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No.13 Quinlan Parade, Manly Vale

Our Ref: E190177

FLOOD STUDY REPORT

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21st January 2020

ISSUE C – For DA Submission

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INTRODUCTION

NY Civil Engineering have been engaged to prepare this Flood Study Report to accompany the Development Application submission for proposed additions at No.13 Quinlan Parade, Manly Vale. Northern Beaches Council have identified in their Engineering Referral Response that the site is affected by overland flow flooding.

The following documentation has been used in the preparation of this Flood Study Report;

- Architectural Plans by Action Plans plan dated October 2019
- Warringah Stormwater Management Policy and Council's Development Control Plan.
- Northern Beaches Council DCP Clause E11 Flood Prone Land
- Northern Beaches Council Flood Prone Land Design Standard
- NSW Floodplain Development Manual

SITE INFORMATION

The proposed development is located within a local depression which runs Northeast from Links Street (upstream) towards Manly Creek (downstream). It has been noted that the site is next to an existing Reinforced Concrete Pipe (RCP) contained within an easement to drain water running through 11 Quinlan Parade. The existing development on the site consists of a single storey dwelling with a free-standing open carport. The general nature of the surrounding development is primarily residential. See Figure 1.

Figure 1: Subject Site – 13 Quinlan Parade, Manly Vale

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PROPOSED DEVELOPMENT

The proposal consists of additions and alterations to the existing single storey dwelling, being an extended alfresco, additional storey and extension of cabin with an inground pool. The proposed alterations & additions are proposed to be constructed at the same level as the existing building.

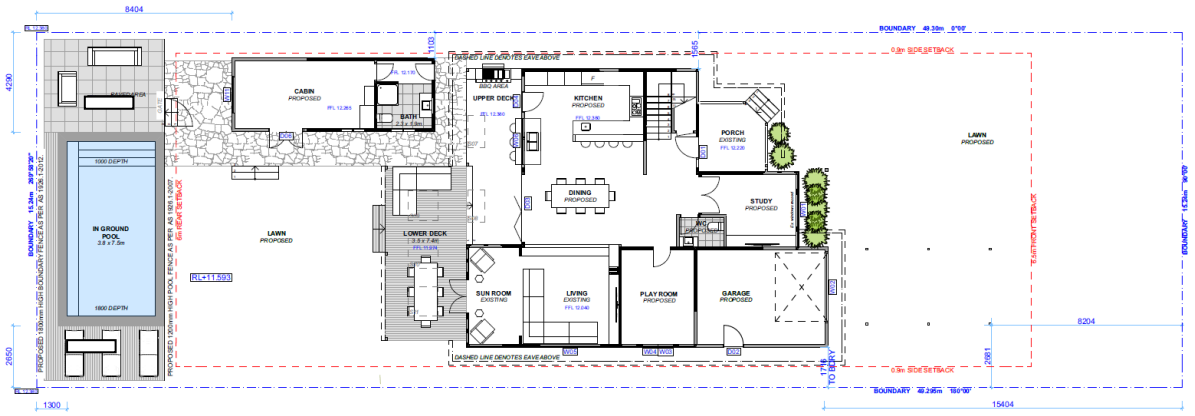

Figure 2: Site Plan

Figure 2 depicts the site plan and footprint of the proposed additions. It should be noted that the proposed footprint is similar to the existing with minor variances.

MODELLING

Th Northern Beaches Council have identified that the proposed development site may be subject to flood related development controls due to possible overland flooding. Council does not have any flood information and hence, NY Civil Engineering have undertaken modelling.

To assess the potential impact of overland flow on the subject site, a two-dimensional *HEC-RAS* model was developed and a two-dimensional analysis was undertaken by NY Civil Engineering, with blockages modelled to reflect the building footprint in both the pre-development and post-development scenarios.

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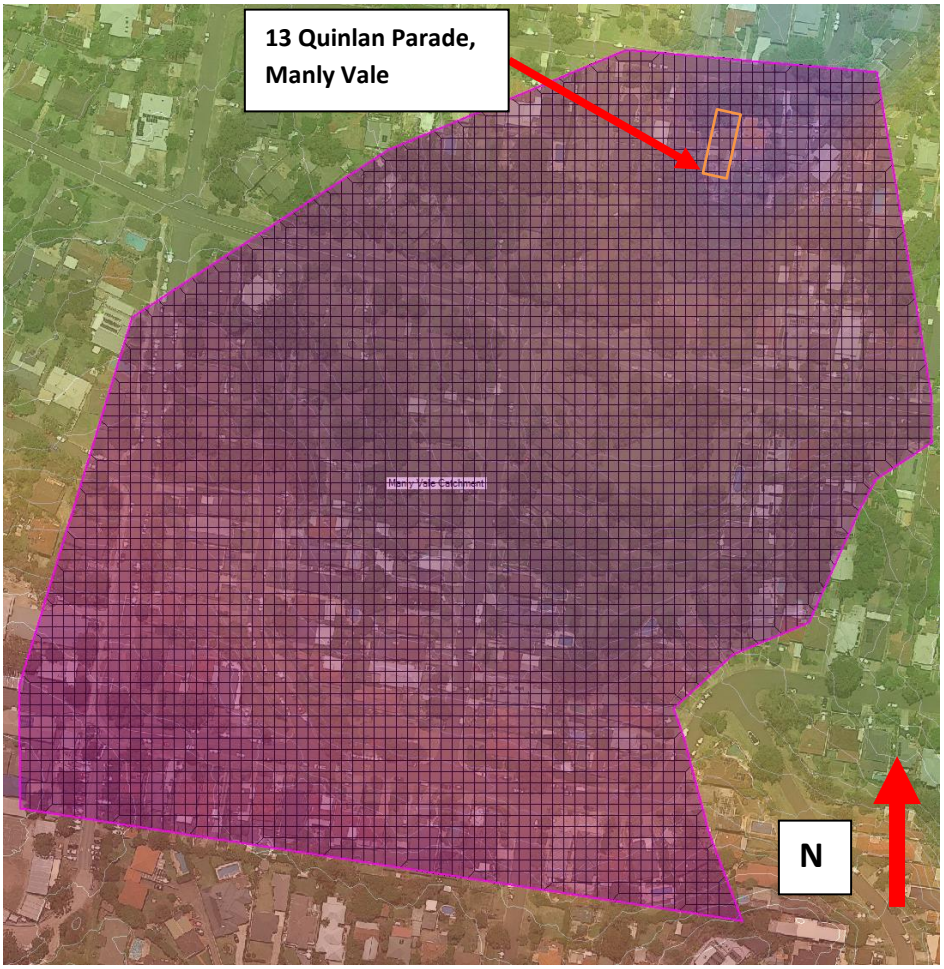

Figure 3: Catchment Area Map

Aerial Survey Data has been used to identify the catchment area potentially draining to the site. Figure 3 depicts the stormwater runoff traversing from the greater catchment in the direction of 13 Quinlan Parade, Manly Vale. The extent of overland flow has been modelled through '*HEC-RAS*' software as a 'rain on grid' model in order to assess the major flow path and catchment area contributing to overland flow. As such, the *HEC-RAS* model was run by NY Civil Engineering, with blockages modelled to reflect the building footprint in both the pre-development and post-development scenarios.

In general, the overland flow will enter the subject site from the rear and side boundaries traverse overland in a north-eastern direction. A Drainage Easement is contained within the neighbouring property which also facilitates overland flow.

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Figure 4: Post Development Scenario HEC-RAS Model

Figure 4 depicts the post-development scenario model prior to the simulation being run. The footprint of the proposal included in the model have been modelled as raised elevations/obstructions, preventing flows from traversing across the footprint.

It should be noted that the blockages will have rainfall on them (albeit negligible due to the rain on grid simulation) will show depth of water & velocities in figures 10 - 23.

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RESULTS

Figure 5 to Figure 23 depict the comparisons in the flow depth and velocity between the pre-development and post-development scenarios at different locations across the site.

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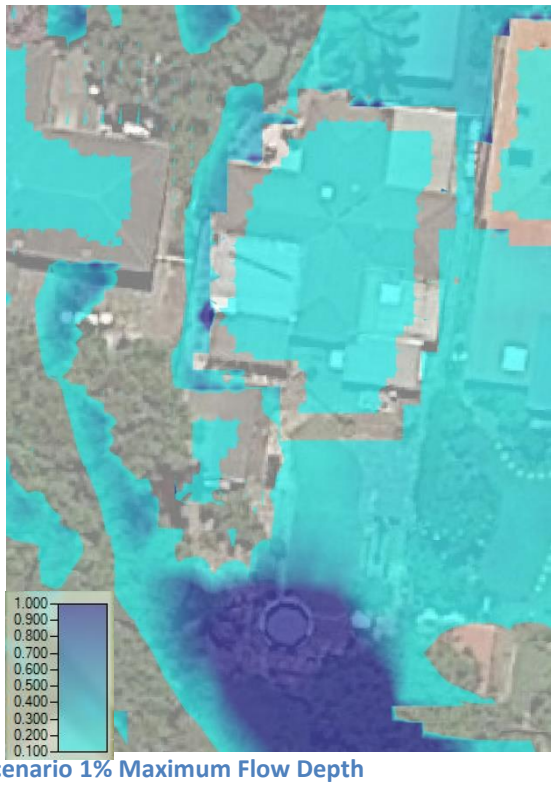

