RANDWICK CAMPUS REDEVELOPMENT – ACUTE SERVICES BUILDING

STATE SIGNIFICANT DEVELOPMENT APPLICATION – CIVIL

Confidential & Commercial in Confidence

Prepared for: Health Infrastructure NSW
By: **en**struct group pty ltd
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enstruct

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ISSUE AUTHORISATION

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Executive Summary

This report supports a State Significant Development Application (SSDA) for the proposed Randwick Campus Redevelopment (RCR) – Acute Services Building (ASB). This report covers:

- Secretary's environmental assessment requirements (SEARs) for site development including the following key issues:
  - 11. Sediment, erosion and dust control
  - 15. Drainage
  - 16. Flooding
  - 17. Groundwater
- Proposed development stormwater drainage
- Flood risk management

Existing Site Conditions

Stormwater

The existing site, is occupied primarily by residential houses and falls in a southerly direction from High Street to Magill Street. The site also falls from Botany Street and Hospital Road to a low point along the line of Eurimbla Avenue which is central to the site.

There are existing services in Eurimbla Avenue which will require removal prior to commencing excavation for the new building. Among these services are two existing stormwater drainage lines which run from north to south. The main stormwater pipes are 600 mm and 1100 mm in diameter and drain catchments from north of High Street and the existing Eurimbla Avenue stormwater runoff. The proposed drainage system for the Sydney Light Rail (SLR) project will connect into these drainage lines.

Flooding

Based on flood studies, the ASB site is affected by overland flooding that is generated from an upstream catchment of approximately 14 ha. Another overland flow path, defined by Botany Street, drains a 3.6 ha catchment that is located to the west of Botany Street. Eurimbla Avenue, being lower than the parallel roads, Botany Street and Hospital Road, is considered as the main overland flow paths. Under existing conditions, the north and west catchments converge at the low point in High Street and flow south along Eurimbla Avenue, through existing residential buildings and discharge into Magill Street.

Potential Impacts

Excavation

Bulk excavation is for the ASB and adjacent external works that will require excavation to an RL of approximately 46.6 m AHD. The excavated area includes proposed Emergency Department, ambulance bays, public drop-off and all associated Level B2 driveways.

The design will consider measures to control soil erosion and sediment transportation to mitigate the risk of sediment affecting the site or areas off-site during construction. Such measures will include sediment fences, settlement ponds and shaker grates in accordance with Landcom's Managing Urban Stormwater: Soils and Construction (Blue Book).

Erosion and Sediment Control will also be further addressed during detailed design and construction.

Dewatering

Preliminary geotechnical investigation of site, by Douglas Partners (2018), did not indicate the presence of groundwater at this depth. During wet season, rain infiltration may introduce perched groundwater inflow to the northern end of the basement excavation at a rate of 3 m^3/day.

Stormwater dewatering is required within the excavated areas and any sediment basins. Excavation dewatering may require treatment to reduce the amount of suspended solids prior to disposal to local stormwater connections.

For protection of receiving waters, quality of the drainage water is to meet the ANZECC Water Quality Guidelines for Fresh and Marine Waters 2000 (95% freshwater).

Flood Planning

Table "A", Section B8 -Water Management of the Randwick City Council Development Control Plan 2013 defines the Flood Planning Level for critical facilities in overland flow situations as being "Two times the depth of flow in the PMF with a minimum of 0.3m above the surrounding surface" as the hospital is classified as a "critical facility".

Water Quality

Recommended treatment targets (Landcom water sensitive urban design (WSUD), 2010) for stormwater for this project are:

- Total Suspended Solids (TSS): 80%
- Gross Pollutants (GP): 70%
- Total Nitrogen (TN): 45%
- Total Phosphorous (TP): 45%

Mitigation Measures

Construction

Prior to commencement of excavation works, a Soil and Water Management Plan (SWMP) must be prepared as part of the Contractor's Construction Environmental Management Plan (CEMP) for the works. The SWMP must include an Erosion and Sediment Control Plan (ESCP) prepared in accordance with the 'Blue Book'. Preliminary ESCP is included in this report.

Stormwater Drainage

Runoff from the roof and helicopter pad will be collected by the building hydraulics system and conveyed into the on-site detention (OSD) tank. Courtyards and terraces at the podium levels will be collected and conveyed via a downpipe system via floor pits to the northern OSD system.

A system of pits and pipes will be provided to collect the runoff generated in the ground areas. The ambulance bay area and sections close to the southern OSD tank will directly discharge into the tank. Rain falling on ground areas that could not be directed into the OSD tank will drain towards Magill Street. Prior to discharge, the stormwater flows will pass through a silt arrestor pit or Gross Pollutant Trap (GPT).

Water Quality

The stormwater system proposed for the site will discharge into Council's drainage pipe. The development will achieve the pollution reduction targets by utilising WSUD treatment. The combination of vegetated buffer, vegetated swales, and filtration devices will be used through a treatment train approach to improve water quality before stormwater discharges from the site. These elements of the Stormwater Quality Management Strategy for the proposed development will achieve all the pollution reduction targets (Gross Pollutants, Total Suspended Solids, Total Phosphorus and Total Nitrogen) required to discharge stormwater to council's stormwater network.

Flood Mitigation

The goal of the flood mitigation design is to keep overland flow within road reserves and prevent entry to ASB access driveways; while maintaining continuous ASB operation during PMF event.

A stormwater diversion system will be constructed part of REF, consisting of a variable depth 1,800 mm wide box culvert diversion system is proposed starting from the High Street low point and will run west along High Street and then south along Botany Street (within the site boundary). A flood storage tank is proposed north-west of the ASB footprint and will receive diverted stormwater from High Street and will discharge via a 1,050 mm diameter pipe along Botany Street towards Magill Street. The pipe diversion runs along Magill Street and connects to the two existing Council's stormwater pipes within the site boundary.

Review of existing and developed site flooding conditions suggests that there is significant overland flow within the site area.

- Impact of 100 year flood event shows minor impact on Hospital Road. The impact is generally less than 5 cm.
- Design the project does not increase flooding impacts (or levels) on private property external to the site during rainfall events up to and including the 1 in 100 year event.
- The PMF level in Magill Street near Hospital Road is critical for ASB operation during emergency conditions, and is approximately 0.6 m lower than the existing conditions. However, results show that flood levels increase by up to 30 cm in High Street low area. A similar increase is observed along Botany Street from the surcharge point of high-level bypass to Barker Street. Elsewhere, the levels increased by 5-10 cm. PMF events are shown to be contained within road reserve.

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1 Introduction

enstruct group have been engaged by Health Infrastructure NSW as the civil and structural engineering consultant to provide civil engineering consultancy and design services in support of the proposed redevelopment of Randwick Campus in Randwick, New South Wales. The proposed Randwick Campus Redevelopment (RCR) is located within Randwick City Council (RCC) Local Government Area (LGA).

This report supports a State Significant Development Application (SSDA) for the proposed RCR – Acute Services Building (ASB). This report covers:

- Secretary's environmental assessment requirements (SEARs) for site development
- Stormwater drainage:
  - Existing conditions
  - Potential impacts by construction activities
  - Proposed drainage diversion during early works (subject to Review of Environmental Factors [REF])
  - On-site stormwater detention
- Flood risk management

1.1 Project Scope

Stage 1 of RCR will involve the construction of the Acute Services Building (ASB) just west of the campus. The site, which has an area of approximately 2 hectares (ha), is currently occupied by residential dwellings. The development site location is shown in 1. Locality plan

The proposed ASB development will consist of the following works:

- Demolition of all existing residential dwellings
- Construction of a 13-level hospital building comprising of the following including:
  - Two (2) levels for plant;
  - Two (2) levels for retail;
  - Hospital square podium;
  - Access roads, ambulance bays, vehicular drop-off, transient car parking; and
  - Landscaped areas.

