GLOUCESTER RACF AND ILU CLEMENT STREET, GLOUCESTER CIVIL WORK DRAWINGS



REVISION	DESCRIPTION	ISSUED	VER'D	APP'D	DATE	CLIENT	ARCHITECT
1	PRELIMINARY ISSUE FOR COMMENT	RG	СР	SC	04.05.18	Anglican	Ν
2	ISSUED FOR APPROVAL	RG	CP	SC	11/05/18	Caro	
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DRAWING SCHEDULE

DRG No.	DRAWING TITLE
DA-C01	COVER SHEET, DRAWING SCHEDULE AND LOCALITY PLAN
DA-C02	CONCEPT SEDIMENT AND EROSION CONTROL PLAN
DA-C06	CONCEPT STORMWATER AND GRADING PLAN

TYPICAL SECTIONS AND DETAILS DA-C07

LOCALITY PLAN



DIMENSIONS TO BE VERIFIED WITH THE ARCHITEC AND ON SITE BEFORE MAKING SHOP DRAWINGS O Commencing Work. NORTHROP ACCEPTS NO RESPONSIBILITY FOR THE USABILITY, COMPLETENESS OR SCALE OF DRAWING TRANSFERRED ELECTRONICALLY.

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ROJECT **GLOUCESTER RACF AND ILU CLEMENT STREET, GLOUCESTER**

SOURCE: NEARMAPS



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DRAWING TITLE



COVER SHEET, **DRAWING SCHEDULE** AND LOCALITY PLAN





ERS	
NSTRAINT	VALUE
	D/F
OUP	D
(K-FACTOR)	0.052
'ITY (R-FACTOR)	2583
STORM INTENSITY	10.9 mm/hr (GLOUCESTER)
GRADIENT	1.76 (80m SLOPE @ 7% GRADE)
L PRACTICE (P-FACTOR)	1.3 (TYPICAL)
-FACTOR)	1.0 (TYPICAL FOR STRIPPED SITE)
THOD) (tonnes/ha/yr)	307.32
ABLE 4.2 BLUE BOOK)	LOW-MODERATE

SEDIMENT BASIN SIZING		
CONSTRAINT	VALUE	UNITS
CV = VOLUMETRIC RUNOFF COEFFICIENT	0.5	
$R = 5 DAY, 75^{TH} PERCENTILE RAINFALL$	25	mm
A = CATCHMENT AREA	3.0	ha
SETTLING ZONE VOLUME (10xCVxRxA)	375	m ³
SOIL LOSS (CALC ABOVE)	307.32	m³/ha/yr
A2 = DISTURBED CATCHMENT AREA	3	ha
SEDIMENT STORAGE VOLUME (0.17xSOIL LOSSxA2)	121	m ³
TOTAL BASIN VOLUME REQUIRED	496	m ³

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TYPICAL ACCESS ROAD DETAIL

TYPICAL ENTRY ROAD DETAIL

TYPICAL DRAINAGE CHANNEL DETAIL

TYPICAL VERGE DETAIL – CLEMENT STREET

VERGE VARIES

/---- FLUSH KERB

CONCEPT STORMWATER MANAGEMENT PLAN

at

1-25 Clement Street, Lot 40 DP 1227815, Gloucester

for

Anglican Care

Job No: Revision:	NL180351 B		
Date:	1	8/05/2018	
	BY	DATE	
Prepared	SC	18/05/2018	
Checked	CP	18/05/2018	
Admin	LD	18/05/2018	

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APPENDIX A – CONCEPT CIVIL DESIGN DRAWINGS

APPENDIX B – MIDCOAST COUNCIL CORRESPONDENCE

1. Introduction

1.1 General

Northrop Consulting Engineers have been engaged by Anglican Care to undertake a Concept Stormwater Management Plan for the proposed development located at 1-25 Clement Street, Gloucester (Lot 40 DP 1227815).

This report has been prepared with consideration to and generally in accordance with the State Environmental Planning Policy - Housing for Seniors or People with a Disability 2004 (SEPP HSPD), which is the code that the development is to be assessed against. In the absence of specific design information within SEPP HSPD, we have referred to Gloucester Shire Council Draft Development Control Plan 2010 and Greater Taree Council's Development Design Specifications - Stormwater Drainage Design.