Figure 5: Pre Development Scenario 1% Maximum Flow Depth

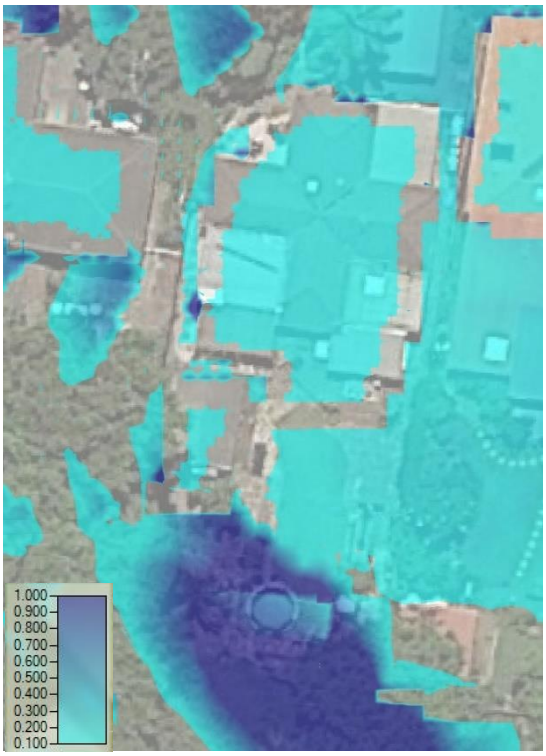

Figure 6: Post Development Scenario 1% Maximum Flow Depth

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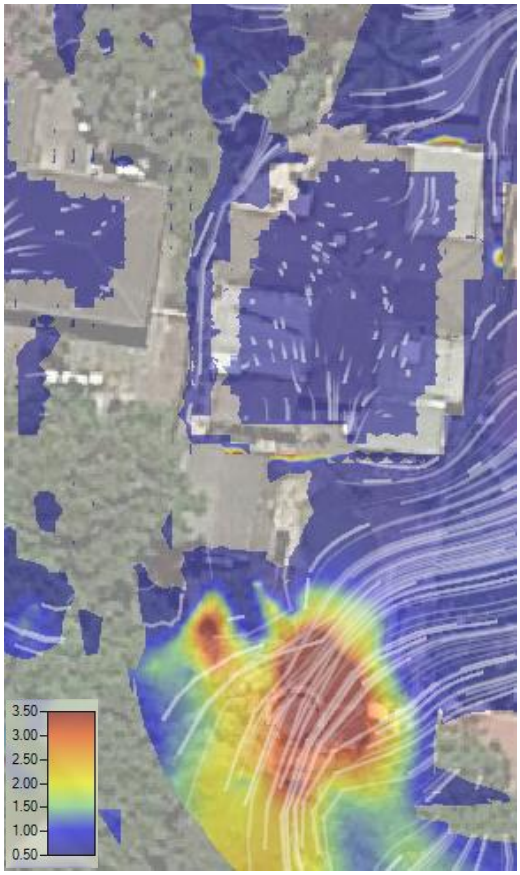

Figure 7: Pre Development Scenario 1% Maximum Water Velocity

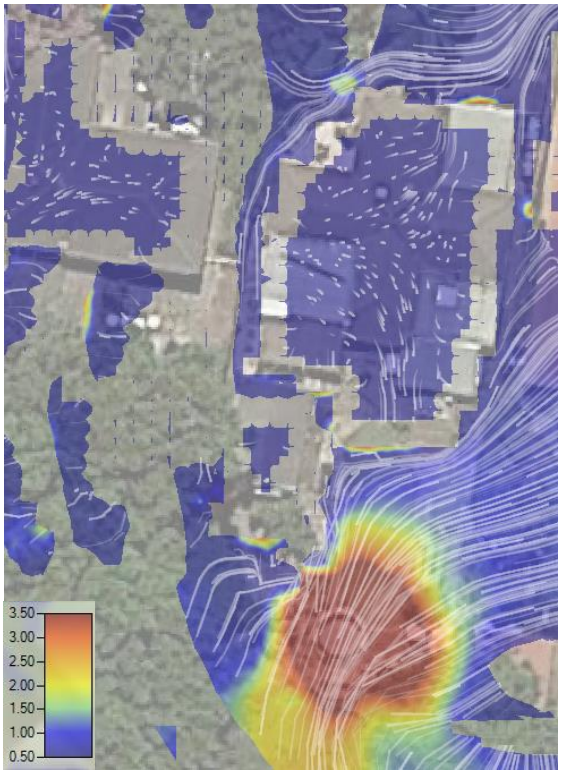

Figure 8: Post Development Scenario Maximum Water Velocity

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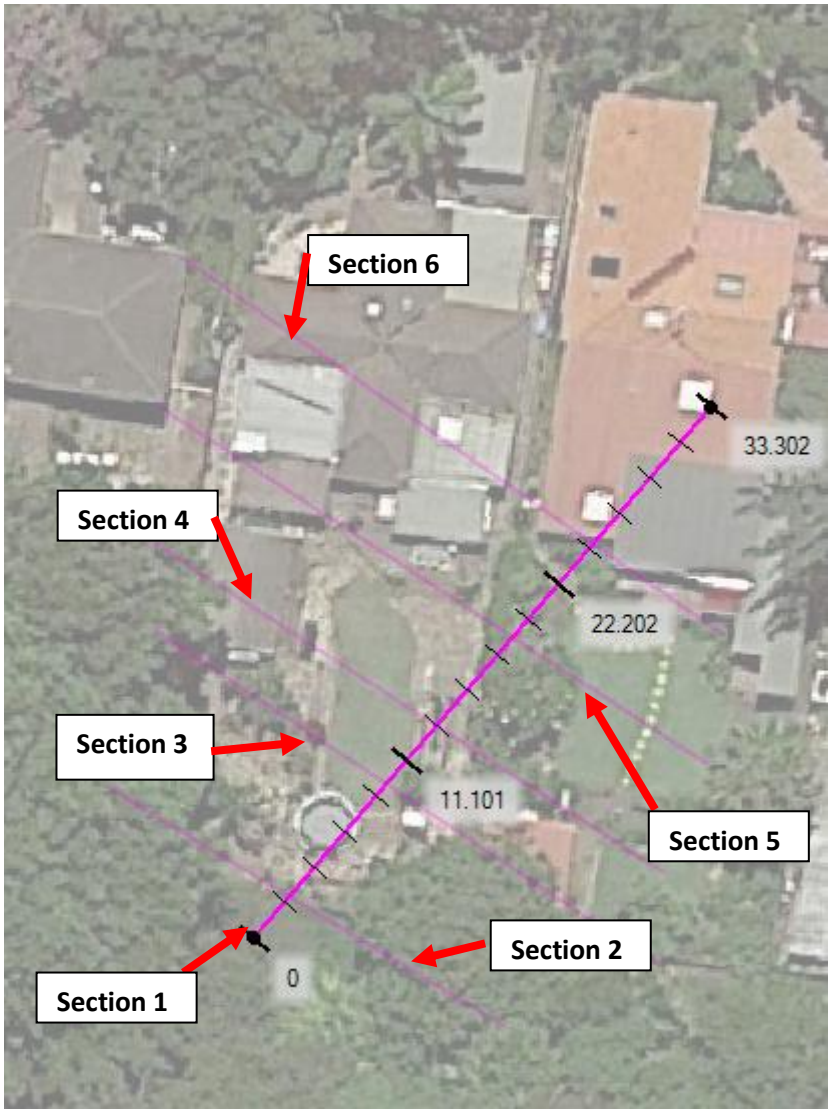

Figure 9: Development Water Profile Sections

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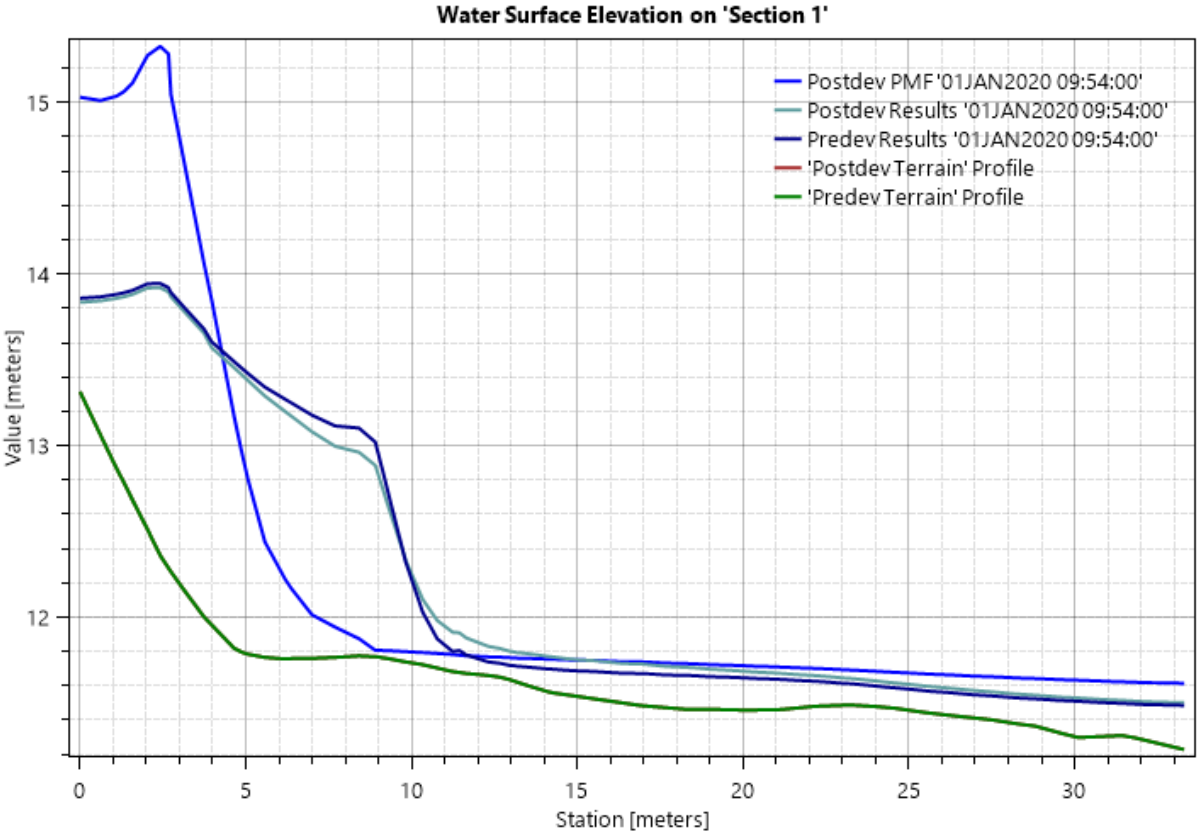

