CAMPBELLTOWN CAMPUS REDEVELOPMENT

STATE SIGNIFICANT DEVELOPMENT APPLICATION – CIVIL

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ISSUE AUTHORISATION

PROJECT: Campbelltown Campus Redevelopment
Project No: 5582

Rev	Date	Purpose of Issue / Nature of Revision	Prepared by	Reviewed by	Issue Authorise by
A	29/05/18	SSDA Submission	PR	QEJ	QEJ
B	30/05/18	Project Team Comments	PR	QEJ	QEJ
C	04/06/18	Update Scope	PR	QEJ	QEJ
D	14/08/18	Update Scope	PR	WW	WW

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NSW Health and Health Infrastructure (ABN 89 600 377 397); and
Any Tenderer (meaning any tenderer whether as an individual, and entity, a joint venture, a partnership or a consortium) to NSW Health or Health Infrastructure for the provision of works or services in any way in connection with the Project.

Executive Summary

This report supports a State Significant Development Application (SSDA) for the proposed Campbelltown Hospital Redevelopment (CHR) – Critical Services Building (CSB). This report covers:

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

Existing Site Conditions

Stormwater

The total site area is approximately 22.4 ha and the catchment is approximately 45% impervious in its existing state. The site topography condition generally slopes down from a high point in the south/east corner and falls approximately 35 metres towards the north/west over a distance of 480 metres. Within the vicinity of the main hospital complex, there is a terrain fall of around 15 metres. Development of the site towards the south/eastern corner would be problematic and costly as extensive site excavation would be required if levels and linkages to the existing hospital are to be maintained.

Surface drainage and stormwater drainage can be divided into three systems:

- Eastern Catchment (A)
- Western Catchment (B)
- Southern Catchment (C)

The eastern catchment is drained by directing stormwater runoff to a series of grated inlet pits with underground pipes directed to main stormwater lines running to the west towards Burinji Creek Basin. The western and southern catchments also followed the same basis of design where these catchments drain into the same basin.

Flooding

The site is part of the Birunji Creek catchment and immediately to the west of the site is a catchment detention basin. This catchment is part of the greater Georges River catchment, extending from its mouth at Botany Bay to upper river reaches near Appin and Royal National Forest.

The site is not subject to inundation due to backwater flooding from Birunji Creek in events up to 100 year ARI (1% AEP) event. However, overland flow has potential of causing flooding deeper than 0.3 m near helipad area, overland flow blocking structures near loading docks and the maternity area, and northern parking lots. High velocities were simulated west of the site near the helipad area and northern parking lots.

Potential Impacts

Excavation

Bulk excavation is for the CSB and adjacent external works that will require excavation to an RL of approximately 83.2 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 excavation depth. During wet season, rain infiltration may introduce perched groundwater inflow to the northern end of the basement excavation at a rate of 3 m3/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 "4.1", Volume 2 Engineering Design Development of the Campbelltown City Council defines the Flood Planning Level for facilities in overland flow situations as being the level with "Minimum freeboard above the predicted 100 year ARI level plus 0.5 m".

Water Quality

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

- Total Suspended Solids (TSS): 85%
- Gross Pollutants (GP): 80%
- Total Nitrogen (TN): 45%
- Total Phosphorous (TP): 65%
- Oil 90%

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 building podiums will be collected by the building hydraulics system and conveyed into local stormwater drain pits. A system of pits and pipes will be provided to collect the runoff generated in the ground areas. Prior to any stormwater discharge, the stormwater flows will pass through a silt arrestor pit or Gross Pollutant Trap (GPT). The ambulance bay area will discharge into a dedicated GPT that connects to stormwater piping.

Water Quality

The stormwater system proposed for the site will discharge into Birunji Creek Basin. 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 CSB access driveways; while maintaining continuous CSB operation during 100 year and PMF events.

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

- Impact of 100 year flood event is required to be assessed by subtracting the post-development flood levels from the existing condition using detailed TUFLOW model.
- Design of the project is not anticipated to increase flooding impacts (or levels) on private property external to the site during rainfall events.
- The PMF level is critical for CSB operation during emergency conditions. At least 1 driveway is required to be operational during PMF event.

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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 Campbelltown Campus in Campbelltown, New South Wales. The proposed Campbelltown Campus Redevelopment (CHR) is located within Campbelltown City Council (CCC) Local Government Area (LGA).

This report supports a State Significant Development Application (SSDA) for the proposed CHR. This report covers:

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

1.1 Project Scope

The Development Application (DA) seeks approval for the following development:

- Demolition of existing structures;
- Partial excavation of the site (due to the sloping topography);

The construction of a new 13 storey (two of these levels are partially below ground) Clinical Services Building containing:

- An Emergency Department;
- Operating Theatres;
- Intensive Care Unit;
- Mental Health;
- Birthing and Speciality Care Nursery;
- Surgical and Medical Beds;
- Helipad facilities; and
- An Ambulance Bay.