The purpose of this report is to address the issues associated with the proposed development of the site, in particular:

- Flooding Assessment
- Management of Stormwater Quantity
- Management of Stormwater Quality
- Roadways and pavement

This report intends to discuss issues relating to the site at a level appropriate for a Development Application submission and should be read in conjunction with drawings DA-C01– DA-C07 (refer Appendix A). It does not attempt to provide detailed design solutions to all issues; rather it will investigate the feasibility of solutions based on information that we have gathered to date from a number of sources and provide outcomes which will be developed further at Construction Certificate and Construction phases of the project.

1.2 Site Description

The site is located on the western side of Clement Street, with an existing educational facility to the north and an existing residential subdivision to the south. The site is undeveloped and covers approximately 3.0 Ha.

A natural swale runs from north-east to south-west through site, eventually reaching an existing 1st order watercourse on the south-western section. The site generally slopes towards the swale at grades varying between 1 and 10%.

As a part of the new development it is proposed that a Residential Aged Care Facility (RACF), 28 Independent Living Units and a Community Centre will be constructed.

Figure 1 Site Plan

2. MidCoast Council Consultation

Consultation has been undertaken with MidCoast Council during the design phase of the development. The following information was provided regarding flooding assessment, stormwater quantity, stormwater quality and rain tanks.

2.1 Flooding Assessment

Consultation with MidCoast Council was undertaken in relation to determining flooding requirements for the proposed development on the subject site. Council's Development Engineer, Mr Aaron Kelly, advised that the site was situated above Probable Maximum Flood (PMF) level from Gloucester River. A copy of the correspondence is included in Appendix B. All habitable floor levels associated with the development will therefore be constructed above the PMF level. The levels proposed for the RACF, Independent Living Units, the Community Centre and the roadways are shown on the drawings in Appendix A.

2.2 Water Quality Objectives

A review of Gloucester Draft Development Control Plan 2010 did not identify any requirement for treatment targets. Additionally, the SEPP HSPD provides only qualitative direction, with Clause 36 (a) stating '*The proposed development should control and minimize the disturbance and impacts of Stormwater runoff on adjoining properties and receiving waters by, for example, finishing driveway surfaces with semi-pervious material, minimizing the width of paths and minimizing paved areas.*'.

Council advised that the site is within a drinking water catchment, and therefore water quality treatment is required, refer to Appendix B for a copy of the correspondence. Northrop have therefore referred to 'Greater Taree Council Development Design Specifications 5 and 7' as a guide for water quality objectives for the development. Greater Taree Council forms part of the MidCoast Council Local Government area, so was considered relevant to the development site. The specifications note that Water Sensitive Urban Design (WSUD) methods should be incorporated in all developments and stormwater runoff quality shall meet the Australian Rainfall Quality (ARQ) guidelines. The ARQ stormwater treatment objectives have therefore been adopted as the pollutant load reduction targets for the development.

2.3 Water Quantity Objectives

MidCoast Council's engineering department advised that the site should limit post development flows to that of undeveloped flows leaving the site. Council also noted that the preferred outcome is for the required detention volume to be integrated into the development, where possible, in the form of rain tanks and in car parking areas. The required storage volume has been found to be too large to be entirely integrated into the form of the development, and therefore some end of line storage will be required. Integrated storage opportunities will be investigated through detailed design, when 3D modelling of the site is developed. The size of the proposed end of line detention basin is therefore considered worst case, and would ideally be reduced during detailed design.

2.4 Rain Tanks

It is noted that Section 11.1 of the Gloucester Shire Council Draft Development Control Plan 2010 requires 2,000 litre rain tanks for each development. As the development will be assessed against the SEPP HSPD, Council advised that the requirements of the DCP will be superseded. Section 36 (b) of SEPP HSPD requires that "the proposed development should include, where practical, on-site stormwater detention or re-use for second quality water uses". In this instance, we have allowed for a nominal 10,000 litre re-use tank attached to the RACF for landscape irrigation.

