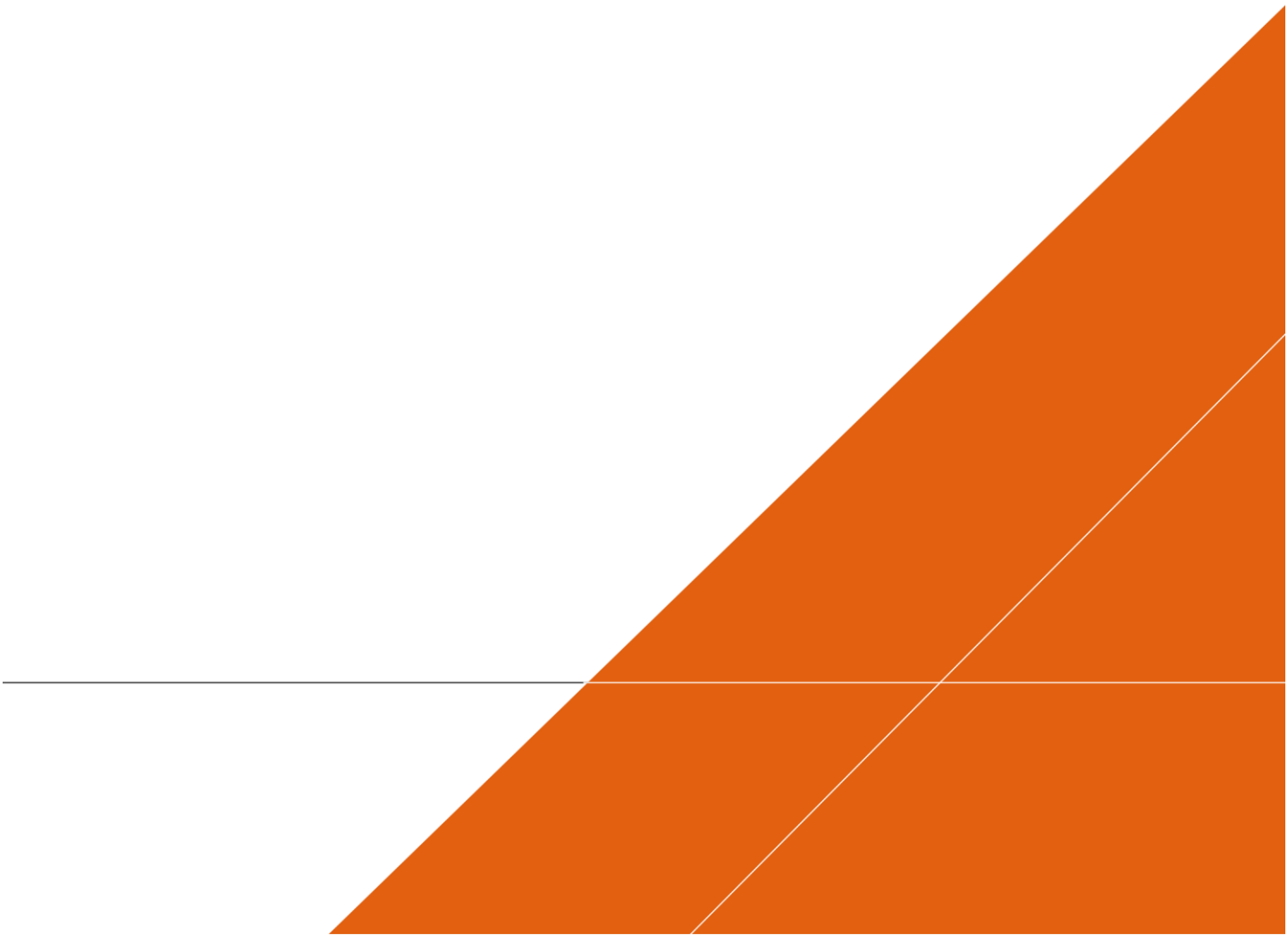
ARCADIS Design & Consultancy for natural and built assets

FORMER MANLY HOSPITAL REDEVELOPMENT

Stormwater Strategy Report

16 JULY 2020



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COX ARCHITECTURE
FORMER MANLY HOSPITAL REDEVELOPMENT

Stormwater Strategy Report

Author _____

Checker _____

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REVISIONS

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A	30/04/2020	Initial Draft	MG	MG
B	16/07/2020	Revised Draft Report	MG	MG

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1 INTRODUCTION

The NSW Government is seeking to redevelop the Former Manly Hospital site located at 150 Darley Road, Manly NSW 2095. Cox Architecture have been engaged by Development and Transactions, Property NSW, Department of Planning, Industry and Environment as the lead consultant for the preparation of the master plan and associated Planning Proposal.

Arcadis has been engaged to provide stormwater consultancy services to assist in the preparation, lodgement and approval of the Planning Proposal. Arcadis has reviewed the existing site conditions, relevant development controls and provided input into the concept master plan.

This stormwater strategy report has been prepared to support the Planning Proposal and outlines how stormwater will be adequately considered in the redevelopment of the site.

1.1 Proposal Site

The Former Manly Hospital Site is located at 150 Darley Road, Manly NSW 2095 within the Northern Beaches Local Government Area (formerly Manly Council prior to the 2016 Council amalgamation). The site is bounded by Darley Road to the north, North Head Scenic Drive and Collins Beach Road to the east, Sydney Harbour National Park to the south and St Paul's Catholic College Manly to the west. The existing main site entry is from Darley Road in the northwest, whilst an informal site access is also available from Collins Beach Road in the southeast.

The 6.18 ha site comprises of four parcels of land from DP 752038 as illustrated in Figure 1 below. To provide a holistic overview of the overall site redevelopment, DP 752038 lot 2728 (the Adolescent and Youth Adult Hospice site) is included in this stormwater strategy report. Whilst this lot forms part of the larger site, please note that it is not included in the current Planning Proposal. The current Planning Proposal is limited to DP 752038 lots 2619, 2727 and 2774 only.

Figure 1: Site Boundary and Lots Numbers

The developed areas of the site are currently zoned SP2 Infrastructure with the surrounding dense bushland zoned E2 Environmental Conservation. The bushland areas to the northeast and south of the site form part of the Sydney Harbour National Park managed by the National Parks and Wildlife Service (NPWS).

1.2 Key Terms & Abbreviations

The key terms and abbreviations used in this report are outlined in Table 1 below.

Table 1: Terminology

Term	Definition
AEP	Annual Exceedance Probability
ARI	Average Recurrence Interval
Council	Northern Beaches Council
DCP	Development Control Plan
FPL	Flood Planning Level
FPA	Flood Planning Area
ha	Hectare
LEP	Local Environment Plan
LGA	Local Government Area
mAHD	Meters to Australian Height Datum
NPWS	National Parks and Wildlife Service
OSD	On-site Detention
PMF	Probable Maximum Flood
WSUD	Water Sensitive Urban Design

2 EXISTING SITE CONDITIONS

The existing site conditions have been investigated utilising the following information sources:

- Site inspection by Arcadis staff conducted on the 13th December 2019. Key photos are provided as **Appendix A**.
- LTS Lockley 2018 topographical site survey.
- NSW Spatial Services 2013 Digital Elevation Models.
- Northern Beaches Council Online Maps.
- Various historical site drawings. Key drawings provided as **Appendix B**.
- Nearmap Imagery dated 28/2/2020.

2.1 Existing Land Use

The developed area of the site is approximately 4 ha and comprises of numerous buildings, internal roadways and connecting pathways with small pockets of vegetated areas. These often interconnected buildings have been added over the life of the former hospital leading to a disorganised site arrangement. Several sealed carpark areas are also located along the southern edge of the developed area.

Dense bushland is located along the eastern and southern edges of the developed area. An Ecological Constraints Assessment and Vegetation Management Plan have recently been developed for the site by Narla Environmental (February 2020).

2.2 Topography

The site is located on a relatively steep south-westerly slope with a significant drop in the terrain immediately south of the developed area. The existing site contours at 2m intervals are shown in **Figure 2** below.

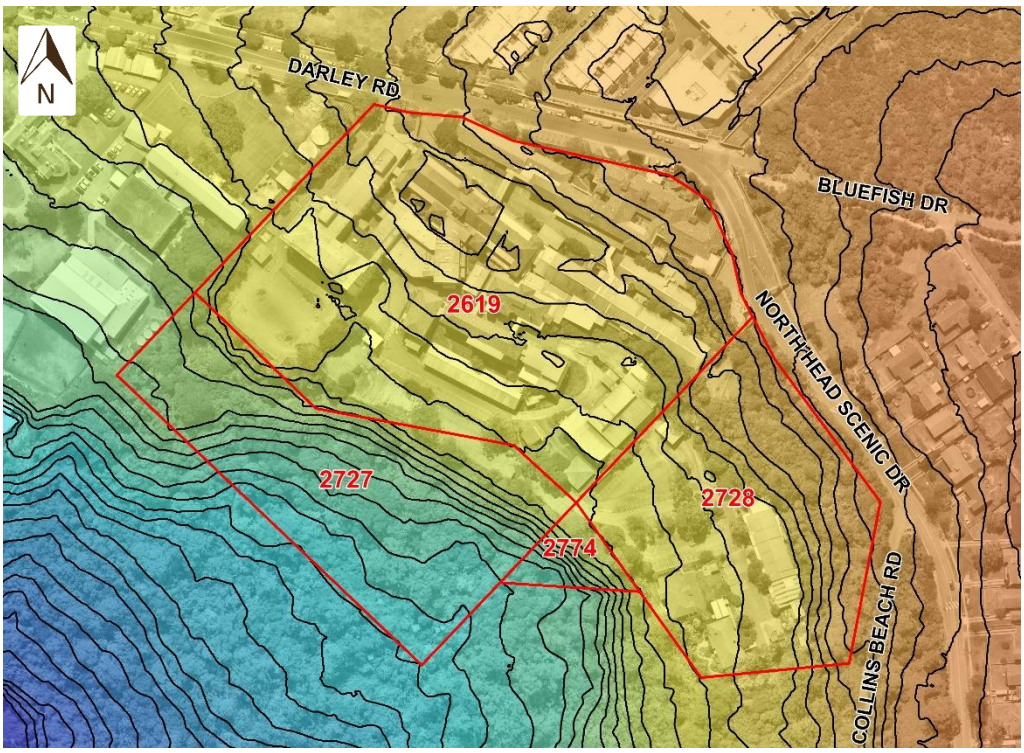


Figure 2: Existing Site Contours -2m Intervals

The developed area of the site falls from 69 mAHD at the corner of North Head Scenic Drive and Collins Beach Road, to 50 mAHD at the southern extent of the carpark area. Following a steep decline, the terrain falls to 32 mAHD along the site boundary to the Sydney Harbour National Park. The terrain continues to fall in a south-westerly direct to Collins Flat Beach at North Harbour.

No mapped watercourses are identified within, upstream or downstream of the site.

2.3 External Stormwater Catchment Area

As shown in **Figure 3** an external upstream catchment area of approximately 6.5 ha drains towards the site from the east. This compares to approximately 4.6 ha within the site which drains through the developed area to Lot 2727.

The external stormwater catchment area is roughly bounded by Bluefish Drive to the north and comprises of dense bushland and residential properties. With no formal drainage network (e.g. stormwater pits and pipes, channels or creeks) within the catchment, stormwater runoff is expected to sheet flow overland towards the site.

Some limited cross drainage is located at the intersection of Darley Road, Bluefish Drive and North Head Scenic Drive. This section of constructed open channel and pipelines drain to the stormwater trunk pipeline running through the site, as discussed further below in **Section 2.4**.

