00 - 11:00
8.12	2.0	9:00 - 11:00	2.0	9:00 - 11:00
8.13	0.0	No Solar Access	0.0	No Solar Access
8.14	0.0	No Solar Access	0.0	No Solar Access

Table 1: Direct Solar Access to the Living Areas and Private Open Space of each Residential Unit between 9am and 3pm (Cont...)

Unit Number	Living Area		Private Open Space	
	Number of Hours	Times of Occurrence	Number of Hours	Times of Occurrence
8.15	0.0	No Solar Access	0.0	No Solar Access
8.16	0.0	No Solar Access	0.0	No Solar Access
8.17	5.3	9:40 - 15:00	5.3	9:40 - 15:00
8.18	4.5	10:30 - 15:00	4.5	10:30 - 15:00
8.19	4.0	11:00 - 15:00	4.0	11:00 - 15:00
8.20	2.8	12:10 - 15:00	2.7	11:30 - 14:10
8.21	2.0	12:10 - 14:10	2.5	11:30 - 14:00
9.01	0.4	12:10 - 12:35	3.0	11:20 - 14:20
9.02	2.0	12:40 - 14:40	3.3	11:20 - 14:40
9.03	2.2	12:50 - 15:00	3.5	11:30 - 15:00
9.04	2.0	9:00 - 11:00	2.2	9:00 - 11:00 and 14:50 - 15:00
9.05	2.2	9:00 - 11:10	2.3	9:00 - 11:20
9.06	2.7	9:00 - 11:40	2.8	9:00 - 11:50
9.07	1.8	9:00 - 10:50	2.0	9:00 - 11:00
9.08	2.0	9:00 - 11:00	2.0	9:00 - 11:00
9.09	2.0	9:00 - 11:00	2.0	9:00 - 11:00
9.10	2.0	9:00 - 11:00	2.0	9:00 - 11:00
9.11	2.0	9:00 - 11:00	2.0	9:00 - 11:00
9.12	2.0	9:00 - 11:00	2.0	9:00 - 11:00
9.13	0.0	No Solar Access	0.0	No Solar Access
9.14	0.0	No Solar Access	0.0	No Solar Access
9.15	0.0	No Solar Access	0.0	No Solar Access
9.16	4.2	10:40 - 14:50	4.3	10:40 - 15:00
9.17	4.5	10:30 - 15:00	4.5	10:30 - 15:00
9.18	0.0	No Solar Access	0.0	No Solar Access
9.19	4.8	10:00 - 14:50	5.0	10:00 - 15:00
9.20	5.3	9:40 - 15:00	5.3	9:40 - 15:00
9.21	5.3	9:40 - 15:00	5.3	9:40 - 15:00
9.22	4.5	10:30 - 15:00	4.5	10:30 - 15:00

Table 1: Direct Solar Access to the Living Areas and Private Open Space of each Residential Unit between 9am and 3pm (Cont...)

Unit Number	Living Area		Private Open Space	
	Number of Hours	Times of Occurrence	Number of Hours	Times of Occurrence
9.23	4.0	11:00 - 15:00	4.0	11:00 - 15:00
9.24	2.8	12:10 - 15:00	3.5	11:30 - 15:00
9.25	2.5	12:10 - 14:40	2.9	11:30 - 14:25
10.01	2.8	12:10 - 15:00	3.5	11:20 - 14:50
10.02	2.3	12:40 - 15:00	3.5	11:20 - 14:50
10.03	2.2	12:50 - 15:00	3.5	11:30 - 15:00
10.04	2.7	9:00 - 11:00, 13:30 - 14:00 and 14:50 - 15:00	2.2	9:00 - 11:00 and 14:50 - 15:00
10.05	2.3	9:00 - 11:10 and 13:50 - 14:00	2.5	9:00 - 11:30
10.06	2.7	9:00 - 11:40	2.8	9:00 - 11:50
10.07	1.8	9:00 - 10:50	2.0	9:00 - 11:00
10.08	2.0	9:00 - 11:00	2.0	9:00 - 11:00
10.09	2.0	9:00 - 11:00	2.0	9:00 - 11:00
10.10	2.0	9:00 - 11:00	2.0	9:00 - 11:00
10.11	2.0	9:00 - 11:00	2.0	9:00 - 11:00
10.12	2.0	9:00 - 11:00	2.0	9:00 - 11:00
10.13	4.0	11:00 - 15:00	4.0	11:00 - 15:00
10.14	2.8	12:10 - 15:00	3.5	11:30 - 15:00
10.15	2.8	12:10 - 15:00	3.5	11:30 - 15:00
11.01	2.8	12:10 - 15:00	3.7	11:20 - 15:00
11.02	2.3	12:40 - 15:00	3.7	11:20 - 15:00
11.03	2.2	12:50 - 15:00	3.5	11:30 - 15:00
11.04	4.8	9:00 - 11:00, 11:40 - 13:00 and 13:30 - 15:00	4.5	9:00 - 11:00, 12:00 - 13:00 and 13:30 - 15:00
11.05	3.7	9:00 - 11:10 and 11:40 - 13:10	5.0	9:00 - 11:30, 11:50 - 13:20 and 13:50 - 14:50
11.06	5.0	9:00 - 13:40 and 14:10 - 14:30	4.5	9:00 - 11:50, 12:10 - 13:30 and 14:10 - 14:30

