SUMMARY EXPERT OPINION

INDEPENDENT CERTIFICATION: OVERSHADOWING ANALYSIS

PROPOSED MULTI RESIDENTIAL DEVELOPMENT

10-14 Merton St Sutherland

22 December 2014

1.0 SUMMARY/CERTIFICATION

I have undertaken an evaluation of the shadow diagrams and overshadowing analysis prepared for the proposed development of multi-storey apartments, at 10-14 Merton St Sutherland. The site and proposed development is the subject of an Urban Design Report by Geoform Architects **to support a planning proposal to the NSW Department of Planning and Environment**.

I supply the following independent expert opinion.

Property: **10-14 Merton St Sutherland**
Approval: **Planning Proposal**
Condition:

I hereby confirm that
OVERSHADOWING ANALYSIS
as undertaken by Geoform Architects,
may be considered as accurate and fit for the purpose described.

Documents to which I refer are:

- Urban Design Report (Final Draft2) issued to me on 19 December 2014
- Digital copy of 3D Model prepared in Trimble SketchUp v.8 software

I refer to the discussion in *3.0 Analysis* below.

Signed,

……
Steve King

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2.0 CREDENTIALS

I have been 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 UNSWGlobal and NEERG Seminars, 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 have 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.

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 practiced as a Registered Architect from 1971 to 2014 and now maintain a specialist consultancy practice in climate responsive building design and compliance. I regularly assist the Land and Environment Court as an expert witness in related matters.

3.0 DISCUSSION AND ANALYSIS

3.1 Introduction

3.1.1 I take as the scope of my expert opinion:

- to verify the *technical accuracy* and adequacy of the 3D digital model analysis;
- to comment as relevant on the interpretation of the analysis in relation to the *predicted overshadowing impacts* of the alternative development options compared in the report;
- to consider the implications if any for achieving amenity compliance under the relevant controls for the proposed development itself.

3.1.2 I infer from the overshadowing analysis undertaken by the architects the following priorities:

- to protect winter sun access to classroom glazing and majority of open playground areas of the schools adjacent to the east and west boundaries of the subject site;
- to optimise as far as practicable the retention of solar access for an existing low rise town house style development to the south of the subject site, and built in close proximity to the southern boundary.

3.1.3 I infer that the fundamental intent of the site layout and massing approach is to:

- investigate the benefits of a 'podium plus tower' strategy as compared to accommodating a similar number of dwellings in low rise building form, but covering more of the subject site;
- increase setbacks from the southern boundary, and thereby reduce likely overshadowing of the townhouses to the south;
- locate any 'tower' component of a notional massing where it might have minimum overshadowing impact, particularly in relation to the two schools;

- anticipate the ability to provide for the maximum number of dwellings within the subject development to comply at a good standard with mandated solar access amenity requirements.

3.2 Accuracy of the applicant's solar access diagrams

3.2.1 Quantification of solar access for compliance with the requirements of the Residential Flat Design Code has been carried out by the architects, by use of a 3D digital model and the heliodon routine of a commercial digital modelling application.

3.2.2 I have independently verified the model direction of True North, by reference to the cadastral grid north, which is within 1° of the 'True North'. I have confirmed that the model is aligned to True North, likely to have been taken from a survey.

3.2.3 I have also independently verified the relevant model and location parameters, as well as time and date settings used to generate the views in the architects' comparison tables. From the model, I have summarily checked the topographical and building dimensions that might otherwise give rise to any errors, by reference where possible to figured dimensions, and elsewhere to typical generic dimensions – such as the assumption of 3.050m for floor to floor heights, conservatively sufficient for the mandated 2.700m ceiling height plus structure and services zones.

Having established the accuracy of the key points, I feel confident to rely on the general accuracy of the modelling.

3.2.4 The architects use the 3D digital model to generate plan and selected 3D shaded views of the proposed layout and massing of buildings on the site.

3D computer software in analysis is generally used to render shadow views in OpenGL. Such rendering can on very rare occasions result in shadow artefacts that do not completely accord with reality. SketchUp prepares the shadow views by reference to accurate solar geometry, and the use of an alternative aerial view called 'views from the sun' can highlight any possible errors of shadow casting, as by definition the views do not include shadows, only sunlit surfaces.