Figure 10: Pre & Post Development Section 1 Water Profile Comparison

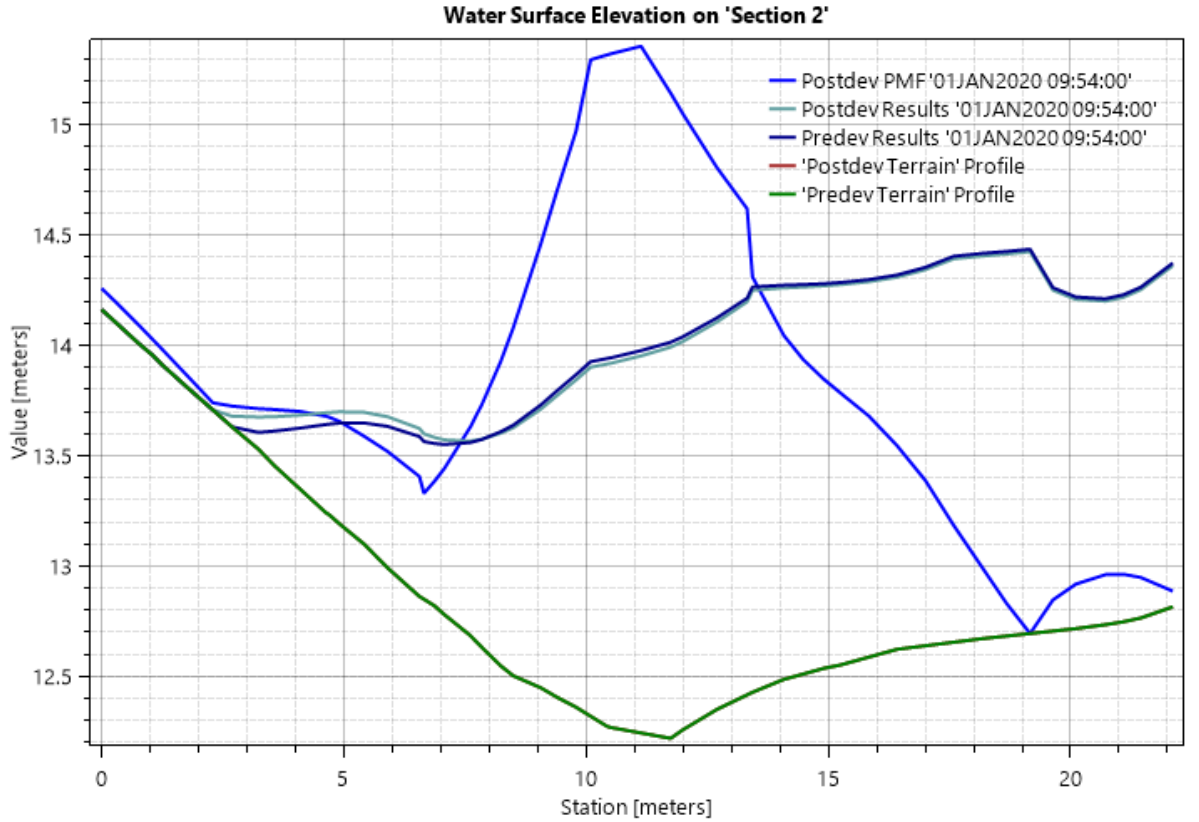

Figure 11: Pre & Post Development Section 2 Water Profile Comparison

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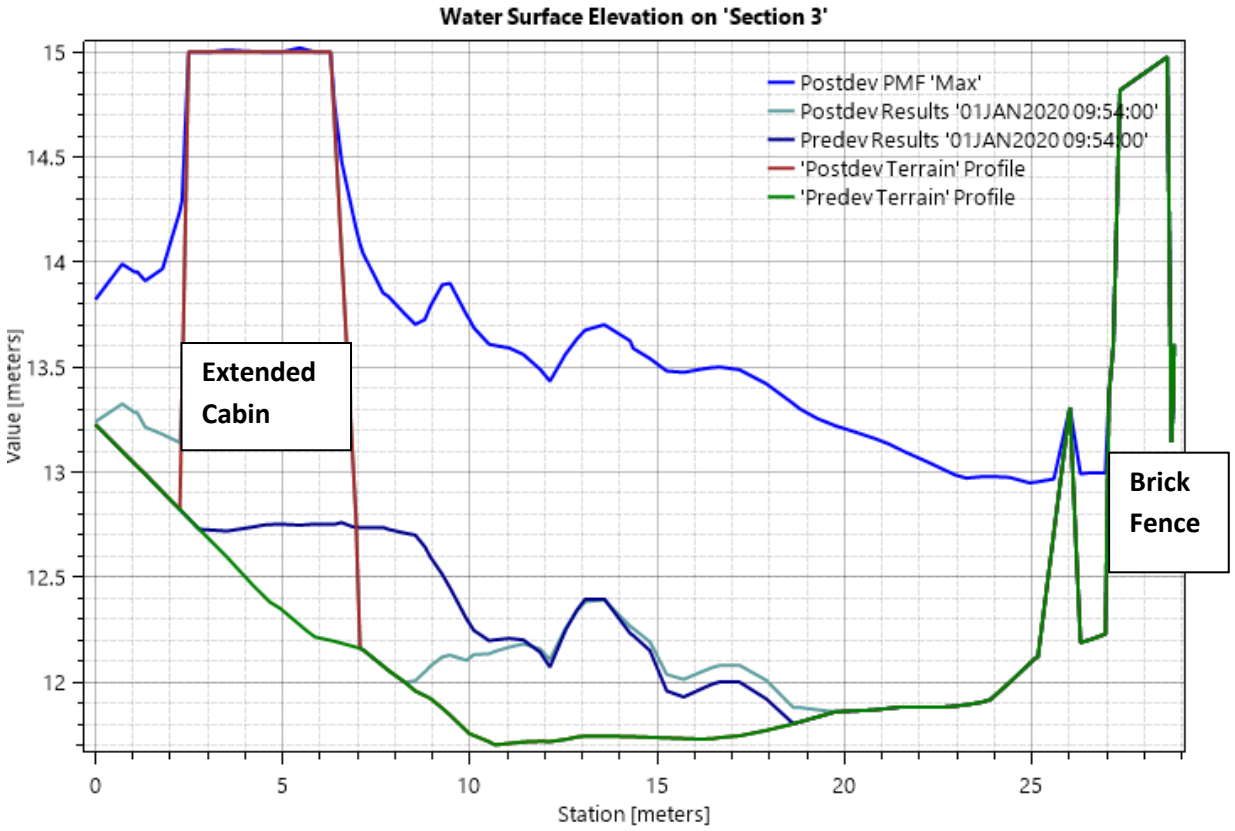

