Nepean Hospital and Integrated Ambulatory Services Redevelopment

SSDA Design Report

Civil

NHR-BON-REP-CIV-TB1-ALL-0000001

Revision: 5
## Report Amendment Register

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1. INTRODUCTION

This civil report has been prepared by Bonacci Group (NSW) Pty Ltd to describe the civil works including the stormwater strategy associated with the State Significant Development Application (SSDA) for the Integrated Nepean Hospital Redevelopment – Stage 1 Building works.

This SSDA report incorporates the demolition of a number of existing structures and the construction of a new 14 storey tower on the location of the existing carpark, extension of Barber Ave to new Hospital Main Entrance, a new cul-de-sac off Somerset St to provide access to the new Emergency Department (ED) Ward, new Ambulance Access Bays to ED, and a new Helipad on the roof of the new hospital tower. A new pedestrian link will be constructed to enable access from the main hospital to the newly upgraded Cancer Care ward.

This report addresses the redirected, upgraded (where required) and proposed new stormwater drainage networks related to the proposed Main Tower works (as well as affected external catchments drainage works), new pavement works, and bulk earthworks associated with the development. This design report also incorporates the water quality strategy for the site including treatment chambers to treat stormwater runoff in accordance with Penrith City Council requirements and a separate SPEL Puraceptor to treat runoff from the Helipad in accordance with NSW Environment Protection Authority (EPA).

1.1. Objectives

The objectives of this State Significant Development Application (SSDA) report is to demonstrate compliance with all the requirements of Penrith City Council DCP 2014 Volume 1, Design Guidelines for Engineering Works for Subdivision and Developments, Stormwater design Specification for Building Developments and Water Sensitive Urban design Technical Guidelines are following:

- To design a stormwater trunk drainage system for the site to accommodate the stormwater runoff up to and including 100 year ARI storm events without having adverse impact to adjoining properties,
- To provide stormwater diversion system to accommodate external catchments peak flows up to including 100 year ARI storm events for better management of the stormwater runoff both construction and fully established periods for the proposed site,
- To maintain the permissible site discharge (peak flows from existing site) for the site due to development from 5 year ARI (minor storm events) up to and including 100 year ARI (major storm events) storm events, and
- To provide a functional Water Sensitive Urban Design (WSUD) measures for the site to improve the water quality system overall and achieves the pollutant removal targets set by Council’s Water Sensitive Urban design Technical Guidelines.
1.2. SEAR’s

The table below responds to the Secretary’s Environmental Assessment Requirements (SEAR’s) issued for the project:

<table>
<thead>
<tr>
<th>SEARs</th>
<th>Response – reference section / Appendix</th>
</tr>
</thead>
<tbody>
<tr>
<td>11. Drainage</td>
<td>Refer Section 3.2 and Drawing 3001 and 3002 in Appendix A of this Report</td>
</tr>
<tr>
<td>Detail drainage associated with the proposal, including stormwater and drainage infrastructure</td>
<td></td>
</tr>
<tr>
<td>12. Flooding</td>
<td>Refer Section 3.1 of this Report</td>
</tr>
<tr>
<td>Assess any flood risk on site and consideration of any relevant provisions of the NSW Floodplain Development Manual (2005), including the potential effects of climate change, sea level rise and an increase in rainfall intensity</td>
<td></td>
</tr>
<tr>
<td>Plans and Documents:</td>
<td>Refer Appendix A of this Report</td>
</tr>
<tr>
<td>• Stormwater concept design</td>
<td></td>
</tr>
<tr>
<td>• Sediment and Erosion Control Plan</td>
<td></td>
</tr>
</tbody>
</table>
2. SITE DESCRIPTION

2.1. Location

The proposed development is located on the Nepean Hospital Campus, Kingswood NSW. The Campus is bordered by Parker Street to the west, Barber Avenue and the Great Western Highway to the north, Somerset Street to the east and Derby St to the south. The location of the proposed Stage 1 Building is centrally located generally over the existing hospital carpark. The proposed site is located within Penrith City Council Local Government Area (LGA). The locality map of the site is shown in Figure 2-1 below.

Figure 2-1: The Locality Map of the Site (Source: Google Maps)
2.2. Topography

The Campus is located on a localised crest. The proposed location of the Hospital Tower and associated infrastructure generally slopes to the east. The existing carpark and surrounding buildings drain via a series of stormwater networks, generally in a north-east direction where they discharge to Councils stormwater infrastructure in Somerset St. In major storm events, any overland flow generally flows eastward towards Somerset St and continues eastward down Rodgers St, following the existing topography.

