Our Ref: 80017026-L03:BCP/bcp
Contact: Dr Brett C. Phillips

19th November 2018

The Manager
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Attention: Mr Wail Thomas

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Dear Wail,

FLOOD IMPACT ASSESSMENT OF WESTFIELD WARRINGAH MALL PROJECT – STAGE 2 REDEVELOPMENT

Cardno was engaged by Scentre Design & Construction to assist in the preparation of a Development Application for Westfield Warringah Mall Stage 2 project for The Northern Beaches Council. The project is the second stage of the Westfield Warringah Mall Project comprising of the redevelopment and refurbishment of the existing Westfield shopping complex. On 10 August 2018 we prepared a Flood Impact Assessment for the Stage 2 Redevelopment of Warringah Mall which is one of the assessments submitted under DA 2018/1514 Warringah Mall.

On 24 October 2018 Addisons Lawyers, acting on behalf of Harrisons Investments Pty Ltd, submitted a letter to Northern Beaches Council raising a number of issues of concern.

We have been requested to provide responses to the various issued raised in the Addisons letter dated 24 October 2018 to inform Council's consideration of the issues raised.

The following comments were detailed under "Flooding Assessment" in the Addisons letter dated 24 October 2018. Our responses are detailed as follows.

1. *Page 10 - second dot point - very general info with no justification for the statement;*

   The justification for the statement are the assessments described in Cardno Willing (2010) and in particular to the assessed impacts of the Amended Stormwater DA given in Table A.5 with reference to points P142 – P154 inclusive. This is supported also by the updated assessment reported in Attachment B of our Flood Impact Assessment dated 10 August 2018 (refer to the results for points P142 – P154 under Diff columns (bi)-(a) and (bj)-(a) for 50% and 0% blockage respectively).

2. *Figure 5 and 6 continues to show high flood depth and flood hazards upstream in Brookvale Creek including on the Harrison property.*

   Figures 5 and 6 are reproductions of Figures 22 and 24 in in Cardno Willing (2010)[1] ie. these results have been in the public domain for 8+ years. It has never been claimed that the substantial downstream drainage augmentation works would eliminate high flood depth and flood hazards upstream in Brookvale Creek

3. *Refers to augmentation undertaken by Scentre Group such as in 2013 and 2014 - but is reliant on predictions or models (including model reconfigurations) not actualities after the augmentation works occurred to test whether the models accurately predicted the outcomes.*

   The floodplain model was amended on two separate occasions based on the outcome of physical modelling of key elements of the augmentation scheme as discussed in Section 2.3 of the 2018 FIA report. The undertaking of one, let alone two, physical model studies is rarely if ever undertaken and gives greater confidence to the prediction of flood behaviour in comparison with a floodplain model which has not benefited from a physical model study.

4. *Table 3 - first line - with reference to DA 1742 S96 results there will be local increases in flood levels of up to 7 cm and when referenced to existing conditions there were reductions in flood levels of up to 27cm. There is a conclusion that the changes do not adversely impact on any adjoining properties on page 16 but there are no further details.*

   On 4 May 2015 Warringah Council released its Notice of Determination in response to the following Application: Mod2014/0285 - Modification of Development Consent DA2008/1742 granted for Construction of stormwater upgrade works for Warringah Mall and watercourse bank stabilisation works. The Notice modified Condition No. 17 as follows:

   C. Modify Condition No. 17 Physical Model Studies to read as follows:

   Physical Model Studies

   A Physical hydraulic model of the large stormwater junction box, (C6 on drawing W4548 – 414 by Cardno) is to be built and accompanied by a report to confirm the hydraulic losses which were assumed in the xpswmm computer model and report (ref Stormwater Management Plan and Stormwater Report November 2014) by Cardno are appropriate. The physical hydraulic model report is to be submitted to the Certifying Authority for approval. The report is also to provide advice on how the hydraulic losses in the junction box can be minimised.

   The details are to be prepared by a suitably qualified Civil Engineer, who has membership to the Institution of Engineers Australia, National Professional Engineers Register (NPER-3) and is an Accredited Certifier (Category C4).

