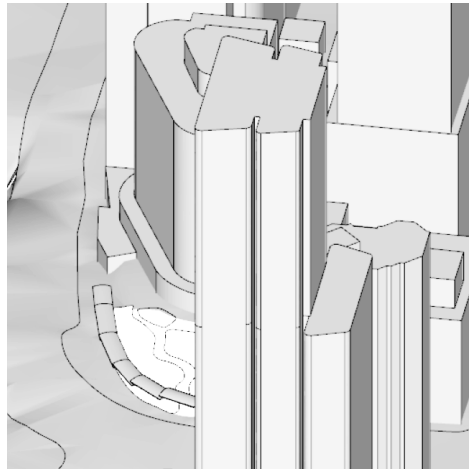
SUMMARY EXPERT OPINION

OVERSHADOWING ANALYSIS



PLANNING PROPOSAL

173-179 Walker Street North Sydney

18 October 2017

Signed,

.....

Steve King

STEVE KING

CONSULTANT

11 Clovelly Road Randwick NSW 2031 Australia

PHONE 0414385485

CONTENTS

1.0 PRELIMINARIES

1.1 I provide this report as an expert opinion and **peer review** of the Applicant's analysis, relating to **overshadowing impacts** of the **Planning Proposal** for the site known as **173-179 Walker Street North Sydney**.

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*.

2.0 CREDENTIALS

I have taught 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 November 2006, I was the Associate Director, Centre for Sustainable Built Environments, UNSW.

My research and consultancy includes work in solar access, energy simulation and assessment for houses and multi-dwelling developments, building assessments under the NSW SEDA Energy Smart Buildings program, appropriate design and alternative technologies for museums and other cultural institutions, and asthma and domestic building design. I am the principal author of *SITE PLANNING IN AUSTRALIA: Strategies for energy efficient residential planning*, funded by the then Department of Primary Industry and Energy, and published by AGPS, and of the RAIA Environment Design Guides on the same topic. Through UNISEARCH, NEERG Seminars and Linarch P/L, 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.

SOLARCH/UNISEARCH were the contractors to SEDA NSW for the setting up and administration of the House Energy Rating Management Body (HMB), which accredits assessors under the Nationwide House Energy Rating Scheme (NatHERS), NSW. I was the technical supervisor of the HMB, with a broad overview of the dwelling thermal performance assessments carried out in NSW over five years. I have been a member of the NSW BRAC Energy Subcommittee, and also a member of the AGO Technical Advisory Committee on the implementation of AccuRate, the new mandated software tool under NatHERS. I undertook the Expert Review for the NSW Department of Planning, of the comparison of NatHERS and DIY methods of compliance for Thermal Comfort under BASIX, and was subsequently a member of a three person expert panel advising on the implementation of AccuRate in BASIX.

I have delivered the key papers in the general area of assessment of ventilation and solar access performance and compliance, for NEERG Seminars, cited by Commissioners of the LEC. Senior Commissioner Moore cited my assistance in reframing of the Planning Principle related to solar access (formerly known as the Parsonage Principle) in *The Benevolent Society v Waverley Council [2010] NSWLEC 1082.*

Of particular relevance, I have taught the wind and ventilation components of environmental control in the undergraduate and postgraduate courses 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.

I practiced as a Registered Architect from 1971 to 2014, and now maintain a specialist consultancy practice advising on sustainability and amenity compliance in 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

- Draft Planning Proposal documents issued to me digitally by KannFinch Architects, dated October 2017, including overshadowing analysis for Dorris Fitton Park and public space proposed for the subject site.
- Digital 3D model in .skp file format.
- North Sydney Local Environmental Plan 2013 North Sydney Centre Map - Sheet CL1_002A
- North Sydney Centre Special Areas Review 2016
- North Sydney Centre Capacity and Land Use Study ,North Sydney Council, November 2016
- 173-179 Walker Street Urban Design Strategy DRAFT 1 by ae design partnership, issued to me 16 October 2017

3.2 I have visited the site.

4.0 OVERSHADOWING ANALYSIS

4.1 The architects' methodology

4.1.1 3D digital modelling

KannFinch Architects have carried out their analysis by use of a full 3D digital model within the Revit CAD application. The model extents include all relevant buildings existing or approved, and prospective envelope massing taken from the *North Sydney Capacity and Land Use Study 2016*.

4.1.2 Analysis

The outcomes of the analysis are illustrated by the architects in the form of conventional plan shadows, identifying the outlines of additional shadowing attributed to the proposed development at relevant times of day. These diagrams are provided for all surrounding areas generally, and in detail for Dorris Fitton Park, and for the new pocket park on the subject land which is part of the Planning Proposal. The plan shadow diagrams for the latter two areas are supported by area calculations.

4.1.3 Comment

The architect's analysis is appropriate to the purpose, exhaustive and clearly illustrated.

The convention of plan shadows has the advantage of allowing precise calculation of relative (percentage) change in overshadowing of defined areas of the ground plane. The disadvantage of limiting illustration of overshadowing to conventional plan diagrams, is that it is sometimes difficult to identify the specific part of the building (or of the surroundings) that causes any particular portion of overshadowing of interest. For that purpose, it is useful to employ a particular 3D aerial perspective projection, known as 'views from the sun'.

4.2 My methodology

The purpose of my analysis is to:

- verify the accuracy of the architects' overshadowing analysis:
- clarify the degree of overshadowing impact of the proposed building, in particular on Dorris Fitton Park;

- more clearly identify the overall solar access opportunity of the new pocket park proposed for the subject site.

4.2.1 My independent analysis of overshadowing is carried out by use of a 3D digital model in the *Trimble SketchUp* software package.

The model was prepared by the architects in the commercial CAD application Revit. The building model is inserted into a context of surrounding buildings. For my analysis, the model was exported as a .skp format file for *SketchUp*.

I have undertaken a summary check of the topographical and building dimensions of the 3D digital model by reference to dimensions assumed from the plans and sections. I feel confident to rely on the general accuracy of the modelling. I have independently geolocated the model. I verified the direction of True North by reference to the provided survey, and for a final check, to the cadastral grid north from the NSW Spatial Services SixMaps web site.

4.1.2 The SketchUp software prepares the shadow projections by reference to accurate solar geometry. I have carried out a new detailed analysis, relying primarily on projections known as *'View from the Sun'*.

A view from the sun shows all sunlit surfaces at a given time and date. *Views from the sun do not show any shadows. Shadows are those areas exactly coinciding with objects in the foreground.* The technique is illustrated in Figure 1.

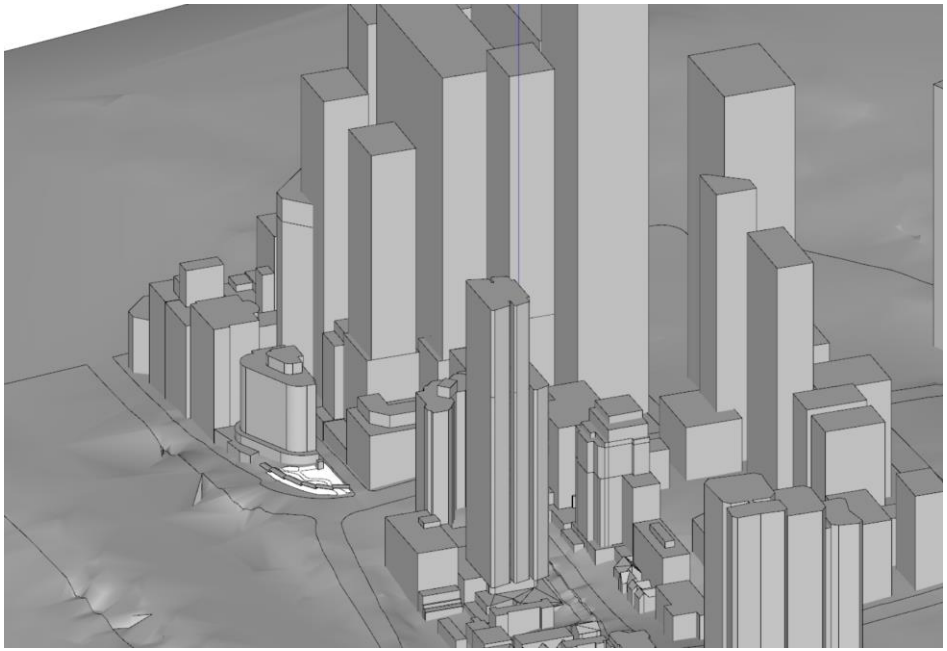


Figure 1: View from the sun10am June 21
Note that the model incorporates surrounding developments. Dorris Fitton Park is highlighted.

In Appendix A I provide a table of half-hourly views from the sun on June 21.

4.3 Accuracy of the architects' analysis

To establish the likely accuracy of the architect's analysis, I compare my views from the sun with their plan shadow projections. It is convenient to use as an example the 12 noon shadow on June 21.