2.3. Existing Documentation

The following relevant existing documentation has been referenced for the proposed design:

- Detail Survey including in ground services by Cardno Pty Ltd, 7th June 2017 including Pit Depth and Existing Stormwater Pipe dimensions.

- Geotechnical Investigation (Ref: 29845Lrpt MWCDB) for Proposed main Works, Commercial and Bunker Developments by JK Geotechnics Pty Ltd, 11 December 2017.

- College, Orth and Werrington Creeks Catchment Overland Flow Flood Study by Catchment Simulation Solutions, Revision 3, 9 November 2016.
3. **PROPOSED DEVELOPMENT**

The proposed development is comprised of a new 14 storey tower on the location of the existing carpark, extension of Barber Ave to new Hospital Main Entrance, a new cul-de-sac off Somerset St to provide access to the new Emergency Department (ED) Ward, new Ambulance Access Bays to ED, and a new Helipad on the roof of the new hospital tower. A new pedestrian link will be constructed to enable access from the main hospital to the newly upgraded Cancer Care ward. The Architectural site plan for the Stage 1 Building works are shown in Figure 3-1 below.

![Figure 3-1: The Architectural Site Plan (by BVN Architects)](image)

3.1. **Flood Impact Assessment**

A flood study “College, Orth and Werrington Creeks Catchment Overland Flow Flood Study, Revision 3, dated 9 November 2016” has been produced by Catchment Simulation Solutions on behalf of Penrith City Council. This study identifies that the north west and north east portions of the Nepean Hospital Campus are flood affected. Stormwater from a major culvert under the rail corridor passes across the North Eastern corner of the site via a combination of pipes and overland flow to the site discharge point on the eastern boundary and ponds at the low point in Somerset Street. The flood study included potential effects of climate change, sea level rise and increase in rainfall intensity.
While the north western portion of the site is inundated, the proposed location of the Stage 1 Building is not within the affected area.

The approximate flood levels immediately adjacent to the north east of the proposed building are as follows:

<table>
<thead>
<tr>
<th>Event</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1% AEP</td>
<td>47.5m AHD</td>
</tr>
<tr>
<td>PMF</td>
<td>49.0m AHD</td>
</tr>
</tbody>
</table>

Section 3.1.2 of Penrith City Council 2016 Stormwater Drainage Guidelines for Building Developments requires minimum 500mm freeboard from 1% AEP water surface to residential, industrial or commercial floor levels for emergency response facilities (e.g. police stations, hospitals), critical infrastructures and other types of developments that required special evacuation needs (e.g. schools, aged care facilities, disabled and child care facilities), adoption of design storm events larger than 1% AEP design storm events and higher freeboard requirements and may be necessary.

The New South Wales Floodplain Development Manual (April 2005) notes that “consideration should also be given to using the Probable Maximum Flood (PMF) as the Flood Planning Level when siting and developing emergency response facilities”.

The proposed finish floor level of the lowest level of the building in the new development is at RL 49.02 AHD. This finished floor level is higher than the PMF, and thus complies with the NSW Floodplain Development Manual recommendations.

In summary the footprint of the proposed development is not located on flood affected land and therefore will not have an effect on the flood levels on adjacent properties. The level of the lowest floor of the building achieves 1.52m free board to the 1%AEP flood event and is above the level of the probable maximum flood complying with the requirements of Penrith City Council and NSW Floodplain Development (2005).

The Complete Overland Flow Study is provided in **Appendix D**.

### 3.2. Stormwater Drainage

#### 3.2.1. Catchment Delineation

The Proposed Site is located within the existing north eastern catchment. The catchment size is approximately 3.07ha in area.

A trunk drainage system is proposed for the site to provide drainage for the affected sub-catchments during construction and to service the proposed tower and associated infrastructure post development.

Two diversion drainage lines are proposed as early works to enable the decommissioning of existing stormwater lines within the construction site. They will be integrated into the final stormwater drainage network at the completion of the works. The stormwater strategy for the site is shown in Drawing No. NHR-BON-DRW-CIV-TB1.ALL.3001 and NHR-BON-DRW-CIV-TB1.ALL.3002.
3.2.2. Hydrology and Hydraulics

The stormwater drainage systems have been designed to cater for design storms up to and including 100 year ARI (1% AEP) storm events as per Section 3.1.1 in Design Guidelines for Engineering Works for sub-division and Developments, November 2013 by Penrith City Council.

