STORMWATER MANAGEMENT REPORT

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Frenchs Forest NSW 2086

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Recipients are responsible for eliminating all superseded documents in their possession.

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1. Introduction

1.1 Background

Van Der Meer Consulting has been commissioned by **Leda Holdings Pty Ltd** to prepare a Stormwater Management Plan to support a Development Application (DA) to Northern Beaches Council for a proposed development at 323-327 Warringah Road, Frenchs Forest.

The scope of this report includes a comprehensive assessment of the stormwater management requirements for the proposed development. Accordingly, this report includes findings of the assessment and proposes a best practice stormwater management strategy.

The following information and documents were utilised in this investigation:

- Concept Civil Engineering Drawings for the Development Application submission prepared by Van der Meer Consulting Engineers;
- Northern Beaches Council - Water Management for Development Policy (2021)
- "Australian Runoff Quality – A Guide to Water Sensitive Urban Design", Engineers Australia (2006)
- "Australian Rainfall and Runoff: Guide to Flood Estimation", Commonwealth of Australia (2016)

1.2 Existing Site

The site is located at 323-327 Warringah Road, Frenchs Forest. It is fronted by the Warringah Road to the North, an access road for the adjacent property to the east, and existing double storey buildings to the west and south. The entry for the site is from Rodborough Road via a service road.