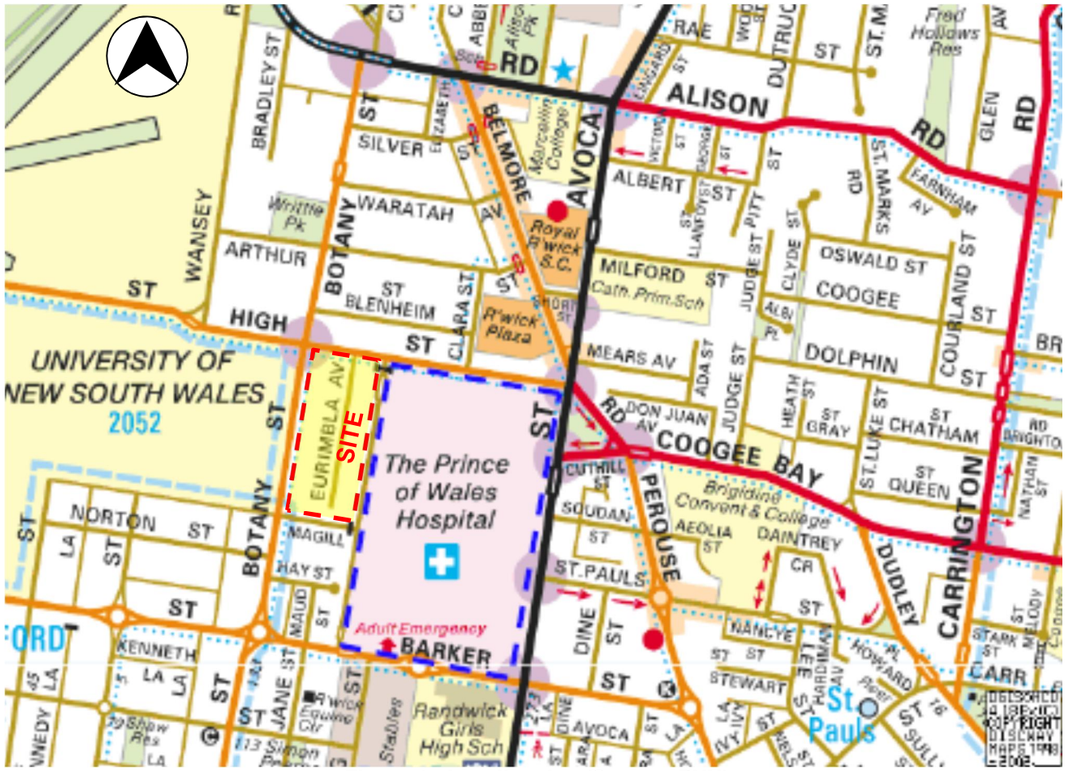


Figure 1. Locality plan (Source: BVN)

1.2 ASB Site Description

The site is located between the campuses of UNSW on the west and Randwick Campus on the east. Residential dwellings currently occupy the site, contributing to an overall imperviousness percentage of roughly 80%. The existing site is bounded to the north by High Street and residential dwellings; to the west by Botany Street and UNSW; to the south by Magill Street and residential dwellings; and to the east by Hospital Road. The proposed development will occupy the entire site and will be nearly 85% impervious. Construction of the Sydney Light Rail (SLR) Zone H alignment is currently being undertaken along High Street with a Light Rail station to be constructed near the north eastern corner of the block where the ASB development is situated.

The proposed ASB precinct is planned to occupy the southern portion of the site, Figure 2. The northern portion will be reserved for future expansion areas.

Figure 2. Location of proposed ASB development *(Source: SIX Maps)*

1.3 SEARs Requirements

SEARs requirements for the preparation of an Environmental Impact Statement (EIS) for the project were issued on 12 March, 2018. These requirements include several civil engineering related issues, as summarised in Table 1.

Table 1. SEARs requirements

SEARs Requirements		Related Report Sections
Key Issues	**11. Sediment, Erosion and Dust Controls** • Detail measures and procedures to minimise and manage the generation and off-site transmission of vapours, sediment, dust and fine particles. • Prepare a Sediment and Erosion Control Plan detailing type of sediment and erosion control measures, location of material stockpiles and storage areas and location of building operations and equipment.	Section 3.1 Appendix B
	15. Drainage • Detail drainage associated with the proposal, including stormwater and drainage infrastructure. • Prepare a Drainage Infrastructure Management Plan for the extended development site (bordered by Botany Street, Magill Street, Hospital Road and High Street). The management plan must identify all existing drainage infrastructure within the extended development site and fully document changes to the infrastructure required to facilitate construction of the proposed development. • Detail measures to minimise operational water quality impacts on surface waters and groundwater and outline measures to not cause surface water flows or flows within the Council owned drainage network to be transferred from one catchment or sub—catchment to a different catchment or sub—catchment, nor change the time of concentration for each sub—catchment as pre—development and post-development hydrographs.	Section 3.2 Appendix A
	16. Flooding Assess flood risk on site (based on the Draft Birds Gully and Bunnerong Road Flood Study) 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.	Section 4
	17. Groundwater Assess the existing groundwater regime for the development site. The design of any basement structures must consider the impact of the structures on groundwater (seepage flows and/or water table) and preclude the need for permanent/extended periods of dewatering of the site in dealing with seepage flows or building within the water table.	Section 3.1
Plans & Documents	Stormwater Concept Plan	Appendix A
	Sediment and Erosion Control Plan	Appendix B

2 EXISTING CONDITIONS

2.1 Stormwater

The existing site falls in a southerly direction from High Street to Magill Street. The site also falls from Botany Street and Hospital Road to a low point along the line of Eurimbla Avenue which is central to the site.