Figure 12: Pre & Post Development Section 3 Water Profile Comparison

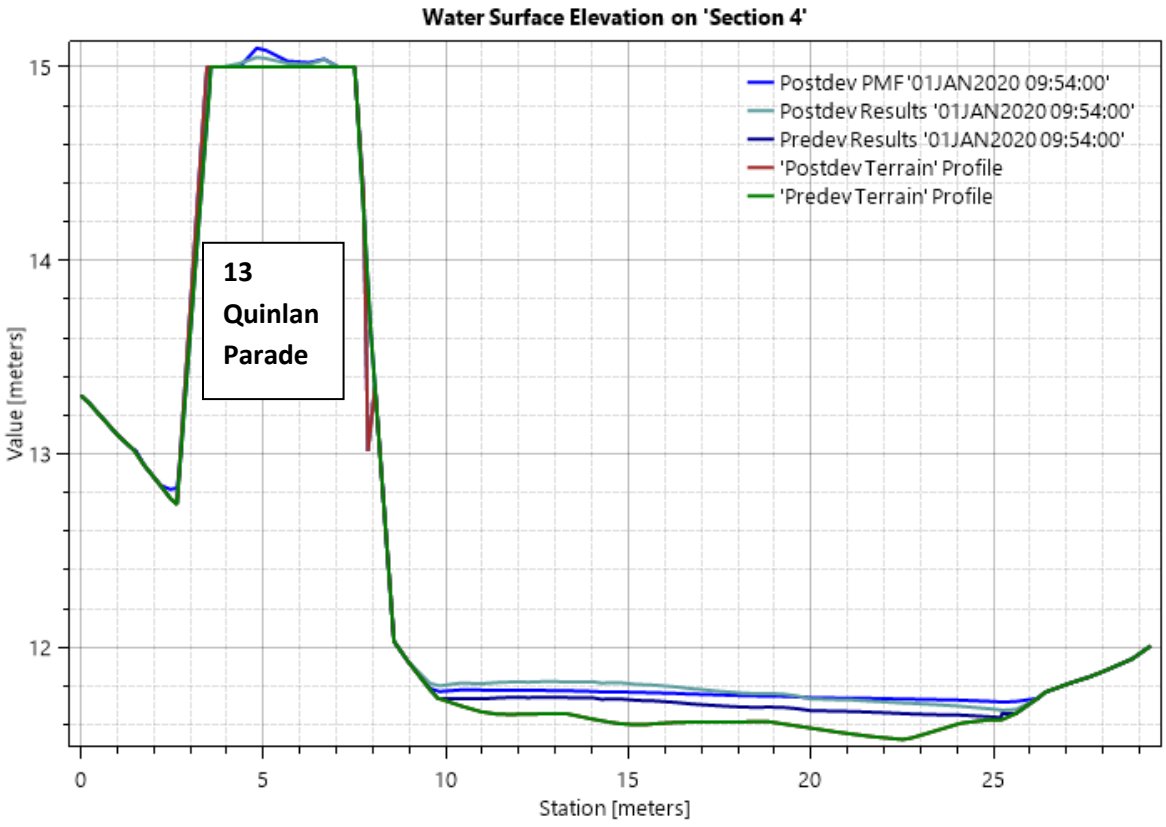

Figure 13: Pre & Post Development Section 4 Water Profile Comparison

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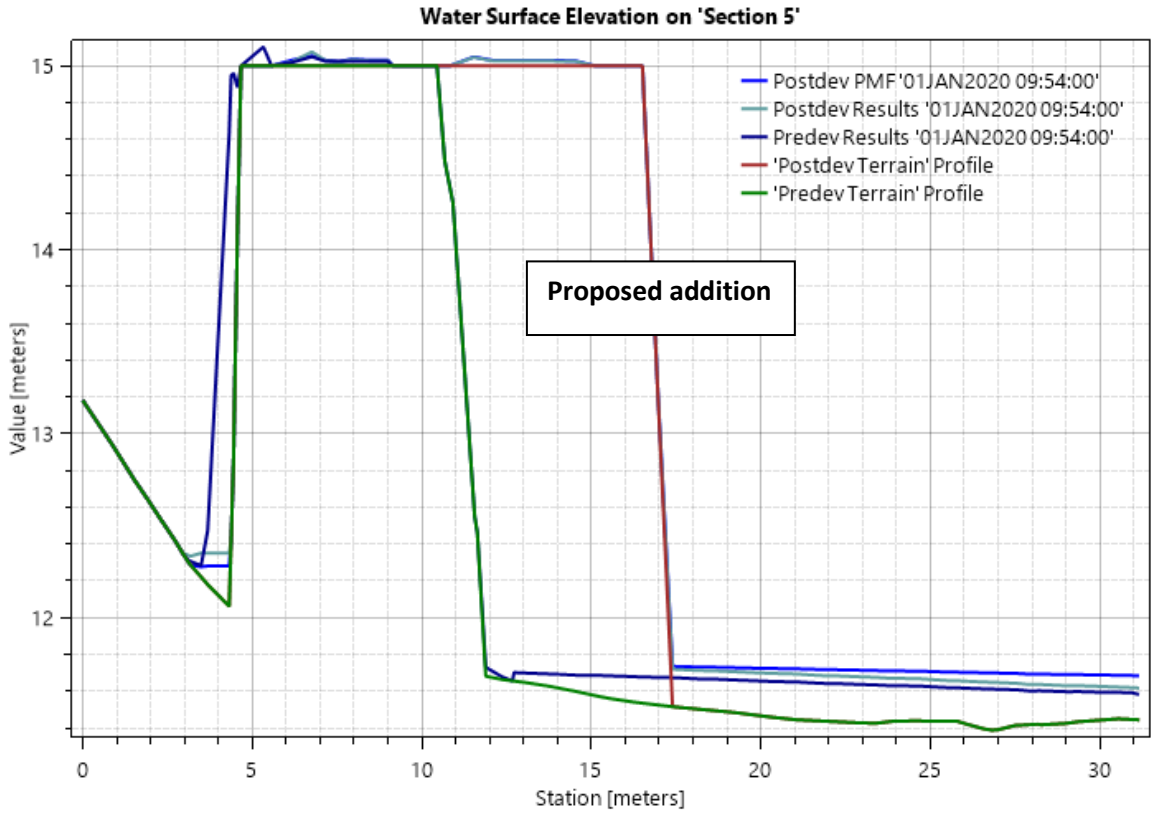

Figure 14: Pre & Post Development Section 5 Water Profile Comparison

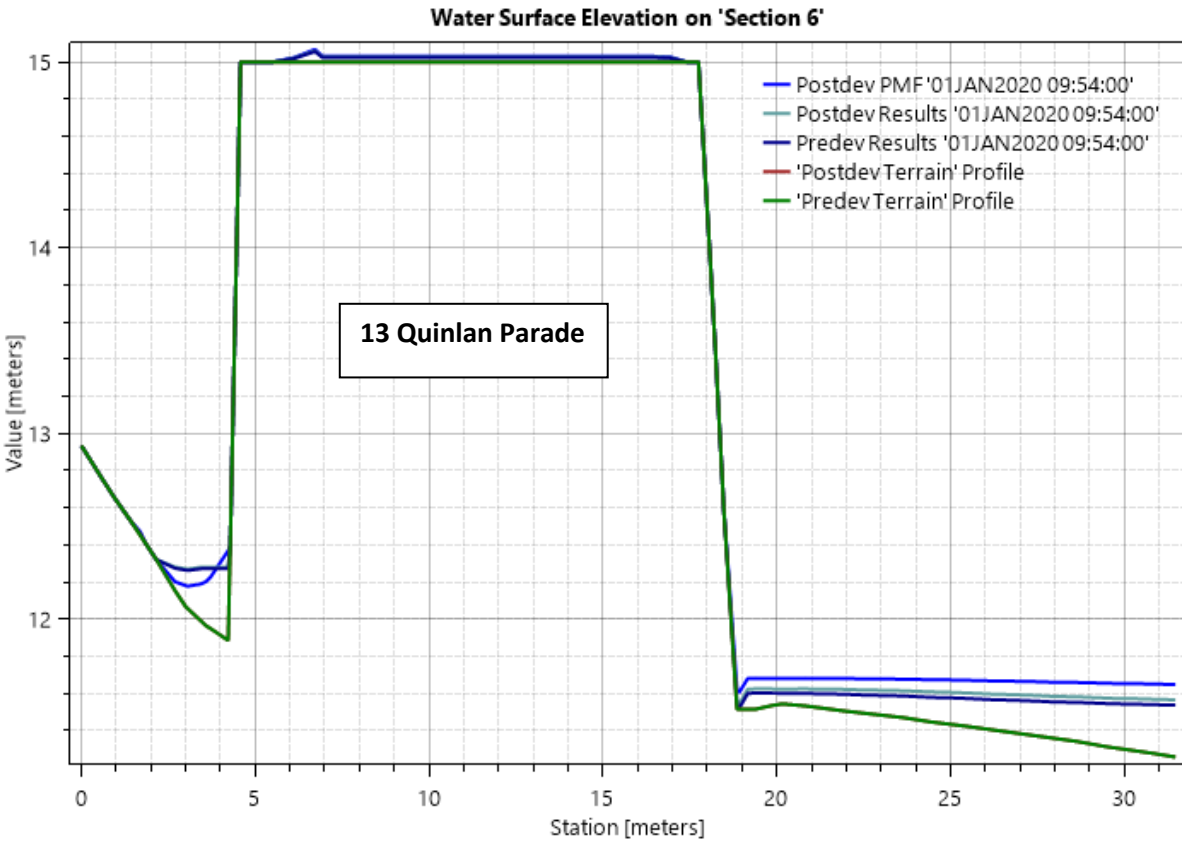

Figure 15: Pre & Post Development Section 6 Water Profile Comparison

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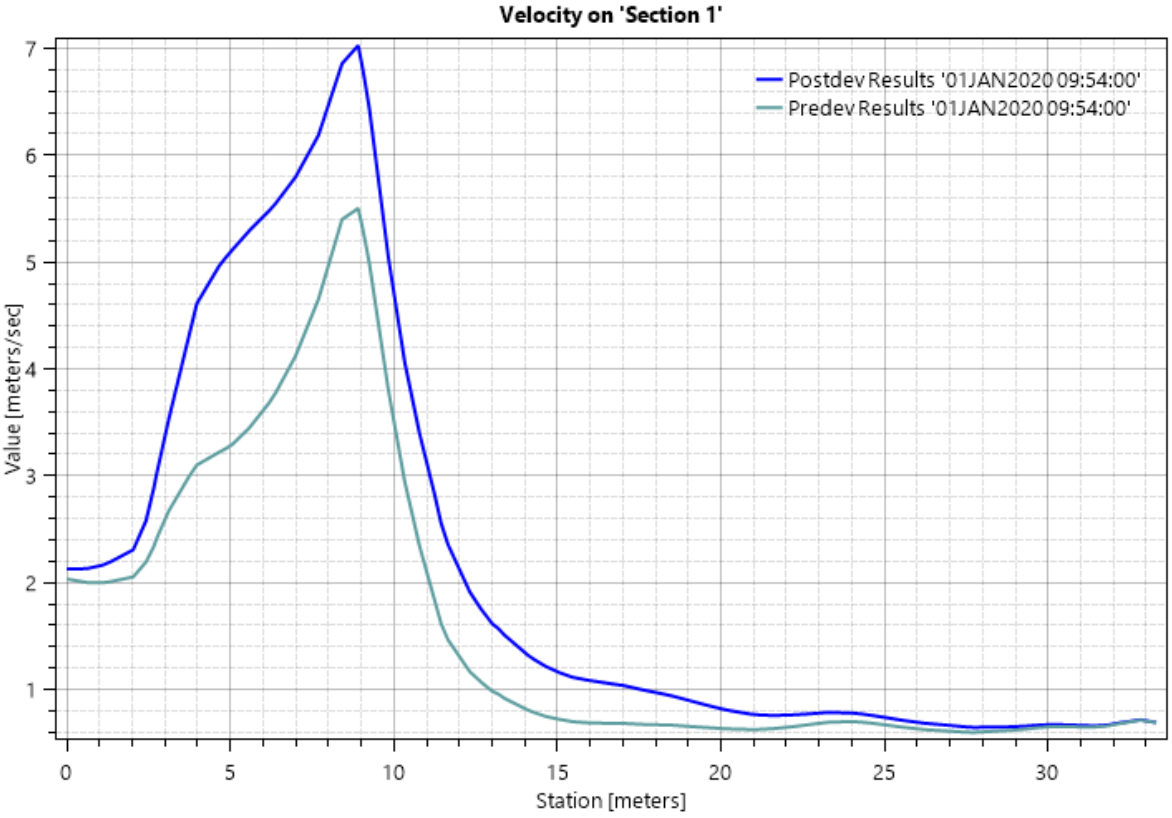