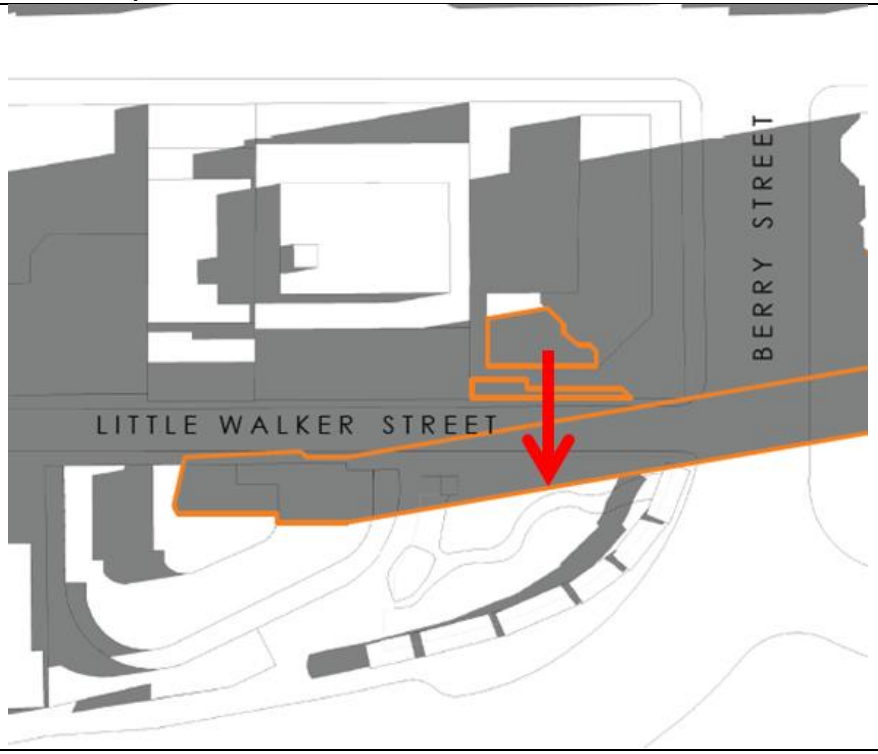
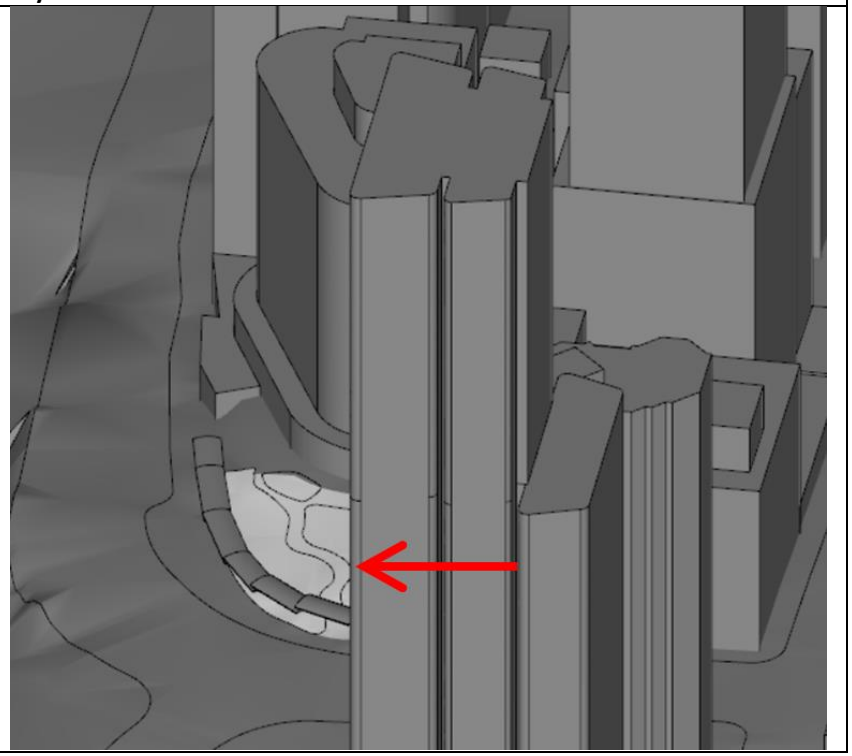
	Architects' plan shadow	My view from the sun
1200 June 21		

Figure 2: Comparison of the architects and my shadow projections

In Figure 2, the arrows indicate a convenient reference point. Note the very small discrepancy in the position of the noon shadow in Dorris Fitton Park. I interpret this small discrepancy in the shadow as caused by a very small difference in the independently set up direction of True North.

In practical terms, the difference between the position of the two shadows translates to between 1 - 2 minutes. In my considered opinion, the discrepancy is negligible and represents accuracy well within acceptable margins for this type of analysis.

After checking the comparison of the shadows at other times on June 21, I conclude that the architects' overshadowing analysis is sufficiently accurate to be relied on.

5.0 DISCUSSION

5.1 Relevant controls and objectives

The relevant control is the North Sydney Local Environmental Plan 2013 Part 6 Division 1 Clause 6.3 .

6.3 Building heights and massing

(1) The objectives of this clause are as follows *(inter alia)*:

(b) to promote a height and massing that has no adverse impact on land in Zone RE1 Public Recreation or land identified as "Special Area" on the North Sydney Centre Map or on the land known as the Don Bank Museum at 6 Napier Street, North Sydney,
(c) to minimise overshadowing of, and loss of solar access to, land in Zone R2 Low Density Residential, Zone R3 Medium Density Residential, Zone R4 High Density Residential, Zone RE1 Public Recreation or land identified as "Special Area" on the North Sydney Centre Map,
(d) to promote scale and massing that provides for pedestrian comfort in relation to protection from the weather, solar access, human scale and visual dominance,
(e) to encourage the consolidation of sites for the provision of high grade commercial space.

(2) Development consent must not be granted for the erection of a building on land to which this Division applies if:
(a) the development would result in a net increase in overshadowing between 12 pm and 2 pm on land to which this Division applies that is within Zone RE1 Public Recreation or that is identified as "Special Area" on the North Sydney Centre Map

The overshadowing compliance issues for this Planning Proposal are:

- Potential overshadowing of residential properties within or outside the North Sydney Centre;
- Limits on the additional overshadowing of one special area, Dorris Fitton Park.

5.2 Potential overshadowing of residential properties

5.2.1 Within the North Sydney Centre

I note that AE Design, in the Draft Urban Design Strategy report provided to me, has prepared a separate analysis for shadow impacts on adjoining sites, also using the Kannfinch Sketch up model.

The analysis identifies limited overshadowing impacts, focusing on 169-171 Walker Street (also known as Century Plaza, 80 Berry St). The report concludes that Century Plaza is subject to:

- No overshadowing until after 9:45am.
- Minor overshadowing of Wet Areas & Secondary Bedroom Window from proposed building at 10:00am
- Majority overshadowing occurs between 11:00am and 1:00pm;
- No overshadowing from 1:45pm onwards.

My interpretation is that the solar access retained would be considered complying with the relevant ADG *Design guidance* under Objective 3B-2:

Overshadowing of neighbouring properties is minimised during mid winter, and therefore satisfies the objective of the NSLEP.

5.2.2 Outside the North Sydney Centre

Having established the reliability of the analysis, I reproduced below selected shadows of the North Sydney Centre. I note that additional morning shadow from the Planning Proposal falls entirely within the city centre itself, and mostly on the Warringah Expressway in the afternoon. Additional afternoon shadow does not affect any residential properties to the east of the Expressway, until immediately before 2pm.

