Lot 1 DP 219742, Concord West

Flood Impact Assessment

Addendum 1

Job Number: EN_N15 - 65

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VALUE | INNOVATION | TRUST

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Document Control

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CONTENTS

1. INTRODUCTION

This report is an addendum to the flood impact assessment report prepared by IGS for the proposed planning proposal at **Lot 1 DP 219742, Concord West** shown in Figure 1-1.

This addendum describes the additional flood modelling carried out to address the specific comments raised by Jacobs in their review of the flood model and the associated report.

The proposed building footprint has not changed from the previous report.

Figure 1-1 - Locality Plan (Aerial Image Source: Nearmap)

1.1 Objective of this report

The objectives of this report and the additional flood modelling are to address specific concerns raised by Council and Jacobs relating to the flood modelling approach and the accuracy of the results. It also addresses the concerns of adjoining property owners that have experienced flooding in previous and recent heavy rainfall events.

In particular, this report provides:

- Revised modelling approach of the proposed building;
- Additional modelling for the 100-yr and the PMF events including sensitivity of design flood levels to partial blockage of infrastructure downstream of the site (ie. culverts under Homebush Bay Drive) and climate change impact on flooding; and
- Additional supportive flood maps.

2. FLOOD MODELLING

The additional flood modelling was undertaken for Scenario 3 only (refer below). The partial blockage in the mangroves downstream of the site is included in this assessment.

The following events were modelled:

- 1% AEP 25 minutes & 120 minutes; and
- PMF 120 minutes.

The modelling was carried out for the normal conditions and for the climate change/sea level rise conditions as well.

2.1 Scenario 3

For the purpose of this additional flood modelling, Scenario 3 is used for the proposed site conditions.

A detailed description of Scenario 3 has been included in this report for clarity. This includes the modelling changes carried out to respond to the comments and concerns received from Council and their consultant (Jacobs).

Scenario 3 provides a flood storage area under the entire building footprint. It is proposed to provide primary flow channels within the floodway void, while providing shallow areas to allow for additional flood storage to maintain the existing flood characteristics in the floodplain.

Scenario 3 relies on the full tanking of the basement level to provide a flood conveyance and storage area between the basement and the ground floor. Whilst the basement is protected from flooding for events up to the 100-yr, it is subject to inundation in extreme events that exceed the 100-yr. The driveway crest could potentially be overtopped by flood waters in extreme events exceeding the 100-yr design storm.

The access stairs from the basement will be used for evacuation from the basement and will discharge at least at level 1 which is elevated above the PMF flood level. This is to ensure that the evacuation from the basement is to a flood free area.

Scenario 3 was found to provide the innovation to the development that council were seeking whilst addressing all the planning requirements for the development. More specifically landscape and amenity was preserved by developing **Scenario 3.** The figures below provide detailed design documentation of **Scenario 3.**