Construction of a new Hospital Spine and connections to existing hospital buildings;

Construction of augmented and new internal hospital access roads and links, including a connection to Appin Road and Therry Road;

- Construction of an at-grade car park;
- Tree removal; and
- Associated building services.

Figure 1. Locality plan *(Source: SIX Maps)*

1.2 Site Description

The site is owned by NSW Department of Health and legally described as Lot 6 in DP 1058047 (as shown on Figure 3.1) and has an approximate area of 19.33 hectares. The site is located approximately 50 km southwest of Sydney's CBD.

The site is generally bound by Campbelltown Private Hospital and a seniors living development to the north; Parkside Crescent and Marsden Park to the west; and arterial roads Appin Road and Therry Road to the east and south respectively.

Marsden Park is public open space with a large open water body that is situated between the Hospital site and low to medium density dwellings located west and southwest of Marsden Park.

To the south and east of the hospital site, on the opposite side of Therry and Appin Roads, is an area of established low scale residential dwellings. Thomas Reddall High School is within the residential development area to the south of the site.

The site comprises several multi-storey buildings, at-grade car parking and large expanses of grassed open space, with some tree coverage primarily in the south-eastern corner of the site. The site generally falls south-east to north-west and ultimately discharges into Birunji Creek. There are two existing drainage outlets discharging site stormwater into Birunji Creek Basin which are crossing under Parkside Crescent. The steepest part of the site is the south-east corner bounded by Appin and Therry Roads and the existing main entry to the south-east corner of the site.

Overall topographic relief ranges from approximately RL 114 m, relative to the Australian Height Datum (AHD) within the south-eastern portion of the site to the lowest part of approximately RL 76 mAHD within the western portion of the site. Figure 3.1 shows a site location plan.

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

1.3 SEARs Requirements

SEARs requirements No. SSD 9241 for the preparation of an Environmental Impact Statement (EIS) for the project were issued on 18 April, 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. • Relevant Policies and Guidelines: ○ Managing Urban Stormwater – Soils & Construction Volume 1 2004 (Landcom) ○ Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (EPA) ○ Guidelines for development adjoining land and water managed by DECCW (OEH, 2013)	Section 3.1 Appendix B
	13. Utilities • Prepare an Infrastructure Management Plan in consultation with relevant agencies, detailing information on the existing capacity and any augmentation and easement requirements of the development for the provision of utilities including staging of infrastructure. • Prepare an Integrated Water Management Plan detailing any proposed alternative water supplies, proposed end uses of potable and non-potable water, and water sensitive urban design.	Section 3.2.3 Section 4.1 Section 4.2
	15. Drainage • Detail drainage associated with the proposal, including stormwater and drainage infrastructure. • Detail measures to minimise operational water quality impacts on surface waters and groundwater. • Guidelines for development adjoining land and water managed by DECCW (OEH, 2013)	Section 3.2 Appendix A
	16. Flooding • Assess any flood risk on site (detailing the most recent flood studies for the project area) 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 4.3
Plans & Documents	Stormwater Concept Plan	Appendix A
	Sediment and Erosion Control Plan	Appendix B

2 EXISTING CONDITIONS

2.1 Stormwater

Surface drainage and stormwater drainage can be divided into three systems, as shown on Figure 3:

- Eastern Catchment (A)
- Western Catchment (B)
- Southern Catchment (C)

The eastern catchment was drained by directing stormwater runoff to a series of grated inlet pits with underground pipes directed to main stormwater lines running to the west towards Birunji Creek Basin. The western and southern catchments also followed same basis of design where these catchments drained into the same basin.

Figure 3. Site catchment plan

The existing stormwater pipe network is depicted in Figure 4. The stormwater pipe drainage network was designed to convey stormwater generated for events up to the 10% AEP with larger events being conveyed within roadways.

Figure 4. Existing stormwater drainage

2.2 Flooding

The site is part of the Birunji Creek catchment (Figure 5) and immediately to the west of the site is a catchment detention basin. This catchment is part of the greater Georges River catchment, extending from its mouth at Botany Bay to upper river reaches near Appin and Royal National Forest.