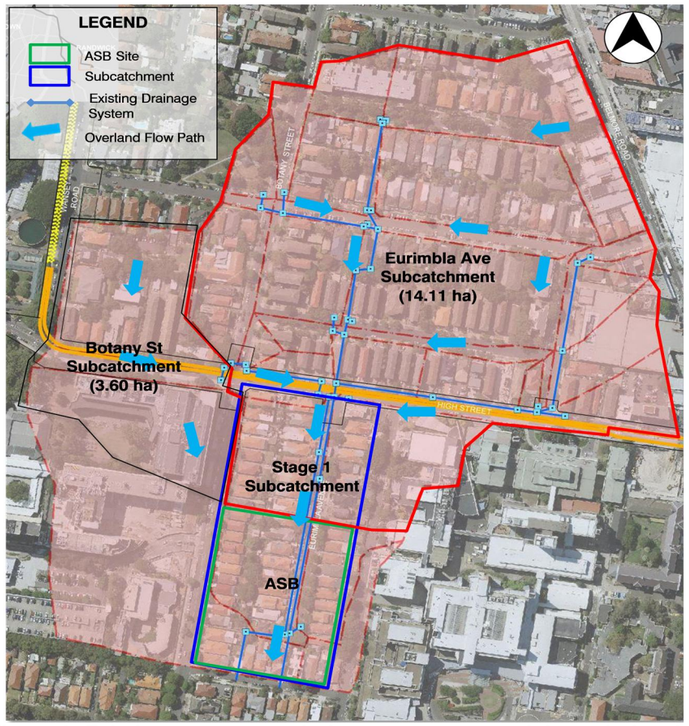


Figure 3. Existing stormwater drainage upstream and through the site

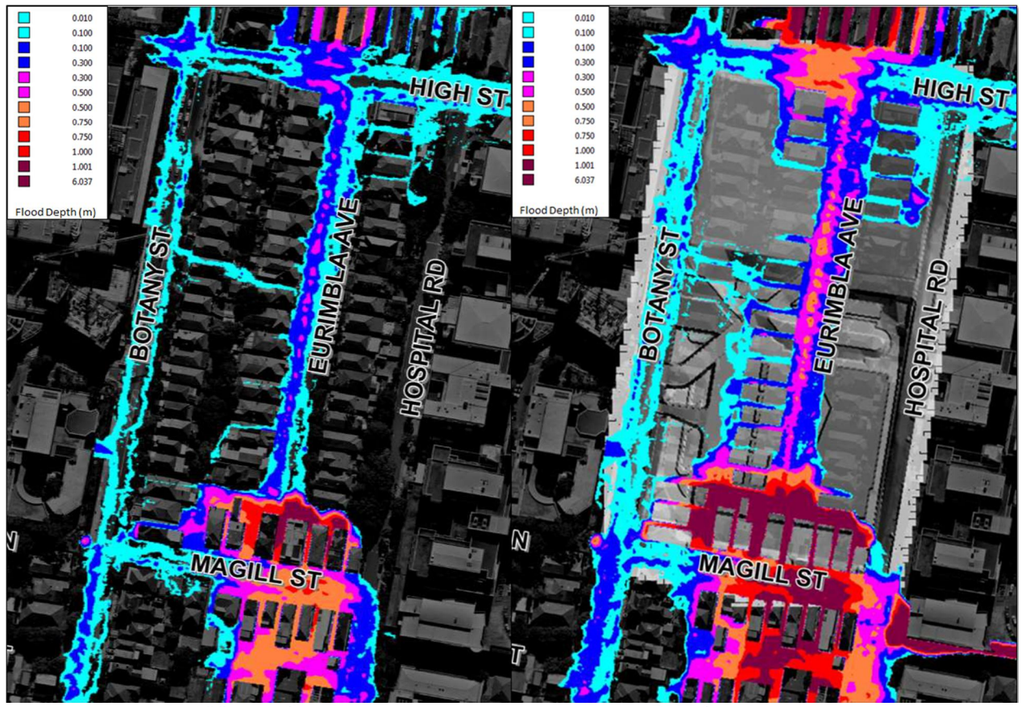
The existing stormwater network in Eurimbla Avenue includes two parallel minor event stormwater drainage lines which flow from north to south. The stormwater lines are 600 mm and 1050 mm in diameter and drain catchments from north of High Street and the existing Eurimbla Avenue stormwater runoff. The proposed drainage system for the SLR project consists of two 1050 mm and one 375 mm RCP pipes which will connect into the existing stormwater lines in Eurimbla Avenue. The SLR design calls for 'existing pipes to be upgraded in future by others to double the capacity' (SLR Civil and Structural Works - Wansey Rd to Avoca St: Drainage General Arrangement Drawing No. SLR-DJV-D40-DRA-DWG-069203; dated 15th May, 2017).

The drainage lines in Eurimbla Avenue continue south to Magill Street where they divert east to connect into the existing Randwick City Council (Council) drainage in Hospital Road. Overland flow which bypasses the drainage network flows through Eurimbla Avenue south to Magill Street.

2.2 Flooding

The site is located within the Birds Gully and Bunnerong Road catchment. SLR undertook a flood immunity and mitigation study for High Street in Randwick in May 2017. A preliminary flood and modelling review has been undertaken and reported by **en**struct; which is consistent with SLR's findings. Council is currently undertaking a catchment-wide flood study, which is expected to be available in mid- to late-2018. Preliminary Council model setup and flow data was utilized in a detailed flood study performed by 3rd party consultant (HydroStorm).

All flood studies concurred that the ASB site is affected by overland flooding that is generated from the upstream catchment of approximately 14 hectares (ha). Another overland flow path, defined by Botany Street, drains a 3.6 ha catchment that is located to the west of Botany Street. Eurimbla Avenue, being lower than the parallel roads, Botany Street and Hospital Road, is considered as the main overland flow path. Under existing conditions, overland flow from the larger catchment converges at the High Street low point, then flows along Eurimbla Avenue and through the existing residential buildings before discharging into Magill Street. Flooding along Eurimbla Avenue during the 100 year storm event has a maximum depth of 0.5 m. Depths exceed 0.5 m on properties at the southern end of Eurimbla Avenue due to obstruction of flows from existing dwellings. During the Probable Maximum Flood (PMF) event, Eurimbla Avenue has a maximum depth of 1.0 m and the Magill Street low point has a maximum depth of 2.0 m.



1 in 100 year flood *PMF flood*

Figure 4. Overland flooding under existing conditions for 100 year and PMF events

2.3 Water Quality

The stormwater quality within the study area is expected to be typical of an urban environment. The majority of the area is residential with high sealed/paved and therefore stormwater runoff flowing overland is expected to be impacted by any pollutants present in the surface (road dirt, litter, etc.)

3 POTENTIAL IMPACTS

3.1 Construction

3.1.1 Excavation

Preliminary geotechnical investigation of the area by Douglas Partners (2018) indicated that existing site is underlain by fill material depths of between 0.5 m and 1.5 m. A 1 m to 2 m thick layer of natural sandy soil is expected below this fill. In some areas, the fill is underlain directly by bedrock. At the southern end of the site, the sandy soils are expected to be deeper and extend to the underlying Hawkesbury Sandstone at approximate depths of between 4.5 m and 7.5 m. The location of basement excavation, with reference to geological section, is depicted on Figure 5.

Based on site topography, published mapping (Randwick Local Environmental Plan (RLEP) 2012, Clause 6.1 Acid sulfate soil) and subsurface conditions encountered to date, acid sulphate soils and saline soils are unlikely to be a geotechnical issues at this site.

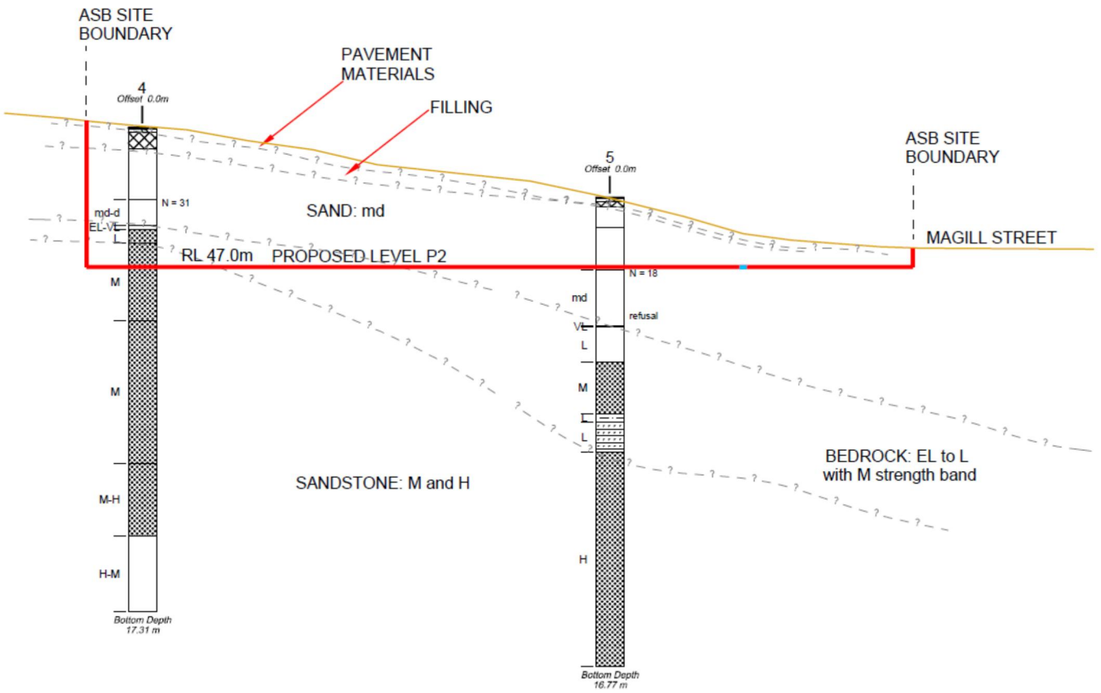


Figure 5. Interpreted geological model for ASB (Source: Douglas Partners)

The excavation work required for the ASB has the potential to cause erosion and sedimentation which have will have a negative impact on water quality leaving the site. Additional construction impacts may result from fuel or chemical spills from construction vehicles and equipment. Water management controls will be implemented while the stormwater diversion and amplification works are underway to

prevent erosion and sedimentation adversely affecting local drainage networks and water courses. Controls will comply with RLEP 2012 Clause 6.2 Earthworks.

3.1.2 Dewatering

Measurements of groundwater in boreholes and monitoring wells indicated groundwater is expected at levels of between RL 49 m and RL 52 m, by Douglas Partners (2018). The maximum depth of excavation is about 5 m below ground level. Geotechnical investigation of the area by Douglas and Partners, did not indicate the presence of groundwater at this depth. Thus, these conditions may change based on rain infiltration during rainy season at nearby areas. Based on the current preliminary information on geology and groundwater at this site, groundwater inflow to the northern end of the basement excavation is estimated to be approximately 3 m^3/day. It is, however, noted that construction techniques such as shoring or sheet piling will reduce groundwater infiltration in the excavated zone.