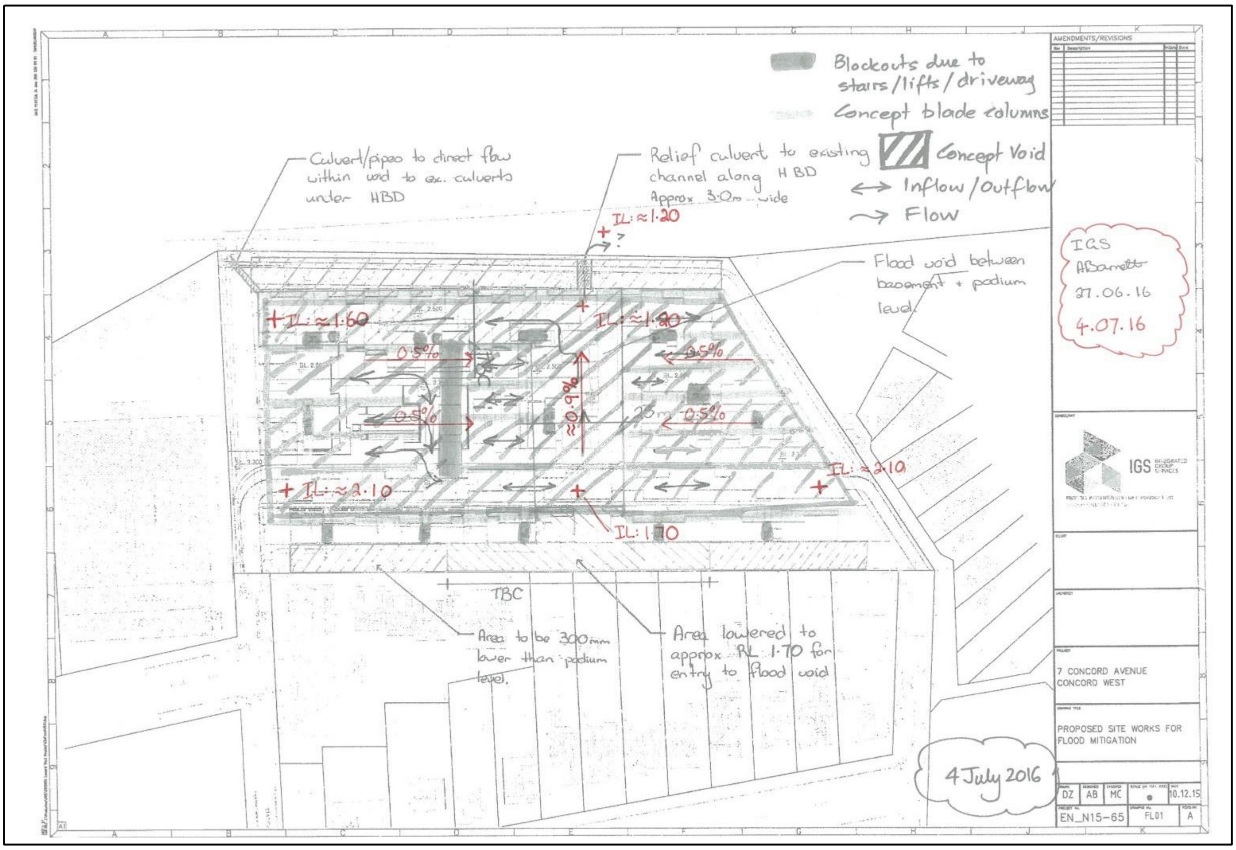

Figure 2.1 - Scenario 3 (Full Floodway / Storage Void Under Entire Building Footprint)

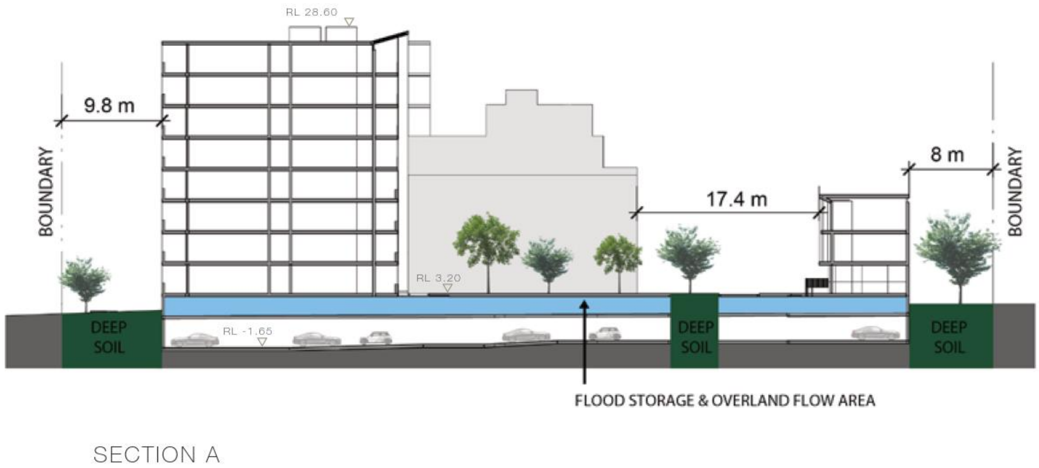

Figure 2.2 - Section Through Building (Scenario 3)

