



CIVIL ENGINEERING

# Integrated Water Management Plan

HammondCare Wahroonga - Stage 2

PREPARED FOR  
HamondCare

Ref: 221346\_STW01  
Rev: 3  
Date: 07/11/2022

# Integrated Water Management Plan

## Revision Schedule

Date	Revision	Issue	Prepared By	Approved By
02/09/21	1	Draft	B.S.	B.S.
06/10/22	2	Issued for Approval	S.C.	C.N.
07/11/22	3	Issued for SSDA	C.B.	C.N.

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# 1. INTRODUCTION

Northrop Consulting Engineers has been commissioned by HammondCare to prepare a Stormwater Management Report for the proposed redevelopment of part of the site at 2-14 Neringah Avenue South, Wahroonga, refer to Figure 1. The report will be submitted to the Department of Planning and Environmental (DPE) in support of a State Significant Development Application (SSD-45121248). The proposal involves the redevelopment of part of the site for the purposes of delivering additional health services, aged care, and seniors housing, that will contribute to the broader operation of 'Neringah Hospital.'



**Figure 1 - Outline of the site, with the portion of the site subject to the SCC shaded dark red (R4 zone)**

Specifically, this SSDA seeks approval for the following:

- Site preparation works comprising:
  - Demolition of the Neringah Hospital building, kiosk, and existing at-grade carparks;
  - Clearing of nominated vegetation on the proposed development areas;
  - Bulk earthworks including basement excavation; and
  - Remediation works where necessary across the site.
- Construction and use of an integrated seniors housing and health services facility across two buildings ranging from 4-5 storeys above ground, comprising:
  - 2 basement levels containing minimum of 130 car parking spaces and service dock;
  - 12 residential aged care facility beds (extension to existing Stage 1 provision);
  - 18 palliative care hospice beds (Schedule 3 health services facility);
  - Community healthcare services, including outpatient palliative care, centre for positive aging and Hammond at Home;
  - 57 seniors housing dwellings;
  - On-site administration, amenities, and ancillary operations spaces.
  - Ground level and on-building landscaping works, including the provision of a through site pedestrian link connecting Archdale Park and Balcombe Park;

- Public domain works, specifically, regrading of part of the pedestrian walkway known as 'Archdale Walk' to provide accessible connection; and
- Extension and augmentation of infrastructure and services as required including new site signage

## 2. DESIGN CONTROLS AND GUIDELINES

The following controls and guidelines have been utilized within design and documentation for the proposed site.

### 2.1 SSD Requirements

The scope of this report includes a comprehensive assessment of the stormwater management procedures, modelling, and results for the proposed development, and proposes a best practice stormwater management strategy. This report has been prepared to respond to the Secretary's Environmental Assessment Requirements (SEARs) for SSD-45121248 that were issued on 24 June 2022, specifically item 14, Stormwater and Wastewater which requires the following:

- Provide an Integrated Water Management Plan for the development that:
  - is prepared in consultation with the local council and any other relevant drainage or water authority.
  - details the proposed drainage design for the site including any on-site treatment, reuse and detention facilities, water quality management measures, and the nominated discharge points.
  - demonstrates compliance with the local council or other drainage or water authority requirements and avoids adverse impacts on any downstream properties.
- Where drainage infrastructure works are required that would be handed over to the local council, or other drainage or water authority, provide full hydraulic details and detailed plans and specification of proposed works that have been prepared in consultation with, and comply with the relevant standards, the local council or other drainage or water authority.

### 2.2 Ku-ring-gai Council Development Control Plan (2022)

Ku-ring-gai Council DCP (2022) Part 24 and 24R outlines the water management strategy to ensure facilitate development in achieving stormwater and water sensitive urban design requirements.

### 2.3 Draft MUSIC Modelling Guidelines – Ku-ring-gai (2010)

The guidelines outline the requirements for water quality treatment and MUSIC modelling requirements in Ku-ring-gai. Any MUSIC models that are not consistent with the MUSIC guidelines should justify the differences from the default parameters.