Table 1: Direct Solar Access to the Living Areas and Private Open Space of each Residential Unit between 9am and 3pm (Cont...)

Unit Number	Living Area		Private Open Space	
	Number of Hours	Times of Occurrence	Number of Hours	Times of Occurrence
11.07	1.8	9:00 - 10:50	2.0	9:00 - 11:00
11.08	2.0	9:00 - 11:00	2.0	9:00 - 11:00
11.09	2.0	9:00 - 11:00	2.0	9:00 - 11:00
11.10	2.0	9:00 - 11:00	2.0	9:00 - 11:00
11.11	2.0	9:00 - 11:00	2.0	9:00 - 11:00
11.12	2.0	9:00 - 11:00	2.0	9:00 - 11:00
11.13	3.2	11:50 - 15:00	3.8	11:10 - 15:00
11.14	2.8	12:10 - 15:00	3.5	11:30 - 15:00
11.15	2.8	12:10 - 15:00	3.5	11:30 - 15:00
12.01	2.8	12:10 - 15:00	3.7	11:20 - 15:00
12.02	2.3	12:40 - 15:00	3.7	11:20 - 15:00
12.03	2.2	12:50 - 15:00	3.5	11:30 - 15:00
12.04	5.7	9:00 - 13:10 and 13:30 - 15:00	5.4	9:00 - 11:00, 11:10 - 13:10 and 13:35 - 15:00
12.05	5.0	9:00 - 13:20 and 13:50 - 14:30	5.6	9:00 - 13:30 and 13:55 - 15:00
12.06	5.0	9:00 - 13:40 and 14:10 - 14:30	5.5	9:00 - 13:40 and 14:10 - 15:00
12.07	1.8	9:00 - 10:50	2.0	9:00 - 11:00
12.08	2.0	9:00 - 11:00	2.0	9:00 - 11:00
12.09	2.0	9:00 - 11:00	2.0	9:00 - 11:00
12.10	2.0	9:00 - 11:00	2.0	9:00 - 11:00
12.11	2.0	9:00 - 11:00	2.0	9:00 - 11:00
12.12	2.0	9:00 - 11:00	2.0	9:00 - 11:00
12.13	2.8	12:10 - 15:00	3.5	11:30 - 15:00
12.14	2.8	12:10 - 15:00	3.5	11:30 - 15:00
13.01	2.8	12:10 - 15:00	3.7	11:20 - 15:00
13.02	2.3	12:40 - 15:00	3.7	11:20 - 15:00
13.03	2.2	12:50 - 15:00	3.5	11:30 - 15:00
13.04	6.0	9:00 - 15:00	5.7	9:00 - 13:10 and 13:30 - 15:00

Table 1: Direct Solar Access to the Living Areas and Private Open Space of each Residential Unit between 9am and 3pm (Cont...)