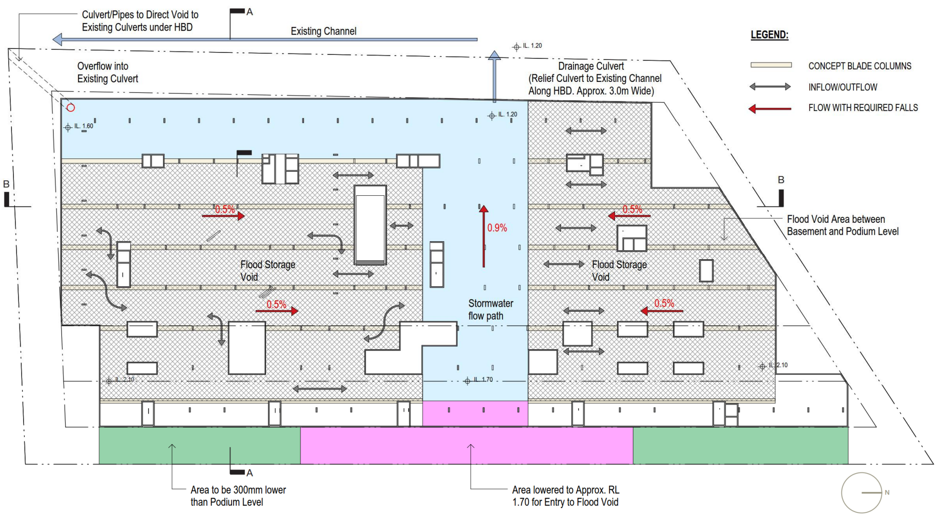

Figure 2.3 - Void Plan View (Scenario 3)

2.2 Modelling Approach

Scenario 3 proposes a flood void for the entire building footprint to increase the flood storage on site. The following modelling approaches were carried out:

- The void area under the building footprint is lowered to the levels shown in Figure 2.3 above. The eastern side is fixed at RL 1.70m AHD, this represents the upstream inflow area. The lower point in the void is in the middle of the western boundary and is fixed at RL 1.20m AHD. This point acts also as the outlet of the void area. The south western corner is fixed at RL 1.60m AHD. The void is graded to its central area at 0.5% grade to force the flows into the opening;

- Areas external to the building (northern and western boundaries) would be raised to provide common open amenity areas. These areas were modelled as raised fill areas (finished levels varying between 2.9m and 3.0m AHD). These setback areas would be turf lined basins falling towards grated surface inlet pits to catch a larger portion of surface flows than are currently captured for the catchment. These turf areas could be underlain with slotted uPVC or alternate subsoil drainage pipes to reduce the likelihood of ponding water becoming a health hazard;

- An opening is provided along the western boundary to provide for flood conveyance from the void to the downstream area facing Homebush Bay Drive;

- Blockouts are proposed in the void to represent the stair cases, the lift shafts and the driveway;

- The flood opening under the building is limited to 22m width along the eastern boundary;

- Part of the setback (60m long) along the eastern boundary is lowered manually within the TUFLOW model to RL1.70m AHD to increase the flood acceptance width from the upstream properties;

- It is not proposed to provide additional stormwater inlet capacity in Scenario 3 to increase the capacity of the culverts under Homebush Bay Drive;

- A surface inlet pit is proposed at the south western corner of the void and is to be connected to the culverts at the south western corner of the site to provide for a low flow drainage system to drain the void area after the flooding event;

- In response to Jacobô s review, the slab on top of the void and the podium have been modelled in TUFLOW as layered constrictions to the flows. This is only affected by the PMF flood event as follows:

  a. The void is given an obstruction percentage of 5% to account for any columns that will be required to support the void;

  b. The slab (assumed to be 0.3m thick) is affected by 100% obstruction percentage (i.e. fully blocked);

  c. A 1m height on top of the slab is affected by 20% blockage percentage to account for any future fencing or similar; and

  d. Unrestricted height over the 1m on top of the slab.