### 2.4 Landcom's Managing Urban Stormwater – Soils and Construction (2004)

Landcom's Managing Urban Stormwater – Soils and Construction provides mitigation guidelines for the land disturbance activities on soils, landform, and receiving water by focusing on erosion and sediment control.

### 2.5 Australian Rainfall and Runoff (2016)

Engineers Australia (EA) published the Australian Rainfall and Runoff – A Guide to Flood Estimation which provided the information and approach for hydrology and stormwater management. It contains information to estimate the stormwater runoff, design storm event, and design method for the urban stormwater drainage systems.



## 3. SITE AND DEVELOPMENT DETAILS

### 3.1 Site Details and Characteristics

The site is located at Lot 1 DP1199937 and Lot 1 DP960051, 2-10 Neringah Avenue South, Wahroonga, refer to Figure 2. The site is currently an aged care facility and hospital. There are three existing multi-storey buildings, a single storey cottage, concrete and bitumen carparks, bitumen driveway, footpaths and general landscaped areas.



**Figure 2 - Site Locality Plan (Sixmaps)**

### 3.2 Surrounding Land Use

According to the Sydney Local Environmental Plan 2012, the site is zoned as Low Density Residential (R2), High Density Residential (R4). The neighboring sites are zoned as Local Density Residential (R2) and High Density Residential (R4).

### 3.3 Existing Site Drainage

There are numerous stormwater pits and pipes on site. Half of the site where works are proposed, drains to Neringah Avenue South and the other half of the site drains to Woonona Avenue.



**Image 1 - Photo taken facing entrance of site from Neringah Avenue**

### 3.4 Description of the Proposed Development

The works involve demolition of the Neringah Hospital building, kiosk, and existing at-grade carparks. And the construction of an integrated seniors housing and health services facility across two buildings ranging from 4-5 storeys above ground, comprising basement level containing over 90 car parking spaces and service dock. There will be ground level and on-building landscaping works, including the provision of a through site pedestrian link connecting Archdale Park and Balcombe Park.

The total site area is approximately 10,733m<sup>2</sup> and the Stage 2 proposed development area will affect approximately 7,547m<sup>2</sup> of the site, refer to Figure 2 below.



**Figure 3 – Site locality plan**

### 3.5 Post-development Catchment Details

A summary of the post-development catchment areas is outlined in Table 1.

Land use/surface type	Total area (m²)	Impervious Area (m²)		Pervious Area (m²)	
		(m²)	(%)	(m²)	(%)
Post-development Scenario					
R4 - High Density Residential	4425	2488	56%	1937	44%
- Landscaped	1937	0	0%	1937	100%
- Impervious	2488	2488	100%	0	0%
Roof area to RWT	2734	2734	100%	0	0%
Vehicular Pavement	388	388	100%	0	0%
TOTAL	7547	5610	74%	1937	26%

**Table 1 - Summary of site sub-catchment areas**



## 4. PROPOSED STORMWATER MANAGEMENT REQUIREMENTS AND MEASURES

This section of the report shall outline the stormwater management requirements and measures that have been proposed for the post-development scenario to ensure that the site meets the necessary water quantity and quality requirements.

### 4.1 Water Quantity

#### 4.1.1 Requirements

The requirements for On-site detention (OSD) and permitted site discharge (PSD) were determined in accordance with Ku-ring-gai Council's DCP (2022) Part 24.

In accordance with Council DCP, the site is in the Spring Gull Creek (SG1) drainage catchment area for On-site Detention which requires the OSD to be designed as per the following:

- Minimum OSD Storage Volume 320 m<sup>3</sup>/ha
- Permitted Site Discharge 134 l/s/ha

#### 4.1.2 Proposed Measures

The OSD storage and discharge required for the site was calculated using Council's On-site Stormwater Detention Calculation Sheet, refer to Appendix A. As per advice received from Council, council allows for a 10% offset for OSD storage volume if a rainwater tank is connected for internal re-use purposes, refer to Appendix C. A 160,000L rainwater tank is proposed and is to be used for irrigation of the site, refer to section 4.2.2.1 below for more details. Based on this, the OSD and PSD requirements were calculated to be the following:

- Minimum OSD Storage Volume (without offset) 145 m<sup>3</sup>
- Permitted Site Discharge 56.4 l/s
- Proposed OSD Storage Volume (with offset) 129 m<sup>3</sup>

### 4.2 Water Quality

#### 4.2.1 Requirements

Ku-ring-gai Council's DCP (2022) requires the following targets to be met to undertake stormwater quality measures to reduce post-development pollutant loads:

- 85% Total Suspended Solids Reduction
- 65% Total Phosphorus Reduction
- 45% Total Nitrogen Reduction
- 70% Gross Pollutant Reduction

#### 4.2.2 Proposed Measures

##### 4.2.2.1 Rainwater tank

A rainwater tank is provided for the development. The rainwater tank is to comply with the following:

- minimum rainwater tank capacity of 160kL;
- To be connected for external reuse including irrigation of at least 2,300m<sup>2</sup> of landscaped area;

- This should feed into the storage, and provide an average of approximately 180,000L rainwater per month (45,000L per week), so generally the collected rainwater should amply cater for most irrigation needs, and slightly exceed it.
- Be fitted with a first-flush device that causes initial rainwater run-off to bypass the tank and must drain to a landscaped area. The first flush device will not be permitted to connect to the stormwater system;
- Have a sign affixed to the tank stating the contents is rainwater;
- Be constructed or installed in a manner that prevents mosquitoes breeding, such as the use of mesh to protect inlets and overflows;
- Have its overflow connected to an existing stormwater drainage system that does not discharge to an adjoining property, or cause a nuisance to adjoining owners;
- Pumping equipment must be housed in a soundproof enclosure; and
- Where the rainwater tank is interconnected to a reticulated water supply, it must be installed in accordance with Plumbing Code of Australia, particularly backflow/cross connection prevention requirements.

#### **4.2.2.2 In-pit filtration baskets**

It is proposed that at least four (4) stormwater inlet pits within the site are to be fitted with a fine mesh in-pit filtration basket such as the 'OceanGuard' or approved equivalent.

#### **4.2.2.3 Tertiary treatment filtration device**

A tertiary stormwater filtration device is proposed to be installed on the eastern front corner of the site within the OSD. Six (6) PSorb StormFilter 690 high by 'Ocean Protect' or approved equivalent are proposed which will need to be maintained in accordance with the manufacturer's specifications. The filters are to treat stormwater run-off from roof, roads and other areas by-passing the rainwater tank.

#### **4.2.2.4 Erosion and Sediment Control Measures**

Appropriate erosion and sediment control measures are to be in place over the duration of the construction works. The measures shall include the following concepts as a minimum:

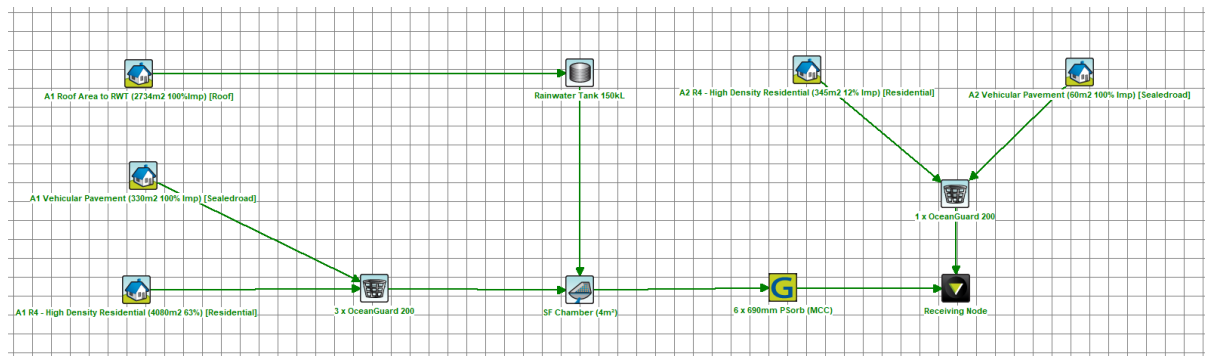
- i. Minimise the extent of disturbed area by fencing of 'no-go' areas;
- ii. Protect and clearly label trees to remain;
- iii. Sediment fencing is to be used downslope of any construction area until works are complete (Standard Drawing SD 6-8, Landcom, 2004);
- iv. Topsoil will be stripped from any construction areas and stockpiled following Standard Drawing SD 4-1 (Landcom, 2004) for later re-use; and
- v. Ensure work areas are sealed/rehabilitated as quickly as possible.

