



Prime Consulting Engineers Pty. Ltd.



FLOOD IMPACT ASSESSMENT REPORT

FLOOD STUDY USING HEC-RAS 2D

**FOR PROPOSED NEW DEVELOPMENT
AT**

***Ref:* R-24-522-1**

40 RIVERVIEW PARADE, NORTH MANLY NSW 2100



REVISION HISTORY

Version	Date	Prepared By	Checked By	Comment
-	17.04.2024	KK	SD	
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The recipient of the latest issue as noted above will be responsible for superseding/destroying all previous documents.

Your Sincerely,

Bijaya Giri

BEng, MEng, MIEAust, CPEng, NER

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Dear Mr. David Dowell,

Re: **New Development at 40 Riverview Parade,**
North Manly NSW 2100

1 Introduction

Prime Consulting Engineers has been engaged by Mr. David Dowell to prepare a Flood study report using HEC-RAS for New Development at 40 Riverview Parade, North Manly NSW 2100 in respect to flooding during an ARI 1:100 rainfall event (1% AEP). The development site is in the suburb of North Manly, legally described as Lot 75 in Deposited plan (DP) 12578 and falls under the jurisdiction of Northern Beaches Council (NBC).

1.1 Site Description

The development site is located in the suburb of North Manly, legally described as Lot 75 in Deposited plan (DP) 12578 and falls under the jurisdiction of Northern Beaches Council (NBC).

The site has a gradual slope from north-east to south-west, with a maximum RL of 2.33 AHD and a minimum RL of 1.90 AHD.

The development site is surrounded by Riverview Parade on the east, Manly Creek to the west and R2 Low Density Residential Zone on north and south, as shown in Figure 1 below.

The site has a gradual slope from north-east to south-west, with a maximum RL of 2.33 AHD and a minimum RL of 1.90 AHD. At present there is a single-story house on the property with a finished floor level of RL 2.73 AHD.

1.2 Proposed Development

At present there is a single-story house on the property with a finished floor level of RL 2.73 AHD.

The proposal is the demolition of the existing building and garage, and construction of a new **two-storey single dwelling** with an open car park on lower ground and an in-ground swimming pool at the rear of the dwelling. The new dwelling is proposed to be constructed on a suspended slab on piers above the 1% AEP flood level, to allow flood water entry, storage and exit during the flooding events.

See **Appendix A** for the proposed development plan along with elevation and sections.

We can confirm that we have reviewed the survey and existing plans and new development plan to prepare the flood modeling for pre and post development condition using HEC-RAS 2D.

The development site is surrounded by Riverview Parade on the east, Manly Creek to the west and R2 Low Density Residential Zone on north and south, as shown in Figure 1 below.



Figure 1 : Aerial Map of 40 Riverview Parade, North Manly,
(Source- Northern Beaches Mapping).

2 Report

The development site lies on flood prone land and is impacted by Medium- High Risk Flood Precinct as identified on the Northern Beaches Council Map. So, this report has been prepared in accordance with **Manly DCP (2013)- 5.4.3 Flood Prone Land** and **Warringah DCP (2011)- E11 Flood Prone Land**.

The main purposes of this Flood Study are to: -

1. Establish a 1% AEP flood level (also provided by NBC) at the site using HEC-RAS 2D modeling to establish the minimum Flood Planning Level (FPL) for new development.
2. Demonstrate that there will be no net loss of flood storage or adverse impacts in events up to 1% AEP as a result of new development.

This flood report is required as part of documentation for submission for Complying Development Certificate Application.

The resources used for the preparation of this report are:

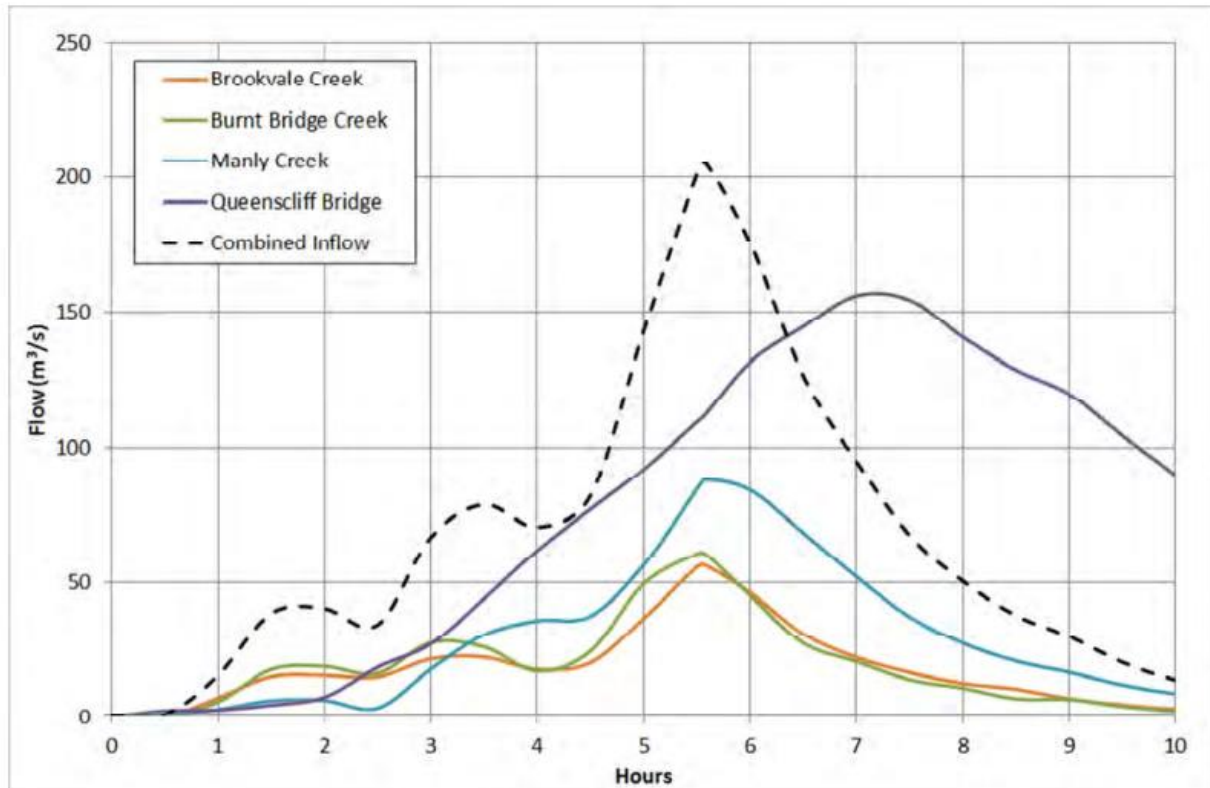
1. Architectural Plan provided by Rapid Plans (Project No.- RP0122DOW, 40 Riverview Parade North Manly, Dated 05/02/2024) **Ref. Appendix A.**
2. Flood Information Report provided by NBC dated 30/10/2023. **Ref. Appendix B.**
3. Manly Lagoon Flood Study 2013 (R.N2069.005.03), BMT WBM dated 23/08/2013. **Ref. Appendix C.**
4. Google Maps.
5. Northern Beaches Council Map.
6. **HEC-RAS 2D Software.**

As per the information provided by NBC, development site has following flood characteristics:

- Flood Risk Precincts: Medium-High
- 1% AEP Flood Level: 3.16m AHD
- Flood Planning Level (FPL): 3.66m AHD.
- 1% AEP Hydraulic Category: Flood Storage
- Probable Maximum Flood (PMF) Level: 5.66m AHD.
- PMF Life Hazard Category: H5

The development site on 40 Riverview Parade is mainly affected by overflow from Manly Creek at the rear of boundary. Further upstream Manly Creek is influenced by Brookvale Creek. The 1% AEP 9-hour duration hydrographs for contributing tributaries were retrieved from **Figure 7-5 Sub-catchment Contributions to Manly Lagoon (1%AEP Event)** on page 86 of **Manly Lagoon Flood Study 2013, BMT WBM** as shown in Figure 2 below.

The flow hydrograph information for Manly Creek and Brookvale Creek are only taken in consideration.



**Figure 2 :Fig 7-5 Sub-catchment Contribution to Manly Lagoon (1% AEP Event),
(Source- Manly Lagoon Flood Study 2013).**

2.1 HEC-RAS MODEL

HEC-RAS 2D was used to model the pre and post development condition of the site to calculate the flood level due to the 1% AEP storm event at the site. The model was created and analysed using the flood information provided by NBC and flow information retrieved from Manly Lagoon Flood Study 2013.

The above-mentioned flows are introduced upstream of the property of interest and flood modelling was performed.