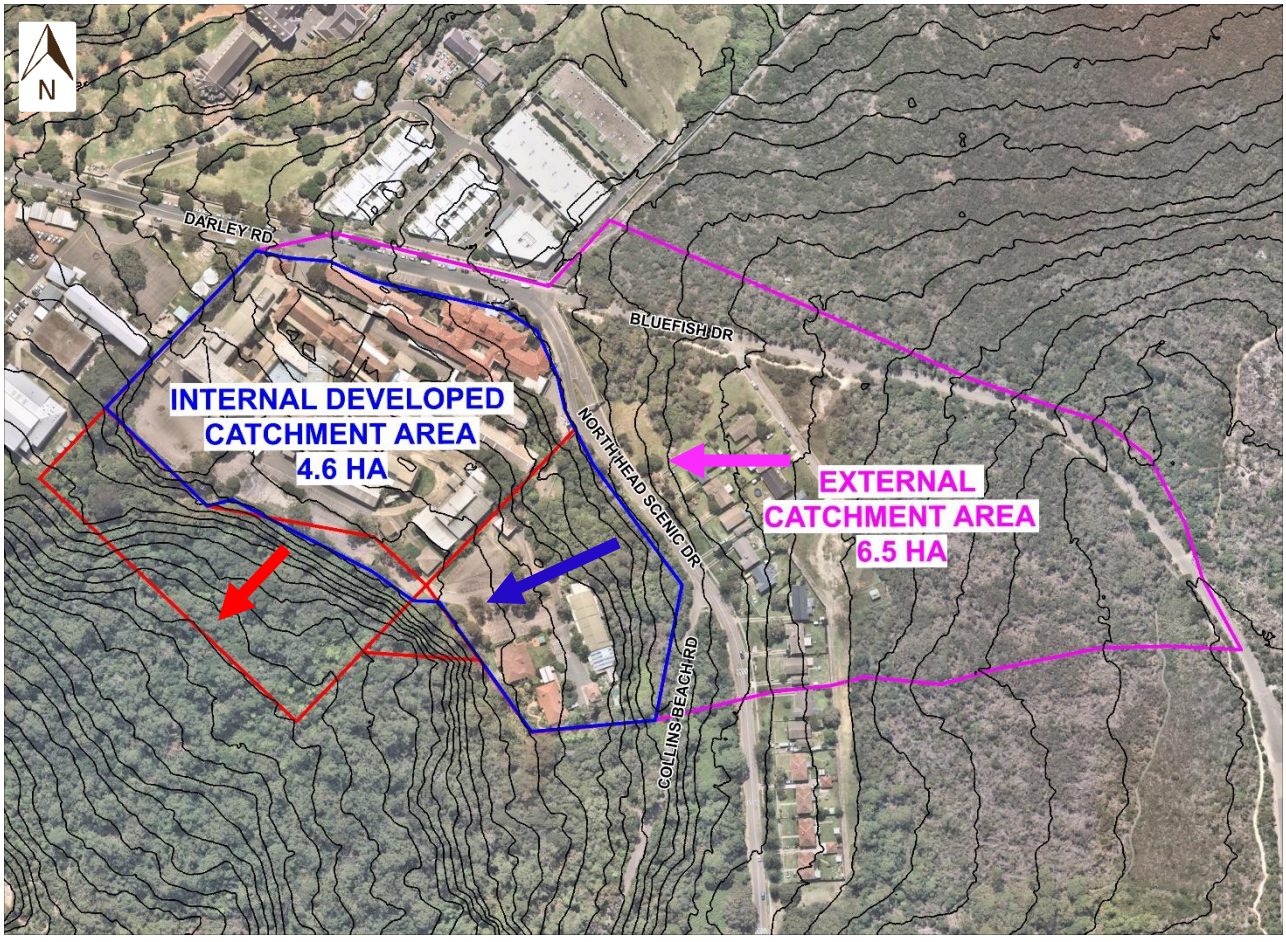


Figure 3: External Catchment Area

2.4 Site Stormwater Drainage Network

The overview of the existing site stormwater drainage network has been informed by the information sources outlined above. In instances where gaps or inconsistencies were apparent, engineering judgement has been used. Further detailed investigation and survey of the stormwater drainage network is recommended to inform the detailed design of the site.

Within the site, stormwater runoff is collected and directed to the downstream via dish drains, roadway kerb and gutters and some formal pit and pipe drainage lines. Whilst some minor drainage lines and inlet pits are located throughout the site, their capacity appears to be low, given the pipe diameters and conditions surveyed. The connectivity of the drainage network through the site is also difficult to establish given the disorganised site arrangement. During large rare rainfall events the majority of stormwater runoff from the site will be conveyed to the downstream via the roadways. In some locations ponding may occur along roadways where no overland flow path is provide to the downstream as discussed further in **Section 2.5** below.

The main stormwater pit and pipe drainage lines running through the site are illustrated in **Figure 4**. As mentioned, stormwater runoff from a portion of the upstream catchment is collected in a constructed open channel and pipeline at the intersection of Darley Road, Bluefish Drive and North Head Scenic Drive. These drainage lines connect to a 600mm diameter concrete pipe running northeast to southwest through the site. This trunk drainage line runs parallel to the site's internal sandstone wall, with the pipeline located approximately 2.5m east of the wall. Additional site drainage is connected to this trunk line prior to it discharging to the bushland (Lot 2727) via a headwall. Additional stormwater drainage lines appear to discharge from the car park areas into the bushland via headwalls at 3 additional locations.

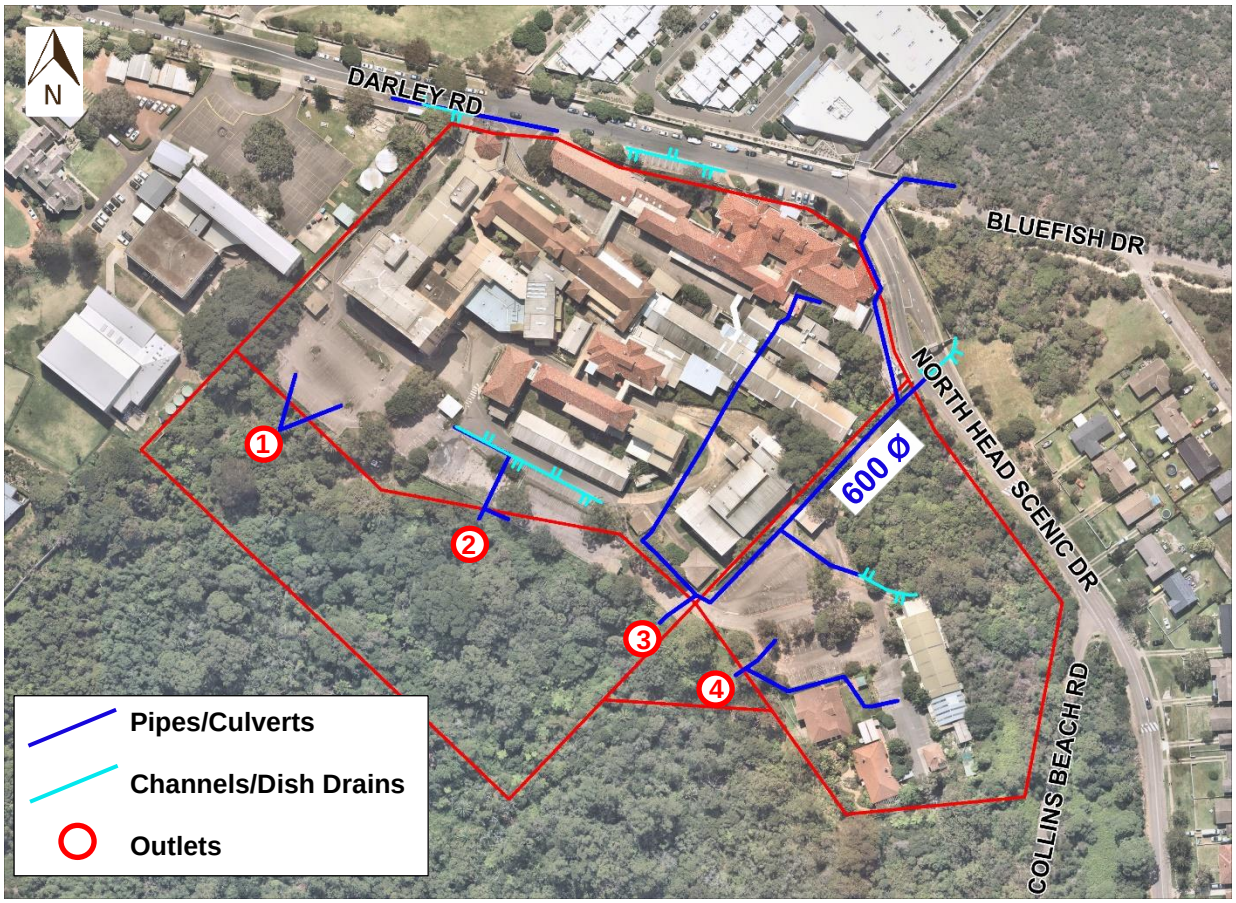


Figure 4: Existing Drainage Network

In addition, a small length of excavated open channel has been identified at the downstream of the site bushland bordering North Head Scenic Drive. This earth channel is adjacent to the roadway and appears to capture stormwater runoff from minor events to drain via a headwall to the site's drainage network.

Stormwater runoff from the site and upstream catchment area drains southwest through the Sydney Harbour National Park eventually discharging to Collins Flat Beach, North Harbour. No watercourses or creek lines are apparent downstream of the site. The lack of concentrated flow paths has likely resulted from the density of the bushland making survey difficult. The density of the bushland within and surrounding the site is expected to significantly slow and detain stormwater runoff.

No stormwater quality treatment measures, such as gross pollutant traps, or stormwater harvesting measures such as rainwater tanks have been identified within the site.

2.5 Flooding

The Northern Beaches Council online maps identify some low to medium flood risk precincts within the site, as shown below in **Figure 5**. Council has confirmed this flood information has been based on the Manly to Seaforth Flood Study (2019) prepared for Council by Cardno. Flood mapping extracts from this flood study report for the 1% Annual Exceedance Probability (AEP) and Probable Maximum Flood (PMF) events have been provided as **Appendix C**. Information is presented for the peak flood depths, hydraulic categories and provisional flood hazard.

This flood mapping illustrates:

- Ponding of flow - isolated ponding of overland flow at several locations across the site is evident. This appears to have resulted from a lack of overland flow paths and/or drainage network capacity in these areas of the site.
- Hospital entrance ponding – the entrance to the existing hospital appears to be the worst location for ponding with a significant flood extent along the roadway during the 20% AEP (5-year ARI) event. Stormwater runoff appears to collect at the low point of the roadway and is unable to sufficiently drain to the downstream. The ponding at this location is considered flood storage with depths in the range of 0.5m to 1m for the 1% AEP (100-year ARI) event.
- During large rare rainfall events, overland flow from the site and upstream catchment area appears to collect near the eastern boundary of Lot 2727. This flow path appears to coincide with the two stormwater drainage network outlets near Lot 2774.

In reviewing the existing flood information, consideration needs to be given to the flood modelling methodology applied and purpose of the flood study. The Manly to Seaforth Flood Study utilised a SOBEK flood model featuring a 2.5m grid size and direct rainfall runoff approach with buildings represented as areas of high ground surface roughness.

As the flood study was developed for a significantly larger catchment area than the site, it may not accurately represent all the hydraulic features of the site, in particular the finer scale features. Whilst some pit and pipe drainage network information were included in the flood model, none of the Former Manly Hospital site drainage network, or that in the immediate area along Darley Road, Bluefish Drive or North Head Scenic Drive has been included. Other above ground obstructions which may influence overland flow paths, such as minor buildings and solid walls are unlikely to have been represented in the flood model. As a result, the areas of ponding within the site may be conservative.

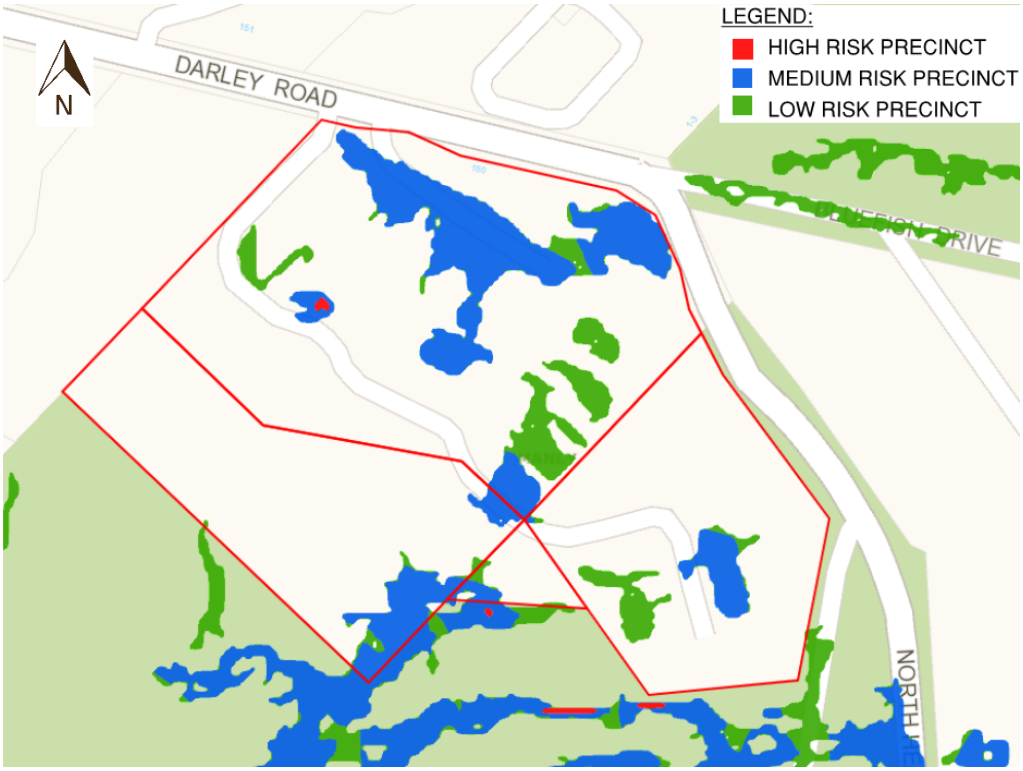


Figure 5: Northern Beaches Council Online Maps - Flood Risk Map

It is recommended that site specific flood modelling be undertaken during the design development of the proposed site. A fit-for-purpose flood model would aid in ensuring any flood constraints are well understood and that any flood risks are adequately mitigated against. It is likely that this flood modelling would also be required to address the Council requirement for a Flood Management Report as discussed in **Section 3.1.4**.

3 DEVELOPMENT CONTROLS

The following section outlines the development controls applicable to the redevelopment of the site relating to stormwater, specifically stormwater quantity, quality and flooding. Given that the site discharges stormwater to the Sydney Harbour National Park, the NSW National Parks & Wildlife Service requirements need to be considered in addition to those of Northern Beaches Council.

The development controls below are relevant to the design outcomes of the proposed redevelopment. Additional erosion and sediment controls will also apply throughout the construction period of the redevelopment.