A concept erosion and sediment control plan is included in Appendix C.

## 5. MUSIC MODELLING

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 model's 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 from the Ku-ring-gai Council MUSIC Link function within MUSIC for Ku-ring-gai Council.



**Figure 4 - MUSIC model**

### 5.1 MUSIC Model Results

The results from the treatment train effectiveness/percentage pollution reductions achieved by the proposed treatment measures are shown in Table 2 and the MUSIC Link report (Appendix B) produced from MUSIC, confirms the site achieves Council requirements for water quality reductions.

	Sources	Residual Load	% Reduction
<b>Flow (ML/yr)</b>	7.75	6.63	14.4
<b>Total Suspended Solids (kg/yr)</b>	881	107	87.8
<b>Total Phosphorus (kg/yr)</b>	1.86	0.648	65.1
<b>Total Nitrogen (kg/yr)</b>	16.6	7.97	52
<b>Gross Pollutants (kg/yr)</b>	187	0.00013	100

**Table 2 - MUSIC modelling pollutant load results**



## 6. CONCLUSIONS

This integrated management plan shows that the proposed stormwater management measures for the site are compliant with local government standards for water quality and quantity and demonstrates that there are no adverse impacts to drainage lines, hydrology, downstream assets and water courses. The results show that the site complies with the relevant requirements to stormwater and water specifically item 14 of the Secretary's Environmental Assessment Requirements (SEARs) for SSD-45121248.

## 7. APPENDICES

### 7.1 Appendix A – Ku-ring-gai On-site Stormwater Detention Calculation Sheet

24R

**24R.4 ON-SITE DETENTION CALCULATION SHEET**

**Address** .4-12 NERINGAH AVENUE, WAHROONGA, NSW, 2076.....

Catchment Detail				
1.	Catchment Name .SG1.....			
2.	Catchment Discharge Rate	0.0134	l/sec/m <sup>2</sup>	<b>A</b>
3.	Catchment Storage Rate	0.032	m <sup>3</sup> /m <sup>2</sup>	<b>B</b>

Site Details				
4.	Site Area	7547	m <sup>2</sup>	60% of site area
		4528.2	m <sup>2</sup>	
5.	Area(s) not draining to the detention system	2200	m <sup>2</sup>	
6.	Total impervious area (roofs, driveways, paving, etc.)	4800	m <sup>2</sup>	<b>D</b>
7.	Impervious area bypassing detention system	361	m <sup>2</sup>	<b>E</b>

Permitted Site Discharge				
8.	C [4528.2 m <sup>2</sup> ] x A [0.0134 l/sec/m <sup>2</sup> ] =		61	l/sec
				<b>Flow 1</b>
9.	Adjustment for any uncontrolled impervious flow E / D =		0.075	(<0.25)
				<b>F</b>
10.	Flow 1 [61 l/sec] x F [0.075] =		4.6	l/sec
				<b>Flow 2</b>
11.	Flow 1 [61] – Flow 2 [4.6] =		56.4	l/sec
				<b>PSD</b>

Site Storage Requirement				
12.	C [4528.2 m <sup>2</sup> ] x B [0.032 m <sup>3</sup> /m <sup>2</sup> ] =		145	m <sup>3</sup>
				<b>SSR1</b>
13.	If the storage is in a landscaped basin, SSR1 x 1.2 =			m <sup>3</sup>
				<b>SSR2</b>