3. Stormwater Quantity Management Strategy

3.1 Stormwater Quantity Targets

The proposed development will consist of impervious roadways, footpaths, hardstand and roof areas. As such, there will be an increase in impervious area which will increase the stormwater runoff from the site. To reduce the peak post-developed flows to equal or less than that of pre-developed conditions, on-site stormwater detention is proposed.

3.2 On-Site Detention

On-site detention is to be provided in the form of integrated storage, such as garden beds, car parking areas and the rain tank, as well as an end of line detention basin. For development application purposes, the end of line basin has been sized to accommodate the full storage requirements. As the development progresses to detailed design, and 3D modelling of the site is undertaken, opportunities for integrated storage would be identified. It is expected that this would reduce the size of the end of line basin.

The site catchment area associated with the proposed detention basin was hydraulically modelled using the computer-based runoff routing model, DRAINS. The modelled catchment area may be viewed below in Figure 2.

Figure 2 - Schematic of catchment area

Peak hydrographs for the catchment area have been determined for both pre and post-developed site conditions by comparing a range of storm durations for the 20%, 10%, 5%, 3% and 1% Annual Exceedance Probability (AEP) storm events. The peak hydrographs have been used to determine the detention volume required.

For the purposes of runoff modelling, pre-developed site conditions considered a greenfield site (0% impervious area with no detention basin). For the post-developed site conditions, the catchment area was modelled as 60% impervious and included a 600m³ detention basin with a 5 metre weir and 300mm outlet orifice.

The estimated peak discharge from the catchment for the pre-developed and post-developed conditions, as predicted by the DRAINS analysis, can be seen in Table 1 below.

Storm Event	Pre-developed	Post-Developed
Storm Event	Peak Discharge (m ³ /s)	Peak Discharge (m³/s)
20%AEP	0.597	0.420
10%AEP	0.702	0.487
5%AEP	0.841	0.655
2%AEP	0.958	0.826
1%AEP	1.100	0.998

Table 1 - 1 Te-developed nows versus post-developed now	Table 1 - Pre-develo	ped flows versus	post-developed flows
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Table 1 shows that the stormwater quantity target is achieved, with post-developed peak discharges lower than pre-developed peak discharges for all modelled storms. DRAINS output files can be provided upon request.

The basin is proposed to be located at the south-western end of the existing drainage channel, as shown in Northrop drawing DA-C06. The basin is intended to make use of the natural fall of the land, minimising the extent of earthworks. The formation of the basin will imitate a typical dam, representative of the surrounding rural area. The floor of the basin will contain a bioretention filter area, as described in Section 4, which will be free draining via pervious filter media and subsoil drainage. The basin will therefore be an ephemeral basin.

Stormwater runoff from the development will be conveyed to the basin by a pit and pipe network, and open channel. The basin outlet will consist of a piped outlet and an emergency overflow weir, which will cater for the internal site catchment, as well as the external catchment from Clement St.

3.3 External Catchment

Survey of the site and surrounding area has identified two 450mm diameter reinforced concrete stomwater culverts that discharge into the site at the eastern boundary. Both culvert outlets align with existing channels that traverse the site.

As shown in Northrop drawing DA-C06, the proposed development will include construction of kerb and channel for the full site frontage to Clement Street. As part of the verge works, new kerb inlet pits will be constructed over the existing culverts and divert flows to the retained drainage channel through the centre of the site.

It is noted that the low point in Clement street does not align with the retained drainage channel. Instead, in the event of inundation of the pit and pipe network, surcharge would be conveyed through the site via the entry road to the retained drainage channel. The entry road has been designed to accommodate the 1%AEP storm event from the external catchment, assuming the pipe network is 100% blocked. The scenario was modelled using the DRAINS software package. A summary of the data and results is provided below.

Catchment Area	1.8Ha
1% AEP flow	0.81m³/s
Flow depth	0.1m
Velocity	1.96m/s
Velocity x Depth	0.2m²/s

Figure L2 Appendix L of the Floodplain Development Manual provides advice on hydraulic and hazard categorization based on flooding depth and velocity. The results above can be classified as 'Low Hazard'.