Figure 16: Pre & Post Development Section 1 Velocity Profile Comparison

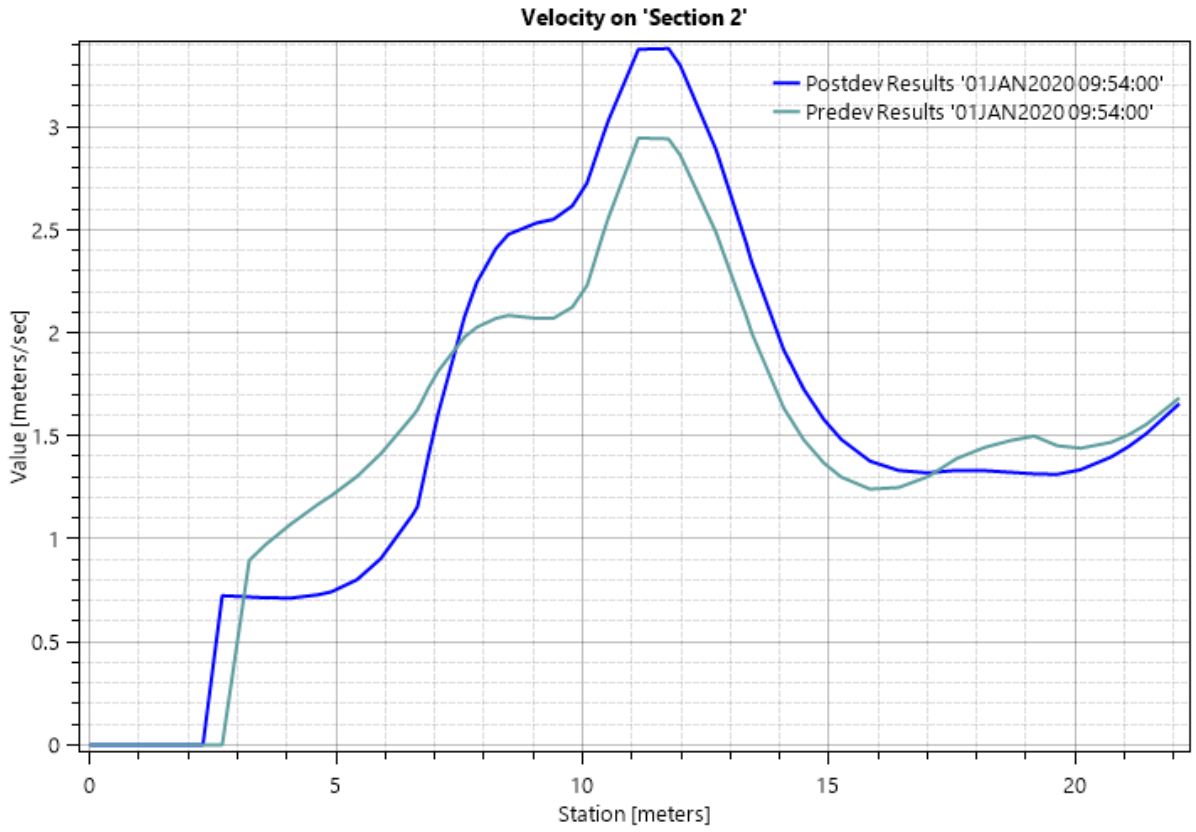

Figure 17: Pre & Post Development Section 2 Velocity Profile Comparison

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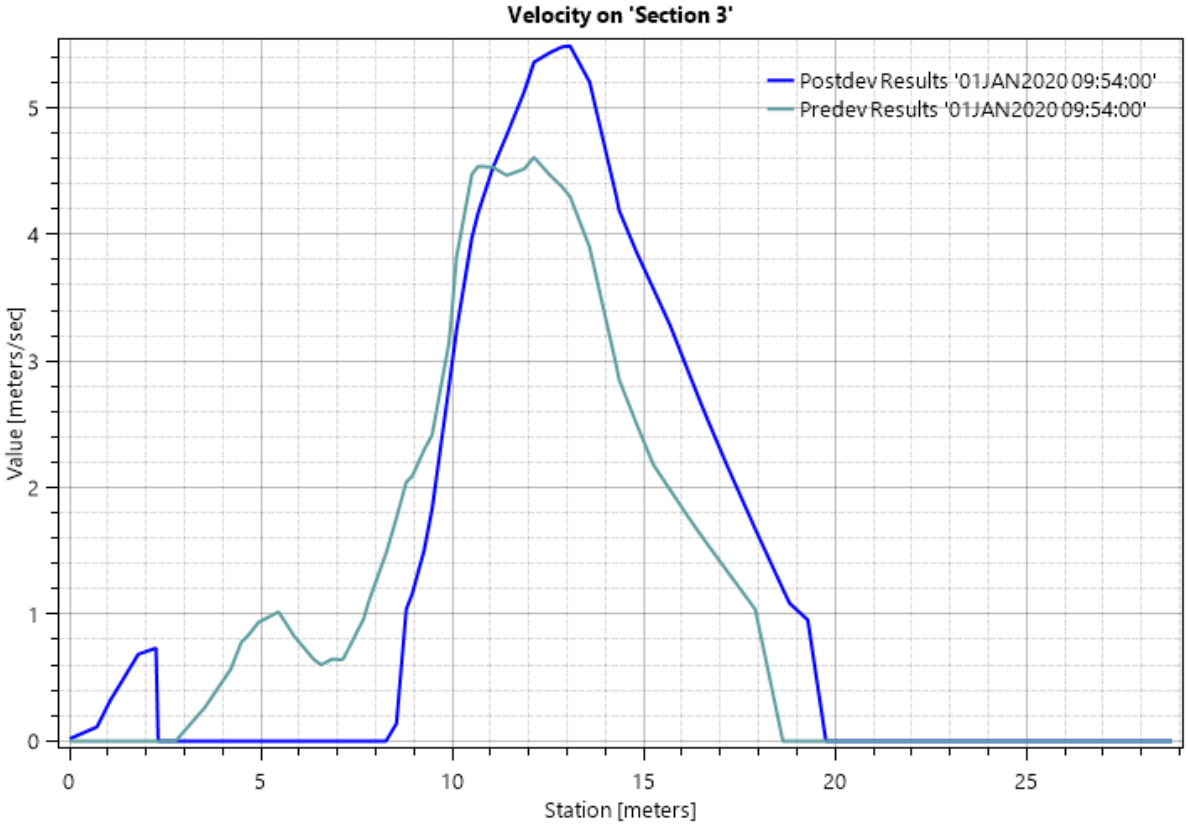

Figure 18: Pre & Post Development Section 3 Velocity Profile Comparison

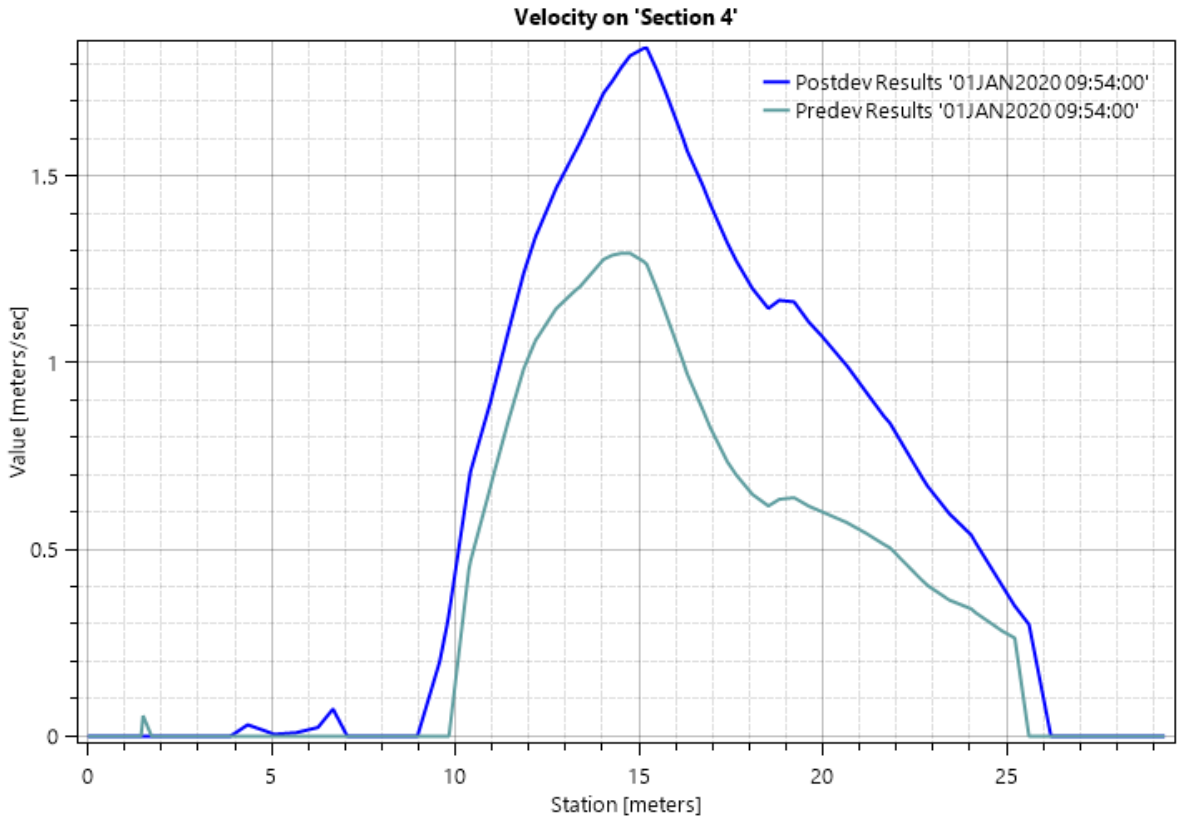

Figure 19: Pre & Post Development Section 5 Velocity Profile Comparison

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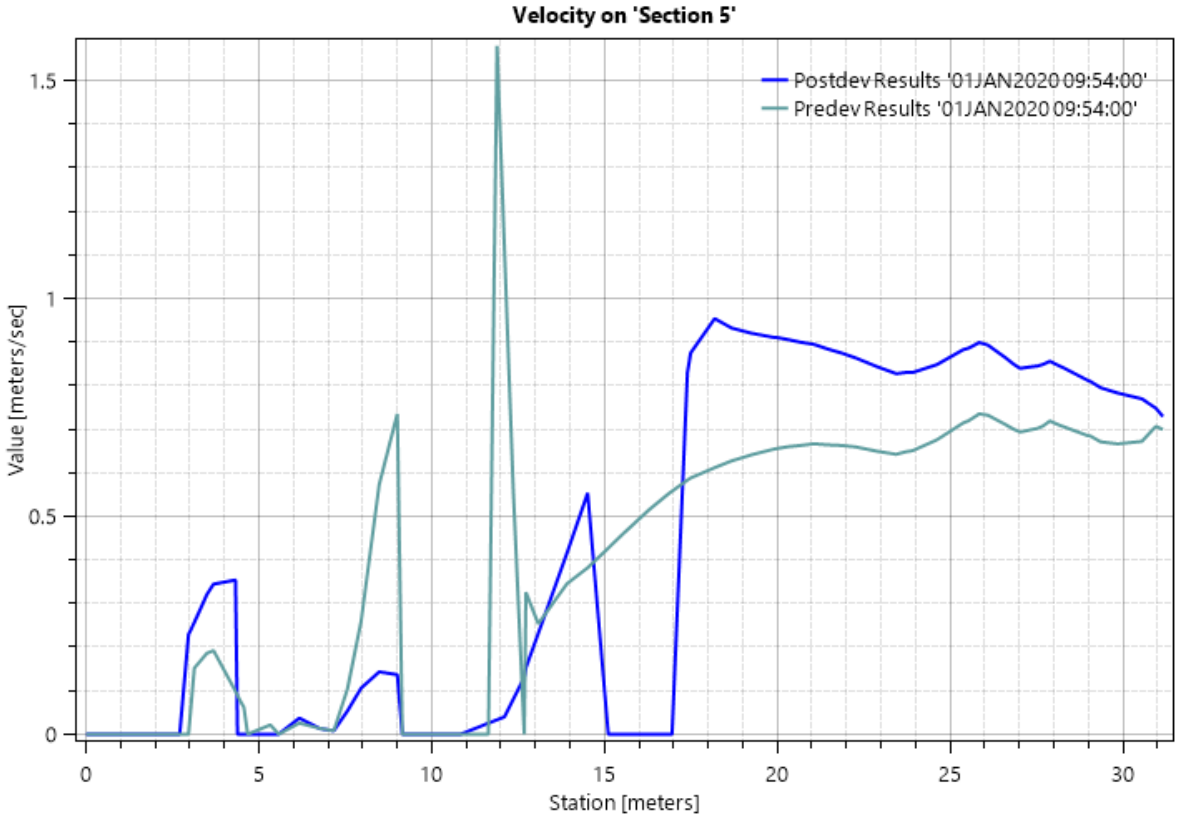