Unit Number	Living Area		Private Open Space	
	Number of Hours	Times of Occurrence	Number of Hours	Times of Occurrence
13.05	5.5	9:00 - 14:30	5.8	9:00 - 13:40 and 13:50 - 15:00
13.06	5.2	9:00 - 13:50 and 14:10 - 14:30	5.8	9:00 - 14:00 and 14:10 - 15:00
13.07	1.8	9:00 - 10:50	2.0	9:00 - 11:00
13.08	2.0	9:00 - 11:00	2.0	9:00 - 11:00
13.09	2.0	9:00 - 11:00	2.0	9:00 - 11:00
13.10	2.0	9:00 - 11:00	2.0	9:00 - 11:00
13.11	2.0	9:00 - 11:00	2.0	9:00 - 11:00
13.12	2.0	9:00 - 11:00	2.0	9:00 - 11:00
13.13	2.8	12:10 - 15:00	3.5	11:30 - 15:00
13.14	2.8	12:10 - 15:00	3.5	11:30 - 15:00
13.15	2.8	12:10 - 15:00	3.5	11:30 - 15:00
13.16	2.8	12:10 - 15:00	3.5	11:30 - 15:00
14.01	2.8	12:10 - 15:00	3.7	11:20 - 15:00
14.02	2.3	12:40 - 15:00	3.7	11:20 - 15:00
14.03	2.2	12:50 - 15:00	3.5	11:30 - 15:00
14.04	6.0	9:00 - 15:00	6.0	9:00 - 15:00
14.05	5.5	9:00 - 14:30	6.0	9:00 - 15:00
14.06	5.5	9:00 - 14:30	6.0	9:00 - 15:00
14.07	1.8	9:00 - 10:50	2.0	9:00 - 11:00
14.08	2.0	9:00 - 11:00	2.0	9:00 - 11:00
14.09	2.0	9:00 - 11:00	2.0	9:00 - 11:00
14.10	2.0	9:00 - 11:00	2.0	9:00 - 11:00
14.11	2.0	9:00 - 11:00	2.0	9:00 - 11:00
14.12	2.0	9:00 - 11:00	2.0	9:00 - 11:00
14.13	2.8	12:10 - 15:00	3.5	11:30 - 15:00
14.14	2.8	12:10 - 15:00	3.5	11:30 - 15:00
14.15	2.8	12:10 - 15:00	3.5	11:30 - 15:00
14.16	2.8	12:10 - 15:00	3.5	11:30 - 15:00
15.01	2.8	12:10 - 15:00	3.7	11:20 - 15:00

Table 1: Direct Solar Access to the Living Areas and Private Open Space of each Residential Unit between 9am and 3pm (Cont...)

Unit Number	Living Area		Private Open Space	
	Number of Hours	Times of Occurrence	Number of Hours	Times of Occurrence
15.02	2.3	12:40 - 15:00	3.7	11:20 - 15:00
15.03	2.2	12:50 - 15:00	3.5	11:30 - 15:00
15.04	6.0	9:00 - 15:00	6.0	9:00 - 15:00
15.05	5.5	9:00 - 14:30	6.0	9:00 - 15:00
15.06	5.5	9:00 - 14:30	6.0	9:00 - 15:00
15.07	1.8	9:00 - 10:50	2.0	9:00 - 11:00
15.08	2.0	9:00 - 11:00	2.0	9:00 - 11:00
15.09	2.0	9:00 - 11:00	2.0	9:00 - 11:00
15.10	2.0	9:00 - 11:00	2.0	9:00 - 11:00
15.11	2.0	9:00 - 11:00	2.0	9:00 - 11:00
15.12	2.0	9:00 - 11:00	2.0	9:00 - 11:00
15.13	2.8	12:10 - 15:00	3.5	11:30 - 15:00
15.14	2.8	12:10 - 15:00	3.5	11:30 - 15:00
15.15	2.8	12:10 - 15:00	3.5	11:30 - 15:00
15.16	2.8	12:10 - 15:00	3.5	11:30 - 15:00
16.01	2.8	12:10 - 15:00	3.7	11:20 - 15:00
16.02	2.3	12:40 - 15:00	3.7	11:20 - 15:00
16.03	2.2	12:50 - 15:00	3.5	11:30 - 15:00
16.04	6.0	9:00 - 15:00	6.0	9:00 - 15:00
16.05	5.5	9:00 - 14:30	6.0	9:00 - 15:00
16.06	5.5	9:00 - 14:30	6.0	9:00 - 15:00
16.07	1.8	9:00 - 10:50	2.0	9:00 - 11:00
16.08	2.0	9:00 - 11:00	2.0	9:00 - 11:00
16.09	2.0	9:00 - 11:00	2.0	9:00 - 11:00
16.10	2.0	9:00 - 11:00	2.0	9:00 - 11:00
16.11	2.0	9:00 - 11:00	2.0	9:00 - 11:00
16.12	2.0	9:00 - 11:00	2.0	9:00 - 11:00
16.13	2.8	12:10 - 15:00	3.5	11:30 - 15:00
16.14	2.8	12:10 - 15:00	3.5	11:30 - 15:00
16.15	2.8	12:10 - 15:00	3.5	11:30 - 15:00