3. FLOOD IMPACTS

Models were prepared for the post-development **Scenario 3** only in this addendum. The critical storm durations for the catchment were determined to be 25 minutes and 120 minutes for the 1% AEP event. For the PMF event, the 120 minutes was adopted as the critical duration.

The pre-development model was used as the basis to determine the changes to the peak flood levels of the proposed development on the surrounding floodplain.

Changes to the peak water levels for the 1% AEP and the PMF events for the post-development **Scenario 3** compared to the existing flood conditions near the subject site.

Under **Scenario 3**, the flood void covering the development footprint shows no major rise in flood levels up- and downstream of the development site. This is due to the additional flood storage provided on the site as part of the proposal from the existing site levels. Similar results are returned by the model in the PMF event.

The following table shows the flood levels in 1% AEP flood event for the existing site conditions and **Scenario 3** and for the events modelled including the climate change consideration.

Location	**1% AEP (Sc0)**	**1% AEP (Sc3)**	**PMF (Sc0)**	**PMF (Sc3)**	**1% AEP + 0.9m SL rise + 30% rainfall (Sc3)**	**1% AEP + 0.9m SL rise + 30% rainfall + 50% Mangroves blockage (Sc3M)**
Concord Ave	2.44	2.44	3.76	3.76	2.44	2.44
Station Ave	2.09	2.19	3.76	3.76	2.33	2.34
George St Sag	4.12	4.28	4.81	4.8	4.32	4.33
NW Corner	2.07	1.99	3.76	3.76	2.32	2.33
SW Corner	2.09	2.04	2.04	3.76	2.33	2.33
King St	2.09	2.08	2.08	3.76	2.33	2.34
SE Corner	2.09	2.09	2.09	3.76	2.33	2.34
NE Corner	2.35	2.35	2.35	3.76	2.35	2.35

The figure below shows the location of the points where the flood levels are tabulated.

For **Scenario 3**, the flood levels are generally lower for the post-development case than the existing flood levels. This reduction in levels is both upstream and downstream of the development site.

The flood impact maps for each of the storm events modelled has been included in Appendix A.

Figure 3.1 - Key Locations of Flood Levels

4. RESPONSES TO JACOBS COMMENTS

This Section provides responses to the specific comments, concerns and notes raised by Jacobs on behalf of Council.

Item	Jacobs Review Comment	IGS Response
1	The flood void is represented in TUFLOW as an unroofed open area, rather than an enclosed chamber as illustrated in the design drawings	N/A ï this was a note / observation only
2	The peak water level in the void in the 1% AEP event is 2.05m AHD with a flat water surface across the void area. This allows for approximately 0.75m freeboard to the roof of the void, assuming the roof level is at 2.8m AHD (TBC) thus the 1% AEP is not flowing under pressure. Although the void is represented in the TUFLOW model as having no roof, this is satisfactory for the assessment of up to the 1% AEP event. Refer for discussion on following pages for model performance for events larger than the 1% AEP.	N/A ï this was a note / observation only
3	The inlet into the void is modelled as a 62m wide opening along the eastern side of the development, using blocked obstruction (i.e. 100% blocked polygons) objects to constrain the opening on either side of the floodway. This is reasonable. However, the design plans indicate that the floodway is 22m wide only. There is not sufficient information on the design plans to confirm that there is 66m of inlet width. It is suspected that if only a 22m wide void flow entry is modelled, that there would be increases in flood levels on the properties to the east. Any impacts should be confirmed. Refer to Figure 3.	The 60m wide opening is at the rear of the site is all open and represents the eastern boundary of a lowered area at RL 1.70m AHD to increase the inflow capacity through the site. The western part of the lowered area is restricted to 22m width which allows for the flows to be conveyed under the void
4	The outlet opening of the void is not modelled at the minimum floodway elevation of 1.2m AHD as indicated on their design. Instead, the outlet opening has an invert level of 1.85m AHD which means there is a 0.65m high sill at the outlet. IGS should confirm whether the outlet invert should be lowered in the model, noting that doing so is likely to reduce the depths of flooding upstream of the opening (including in the void) and potentially increase flooding and flows downstream. Otherwise, whether the model reflects what is intended, in which case the design drawings may need to be updated. Refer to note on Figure 3.	This has been addressed in the revised model and shown to have negligible effects to the flood model.