Figure 20: Pre & Post Development Section 5 Velocity Profile Comparison

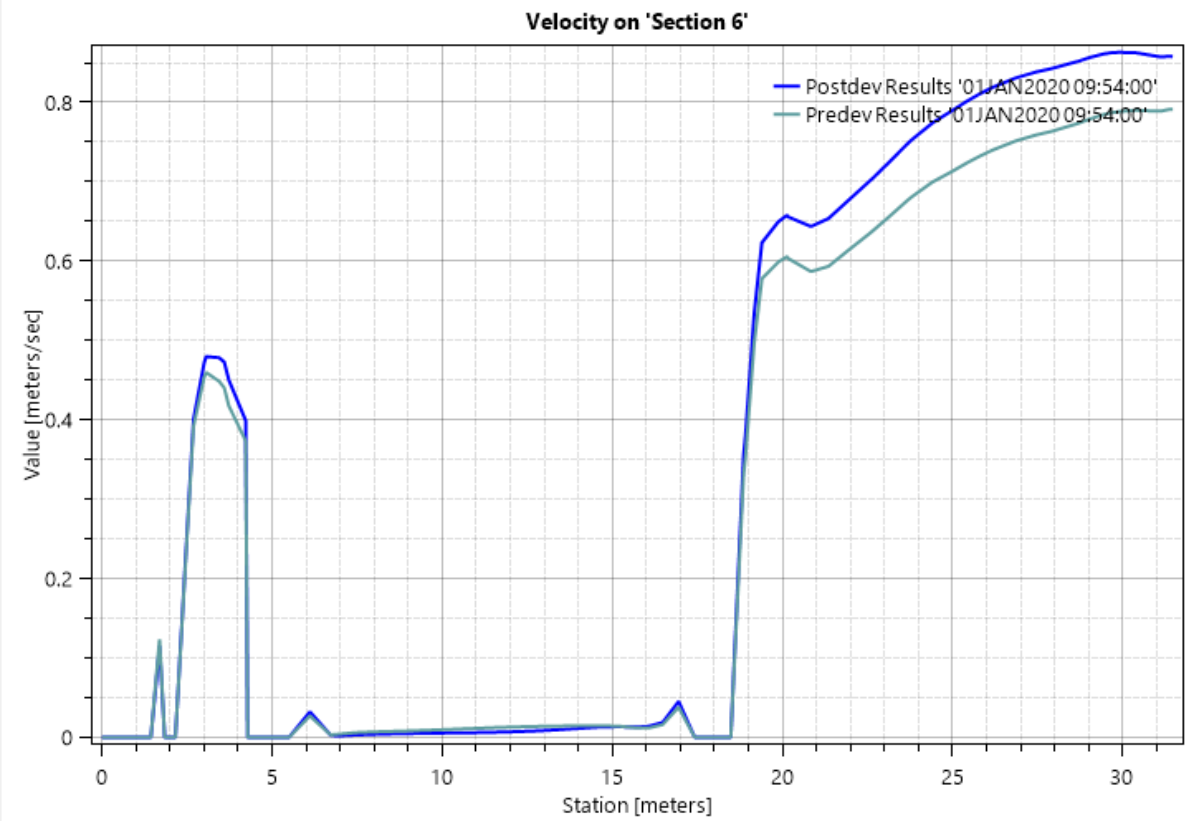

Figure 21: Pre & Post Development Section 6 Velocity Profile Comparison

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DISCUSSION

It should be noted that the two-dimensional HEC-RAS model developed by NY Civil Engineering and the results may differ from models conducted in the future. These differences may be the result of different assumptions of Manning's 'n' values, the accuracy of the digital terrain model (DTM) and a number of other factors. However, identical models have been used to assess the pre-development and post-development scenarios, with the only difference being the building footprint, in order to gauge the impact of the proposed development to adjoining properties.

Figures 5 and 6 depict the maximum water depth across the entire site. Figures 7 and 8 depict the maximum water velocity across the entire site. These figures indicate that pre-development and post development scenario flood regimes have not varied significantly. This indicates that the proposed development has no adverse impact on the behaviour of flows traversing through the site. This is due to the proposed development largely maintaining the existing footprint.

Figures 10 to 17 are sections through the model taken parallel and perpendicular to the overland flow path representing water surface elevations. These sections indicate slight variance in results between the pre-development and post-development scenario. This again is due to the proposed development maintaining the existing footprint and the small extension of the cabin.

Figures 18 to 24 are the same sections as above taken parallel and perpendicular to the overland flow path but represent the changes in velocity. These figures again depict similar results between the pre and post scenarios and results with a net zero increase within the subject site as well as no adverse impact on the surrounding properties.

Section	Post-dev Top Water Level (1% AEP)	Post-dev Top Water Level (PMF)
1	14.20m AHD	15.20m AHD
2	14.50m AHD	15.60m AHD
3	13.50m AHD	14.80m AHD
4	12.80m AHD	12.90m AHD
5	12.20m AHD	12.30m AHD
6	12.00m AHD	12.20m AHD

Table 1: Post development Top Water Levels along proposed building

Figure 22 is taken from the NSW Floodplain development manual and indicates flood hazard based on depth and velocity values.

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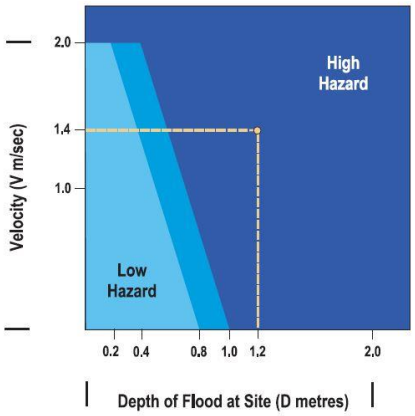

Figure 22: Hazard Definition Table

Flood Risk Precinct (definitions):

High Flood Risk: This is area within the 100-year ARI flood extents subject to high hydraulic hazard (in accordance with the criteria set out in Figure 23). This may also be considered to be area within the 20-year ARI flood extents subject to more frequent risk of inundation in lower storm events.
Medium Flood Risk: This is area within the 100-year ARI flood extents that is not subject to high hydraulic hazard.
Low Flood Risk: This is area beyond the 100-year ARI flood extents however within the PMF flood extents.

High Hazard: Possible danger to personal safety; evacuation by trucks difficult; able-bodied adults would have difficulty in wading to safety; potential for significant structural damage to buildings.
Low Hazard: Should it be necessary; truck could evacuate people and their possession; able-bodied adults would have very little difficulty wading to safety.

NY Civil Engineering flood mapping has identified flood extents, velocity and depths with excerpts shown in figures 10-21. High flood risk areas occur within the areas defined as over 1m in flood depth, in excess of 2m/s flow velocity, or as determined by the diagrammatic relationship between velocity and depth as depicted in Figure 22.

It can be seen from the figures 12-14 & 18-20 (sections of building footprint) that the maximum flow traversing along the building footprint is 1.30m/s at section 3 and a maximum depth of 200mm at sections. This combination of maximums defines the site as **Low Hazard**. However, it should be noted in the rear yard sections 1 & 2 indicate a significant portion is considered as High Hazard this is highlighted as the red area in the rear yard of figure 8.

The proposed pool is to be flush with natural ground level. It should be noted that the reserve at the rear is still above the RL of the pool coping and is therefore not impeding on the overland flow regime.

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Figure 23: Flood Storage Loss

It is thus deemed that the proposed development is not impacting adjoining properties.

DCP COMPLIANCE

The proposed alterations & additions have triggered the flood controls for residential development under Northern Beaches Council DCP E11 Flood Prone Land. As such, NY Civil Engineering have undertaken an assessment of the proposed development's compliance with these requirements under 'Medium' and 'High' Risk categories;

Flood effects caused by Development;

A1. Development (including earthworks and subdivision) shall not be approved unless it can be demonstrated in a Flood Management Report that it complies with the Flood Prone Land Design Standard found on Council's webpage.

An assessment of the proposal's compliance with the requirements of Council's Flood Prone Land Design Standard has been undertaken later in this report.

A3. The applicant shall include in their submission, calculations to illustrate that any fill or other structures that reduce the total flood storage are replaced by Compensatory Works.

Figures 5 and 6 indicate some flood storage loss due to the proposed lower deck and extended cabin, the flood model has indicated that the depth of flows at the location of the proposed works is 0.20m. The architectural plans indicate an increase of 12.15m^2 in the rear yard due to the lower deck. 12.15m^2 x 0.20m depth of flows equates to a total volume 2.43m^3. This loss of storage volume will need to be reclaimed in the rear yard which has an RL of 11.593m AHD and an area of approx. 94m^2. **It is proposed that scraping of 25mm of topsoil be observed on site to compensate for the storage loss.**

Drainage Infrastructure & Creek Works;

B1. Flood mitigation works or stormwater devices that modify a major drainage system, stormwater system, natural water course, floodway or flood behaviour within or outside the development site may be permitted subject to demonstration through a Flood Management Report that they comply with the Flood Prone Land Design Standard found on Council's webpage. Suitably qualified structural engineer to certify at CC stage that the building materials proposed are of flood compatible materials up to the PMF flood level.

As indicated earlier in the report a nominal scraping of 25mm of the rear yard is required in order to compensate for the loss of flood storage. This course of building practice will allow for the removal of sufficient material from the site to offset the impacts on flood volume of the proposed deck.

B2. A Section 88B notation under the Conveyancing Act 1919 may be required to be placed on the title describing the location and type of flood mitigation works with a requirement for their retention and maintenance.

No flood mitigation works are proposed requiring a Section 88B notation.

Building Components & Structural;

C1. All buildings shall be designed and constructed as flood compatible buildings in accordance with Reducing Vulnerability of Buildings to Flood Damage: Guidance on Building in Flood Prone Areas, Hawkesbury-Nepean Floodplain Management Steering Committee (2006).

It is considered that the proposed brick veneer structure is of flood compatible material.

C2. All structures must be designed and constructed to ensure structural integrity up to the Flood Planning Level, taking into account the forces of floodwater, wave action, flowing water with debris, buoyancy and immersion. Structural certification shall be provided confirming the above. Where shelter-in-place refuge is to be provided the structural integrity is to be to the Probable Maximum Flood level.