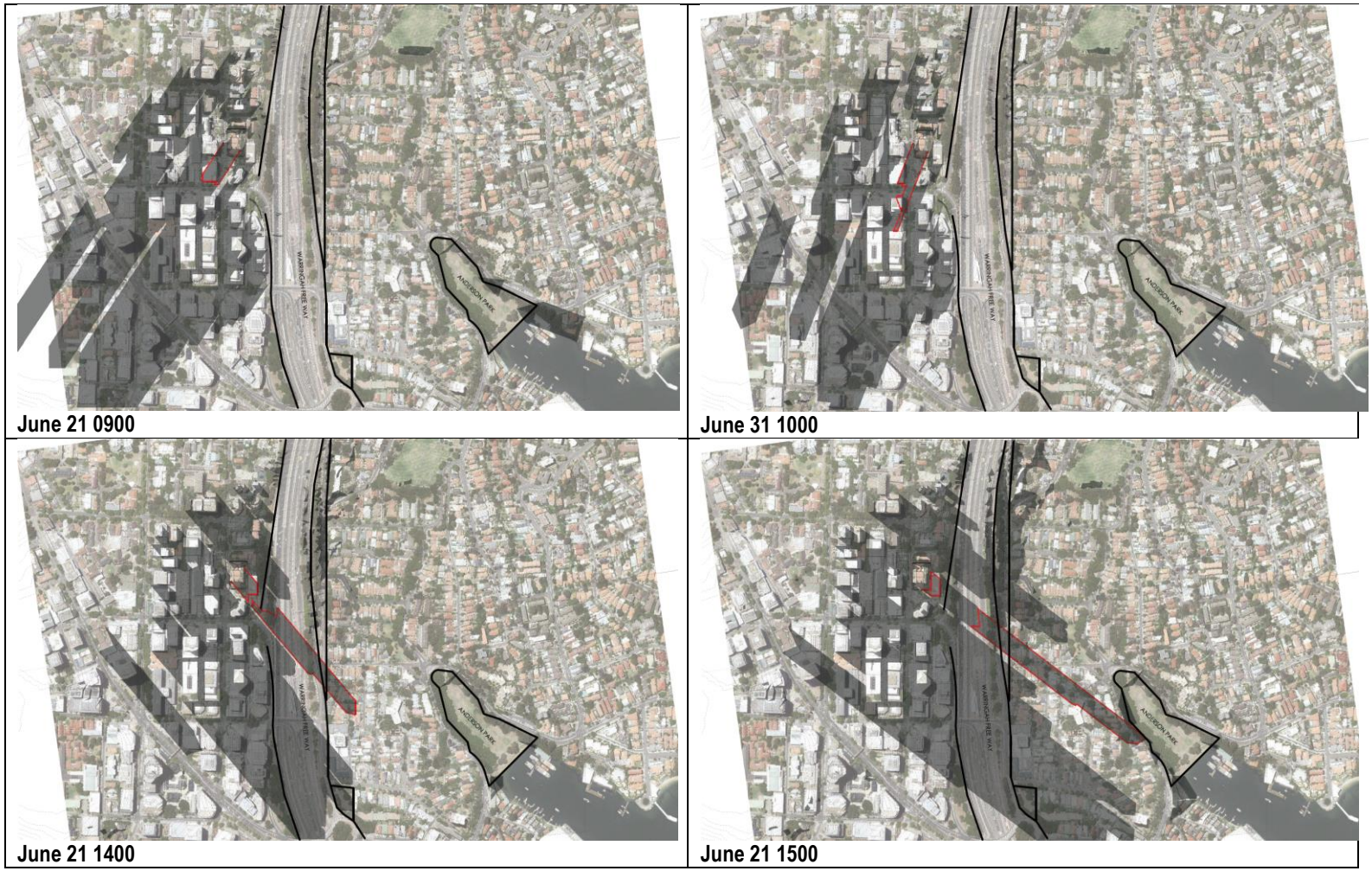


Figure 3: Overshadowing potentially outside the North Sydney city core

I refer to the *Planning proposal to implement the North Sydney CBD Capacity and Land Use Strategy (Approx. 7,000 jobs and 0 dwellings),* approved at Gateway and with RPA for implementation.

I note the Decision of 3690th Council Meeting held on 1 may 2017. Page 67 *(inter alia)*:

> "….10-2 additional overshadowing restriction are considered to represent a supportable balance between unlocking capacity and maintaining a level of amenity protection that has been the foundation of past and present controls."

I strongly infer that the proposed height of the tower in the Planning Proposal was targeted to achieve compliance with the objective of the NSLEP, while foreshadowing the adoption of the specific 10am to 2pm restriction.

For completeness, I focus on the very few properties to the east of the Expressway, affected by additional shadow at exactly 2pm. I note that those properties have unaffected solar access opportunity for nearly 5 hours from 9am. In my considered opinion, therefore, those few minutes of additional shadows do not constitute a breach of the proposed solar access controls.

5.3 Dorris Fitton Park

5.3.1 North Sydney Centre Special Areas Review 2016

Dorris Fitton Park is identified on North Sydney Centre Map - Sheet CL1_002A as a 'Special Area'. As one of such identified special areas, the park is subject of evaluation in the *North Sydney Centre Special Areas Review 2016*.

The evaluation of the park in the Review (pp.30-31) is illustrated by Council's own modelling of the overshadowing on June 21. The existing winter solar access is summed up as:

> During the mid-winter solstice, Doris Fitton Park receives moderate levels of solar access with approximately 10% of the park is overshadowed at 12.20pm and 95% by 1pm.

The review describes the user experience in the following terms:

> While it is a generally well maintained, aesthetically pleasing and unique outdoor space to the Centre, it attracts low levels of activity due to its poor visibility from the street and poor connection to high activity areas in the Centre. In particular, the changing topography of the Centre at the eastern edge makes it a very difficult space to access.

I take from the above that Council is aware that Doris Fitton Park is completely overshadowed by existing buildings after 1pm. Paying regard to the overshadowing impact of the planning proposal, both the architects' and my analysis confirm that the Park enjoys full solar access from very early morning to nearly 12 noon.

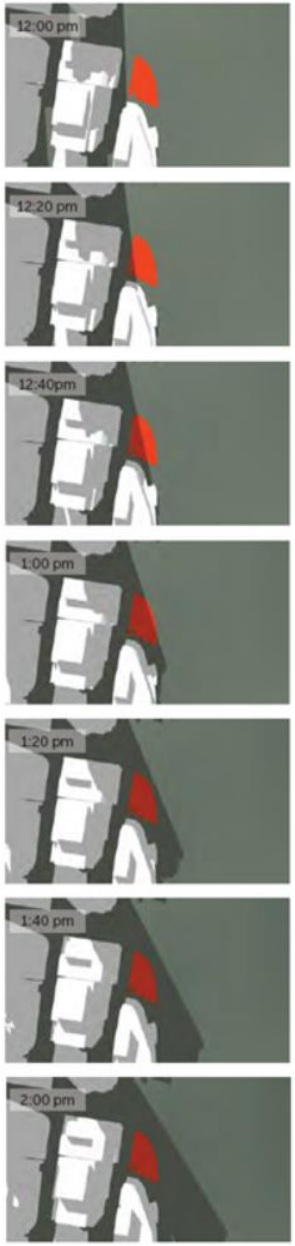
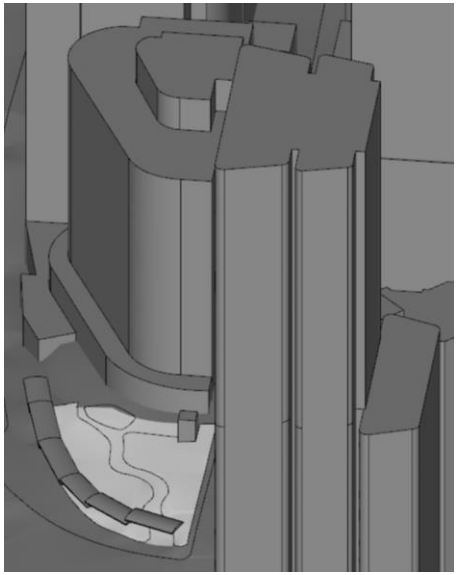


Figure 4: Overshadowing of Doris Fitton Park

5.3.2 Comment

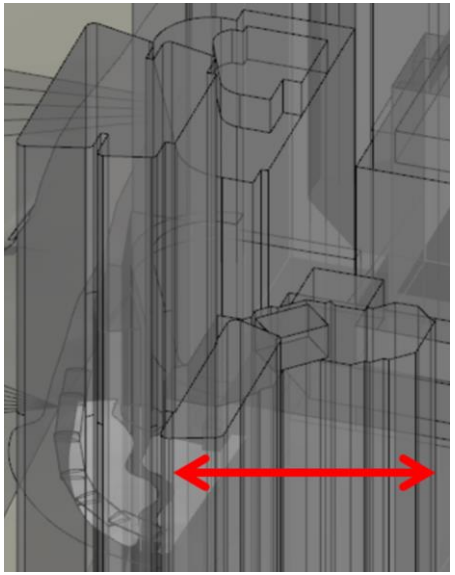
For all intents and purposes therefore, the incremental overshadowing impact of the Planning Proposal is limited to varying degree between just before 12 noon and 1pm. The 'X-ray' views from the sun in Figure 4 make clear that from just after 1230pm, the major share of the overshadowing impact on Dorris Fitton Park is in fact the existing shadow from the Century Plaza at 80 Berry Street – and that by 1pm, shadow that can be attributed to the subject Planning Proposal is so small as to be negligible.

1150

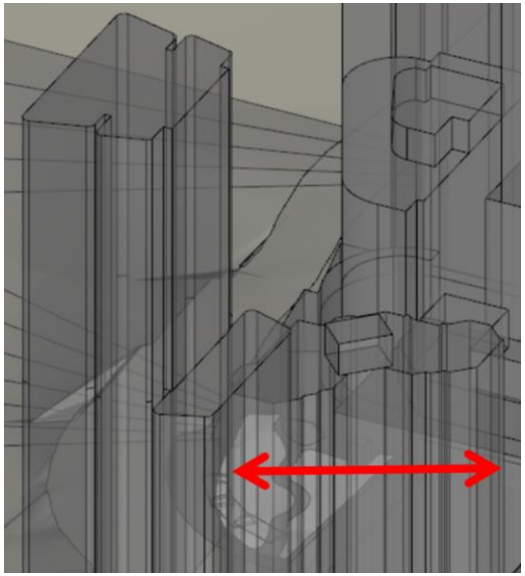


No shadow at 1150

1230



1300



The arrows show the portion of existing shadow attributable to Century Plaza at 80 Berry St.