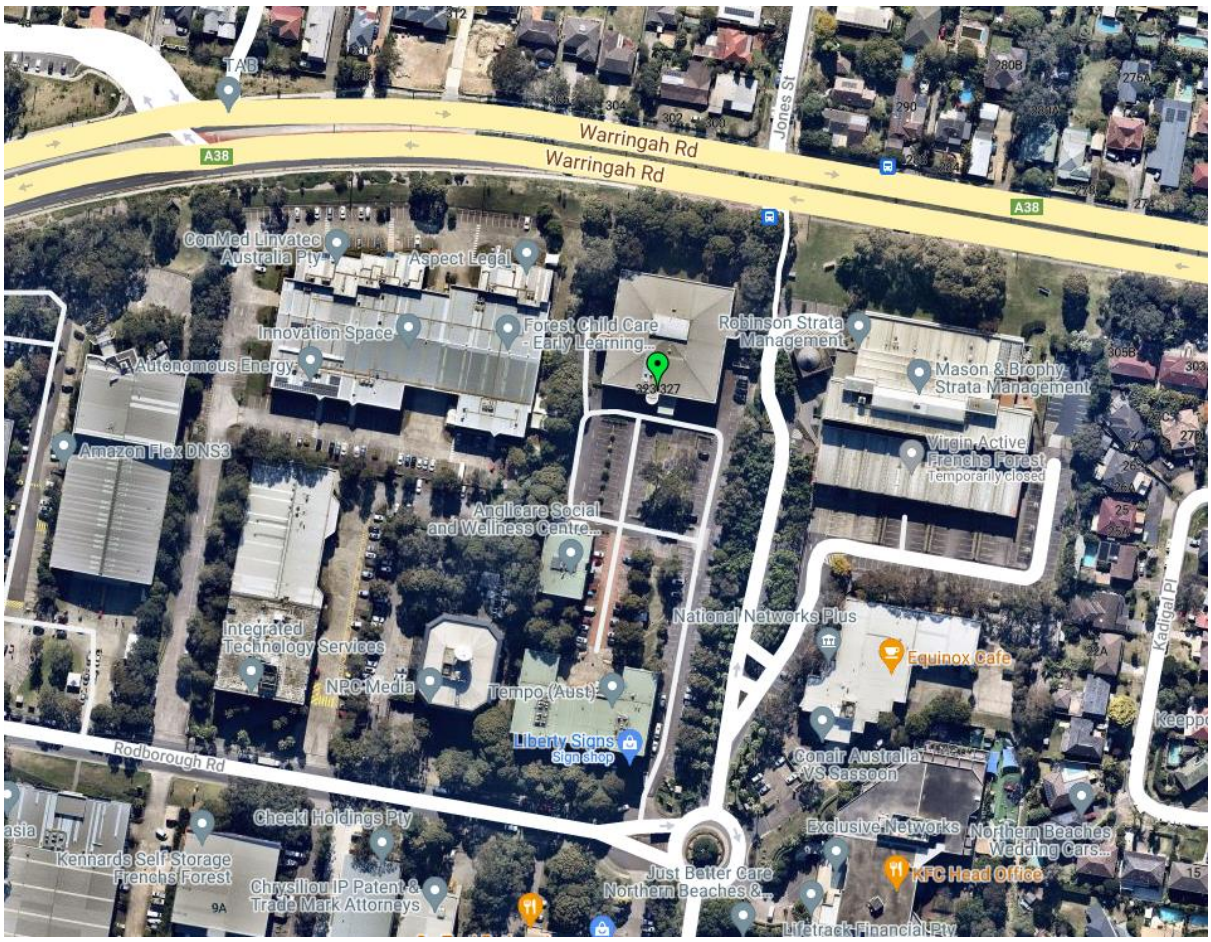


Figure 2.1 – Site Area

The site area is approximately 0.865ha. It currently occupied by a commercial building with adjoining carpark. Two inter-allotment easements are running along eastern and southern boundaries within the subject site. The site falls from north to south.

On-site detention or water quality improvement devices are not currently in place.

1.3 Proposed Works

The proposed development includes the demolition of the existing building and infrastructure and the construction of a multi storage structure including roof parking, driveways, surrounding carparking, stormwater drainage infrastructure and utility services.

1.4 Key Issues

The key issues to be addressed in this report include:

• **Water Quantity** – Increases in impervious areas as a result of the development (such as roofs, driveways, etc) has the potential to increase stormwater flows from the site during storm events. To avoid impacting the site and downstream properties, the site stormwater system must be designed to safely convey flows through the site and within the capacity of the downstream drainage system.

• **Water Quality** – Urban developments have the potential to increase gross pollutants, sediments and nutrient concentrations in storm water runoff. To limit the impact on the downstream water quality, pollution control measures will be provided within the site's stormwater management system prior to discharging into the drainage network.

2. Objectives & Targets

The objective is to provide stormwater controls that ensure that the proposed development does not adversely impact on the quantity or quality of stormwater flows within, adjacent and downstream of the site.

The site-specific stormwater management and planning elements are to be designed and constructed in accordance with the following:

Water Quantity

Guidelines: Northern Beaches Council - Water Management for Development Policy 2021

The proposed site is in the region 2 – Central Stormwater Region as shown below council's catchment map, and the development increases the total impervious area of the existing site and therefore may increase the discharge rate to the downstream drainage network and waterways. The main objective is to achieve a natural water balance which seeks to approximate the pre-development site conditions as well as controlling erosion and sediment removal.

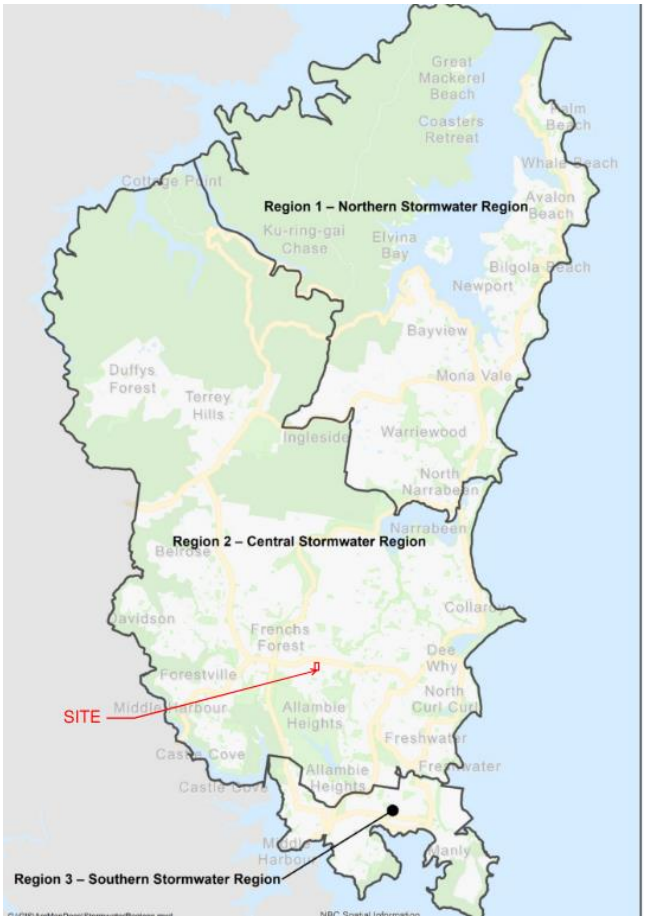


Fig. 2.1 – Northern Beaches Stormwater Regions

Water Quality

Guidelines: Northern Beaches Council - Water Management for Development Policy 2021