A suitably qualified structural engineer to certify at Construction Certificate stage that the structural integrity of is the proposed additions to the PMF level – RL 12.18m AHD, accounting for forces of floodwater, debris and buoyancy.

C3. All new electrical equipment, power points, wiring, fuel lines, sewerage systems or any other service pipes and connections must be waterproofed and/or located above the Flood Planning Level. All existing electrical equipment and power points located below the Flood Planning Level must have residual current devices installed that turn off all electricity supply to the property when flood waters are detected.

Noted and supported.

Storage of Goods;

D1. Hazardous or potentially polluting materials shall not be stored below the Flood Planning Level unless adequately protected from floodwaters in accordance with industry standards.

No storage area is proposed below the flood planning area.

D2. Goods, materials or other products which may be highly susceptible to water damage are to be located/stored above the Flood Planning Level.

No storage area is proposed below the flood planning area.

Flood Emergency Response;

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E1. Development shall comply with Council's Flood Emergency Response Planning for Development in Pittwater Policy and the outcomes of any Flood Risk Emergency Assessment Report where it applies to the land.

Aforementioned in the report the whole site is considered as low hazard except for the rear yard which is classed as high hazard. Given the nature of the site it is safe to class it within the H3 Flood Life Hazard Category. Thus, a flood response plan has been provided in Appendix A and the shelter in place requirements are addressed throughout this report.

E2. New development must provide an appropriately sized area to safely shelter in place above the Probable Maximum Flood level and appropriate access to this area should be available from all areas within the development.

The PMF level at the site is RL 12.18m AHD. The finished floor level of the proposed alterations is RL 12.38m AHD, well above the PMF level, thus making sheltering in place suitable. It should also be noted that the FFL of the additional story is 15.58m AHD providing further shelter for the residents during a major storm event.

Floor Levels;

F1. New floor levels within the development shall be at or above, the Flood Planning Level. A reduced Flood Planning Level may be considered only where it is permitted in this Development Control Plan. The structure must be flood proofed (wet or dry) to the Flood Planning Level. This control cannot be applied to critical or vulnerable uses.

The finished floor level of the ground floor alterations is RL 12.38m AHD consistent with the existing dwelling. The alterations & additions of the habitable areas do not extend the footprint of the building hence, it should be taken into consideration given there is a 200mm freeboard.

F2. All development structures must be designed and constructed so as not to impede the floodway or flood conveyance on the site, as well as ensuring no loss of flood storage in a 1% AEP Event. Where the dwelling is located over a flow path it must be elevated on suspended pier/pile footings such that the level of the underside of all floors including balconies and decks within the flood affected area are at or above, or raised to the Flood Planning Level to allow clear passage of the floodwaters under the building. The development must comply with the Flood Prone Land Design Standard.

As mentioned previously the proposed lower deck is the only section covering existing flood storage area. It should be noted that this area does not seem to be a flow path hence, no elevation required.

F3. Where the lowest floor has been elevated to allow the passage of flood waters, a restriction shall be imposed on the title of the land, pursuant to S88B of the Conveyancing Act confirming that the undercroft area is not to be enclosed.

This lowest floor has not been elevated to allow passage of flood waters hence no requirement for an S88B for the undercroft area.

F6. Any existing floor level may be retained below the Flood Planning Level when undertaking a first floor addition provided that:
(a) it is not located within a floodway;
(b) there is no increase to the building footprint below the Flood Planning Level;
(c) it is flood proofed to the Flood Planning Level;

The increase in footprint within the floodway is non habitable (lower deck)

F8. The minimum floor level of any first-floor additions shall be at or above the Probable Maximum Flood Level.

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FFL of the first-floor addition is 15.58m AHD which is well above the PMF at RL 12.18m AHD.

Car Parking;

G1. Open carpark areas and carports shall not be located within a floodway.

No change to the existing parking arrangement is proposed.

G2. The lowest floor level of open carparks and carports (unroofed or with open sides) shall be constructed no lower than the natural ground levels.

No change to the existing parking arrangement is proposed.

G3. All enclosed car parks must be protected from inundation up to the relevant flood planning level. For example, basement carparks must be provided with a crest at the entrance, the crest of which is at the relevant Flood Planning Level. All access, ventilation and any other potential water entry points to any enclosed car parking shall be above the relevant Flood Planning Level. Council will not accept any options that rely on electrical, mechanical or manual exclusion of the floodwaters from entering the enclosed carpark.

No change to the existing parking arrangement is proposed.

G4. Vehicle barriers or restraints are to be provided to prevent floating vehicles leaving the site where there is more than 300mm depth of flooding in a 1% AEP flood event. The minimum height of the vehicle barriers or restraints must be at or above the Flood planning Level. Vehicle barriers or restraints must comply with the Flood Prone Land Design Standard.

There are no locations within the site which harbour depths more than 300mm hence, no barriers required.

G5. Enclosed Garages must be located at or above the 1% AEP level

The proposed garage to have a minimum FFL of 11.44m AHD.

G6. Carports must comply with the Flood Prone Land Design Standard

An assessment of the proposal's compliance with the requirements of Council's Flood Prone Land Design Standard has been undertaken later in this report.

G7. Where a driveway is required to be raised it must be demonstrated that there is no loss to flood stage in the 1% AEP flood event and no impact on flood conveyance through the site.

No change to the existing parking arrangement is proposed.

Fencing;

H1. Fencing, including pool fencing, shall be designed so as not to impede the flow of flood waters and not to increase flood affectation on surrounding land. Appropriate fencing must comply with the Flood Prone Land Design Standard in addition to other regulatory requirements of pool fencing.

Any proposed fencing is to be 'open form' up to RL 12.18m AHD.

Pool;

I1. Pools located within the 1% AEP flood extent are to be in-ground, with coping flush with natural ground level. Where it is not possible to have pool coping flush with natural ground level, it must be demonstrated that the development will result in no net loss of flood storage and no impact on flood conveyance on or from the site. All electrical equipment associated with the pool (including pool pumps) is to be waterproofed and/or located at or above the Flood Planning Level. All chemicals associated with the pool are to be stored at or above the flood planning level

Pool Coping to be flush with the natural ground to avoid impeding overland flows.

Flood Prone Land Design Standard

A1. The development has been designed and can be constructed so that in a 1%AEP flood event: (a) There is no net loss of flood storage/ floodway; (b) There are no adverse changes in flood levels and velocities caused by alterations to the flood conveyance; (c) There are no adverse effects on surrounding properties; and (d) It is sited to minimise exposure to flood hazard. Where relevant certification shall also be provided in Northern Beaches Council's Standard Certification Form (Form A in Flood Risk Management Policy for Development) to this effect.

As previously discussed, the proposal will have minor losses but are to be compensated via 110mm scrapping of the yard. Ultimately the proposed development will have no material impact to the existing flood regime.

B1. The development has been designed and can be constructed so that in a 1% AEP flood event: (a) There is no loss of flood storage/floodway; (b) There are no adverse effects on surrounding properties; (c) The works do not have an adverse impact on the environment. (This includes but is not limited to the altering of natural flow regimes, the clearing of riparian vegetation, artificial modification of the natural stream, such as by relocation, piping etc, in accordance with Council's Protection of Waterways and Riparian Land Policy). Certification shall also be provided in Northern Beaches Council's Standard Certification Form (Form A in Flood Risk Management Policy for Development) to this effect.

As previously discussed, the proposal will have minor losses but are to be compensated via 110mm scrapping of the yard. Ultimately the proposed development will have no material impact to the existing flood regime.

F2. For suspended pier/pile footings, there must also be sufficient openings in perimeter walls located below the 1% AEP flood level to allow for the flood waters to flow through unimpeded: a) The underfloor area of the dwelling below the 1% AEP flood level is to be designed and constructed to allow clear passage of floodwaters, and (b) 50-75% of the perimeter of the underfloor area is of an open design between the natural ground level and the 1% AEP flood level. Only 25-50% of the perimeter would be permitted to be solid, and (c) No solid areas of the perimeter of the underfloor area would be permitted in a floodway.

N/A – Existing foundations being used for the alterations.

F9. It must be demonstrated that: (a) The Flood Planning Level is more than 1 metre above the typical existing ground level, and (b) The maximum footprint of the foyer is limited to 15 square metres, and (c) The foyer is not used for habitable purposes, and (d) All structural elements, external finishes and internal finishes are constructed from flood compatible materials, and (e) All electrical services, power points, fittings and equipment are located above the Flood Planning Level.

N/A – the Flood Planning Level is not 1m above existing ground level.

F10. It must be demonstrated that: (a) The development is located within an existing Business Zone and; (b) The minimum floor level of the first internal 5 metres from one street front only, is no lower than the adjacent footpath level, and (c) The maximum internal distance from the front of the building is 5 metres, and (d) The maximum area for each individual premises below the Flood Planning Level is 30 square metres, and (e) There

is direct internal access between areas above and below the Flood Planning Level for each individual premises, and (f) All new and existing structural elements, external finishes and internal finishes below the Flood Planning Level are constructed from flood compatible materials, and (g) All electrical services, power points, fittings and equipment are located above the Flood Planning Level, and (h) All internal areas below the Flood Planning Level are assumed to be enclosed and so will not be available to form an offset for floodplain storage volume.

N/A – the proposed development is not located within a Business Zone.

G4. Vehicle barriers or restraints (such as mounding, bunding, louvers or similar) that redirect and/or exclude floodwaters will not be permitted. Perimeter walls/louvers installed as vehicle barriers or restraints are to be of an open design, where 50-75% of the perimeter walls/louvers are 'open' between natural ground level and the Flood Planning Level. Only 25-50% of the perimeter walls/louvers would be permitted to be 'solid', openings should permit a 75 mm sphere to pass through, and should not impede the flow of water.

N/A – No vehicle restraints required.

G6. Car ports must: (a) Be of an open design, where 50-75% of the perimeter walls are 'open' between natural ground level and the Flood Planning Level. Only 25-50% of the perimeter wall would be permitted to be 'solid', openings should permit a 75 mm sphere to pass through, and should not impede the flow of water; and (b) Constructed of flood compatible material.

The existing carport is currently supported by four columns with no walls hence, complying with the above requirement.