Figure 5: Relative share of overshadowing impact from Planning Proposal

1230

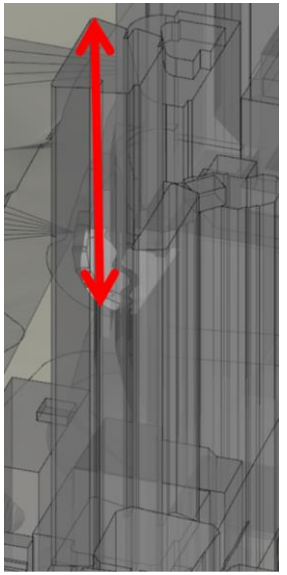


Figure 6: Height reduction required to eliminate shadow at 1230pm

Using the same technique, Figure 5 identifies *what would be the necessary reduction in height* of the Planning Proposal, in order to eliminate the relatively small additional overshadowing impact on Dorris Fitton Park. I estimate the required height reduction as over 40% of the proposed height. *To my mind this is a clearly disproportionate limitation on the development potential of the subject site, to deal with the relatively small overshadowing impact.*

Notwithstanding the relatively small additional overshadowing impact on Dorris Fitton Park, the design of the Planning Proposal is predicated on providing an offset to meet and exceed the objectives of Council with respect to public spaces within the city centre, in the form of a new pocket park on the subject site.

5.4 New pocket park

The concept design for the 'one tower' scheme for which the planning proposal seeks Council support has been developed in part explicitly to create a favourably oriented public space at ground level. The multilevel open space serves as a useful new through site link, and a pocket park with high amenity activation at the building edge.

The Planning Proposal report provides the following solar access analysis for the proposed new pocket park.

Figure 7: Architects' solar access analysis for the proposed pocket park

My check of the views from the sun suggests that in fact, this location may have the benefit of an additional one hour or more of sun to a substantial portion of the proposed space, beginning before 2pm (See the views from the sun in Appendix A).

6.0 CONCLUSIONS

6.1 Accuracy and reliability of architects' analysis

The architects carried out their overshadowing analysis using a full three-dimensional digital model in the Revit software package, and quantifying the relevant overshadowing impacts in considerable detail. Their analysis is documented in a clear representation of existing and additional shadows in conventional plan diagrams. I have checked key images from the architects' analysis, using views from the sun generated from SketchUp. I identify a minor discrepancy between the two models. The source of the discrepancy appears to be the direction of True North, and the potential error to which it gives rise is equivalent to at most two minutes duration. This is

negligible in comparison to normal allowances for error in such modelling, and I emphasise that the cause of the discrepancy may well be in my model set up, rather than that of the architects.

In my considered opinion, the solar access/overshadowing analysis carried out by the architects is accurate and can be relied on.

6.2 Overshadowing compliance

6.2.1 Potential overshadowing of residential properties within the North Sydney Centre

There are only limited such overshadowing impacts, effectively confined to 169-171 Walker Street (also known as Century Plaza, 80 Berry St). In my view, the solar access retained for that property would be considered complying with the relevant ADG *Design guidance* under Objective 3B-2: *Overshadowing of neighbouring properties is minimised during mid winter,* and therefore satisfies the objective of the NSLEP.

6.2.2 Potential overshadowing of residential properties outside the North Sydney Centre

I strongly infer that the proposed height of the tower in the Planning Proposal was targeted to achieve compliance with the objective of the NSLEP, while paying regard to the imminent adoption of the specific 10am to 2pm restriction.

There are only a very few properties to the east of the Warringah Expressway affected by additional shadow at exactly 2pm, and only for a very short duration before that time. Given those properties have unaffected solar access opportunity for nearly 5 hours from 9am, in my considered opinion, the few minutes of additional shadows do not constitute a breach of the foreshadowed solar access controls.

6.2.3 Dorris Fitton Park

I note that the Planning Proposal is for a site outside the area to which the limitations on additional overshadowing of a 'Special Area' apply. I interpret this as meaning that the identified small additional overshadowing of the Park is technically not a breach of the NSLEP control. Nevertheless, it has been the focus of attention by thee proponent of the Planning proposal. Additional overshadowing which may be attributed to the Planning Proposal has been identified as starting with a sliver immediately prior to 12 noon, increasing as a proportion of the park until substantially overtaken by existing overshadowing between 1230 and 1pm. It would be fair to characterise this additional impact as minor, if not negligible – and the significance of the short duration of additional overshadowing has to be interpreted in the context of Council's own evaluation of the user experience of Doris Fitton Park, attracting "low levels of activity due to its poor visibility from the street and poor connection to high activity areas in the Centre".

The views from the sun generated by my modelling make clear that to eliminate the relatively small amount of additional extra overshadowing of Doris Fitton Park would require a height reduction as over 40% of the height of the proposed building. To my mind, in order to deal with the relatively small impact on the amenity of the park, to be required to eliminate it is a disproportionate limitation on the development potential of the subject site.

6.3 New pocket park

The Planning Proposal responds to the objectives of the LEP for the maintenance of amenity of such small public spaces within the city centre, by providing for a small pocket park. The proposed pocket park is well located on the site for maximum winter solar access, with good activation at its edges to take advantage of that amenity, and providing a much-needed through site link on what is acknowledged to be a difficult topography at the eastern edge of the city centre.

In my mind, this aspect of the Planning Proposal more than compensates for a relatively minor reduction in the amenity of Doris Fitton Park, and should be regarded as a well-considered added value of the proposal.

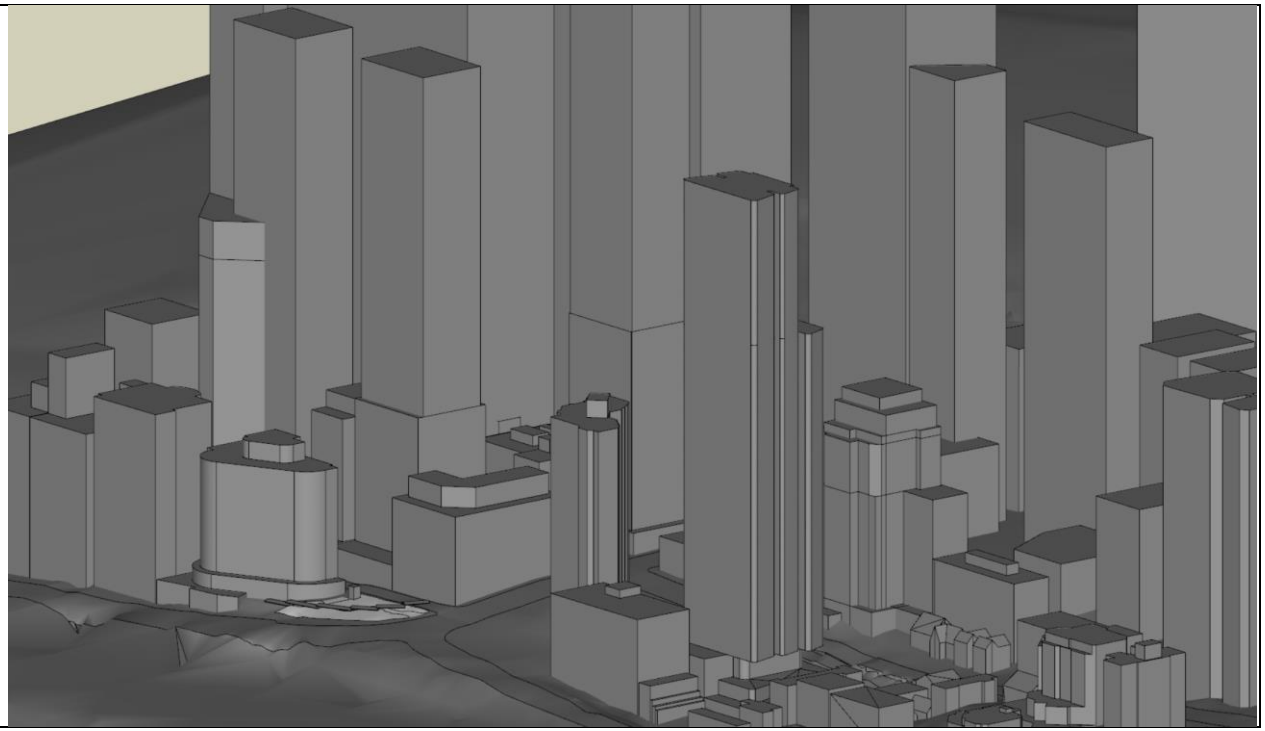
A.0 APPENDIX A VIEWS FROM THE SUN JUNE 21

