

EXTERNAL CATCHMENT ASSESSMENT REPORT

For Proposed Residence

at

10 Gardere Avenue, Curl Curl

Prepared for:

Mr and Mrs. Torrington

Prepared By:	Robert Xu
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Introduction

As part of the Development Application for the proposed residence at 10 Gardere Avenue, Curl Curl, an External Catchment Assessment Report has been undertaken as requested by Northern Beaches Council. The purpose of the Catchment Assessment is to determine any impacts the proposed development will have on the existing overland flow paths and to ensure the proposed residence is safeguarded against potential flooding.

Engineering Studio has been commissioned by Mr and Mrs. Torrington to complete the external catchment assessment and report for the proposed residence.

The external catchment assessment has been prepared with reliance on the following documentation:

- Architectural plans by Urban Harmony Project No. 580, dated 20.11.2020
- Survey Plans by Terralinks Job No. 5889 Revision B, dated 19.11.2020
- Civil Engineering Plans by Engineering Studio Job No. 20503 Revision C
- HEC-RAS River Analysis System 2D Modeling User's Manual
- Warringah Council PL850 – Water Management Policy (Adopted 15.20.2015)
- Warringah Council 'Building Over or Adjacent to Constructed Council Drainage Systems and Easements Technical Specifications
- NSW Spatial Services 'SIX Maps'

Objectives

This report identifies the localised flood risks and management procedures necessary for the proposed residential development.

The objectives of this report are listed below:

- Guidelines to minimise the impact of flooding on the proposed development and the surrounding residential properties.
- Ensure no loss of flood storage as a result of the proposed development.
- Ensure no changes to flood levels, flows, velocities, and hazards caused by altering the flood flows
- To determine a 1 in 100-year ARI flood level and set proposed floor levels above the required freeboard.
- A review of flood hazards for the site & proposes suitable construction methods to accommodate them.

In order to achieve the above, the following has been undertaken:

- Liaison with Local Council officers regarding the proposed development and implementation of suitable development controls to ensure the adequate performance of the proposed development during flood events.
- A review of existing Council flood study, topography maps, catchment plans, etc.
- Visual observations of surface features of the existing site and surrounding areas by a walkover conducted by an experienced civil engineer.
- Engineering assessment and reporting of the proposed development and its impact on the existing residences.

Flood risk management will be achieved by imposing the following guidelines:

- Provide minimum floor levels for the proposed development, including minimum freeboard requirements.
- Recommendations for the structural design of the proposed development to resist additional loadings due to flooding, including the effects of impact loading from floating debris, etc.
- Recommendations in the use of flood-proof materials in the building's construction in accordance with the Council's policy.

Existing Site Condition

The site, shown in Figure 1, is located on the western side of Carrington Parade and the corner of Tanderra Place and Gardere Avenue. The overall ground surface varies within the subject property, with an overall site slope from the western boundary to the eastern boundary with a gradient of approximately 17.50%.

Water is conveyed from upstream properties and the public domain along Seaview Avenue, Beverley Place, Tanderra Place, and Gardere Avenue towards the subject property. Flow from the external catchments drains to the existing natural depression traversing from the western side to the eastern sag point of the subject development site. Minor flows are conveyed via the trunk drainage system from Beverley Place through to Carrington Parade. The subject development site is burdened by a 525 diameter R.C.P. pipe traversing from the western boundary to the eastern boundary. Overland flow unable to be captured and conveyed by the pipe drainage network is conveyed around the existing blockage within the subject development site and to the sag point to the east.

Existing on the site is a single-story residential dwelling, and detached garage and replaced with a new residence. There are no other significant structures located within the property. The existing dwelling is approximately 7m wide x 26m long.

The property is approximately 50.29m long and 10m wide; the total site area is 455.30 square meters. A full copy of the site survey plan has been provided in Appendix A of this report.



Figure 1 - Site Location

Proposed Development

The proposed development involves the demolition of the existing dwelling, detached garage, and then the construction of a new two-story residence. The development proposes a two-story double brick and concrete structure to be constructed on footings and a concrete slab on ground.

A detailed copy of the proposed development architectural plans has been provided in Appendix B of this report.