G8. It must be demonstrated that: (a) The Flood Planning Level is more than 1.5m above the typical existing ground level, and (b) All structural elements, external finishes and internal finishes below the Flood Planning Level are constructed from flood compatible materials, and (c) All electrical services, power points, fittings and equipment are located above the Flood Planning Level, and (d) 50-75% of the perimeter walls are 'open' between natural ground level and the Flood Planning Level. Only 25-50% of the perimeter would be permitted to be 'solid', Openings should permit a 75 mm sphere to pass through, and should not impede the flow of water, and (e) Internally there are no solid dividing walls within the carparking area, and (f) No 'storage cages' are permitted within the carparking area below the Flood Planning Level, and (g) Prominent signage is displayed that warns of the possibility of flooding and that personal goods other than vehicles must not be stored in the carparking area, and (h) Vehicle barriers or restraints will be provided to prevent floating vehicles leaving the carparking area.

N/A – the Flood Planning Level is not 1.5m above existing ground level.

H1. Fencing (including pool fencing, boundary fencing, balcony balustrades and accessway balustrades) shall be open for passage of flood waters - All new fencing on the property must be flood compatible with 50-75% of the fence being of an open design between the natural ground level and the Flood Planning Level. Only 25-50% of the perimeter fence would be permitted to be solid. Openings should permit a 75 mm sphere to pass through, and should not impede the flow of water.

All proposed fencing is to be 'open form' to the Flood Planning Level and have a clear gap of 150mm.

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CONCLUSIONS AND RECOMMENDATIONS

Based on our Flood Study Report, we have concluded and summarise as follows:

1. **The proposed development meets all freeboard and finished floor level requirements.**

2. **The proposed development has no material impact on the existing flood regime.**

3. **25mm scraping of 94m^2 to rear yard required to compensate flood storage loss**

4. The minimum finished floor levels (FFL) for the proposed addition shall be based on the levels outlined below:

   - **Habitable Floor Level - FFL 12.38m AHD**
   - **Garage Floor Level - FFL 11.44m AHD**
   - **Rear Yard Level - FFL 11.568m AHD**

5. All new electrical equipment, power points, wiring, fuel lines, sewerage systems or any other service pipes and connections must be waterproofed and/or located above the Flood Planning Level. All existing electrical equipment and power points located below the Flood Planning Level – RL 12.38m AHD - must have residual current devices installed that turn off all electricity supply to the property when flood waters are detected.

6. A suitably qualified structural engineer to certify at Construction Certificate stage that the structural integrity of the proposed granny flat is maintained to the flood planning level – RL12.38m AHD accounting for forces of floodwater, debris and buoyancy.

7. Any proposed fence lines along the boundaries to have a clear 150mm gap between the underside of the fence line and the natural ground level to allow overland flow to traverse unimpeded

8. The conclusions of this Flood Study Report are to be reflected on the Stormwater Management Plans and Architectural Plans for the proposed additions.

9. A laminated copy of the Flood Emergency Response Plan is to be displayed in the rear yard and pool area.

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APPENDIX A

FLOOD RESPONSE MANAGEMENT PLAN – 13 QUINLAN PARADE, MANLY VALE

SITE INFORMATION

Council has advised that this property is subject to potential flooding. This means runoff from the upstream catchment may the site in a 100-year storm event. This is due to the geographically low location of the site, allowing flows to travel overland in the vicinity of the site.

PROCEDURE IN CASE OF FLOODING

1. During floods, many local streets and roads will be cut off by floodwaters that may make the escape by vehicle difficult. Travelling through floodwaters on foot or in a vehicle can be dangerous as obstructions can be hidden under the floodwaters, or you could be swept away, even if in a car, or the water may be polluted. Stay within the building as much as practical as this is the safest option. In the possible occurrence of a flood event, overland flows will most likely first enter the site through the rear and side boundaries. The minimum ground floor level for the development (12.38m AHD) is above the possible 100-year ARI overland flow levels, however it may be necessary to evacuate the proposed development in a storm event greater than the 100-year storm. **It should be noted that if overland flows are entering the rear of the site, it may be unsafe for pedestrian/vehicular evacuation. In such case, staying indoors in the safer option unless otherwise instructed by the SES or relevant authorities.**

   Due to the unpredictable nature of overland flows and the location of the subject site in the catchment area, evacuation is only to be undertaken prior to the storm event occurring.

100-year ARI Flood Level	RL 12.15m AHD
(Minimum) Habitable floor Level	RL 12.38m AHD
Probable Maximum Flood Level	RL 12.18m AHD

If evacuation is necessary prior to a severe storm event, the following evacuation route is to be undertaken;

- Immediately leave the rear yard/pool area
- Move towards the dwelling
- Shelter in the dining room of the proposed dwelling – above the probable maximum flood level

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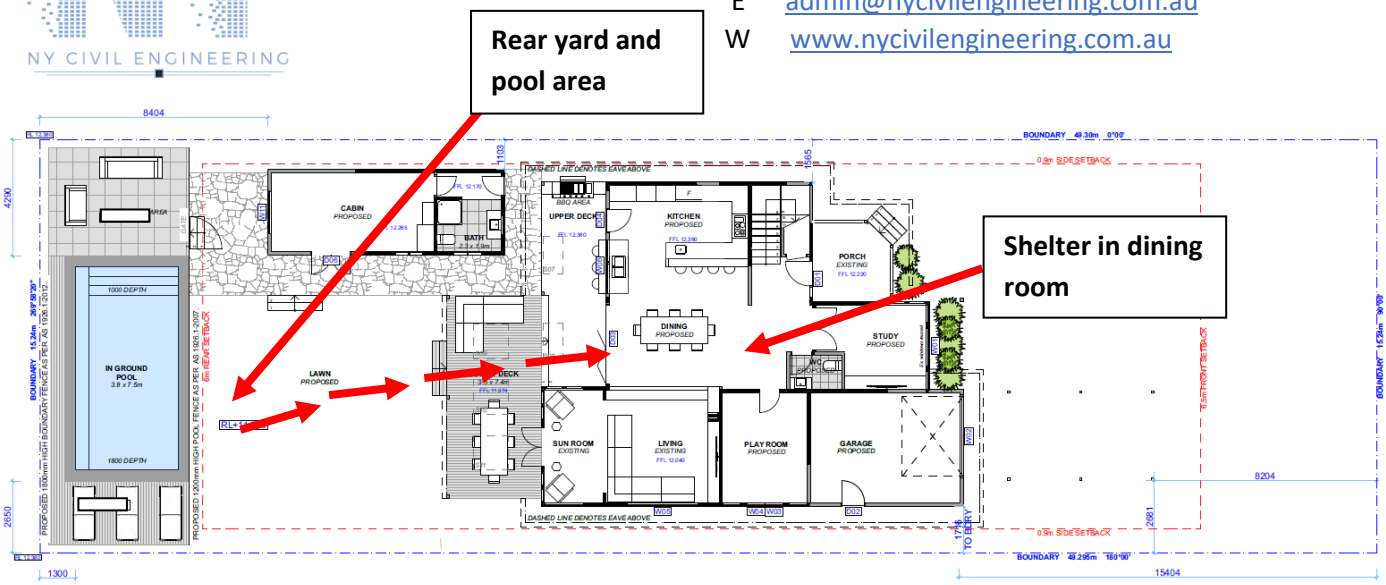

Evacuation Route

2. Develop your own family flood plan and be prepared if flooding should occur while the kids are coming home from school, or when you are returning from work. Make arrangements with neighbours or family members to look after children if there are no adults at home.

3. As flood levels appear to approach the ground floor level of the residence:
   (a) move important documents, personal effects, precious photographs and vital medical supplies to a safe and easily accessible place with your emergency flood kit
   (b) gather medicines, special requirements for babies or the elderly, mobile phones, first aid kit, special papers, battery operated torch and radio, fresh water, canned food and opener, water proof clothing and small valuables into a backpack or bag in one location
   (c) locate your pets and gather any special requirements for them
   (d) put on strong shoes, raise any items within the home that may be damaged by water to as high a level as possible, with electrical items on top. Turn off any large electrical items at the power point such as a TV that cannot be raised.

   Note: Suitable storage areas may be on top of desks/tables/bench tops/attics/beds.

4. In the rare event that flood waters appear that they may enter the dwelling:
   (a) switch off electricity at switchboard
   (b) turn off gas at the meter
   (c) turn off water at the meter
   (d) block toilet bowls with a strong plastic bag filled with earth or sand
   (e) cover drains in showers, baths, laundries etc with a strong plastic bag filled with earth or sand

5. In the event that flood waters have risen up to the building, do not evacuate the building at this time unless instructed to do so by the SES or the Police. Floodwaters are much deeper, run much faster and are more dangerous outside.

6. Continue to monitor Bureau of Meteorology forecasts and warnings, listen to ABC 702 radio.

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7. In the case of a medical or life-threatening emergency ring 000 as normal, but explain about the flooding.

8. A laminated copy of this flood plan should be permanently attached to an inside cupboard door in the kitchen and/or laundry of the main house and to the inside of the electrical meter box.

9. This flood management plan should be reviewed every 5 years, particularly with the potential sea level rise due to the greenhouse effect.

Important Phone Numbers

State Emergency Service: Emergency 132 500 General Enquires: 4251 6111

Police, Fire, Ambulance: Emergency 000

Bureau of Meteorology (Website): http://www.bom.gov.au/weather

Land, Weather and Flood Warnings, phone: 1300 659 215

DR/Hospital: .....

Family: .....

Friends: .....

Other: .....

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IF YOU NEED TO EVACUATE

- Pack warm clothing, essential medications, valuables, personal papers, mobile phones, photos and mementos in waterproof bags to be taken with your emergency kit
- Decide on how to look after your pets if you cannot take them with you
- Raise furniture, clothing and valuables on bed, tables and into roof spaces
- Empty freezers and refrigerators, leaving doors open
- Turn off power, water and gas
- Whether you leave or stay, put sandbags in the toilet bowl and over all laundry/bathroom drain holes to prevent sewage back-flow
- Lock your home and proceed to Alice Street
- Don't drive in water of unknown depth and current
- Remember that walking through floodwaters is very dangerous

AFTER THE FLOOD

- Stay tuned to ABC 702 on a battery powered radio for official advice and warnings
- Don't return home until authorities have said it is safe to do so
- Don't allow children to play in or near flood waters
- Avoid entering flood waters, it is dangerous. If you must, wear solid shoes and check depth and current with a stick
- Stay away from drains, culverts and water over knee-deep
- Don't turn on your gas and electricity until it has been checked by a professional/licensed repairer
- Avoid using gas or electrical appliances which have been in flood water until checked for safety
- Don't eat food that has been in flood waters
- Boil tap water until supplies have been declared safe
- Watch for trapped animals
- Beware of fallen power lines
- Take many photos for all damage for insurance purposes
- Notify family and friends of your whereabouts