The hydrology and hydraulic analysis for the proposed site was established using a DRAINS (computer program for hydrological and hydraulic assessment) model. The hydrological parameters used in DRAINS are in accordance with Penrith City Council’s “Design Guidelines for Engineering Works for Subdivision and Developments, 2013”.

The intensity-frequency-duration (IFD) data for the site was extracted from Australian Rainfall and Runoff Volume 1, 1987 (Also provided in Council’s Design Guidelines for Engineering Works for Subdivision and Developments, 2013 Appendix 5) is provided in Appendix B.

The DRAINS model was adopted to obtain permissible site discharge (PSD) for existing scenarios in accordance with “Stormwater Drainage Specification for Building Developments, 2013” and as well as to design the on-site detention tank (if required to maintain existing PSD). The Drains model flows were obtained for 5 year, 20 year and 100 year ARI storm events. The effect of climate change was considered in hydraulic modelling, with effects of an increase in rainfall intensity checked. The increase will result in additional overland flows (with potentially the capacity of the pipe system reducing from the 5% event to the 10% or 20% event), however they would be maintained within overland flowpaths with appropriate freeboard to building floor levels provided. An increase in sea level is not likely to have significant impacts on the site, as the hospital is located approximately 55km from the ocean.

3.2.3. Permissible Site Discharge (PSD)

The proposed site is approximately 3.07ha in area. The impervious area of proposed site has decreased to 50.4% whereas the impervious area for the existing site is 73.4%. There is no on-site stormwater detention system on the current site.

Since the proposed development results in the reduction of total impervious area and consequently the corresponding site discharge is reduced, therefore, according to Penrith City Council requirements, the current Permissible Site Discharge is preserved and thus negating the need for an on-site detention system. The proposed catchment plan is provided in Appendix A.

The stormwater concept plans are shown in Drawing No. NHR-BON-DRW-CIV-TB1.ALL.3001 and NHR-BON-DRW-CIV-TB1.ALL.3002. A minimum 5 minutes time of concentration (t_c) has been adopted for DRAINS modelling. The permissible site discharge for the site is summarised in tabular format below. The external catchments are also included in the modelling. A schematic diagram of DRAINS model for the existing scenario is shown below.
Table 3-1: Summary of PSD for the Site

<table>
<thead>
<tr>
<th>Nodes</th>
<th>Location</th>
<th>Area (ha)</th>
<th>PSD (Permissible Site Discharge) (m³/s)</th>
<th>Time of Concentration (tₖ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ex. Outlet Discharge Level</td>
<td>Somerset St</td>
<td>3.07</td>
<td>0.964, 1.29, 1.59</td>
<td>5</td>
</tr>
<tr>
<td>Proposed Outlet</td>
<td>Somerset St</td>
<td>3.07</td>
<td>0.932, 1.26, 1.56</td>
<td>5</td>
</tr>
</tbody>
</table>

3.2.4. Stormwater Analysis and Design

The proposed stormwater drainage network was designed using DRAINS software. All stormwater runoff from the new tower, associated infrastructure and landscape areas was captured and directed into the proposed new stormwater pit and pipe system. DRAINS was used to model the proposed network and to correctly size the inlet pits and the network pipes. A schematic diagram of DRAINS model for developed is shown below. The pits and pipes are design for 5% ARI for minor storms storm events. Overland flow paths were designed for major storm events.

Figure 3-2: A Schematic Diagram of DRAINS (Hydrology and Hydraulics) Model for Existing and Developed Scenario
The eastern and western roofs of the tower are drained via eight (8) downpipes (4 downpipes on each side). The four (4) eastern downpipes drain the Helipad area to a SPEL Puraceptor (located between the ambulance bays and the new cul-de-sac servicing ED.

3.2.5. Diversion Drainage Lines

The trunk drainage system proposed for the site is designed to accommodate external catchment peak flows as well as draining the new tower and associated infrastructure.

The trunk drainage system is designed to accommodate not only the diversions required for the construction stage, but also the complete drainage requirements for the proposed site works. There are two trunk drainage systems proposed for the site – the north-western and southern/eastern drainage systems that connect to corresponding existing Campus stormwater infrastructure.