3.1 Northern Beaches Council

In 2016, the Northern Beaches Council was formed from the amalgamation of the former Manly, Pittwater and Warringah Councils. Until such a time as a combined Local Environmental Plan (LEP) and Development Control Plan (DCP) is announced for the Northern Beaches local government area (LGA), the Manly 2013 LEP and DCP apply to the site. Relevant extracts from the Manly DCP are provided as **Appendix D**. With respect to stormwater the DCP is supported by the following Manly Council specifications:

- Specification for Stormwater Drainage (2003)
- Specification for On-site Stormwater Management (2003)

3.1.1 Stormwater Drainage Design

The Specification for Stormwater Drainage (2003) provides guidelines for the design of drainage systems to cater for public and private stormwater infrastructure.

In accordance with *Section 5 - Stormwater Disposal*, stormwater drainage shall follow the natural fall of the land and must be disposed by gravity. Re-directing runoff from one catchment to another is not permitted. *Section 7 – Hydrology* also requires minor drainage systems for commercial buildings to be designed for the 1 in 50 year ARI (2% AEP) with major drainage systems consisting of overland flow paths to be designed for the 1 in 100 year ARI (1% AEP). A percentage impervious of 100% is required to be adopted for commercial areas.

3.1.2 On-Site Detention (OSD)

In accordance with the Specification for On-site Stormwater Management (2003), the site is located within Zone 3 as indicated in **Figure 6** below. Properties within Zone 3 are required to control stormwater runoff to protect adjoining properties, bushland, roadways and receiving waters from degradation due to silt laden stormwater runoff using appropriate scour and erosion control devices. The specification requires the installation of pollution control devices (such as gross pollutant traps) and scour protection devices (such as energy dissipators, concrete aprons). However, on-site detention is not required for the site in line with this specification. Relevant extracts from this specification are provided as **Appendix E**.

3.1.3 Water Sensitive Urban Design

It is anticipated that Northern Beaches Council will require a Water Sensitive Urban Design Strategy to be presented for the redevelopment of the site. In accordance with the Manly DCP (2013), *Section 3.5.8.2* this strategy is to describe the measures used to achieve the pollutant reduction targets in post development average annual loads as provided in **Table 2** below.

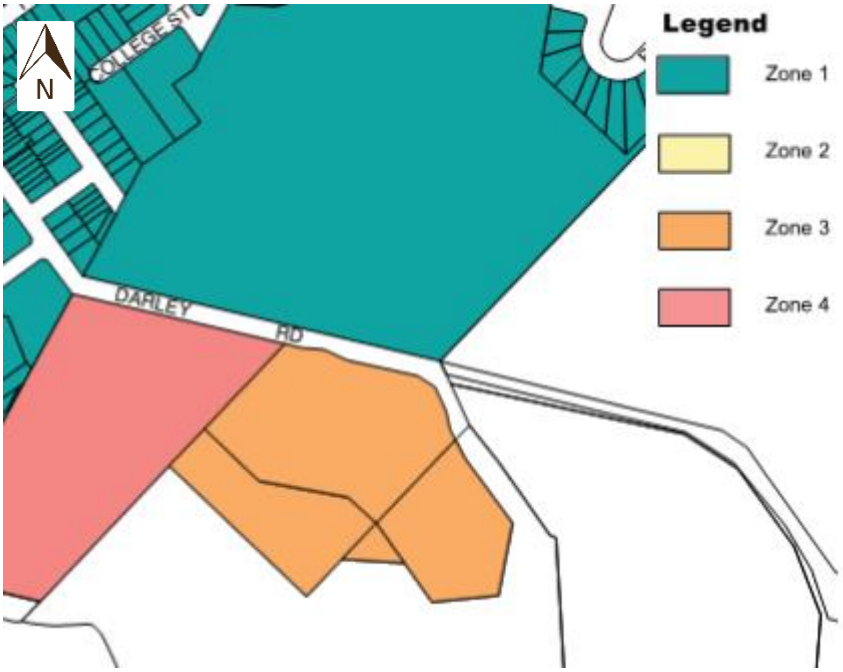


Figure 6: Manly Council - Specification for On-site Stormwater Management (2003) – Map D

Table 2 – Pollutant Reduction Targets

Pollutant	Reduction Targets
Gross Pollutants	90%
Total Suspended Solids (TSS)	80%
Total Phosphorus (TP)	60%
Total Nitrogen (TN)	45%

3.1.4 Flooding

In accordance with the Manly DCP (2013), *Section 5.4.3 Flood Prone Land* specifies the requirements for flood affected developments. As noted in **Section 2.5** there is some flood risk identified within the existing site, generally within the Medium Flood Risk Precinct.

The Manly DCP provides a Development Matrix of Flood Prone Risk Precincts which specifies the prescriptive controls that applied to development on flood prone land. A complete summary table of the relevant controls for the site is included in **Appendix F**. The site land use would be classified as vulnerable uses based on the developed concept master plan. Of note at this stage of the project are the controls related to:

- Flood effects caused by development
- Flood emergency response
- Floor levels
- Car parking

The redevelopment of the site will aim to reduce the flood risk on site and consequently lesser development controls may apply.

A Flood Management Report will need to be submitted to Council as part of future development applications. This will require a flood analysis of the predicted 1% AEP, PMF, FPL, Flood Risk Precinct and flood characteristics as well as an assessment of potential flood impacts.

3.2 National Parks and Wildlife Service

Given that the site discharges stormwater to the Sydney Harbour National Park, approval of the proposed redevelopment will be sought from the National Parks & Wildlife Service (NPWS). Guidance on this matter is provided in the NSW National Parks and Wildlife Service's *Guidelines for developments adjoining land managed by the Office of Environment and Heritage* (2013). Relevant extracts from these guidelines are provided as **Appendix G**.

Regarding stormwater runoff, the guidelines recommend:

- Development proposals for areas adjacent to OEH land should incorporate stormwater detention and water quality systems (with appropriately managed buffer areas) within the development site.
- Stormwater should be diverted to council stormwater systems or to infiltration and subsurface discharge systems within the development site.
- The discharge of stormwater to OEH land, where the quantity and quality of stormwater differs from natural levels, must be avoided.

Approval may be granted to allow the discharge of stormwater where it cannot be avoided. In requesting approval developments are required to meet the following stormwater management standards:

- No increase in pre-development peak flow from rainfall events with a 1 in 5 year and 1 in 100 year recurrence interval
- No increase in the natural annual average load of nutrients and sediments
- No increase in the natural average annual runoff volume.

With respect to these standards NPWS (L. De Gail 2020, pers. comm., 25 May) have clarified that "pre-development" refers to the existing site conditions i.e. 2020 and not those prior to any historical development of the site. To achieve these stormwater management standards on-site detention, water quality treatment, stormwater infiltration and/or stormwater reuse may be required.

NPWS are expected to request an assessment identifying the current site conditions and consideration of any potential changes in stormwater runoff quantity or quality. This assessment is to cover all stages of the development from pre-construction site preparation works, through to construction of all stages of works and lastly the post-construction stage before and after any proposed stabilisation works. Ongoing consultation with NPWS is recommended throughout the design of the redevelopment.

4 PROPOSED STORMWATER STRATEGY

In redeveloping the site, the following general stormwater management principles will be considered:

- Maintaining existing sub-catchment areas
- Maintaining existing and creating adequate overland flow paths to the downstream
- Maximising pervious areas
- Providing stormwater quality treatment measures
- Maintaining flood storage
- Identification and reduction of flood risk through design

By considering these principals, the relevant development controls can be achieved, and any potential impacts of the proposed redevelopment minimised.

The developed stormwater strategy for the proposed redevelopment is outlined in the following sections. An integrated water management approach adopting best practice water sensitive urban design measures is at the centre of the redevelopment's stormwater strategy. Where feasible the redevelopment will aim to go beyond minimum development control requirements to sustainably reduce flood risk, maximise water quality treatment and water reuse.

4.1 Stormwater Drainage Network

4.1.1 Existing Trunk Drainage Maintained

The existing trunk drainage pipeline (600mm diameter concrete pipe) running through the site will be maintained. By preserving this drainage line in place, this will avoid impacts on the upstream drainage infrastructure and the sandstone wall running parallel to the pipeline. Where ground levels may change as a result of the redevelopment, consideration needs to be given to maintaining sufficient cover over the existing drainage line.

In instances where additional site drainage discharges to this trunk drainage line, any water quality treatment will occur prior to discharge.

4.1.2 Pit and Pipe Network Expanded

The formal drainage network within the site will be replaced and/or expanded to accommodate the proposed redevelopment. Where feasible utilising natural drainage lines and vegetated swales will take priority over pipe drainage systems in line with a WSUD approach.

The capacity of the drainage network will be required to meet Council specifications as mentioned in **Section 3.1.1**. Kerbs and dish drains will be used to convey flows along roadways. Vegetated swales will be used to collect flows from bushland as they approach landscaped areas. Castellated kerbs will also be used to convey runoff from roadways to landscapes areas, vegetated swales and bioretention basins as discussed further in **Section 4.2** below.

Internal roadways will be graded to ensure that overland flows during large rare rainfall events, can be conveyed to the downstream. The redevelopment will aim to avoid any ponding of flows within the site through the provision of adequate site drainage and the elimination of trapped low points in the terrain aiming to reduce the flood risk within the site.

4.1.3 Stormwater Drainage Outlets Maintained

The locations of the existing stormwater drainage outlets will be maintained. The site drainage design will aim to maintain the existing sub-catchment areas draining to each outlet. Further site survey is required to determine the exact location and condition of the existing stormwater drainage outlets which are located within dense bushland. It is unclear if any of the existing outlets will need to be extended or impacted by the extent of the redevelopment. Additional scour protection measures may be required for these drainage outlets. Where required, natural materials will be used to assist with scour protection.

Any modification works regarding to the existing outlet structures will need to weigh up the benefit of infrastructure improvements against the environmental impacts of construction activities occurring within the dense bushland environment.

4.1.4 On-site Detention Considered

Hydraulic modelling of the existing and proposed drainage network will be undertaken to determine any impacts on peaks flows leaving the site. Should peaks flows increase at any outlets, additional on-site detention will be required. Any on-site detention is proposed to be located in landscaped or car parking areas of the site. The preference will be for an on-site detention to be located in above ground landscape areas than below ground tank alternatives in line with a more sustainable approach.

As mentioned in **Section 3.1.2**, Council does not explicitly require on-site detention for the site in accordance with their specification, however NPWS require mitigation of peak flows to existing conditions.

In reviewing the concept master plan, it appears the percentage imperviousness of the site is not proposed to increase. By maximising the perviousness of the site and maintaining existing sub-catchment areas, the need for any on-site detention will reduce. The redevelopment will aim to maintain the existing percentage perviousness of the site, whilst considering an increase in perviousness as a stretch goal.

The redevelopment will aim to minimise directly connected impervious areas and adopt permeable pavement to further minimise the need for on-site detention.

In providing an adequate site drainage network (by expanding the drainage network and providing adequate overland flow paths), the flood risk within the site may be reduced but this may result in increased peak flow leaving the site and the need for additional on-site detention at the downstream.

The need for on-site detention will be analysed and determined through the detailed design of the redevelopment.

4.2 Water Sensitive Urban Design

In line with best practice, as well as the need to meet Council's requirements (as outlined in **Section 3.1.3**), water sensitive urban design (WSUD) measures will be incorporated into the design of the redevelopment aiming to:

- Improve stormwater quality
- Improve water efficiency
- Utilise alternative water sources

In order to improve the stormwater quality discharging from the site the redevelopment proposes to incorporate gross pollutant traps and bioretention basins as the primary means of achieving the stormwater pollutant reduction targets. Other measures such as tree pits and vegetated swales will also be implemented where site conditions are suitable. Castellated kerbs will be used to convey flows to vegetated areas to support passive irrigation and the use of vegetated swales and bioretention

basins to provide stormwater conveyance as an alternative to traditional kerbs, impervious channels and pipes. Plant species selection will be adopted to maximise the water quality treatment performance of these vegetated systems.

Gross pollutants traps are recommended to be located prior to collected runoff being treated by bioretention basins. Both the gross pollutant traps and bioretention basins are to receive the very frequent runoff from minor storm events, typically defined as the 3 month design flow. Higher flows from larger rarer storm events are designed to bypass the water quality treatment measures.

These measures will be provided for the majority of stormwater runoff collected by the site drainage network. The site drainage design will aim to avoid and minimise any sub-catchment areas from bypassing these treatment measures.

In addition to these measures and as discussed above, on-site detention and scour protection devices (such as energy dissipators, concrete aprons) may be required. The need for such measures will be determined during the detailed design of the redevelopment.

Rainwater harvesting will be incorporated into buildings to supplement the water quality treatment train and ultimately reduce the potable water demand. This will be achieved by potentially utilising harvested water for toilet flushing, laundry and irrigation on new buildings. Exiting buildings can also be retrofitted with rainwater tanks to help with irrigation demands.

We recommend further consultation with Council to confirm their preferences for specific water sensitive urban design measures. To access the performance of the proposed WSUD measures MUSIC modelling will be carried out to confirm compliance with Council requirements during the detailed design phase.

4.3 Flood Constraints Considered

The potential flood risk on site has the potential to impact the floor levels of the proposed additional buildings. However, consideration also needs to be given to the historical buildings remaining on site. The historical buildings represent a site constraint to the surrounding works, which may need to consider flood proofing where flood risk remains.

The redevelopment will however aim to reduce the flood risk on site through the redesign of roadways and the stormwater drainage network. Flood controls appliable to the redevelopment may reduce as a result.