Stormwater dewatering may be required following significant rainfall within the excavated area and any sediment basins. Potential impacts on water quality could occur if dewatering activities are undertaken in an uncontrolled manner. Based on available data, excavation dewatering may require treatment to reduce the amount of suspended solids prior to disposal to local stormwater connections.

3.2 Operation

3.2.1 Flooding and Stormwater

Flood mitigation will be provided through amplification of the stormwater network. During operation, the proposed design (as detailed in Section 4) will reduce the potential for flooding during major storm events.

3.2.2 Flood Planning

RLEP 2012 Clause 6.3 Flood Planning and Randwick Development Control Plan 2013 (DCP) requires the habitable floors of critical facilities such as hospitals to have adequate freeboard above the PMF level, as summarised in below table.

Table 2. Council's flood planning level requirements*

Type of Flooding	Habitable Floor – Flood Planning Level Requirement
Mainstream Flooding	PMF level + 0.5 m
Overland Flooding	Two times the depth of flow in the PMF event with a minimum of 0.3 m above the surrounding surface

* Table A in Section B8 – Water Management of the Randwick DCP 2013.

Office of Environment and Heritage (OEH) recommends that its guideline Practical Considerations of Climate Change (DECC, 2007) be used as the basis for examining climate change induced increases in rainfall intensities in projects undertaken under the State Floodplain Management Program, according to procedures set out in NSW Government's Floodplain Development Manual (NSWG, 2005). The principal issue regarding climate change is the potential increase in peak flood levels adjacent to the proposed development and how this will impact on the available freeboard to finished floor levels.

The guideline recommends applying sensitivity analyses based on increases in rainfall intensities ranging between 10 and 30 percent. On current projections, the increase in rainfalls within the service life of developments or flood management measures is likely to be around 10 percent, with the higher value of 30 percent representing an upper limit. Under present day climatic conditions, increasing the 1% Average Exceedance Probability (AEP) design rainfall intensities by 10 percent would produce a 0.5% AEP flood; and increasing those rainfalls by 30 per cent would produce a 0.2% AEP event.

3.2.3 Water Quality

Council (RLEP Clause 6.4 Stormwater Management) recommends water quality measures outlined in the 'Guidelines for development adjoining land and water managed by the Office of Environment and Heritage (OEH 2012)' to minimise operational quality impacts on surface waters. The guideline requires no increase in the natural annual average load of nutrients and sediments of stormwater discharged from proposed developments.

Recommended treatment targets (Landcom water sensitive urban design (WSUD), 2010) for stormwater for this project are summarised in Table 3. These targets ensure the loads of stormwater pollutants discharged to receiving waters do not adversely impact on the ecological health of these waterways.

Table 3. Stormwater pollution reduction target (% of typical urban annual load)

Pollutant	Best Practice Performance Objective (%)
Total Suspended Solids (TSS)	80
Gross Pollutants (GP)	70
Total Nitrogen (TN)	45
Total Phosphorous (TP)	45

4 MITIGATION MEASURES

4.1 Construction

4.1.1 Soil and Water Management Plan

Prior to commencement of excavation works, a Soil and Water Management Plan (SWMP) must be prepared as part of the Contractor's Construction Environmental Management Plan (CEMP) for the works. The SWMP must include an Erosion and Sediment Control Plan (ESCP) prepared in accordance with the 'Blue Book'. Preliminary ESCP is included in Appendix B.

The SWMP must address the following requirements:

- Provision of sediment and erosion controls at downstream locations from the construction areas (e.g. sediment fences, sediment basins, other as required).
- Provision of stormwater diversion to divert clean run-off from undisturbed areas around any disturbed areas.
- Designated stockpile location away from gutters, stormwater pits, site boundary, footpaths and roadways or traffic areas.
- Coverage and/or stabilisation of stockpiles as required to minimise erosion.
- Sediment control barriers to be established around the stockpile area to restrict runoff from the stockpile area entering areas beyond the project site.
- Protection of on-site drains and exposed areas using erosion control mats or similar.
- Work staging to limit the area and duration that soils are exposed.
- Disturbed areas to be stabilised progressively to ensure that no areas remain exposed for any extended period of time.
- Where available and practicable, stormwater, recycled water or other water sources shall be used in preference to potable water for construction activities, including dust control.
- Provision of dewatering requirements as further discussed below.
- Any water collected from the site and requiring disposal is to be tested and discharged in compliance with ANZECC (2000) water quality guidelines for protection of aquatic ecosystems.
- Any truck transporting dusty loads, including excavated materials, must be covered.
- Soil not to leave the site as a result of vehicle, plant and equipment movements.
- Regular maintenance and inspection of plant and equipment and of sediment and erosion controls.
- Provision of a spill kit on site
- Provision of vapour monitors for unexpected finds; such as chemical contamination.

4.1.2 Dewatering

As stated in Section 3.1.2 of this report, groundwater dewatering is not projected for this project. However, stormwater dewatering of the excavated area is anticipated.

Management options for potential dewatering activities include:

- Pumping, transport and disposal off-site at a licensed liquid waste facility;
- On-site treatment and discharge to stormwater connections in accordance with acceptable criteria (e.g. ANZECC (2000), the 'Blue Book', and ANZECC Water Quality Guidelines for Fresh and Marine Waters 2000); or
- On-site treatment and discharge to Council stormwater drains to criteria acceptable to relevant authorities.
- Treated dewatering effluent may be allowed to be used for dust suppression.

Monitoring of discharged water will also be required to demonstrate compliance with the acceptable criteria.

4.1.3 Water Quality

For protection of groundwater and receiving waters, the threshold concentrations are based on the ANZECC Water Quality Guidelines for Fresh and Marine Waters 2000 (95% freshwater).

In order to ensure adequate response times in the event of detection of undesirable concentrations of contaminants, a Trigger and Action level for target contaminants has been formulated. The trigger level being 50% of the recommended threshold with the action level set at 75% of the relevant threshold.

Table 4. Stormwater disposal criteria

Water Parameter	Objective	Units
pH	6.5 – 8.5	pH
Total Suspended Solids (TSS)	<50	TSS
Turbidity (where correlation established through sampling and analysis at a NATA accredited laboratory)	86	NTU
Hydrocarbons	No hydrocarbon sheens observed	N/A

Other treatment methods can be deployed depending on the contaminant levels. If onsite treatment is not feasible, offsite disposal and treatment is recommended.

4.2 Operation

4.2.1 Stormwater Management

Internal stormwater drainage system consists of building gutters and downpipes will be designed by the building hydraulics consultant. The roof drainage system of gutters, downpipes and associated pipework is to be designed in accordance with AS/NZS 3500.3.

The collection and conveyance of runoff generated in different areas within the ASB development are described as follows:

- **Roof and podium levels** – Runoff from the roof will be collected by the building hydraulics system and conveyed into the on-site detention (OSD) tank. Rainwater from the terraces will be collected and conveyed via a downpipe system to the northern OSD tank.
- **Ground areas** – A system of pits and pipes will be provided to collect the runoff generated in the ground areas. The ambulance bay area and sections close to the southern OSD tank will directly discharge into the tank.
- **Bypass areas** – Rain falling on ground areas that could not be directed into the southern OSD tank (if any) will drain towards Magill Street.
- **Other areas** - Courtyards and terraces at ground level and Level -01 will be collected and conveyed via a downpipe system via floor pits to the northern OSD system. Level -02 surface water will be directed to the tree pits and landscaped areas. Surface water will also be routed to the southern OSD.

4.2.2 Water Quality

The stormwater system proposed for the site will discharge into Council's drainage pipes intersecting Magill Street. The development will achieve the pollution reduction targets by utilising WSUD treatment targets.

A hydrocarbons trap or separator will be required to treat runoff generated from the helipad. The nominated proprietary product will be specifically designed to provide high removal efficiencies of suspended solids and their associated pollutants, oil, and floatables over a wide range of flow rates.

As per Health Infrastructure (HI) requirements, a continuous deflection separation (CDS)-type gross pollutant trap (GPT) unit has been included in the ASB's treatment strategy. This will be located immediately upstream of the belowground OSD tanks to service the ground vehicular movement access roads and internal car parking areas.