3.4 Overland Flow Paths

A key feature of the proposed development is the retention of the existing drainage channel alignment through the centre of the site. The channel has been sized to accommodate the 1% AEP event with 500mm freeboard. The scenario was modelled using the DRAINS software package. A summary of the data and results is provided below.

Catchment Area	5.2Ha
1% AEP flow	2.51m³/s
Flow depth	0.5m
Velocity	1.31m/s
Velocity x Depth	0.64m²/s

The results above are situated within the transition zone between 'Low Hazard' and 'High Hazard' of Figure L2 Appendix L of the Floodplain Development Manual. It is therefore proposed that pool fencing be provided to prevent pedestrian access to the central channel.

Noting the vulnerability of the intended residents, consideration was given the effect of the Probable Maximum Flood (PMF) event on the channel. The PMF was calculated nominally as $3 \times 1\%$ AEP, and gave the results below:

1% AEP flow	7.53m³/s
Flow depth	0.82m
Velocity	1.75m/s
Velocity x Depth	1.43m²/s

The flow above can be contained within the channel, with a freeboard of approximately 180mm. The results above can be classified as 'high hazard' in Figure L2, which further supports the proposed safety fencing.

Consideration has also been given to overland flow through the site during major storm events, to ensure no trapped low points, and that stormwater can be conveyed safely through the development. The intended overland flow paths are shown on Northrop drawing DA-C06.

4. Stormwater Quality Management Strategy

4.1 Stormwater Quality Philosophy and Targets

The proposed development will involve the construction of roadways, footpaths, hardstand and roof areas which will increase the mean annual pollutant load generated by the site. In accordance with Clause 36 (a) of the SEPP HSPD, the proposed development will include controls to minimise the impact of stormwater runoff on receiving waters. The controls will consist of vegetated swales and an end of line bio retention system to reduce the pollutant load in line with the selected treatment targets.

As described in Section 3.2 of this report, and in the absence of Council nominated treatment targets, we have adopted those nominated in Australian Rainfall Quality guidelines. Chapter 1, Section 1.4.3, Table 1.2 of ARQ nominates the Stormwater treatment objectives for Victoria and New South Wales, as reproduced in Table 2 below:

Pollutant	Stormwater Treatment Objective
Total Suspended Solids (TSS)	80% retention of average annual load
Total Phosphorous (TP)	45% retention of average annual load
Total Nitrogen (TN)	45% retention of average annual load
Gross Pollutants	Retention of litter greater than 50mm for flows up to the 3-month ARI peak flow
Coarse Sediment	Retention of sediment coarser than 0.125mm for flows up to the 3-month ARI peak flow
Oil and grease	No visible oils for flows up to the 3-month ARI peak flow

Table 2 – Stormwater Treatment (Objectives for	Victoria and New	South Wales
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4.2 Treatment Train Assessment

To substantiate the effectiveness of the proposed water quality control measures, stormwater quality modelling was undertaken using the Model for Urban Stormwater Improvement and Conceptualisation (MUSIC) V6.3.0. Rainfall and potential evapotranspiration (PET) data was obtained from the MUSIC website and set up using the meteorological template build tool. The model used Gloucester rainfall data from 1993-2010 with a 6-minute timestep and Taree PET data, as this was the closest available data to the site.

Modelling was completed in accordance with the "NSW MUSIC Modelling Guidelines" (BMT WBM, 2015). The pervious area parameters adopted were consistent with that of a silty clay loam, based on a geotechnical investigation undertaken at the site and presented in Douglas Partners Geotechnical and Preliminary Site Investigation report 91290.00.

The catchment area was broken down into seven sub-catchments to effectively simulate the proposed treatment measures along the treatment train. Figure 3 below illustrates the sub-catchments and a schematic of the model is shown in Figure 4.

Figure 4 - MUSIC Model Layout Schematic

The source nodes adopted to represent the development were Urban Residential, Urban Sealed Road, Urban Roof, Urban Mixed and Urban Revegetated Land. The residential node was used to represent the ILUs and the impervious percentage adopted was 80%.