Item	Jacobs Review Comment	IGS Response
5	At the south-eastern corner of the void, there is a proposed sump pit to drain the void low-flow water out to the existing stormwater line crossing under Homebush Bay Drive to the south of the site (i.e. the ñsouthern culvertò). It is noted that the finished level in the void in this corner is 1.6m AHD. The Hydraulic Grade Line (HGL) level in the connection pit on the existing stormwater line is 1.8m AHD even in frequent events such as the 1 EY event and hence it is expected that the sump pit in the void would surcharge during frequent flood events. It is therefore recommended that the void low-flow sump drain to the northern culvert crossing of Homebush Bay Drive, which is already running full, but the runoff from the site in the existing case already drains to this location in any case.	The reason a low flow pit is added is because the infrastructure is fully sealed. The model provided by Jacobs does not reflect this and allows the water to flow into the 1D domain (I.e. assuming the system has inlet capacity). Although the system is full, the void will drain after the rainfall event. The reason it is connected to the southern culvert is because the northern culvert is too high and it cannot drain the void.
6	It is noted that the sump pit connection to the existing stormwater was not modelled in the IGS TUFLOW model.	The low flow system is modelled now and shown to have negligible effects to the flood model. Refer amended model details.
7	The model does not reflect the lowered corridor along the eastern boundary of the site which is intended to collect overland flows from the eastern adjacent properties and direct them to the void entry. The blocked obstructions in the model are situated in their place. Refer to Figure 3. It is unclear whether the modelled performance of the void entry and changes to flood levels will be affected by precise representation of the lowered corridor, in conjunction with modelling the width of the entry width (if the modelled entry width differs from what is actually proposed).	The lowered area is represented in the TUFLOW model with a constant level of RL 1.70m AHD.
8	Following on from the comment above, it is Jacobsôopinion that the blocked obstructions shown in Figure 3 have not been represented in an optimal manner in the TUFLOW model. Their locations are satisfactory for representing the void volume but the obstruction objects are overly thick, likely leading to impacts being overestimated. For example, the obstruction object on the southern side of the site is almost completely blocking off the flow path in the actual 9m setback between the site boundary and the building, resulting in a 0.25 ï 0.27 m impact estimated for the western end of Station Avenue. Refer to Figure 5. This may be a false result which could be detrimental to IGSôs reported impacts. The blocked obstructions could be modelled as 2-4m wide, rather than the 6-10m widths represented by IGS, although it is unlikely that there would be significant changes to the outcomes of their study.	The external areas outside the building footprint have been remodelled as raised fill areas as proposed by the architect and shown to have negligible effects to the flood model.

Item	Jacobs Review Comment	IGS Response
9	Jacobs has concerns that the head losses across the screen on the void entry, in addition to the upstream flood afflux on adjacent properties, has been underestimated. The screen has been assumed to fully open with no hydraulic losses but its design (refer Figure 2) indicates a relatively high level of blockage due to the screen elements themselves. The screen would also be highly prone to additional debris blockage. Further, the design configuration of the screen is not expected to be hydraulically efficient and a high hydraulic energy loss could be expected. The overall blockage and an appropriately high energy loss coefficient should be represented in the TUFLOW model (it currently is not) either by using a 2d_lfcsh object or by manually restricting the entry width to the effective waterway area, in order to assess the impacts to flooding. A more open arrangement of screen design is also recommended.	No screen will be allowed in front of the 22m wide opening. The opening should be unrestricted to allow for the incoming flows to go under the void without obstruction. This will be reflected in the architectural plans and is modelled accordingly. This can be addressed through the detailed design development phase of the project.
10	Review of the flood extent grids for the Probable Maximum Flood (PMF) results for Scenario 3 indicate that the flooding on the site is controlled by the Homebush Bay Drive embankment, with a peak flood level of 3.76m AHD, meaning the podium of the development is flooded to a depth of 0.56m and the void is submerged. However, since the void is modelled as an open space (no roof or podium) and only constrained by blocked obstructions representing the walls of the void, the overall obstruction posed by the podium slab and overlying buildings is not considered in the model. Hence, impacts to flooding in the PMF are not accurately estimated. If the PMF impacts are required to be assessed accurately, it is recommended that the overall development be modelled as a bulk blocked obstruction and/or raised topography, with a 1d network and 1d nodal storage objects to represent the void floodway and storage area. This will allow the constraints of the void entry and the void roof to be represented.	The impact of the PMF flood event has been addressed. Refer to flood maps. The building has been modelled as a layered flow constriction and shown to have negligible effects to the flood model..