The main objective for stormwater quality is to minimise the impacts on downstream water bodies. Northern Beaches Council has adopted a stormwater management policy that incorporates “best practice” principles of Water Sensitive Urban Design. The site-specific water quality targets are outlined in Table 1.

Pollutant	Criteria
Total Suspended Solids (kg/yr)	85% reduction of the annual load
Total Phosphorus (kg/yr)	65% reduction of the annual load
Total Nitrogen (kg/yr)	45% reduction of the annual load
Gross Pollutants (kg/yr)	90% reduction of the annual load

Flood Impact and Overland Flow Path Analysis

To assess the risk of flooding to the development and to determine any overland flow from upstream catchments and risk associated with determined flows. Further, to determine treatment of any overland flow to ensure no affect on the proposed or surrounding properties.

3. Stormwater Quantity Control

3.1 Proposed Drainage System

The drainage system for the proposed development will be designed to collect the majority of concentrated flows from impermeable surfaces such as access ways, parking areas and buildings. Where possible (and practical), runoff from pervious areas will also be collected.

The proposed stormwater management system for the development includes:

- A pit and pipe network to collect minor storm runoff from areas
- Overland flow paths to carry major storms through the site
- An on-site detention (OSD) tank (150m^3 volume) with a 350mm diameter circular orifice and weir control

A reduced set of concept civil engineering drawings is included in Appendix B.

3.2 On-Site Detention (OSD)

The main criterion for the stormwater quantity control is to ensure that the post-developed peak flows to be maintained at the 'state of nature' flow for all storm events up to and including a 1% AEP event.

The OSD was modelled using the runoff routing software DRAINS. A pre vs post development model was set up within DRAINS with the assumption that the predevelopment condition was fully pervious. The permissible site discharge was then limited to the pre-development flow rates for all storm events from the 20% AEP (1 in 5 Year ARI) up to and including the 1% AEP (1 in 100 Year ARI) storm event. The results are shown in Table 3.2.1.

AEP	Pre-development Flow rate (L/s)	Post-development Flow rate (L/s)	OSD Tank Storage (m3 as per Drains)
20%	180	**171**	**53.8**
10%	236	**199**	**73.4**
5%	288	**222**	**93.3**
2%	356	**288**	**123.9**
1%	414	**387**	**140.2**

Refer to Appendix B for orifice plate and OSD tank details.

4. Water Quality Control

4.1 Introduction

The quality of runoff from a catchment depends upon many factors such as land use, degree of urbanisation, population density, sanitation, waste disposal practices, landform, soil types, and climate. Pollutants typically transported by runoff include litter, sediment, nutrients, oil, grease, and heavy metals. Whilst all these pollutants have a negative impact on the receiving water quality, suspended solids and nutrients cause the highest detrimental impact to the environment

Also, soil erosion during the construction phase presents a potential risk to water quality. The primary risk occurs while soils are exposed during earthworks when suspended sediment and associated pollutants can be washed into downstream watercourses.

4.2 Water Quality Control Measures

The measures proposed for the redevelopment are summarised below:

Gross Pollutant Traps

- An *Oceanguard* is a catch basin insert installed inside inlet pits. It is effective in removing trash, debris and other pollutants from runoff.
- *Oceanguard* proposed for the project utilise a 200 micron filter system.
- These filter baskets will be installed in indicated pits for the proposed development.

Filter Cartridges

- *StormFilter* is a proprietary device containing multiple cartridge units in a single system, thereby suitable for larger catchments.
- An advantage of using *StormFilter* is that the cartridges come with various filtration media available to target site-specific pollutants.
- There will be 10 x 690mm Storm Filter cartridges within the OSD tank as detailed in the engineering drawings.