Pre-Development Site Modeling

The site area bounded by Riverview Parade on the east, Manly Creek on the west, 2 storey neighboring building at the north and similar type neighboring building to the south was modeled in the software. Two separate flow hydrographs for each Manly Creek and Brookvale Creek was introduced as upstream flow and normal depth flow was considered as downstream as shown on Figure 3. Mannings coefficient used: Road:0.02, Other areas: 0.06.



Figure 3 : HEC-RAS 2D Pre-Development Site Model

Pre-development HEC RAS model was run to get following results:

- The maximum predevelopment 1% AEP flood depth at the property is 1.16 m.

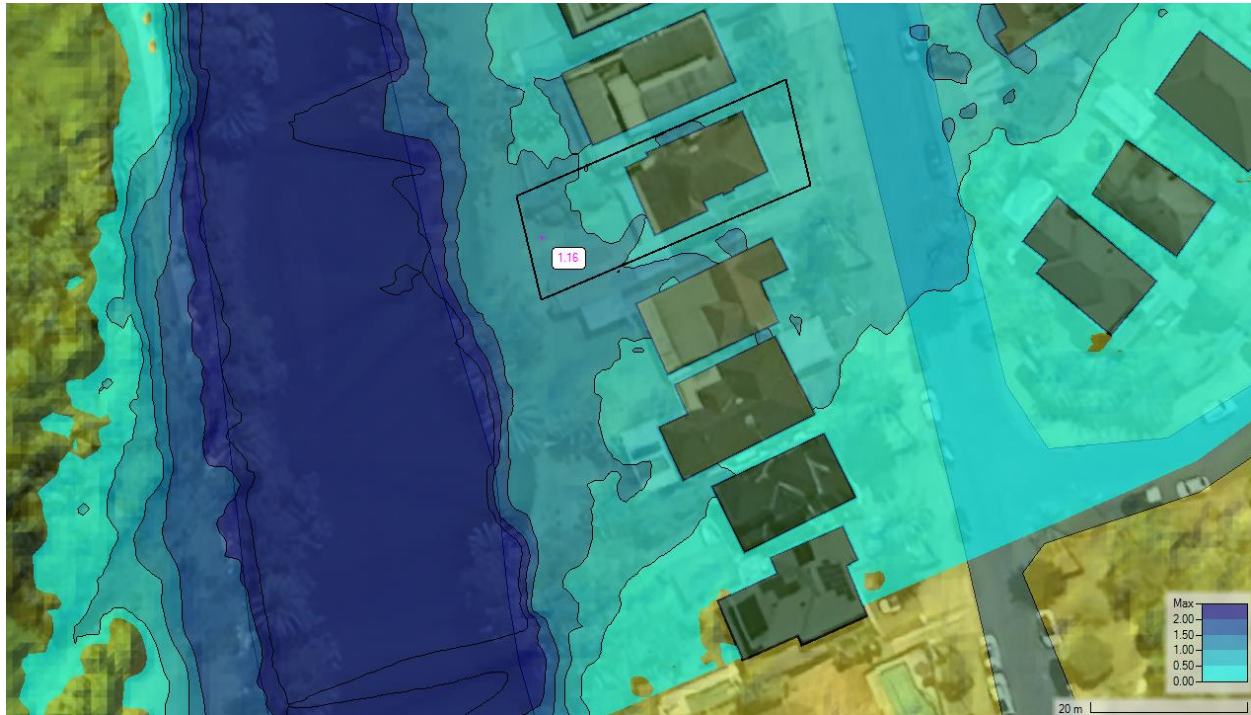


Figure 4 : Pre-Development Flood Depth

- The maximum predevelopment 1% AEP Water Surface Elevation at the property is 3.16m AHD.



Figure 5 : Pre-Development Water Surface Elevation

Predevelopment results were compared with information provided by council to confirm the accuracy of flood modelling. The maximum predevelopment 1% AEP Water Surface Elevation at the rear boundary of property is 3.16m AHD which is same as flood level provided at **Location 18** by NBC (Ref. Appendix B). Similar values were observed at other locations which is tabulated in Table 1.

Location	100-year ARI from NBC (m AHD)	100-year ARI observed by PCE (m AHD)	Difference
1	3.16	3.16	No
2	3.16	3.16	No
3	3.16	3.16	No
4	3.16	3.16	No
5	3.16	3.16	No
6	3.16	3.16	No
7	3.16	3.16	No
8	3.6	3.6	No
9	3.16	3.16	No
10	3.16	3.16	No
11	3.16	3.16	No
12	3.16	3.16	No
13	3.16	3.16	No
14	3.16	3.16	No
15	3.16	3.16	No
16	3.16	3.16	No
17	3.16	3.16	No
18	3.16	3.16	No

Figure 6 : Table for results comparison for provided location.