   Details demonstrating compliance are to be submitted to the Certifying Authority for approval prior to the issue of the Construction Certificate for the stage three stormwater augmentation works (Culvert)

[1] Cardno Willing (2010) "Warringah Mall Flood Impact Assessment", *Addendum*, prepared for AMP Capital Investors and Westfield Design & Construction, January.

Reason: To confirm parameters assumed in the flood model

A letter report titled "Modification of Development Consent DA2008/1742 at Warringah Mall (MOD2014/0285) – Condition 17 Physical Model Studies" dated 21 August 2014 was prepared in response to Condition No. 17. Table 3 was extracted from this letter report.

This letter report included a tabulation of estimated 100 yr ARI flood levels in the form of Table A.5. The local increases of 7 cm in comparison to the previous DA1742 S96 results were reported at P142, P143 and P144 (all located in Brookvale Creek close to Warringah Mall). At these same locations the reductions in comparison to 100 yr ARI flood levels under Existing Conditions were 20 cm, 20 cm and 24 cm respectively.

The details provided in the 2014 letter report support the conclusion.

5. *Table A.5 in Attachment B and Attachment A - the Table provides comparison of the baseline 100 yr flood scenarios and levels at many locations upstream of the Mall.*

   The location of all reference locations are given in the attached Figures which identify the locations of the original reference points (which have remained unchanged for 10+ years) and the locations of series, 200, 300, 400 and 500 reference points which were subsequently added in local areas of interest in 2013.

It is further requested by Addisons that Council take into account and/or respond to a series of requests. Our comments on these requests are detailed as follows.

1. *The applicant should provide a plan similar to Attachment A which shows the location of all the Survey Points listed in Table A.5. This will allow review of all the results in and around the Harrison property so we can gain a better understanding of the flood behaviour in the area.*

   The location of all reference locations are given in the attached Figures which identify the locations of the original reference points (which have remained unchanged for 10+ years) and the locations of series, 200, 300, 400 and 500 reference points which were subsequently added in local areas of interest in 2013. It is noted that the reference points in and around the Harrison property are also included in the final Flood Management Plan for Lot 2 DP 600059 No. 75 Old Pittwater Road, Brookvale dated 16 August 2016.

2. *Council and ourselves, after provision of the above information, should examine the change in flood velocities to assess impacts on bank stability. This is because the creek lines in the Harrison property (upstream of the augmentation works) are natural and susceptible to erosion in floods. There is already evidence of erosion.*

   In the 2011 modification to DA 2008/1742 – Brookvale Creek Waterway Impact Statement Addendum it is stated:

   > "Based on the approach adopted in the 2011 Waterway Impact Statement for Brookvale Creek, the impact of the proposed works on 2 year, 5 year, 20 year and 100 year ARIs flood velocities in Brookvale Creek was also assessed. Flood velocity difference plots for the 2 year, 5 year, 20 year and 100 year ARIs are included in **Appendix C.**

Upstream of Warringah Mall

The velocity plots presented in **Figures 1** to **4** show the differences in peak velocities estimated under future conditions based on DA2008/1742 and the proposed Section 96 works in comparison with the peak velocities estimated under existing conditions. It is evident that the local increases in velocity are contained within the proposed creek works upstream of Warringah Mall. The impact of the velocity on the stability of Brookvale Creek will be managed by the selection of suitable materials in the design as discussed in the In-stream Works Schedule, to be prepared as part of the Controlled Activities Approval.

Figures 9 and 10 show the differences in peak velocities estimated under future conditions based on DA2008/1742 and the proposed Section 96 works in comparison with the peak velocities estimated under DA2008/1742 only. It is evident that the updated drainage design lowers the velocity in Brookvale Creek by up to 0.2m/s in comparison to DA2008/1742 conditions, having a positive impact of flow behaviour in terms of stream stability. No changes to the model parameters or geometry have been made upstream of Warringah Mall.