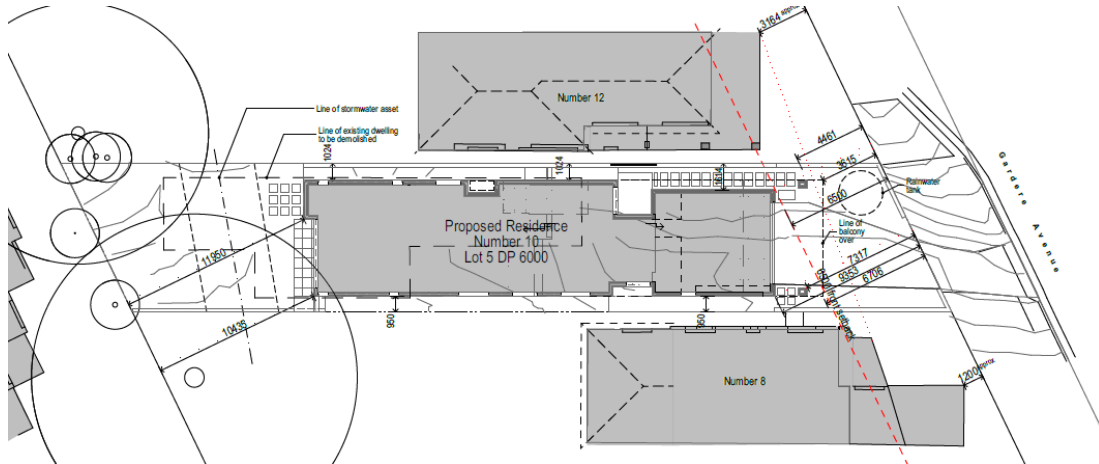


Figure 2 - Proposed Development Site

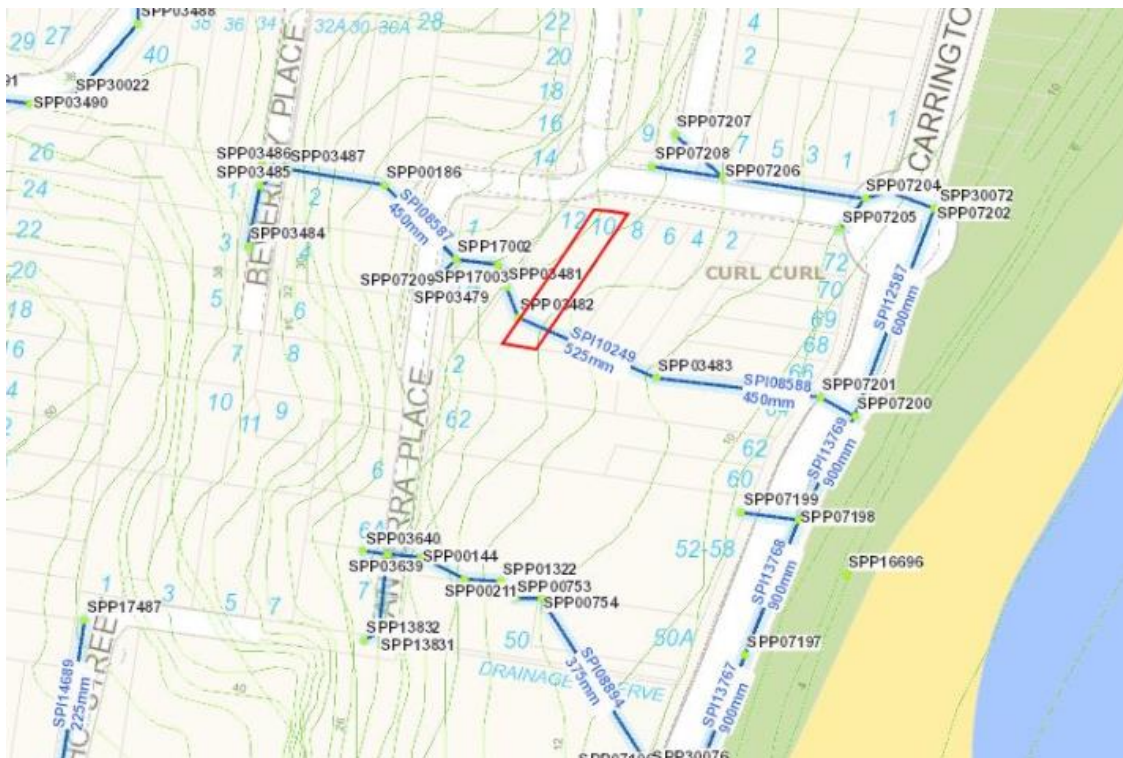


Figure 3 – Warringah Council Stormwater Mapping

Flood Modelling

Rational Method

The rational method has been adopted to calculate the critical 1 in 100 year ARI incoming flows reaching the proposed development sites at relative points. The followings parameters were used:

- Catchment Area = 1.818 ha (determined based on contours)
- Time of Concentration = 20 minutes
- Runoff Coefficient = 1.08
- 100 year, 20 minute rainfall intensity = 156 mm/hr

Manning's 'n' value adopted in the overland flow calculation has a significant effect on the inflow. A Manning's 'n' of 0.08 was adopted for the external catchment in accordance with 'HEC-RAS River Analysis System 2D Modeling User's Manual'. The adopted value of 0.08 in accordance with the aforementioned documentation carries a description of 'Developed, Medium Intensity – Including constructed surface areas of impervious and pervious structures, most commonly include single-family housing units with 50 to 79 percent impervious site cover'

From these parameters, a total flow rate of 0.851 m³/s was calculated as a peak flow from the upstream external catchment. A 50% blockage factor has been applied to the pipe area of the existing 525 mm RCP draining this catchment. Based on this blockage factor, the equivalent capacity of the 370 mm pipe was calculated to be 0.549 m³/s. Therefore, the peak overland flow from the upstream catchment was determined to be 0.302 m³/s. Refer to Engineering Studio drawing number 20280-C11.01 for detailed calculations.

Land Cover Layer		
	Name	Default Mann n
1	nodata	
2	barren land rock/sand/clay	0.04
3	cultivated crops	0.06
4	deciduous forest	0.1
5	developed, high intensity	0.15
6	developed, low intensity	0.1
7	developed, medium intensity	0.08
8	developed, open space	0.04
9	emergent herbaceous wetlands	0.08
10	evergreen forest	0.12
11	grassland/herbaceous	0.045
12	mixed forest	0.08
13	open water	0.035
14	pasture/hay	0.06
15	shrub/scrub	0.08
16	woody wetlands	0.12

Figure 4 – Manning's n Value for Various Land Covers (HEC-RAS River Analysis System 2D Modeling User's Manual Fig. 3-

HEC-RAS Modelling

An HEC-RAS model has been prepared for the subject site to determine the flood levels and flood extents through the site. The HEC-RAS model showed the proposed development is located within the overland flow path. A grass-lined channel is proposed to the southern side of the dwelling to direct the 1% AEP overland flow to the existing sag point at the eastern boundary.

The upstream and downstream boundary conditions were calculated using a normal depth with an approximate slope as calculated by the site survey and NSW Spatial Services topography data. An upstream slope of 10% and a downstream slope of 6% were adopted.

Manning's 'n' value adopted for the grass-lined channel in the HEC-RAS model has a significant effect on the capacity of the proposed channels. A Manning's 'n' of 0.05 was adopted for landscaped areas and a Manning's 'n' of 0.015 was adopted for paved surface areas.

An output summary of the HEC-RAS model can be found in the appendices of this report. A full electronic copy of the pre-development HEC-RAS model can be provided upon request. The table below outlines the maximum water level for the overland flow channel at the HEC-RAS cross-sections. An accurate reflection of the pre and post-development flood extents can be found on the civil engineering plans prepared by Engineering Studio; job number 20503.

HEC-RAS Channel Chainage	Pre-Development Max Water Level	Post-Development Max Water Level
18.86	17.60	17.59
14.06	17.42	17.39
13.86	16.90	16.01
10.64	16.86	16.01
05.00	15.36	15.32
00.00	14.44	14.43

Pre-Development Flood Behaviour

The overland flow overtops at the sag point of the kerb fronting No. 1A Tanderra Place to the west of the subject property. As the water overtops the kerb, it travels into the neighbouring property at 1A Tanderra Place and 12 Gardere Avenue via. the natural depression. This natural depression continues downstream,

where it is impeded by the existing dwelling on the 68 and 69 Carrington Parade further downstream and directed to the public domain on Carrington Parade.