As discussed in **Section 2.5**, it is recommended that site specific flood modelling be undertaken to determine the proposed flood behaviour of the redeveloped site. A fit-for-purpose flood model would aid in ensuring any flood constraints are well understood and that any flood risks are adequately mitigated against. It is expected that this flood modelling will also be required to address the Council requirement for a Flood Management Report as discussed in **Section 3.1.4**.

5 CONCLUSION

The presented stormwater strategy for the redevelopment adopts an integrated water management approach. Looking beyond conventional pits and pipes, stormwater is treated as a valuable resource and suitably considered across the civil, buildings and landscape design. The impacts of the site urbanisation on the water cycle are mitigated by employing a range of appropriate water sensitive urban design measures.

Where feasible the redevelopment will aim to go beyond minimum development control requirements to sustainably reduce flood risk, maximise water quality treatment and water reuse potential.

To maximise the potential for the redevelopment to achieve a sustainable and resilient outcome this integrated water management approach is recommended to be considered, promoted and supported from the onset through to the detailed design. To further support the stormwater strategy as the project progresses, we recommend:

- Ongoing consultation with Northern Beaches Council and NPWS. This will enable the design of the site redevelopment to progress collaboratively and ensure any stakeholder preferences or concerns are adequately addressed.
- Further topographical survey of the existing site drainage network and outlets. Understanding the existing drainage network (layout, catchments and capacity) is essential as this forms the base case against which proposed development will be measured against.
- MUSIC modelling and design detailing of the proposed water quality treatment measures early in the design process. By understanding their requirements earlier, it ensures they are prioritised in the design process.
- Developing a site specific, fit-for-purpose flood model early in the design process. This would aid in ensuring flood constraints are well understood and that any flood risks are adequately mitigated against.

APPENDIX A

Site Inspection Photos

13th December 2019

Photo 1: Internal Roadway – Existing Hospital Entrance

Photo 2: Internal Roadway – Rear of Existing Hospital Main Building

Photo 3: Internal Roadway – Approach to Darley Road from Southern Carpark Areas

Photo 4: Internal Roadway and Southern Carpark with Dish Drain

Photo 5: Carpark along Southwest Boundary of Lot 2619

Photo 6: Kerb Inlet Pit and Dense Bushland along Southwest Boundary of Lot 2619

Photo 7: Excavated Earth Channel Downstream of Bushland in Lot 2728

Photo 8: Sandstone Wall Parallel to Stormwater Trunk Drainage Line

Photo 9: Site Access from Collins Beach Road with Surrounding Dense Bushland

Photo 10: Drainage Channel and Culverts Crossing North Head Scenic Drive

APPENDIX B

Historical Plans

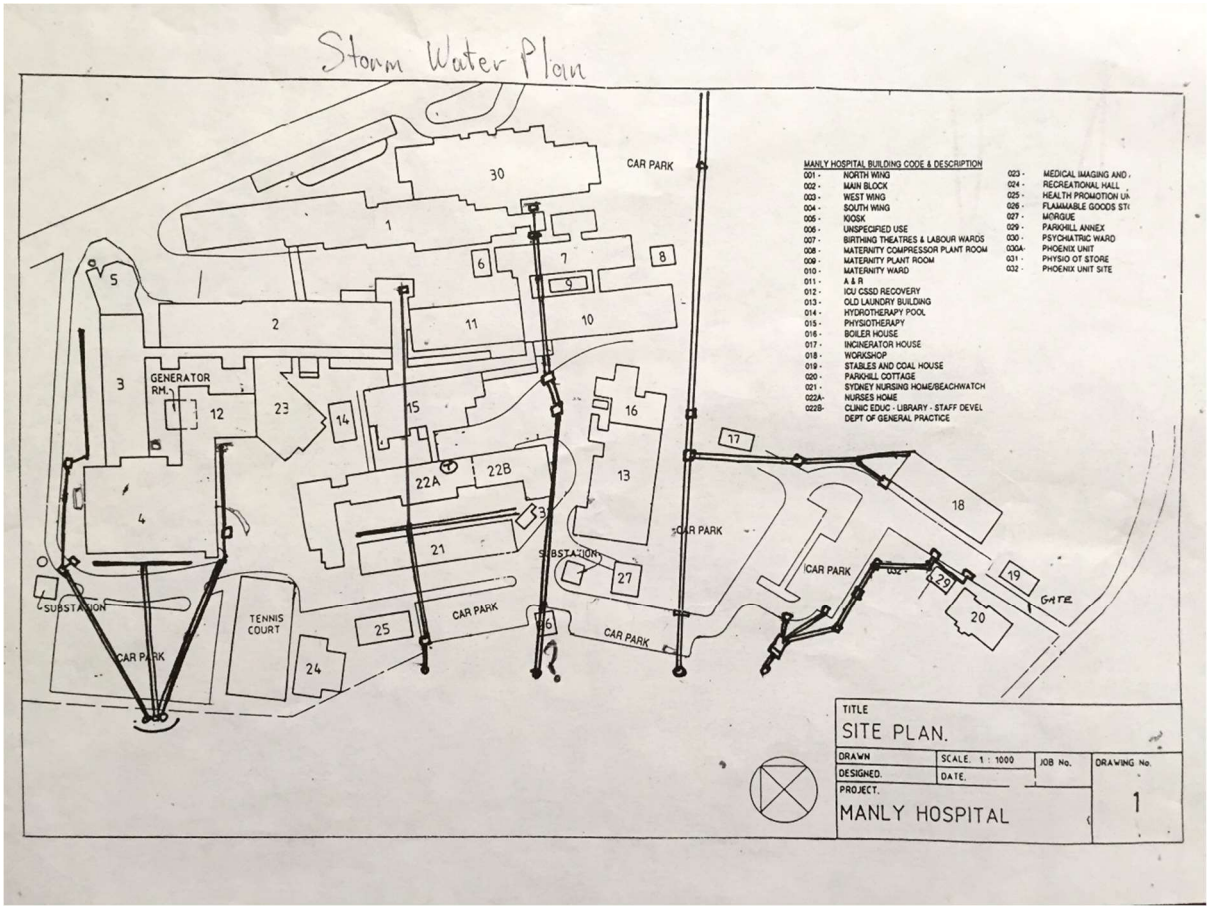


Photo 1: Site Plan

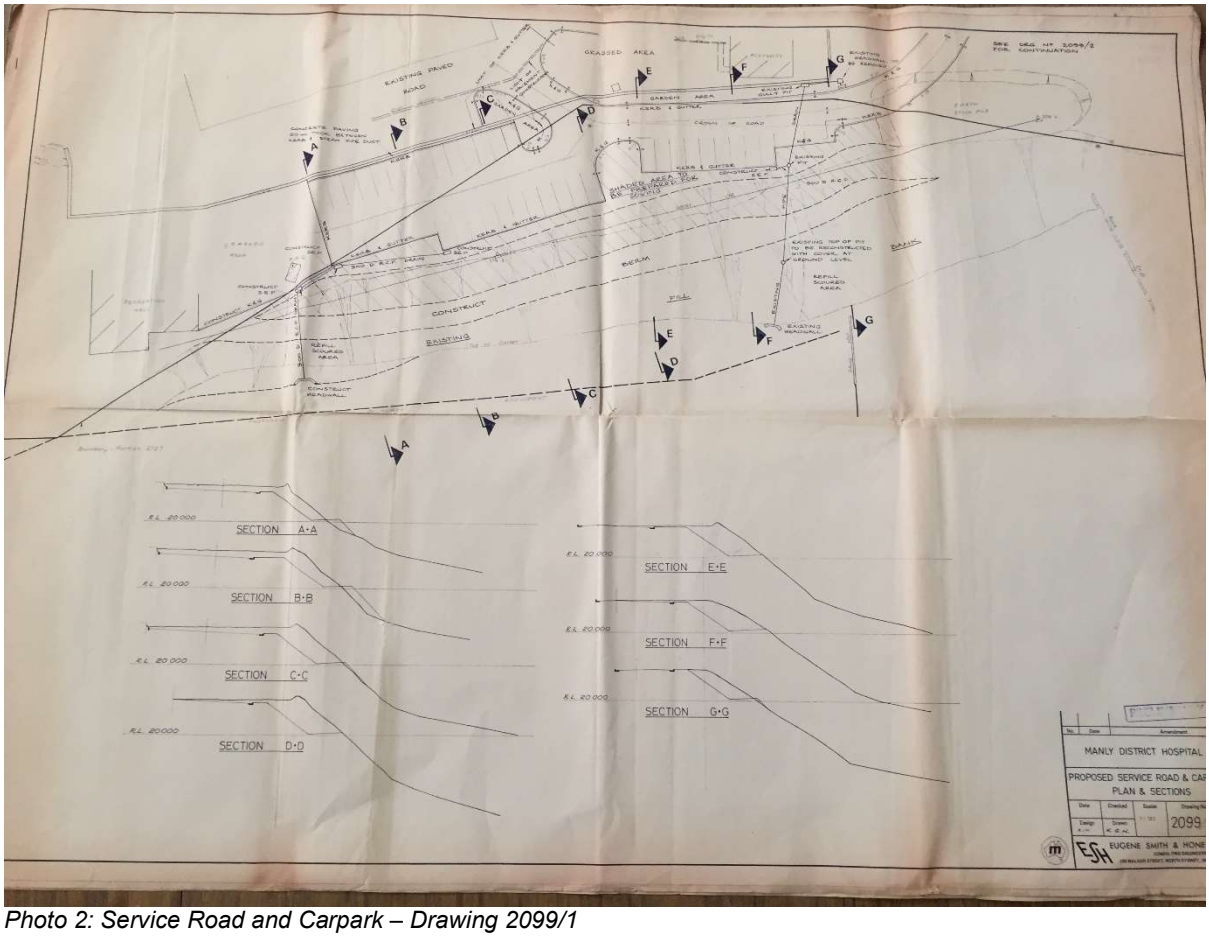


Photo 2: Service Road and Carpark – Drawing 2099/1

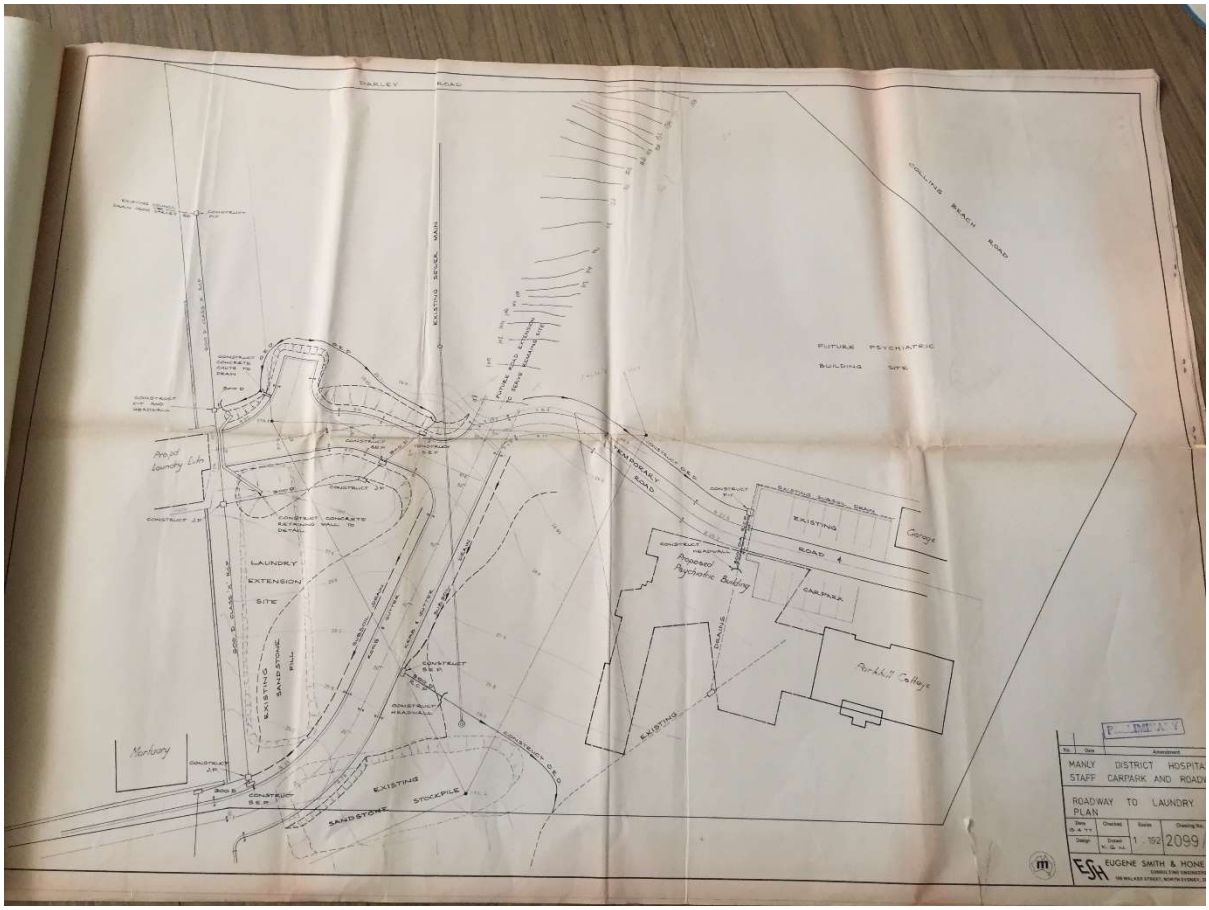


Photo 3: Staff Carpark and Roadway – Drawing 2099/2 (1977)