After comparing HEC-RAS 2D results with flood level data table provided by NBC, we have concluded that our model is accurate enough for further analysis of post development effect.

Post-Development Site Modeling.

The new proposed development area was introduced in the model with the same parameters used for modeling the predevelopment condition and the post development flood depth and flood water surface elevation was calculated.

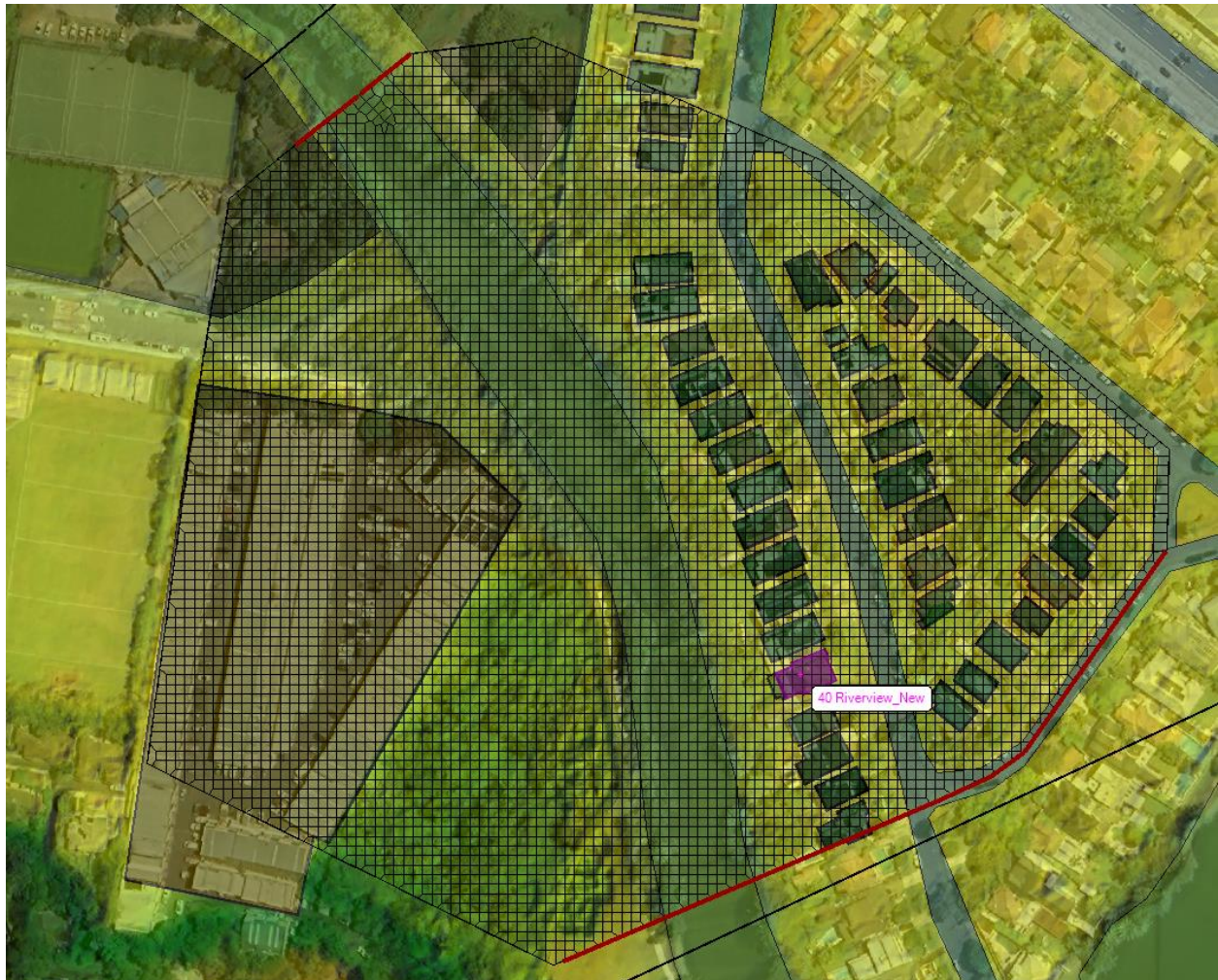


Figure 7 : HEC-RAS 2D Post Development Site Model

Post-development HEC RAS model was run to get following results:

- The maximum post development 1% AEP flood depth at the property is 1.16m.