Outlet Control				
14.	Height difference between top water surface level and the centre of the orifice		1.2	m
				<b>G</b>
15.	Orifice Diameter	21.8 x $\sqrt{\frac{PSD}{G}}$	156.4	mm
				<b>OD</b>

PSD = Permitted Site Discharge  
 SSR1 = Site Storage Requirement (except for landscaped basins)  
 SSR2 = Site Storage Requirement (landscaped basins) (**Note: Use only SSR1 or SSR2**)  
 OD = Orifice Diameter

**Signature**.......... **Name**..... Lucy Martin.....  
**Qualifications**..... Civil Designer..... **Date**..... 06/10/2022.....

REFERENCES

## 7.2 Appendix B - MUSIC Link Report





## MUSIC-link Report

Project Details		Company Details	
<b>Project:</b>	HammondCare Wahroonga - Stage 2	<b>Company:</b>	Northrop - Consulting Engineering Services
<b>Report Export Date:</b>	7/11/2022	<b>Contact:</b>	Connor Barry
<b>Catchment Name:</b>	221346_2-10 Neringah Avenue South	<b>Address:</b>	2-10 Neringah Avenue South, Wahroonga
<b>Catchment Area:</b>	0.755ha	<b>Phone:</b>	42263333
<b>Impervious Area*:</b>	76.02%	<b>Email:</b>	bowral@northrop.com.au
<b>Rainfall Station:</b>	66062 SYDNEY		
<b>Modelling Time-step:</b>	6 Minutes		
<b>Modelling Period:</b>	1/01/1963 - 31/12/1993 11:54:00 PM		
<b>Mean Annual Rainfall:</b>	1275mm		
<b>Evapotranspiration:</b>	1261mm		
<b>MUSIC Version:</b>	6.3.0		
<b>MUSIC-link data Version:</b>	6.34		
<b>Study Area:</b>	Ku-ring-gai Council		
<b>Scenario:</b>	Ku-ring-gai		

\* takes into account area from all source nodes that link to the chosen reporting node, excluding Import Data Nodes

Treatment Train Effectiveness		Treatment Nodes		Source Nodes	
Node: Receiving Node	Reduction	Node Type	Number	Node Type	Number
Flow	14.5%	Sedimentation Basin Node	1	Urban Source Node	5
TSS	88.1%	Rain Water Tank Node	1		
TP	65%	GPT Node	2		
TN	52.1%	Generic Node	1		
GP	100%				

## Comments

Certain parameters are outside those specified within the MUSIC-Link as proprietary products are being proposed from 'Oceanprotect' such as PSorb Stormfilters and the Oceanguard.