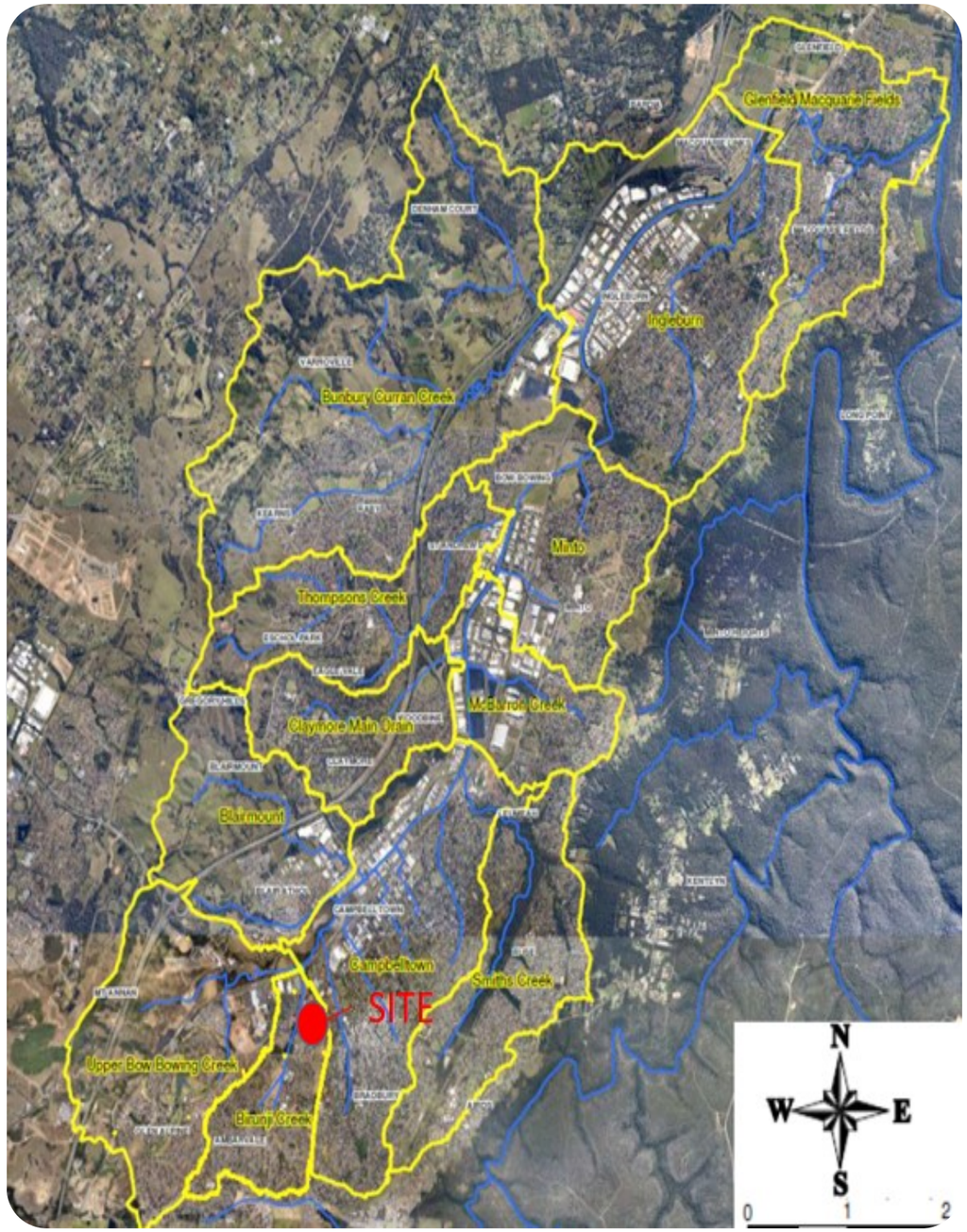


Figure 5. Birunji Creek catchment (Source: Georges River Catchment Org)

Based on information contained in the Integrated Water Management Plan report prepared for the Stage 1 Redevelopment (C&M, 2012), the site is not subject to inundation due to backwater flooding from Birunji Creek in events up to 100 year ARI (1% AEP) event. Subsequent to the report prepared by C&M in 2012, Council has completed a Flood Study for the Bow Bowing Bunbury Curran Creek system (including Birunji Creek), which is expected to contain details of flood extents adjacent to the Hospital site.

Through Stage 1 Redevelopment, advice provided from Council notes that the site is affected by the 1% AEP overland flow from the local subcatchment from Appin Road that traverses the site. This will need to be considered in the planning and design for the site redevelopment.

In order to further investigate flooding condition, a request has been made to Council and an advice letter has been obtained. The advice from Council states that the hospital site may be affected/at risk by flooding from a 1 % AEP flood due to overland flow from the local subcatchment traversing the property. The Council's flood model identifies several ponding areas up to 0.5m depth within the site, however it does not indicate the locations nor the flood levels.

Council noted that the model prepared for the Bow Bowing Bunbury Curran Creek Flood Study does not take into the account the site's internal stormwater drainage system, and it is evident that recent topographic developments within the site have not been incorporated into the model. Council recommended that an overland flow flood model should be constructed for the proposed site development locations.

2.2.1 Conceptual Flood Modelling

enstruct has developed a conceptual flood model, using HECRAS 2D, that included Stage 1 site conditions as well as downstream areas. The model was constructed to simulate overland flow without consideration to piped drainage network at the site.