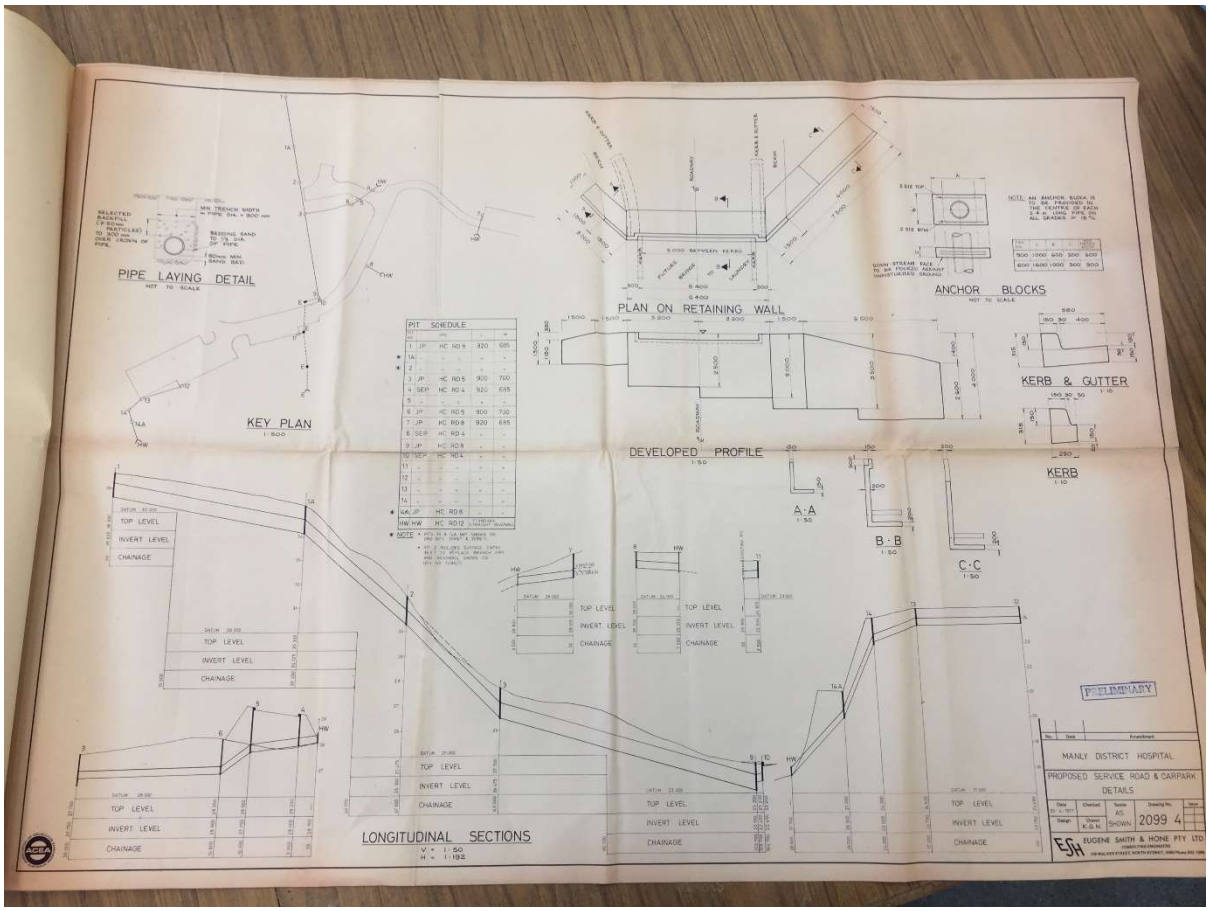


Photo 4: Proposed Service Road and Carpark Details – Drawing 2099/4 (1977)

APPENDIX C

Manly to Seaforth Flood Study (Cardno, 2019) Extracts

Manly to Seaforth Flood Study

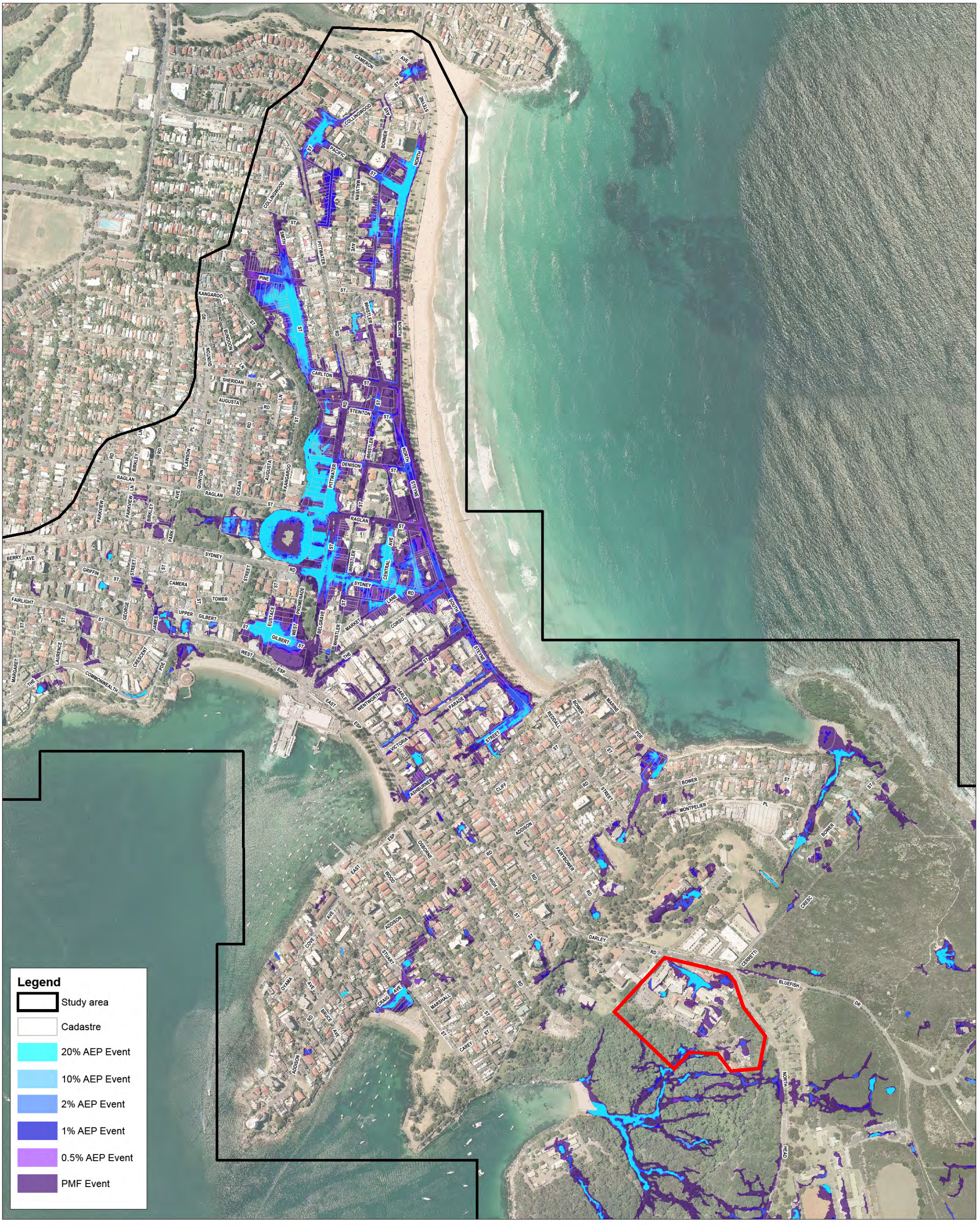
Flood Study Report

NA49913018

Prepared for
Northern Beaches Council

22 February 2019

Cardno
Shaping the Future



Manly to Seaforth Flood Study
Peak Flood Inundation Extent
Map 3/4

Figure 3

Cardno

Legend

Study area

Cadastre

Peak Flood Depth (m)

0.15 to 0.5

0.5 to 1

1 to 1.5

1.5 to 2

2 to 3

3 to 4

> 4

N

0.2 0 0.2 0.4 0.6

Kilometers

Manly to Seaforth Flood Study
1% Peak Flood Depths
Map 3/4

Figure 23

Cardno

Legend

Study area

Cadastre

Peak Flood Depth (m)