## Passing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
GPT	1 x OceanGuard 200	Hi-flow bypass rate (cum/sec)	None	None	0.02
GPT	3 x OceanGuard 200	Hi-flow bypass rate (cum/sec)	None	None	0.06
Rain	Rainwater Tank 160kL	% Reuse Demand Met	80	None	96.9792
Receiving	Receiving Node	% Load Reduction	None	None	14.5
Receiving	Receiving Node	GP % Load Reduction	70	None	100
Receiving	Receiving Node	TN % Load Reduction	45	None	52.1
Receiving	Receiving Node	TP % Load Reduction	65	None	65
Receiving	Receiving Node	TSS % Load Reduction	85	None	88.1
Sedimentation	SF Chamber (4m <sup>3</sup> )	% Reuse Demand Met	None	None	0
Sedimentation	SF Chamber (4m <sup>3</sup> )	High Flow Bypass Out (ML/yr)	None	None	0
Urban	A1 R4 - High Density Residential (4080m <sup>2</sup> 63%)	Area Impervious (ha)	None	None	0.257
Urban	A1 R4 - High Density Residential (4080m <sup>2</sup> 63%)	Area Pervious (ha)	None	None	0.150
Urban	A1 R4 - High Density Residential (4080m <sup>2</sup> 63%)	Total Area (ha)	None	None	0.408
Urban	A1 Roof Area to RWT (2734m <sup>2</sup> 100% Imp)	Area Impervious (ha)	None	None	0.273
Urban	A1 Roof Area to RWT (2734m <sup>2</sup> 100% Imp)	Area Pervious (ha)	None	None	0
Urban	A1 Roof Area to RWT (2734m <sup>2</sup> 100% Imp)	Total Area (ha)	None	None	0.273
Urban	A1 Vehicular Pavement (330m <sup>2</sup> 100% Imp)	Area Impervious (ha)	None	None	0.033
Urban	A1 Vehicular Pavement (330m <sup>2</sup> 100% Imp)	Area Pervious (ha)	None	None	0
Urban	A1 Vehicular Pavement (330m <sup>2</sup> 100% Imp)	Total Area (ha)	None	None	0.033
Urban	A2 R4 - High Density Residential (345m <sup>2</sup> 12% Imp)	Area Impervious (ha)	None	None	0.004
Urban	A2 R4 - High Density Residential (345m <sup>2</sup> 12% Imp)	Area Pervious (ha)	None	None	0.030
Urban	A2 R4 - High Density Residential (345m <sup>2</sup> 12% Imp)	Total Area (ha)	None	None	0.035
Urban	A2 Vehicular Pavement (60m <sup>2</sup> 100% Imp)	Area Impervious (ha)	None	None	0.006
Urban	A2 Vehicular Pavement (60m <sup>2</sup> 100% Imp)	Area Pervious (ha)	None	None	0
Urban	A2 Vehicular Pavement (60m <sup>2</sup> 100% Imp)	Total Area (ha)	None	None	0.006

Only certain parameters are reported when they pass validation



#### Failing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
Sedimentation	SF Chamber (4m $\diamond$ )	Notional Detention Time (hrs)	8	12	0.115
Sedimentation	SF Chamber (4m $\diamond$ )	Total Nitrogen - k (m/yr)	500	500	1
Sedimentation	SF Chamber (4m $\diamond$ )	Total Phosphorus - k (m/yr)	6000	6000	1
Sedimentation	SF Chamber (4m $\diamond$ )	Total Suspended Solids - k (m/yr)	8000	8000	1

Only certain parameters are reported when they pass validation



### **7.3 Appendix C – Concept Erosion and Sediment Control and Stormwater Drainage Plans**

#### 7.4 Appendix D – Email correspondence from Council regarding OSD Offsets

**From:** Ross Guerrero <rguerrera@krg.nsw.gov.au>  
**Sent:** Friday, 14 October 2022 11:33 AM  
**To:** Connor Barry; Mailbox Ku-ring-gai Council  
**Cc:** Claudia Novati  
**Subject:** RE: Stormwater Management Department - OSD/RWT Offset Allowances

Hi Connor,

A maximum 10% offset for OSD is only permitted if the RWT is connected internally.

If OSD is located within the exemption area then a 10,000L RWT can be provided in lieu of OSD.

Other than described above, Council does not permit an oversized RWT to offset OSD.

Regards

**Ross Guerrero** | Team Leader Engineering Assessment | Ku-ring-gai Council  
P: 9424 0950 | M: 0438 465 200 | F: 9424 0001  
E: [rguerrera@krg.nsw.gov.au](mailto:rguerrera@krg.nsw.gov.au) | [www.krg.nsw.gov.au](http://www.krg.nsw.gov.au)  
*Ku-ring-gai: Sydney's green heart*



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**From:** Connor Barry <CBarry@northrop.com.au>  
**Sent:** Tuesday, 11 October 2022 11:26 AM  
**To:** Mailbox Ku-ring-gai Council <krg@krg.nsw.gov.au>  
**Cc:** Claudia Novati <CNovati@northrop.com.au>  
**Subject:** Stormwater Management Department - OSD/RWT Offset Allowances

To whom it may concern,

My name is Connor Barry, and I am a civil engineer here at Northrop.

Does Council accept an oversized rainwater tank to offset on-site stormwater detention (OSD) storage requirements?

Regards,

**Connor Barry**  
Civil Engineer

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