2.2.2 Existing Flooding Patterns

Figures 6 and 7 show the characteristics of overland flow at the site under present day conditions for the 100 year ARI flood event. The key findings of the investigation as they relate to present-day conditions are as follows:

- Overland flooding at site is generally less than 0.1 m deep during the 100 year ARI storm event.
- Flooding deeper than 0.3 m was simulated near helipad area, overland flow blocking structures near loading docks and maternity area, and northern parking lots;
- High velocities were simulated west of the site near helipad area and northern parking lots.

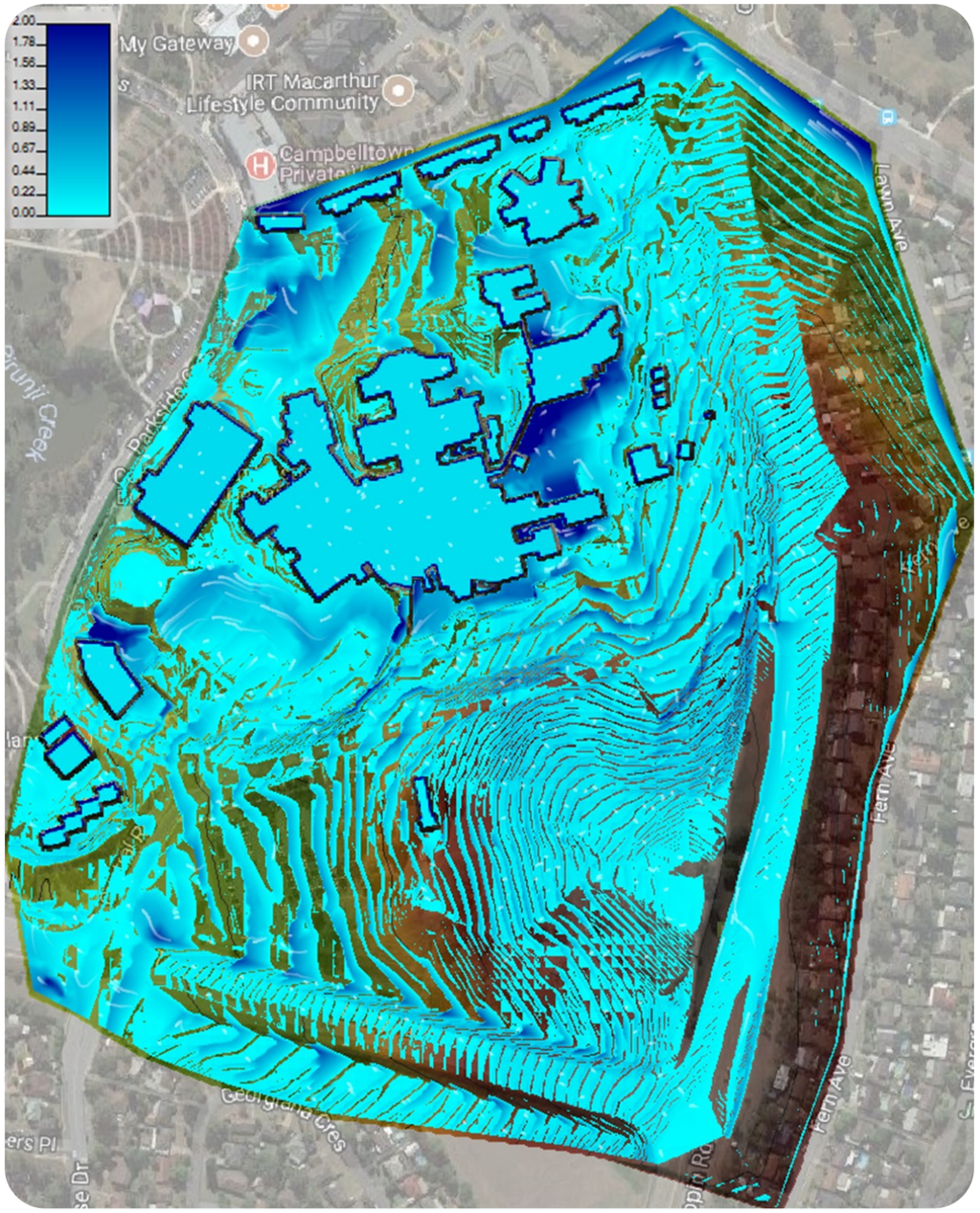


Figure 6. Overland flooding depths for 100 year event

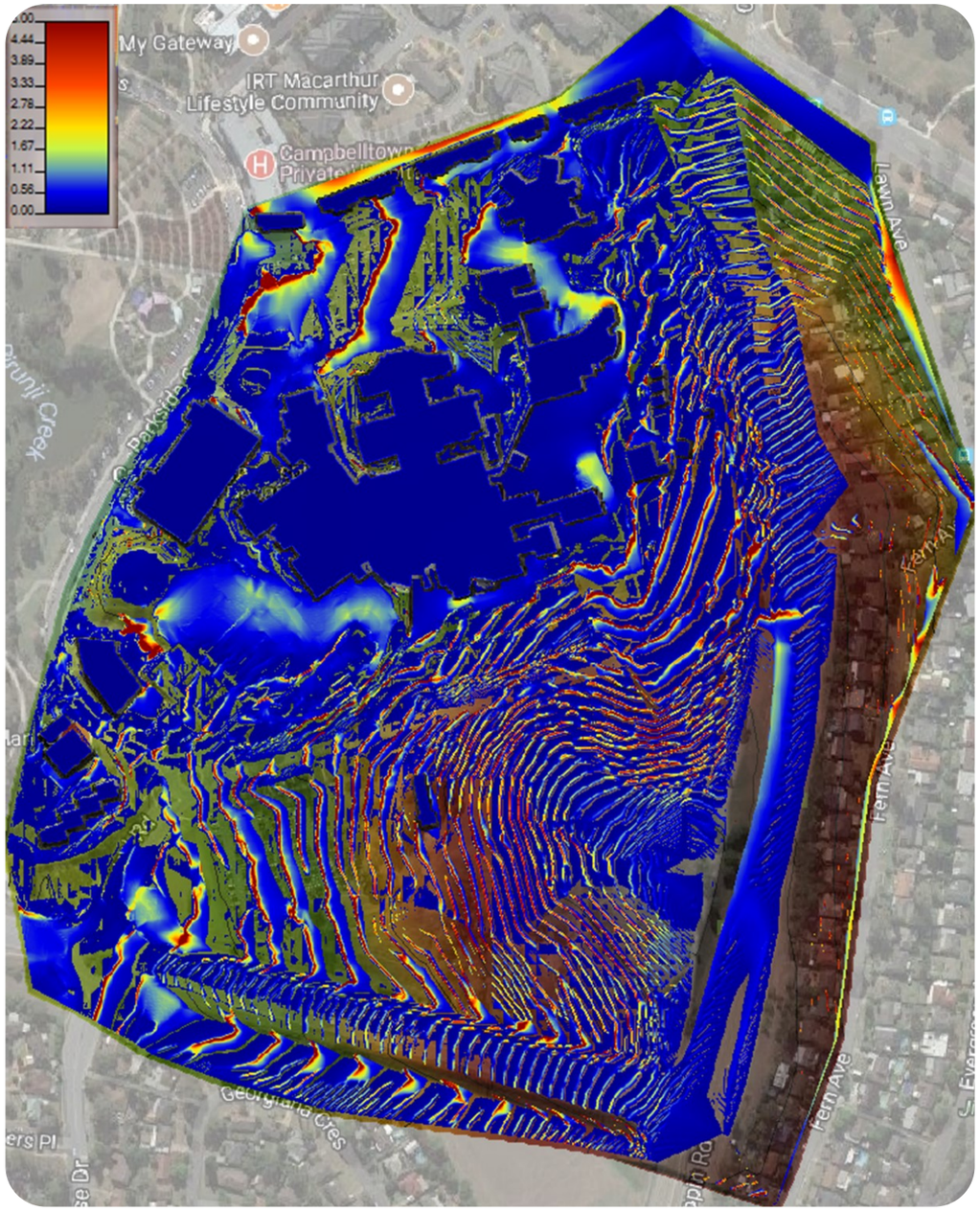


Figure 7. Overland flow velocities for 100 year event

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.)