Rainwater Tank

- Rainwater tanks are effective in removal of pollutant loads at source. The pollutant removal process is by harvesting runoff for reuse, thereby limiting the nutrients discharging to the waterways.
- A 20,000L storage tank will be provided in accordance with Council's minimum requirements and is to be reused for irrigation purposes.

Erosion & Sediment Control Plan

During construction, water quality control is achieved by deposition and trapping of silts and clays which often have nutrients such as phosphorus and nitrogen attached to their surfaces. Silt fences will be erected prior to construction to control sediment runoff. This will reduce and isolate sediments and particulate matter.

An Erosion and Sediment Control Plan has been provided in accordance with Landcom's "Managing Urban Stormwater – Soils and Construction (2004) and council Condition 41. This will ensure that a significant portion of sediments and attached nutrients can be contained on site during construction.

A copy of the preliminary Erosion and Sediment control plan is shown in Appendix B.

4.3 Water Quality Modelling

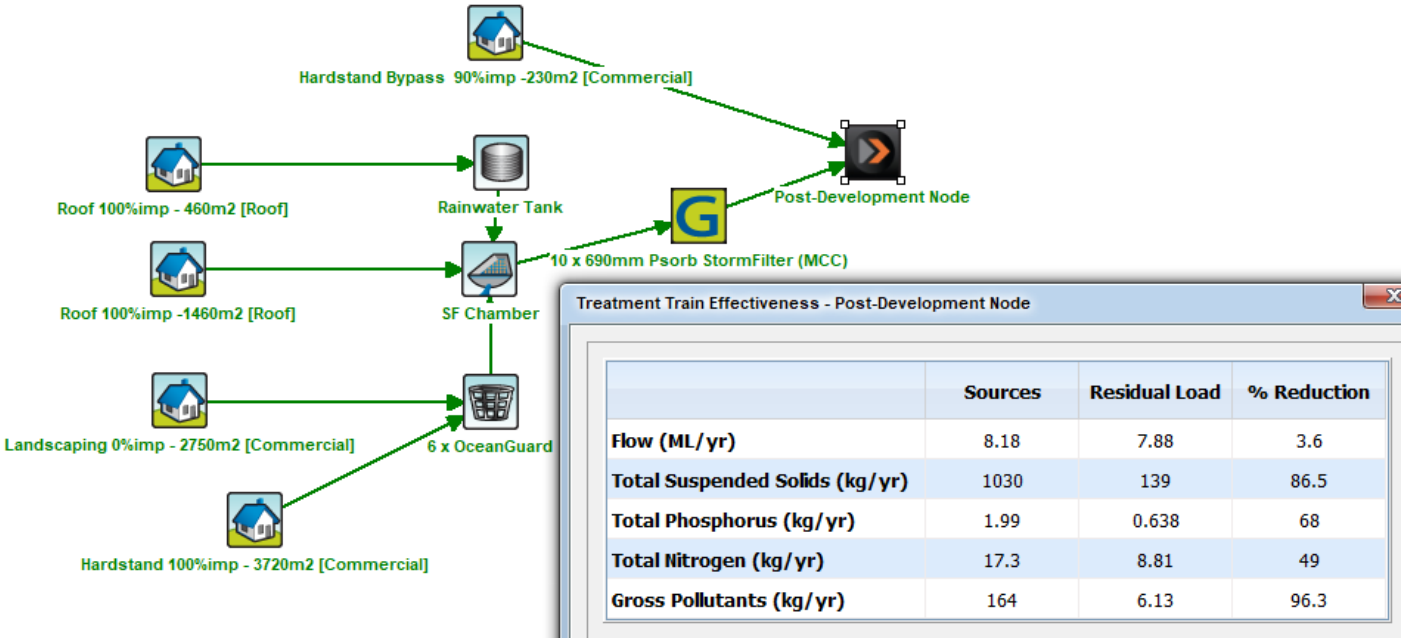
4.3.1 MUSIC

The effectiveness of the proposed water quality measures has been assessed using numerical modelling. Water quality modelling has been conducted using the software program MUSIC (Model for Urban Stormwater Improvement Conceptualisation). This program is used to establish the effectiveness of the water quality treatment proposed for the development site. MUSIC has been developed by the Cooperative Research Centre for Catchment Hydrology, and is designed as a planning tool for water quality treatment trains for catchment runoff. The program is able to model pollutant loads present in stormwater runoff from a catchment and assess the effectiveness of different treatment devices in terms of pollutant load reduction.