The treatment train incorporates:

- Primary treatment via a 10kL rainwater tank connected to the RACF; and
- Secondary treatment via a bioretention basin and two vegetated swales.

Treatment nodes were created within the MUSIC model to represent the water quality treatment devices. A description of each of these measures is included below.

4.3 Rainwater Tank

Runoff from approximately 50% of the RACF roof will be collected and diverted to a 10kL rainwater tank located adjacent to the building. The only re-use demand for input in the MUSIC model was external re-use. A re-use demand of 151kL/yr was adopted, based on the "NSW MUSIC Modelling Guidelines" (BMT WBM, 2015) for outdoor uses for a single dwelling. The proposed system satisfies 84% of re-use demand which is considered an acceptable design outcome.

All downpipes reporting to the tank will be connected to a first flush device located prior to the tank inlet.

4.4 Bioretention Basin

To attain the stormwater quality targets, a bioretention basin will be located within the proposed detention basin. The basin will direct water to the bioretention trench where, through infiltration, it will collect and treat stormwater runoff from the proposed development, before discharging treated stormwater to the existing channel.

The bioretention basin has been modelled with a filter area of 150m², a filter depth of 0.4m and an extended detention depth of 0.3m. Parameters for the bioretention basin were adopted in accordance with the "NSW MUSIC Modelling Guidelines" (BMT WBM, 2015).

4.5 Vegetated Swales

Two trapezoidal shaped open channels are proposed at the stormwater outlets to convey runoff to the bioretention basin. A typical section can be seen in drawing DA-C07.

4.6 Results

The MUSIC modeling results for the receiving node are shown in Table 3 below.

	Source Load (kg/yr)	Residual Loads (kg/yr)	Percentage Reduction	Target Objectives
Total Suspended Solids (TSS)	2270	250	89.0	85
Total Phosphorous (TP)	4.11	1.34	67.4	45
Total Nitrogen (TN)	29.5	15.2	48.4	45
Gross Pollutants	359	8.06	97.8	

Table 3 shows that the proposed storm water quality management strategy is predicted to achieve the load reduction targets, as estimated by MUSIC. MUSIC data files can be provided upon request.

5. Road Layout and Grading

5.1 Subdivision Roads

Drawings DA-C06 and DA-C07 (Appendix A) show the layout of the proposed internal road network as well as the preliminary typical road cross-section. The proposed internal road network has been designed to achieve adequate stormwater conveyance and to have compliant disabled access from the road to the proposed ILUs.

5.2 Road Grading

Preliminary grading for all proposed internal roads has been prepared in accordance with MidCoast Council's - Gloucester Development Control Plan which follows Austroads Standards. Maximum longitudinal grades adopted for the internal roads are approximately 1 - 5%, with the exception of the 6% entry road from the roundabout at southern end.

5.3 Pedestrian Access

Pedestrian access throughout the development is proposed to be via the road network as it will be a low-risk environment with low speeds and minimal car movements. The roads are graded between 1-5% which generally complies with the accessibility grades nominated in AS1428.1. The site access leading into the site from the roundabout on clement street is shown as 6%, and is not intended for pedestrian access due to the proximity to the roundabout.

5.4 Road Types

Typically, road surface treatments throughout the development will consist of an inverted crown bituminous flexible seal with flush kerbs, in accordance with the Gloucester DCP. The entry road will be provided with upright kerb to provide sufficient capacity to convey stormwater.

Roads have been designed to have a two-way cross-fall towards the centerline of the road aiding in directing storm water towards the proposed storm water drainage network.

It is anticipated that the proposed driveways will be constructed using either bitumen or concrete.

5.5 External Works

It is proposed that kerb and channel will be constructed for the full site frontage to Clement Steet, to tie in with the existing kerb on Ravenshaw Street. Construction of the new kerb will include shaping of the verge to comply with Council's typical requirement being a nominal 2% crossfall towards the carriageway.