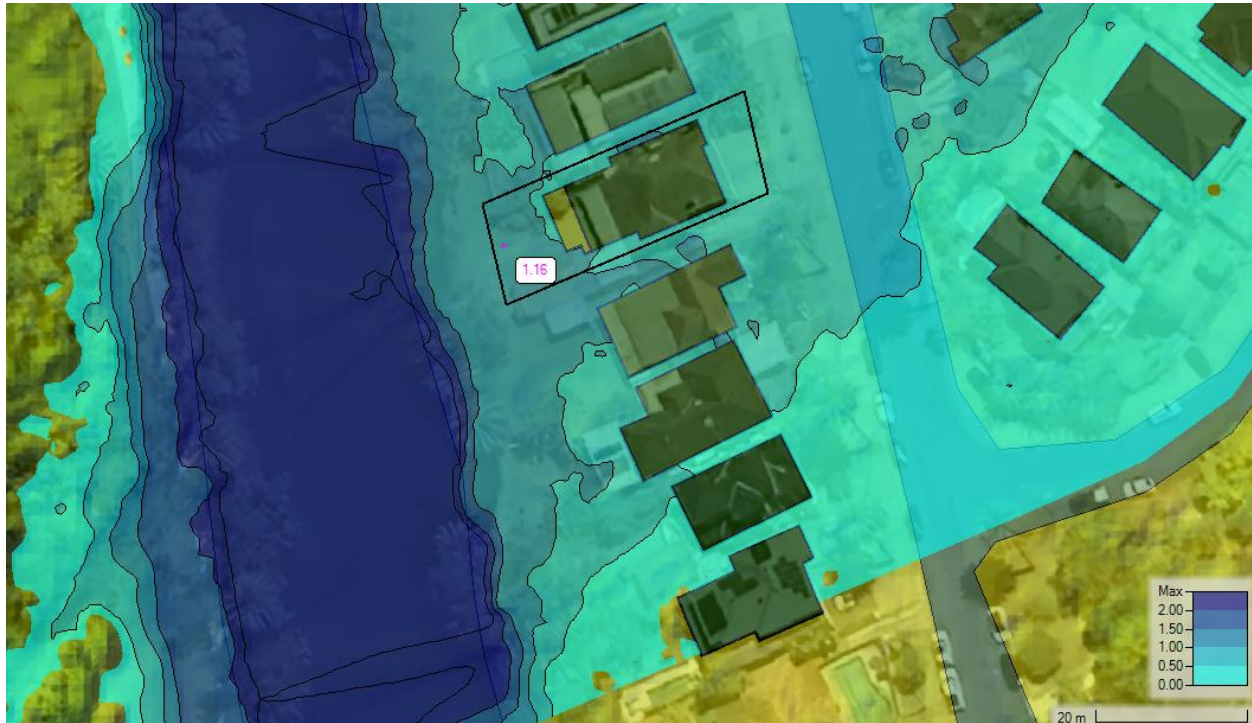


Figure 8 : Post Development Flood Depth (d)

- The maximum Post development 1% AEP Water Surface Elevation at the property is 3.16 mAHd.



Figure 9 : Post Development Water Surface Elevation

The effect of new construction on flood level at the property is tabulated in Table 2.

Location	Predev_100-year ARI WSE observed by PCE (m AHD)	Postdev_100-year ARI WSE observed by PCE (m AHD)	Difference
1	3.16	3.16	No
2	3.16	3.16	No
3	3.16	3.16	No
4	3.16	3.16	No
5	3.16	3.16	No
6	3.16	3.16	No
7	3.16	3.16	No
8	3.6	3.6	No
9	3.16	3.16	No
10	3.16	3.16	No
11	3.16	3.16	No
12	3.16	3.16	No
13	3.16	3.16	No
14	3.16	3.16	No
15	3.16	3.16	No
16	3.16	3.16	No
17	3.16	3.16	No
18	3.16	3.16	No

Figure 10 : Table 2 Comparison of Pre-Development & Post-Development Water Surface Elevation



Figure 11 : Graphical comparison of WSE_Postdev-Predev from HEC RAS 2d model.

It is observed that there is a 2mm increase in water surface level because of the newly proposed development on the boundary and around neighboring properties which is considered negligible.