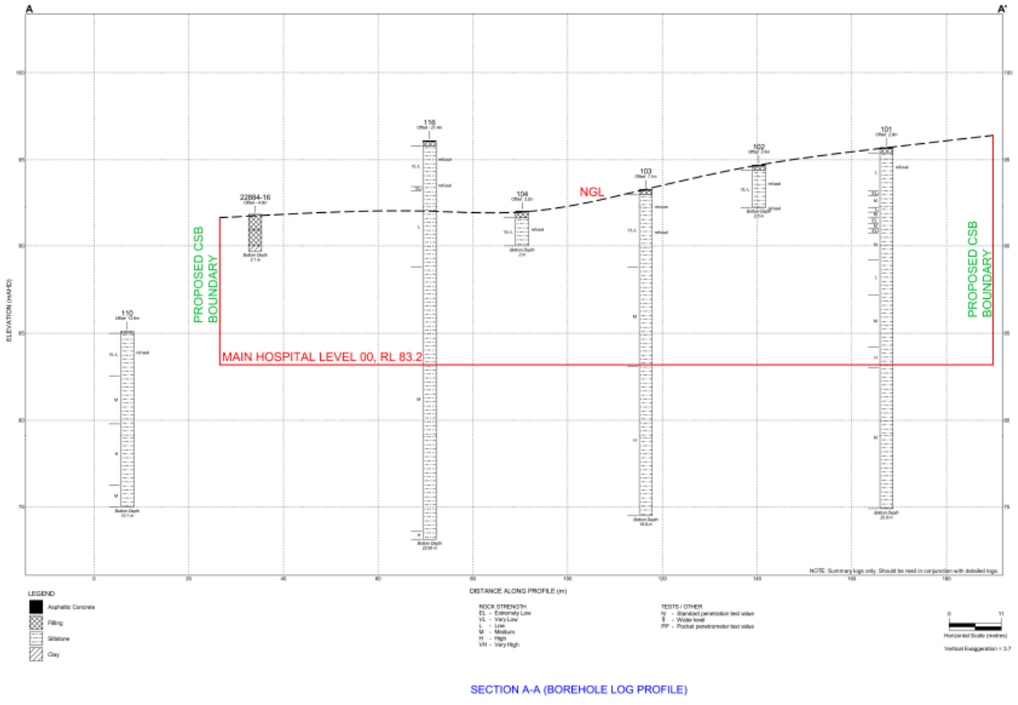
3 POTENTIAL IMPACTS

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 0.1 m and 0.3 m. A 1 m to 4 m thick layer of natural low to medium strength siltstone. In some areas, the fill is underlain directly by bedrock. High strength sandstone was encountered at depths exceeding RL 80 m. The location of basement excavation, with reference to geological section, is depicted on Figure 5.

Based on NSW published maps and subsurface conditions encountered to date, acid sulphate soils and saline soils are unlikely to be a geotechnical issues at this site.



SECTION A-A (BOREHOLE LOG PROFILE)

Figure 8. Interpreted geological model for CSB (Source: Douglas Partners)

The excavation work required for the CSB 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 CLEP 2009 Volume 2: Engineering Design for Development.

3.1.2 Dewatering

Measurements of groundwater in boreholes and monitoring wells indicated groundwater is expected at levels of between RL 75 m and RL 81 m, by Douglas Partners (2018). The maximum depth of excavation is RL 83.2 m. 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 southern 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

Flood Planning in CLEP 2009 Volume 2: Engineering Design for Development requires the habitable floors of critical facilities such as hospitals to have adequate freeboard above the 100 year ARI level, as summarised in below table.

Table 2. Council's flood planning level requirements*

Type of Flooding	Minimum Freeboard above the predicted 100 yr ARI level
Floor level in relation to overland flow paths for any dwelling room and commercial or industrial areas	+ 0.5 m
Floor level in relation to any creek or major stormwater line including detention basins for any dwelling room and commercial or industrial areas	+ 0.5 m

Note: Table 4.1 Floor Level and Freeboard Requirements.

Climate change and rising sea water levels consideration is required to be assessed for flood planning levels. 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 (Engineering Design for Development Section 4.15) 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) *	85
Gross Pollutants (GP)	80
Total Phosphorous (TP)	65
Total Nitrogen (TN)	45
Oil *	90

Note: * Best practice adopted from WSUD Guidelines for Western Sydney, 2003.

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 CSB development are described as follows:

- **Roof and podium levels** – Runoff from the roof will be collected by the building hydraulics system and conveyed into stormwater pits leading to a main drain.
- **Ground areas** – A system of pits and pipes will be provided to collect the runoff generated in the ground areas.
- **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 stormwater drainage system. Level -02 surface water will be directed to the tree pits and landscaped areas. Surface water will also be routed to the stormwater drainage system.

4.2.2 Water Quality

The stormwater system proposed for the site will discharge into Birunji Creek Basin. 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 CSB's treatment strategy. This will be located downstream of the ground vehicular movement access roads and internal car parking areas.

Measures that can help minimise operational water quality impacts on surface waters and groundwater include:

- Restricting surface water flows in its existing streams (subcatchment) and minimise discharge into adjacent catchments.
- Maintaining the time of concentration (flow velocity) of each subcatchment; with reference to pre-development and post-development hydrographs.

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 Birunji Creek Basin.

4.3 Flood Mitigation

4.3.1 Site Drainage

The minor site drainage system for the new development will be designed in accordance with requirement of Campbelltown City Council's DCP – Volume 2 for Engineering Design for Development.

A system of pits and pipes will be provided to collect roof water and runoff generated in the ground areas. The ambulance bay area will be discharge into GPT to stormwater drainage system. Full detain of system design is included in Appendix A.

4.3.2 Flood Mitigation Options

4.3.2.1 Flooding Patterns

Overland flow in the vicinity of the CSB site for the 100 year ARI flood is depicted below.