During the construction stage, the southern diversion line and the western diversion line will be constructed and connected to the existing downstream stormwater lines. This will enable commencement of demolition of existing structures and the commencement of the Stage 1 Building construction. Diversion of the upstream catchments will ensure the construction site and adjacent hospital operations do not experience any interruption due to stormwater issues. The stormwater lines will remain and be integrated with the permanent stormwater drainage network.

3.2.6. Water Quality

The water quality treatment measure for the proposed Main Tower is designed to satisfy the requirements set by Penrith City Council’s Water Sensitive Urban Design (WSUD) Policy, December 2013. The water quality targets set by Penrith City Council’s WSUD policy are provided below:

- **Reduction of Mean annual Load of Gross Pollutants** – 90% (greater than 5mm)
- **Reduction of Mean annual Load of Total Suspended Solids** – 85%
- **Reduction of Mean annual Load of Total Phosphorous** – 60%
- **Reduction of Mean annual Load of Total Nitrogen** – 45%

Currently the site does not have any treatment measures. The proposed strategy provides water quality measures specifically for the new tower and associated infrastructure. The proposed water quality strategy for the site is described in detail below. Water Sensitive Urban Design measures have been incorporated in the proposed development in accordance with best practice (where possible, opportunity for infiltration of stormwater runoff has been provided).

3.2.7. Water Quality Strategy

The water quality treatment measures for the site are provided to reduce pollutant loads due to the proposed development. Even though the total impervious area is reduced, as the works constitute a new development, the above water quality targets set by Penrith City Council will be adhered.

The proposed site has been distributed into following sub-catchments based on the specific WSUD measures required for the site. The sub catchments can be seen in the proposed catchment plan NHR-BON-DRW-CIV-TB1.ALL.3052. A calculation of the impervious area was obtained based on the landscape plan (Refer to Landscape Drawings for Integrated Nepean hospital by Arcadia Pty Ltd).
The water quality strategy for the site incorporates a swale, enviropods and stormfilters. The eastern roof including the helipad drains towards a Puraceptor (SPEL) model P050 (located between the new Ambulance Bays and the new cul-de-sac servicing the Emergency Department) to treat stormwater runoff (potentially from a fuel/oil spill) before entering the stormfilter chamber for further treatment. The western roof area drains to a stormfilter chamber for treatment.

The runoff from Barber Avenue road extension and the new cul-de-sac servicing the proposed Emergency Department is captured and filtered by Enviropods in each stormwater inlet pit before passing through a Stormfilter chamber to meet Council’s water quality targets.

Figure 3-3 Catchment Areas
Table 3-2: Summary of Sub-catchments and Water Quality Measures for overall Site

<table>
<thead>
<tr>
<th>Sub-catchments</th>
<th>Area (ha)</th>
<th>Impervious Fraction (%)</th>
<th>WSUD Treatment Measures</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road 1</td>
<td>0.130</td>
<td>100</td>
<td>Enviropods, Storm filter chamber</td>
<td></td>
</tr>
<tr>
<td>Road 3</td>
<td>0.055</td>
<td>100</td>
<td>Enviropod, Storm filter chamber</td>
<td></td>
</tr>
<tr>
<td>Roof 5</td>
<td>0.380</td>
<td>100</td>
<td>Storm filter chamber</td>
<td></td>
</tr>
<tr>
<td>Grass 1</td>
<td>0.734</td>
<td>19.56</td>
<td>Enviropods, Storm filter chamber</td>
<td></td>
</tr>
<tr>
<td>Grass 2</td>
<td>0.276</td>
<td>23.35</td>
<td>Swale</td>
<td></td>
</tr>
<tr>
<td>Roof 6</td>
<td>0.117</td>
<td>100</td>
<td>Storm filter chamber</td>
<td></td>
</tr>
<tr>
<td>Road 4</td>
<td>0.082</td>
<td>100</td>
<td>Enviropods, Storm filter chamber</td>
<td></td>
</tr>
<tr>
<td>Road 5</td>
<td>0.249</td>
<td>100</td>
<td>Enviropods, Storm filter chamber</td>
<td></td>
</tr>
<tr>
<td>Roof 7</td>
<td>0.315</td>
<td>100</td>
<td>SPEL Puraceptor, Storm filter chamber</td>
<td>Includes the Helipad</td>
</tr>
<tr>
<td>Grass 4</td>
<td>0.337</td>
<td>3.50</td>
<td>Storm filter chamber</td>
<td></td>
</tr>
<tr>
<td>Grass 3</td>
<td>0.355</td>
<td>0</td>
<td>Storm filter chamber</td>
<td></td>
</tr>
<tr>
<td>Grass 5</td>
<td>0.039</td>
<td>0</td>
<td>Bypass</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>3.070</td>
<td>-</td>
<td>Rounding accounts for the difference in site area.</td>
<td></td>
</tr>
</tbody>
</table>