2.2 Results

To address the guidelines to be satisfied for new developments, the finished floor levels is calculated by adding freeboard to the 1% AEP flood level in accordance with Northern Beaches Council's DCP. Freeboard of a minimum 500mm above 1% AEP flood level for habitable floor levels and a minimum of 300 mm freeboard above 1% AEP flood level for non-habitable floor levels was applied in accordance with Manly and Warringah DCPs.

2.3 Flood Planning Level

HEC-RAS 2D analysis has revealed that maximum water surface elevation throughout the property 3.16 mAHD which is in line with the maximum flood level provided by NBC for 1% AEP flood event. The results of the assessment are tabulated below.

AREA	Min. Flood Planning Level (m AHD)
Habitable	3.66
Non-Habitable	3.46

The proposed development as noted on proposed architectural plan has adopted a finished floor level of RL 3.7 m AHD for main residence and 3.63 m AHD for deck which are above min. FPL for respective habitable and non- habitable area which complies with flood planning level.

The proposed architectural plan has adopted an open car park designed at 2.35 m AHD. The carport has been proposed to be of open design, with at least 2 sides completely open such flow is not obstructed up to 1% AEP flood level (3.16 mAHD). The lowest floor level of the open carport shall be constructed no lower than the natural ground level. The current proposed FFL 2.35 m AHD for carport is more than 300mm depth below 1% AEP level, vehicle barriers or restrains are to be provided to prevent floating vehicle leaving the property. This can be achieved by having grill perforated door on front end of garage and having similar perforated grill or battens wall void open up to 1% AEP flood level on northern or southern wall.

Inground Swimming pool in the rear of the boundary can be located within 1% AEP flood extent, with coping flush with natural ground level.

2.4 Flood Storage

From HEC RAS analysis it is observed that there are no adverse impacts on surrounding properties as there was none to negligible (2mm) increase in 1% AEP flood level. So based on this Flood Study, PCE can suggest that there is no net loss on flood storage in an event up to 1% AEP event.

The council DCP requires the proposed development to be compliant to control C3 of WDCP (2011). So, to comply with C3: -

- Underfloor area of proposed development below 1% AEP flood level is to be designed and constructed to allow clear passage of floodwaters, and
- At least 50% of the perimeter of underfloor area is of an open design from natural ground level (NGL) up to the 1% AEP flood level, and
- No solid area of the perimeter of underfloor area is permitted in a floodway.

To achieve all the above clauses, new developments have been proposed to be constructed on a suspended slab on piers above 1% AEP flood level to allow flood water to enter, store and exist freely during flood events.

For any Carpark option, if driveway is required to be raised it must be demonstrated that there is no net loss to available flood storage to event up to 1 % AEP flood event and no impact on flood conveyance through the site.

3 Conclusions

This report demonstrates the effects of new developments on 40 Riverview Parade, North Manly. In reference to WDCP (2011) A1, A2, B1, B2, B3, C1, C3, D2, D3, D4, D5, D6, E1, F1, G1, H1 controls are applicable to development on 40 Riverview Parade, North Manly.

Controls	Compliance	Description
A1	Yes	Addressed in Cl. 3.1
A2	Yes	Addressed in Cl. 3.2
B1	Not part of this report.	Structural Engineer to Confirm During CC Stage, recommendation of flood compatible material has been made as part of this submission
B2	Not part of this report.	Structural Engineer to Confirm During CC Stage, recommendation of flood compatible material has been made as part of this submission
C1	Yes	Addressed in Cl. 3.1
C3	Yes	Addressed in Cl. 2.4
D2	Yes	Addressed in Cl 2.3
D3	Yes	Addressed in Cl 2.3
D4	Yes	Addressed in Cl 2.3
D5	N/A	N/A
D6	N/A	N/A
E1	Yes	Separate Flood Risk/Emergency Management Plan has been provided.
F1	Yes	Reflected in architectural Plan
G1	Yes	Provided
H1	Yes	Addressed in 2.3 and architectural plan

Your Sincerely,

Bijaya Giri

BEng, MEng, MIEAust, CPEng, NER



APPENDIX A – Architectural Plan



APPENDIX B – Flood Information Report provided by NBC dated 30/10/2023



APPENDIX C – Manly Lagoon Flood Study 2013 (R.N2069.005.03)

<https://files-preprod-d9.northernbeaches.nsw.gov.au/nbc-prod-files/manly-lagoon-flood-study-2013.pdf>



APPENDIX D – HEC RAS 2d STUDY MODEL

The Model File is attached with this report.



APPENDIX E – FLOOD EMERGENCY ASSESSMENT REPORT