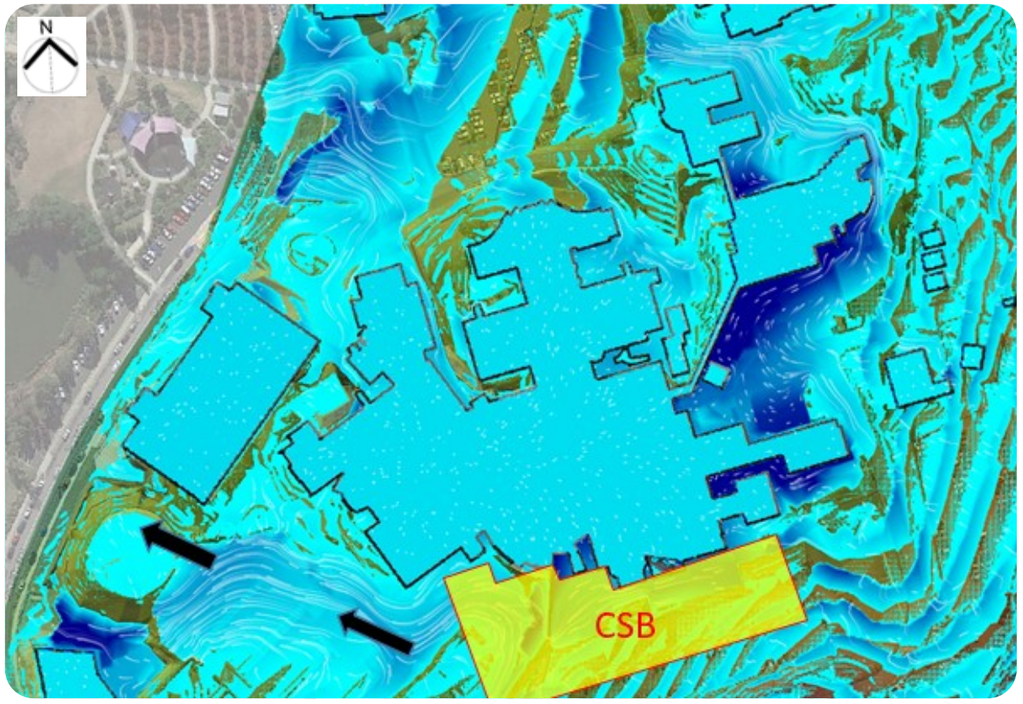


Figure 9. Overland flooding under post-development conditions for 100 year event

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 CSB. In addition to managing the flood impact, it is required that hospital operations remains unaffected during an extreme flood event, since the CSB is a critical form of community infrastructure.

4.3.2.2 Floor Planning Levels

The goal of the flood mitigation design is to maintain:

- overland flow within road reserves and prevent entry to CSB access driveways near basement; and
- continuous CSB operation during major storm events.

Overland flooding along proposed public drop off and Emergency Department entry area was generally less than 0.1 m deep during the 100 year event. However, ambulance bays were generally flood impacted to about 0.25 m. The proposed overland flow diversion channel (Figure 10) had resulted in less than 0.1 m water depth near CSB area. Thus, impact of the flow diversion on helipad area is required to be assessed in more details.

Since flooding mitigation overland levels were assessed less than 0.1 m, it is reasonable to consider CSB area as not being flood affected. Thus, flood planning levels (as per Section 3.22) would not apply for this development.