The rainfall data used was the six-minute time step from 1990 to 2010 from Sydney Airport Rainfall Station.

Catchment characteristics were defined using a combination of roof areas and non-roof catchments with varying imperviousness ratios to replicate the catchment for the developed condition.

The MUSIC model layout is shown below.



	Sources	Residual Load	% Reduction
Flow (ML/yr)	8.18	7.88	3.6
Total Suspended Solids (kg/yr)	1030	139	86.5
Total Phosphorus (kg/yr)	1.99	0.638	68
Total Nitrogen (kg/yr)	17.3	8.81	49
Gross Pollutants (kg/yr)	164	6.13	96.3

Fig. 4.1 – Water Quality Treatment Train Diagram

Refer to drawing DAC403 in appendix B for details the various land use areas for both the northern & southern portions of the proposed development.

4.3.3 Results

Table 4.1 below shows the calculated mean annual pollutant loads for the proposed site conditions before and after the implementation of the treatment devices.

	Total Suspended Solids (kg/yr)	Total Phosphorus (kg/yr)	Total Nitrogen (kg/yr)	Gross Pollutants (kg/yr)
Pre-treatment	1030	1.99	17.3	164
Post-treatment	139	0.638	8.81	6.13

Table 4.1 – Summary of Treatment Train and Results

Northern Beaches Council Water Management for Development Policy Version 2 26 Feb. 2021 outlines council's requirements for the reduction of pollutants from stormwater before it can be discharged from the site. These targets are listed in Table 4.2 below together with the percentage pollution reductions that will be achieved by the proposed treatment train.

Pollutant	Reduction Target	Reduction Achieved	Target Achieved
Total Suspended Solids (kg/yr)	85%	86.5%	YES
Total Phosphorus (kg/yr)	65%	68.0%	YES
Total Nitrogen (kg/yr)	45%	49.0%	YES
Gross Pollutants (kg/yr)	90%	96.3%	YES