The properties of the individual WSUD measures are provided in Appendix C.
3.2.8. Water Quality Model

The water quality strategy for the proposed site was established using MUSIC [Version 6.2] model. The MUSIC model was established using Penrith City Council’s MUSIC link as per Section 4 in WSUD Technical Guidelines, June 2015. The Catchment summary along with WSUD measures for the site are already summarised in
Table 3-1 above. A screen shot of *Music* [version 6.2] model representing the site is provided below.

The Pollutant generation parameters for the site are as per Penrith city Council's WSUD Technical Guidelines and *MUSIC link* report for the site (as attached in Appendix C).

![Figure 3-4: A Schematic Diagram of the Music Model Showing Existing and Proposed Scenario](image)

### 3.2.9. Water Quality Results

The results of MUSIC modelling show that the pollutant removal rate achieves pollutant reduction targets provided in Section 3. The results from the MUSIC model are shown below as a screen shot.

![Figure 3-5: Music model Results](image)
3.3. Bulk Earthworks / Excavation

The bulk earthworks for the proposed main tower and associated infrastructure are detailed on Drawing No. NHR-BON-DRW-CIV-TB1.ALL.2001 and NHR-BON-DRW-CIV-TB1.ALL.2002. The proposed finished floor level for the main tower ground floor is RL49.0.

Approximate volumes of cut and fill are 32,315m$^3$ and 1,550m$^3$ cubic metres respectively, resulting in excess cut volume of 30,765m$^3$.

The Soil and water management of the proposed site will be implemented during construction. The design of these measures is in accordance with the Landcom “Blue Book”. Refer to drawings NHR-BON-DRW-CIV-TB1.ALL.1100, NHR-BON-DRW-CIV-TB1.ALL.1101 and NHR-BON-DRW-CIV-TB1.ALL.1102 for the Soil and Water Management plan, Typical Detailing and sediment basin volume calculation sheets.

For soil and water management of the site, the following measures are provided to minimise the risk of sediments being washed into neighbourhood property and erosion of the site.

- A sediment fence/catch drain (or diversion bund) around the site
- Temporary access to site with shaker pad
- An indicative stockpile area with sediment fence around it during construction. The stockpile must be located out of water flow paths (and be protected by earth banks/drains as required).
- A sediment basin of minimum volume 170 cubic metres is to be provided to the overall disturbed catchments, assuming that upstream catchment is excluded by providing diversion stormwater drainage lines (which bypasses the proposed site during the construction stage) to control stormwater quality overall as per Soil and Construction Volume 1, March 2004 by Landcom.

3.4. Pavement

The road pavement has been designed in accordance with Austroads Pavement Design for light traffic (APT36/06) with an assumed traffic of 8x10$^4$ ESA’s. This corresponds to a local access road with buses (Refer to Table 7.9 Austroads APT 36/06).

The flexible pavement meeting the report requirement is 50mm AC wearing course, 320mm granular road base over compacted subgrade (Assumed 3% CBR). Refer to drawing No. NHR-BON-DRW-CIV-TB1.ALL.3001 and NHR-BON-DRW-CIV-TB1.ALL.3002 for Pavement Plan with typical details. All pavement construction works are to be in accordance with the recommendations/specifications of the geotechnical engineer.
4. SUMMARY


The proposed stormwater strategy for this State Significant Development Application (SSDA) demonstrates compliance with Penrith City Council water quantity requirements by limiting stormwater discharge to PSD up to and including 100 year ARI storm events. The proposed development complies with the NSW Floodplain Development Manual guidelines - provision of a floor level and protection to a height above the PMF level.

The proposed water quality improvement measures (demonstrated in Section 3.3) improve the existing stormwater quality conditions and fulfil all requirements of Penrith City Council “Water Sensitive Urban Design (WSUD) Policy, December 2013”.

The proposed stormwater management strategy for the SSDA stated in this report improves the existing stormwater drainage system by reducing stormwater pollution and improving the overall water quality for the site.