The combination of vegetated buffer, bioretention swales, vegetated swales, and filtration devices will be used through a treatment train approach to improve water quality before stormwater discharges from the site. These elements of the Stormwater Quality Management Strategy for the proposed development will achieve all the pollution reduction targets (Gross Pollutants, Total Suspended Solids, Total Phosphorus and Total Nitrogen) required to discharge stormwater to Council's stormwater network.

4.3 Flood Mitigation

4.3.1 Stormwater Drainage Diversion (Subject to REF)

The works described in this section are to be carried out as part of REF – Early and Enabling Works and is provided for information only in response to the SEARs requirement for the preparation of a Drainage Management Plan for the lands bound by Botany, High and Magill Streets and Hospital Road.

A diversion system, Figure 6, within acquired properties for the lands described above, consisting of a variable depth 1,800 mm wide box culvert diversion system is proposed starting from the High Street low point and will run west along High Street and then south along Botany Street (within the site boundary). A flood storage tank is proposed north-west of the ASB footprint and will receive diverted stormwater from High Street and will discharge via a 1,050 mm diameter pipe along Botany Street towards Magill Street. The pipe diversion runs along Magill Street and connects to the two existing Council's stormwater pipes within the site boundary.

The southern section of the two existing stormwater pipes along Eurimbla Avenue will be decommissioned and removed to make way for the construction of the ASB. The northern section of the existing stormwater system will continue to service the northern section of the ASB site. The remaining stormwater pipes will connect to a new stormwater pit located at the low point of the access road north of the ASB site which will be connected to the diversion pipe.

Overland flows generated from the northern areas will discharge into the stormwater pit located north of the ASB site. Additional OSD tanks may be provided to attenuate flows leaving the buildings within the future expansion area to the north of the ASB that would be subject of separate applications.

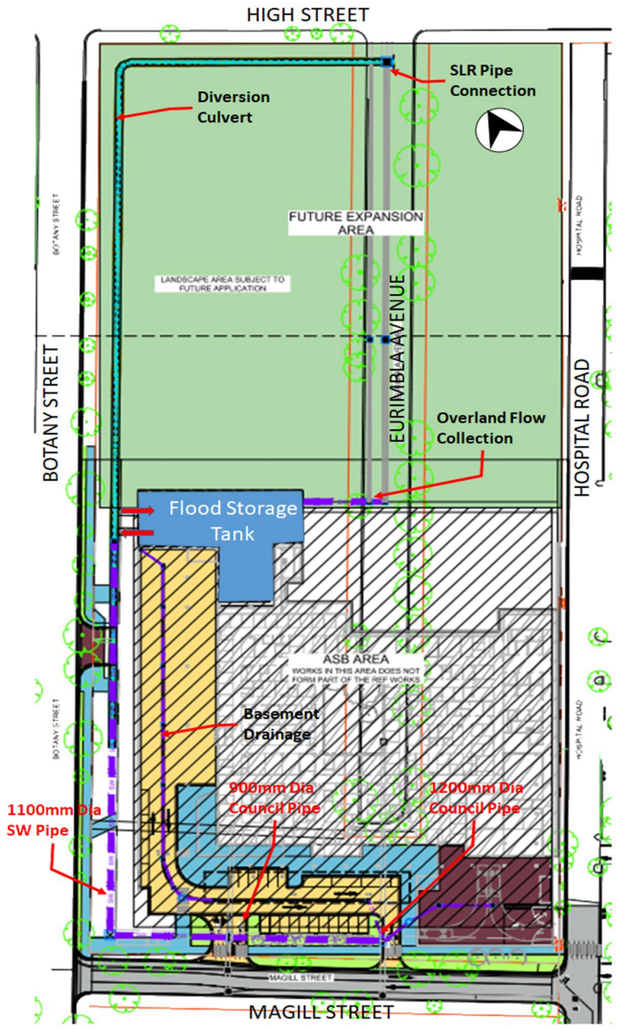


Figure 6. Stormwater Diversion Layout

4.3.2 Site Drainage and On-site Stormwater Detention (SSDA)

The minor site drainage system, depicted on Figure 7, will be designed in accordance with RLEP requirements of Clauses 6.3 and 6.4. OSD is required by Council's Private Stormwater Drainage Code 2013 to ensure there is no increase in discharges from the site resulting from storm events up to the 20 year event. Two OSD tanks will be provided for the ASB development. The first OSD tank will be located in the north-west corner of the site to receive flows from the roof and podium areas. The second OSD tank will be located in-ground at the lowest point of the site to ensure the capture of runoff from the ground areas and minimise any bypassing flows. The second OSD tank will be located in the site's south-east corner.

The required OSD volumes and orifice sizes are determined by hydraulic modelling to restrict peak post-development discharges for storms up to the 20 year Average Recurrence Interval (ARI) storm event to the permissible site discharge (PSD) level specified by Council. The estimated OSD volumes will allow the proposed ASB development to comply with Council's OSD requirement.

Rainwater from the roof, courtyards and terraces at the podium levels will be collected and conveyed via a downpipe system and floor pits to the OSD system. A system of pits and pipes will be provided to collect the runoff generated in the ground areas. The ambulance bay area and sections close to the OSD tank will directly discharge into the tank. Rain falling on ground areas that cannot be directed into the OSD tank will drain towards Magill Street. Prior to discharge, the stormwater flows will pass through a silt arrestor pit or GPT.

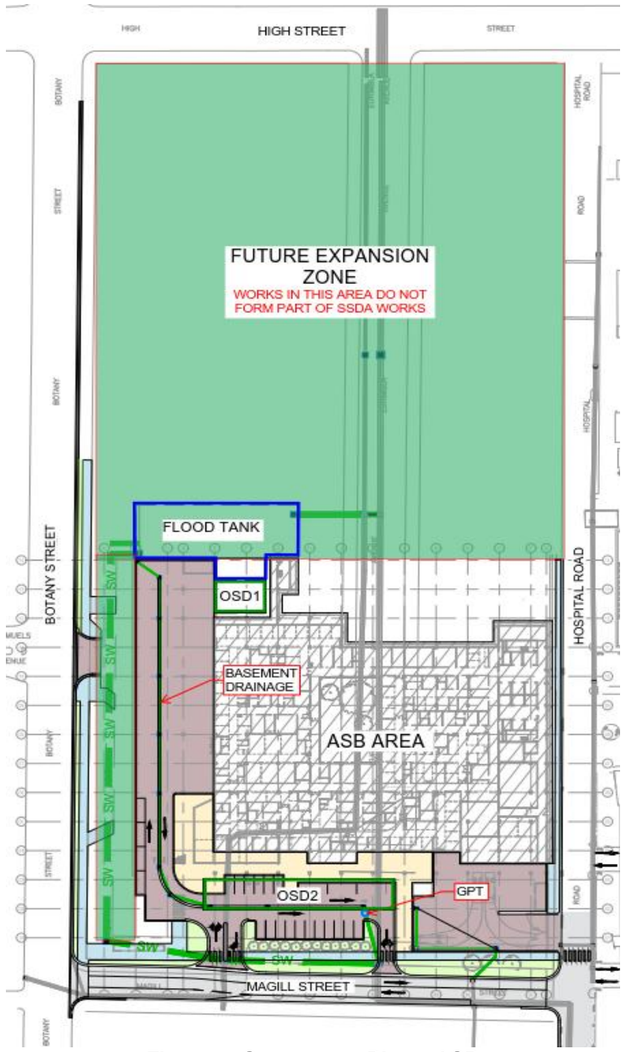
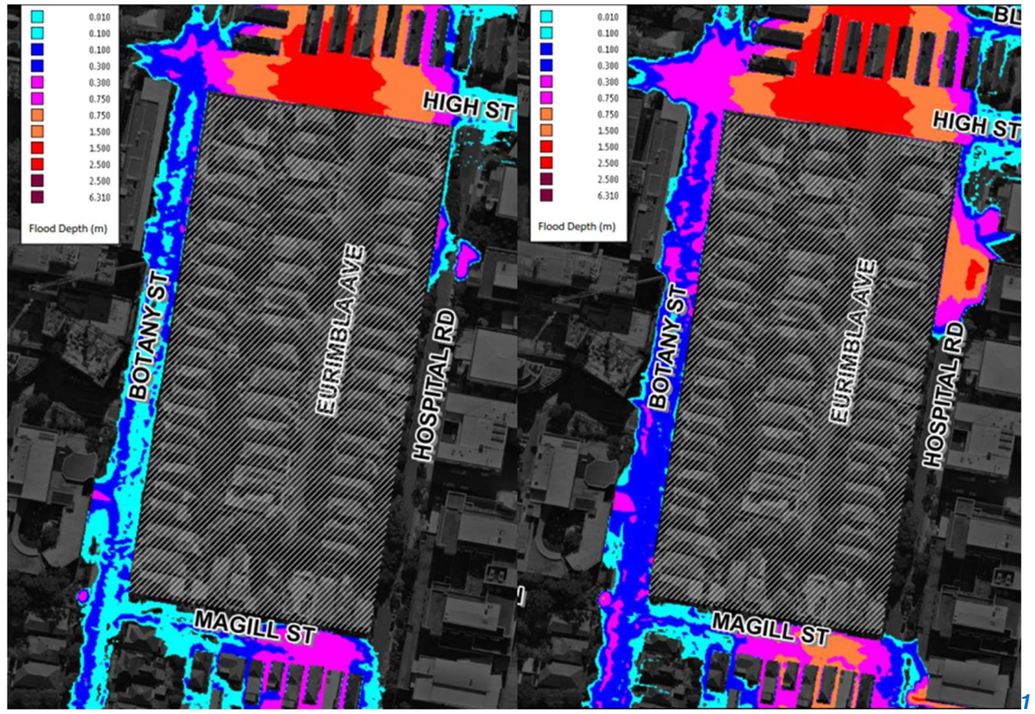