Therefore, although the results show an increase in velocity when compared to the existing conditions, the proposed Section 96 modifications actually result in a decrease in the predicted velocities when compared to the existing DA (DA2008/1742). As a result no additional water stability measures are required from those currently proposed under DA2008/1742."

3. *What are the 100 yr ARI design flood depths under existing conditions for 71-75 Old Pittwater Rd site (Harrison Group Property)? What might the 100 yr ARI design flood levels after the proposed works in DA2018/1514? Can Council or the Applicant confirm that there will be no change to the flood levels?*

The estimated 100 yr ARI flood levels under Existing Conditions are given in Table A.5 under 50% and 0% blockage scenarios. The 100 yr ARI flood levels under DA2018/1514 (Updated Stormwater DA + Brookvale Creek Design + Stage 2 Redevelopment) are also given in Table A.5 under 50% and 0% blockage scenarios.

Changes to estimated flood levels could occur in the future due to changes in hydrological data (design rainfall intensities, storm temporal patterns, rainfall losses, etc) released by the Bureau of Meteorology periodically and/or changes in industry best practice for flood estimation. Any changes in estimated flood levels due to any development on the floodplain which may be proposed in the future would be required to undertake flood impact assessments in accordance with Council's requirements and to limit any adverse impacts on adjoining properties to negligible impacts.

4. *Is Council satisfied that the 100 yr flood levels have reduced by 67cm as predicted on page 9 of the Flood Impact Assessment? If the actual levels do not match the prediction, then how can Council be satisfied that the impacts of Stage 2 are acceptable?*

The statement on Page 9 is in relation to the assessments undertaken in 2010 and reported in the Warringah Mall Flood Impact Assessment. The 2010 assessments have been superseded by subsequent assessments of proposed re-configuration of elements of the scheme reviewed in 2010.

The floodplain model was amended on two separate occasions based on the outcome of physical modelling of key elements of the augmentation scheme as discussed in Section 2.3 of the 2018 FIA report. The current estimates of the reductions in flood levels are given in Table A.5 in the 2018 FIA report and represent the best available estimate of design flood levels in Brookvale Creek upstream of Warringah Mall.

5. *Has Council tested the assumptions in the model now that the augmentation works are complete?*

   As indicated above Council has required that physical modelling be undertaken on two separate occasions *To confirm parameters assumed in the flood model.* The undertaking of one, let alone two, physical model studies is rarely if ever undertaken and gives greater confidence to the prediction of flood behaviour in comparison with a floodplain model which has not benefited from a physical model study.

6. *Can Council acknowledge that the Cardno Stormwater Management Report for Westfield Shopping Centre, Warringah Mall, dated 17 August 2018 and the letter from Cardno to Scentre Design and Construction Pty Ltd, ref 80017026-L02:BCP/bcp are correct and we can rely on these reports as being accurate?*

   The current estimates of the reductions in flood levels are given in Table A.5 in the 2018 FIA report and represent the best available estimate of design flood levels in Brookvale Creek upstream of Warringah Mall.

7. *Council should obtain an independent peer review considering the long history of flooding issues and reliance on models and because it has used a peer reviewer in the past.*

   Based on Council's review of various flood impact assessments which have been submitted progressively since the completion of the Peer Review in 2009 and with the benefit of two physical model studies which have informed the parameters adopted in the floodplain model and which were inspected by Council officers, there is little merit in commissioning a further Peer Review.

8. *Will Council verify that there are no negative impacts on the Harrison Group Property from the outcomes of the proposed DA?*

   The current estimates of the reductions in flood levels are given in Table A.5 in the 2018 FIA report and represent the best available estimate of design flood levels in Brookvale Creek upstream of Warringah Mall.