0.15 to 0.5

0.5 to 1

1 to 1.5

1.5 to 2

2 to 3

3 to 4

> 4

N

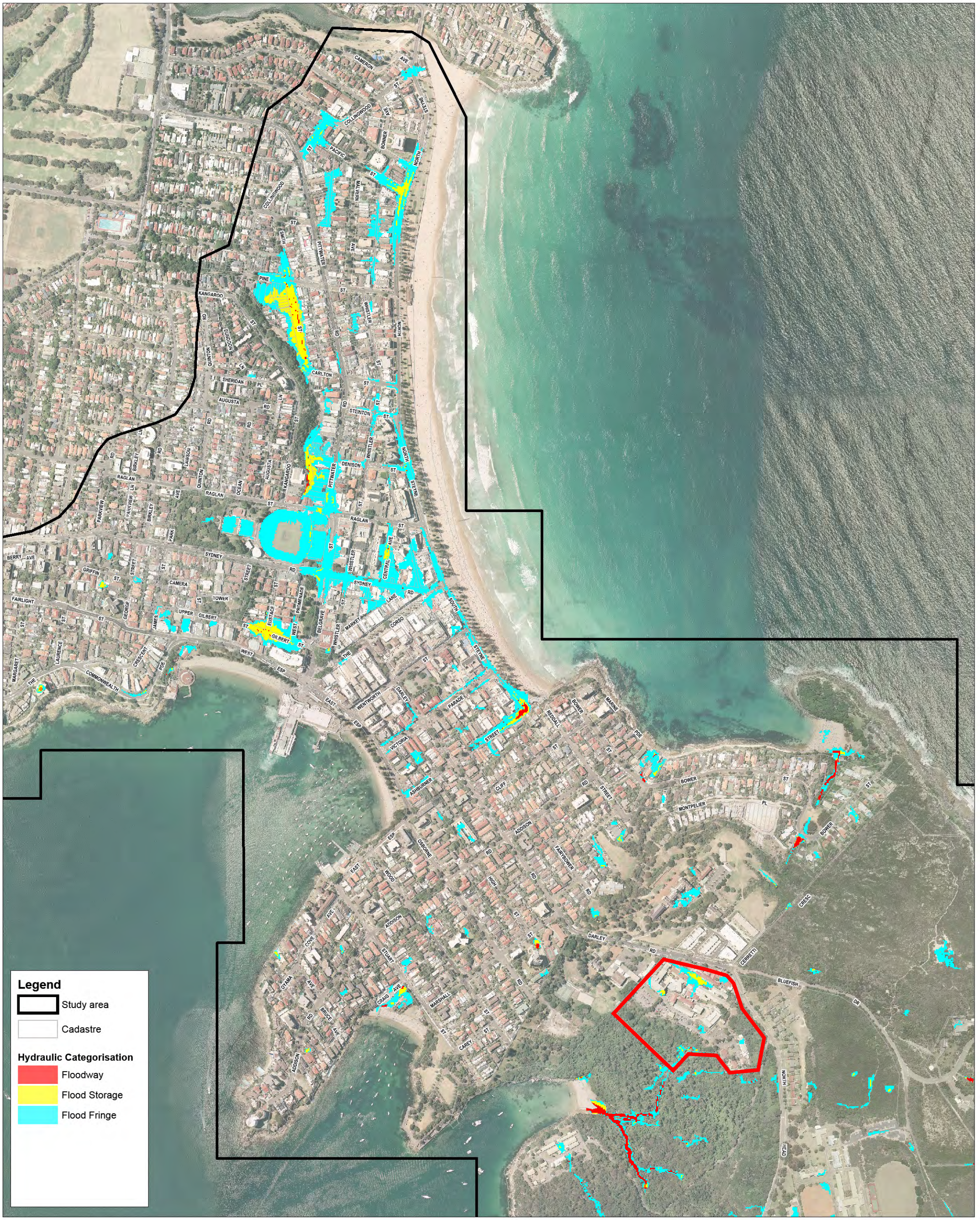
0.2 0 0.2 0.4 0.6

Kilometers

Manly to Seaforth Flood Study
PMF Peak Flood Depths
Map 3/4

Figure 27

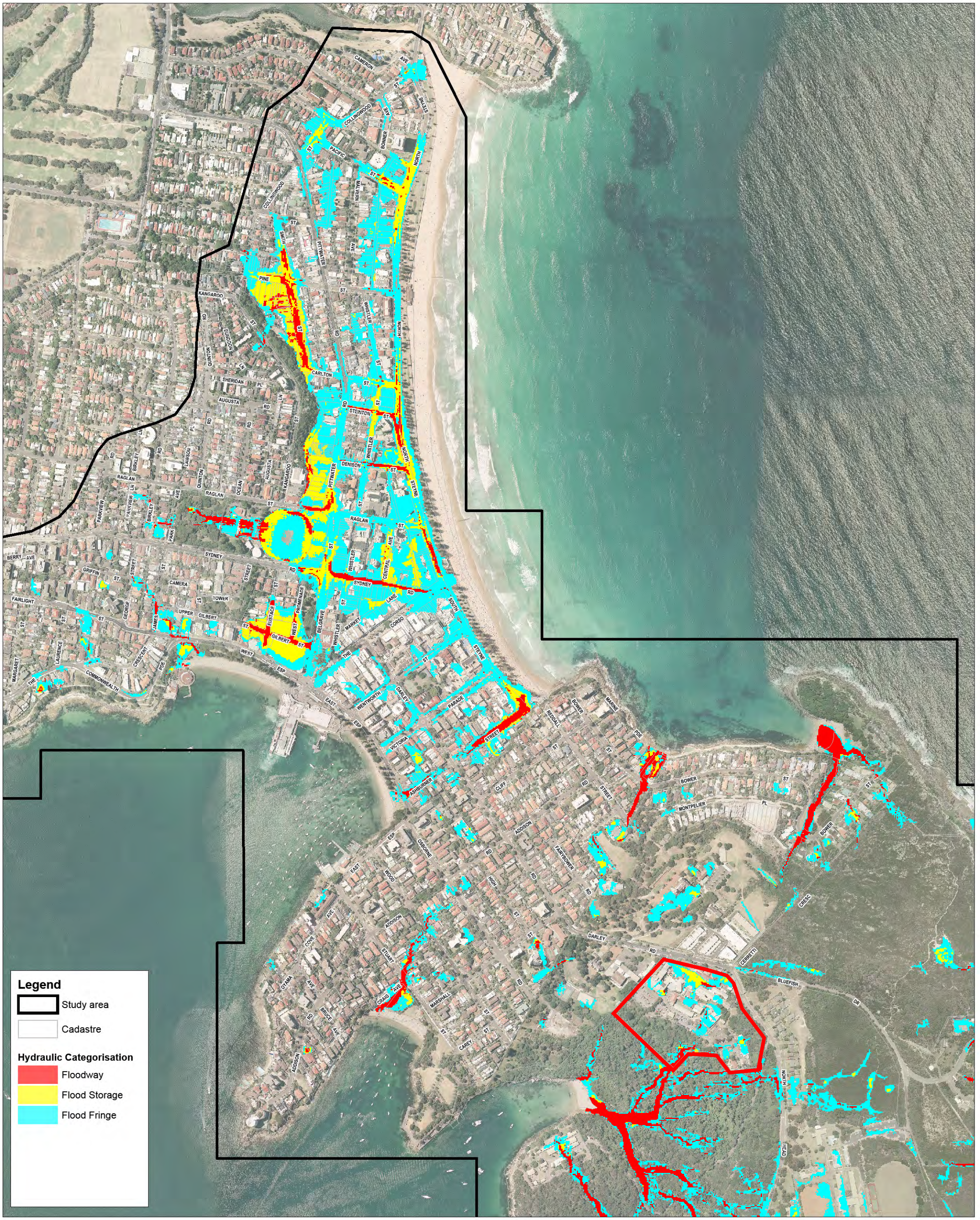
Cardno



Manly to Seaforth Flood Study
1% Hydraulic Categories
Map 3/4

Figure 47

Cardno



Manly to Seaforth Flood Study
PMF Hydraulic Categories
Map 3/4

Figure 51

Cardno

Legend

Study area

Cadastre

Provisional Flood Hazard

Low Hazard

Medium Hazard

High Hazard

N

0.2 0 0.2 0.4 0.6

Kilometers

Manly to Seaforth Flood Study
1% Provisional Flood Hazard
Map 3/4

Figure 59

Cardno

Legend

Study area

Cadastre

Provisional Flood Hazard

Low Hazard

Medium Hazard

High Hazard

N

0.2 0 0.2 0.4 0.6

Kilometers

Manly to Seaforth Flood Study
PMF Provisional Flood Hazard
Map 3/4

Figure 63

Cardno

Legend

Study Area

Cadastre

Provisional Flood Hazard

H1

H2

H3

H4

H5

H6

N

0.2 0 0.2 0.4 0.6

Kilometers

Manly to Seaforth Flood Study
1% Provisional Flood Hazard
Map 3/4

Figure 67

Cardno

Legend

Study Area

Cadastre

Provisional Flood Hazard

H1

H2

H3

H4

H5

H6

N

0.2 0 0.2 0.4 0.6

Kilometers

Manly to Seaforth Flood Study
PMF Provisional Flood Hazard
Map 3/4

Figure 71

Cardno

APPENDIX D

Manly 2013 Development Control Plan Extracts

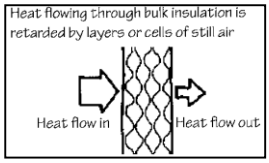
northern beaches council

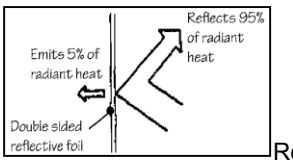
MANLY DEVELOPMENT CONTROL PLAN

2013

AMENDMENT 11

Adopted on 16 July 2012
Commenced on 19 April 2013
Last Amended on 28 August 2017



Bulk Insulation & Heat Flow 

Reflective Insulation

Figure 22 - Types of Insulation

To prevent moisture laden air reaching insulation in a wall cavity, provide a vapour barrier on the warmer side of the insulation

Draught proofing:

a) In winter, draughts can cause a heat loss of around 20 percent in homes with insulated ceilings. In summer, hot air leaking into a building can be uncomfortable. To reduce heat loss/gain from a building, provide adequate draught excluders or weather-stripping to all windows and doors.

Fitted curtains with pelmet:

b) To reduce heat loss in winter and heat gain in summer, fit internal close fitting curtains with pelmet.

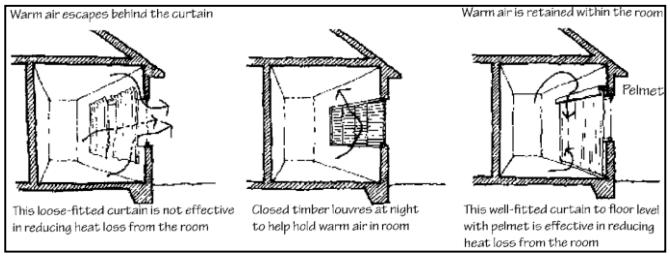


Figure 23 - Curtains

Wall and roof colour

c) Lighter colours are preferred for wall and roof materials. Dark walls and roofs absorb heat, light walls and roofs reflect heat. This phenomenon is particularly important in summer where solar radiation is absorbed by the roof and walls, heating the building.

Pipes and storage tanks

d) Pipes and storage tanks should be insulated for hot water systems.

3.5.8 Water Sensitive Urban Design

Relevant DCP objectives to be met in relation to this part include:

Objective 1) To ensure Water Sensitive Urban Design by:

- Potable water conservation;
- Wastewater minimisation;
- Stormwater management.

Note: Water Sensitive Urban Design is an approach that aims to manage the effects of urban development on the urban water cycle by considering the management of potable water, wastewater, groundwater and stormwater elements in an integrated manner.

3.5.8.1 Principles of Water Sensitive Urban Design

Under LEP clause 6.4 Stormwater Management, the principles of Water Sensitive Urban Design to be considered in granting development consent for any development in residential, business and industrial zones are summarised as follows:

a) protection and enhancement of natural water systems (including creeks, rivers, lakes, wetlands, estuaries, lagoons, groundwater systems) and riparian land;

b) protection and enhancement of water quality, by improving the quality of stormwater runoff from urban catchments;

c) minimisation of harmful impacts of urban development by mimicking natural water runoff regimes where possible and appropriate;

d) integration of vegetated stormwater treatment and harvesting systems into the landscape in a manner that maximise visual and recreational amenity of urban development and also provides water quality benefits;

e) reduction in potable water demand through water efficiency and rainwater and stormwater harvesting; and

f) location of water quality and stormwater treatment measures outside riparian land.

3.5.8.2 Water Sensitive Urban Design Targets

a) Stormwater Quality Management

Note: Urbanisation places pressure on waterways and stormwater systems and can increase pollutants entering receiving environments.

Objective 1) To reduce the pollutant loads reaching downstream receiving waters and environments.

i) For all development, the impervious areas that are directly connected to the stormwater system should be minimised.

ii) For development requiring a Water Sensitive Urban Design Strategy under Council's Administrative Guidelines the following reductions in post development average annual loads of pollutants are required:

- 90 percent reduction in the post development average annual load of Gross Pollutants (greater than 5mm);
- 80 percent reduction in the post development average annual load of Total Suspended Solids;
- 60 percent reduction in the post development average annual load of Total Phosphorus; and
- 45 percent reduction in the post development average annual load of Total Nitrogen.

Notes: The post development annual load should be determined by the applicant and presented to Council in a Water Sensitive Urban Design Strategy, along with a description of the measures used to achieve the reduction target.

Legislated pollution reduction targets are not currently established by the NSW Government but guidance is provided to Councils through the NSW Government Sydney Metropolitan Catchment Management Authority.

See also Landcom Water Sensitive Urban Design Book 1 "Policy" (page 9) Table 1 (Reference www.landcom.com.au/downloads/uploaded/WSUD_Book1_Policy_Draft_0409_6d9c.pdf) for NSW Government established pollution reduction targets for land development. Pollution reduction targets are also described in this Landcom document.

The above stormwater quality controls have been derived through the modelling of numerous combinations of Water Sensitive Urban Design elements and technologies and development types at various locations. They reflect a cost-effective level of stormwater treatment that is considered to be technically feasible in terms of the footprint or land take of measures likely to be required for compliance, and environmental benefits.

b) Water Conservation

Note: Urbanisation results in significant volumes of imported potable water from Warragamba Dam and large volumes of generated waste water discharged to the environment at North Head wastewater treatment plant. Significant financial, social and sustainability benefits exist through local adoption of water conservation measures.

Objective 1) To enhance potable water conservation in developments to provide enhanced sustainability benefits.

i) Buildings that are not affected by Building Sustainability Index (BASIX) that are installing any water use fittings must demonstrate compliance with the minimum standards defined by the Water Efficiency Labelling and Standards Scheme. Minimum ratings recommended under this scheme include:

- 3 star showerheads;
- 3 star urinals;
- 4 star dual-flush toilets; and
- 4 star taps (for all taps other than bath outlets and garden taps).

ii) Water efficient washing machines and dishwashers are to be specified and used wherever possible.

iii) Industrial and commercial developments must supply 80 percent of their non potable demand using non potable sources. This shall include the use of rainwater as the primary source and be supplemented

3.7 Stormwater Management

See also *paragraph 5.4.3 Flood Effected Land,* which identifies flood affected land which is subject to Council's Interim Policy and Administration Guidelines for Manly Lagoon.

See also *paragraph 3.5.5 Landscaping* (Sustainability) & *paragraph 3.5.8 Water Sensitive Urban Design*.

See also NSW Road and Maritime Services standard requirements for the management of stormwater in relation to development near the foreshore.

See also Council's Stormwater Control Policy Reference S190 under the Manly Policy Register.

Relevant objectives to satisfy relation to this part include the following:

Objective 1) To manage urban stormwater within its natural catchments and within the development site without degrading water quality of the catchments or cause erosion and sedimentation.

Objective 2) To manage construction sites to prevent environmental impacts from stormwater and protect downstream properties from flooding and stormwater inundation.

Objective 3) To promote ground infiltration of stormwater where there will be no negative (environmental) impacts and to encourage on-site stormwater detention, collection and recycling.

Objective 4) To make adequate arrangements for the ongoing maintenance of stormwater facilities.

Note: Development consent must not be granted on residential, business and industrial lands unless Council is satisfied that the matters identified in LEP clause 6.4(3) are satisfied.

The following consideration and requirements apply to the management of stormwater:

a) In support of the purposes of LEP clause 6.4(3), all developments must comply with the Council's 'Stormwater Control Policy" (see Council Policy Reference S190). The standards to achieve the controls contained in the Stormwater Control Policy are provided in Council's "Specification for On-site Stormwater Management 2003" and "Specification for Stormwater Drainage". Stormwater management measures are to be implemented and maintained in accordance with the Specification for Stormwater Management;

b) Stormwater disposal systems must provide for natural drainage flows to be maintained;

c) Pervious surfaces and paving will be used for driveways, pathways and courtyards where practical;

d) Notwithstanding the prevailing BASIX water conservation targets, the collection of rainwater/run-off for non-potable uses exceeding the target is encouraged; and

e) A qualified drainage/hydraulic engineer will design all stormwater controls, devices and water storage systems; and

f) In relation to development in the LEP Zone B6 Enterprise Corridor, Burnt Bridge Creek runs through this land. Land in this locality is also generally low-lying. In this regard stormwater runoff from new developments in these LEP zones must be limited to that currently existing for the site for a 1 in 5 year storm or 40 litres per second whichever is the least, unless the drainage system is demonstrated to be sufficient for unimpeded discharge for a fully developed catchment area. Developers should assess whether their land warrants additional drainage considerations because of its location. The NSW Government Floodplain Development Manual may be useful in this assessment.

5.4.2 Threatened Species and Critical Habitat Lands

Any development of land with known habitat for threatened species must consider the likely impacts of the development and whether further assessment needs to be undertaken by a Species Impact Statement.

See also Council's Administrative Guidelines for DA lodgement requirements.

a) Any DA on land identified in Schedule 1 - Map D, being land generally to the south-east of Ashburner Street, Manly and including North Head must be accompanied by an Assessment of Significance Report ('7 Part Test') under Section 5A Environmental Planning and Assessment Act 1979. Critical habitat for the little penguin (eudyptula minor) and habitat for the long nosed bandicoot (threatened species) is prescribed in the Threatened Species and Conservation Act 1995.

Notes: The Minister for the Environment and the Minister for Primary Industries, with the concurrence of the Minister for Planning, have prepared assessment guidelines to assist in the interpretation and application of the factors of assessment. The guidelines clarify the specific terminology of the relevant legislation and provide clear interpretations of the factors of assessment.