Figure 7. Stormwater Plan – ASB

4.3.3 Flood Mitigation Options

4.3.3.1 Post-Development Flooding Patterns

Overland flow in the vicinity of the ASB site under post-development conditions for the 100 year ARI flood and PMF events are depicted below.



1 in 100 year post-development flood *PMF post-development flood*

Figure 8. Overland flooding under post-development conditions for 100 year and PMF events

The flood maps under both existing and developed conditions concludes that overland flow is required to be diverted away from the hospital basement to achieve flood planning levels for the ASB. Flood mitigation is also required to reduce downstream flooding impacts. In addition to managing the flood impact, it is required that hospital operations remains unaffected during an extreme flood event, since the ASB is a critical form of community infrastructure.

Detail measures to minimise operational water quality impacts on surface waters and groundwater and outline measures to not cause surface water flows or flows within the Council owned drainage network to be transferred from one catchment or sub-catchment to a different catchment or sub-catchment, nor change the time of concentration for each sub-catchment as pre-development and post-development hydrographs.

4.3.3.2 Detailed Stage 1 Flood Study

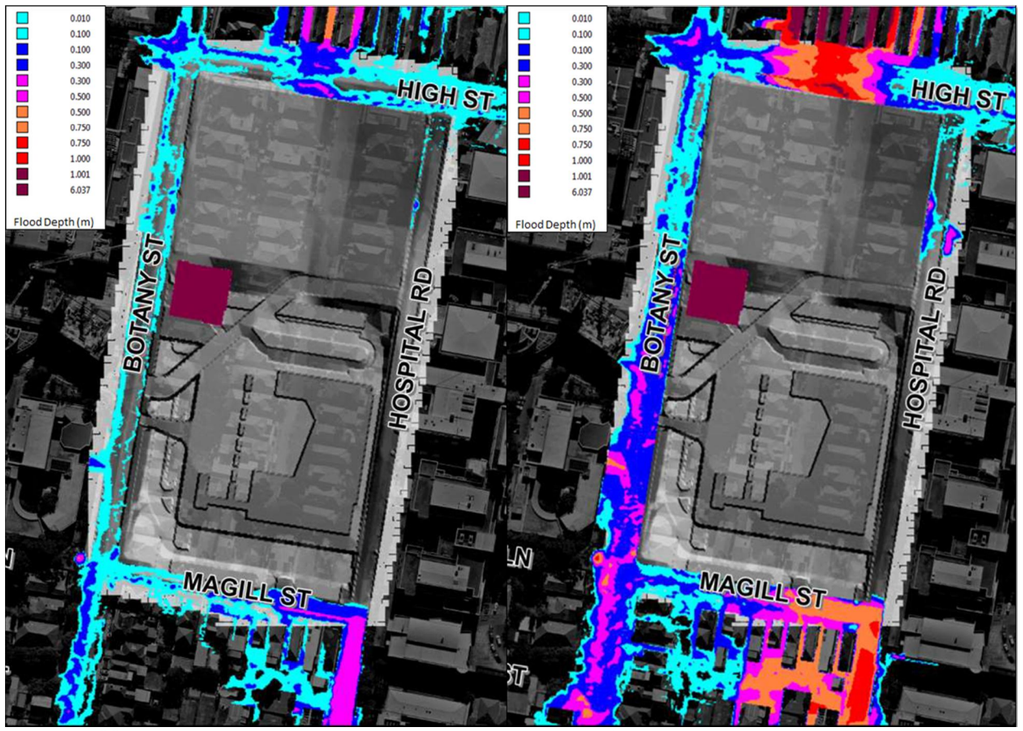
Hydraulic modelling for the study area was carried out using TUFLOW modelling software. TUFLOW is an industry standard hydraulic modelling software system, which is used for fully dynamic modelling of floodplains by representing one (1D) and two dimensional (2D) elements of a floodplain.

Several flood management options were identified and modelled to reduce the impact of the development and achieve satisfactory outcomes regarding management of the extreme flood (PMF)

event. Option 5, achieving these objectives, was utilised in the layout of the stormwater diversion plan.

A summary of the hydraulic modelling results is presented below:

- 100 year flood level in High Street is slightly lower than the existing conditions.
- 100 year flood level is approximately 0.6 m lower than the existing conditions in Magill Street near Hospital Road.
- The PMF level is approximately 0.6 m lower than the existing conditions in Magill Street near Hospital Road.
- Driving in Magill Street is permitted during the 100 year event. However, in rare rain events, access would limit Magill Street entry only from Botany Street intersection.



100 year post-development flood *PMF post-development flood*

Figure 9. Overland flooding under flood mitigation conditions for 100 year and PMF events

4.3.3.3 Floor Planning Levels

Flood levels under mitigated conditions for the 100 year and the PMF events are shown in Figure 10