I have prepared my own hourly views from the sun for the architects' preferred option. The technique is illustrated in Figure 1. I attach a table of hourly views from the sun of Option 2, in Appendix A.

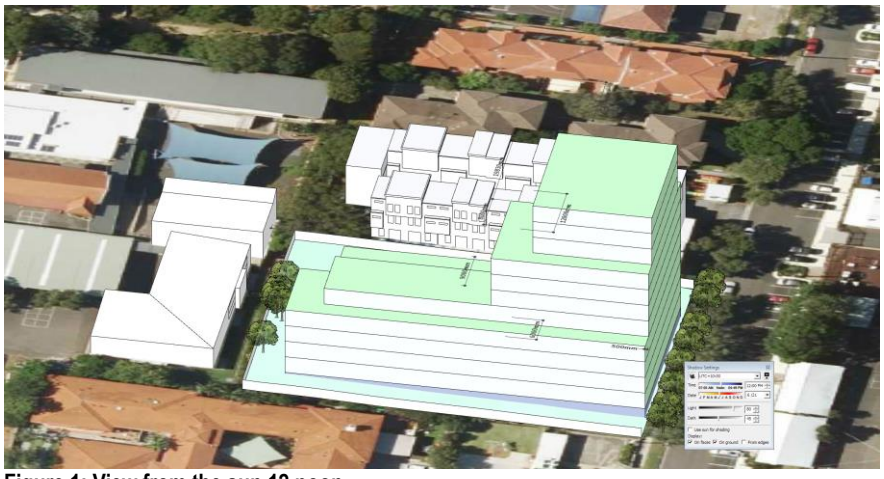


Figure 1: View from the sun 12 noon

3.3 Projected overshadowing

3.3.1 General impacts

The architects examine the overshadowing impact of four different options of what I have called the 'podium plus tower strategy', where the tower is of various heights. They compare these with a nominal lower rise option of comparable height to the neighbouring townhouses, in a 'street wall and courtyard' typology. For reference they also illustrate complying development of the site.

Option 1	**40m Height Limit**	
Option 2	**36m Height Limit**	
Option 3	**30m Height Limit**	
Scheme A	**20m Height Limit**	
Scheme B	**20m Height Limit**	

The architects tabulate the overshadowing impacts of the different options in terms of plan shadow projections, and two alternative three-dimensional aerial views of hourly shadows. Those shadow projections are accurate and can be interpreted to predict the overshadowing impacts on the neighbouring sites.

3.3.2 Detailed analysis of shadow impacts on school grounds

The architects also undertake a detailed analysis of the overshadowing impacts on the grounds and classroom glazing for the schools adjacent to the subject site. They tabulate relevant morning or afternoon

hourly shadows at the relevant times, and identify all projected shadow impacts in plan and in 3D views as appropriate. A seasonal comparison of shadows to glazing at 9am for the primary school confirms that it is not affected in the winter, and arguably beneficially shaded in the summer.

I verify that that analysis is accurate.

With reference to the loss of direct sun to some classroom glazing for a period before 3pm for St Patrick's College in particular, I rely on my experience of previously having been commissioned to advise on solar access and sun control in schools. From that experience I am aware that direct gain solar access in classrooms *during class times* is *actually contraindicated*, as it is an unacceptable source of glare for the predominantly visual tasks in the classroom.

I therefore observe that a reasonable conclusion may be drawn that the overshadowing impacts are small, and for all intents and purposes negligible.

3.4 Preferred option – Option 2

3.4.1 Overshadowing impacts

I note that from the architects' conventional representation of the projected shadows, the basis for preference of Option 2 with respect to overshadowing impact is not immediately clear.

I refer again to my preferred technique of 'views from the sun'. Figure 2 uses the same base as Figure 1, but is annotated with some key considerations.

Figure 2: Critical envelope limits, Option 2 view from the sun 12 noon June 21

A **Critical tower height:**

- If tower is *taller*, it will have impacts to the south beyond that of the existing townhouses.
- *Reduction* in tower height does not make a significant difference in overshadowing of townhouses on immediately adjacent site.

B **Critical podium height and location:**

- Relevant parapet heights of podium in this location preserve solar access to ground floor of townhouses to the south of the subject site.