The existing single dwelling is considered to be a blockage to the existing natural overland flow path as the flow width wraps around the southern and northern side of the existing dwelling and it is then carried to the natural sag point to the eastern boundary. As it moves downstream, the steep terrain past the eastern boundary conveys water through the rear set back of the downstream properties.

Post-Development Flood Behaviour

The development proposes cutting of the existing ground levels along the western boundary to improve the capacity of the overland flow channel, by conveying overland flow away from the proposed dwelling and maintaining or reducing pre-development flow depths/widths. A minimum 5.6m wide proposed grass-lined channel is to convey the 1% AEP overland flow from the western boundary to the eastern sag point. This channel is bounded by the rear of the proposed building footprint, which is to be constructed on a concrete edge beam or masonry structure and a reinforced concrete masonry retaining wall to the southern side. The retaining wall has been designed to have a minimum horizontal clearance with the existing 525 RCP pipe in accordance with Warringah Council 'Building Over or Adjacent to Constructed Council Drainage Systems and Easements Technical Specifications'

Conditions are recommended to be placed over the proposed development to ensure all possible obstructions such as rainwater tanks and air conditioning units are to be placed either on stands that allow water to flow naturally or to be located outside of the 1% AEP flood extents.

It is considered that the proposed development will help ease the existing flood situation as the existing blockage to the natural overland flow path is to be demolished and a uniform flow path is proposed to convey overland flow from the west to the east boundary

An output summary of the pre-development HEC-RAS model can be found in the appendices of this report. A full electronic copy of the pre-development HEC-RAS model can be provided upon request.

Freeboard to Habitable Floor Levels

In accordance with Northern Beaches Council requirements, the minimum habitable floor level for residences adjacent to an overland flow path is to be set at the 100-year flood level plus a minimum 300mm freeboard.

The proposed habitable floor areas on the ground floor have been set at RL16.328 to the rear Habitable area, this results in a freeboard of 318 mm and 1008 mm to the western high point and eastern low point, respectively, at the relevant chainages. The proposed dwelling is therefore considered to be located clear of any floodwaters and not impacted by the overland flow paths.

DEVELOPMENT CONTROLS

Building Construction

The proposed dwelling is to be constructed clear of the overland flow path and therefore there will be no specific requirement for the use of any specific flood compatible materials. The following construction materials are proposed in the current DA submission are therefore considered suitable:

Floor: Slab on ground

Walls: External – brick walls

Internal – timber stud

The structural engineer will need to provide at the Construction Certificate stage a structural design certificate stating that the building has been designed to suit relevant Australian Standards and NCC requirements, no additional flood forces are required to be assessed.

On-site Detention System

It is in my opinion, that an on-site detention system which will be required to discharge to the existing trunk drainage system to the rear at the natural low point, will have a detrimental effect on the overall flow width and depth within the subject development site and downstream catchments. The piped drainage network has been shown to have an inadequate capacity. Therefore, connecting the piped drainage to this existing drainage line will further exacerbate this issue and worsen flooding issues downstream.

It is recommended for the proposed 10,000 L below ground rainwater re-use tank to be connected to the laundry, toilets, and irrigation to reduce the rainfall-runoff days as the water cycle solution. This will result in an overall reduction in inflows to the receiving systems. The high level overflow from the rainwater re-use tank will be directed to the Gardere Avenue which will carry the flow to the receiving system.

Furthermore, it is observed that the subject development site is located within the lower areas of the catchment, approximately 150m away from the receiving system at Curl Curl Beach; therefore an on-site detention system will have a negligible effect on flooding within the receiving system.

CONCLUSION

It is apparent from the design review that the site is currently affected by overland flows during the 1:100 ARI storm event. Overland flows from upstream catchments generate a total maximum of the 100-year flow rate of $0.302 \text{ m}^3/\text{s}$. Overland flows reaching the subject site are conveyed through the site along the proposed grass-lined channel. The existing ground levels are to be excavated in accordance with the referenced documentation to alleviate flooding issues within the site.

Based on the External Catchment Assessment Report undertaken, it has been shown that the new residence can be constructed on the site with a nil impact on surrounding properties and within the guidelines imposed by the regulatory authorities.

We trust the above and attached clarify the situation, if you have any further queries please contact the undersigned at your convenience.

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APPENDIX A

Existing Site Survey

APPENDIX B

Architectural Plans

APPENDIX C

HEC-RAS Print Out