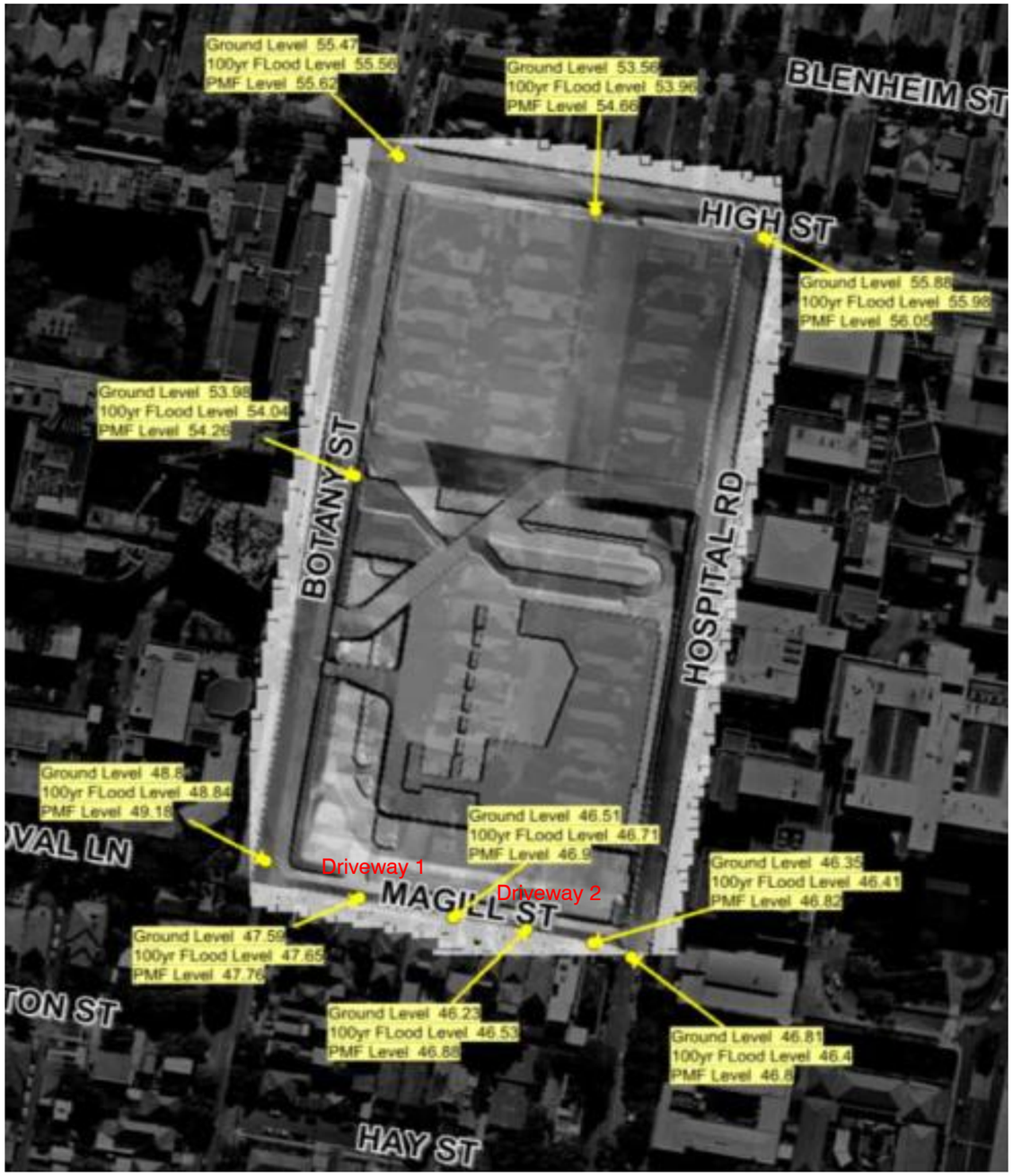


Figure 10. Flood levels under flood mitigation conditions for 100 year and PMF events

The goal of the flood mitigation design is to maintain:

- overland flow within road reserves and prevent entry to ASB access driveways; and
- continuous ASB operation during PMF event.

Overland flooding along Hospital Road and Botany Street was generally less than 0.1 m deep during the 100 year event, and 0.3 m for PMF event. However, High Street and Magill Street were generally flood impacted. The proposed ASB and future developments are anticipated to have retention walls parallel to High and Botany Streets and Hospital Road; to elevations exceeding flood levels indicated on Figure 10.

The proposed ASB basement level ambulance entry at Magill Street required special treatment to manage flooding levels. The existing intersection of Magill Street and Hospital Road is acting as a weir restricting surface water flow to RL 47.2 m AHD (without flood mitigation). This weir is forcing more ponding at this intersection, which causes Magill Street to be further inundated by flooding. Existing levels of Magill Street and rain events are depicted on Figure 11.

Schematic design for Magill Street identified many utilities that the limited the intersection with Hospital Road to be lowered further.

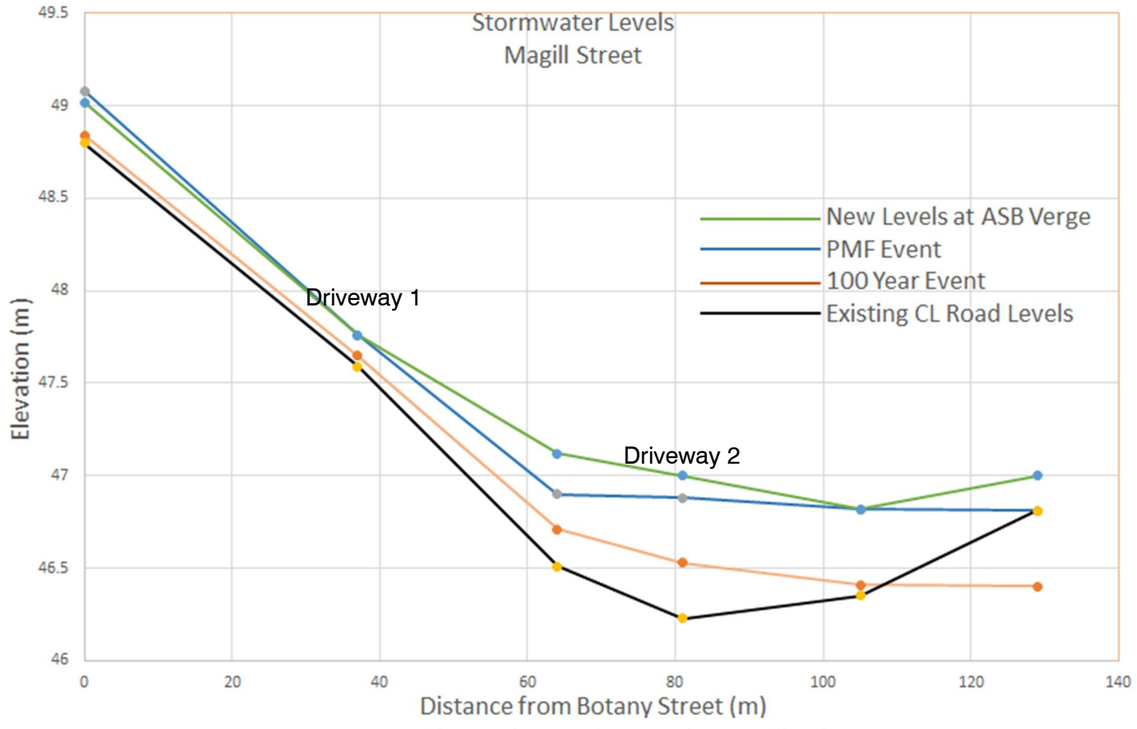


Figure 11. Stormwater event levels at Magill Street

Figure 11 illustrates the level of PMF do not exceed 46.9 m within sag area of Magill Street, near Hospital Road. The proposed footpath and driveway design levels were ramped up, an average of 100mm above PMF levels, from front ASB boundary to prevent any flood waters entering the basement parking.

Since overland flooding is maintained within Magill Street, flood planning levels (as per Section 3.22) for ASB shall be a minimum of 0.3 m above surrounding surface. ASB is to be accessed via 2 driveways from Magill Street into ASB ambulance and visitor parking through fully drained internal access roads with levels from 0.35 to 0.5 m below the proposed ASB basement level.

5 SUMMARY

Stormwater from the development will be discharged into existing Council infrastructure. The Council may require OSD which can be accommodated within the site. OSD tank volumes will be confirmed during the detailed design stages.

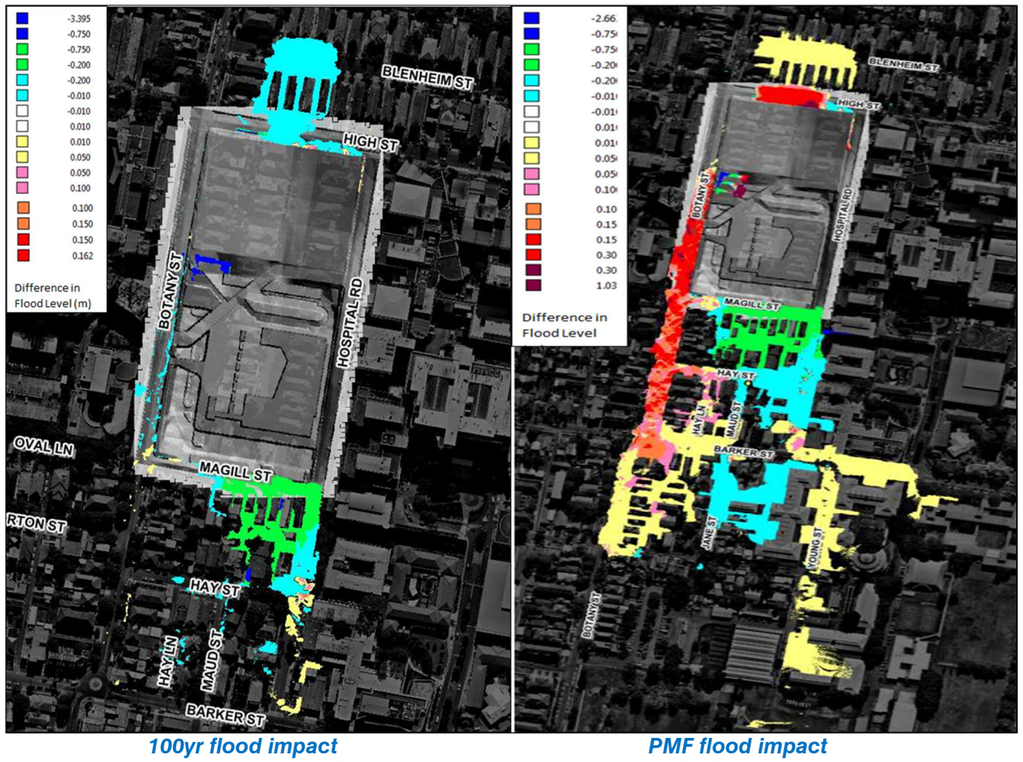
Review of existing and developed site flooding conditions suggests that there is significant overland flow within the site area.