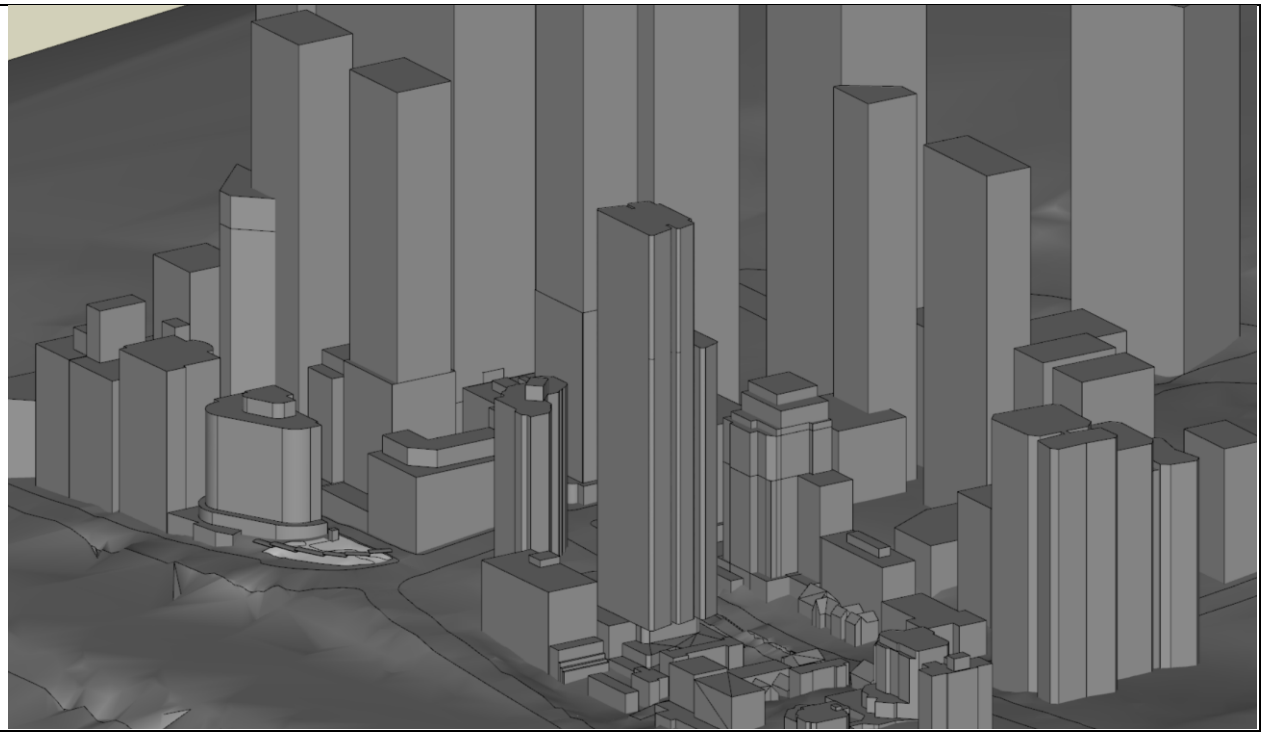
The Table below reproduces for reference the detailed ‘views from the sun’ on a half hourly basis.

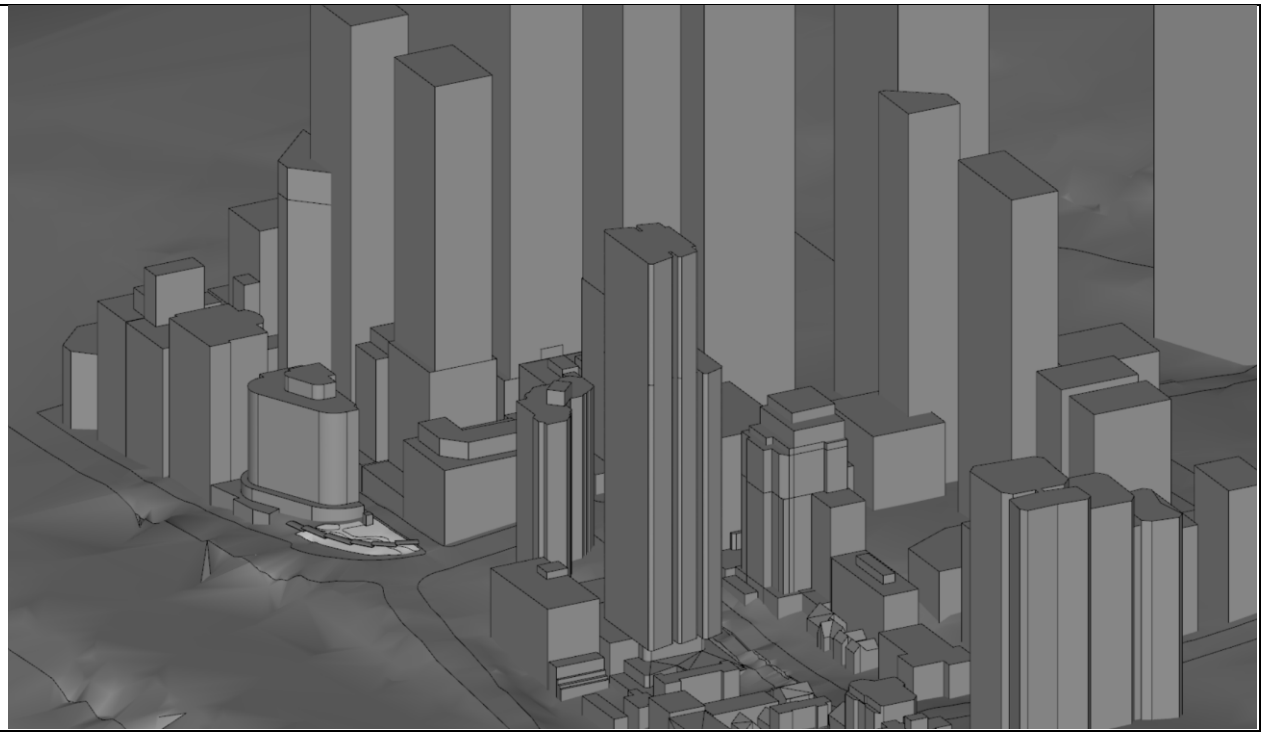
8.00	

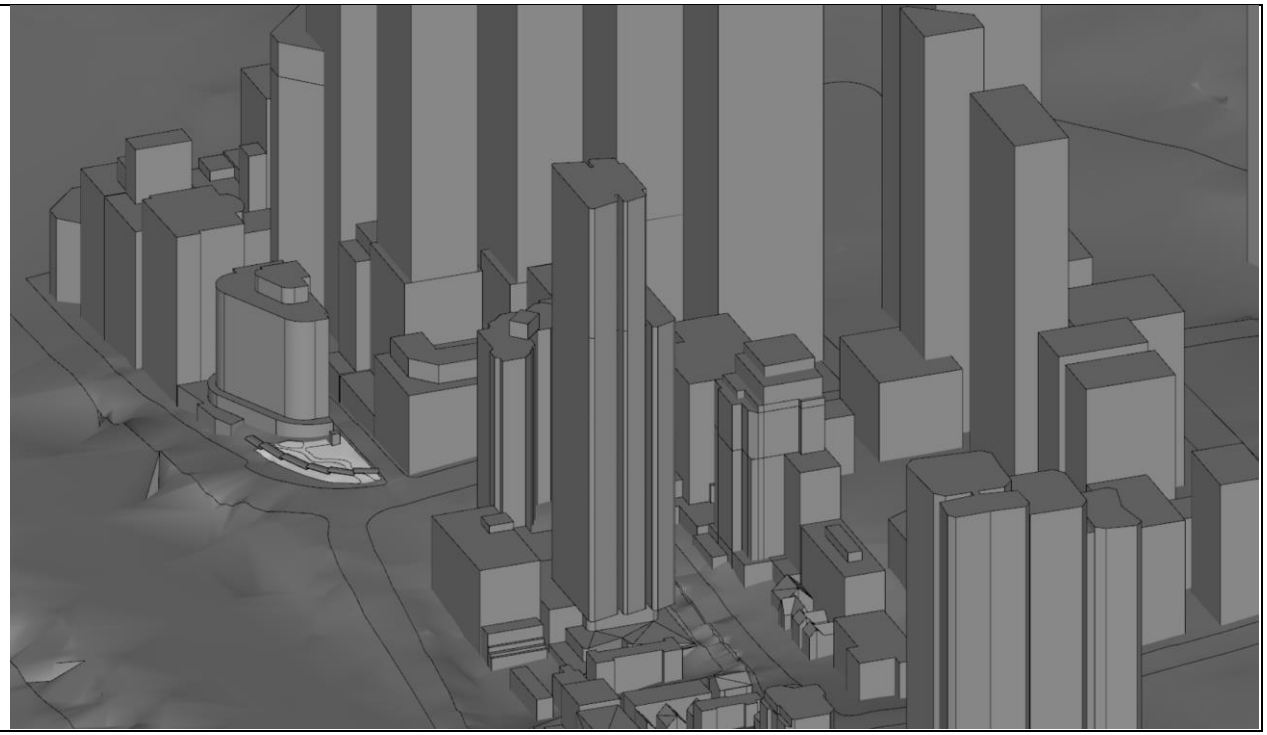
Dorris Fitton Park circled.
In following images, the area of the park is highlighted in white.