5.4.3 Flood Prone Land

Note: This paragraph applies to land identified on the Council' Flood Risk Precinct Maps as being affected by flooding.

Note: Manly LEP clause 6.3 states that any development of land at or below the flood planning level must not be granted development consent unless Council is satisfied on certain matters identified at LEP clauses 6.3(3)(a) to 6.3(3)(e).

Relevant DCP objectives in this plan in relation to these paragraphs include:

Objective 1) Protection of:
- people;
- the natural environment; and
- private and public infrastructure and assets.

Requirements

a) The purpose of this paragraph is to guide development in accordance with the objectives and processes set out in the NSW Government's Flood Prone Land Policy as outlined in the NSW Government, Floodplain Development Manual, 2005.

b) Development to which this paragraph applies must comply with the performance criteria set out in paragraph 5.4.3.1 Performance Criteria.

c) Forms A and A1 (see Attachment A of Northern Beaches Council's Guidelines for preparing a Flood Management Report) are to be completed and submitted to Council.

d) Development that satisfies the prescriptive controls in paragraph 5.4.3.2 Prescriptive Controls is deemed to have satisfied paragraph 5.4.3.1 Performance Criteria.

5.4.3.1 Performance Criteria

Site Layout and Built Form

a) The site layout and ultimate built form of the proposed development should be compatible with the flood risk. Site analysis and layout should incorporate flood risk as a critical element in site planning.

Public Interest

b) The proposed development should not result in increased risk—to human life or damage to property or infrastructure—beyond acceptable limits.

Private and Public Costs

c) The economic and social costs, which may arise from damage to property from flooding, should not be exacerbated by proposed development.

Flood Effects Caused by Development Activity

d) Development should not detrimentally increase the potential flood effects on other development or properties either individually or in combination with the cumulative impact of development that is likely to occur in the same floodplain.

Drainage Infrastructure and Creek Works

e) Any proposed works on drainage infrastructure or natural creeks, whether or not carried out as flood modification measures, shall:
   i) not cause adverse flooding impacts;
   ii) not result in a loss of flood storage;
   iii) increase protection of existing and proposed development; and
   iv) not have a detrimental impact on the environment.

Building Components

f) Building components and materials likely to be affected by flood waters should be designed, built and installed so as not to be damaged by those floodwaters.

Structural Soundness

g) The proposed development shall be designed and constructed so that it remains structurally sound for its intended life taking into account all the likely flood events during that lifetime.

Storage of Goods

h) Goods that are likely to amplify the damages arising from flood events—including but not limited to pollutants and toxic chemicals—shall be stored so as not to find their way into floodwaters.

Flood Emergency Response

i) Proposed developments should only be permitted where effective warning time and reliable access is available for evacuation from an area potentially affected by floods to an area free of risk from flooding. Such an area may be within the same building where a shelter-in-place option is appropriate and achievable. The emergency response should be consistent with the *Flood Emergency Response Planning for Development in Pittwater Policy* where it applies to the land. The proposed development should have procedures in place (such as warning systems, signage or evacuation drills) so that people are aware of the need to evacuate and relocate goods and motor vehicles during a flood and are capable of identifying an appropriate evacuation route.

Floor Levels

j) All floor levels within a proposed development shall be set at the required prescriptive level with additional consideration for the following:
   i) the passage of flood waters;
   ii) the purpose for which that floor area is to used;
   iii) the relationship with the surrounding roadways;
   iv) the relationship with the existing building if the proposal is an extension; and
   v) surrounding built form and streetscape.

Fencing

k) Fencing shall be designed and constructed so that it does not impede and/or direct the flow of floodwaters, add debris to floodwaters or increase flood affectation on surrounding land.

5.4.3.2 Prescriptive Controls

The prescriptive controls that may be applied to development on flood prone land are listed below. A matrix has been prepared showing which of the controls apply to the various development types and flood risk precincts.

The Development Matrix

The following is a summary of the major steps to be followed in applying this part of the DCP:

(a) Determine the Flood Risk Precinct i.e. High Flood Risk Precinct, Medium Flood Risk Precinct and Low Flood Risk Precinct within which the site is situated;
Note: Where a property is located in more than one Precinct, the assessment must consider the controls relevant to each Precinct.
(b) The various land use or development types have been grouped into 7 Land Use Categories (refer to figure 53A). Determine the Land Use Category relevant to the proposal.
(c) Check if the proposal will satisfy the prescriptive controls for the relevant land use category in the applicable Flood Risk Precinct.

(d) If the proposal does not satisfy any one of the applicable prescriptive controls, or where those controls require the preparation of a Flood Management Report, then such a report shall be prepared. The Flood Management Report shall be prepared by a suitably qualified professional and shall outline the identified flood risks relevant to the proposal, indicate the extent of compliance with prescriptive controls and provide a thorough assessment of the appropriateness of the development by reference to each of the performance criteria.

Figure 53 - Development Matrix of Flood Prone Risk Precincts

	MATRIX : Flood Risk Precincts																		
	High Flood Risk							**Medium Flood Risk**							**Low Flood Risk**						
	Critical Uses	Vulnerable Uses	Subdivision	Residential	Business & Industrial	Recreational & Environmental	Concessional	Critical Uses	Vulnerable Uses	Subdivision	Residential	Business & Industrial	Recreational & Environmental	Concessional	Critical Uses	Vulnerable Uses	Subdivision	Residential	Business & Industrial	Recreational & Environmental	Concessional
A. Flood effects caused by Development	A1 A3 A4	A1 A3 A4	A1 A3	A1 A3	A1 A3	A2 A3	A2 A3	A1 A3 A4	A1 A3 A4	A1 A3	A1 A3	A1 A3	A2 A3	A2 A3	A2 A3 A4	A2 A3 A4	A2 A3				
B. Drainage Infrastructure & Creek Works	B1 B2	B1 B2	B1 B2	B1 B2	B1 B2	B1 B2		B1 B2	B1 B2	B1 B2	B1 B2	B1 B2	B1 B2		B1 B2	B1 B2	B1 B2				
C. Building Components & Structural	C1 C2 C3	C1 C2 C3		C1 C2 C3	C1 C2 C3	C1 C2 C3	C1 C2 C3	C1 C2 C3	C1 C2 C3		C1 C2 C3	C1 C2 C3	C1 C2 C3	C1 C2 C3	C1 C2 C3	C1 C2 C3					
D. Storage of Goods	D1 D2	D1 D2		D1 D2	D1 D2	D1 D2	D1 D2	D1 D2	D1 D2		D1 D2	D1 D2	D1 D2	D1 D2	D1 D2	D1 D2					
E. Flood Emergency Response	E1 E2 E3	E1 E2 E3	E1 E4	E1 E2	E1 E2 E3	E1	E1	E1 E2 E3	E1 E2 E3	E1 E4	E1 E2	E1 E2 E3	E1	E1	E1 E2 E3	E1 E2 E3	E4				
F. Floor Levels	F2 F3 F7	F2 F3 F7	F5	F1 F2 F3 F6 F8	F1 F2 F3 F6 F8 F10	F2	F2 F3 F6	F2 F3 F7	F2 F3 F7	F5	F1 F2 F3 F4 F6 F8 F9	F1 F2 F3 F4 F6 F8 F9 F10 F11	F2	F1 F2 F3 F4 F6 F11	F2 F3 F7	F2 F3 F7	F5		F1 F2 F3 F8		

	MATRIX : Flood Risk Precincts																		
	High Flood Risk							**Medium Flood Risk**							**Low Flood Risk**						
	Critical Uses	Vulnerable Uses	Subdivision	Residential	Business & Industrial	Recreational & Environmental	Concessional	Critical Uses	Vulnerable Uses	Subdivision	Residential	Business & Industrial	Recreational & Environmental	Concessional	Critical Uses	Vulnerable Uses	Subdivision	Residential	Business & Industrial	Recreational & Environmental	Concessional
G. Car Parking	G1 G4 G6 G7 G9 G10	G1 G4 G6 G7 G9 G10	G1	G1 G2 G3 G4 G5 G6 G7	G1 G2 G3 G4 G5 G6 G7	G1 G2 G3 G4 G5 G6 G7	G1 G2 G3 G4 G5 G6 G7	G1 G4 G6 G7 G9 G10	G1 G4 G6 G7 G9 G10	G1	G1 G2 G3 G5 G6 G7 G8	G1 G2 G3 G4 G5 G6 G7	G1 G2 G3 G4 G5 G6 G7	G1 G2 G3 G4 G5 G6 G7	G2 G6 G7 G9 G10	G2 G6 G7 G9 G10					
H. Fencing	H1	H1	H1	H1	H1	H1	H1	H1	H1	H1	H1	H1	H1	H1	H1	H1					
I. Pools	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1					

Figure 53A - Land Use Groups

Critical	Vulnerable Uses	Residential
Emergency services facility	Child care centre	Boarding house
Hospital	Educational establishment	Dual occupancy
Sewerage system	Home-based child care	Dwelling house
Telecommunications facility (SP2)	Community health service facility	Exhibition home
Public Utility Undertaking (SP2)	Information and education facility	Exhibition village
Electricity generating works	Respite day care centre	Hostel
	Seniors housing	Residential flat building
	Caravan park	Rural worker's dwelling
	Group home	Secondary dwelling
	Residential care facilities	Semi-detached dwelling
	Correctional centre	Multi dwelling housing
	Tourist and visitor accommodation	Shop top housing
		Attached dwelling

Business & industrial		
Animal boarding or training establishment	Boat building and repair facility	Business premises
Camping ground	Car park	Charter and tourism boating facility
Community facility	Crematorium	Depot
Eco-tourist facilities	Entertainment facility	Freight transport facility
Function centre	General industry	Health consulting rooms
Heavy industrial storage establishments	Highway service centre	Home business
Home occupation	Home occupation (sex services)	Industrial retail outlet
Industrial training facility	Industries	Management facility
Marina	Medical centre	Mortuary
Neighbourhood shop	Office premises	Patient transport facilities
Place of public worship	Port facility	Public administration building
Recreation facility (indoor)	Registered club	Research station
Restricted premises	Retail premises	Rural industry
Service station	Sex services premises	Storage premises
Transport depot	Truck depot	Turf farming
Vehicle body repair workshop	Vehicle repair station	Veterinary hospital
Warehouse or distribution centre	Waste disposal facility	Waste water disposal system
Water recreation structure	Water supply system	Wharf or boating facilities
Wholesale supplies		

Recreational and Environmental	Subdivision	Concessional
Aquaculture	Subdivision	Development ancillary to residential development
Boat launching ramp		
Boat shed		Occupation/change of use of an existing premises
Earthworks		
Environmental facility		Demolition

Environmental protection works		Additions/alterations to residential dwelling
Extensive agriculture		Additions/alterations to business/industrial buildings
Extractive industry		Advertising structure
Farm building		Signage
Flood mitigation works		
Forestry		
Horticulture		
Recreation area		
Recreation facility (major)		
Recreation facility (outdoor)		
Road		
Viticulture		

No controls
Intensive livestock agriculture
Intensive plant agriculture
Open cut mining
Jetty
Mooring
Mooring pen
Tree and/or bushland removal
Development / subdivision of a sector, buffer area or development site in a release area

The Prescriptive Controls
Note: for applicability refer to the Development Matrix above

A. 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.
A2	Certification shall be provided in accordance with Northern Beaches Council's Standard Hydraulic Certification Form (Forms A and A1 of Northern Beaches Council's Guidelines for preparing a Flood Management Report) to the effect that the works have been designed and can be constructed to adequately address flood risk management issues.
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.
A4	Development (including earthworks and subdivision) shall not be approved unless it can be demonstrated in a Flood Management Report that it been designed and can be constructed so that in a Probable Maximum Flood event: (a) There are no adverse impacts on flood levels and velocities caused by alterations to the flood conveyance; (b) There are no adverse impacts on surrounding properties; and (c) It is sited to minimise exposure to flood hazard. Where relevant certification shall also be provided in Northern Beaches Council's Standard Certification Form (Forms A and A1 of Northern Beaches Council's Guidelines for preparing a Flood Management Report) to this effect.

B. DRAINAGE INFRASTRUCTURE AND 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.
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.

C. BUILDING COMPONENTS AND STRUCTURAL SOUNDNESS

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).
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.
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.

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

E. FLOOD EMERGENCY RESPONSE

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.
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.
E3	Adequate Warning Systems, Signage and Exits shall be installed to allow safe and orderly evacuation without reliance upon the SES or other authorised emergency services personnel.
E4	The application shall demonstrate that evacuation/shelter in place in accordance with the requirements of this DCP will be available for any potential development arising from a Torrens title subdivision.