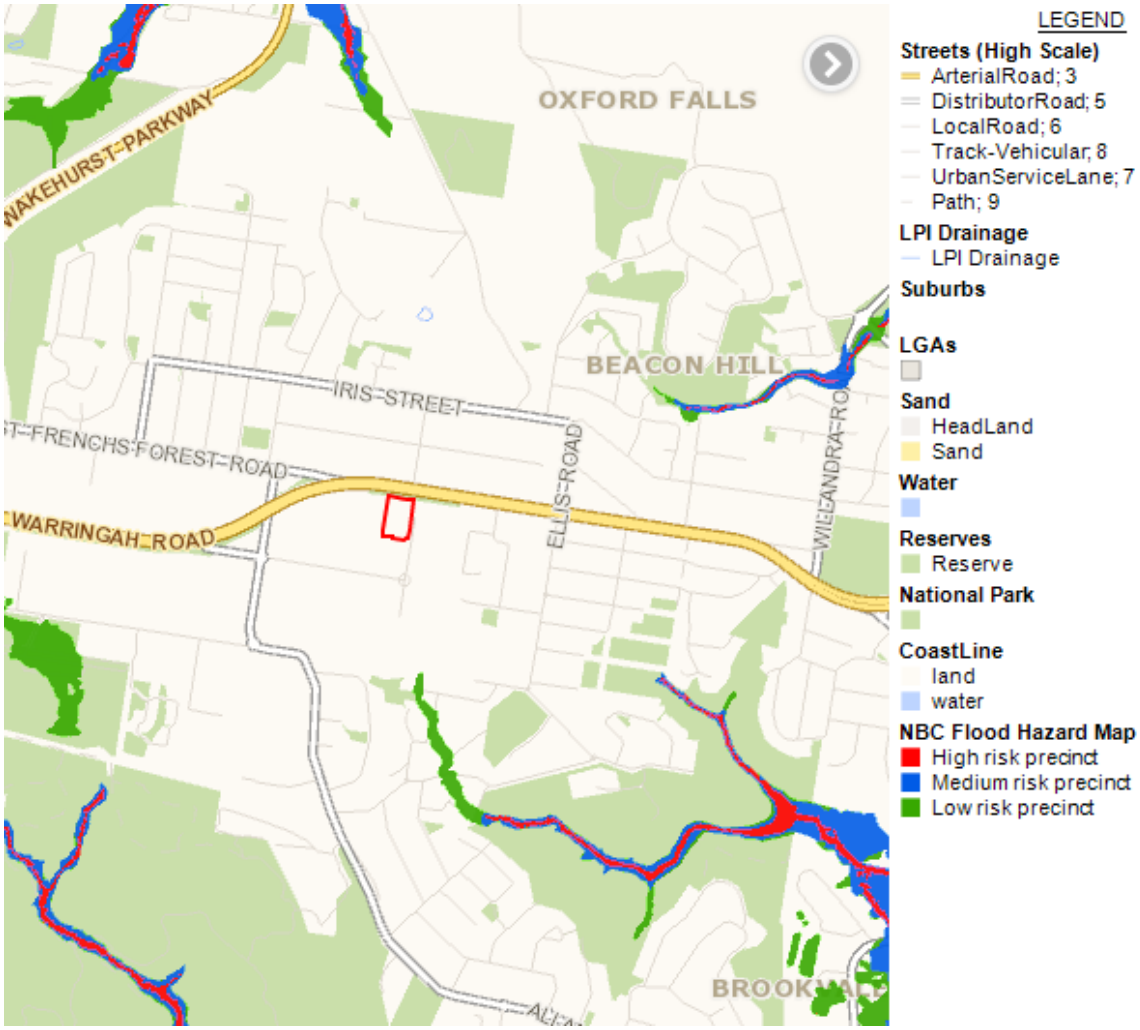
Table 4.2 – Comparison of Pollutant Reduction Target vs. Achieved

It is clear from the table above that the proposed water quality measures enable the reduction targets to be achieved for all key stormwater pollutants. Therefore, by implementing the proposed treatment train measures within the proposed development there will be no detrimental effect on the quality of stormwater running off from the site.

5. Flood Impact and Overland Flow Path Analysis

5.1 Flood Impact

The proposed development is unaffected by flooding as is within the flood-free zone. This is evident from the screen shot below obtained from the Northern Beaches Council Website.



5.2 Overland Flow Path Assessment

The existing site is fronted by the Warringah Road to the North and slopes from north to south. The proposed development can be found in appendix A in a similar location as the existing in terms of position and level with access road to the east of west of the building.

The Warringah Road frontage varies in level. In and east to west direction the top of kerb level varies from RL 164.12 to the east rising up to a crest at RL 164.5 back down to RL 163.15 to the west. Street view confirms the crest is located around the bus stop location and there are no pits on the Warringah Road frontage.

Evidence shows that there is no upstream catchment from the north of our boundary entering the property. The perimeter road will be able to cater for any minor nuisance flows from adjoining properties to the east or west.

6. Recommendations

The proposed development of the site could potentially lead to significant changes in water quantity and quality if a water sensitive urban design approach is not adopted as part of the development strategy.

The key strategies to be adopted for this development include the following:

1. A pit and pipe network to collect minor storm runoff from surface areas which will minimise nuisance flooding
2. Overland flow paths to carry major storms through and around the site without causing damage to property from overland flow;
3. Rainwater harvesting to allow rainwater reuse while at the same time providing improvement to the quality of stormwater runoff from the site and also providing some level of stormwater detention
4. Oceanguards at nominated inlet pits will form part of the water quality treatment train, removing pollutants and nutrients that are detrimental to downstream waterways;
5. An on-site stormwater detention tank to maintain existing peak flows will be constructed. The tank will be fitted with a StormFilter chamber to treat the water prior to it leaving the site.

The results from the investigations and modelling for this project that have been summarised in this report indicate that the development with the proposed WSUD strategy and management can provide a safe and ecologically sustainable environment.

Appendix A – Architectural Plans

Appendix B – Civil Plans

Appendix C – Survey Plan

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