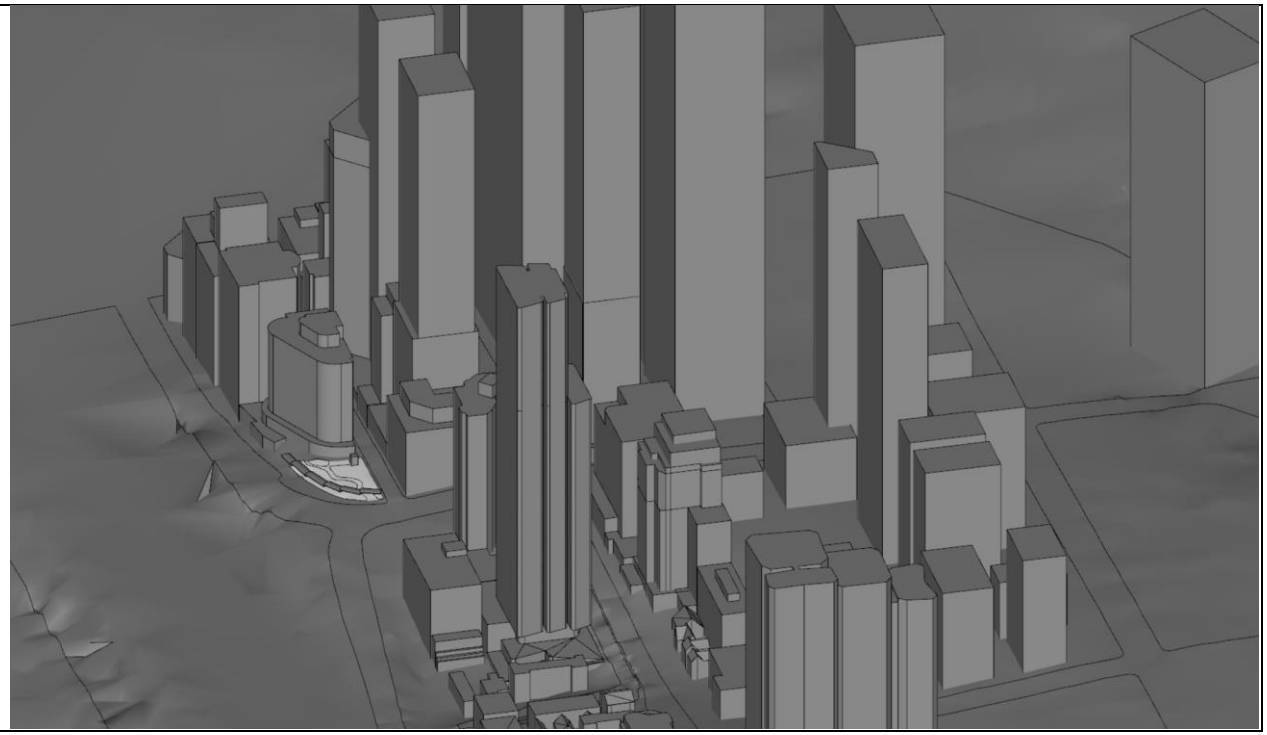
Arrow points at proposed new pocket park.