Table 1: Direct Solar Access to the Living Areas and Private Open Space of each Residential Unit between 9am and 3pm (Cont...)

Unit Number	Living Area		Private Open Space	
	Number of Hours	Times of Occurrence	Number of Hours	Times of Occurrence
16.16	2.8	12:10 - 15:00	3.5	11:30 - 15:00
17.01	2.8	12:10 - 15:00	3.7	11:20 - 15:00
17.02	2.3	12:40 - 15:00	3.7	11:20 - 15:00
17.03	2.2	12:50 - 15:00	3.5	11:30 - 15:00
17.04	6.0	9:00 - 15:00	6.0	9:00 - 15:00
17.05	5.5	9:00 - 14:30	6.0	9:00 - 15:00
17.06	5.5	9:00 - 14:30	6.0	9:00 - 15:00
17.07	1.8	9:00 - 10:50	2.0	9:00 - 11:00
17.08	2.0	9:00 - 11:00	2.0	9:00 - 11:00
17.09	2.0	9:00 - 11:00	2.0	9:00 - 11:00
17.10	2.0	9:00 - 11:00	2.0	9:00 - 11:00
17.11	2.0	9:00 - 11:00	2.0	9:00 - 11:00
17.12	2.0	9:00 - 11:00	2.0	9:00 - 11:00
17.13	2.8	12:10 - 15:00	3.5	11:30 - 15:00
17.14	2.8	12:10 - 15:00	3.5	11:30 - 15:00
17.15	2.8	12:10 - 15:00	3.5	11:30 - 15:00
17.16	2.8	12:10 - 15:00	3.5	11:30 - 15:00
18.01	2.8	12:10 - 15:00	3.7	11:20 - 15:00
18.02	2.3	12:40 - 15:00	3.7	11:20 - 15:00
18.03	2.2	12:50 - 15:00	3.5	11:30 - 15:00
18.04	6.0	9:00 - 15:00	6.0	9:00 - 15:00
18.05	5.5	9:00 - 14:30	6.0	9:00 - 15:00
18.06	5.5	9:00 - 14:30	6.0	9:00 - 15:00
18.07	1.8	9:00 - 10:50	2.0	9:00 - 11:00
18.08	2.0	9:00 - 11:00	2.0	9:00 - 11:00
18.09	2.0	9:00 - 11:00	2.0	9:00 - 11:00
18.10	2.0	9:00 - 11:00	2.0	9:00 - 11:00
18.11	2.0	9:00 - 11:00	2.0	9:00 - 11:00
18.12	2.0	9:00 - 11:00	2.0	9:00 - 11:00
18.13	2.8	12:10 - 15:00	3.5	11:30 - 15:00

Table 1: Direct Solar Access to the Living Areas and Private Open Space of each Residential Unit between 9am and 3pm (Cont...)