C **Minimise overshadowing of schools to the east and west:**

- In the middle of the day there is no overshadowing impact on the adjacent schools;
- The morning shadow to a portion of the playground of the primary school is determined by the plan, not the height of the 'tower';
- The afternoon shading of St Patrick's is from the identical 'podium' portion and is insensitive to the tower height.

Scheme B, locating a three storey wing at minimum setback from the southern boundary self-evidently produces more adverse overshadowing impact for the townhouses to the south of the subject site.

3.4.2 Solar access potential

I note that all of the podium plus tower options are superior to Scheme B, the 'street wall and courtyard' typology, in terms of the proportion of units which are likely to have complying sun to meet the requirements of the Residential Flat Design Code and the local controls.

4.0 CONCLUSION

4.1 Accuracy of the overshadowing analysis

I confirm that the overshadowing analysis carried out by use of the Trimble SketchUp software package, can be characterised as industry best practice.

The model is prepared with sufficient of the adjacent developments appropriately represented to allow evaluation of the relevant overshadowing impacts.

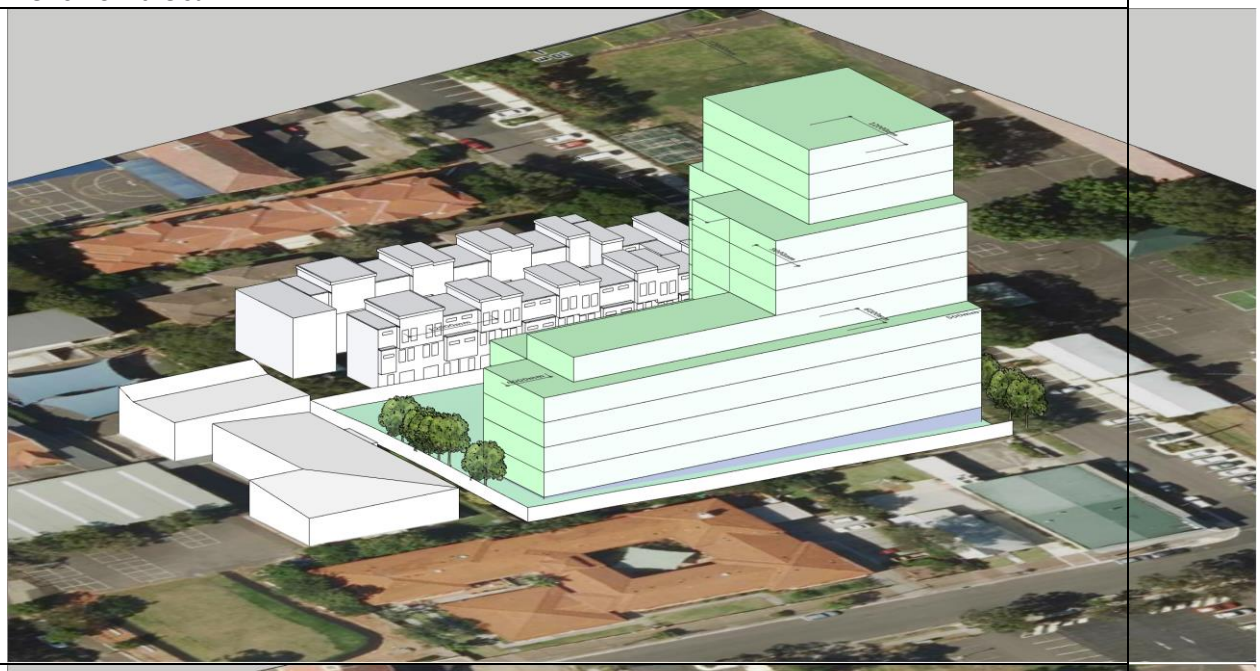
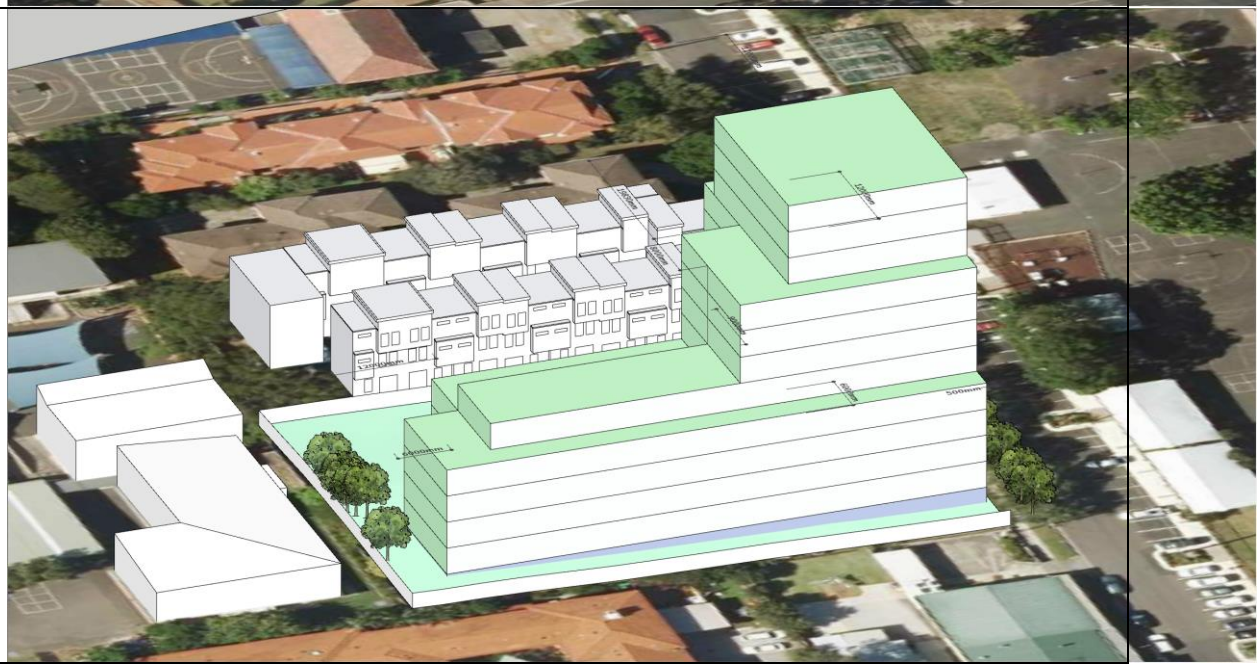
4.2 Preferred option