Item	Jacobs Review Comment	IGS Response
11	The entry into the underground basement is via an entry ramp with a raised crest to prevent inflows into the basement in up to the 1% AEP event (or greater, depending on the amount of freeboard). Section 3.2 of IGSô s flood report states that the basement would potentially experience inflow of floodwaters in extreme events exceeding the 1% AEP. While the report does identify that evacuation during a flood event vertically within the development (including from the basement) to floor levels above the floodwater is appropriate, it has not considered the potential rate of rise of floodwaters within the basement, and whether there is sufficient time for anyone in the basement to reach the stairwells for vertical evacuation. Consideration should be made on: o What the rate of rise is within the basement for the PMFï does it differ from the rate of rise external to the basement. This may require modelling with the basement entry modelled as a 1d weir spilling into a 1d nodal storage object; and o whether there is sufficient warning time to evacuate the basement (it is noted that there would be flooding evacuation alarms in place).	This has been discussed in the report. This can be achieved through a plan of management that addresses evacuation from the basement and the ground floor to higher areas during DA and/or CC stages

5. CONCLUSIONS

An assessment was undertaken to address the flooding considerations for a planning proposal at the site which IS based on contemporary planning requirements in other LGAs which consider the development of land with similar flood affection as the subject site. This addendum addresses Council's specific comments received on the flood modelling approach and the flood impact report.

The preferred development configuration (**Scenario 3**) is based on the full tanking of the basement car parking level to provide a flood conveyance and flood storage area between the basement and the ground floor. Whilst the basement is protected from flooding for events up to the 1% AEP, it would be subject to inundation in extreme events that exceed the 1% AEP because the driveway crest could potential be overtopped by flood waters.

Two options are available to address potential flooding of the basement car parking level in an extreme flood are as follows:

- Protect the basement from flooding up to and including the PMF flood level by a flood gate installed at the crest of the driveway. All access starts to the basement would discharge at RL 3.80m AHD minimum prior to coming down to the podium level. All mechanical shafts and opening would also be raised to RL 3.80m AHD; or

- Allow the basement to flood in storm events exceeding the 1% AEP and implement and maintain a flood management and response plan to evacuate the persons at risk from the basement efficiently and in a timely manner to a safe higher level within the development during extreme floods.

The access stairs from the basement will be used for evacuation from the basement and will discharge to at least Level 1, which is elevated above the PMF flood level. This is to ensure that the evacuation form the basement is to a flood free area. This preferred configuration is reflected in the latest architectural plans.

It is concluded from the flood impact assessment that the preferred development configuration:

- Preserves the current flood storage within the site by fully tanking the basement car parking level and creating a void between the basement and the ground floor which extends across the complete extent of the podium;
- Provides enhanced amenity such as common areas, private courtyards, internal roads which are raised substantially above the 1% AEP flood level;
- Does not increase flood levels, velocities and hazards elsewhere on the floodplain;
- This void can be easily maintained through the provision of access openings at regular intervals to the flood void, which varies in height between 1.0m and 1.8m assuming a slab thickness on the ground floor of 0.3m; and
- Responds to the residual flood risk in extreme floods by adopting a shelter-in-place strategy for residents and visitors.

It is further concluded that the preferred development configuration (**Scenario 3**) addresses Council's concerns, complies and exceeds industry flood planning principles and standards while preserving and enhancing the amenity within the proposed development.

Scenario 3 is also supported by Cardno who conducted the expert peer review of this flood impact assessment.

Appendix A

Supportive Flood Maps