Unit Number	Living Area		Private Open Space	
	Number of Hours	Times of Occurrence	Number of Hours	Times of Occurrence
18.14	2.8	12:10 - 15:00	3.5	11:30 - 15:00
18.15	2.8	12:10 - 15:00	3.5	11:30 - 15:00
18.16	2.8	12:10 - 15:00	3.5	11:30 - 15:00
19.01	2.8	12:10 - 15:00	3.7	11:20 - 15:00
19.02	2.3	12:40 - 15:00	3.7	11:20 - 15:00
19.03	2.2	12:50 - 15:00	3.5	11:30 - 15:00
19.04	6.0	9:00 - 15:00	6.0	9:00 - 15:00
19.05	5.5	9:00 - 14:30	6.0	9:00 - 15:00
19.06	5.5	9:00 - 14:30	6.0	9:00 - 15:00
19.07	1.8	9:00 - 10:50	2.0	9:00 - 11:00
19.08	2.0	9:00 - 11:00	2.0	9:00 - 11:00
19.09	2.0	9:00 - 11:00	2.0	9:00 - 11:00
19.10	2.0	9:00 - 11:00	2.0	9:00 - 11:00
19.11	2.0	9:00 - 11:00	2.0	9:00 - 11:00
19.12	2.0	9:00 - 11:00	2.0	9:00 - 11:00
19.13	2.8	12:10 - 15:00	3.5	11:30 - 15:00
19.14	2.8	12:10 - 15:00	3.5	11:30 - 15:00
19.15	2.8	12:10 - 15:00	3.5	11:30 - 15:00
19.16	2.8	12:10 - 15:00	3.5	11:30 - 15:00
20.01	2.8	12:10 - 15:00	3.7	11:20 - 15:00
20.02	2.3	12:40 - 15:00	3.7	11:20 - 15:00
20.03	2.2	12:50 - 15:00	3.5	11:30 - 15:00
20.04	6.0	9:00 - 15:00	6.0	9:00 - 15:00
20.05	5.5	9:00 - 14:30	6.0	9:00 - 15:00
20.06	5.5	9:00 - 14:30	6.0	9:00 - 15:00
20.07	1.8	9:00 - 10:50	2.0	9:00 - 11:00
20.08	2.0	9:00 - 11:00	2.0	9:00 - 11:00
20.09	2.0	9:00 - 11:00	2.0	9:00 - 11:00
20.10	2.0	9:00 - 11:00	2.0	9:00 - 11:00
20.11	2.0	9:00 - 11:00	2.0	9:00 - 11:00

Table 1: Direct Solar Access to the Living Areas and Private Open Space of each Residential Unit between 9am and 3pm (Cont...)

Unit Number	Living Area		Private Open Space	
	Number of Hours	Times of Occurrence	Number of Hours	Times of Occurrence
20.12	2.0	9:00 - 11:00	2.0	9:00 - 11:00
20.13	2.5	12:30 - 15:00	3.5	11:30 - 15:00
20.14	2.5	12:30 - 15:00	3.5	11:30 - 15:00
20.15	2.5	12:30 - 15:00	3.5	11:30 - 15:00
20.16	3.0	12:02 - 15:00	3.5	11:30 - 15:00
21.01	2.8	12:10 - 15:00	3.7	11:20 - 15:00
21.02	2.3	12:40 - 15:00	3.7	11:20 - 15:00
21.03	2.2	12:50 - 15:00	3.5	11:30 - 15:00
21.04	6.0	9:00 - 15:00	6.0	9:00 - 15:00
21.05	5.5	9:00 - 14:30	6.0	9:00 - 15:00
21.06	5.5	9:00 - 14:30	6.0	9:00 - 15:00
21.07	1.8	9:00 - 10:50	2.0	9:00 - 11:00
21.08	2.0	9:00 - 11:00	2.0	9:00 - 11:00
21.09	2.0	9:00 - 11:00	2.0	9:00 - 11:00
21.10	1.0	9:00 - 10:00	2.0	9:00 - 11:00
21.11	0.2	9:00 - 9:10	2.0	9:00 - 11:00
21.12	0.7	14:20 - 15:00	3.5	11:30 - 15:00
21.13	1.2	13:50 - 15:00	3.5	11:30 - 15:00
22.01	2.8	12:10 - 15:00	3.7	11:20 - 15:00
22.02	2.3	12:40 - 15:00	3.7	11:20 - 15:00
22.03	2.2	12:50 - 15:00	3.5	11:30 - 15:00
22.04	6.0	9:00 - 15:00	6.0	9:00 - 15:00
22.05	5.5	9:00 - 14:30	6.0	9:00 - 15:00
22.06	5.5	9:00 - 14:30	6.0	9:00 - 15:00
22.07	2.0	9:00 - 11:00	2.0	9:00 - 11:00
22.08	2.0	9:00 - 11:00	2.0	9:00 - 11:00
22.09	2.0	9:00 - 11:00	2.0	9:00 - 11:00
23.01	2.5	12:30 - 15:00	3.5	11:30 - 15:00
23.02	2.2	12:50 - 15:00	3.5	11:30 - 15:00
23.03	2.2	12:50 - 15:00	3.5	11:30 - 15:00