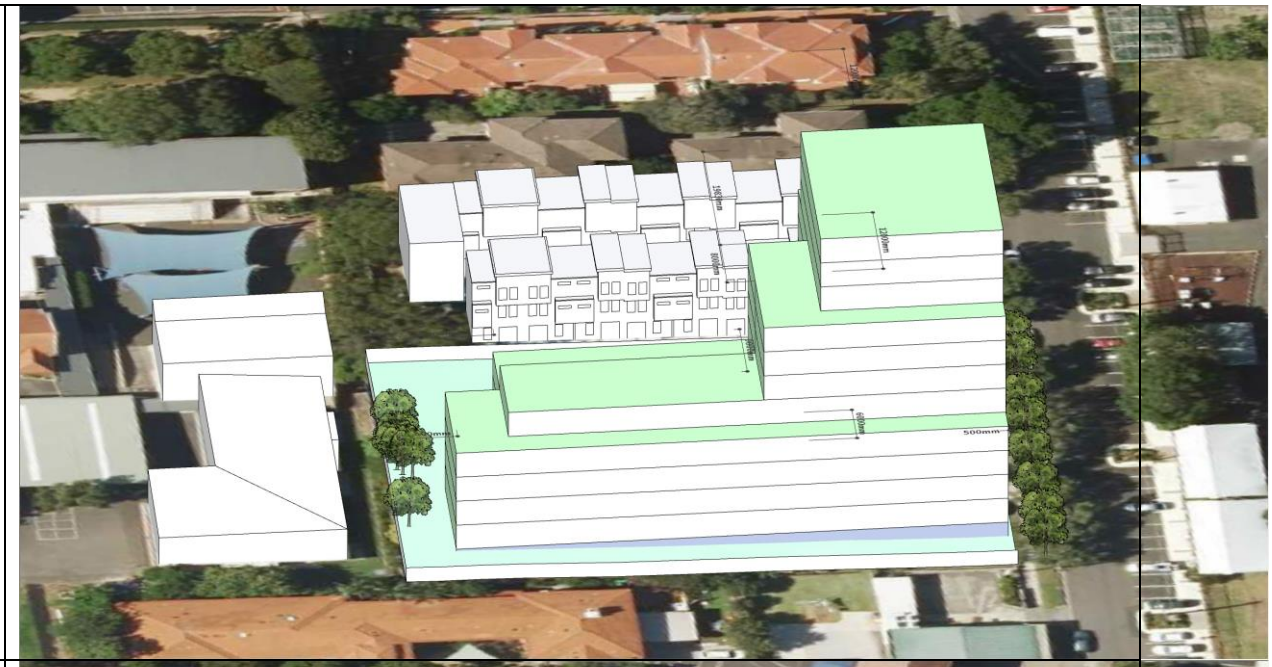
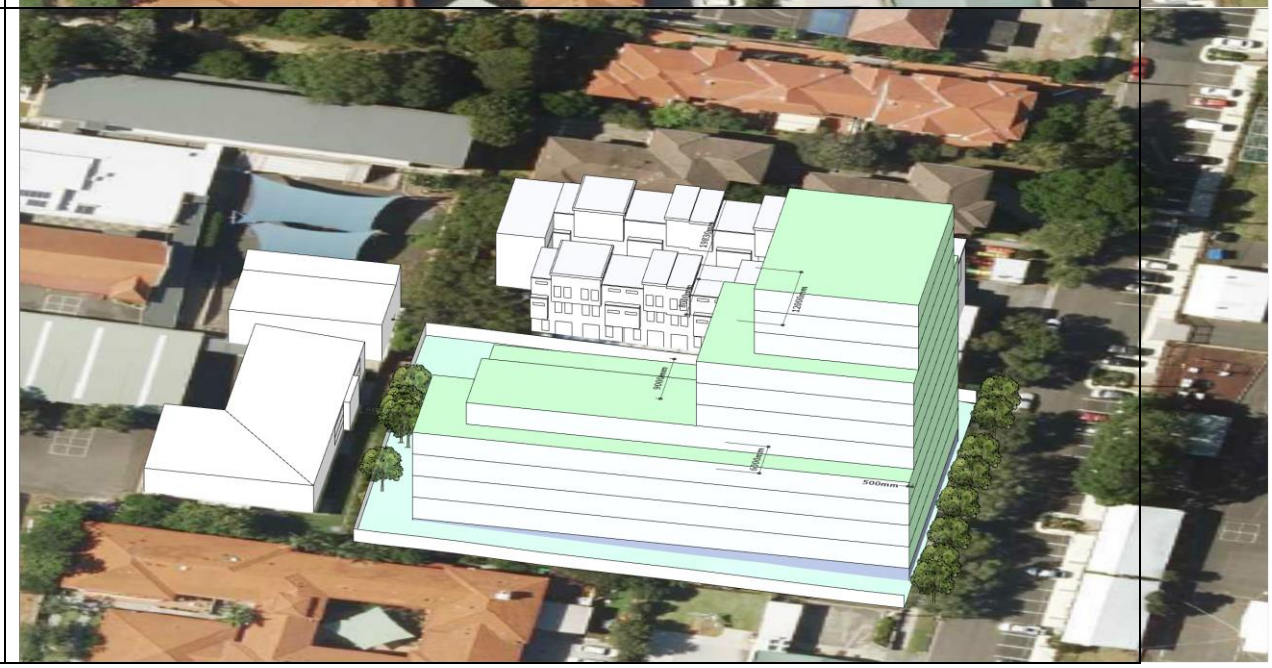
I do not comment on considerations other than overshadowing impact. In my considered opinion Option 2 is appropriately identified as the critical height at which it minimises overshadowing beyond the extent of the site immediately to the south, but also gives rise to negligible additional overshadowing compared to the lower tower forms.

In my considered opinion the overshadowing impact analysis by the architects may be relied on for the evaluation of development options for the site.

A.0 APPENDIX: VIEWS FROM THE SUN

The attached table reproduces in reduced form for reference the hourly views of solar access projections for June 21.

	Views from the sun
9.00	
10.00	

11.00	
12.00	

1.00	
2.00	

3.00