F. 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.
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 percent 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.
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.
F4	A one- off addition or alteration below the Flood Planning Level of less than 30 square metres or an increase of less than 10 percent of the ground floor area (whichever is the lesser) for residential development may be considered only where: (a) it is an extension to an existing room (b) the Flood Planning Level is incompatible with the floor levels of the existing room This control will not be permitted if this provision has previously been utilised since the making of this Plan. The structure must be flood proofed to the Flood Planning Level.
F5	The applicant must demonstrate that future development following a subdivision proposal can be undertaken in accordance with this Control.
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;
F7.	All floor levels within the development shall be at or above the Probable Maximum Flood level or Flood Planning Level whichever is higher.
F8.	The minimum floor level of any first floor additions shall be at or above the Probable Maximum Flood Level.
F9.	Foyers – consideration may be given to a minimum floor level of a foyer being set at the 5 percent AEP flood level, provided it can be demonstrated that it complies with the Flood Prone Land Design Standard.
F10	Consideration may be given to a minimum floor level for the first 5m from the street front of new development in business zonings below the Flood Planning Level provided it can be demonstrated that it complies with the Flood Prone Land Design Standard.
F11	A one-off addition or alteration below the Flood Planning Level of less than 100 square metres or an increase of less than 10 percent of the ground floor area (whichever is the lesser) for non-residential development may be considered only where the required floor level cannot be achieved for the following reason: (a) it would be incompatible with floor levels of the existing building This control will not be considered if the existing floor level of the additions/alterations are located within a high hydraulic hazard area. This control will not be permitted if this provision has previously been utilised since the making of this Plan. Any features of the additions or alterations on the floor level must be flood proofed to the Flood Planning Level

G. CAR PARKING

G1	Open carpark areas and carports shall not be located within a floodway.
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.
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
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 percent 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.
G5	Enclosed Garages must be located at or above the 1 percent AEP level
G6	Carports must comply with the Flood Prone Land Design Standard
G7	Where a driveway is required to be raised it must be demonstrated that there is no loss to flood stage in the 1 percent AEP flood event and no impact on flood conveyance through the site
G8	Multi Dwelling Housing and Shop Top Housing residential carparking – consideration may be given to a minimum floor level for open or covered carparking being set at the 5 percent AEP flood level, provided it can be demonstrated that it complies with the Flood Prone Land Design Standard.

G9	All enclosed car parks must be protected from inundation up to the Probable Maximum Flood level or Flood Planning Level whichever is higher. For example, basement carparks must be provided with a crest at the entrance, the crest of which is at the relevant Probable Maximum Flood level or Flood Planning Level whichever is higher. All access, ventilation and any other potential water entry points to any enclosed car parking shall be above the relevant Probable Maximum Flood level or Flood Planning Level whichever is higher.
G10	Enclosed Garages must be located at or above the Probable Maximum Flood Level or Flood Planning Level whichever is higher.

H. 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.

I. POOLS

I1	Pools located within the 1 percent 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.

Notes: Applications must demonstrate compliance with the following references:

- Flood Prone Land Design Standard
- Flood Risk Management Policy

5.4.4 Riparian Land and Watercourses

This paragraph supports LEP clause 6.6 detailing more specific objective and control underlying this standard as follows:

Objective 1) To maintain, protect and improve the waterways and riparian land in Manly.

5.4.4.1 Protection and /or Rehabilitation of Riparian Land and Watercourses

Development to which this paragraph applies is to protect and /or rehabilitate fully vegetated local riparian vegetation (comprising local native trees, shrubs and groundcover species) and watercourses.

5.4.4.2 Perimeter Treatment of Riparian Land

Roads, cycle ways and pedestrian paths are to be generally located on the perimeter, adjacent to the riparian land to improve public surveillance and safety of these areas, prevent rubbish dumping and degradation of the riparian land. Appropriate fencing and bollards on the outer edge of the riparian land may also discourage informal access and the mowing/slashing of riparian vegetation.

5.4.4.3 Inappropriate development on Riparian Land

New development including water treatment measures, detention basins, recreational facilities, Asset Protection Zones etc. should be generally located outside the riparian land.

APPENDIX E

Manly Council – Specification for On-site Stormwater Management (2003) Extracts

MANLY

Specification for

On-site Stormwater Management 2003

Manly Council

Updated March 2004 with addendum to Section 4.1

Date of Adoption—19 May 2003
Date of Enforcement—16 June 2003.

6. ZONE 3: SCOUR AND EROSION CONTROL

6.1 General

Properties within zone 3 are required to control its runoff to protect adjoining properties, bush land, roadways and receiving waters from degradation due to silt laden stormwater runoff as a result of any development and/or concentration of runoff using appropriate scour and erosion control devices. Reference is made to ***Council's Specification for Stormwater Drainage***.

Erosion control shall be provided as follows:

- appropriate scour protection devices installed at the outlet to stormwater conduits, and
- installation of pollution control devices at the source, on-line*, off-line or at the end of the line to control sediment laden overland stormwater flows.

* **Note**: stormwater management measures shall not be located on-line in water courses or within riparian zones or areas of remnant native vegetation.

Scour protection devices shall include embankment stabilisation e.g. rock walls, concrete aprons, gabions, turfing, jute mesh, energy dissipating units, or other more appropriate erosion control devices approved by Council. Preference is for 'soft engineering' solutions.

Please note that stormwater devices are not appropriate within or adjacent to creek locations. In this regard, The Department of Infrastructure, Planning and Natural Resources (DIPNR) and NSW Fisheries shall be contacted for advice about suitable erosion control measures here.

Control devices may also be necessary as part of a development to remove pollutants during the 'first flush'. These devices shall be installed within the site and may include proprietary items such as Humeceptors or CDS units, silt and grease arrestors approved by Council. Installation of these devices shall be in accordance with the manufacturers specification.

Other sediment control devices such as stilling basins, constructed wetlands shall be required for large-scale developments. Council will provide guidelines as to when these are required as part of the Conditions of Consent. These shall include land and community title subdivisions. Design of these devices shall be in accordance with the ***Managing Urban Stormwater, Soils and Construction Manual by the NSW Department of Housing, August 1998***.

It will also be necessary to install silt traps in all stormwater pits to contain silt and debris. Silt traps shall be installed at the bottom of pits at a depth of 200mm to capture silts and fines. Weep holes shall be drilled into the base of the pit to ensure that it does not permanently hold water and create a breeding ground for insects. Where the pit is located over impervious material, subsoil drains will also need to be laid.

6.2 Soil and water management plan

Any development in zone 3 and zone 4 shall require the submission of a soil and water management plan. This Plan must be approved by Council prior to the commencement of any works. Sediment control measures must be taken into consideration during any development. Specification shall be in accordance with the ***Managing Urban Stormwater, Soils and Construction Manual by the NSW Department of Housing, August 1998***.

All sediment control devices are to be installed prior to any commencement of clearing and earthworks on the site. Ongoing maintenance of these devices during construction will be required.

Council may request a maintenance schedule to ensure that the devices are cleaned on a regular basis.

APPENDIX F

Prescriptive Flood Controls – Development Matrix

Prescriptive Flood Controls – Development Matrix

	MEDIUM FLOOD RISK (Vulnerable Uses)
A. 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. **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. **A4** - Development (including earthworks and subdivision) shall not be approved unless it can be demonstrated in a Flood Management Report that it been designed and can be constructed so that in a Probable Maximum Flood event: (a) There are no adverse impacts on flood levels and velocities caused by alterations to the flood conveyance; (b) There are no adverse impacts on surrounding properties; and (c) It is sited to minimise exposure to flood hazard. Where relevant certification shall also be provided in Northern Beaches Council's Standard Certification Form (Forms A and A1 of Northern Beaches Council's Guidelines for preparing a Flood Management Report) to this effect.
B. 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. **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.
C. 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). **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. **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.
D. 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.

	MEDIUM FLOOD RISK (Vulnerable Uses)
	D2 - Goods, materials or other products which may be highly susceptible to water damage are to be located/stored above the Flood Planning Level.
E. Flood Emergency Response	**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. **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. **E3** - Adequate Warning Systems, Signage and Exits shall be installed to allow safe and orderly evacuation without reliance upon the SES or other authorised emergency services personnel.
F. Floor Levels	**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 percent 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. **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. **F7** - All floor levels within the development shall be at or above the Probable Maximum Flood level or Flood Planning Level whichever is higher.
G. Car Parking	**G1** - Open carpark areas and carports shall not be located within a floodway. **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 percent 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. **G6** - Carports must comply with the Flood Prone Land Design Standard **G7** - Where a driveway is required to be raised it must be demonstrated that there is no loss to flood stage in the 1 percent AEP flood event and no impact on flood conveyance through the site **G9** - All enclosed car parks must be protected from inundation up to the Probable Maximum Flood level or Flood Planning Level whichever is higher. For example, basement carparks must be provided with a crest at the entrance, the crest of which is at the relevant Probable Maximum Flood level or Flood Planning Level whichever is higher. All access, ventilation and any other potential water entry points to any enclosed car parking shall be above the relevant Probable Maximum Flood level or Flood Planning Level whichever is higher.

	MEDIUM FLOOD RISK (Vulnerable Uses)
	G10 - Enclosed Garages must be located at or above the Probable Maximum Flood Level or Flood Planning Level whichever is higher.
H. 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.
I. Pools	**I1** - Pools located within the 1 percent 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.

Notes:

FPL – Flood Planning Level – This is defined in the Manly 2003 LEP as the level of a 1 in 100 ARI flood event plus 0.5m freeboard.

APPENDIX G

NPWS Guidelines (2013) Extracts

Office of Environment & Heritage
NSW National Parks & Wildlife Service

Guidelines for developments adjoining land managed by the Office of Environment and Heritage

To prevent sediment moving from an adjacent property onto OEH land and to avoid and minimise erosion risks, OEH also recommends that appropriate controls should be applied in accordance with the following guidance documents:

- *Erosion and sediment control on unsealed roads* (OEH 2012)[2]
- *Managing Urban Stormwater – Soils and Construction, Volume I* (Landcom 2004)[3]
- *Managing Urban Stormwater – Soils and Construction, Volume II* (DECC 2008)[4]
- *A Resource Guide for Local Councils: Erosion and Sediment Control* (DEC 2006).[5]

2.2 Stormwater runoff

Aim

Nutrient levels are minimised, and stormwater flow regimes and patterns mimic natural levels before it reaches OEH land.

Risks to OEH land

The discharge of stormwater to OEH land poses a threat to the values of land and downstream environments by:

- dispersing litter and pest species (especially weeds)
- altering nutrient composition and pollutant levels, which can damage native vegetation and aquatic ecosystems, reduce water recreation safety and promote weed growth
- causing potential erosion and sedimentation in watercourses, particularly where new developments have led to an increased volume and concentration of flow
- impacting on Aboriginal sites, which are frequently located close to watercourses, and historic heritage.

These potential impacts, which are also cumulative, have a range of implications for the management of OEH land. They pose serious risks to the protection of park values and assets, and to catchment ecological health.

These risks are recognised in provisions in the National Parks and Wildlife Regulation 2009 which requires the consent of OEH to discharge stormwater into a park (for example, where a development proposes new infrastructure that alters stormwater flows and directs them into a park). In addition, State Environmental Planning Policy 71 – Coastal Protection provides that untreated stormwater may not be discharged into certain coastal lakes and other areas.

Information and support is available to deal with diffuse source pollution associated with stormwater, including a tool developed by OEH to estimated changes in pollutant loads resulting from land-use changes.[6]

[2] http://www.environment.nsw.gov.au/Stormwater/ESCtrlUnsealedRds.htm
[3] www.landcom.com.au/whats-new/publications-reports/the-blue-book.aspx
[4] www.environment.nsw.gov.au/stormwater/publications.htm
[5] www.environment.nsw.gov.au/stormwater/publications.htm
[6] www.environment.nsw.gov.au/water/dswpoll.htm

Recommended approach

- Development proposals for areas adjacent to OEH land should incorporate stormwater detention and water quality systems (with appropriately managed buffer areas) ***within*** the development site.
- Stormwater should be diverted to council stormwater systems or to infiltration and subsurface discharge systems ***within*** the development site.
- The discharge of stormwater to OEH land, where the quantity and quality of stormwater differs from natural levels, must be avoided.

Infrastructure associated with stormwater treatment must ***not*** be located on OEH land and any stormwater outlets should disperse the flow at pre-development levels. Landowners and development proponents are responsible for ensuring that all tanks, storage areas and associated infrastructure are appropriately sized and maintained to ensure that there is no unauthorised overflow onto OEH land.

OEH acknowledges that in some limited and exceptional cases it may not be possible to avoid the discharge of stormwater from development sites onto OEH land. In these cases OEH may be willing to grant an approval to allow the discharge of stormwater onto OEH land. Such an approval will only be granted where it can be clearly shown to be in the best overall interests of the environment (for example, by addressing existing impacts from unmanaged stormwater). The final decision rests solely with OEH.

Any person seeking approval to discharge stormwater onto OEH land should provide a written request to the relevant NPWS Regional Office containing detailed information on the proposal which should include:

- current stormwater flows (volume and quality) emanating from the adjoining property into OEH land, including existing undeveloped and developed areas
- current stormwater management arrangements (if any)
- identification of any existing impacts on the land as a result of stormwater from the property (including erosion, sedimentation, weeds and tree dieback)
- proposed changes to stormwater related to the development where the following stormwater management standards should be met:
  - for subdivisions, multi-unit dwellings, commercial and industrial development:
    - no increase in pre-development peak flows from rainfall events with a 1 in 5 year and 1 in 100 year recurrence interval
    - no increase in the natural annual average load of nutrients and sediments
    - no increase in the natural average annual runoff volume.
  - for single residential dwellings or small developments on highly constrained lots:
    - standard local council discharge requirements and best practice stormwater treatment to reduce nutrient and sediment loads and average annual runoff volumes to pre-development levels.
- likely impacts from those changes to OEH land
- clear explanation of the reasons why stormwater discharge is considered unavoidable
- an explanation of the overall environmental benefits to OEH land from the proposed stormwater management system.

In considering any requests to allow stormwater discharge, OEH may also require the proponent to submit an environmental impact assessment to meet relevant requirements of Part 5 of the *Environmental Planning and Assessment Act 1979*.

Councils and other planning authorities should ***not*** grant approvals that involve the discharge of stormwater to OEH land or include conditions requiring such an outcome from OEH.

ARCADIS Design & Consultancy for natural and built assets