Table 1: Direct Solar Access to the Living Areas and Private Open Space of each Residential Unit between 9am and 3pm (Cont...)

Unit Number	Living Area		Private Open Space	
	Number of Hours	Times of Occurrence	Number of Hours	Times of Occurrence
23.04	6.0	9:00 - 15:00	6.0	9:00 - 15:00
23.05	5.5	9:00 - 14:30	6.0	9:00 - 15:00
23.06	5.5	9:00 - 14:30	6.0	9:00 - 15:00
23.07	2.0	9:00 - 11:00	2.0	9:00 - 11:00
23.08	2.0	9:00 - 11:00	2.0	9:00 - 11:00
23.09	2.0	9:00 - 11:00	2.0	9:00 - 11:00
24.01	1.3	13:40 - 15:00	3.5	11:30 - 15:00
24.02	1.3	13:40 - 15:00	3.5	11:30 - 15:00
24.03	6.0	9:00 - 15:00	6.0	9:00 - 15:00
24.04	6.0	9:00 - 15:00	6.0	9:00 - 15:00
24.05	6.0	9:00 - 15:00	6.0	9:00 - 15:00
24.06	1.2	9:00 - 10:10	3.5	11:30 - 15:00
24.07	0.3	9:00 - 9:20	3.5	11:30 - 15:00

5.2 Results Summary

The results of the analysis are summarised as follows.

- 9% (32 out of 367) of the residential apartments have the living room window(s) facing towards the south, which is within the 10% limit.
- 74% (270 of the total 367) of the residential apartments receive at least 2 hours of direct solar access to the glass-line of the window(s) of the living areas between 9am and 3pm.
- 84% (309 out of 367) of the residential apartments receive at least 2 hours of direct solar access to the floor of the private open spaces between 9am and 3pm.

6.0 References

R.O Phillips, *Sunshine and Shade in Australia 6th edition*, CSIRO Technical Report 92/2.

Parramatta City Council, Parramatta City Council Development Control Plan 2005, Part 4.3.4.

Department of Infrastructure, Planning and Natural Resources, Residential Flat Design Code, Part 3 Building Design, 2002.