- Impact of 100 year flood event has been assessed by subtracting the post-development flood levels from the existing condition. The 100 year flood event shows minor impact on Hospital Road. The impact is generally less than 5 cm downstream of the site.
- Design the project does not increase flooding impacts (or levels) on private property external to the site during rainfall events up to and including the 1 in 100 year event.
- The PMF level in Magill Street near Hospital Road is critical for ASB operation during emergency conditions, and is approximately 0.6 m lower than the existing conditions. However, results show that flood levels increase by up to 30 cm in High Street low area. A similar increase is observed along Botany Street from the surcharge point of high-level bypass to Barker Street. Elsewhere, the levels increased by 5-10 cm. PMF events are shown to be contained within road reserve.

This report provides technical content to support the SSDA for ASB development. The attached plans show the proposed stormwater and flood mitigation works.

The civil engineering components of the works will be designed in accordance with the following Australian standards and guidelines:

- Australian Rainfall & Runoff: Volumes 1 & 2
- NSW Government Floodplain Development Manual (2005)
- AS3500.3 Plumbing and Drainage: Stormwater Drainage
- Managing Urban Stormwater, Soils and Construction, Volume 1, 4th edition, Landcom, March 2004
- Concrete Pipe Selection and Installation - Concrete Pipe Association 1990
- Randwick Development Control Plan 2013 (Section B8 – Water Management)
- Randwick Council Private Stormwater Drainage Code 2013
- Guidelines for developments adjoining land managed by the Office of Environment and Heritage (OEH 2013)



100yr flood impact *PMF flood impact*

Figure 12. Flood impact of the 100 year and PMF events

APPENDIX A

STORMWATER CONCEPT DESIGN

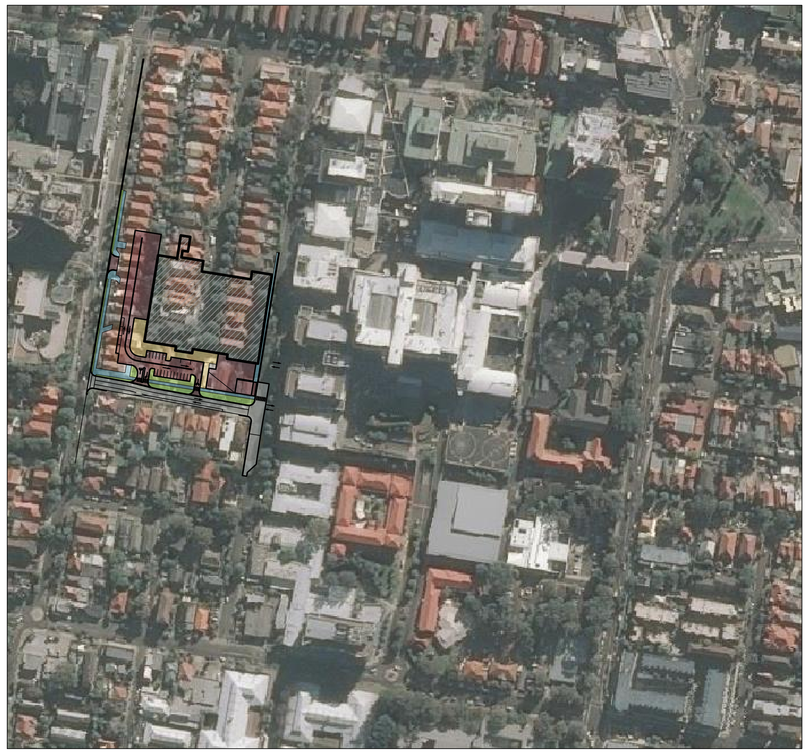
RANDWICK CAMPUS REDEVELOPMENT
ACUTE SERVICES BUILDING

enstruct

CONSTRUCTION WORKS

CIVIL ENGINEERING DRAWING LIST:

RCR-ENS-CV-50-DWG-000-00	COVER SHEET AND DRAWING LIST
RCR-ENS-CV-50-DWG-100-01	SITE WORKS AND DRAINAGE PLAN - LEVEL B2 SHEET 1
RCR-ENS-CV-50-DWG-100-02	SITE WORKS AND DRAINAGE PLAN - LEVEL B2 SHEET 2
RCR-ENS-CV-50-DWG-100-03	SITE WORKS AND DRAINAGE PLAN - LEVEL B2 SHEET 3
RCR-ENS-CV-50-DWG-300-01	BULK EXCAVATION PLAN SHEET EARLY WORKS
RCR-ENS-CV-50-DWG-301-01	BULK EXCAVATION PLAN SHEET PROPOSED BUILDING
RCR-ENS-CV-50-DWG-400-01	EROSION AND SEDIMENT CONTROL PLAN- SHEET 1
RCR-ENS-CV-50-DWG-400-02	EROSION AND SEDIMENT CONTROL PLAN- SHEET 2
RCR-ENS-CV-50-DWG-400-03	EROSION AND SEDIMENT CONTROL PLAN- SHEET 3
RCR-ENS-CV-50-DWG-400-10	EROSION AND SEDIMENT CONTROL DETAILS
RCR-ENS-CV-50-DWG-800-01	CIVIL WORKS DETAILS - SHEET 1
RCR-ENS-CV-50-DWG-800-02	CIVIL WORKS DETAILS - SHEET 2
RCR-ENS-CV-50-DWG-900-01	STORM WATER DRAINAGE LONG SECTIONS - SHEET 1
RCR-ENS-CV-50-DWG-900-10	STORM WATER DRAINAGE PIT SCHEDULES
RCR-ENS-CV-50-DWG-901-01	STORM WATER DRAINAGE LONG SECTIONS - SHEET 1
RCR-ENS-CV-50-DWG-901-02	STORM WATER DRAINAGE LONG SECTIONS - SHEET 2
RCR-ENS-CV-50-DWG-901-10	STORM WATER DRAINAGE PIT SCHEDULES



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NOTE

CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS ON SITE PRIOR TO COMMENCEMENT OF WORK OR PREPARATION OF SHOP DRAWINGS. DO NOT SCALE THIS DRAWING

ISSUE	DATE	FOR
A	240717	40% ISSUE
B	171117	70% ISSUE
D	17.11.13	95% ISSUE
E	17.11.30	95% ISSUE
F	06.02.18	100% SD ISSUE
G	18.04.18	100% SD ISSUE

CONSTRUCTION WORKS

CONSULTANT

CONSULTANT

CONSULTANT

CONSULTANT

PROJECT MANAGER

CLIENT

NSW GOVERNMENT Health Infrastructure

CLIENT NUMBER

PROJECT

POW - REDEVELOPMENT ACUTE SERVICES BUILDING
RANDWICK NSW AUSTRALIA

ENSTRUCT PROJECT NUMBER

5385

DRAWING KEY

TRUE NORTH PROJECT NORTH

GRAPHIC SCALE

0 40 100

SCALE

1:2000@B1 DO NOT SCALE

STATUS

PRELIMINARY

DRAWING

BUILDING 50
COVER SHEET - DRAWING LIST

DRAWING NUMBER	ISSUE
RCR-ENS-CV-50-DWG-000-00	G