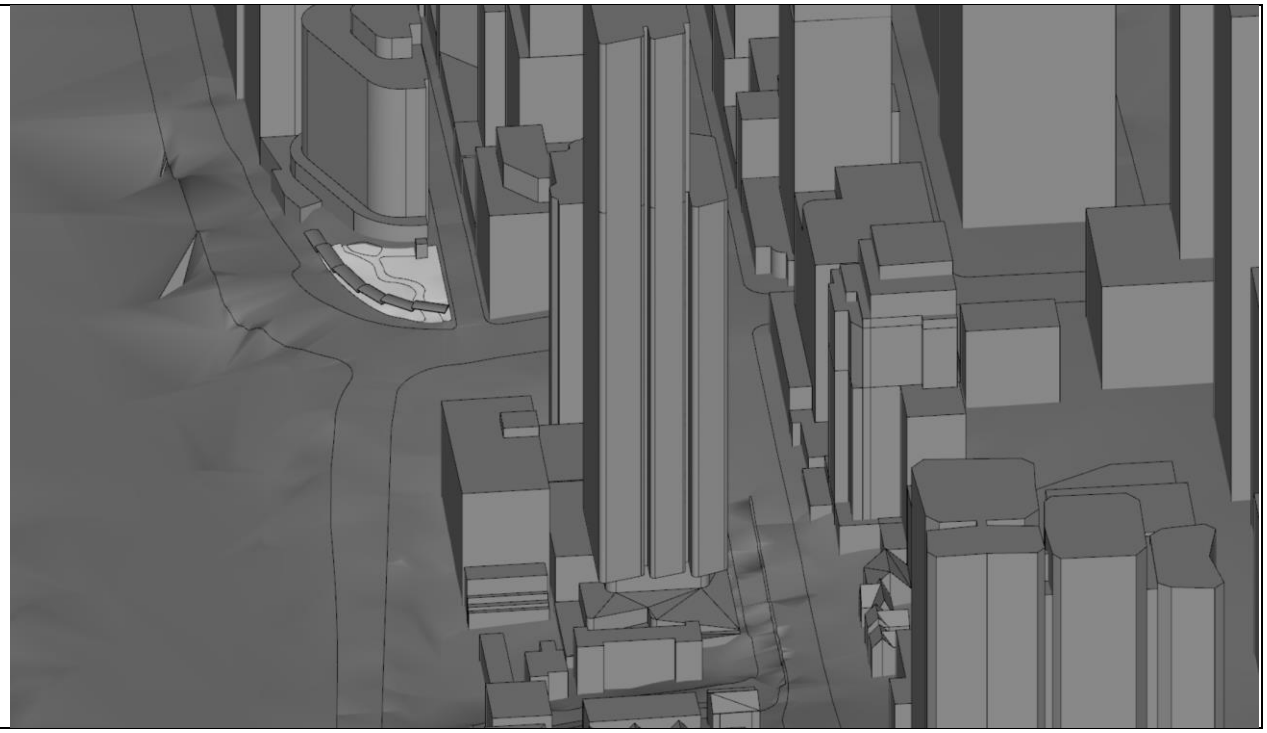
8.30	

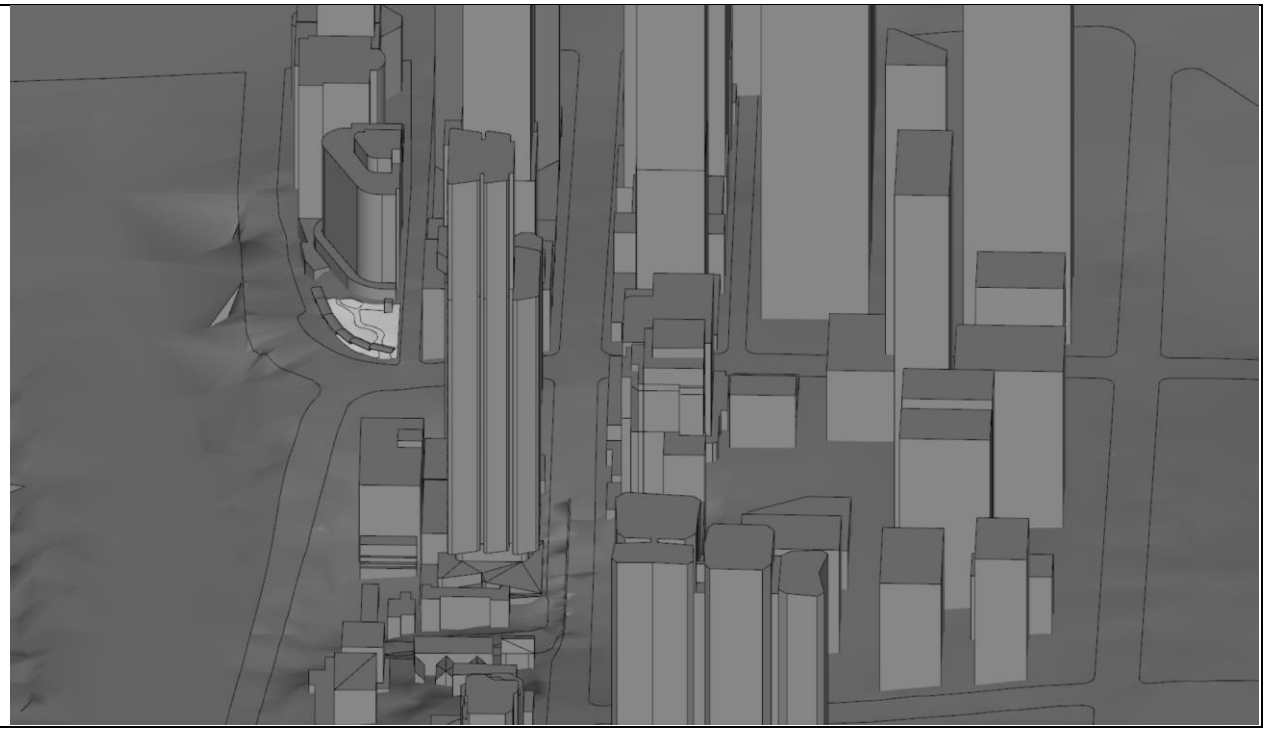
9.00	

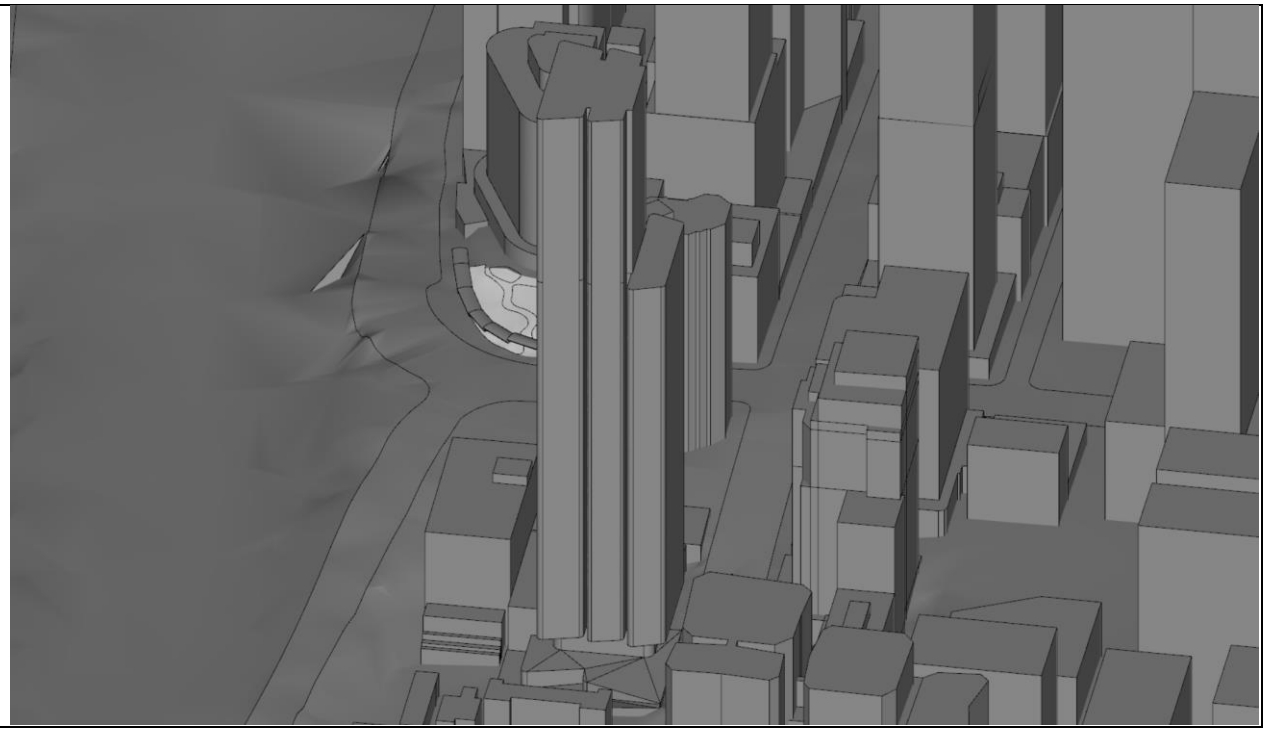
9.30	

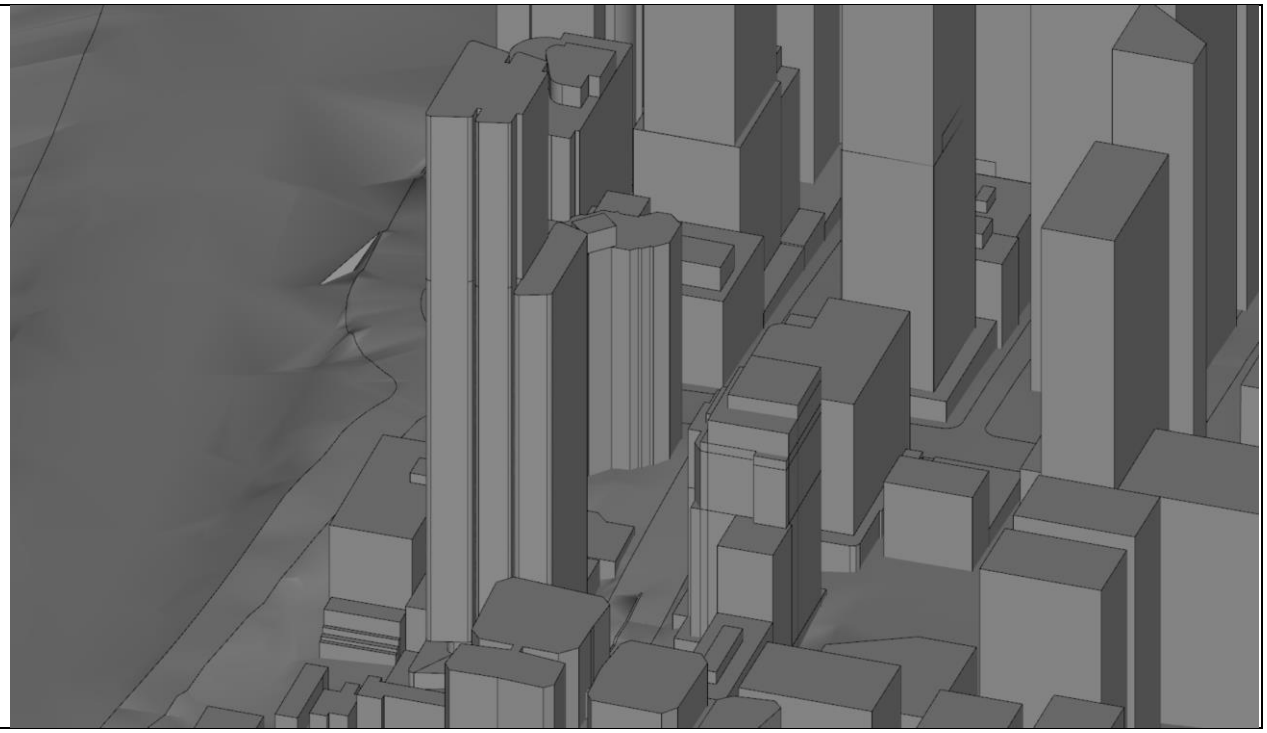
10.00	

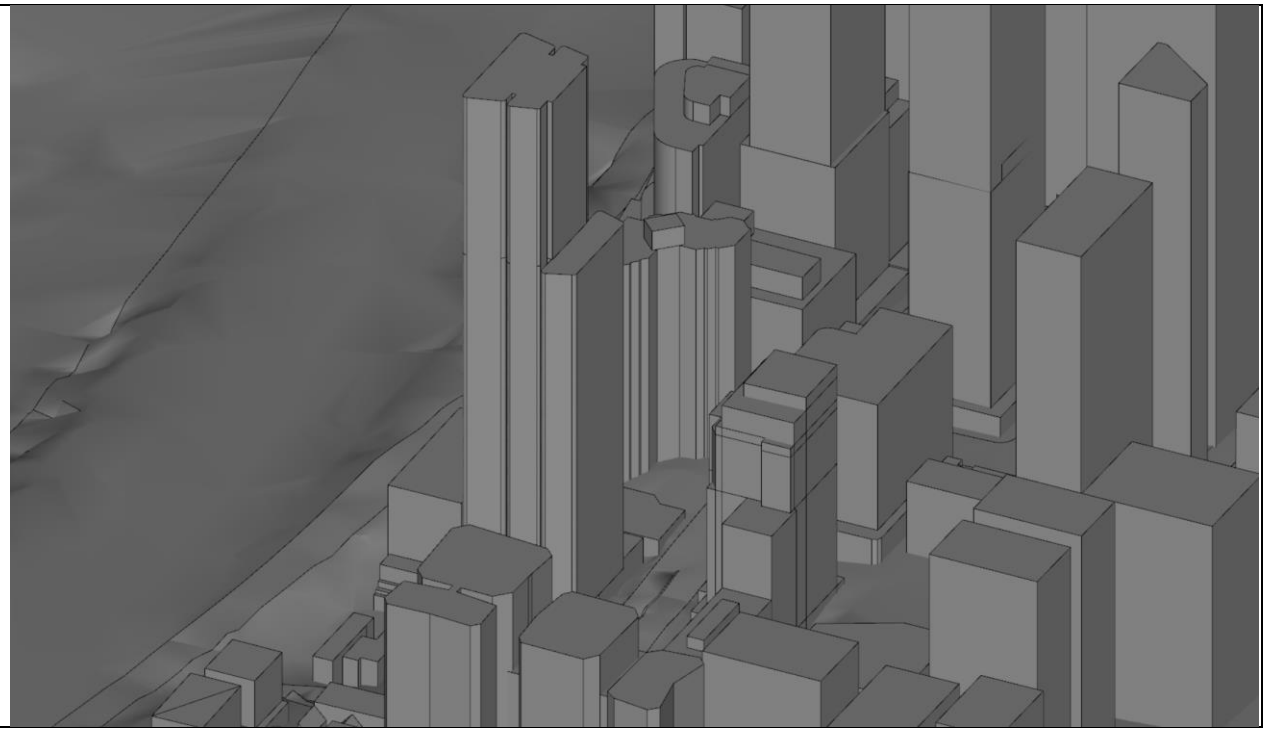