Appendix A

Solar Chart for the
Sydney Region

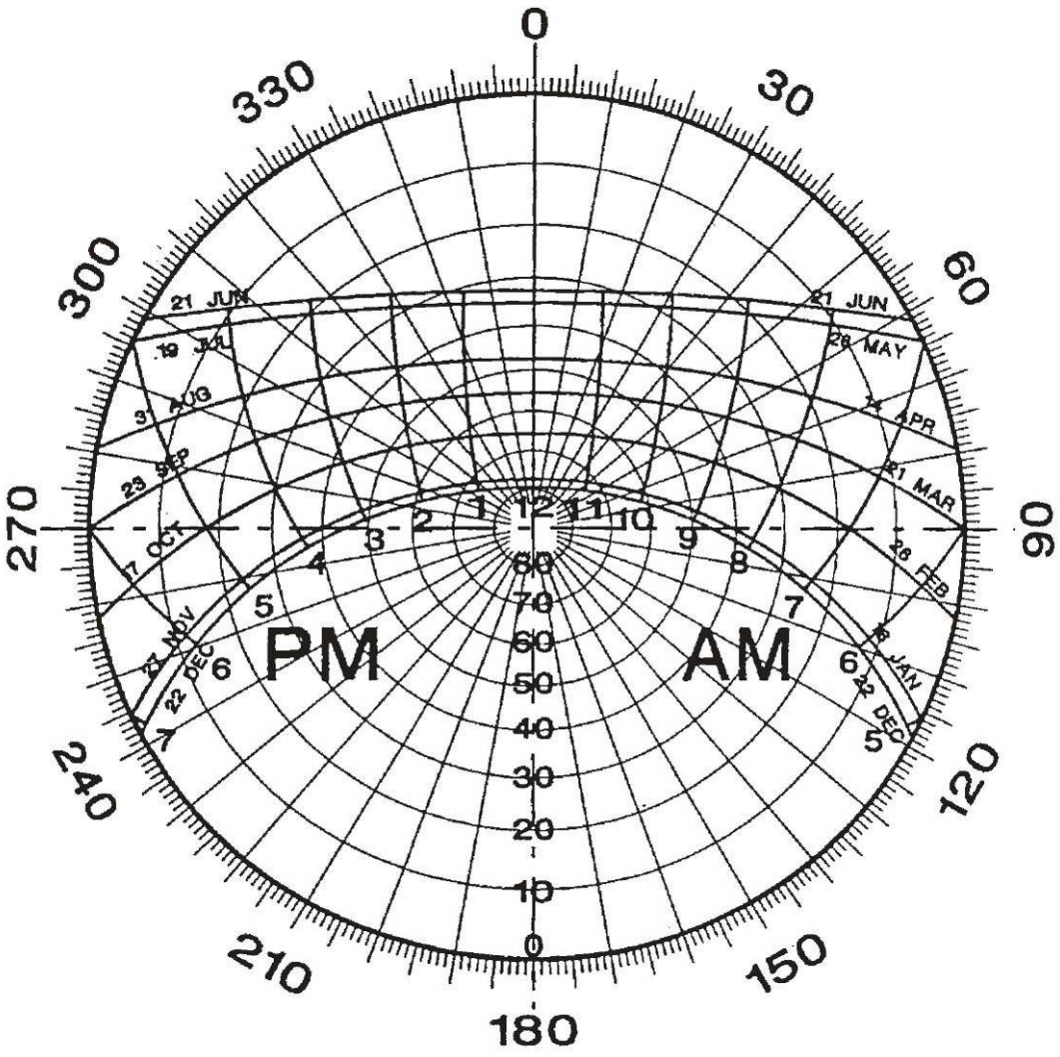

Figure A1: Solar Chart for the Sydney Region

Appendix B

Solar Access Screenshots

(Living room glazing in blue)

Figure B1: Eastern Aspect (9:00am)

Figure B2: Eastern Aspect (10:00am)

Figure B3: Eastern Aspect (11:00am)

Figure B4: Eastern Aspect (12:00pm)

Figure B5: Eastern Aspect (1:00pm)

Figure B6: Eastern Aspect (2:00pm)

Figure B7: Eastern Aspect (3:00pm)

Figure B8: Northern-Eastern Aspect (9:00am)

Figure B9: Northern-Eastern Aspect (10:00am)

Figure B10: Northern-Eastern Aspect (11:00am)

Figure B11: Northern-Eastern Aspect (12:00pm)

Figure B12: Northern-Eastern Aspect (1:00pm)

Figure B13: Northern-Eastern Aspect (2:00pm)

Figure B14: Northern-Eastern Aspect (3:00pm)

Figure B15: Northern-Western Aspect (9:00am)

Figure B16: Northern-Western Aspect (10:00am)

Figure B17: Northern-Western Aspect (11:00am)

Figure B18: Northern-Western Aspect (12:00pm)

Figure B19: Northern-Western Aspect (1:00pm)

Figure B20: Northern-Western Aspect (2:00pm)

Figure B21: Northern-Western Aspect (3:00pm)

Figure B22: Western Aspect (9:00am)

Figure B23: Western Aspect (10:00am)

Figure B24: Western Aspect (11:00am)

Figure B25: Western Aspect (12:00pm)

Figure B26: Western Aspect (1:00pm)

Figure B27: Western Aspect (2:00pm)

Figure B28: Western Aspect (3:00pm)