As noted in Section 3.3, construction of the new kerb and channel will include provision of kerb inlet pits at the location of the existing drainage culverts. Drainage pits at the low point in Clement Street will be sized to convey the minor event to the proposed central drainage channel. Surcharge from major storm events, or in the event of blockage, will be conveyed in the entry road to the central drainage channel, as described in Section 3.3.

6. Conclusion

Given the results of the above investigations, it is reasoned that the development meets SEPP HSDP and MidCoast Council's requirements.

As confirmed by MidCoast Council, flooding from external waterways is not expected to impact the proposed development. Flooding from the upstream and internal catchments will be managed through the provision of a drainage channel through the centre of the site, sized to accommodate the 1% AEP with a 500mm freeboard. Consideration has been given to overland flow paths to ensure that there are not trapped low points within the development.

To comply with SEPP HSPD Clause 36 (a), the proposed development will control and minimise disturbance and impacts of stormwater runoff on adjoining properties and receiving waters, as follows:

- In collaboration with MidCoast Council, the pollutant load reduction targets have been established to comply with those nominated in Chapter 1, Section 1.4.3, Table 1.2 of Australian Rainfall Quality guidelines; and,
- The treatment of stormwater for waterborne pollutants to achieve the selected treatment targets is achieved through the proposed treatment train. This includes the use of a rainwater tank, a bioretention basin and three swales.

To comply with SEPP HSPD Clause 36 (b) the proposed development will include on-site stormwater detention and re-use for second quality water uses, as follows:

- Runoff from approximately 50% of the RACF roof will be connected to a 10kL tank for reuse in landscape irrigation;
- Stormwater from the ILUs, Community Centre and roadways will be conveyed to the combined stormwater detention and water quality treatment basin, before being discharged into the adjacent water; and,
- The proposed detention basins will reduce post-developed peak discharge to below the predeveloped peaks.

To comply with SEPP HSPD Clause 38 (b) the proposed development will provide attractive, yet safe, environments for pedestrians and motorists with convenient access and parking for residents and visitors, as follows:

 Building and ground levels throughout the site have been set to ensure that grades generally comply with AS1428.1, in all locations with pedestrian access.

Limitation Statement

Northrop Consulting Engineers Pty Ltd (Northrop) has been retained to prepare this report based on specific instructions, scope of work and purpose pursuant to a contract with its client. It has been prepared in accordance with the usual care and thoroughness of the consulting profession for use by Anglican Care. The report is based on generally accepted practices and standards applicable to the scope of work at the time it was prepared. No other warranty, express or implied, is made as to the professional advice included in this report.

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APPENDIX A

Concept Civil Design Drawings

GLOUCESTER RACF AND ILU CLEMENT STREET, GLOUCESTER CIVIL WORK DRAWINGS

DRAWING SCHEDULE

- DRG No. DRAWING TITLE
- DA-C01 COVER SHEET, DRAWING SCHEDULE AND LOCALITY PLAN
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LOCALITY FLAN

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APPENDIX B

MidCoast Council Correspondence

Chris Piper

From:	Chris Piper
Sent:	Tuesday, 13 March 2018 12:56 PM
То:	'aaron.kelly@midcoast.nsw.gov.au'
Subject:	Gloucester RACF

Hi Aaron,

Thanks for the phone call just now, we'll progress with design based on our discussion, summarised below.

- The proposed site is well above PMF level and does not need to be investigated further;
- On site detention (OSD) is to limit post development flows to pre development flows.
- OSD should consider rain tanks / car park for storage opportunities, and avoid a damn where possible.
- Amenity of the OSD outcome is key.
- The site catchment falls within a drinking water catchment.
- While not explicitly described in the DCP, water quality will need to be considered. The central channel provides a good opportunity for treatment.
- There are not any documented treatment targets, however Northrop will undertake and provide the results of MUSIC modelling to identify the treatment achieved

Please let me know if I have misunderstood any of the above. Thanks again for your assistance.

Kind regards **Chris Piper** Senior Engineer **Northrop Consulting Engineers Pty Ltd** M: 0407 9404 81 F: 02 4943 1577 Level 1, 215 Pacific Highway Charlestown NSW 2290 PO Box 180 Charlestown NSW 2290 www.northrop.com.au