Yours faithfully

Brett C. Phillips

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Dr Brett C. Phillips
Director, Water Engineering
for **Cardno**

Figure A.1A
Reference Locations for Flood Levels

Figure A.1B
Reference Locations for Flood Levels

Figure A.1C
Reference Locations for Flood Levels

Figure A.1D
Reference Locations for Flood Levels

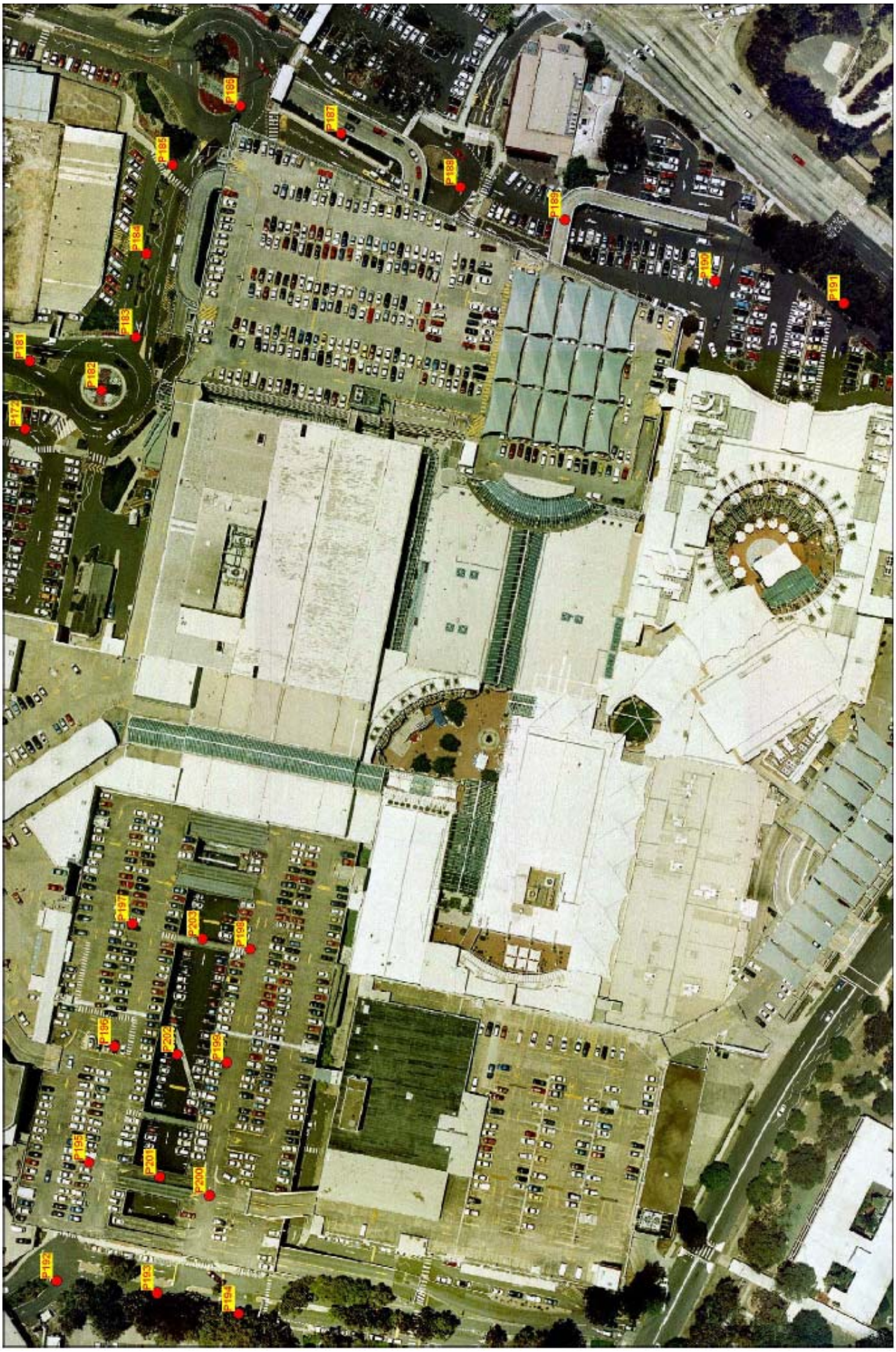

Figure A.1E
Reference Locations for Flood Levels

Figure A.1F
Reference Locations for Flood Levels


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403
404
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504
505

Warringah Mall _ Additional Points