10.30	

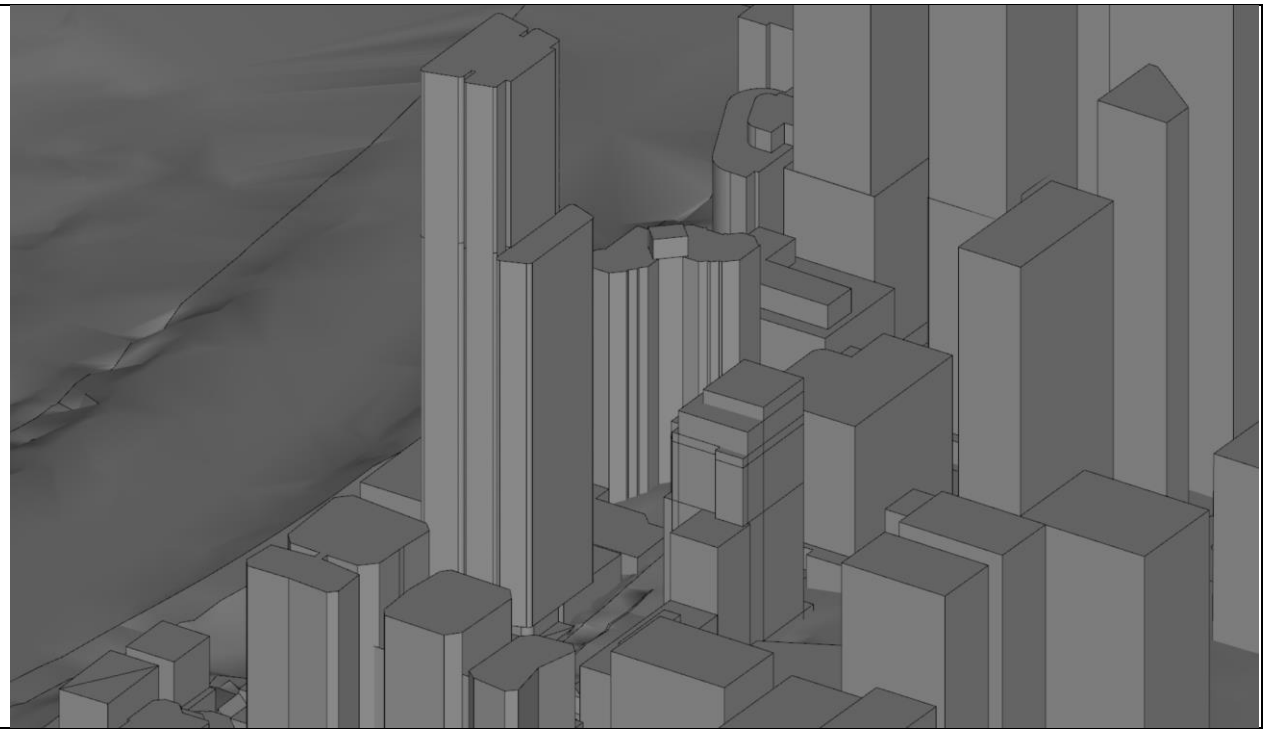
11.00	

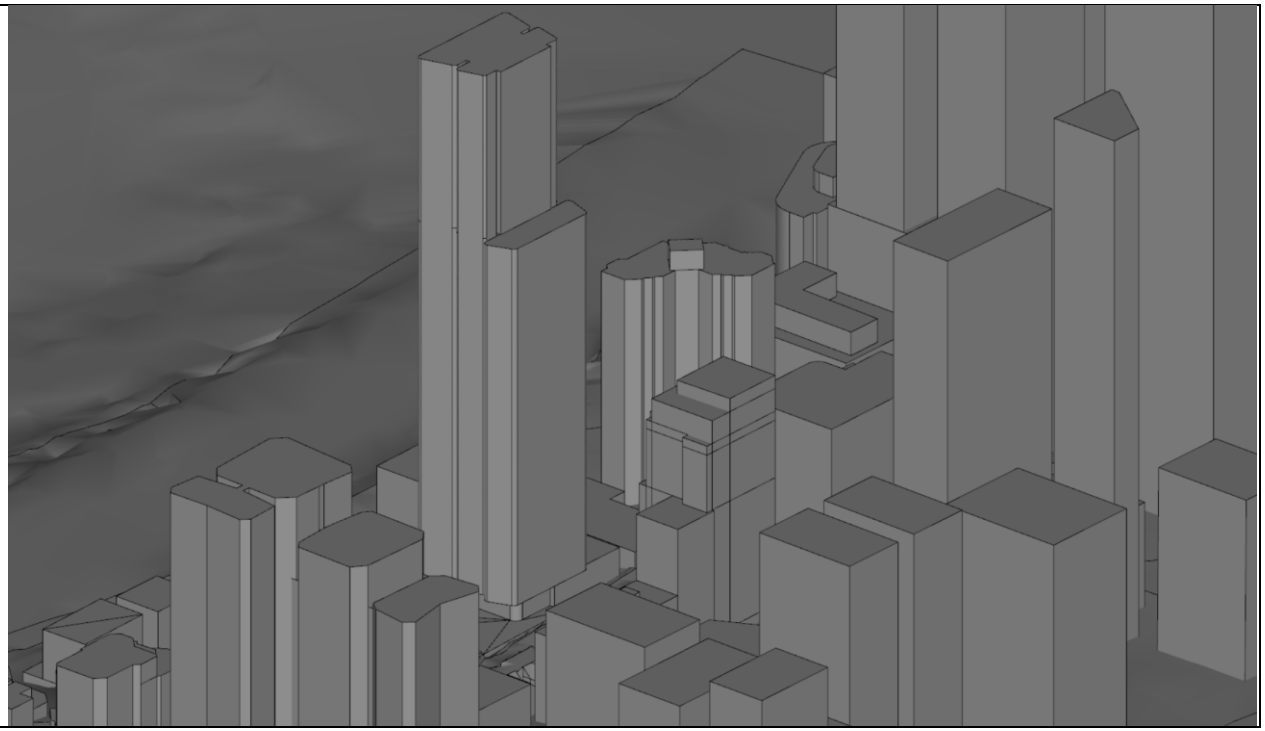
11.30	

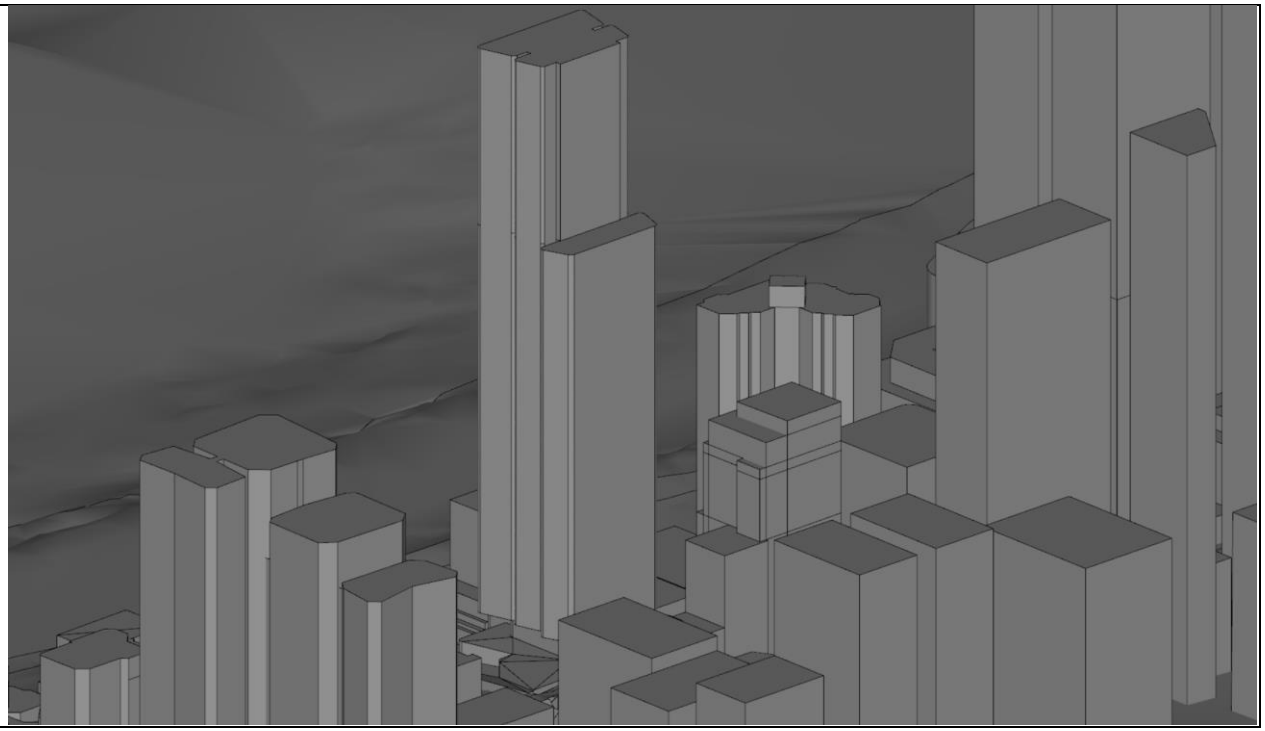
12.00	

12.30	

1.00	

1.30	

2.00	

2.30	

3.00