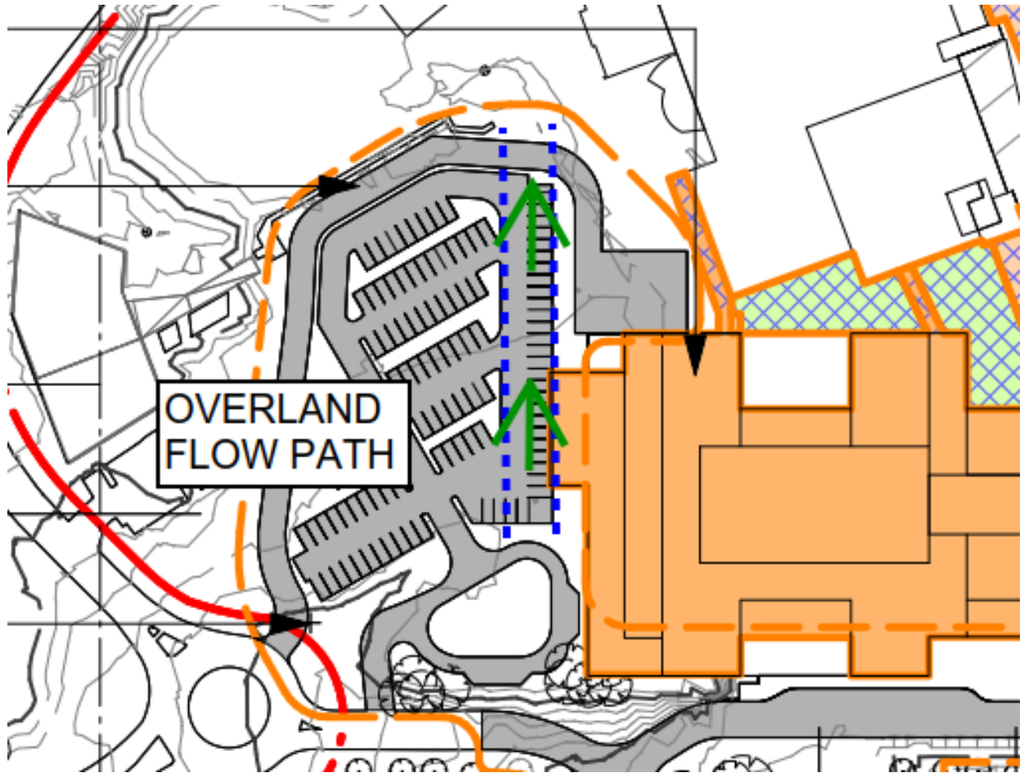


Figure 10. Emergency Department access way (Source: BLP Architects)

The proposed floor level for the Emergency Department (Level 00) is set at RL 83.2 m and appears to be adequate for the 100 year ARI storm.

4.3.2.3 *Detailed Stage 2 Flood Study*

Detailed hydraulic modelling for the study area will be 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 will be identified and modelled to reduce the impact of the development and achieve satisfactory outcomes regarding management of flooding, including extreme flooding (PMF) event. Campbelltown Council agreed to incorporate site information into their catchment-wide model. The Council's updated TUFLOW model can be utilized to design overland flooding mitigation for the proposed redevelopment of the hospital.

5 SUMMARY

Stormwater from the development will be discharged into existing Council infrastructure (Birunji Creek Basin).

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

- Impact of 100 year flood event is required to be assessed by subtracting the post-development flood levels from the existing condition using detailed TUFLOW model.
- Project design is not anticipated to increase flooding impacts (or levels) on private property external to the site during rainfall events.
- The PMF level is critical for CSB operation during emergency conditions. At least 1 driveway is required to be operational during PMF event.

This report provides technical content to support the SSDA for CSB 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
- Campbelltown City Council Development Control Plan Volume 2 – Engineering Design for Development, June 2009
- Guidelines for developments adjoining land managed by the Office of Environment and Heritage (OEH 2013)

APPENDIX A

STORMWATER CONCEPT DESIGN

CAMPBELLTOWN HOSPITAL REDEVELOPMENT

enstruct

CIVIL ENGINEERING WORKS

CIVIL ENGINEERING DRAWING LIST:

CHR-ENS-CV-DWG-ZSW-0000	COVER SHEET AND DRAWING LIST
CHR-ENS-CV-DWG-ZS01-0201	STORM WATER DRAINAGE PLAN
CHR-ENS-CV-DWG-ZS02-0201	STORM WATER DRAINAGE PLAN
CHR-ENS-CV-DWG-ZS03-0201	STORM WATER DRAINAGE PLAN
CHR-ENS-CV-DWG-ZS04-0201	STORM WATER DRAINAGE PLAN
CHR-ENS-CV-DWG-ZS05-0201	STORM WATER DRAINAGE PLAN
CHR-ENS-CV-DWG-ZS06-0201	STORM WATER DRAINAGE PLAN
CHR-ENS-CV-DWG-ZS01-0401	EROSION AND SEDIMENT CONTROL PLAN FOR BUILDING
CHR-ENS-CV-DWG-ZS02-0401	EROSION AND SEDIMENT CONTROL PLAN FOR BUILDING
CHR-ENS-CV-DWG-ZS03-0401	EROSION AND SEDIMENT CONTROL PLAN FOR BUILDING
CHR-ENS-CV-DWG-ZS04-0401	EROSION AND SEDIMENT CONTROL PLAN FOR BUILDING
CHR-ENS-CV-DWG-ZS05-0401	EROSION AND SEDIMENT CONTROL PLAN FOR BUILDING
CHR-ENS-CV-DWG-ZS06-0401	EROSION AND SEDIMENT CONTROL PLAN FOR BUILDING
CHR-ENS-CV-DWG-ZS01-0411	EROSION AND SEDIMENT CONTROL PLAN FOR ROADS
CHR-ENS-CV-DWG-ZS02-0411	EROSION AND SEDIMENT CONTROL PLAN FOR ROADS
CHR-ENS-CV-DWG-ZS03-0411	EROSION AND SEDIMENT CONTROL PLAN FOR ROADS
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CHR-ENS-CV-DWG-ZS05-0411	EROSION AND SEDIMENT CONTROL PLAN FOR ROADS
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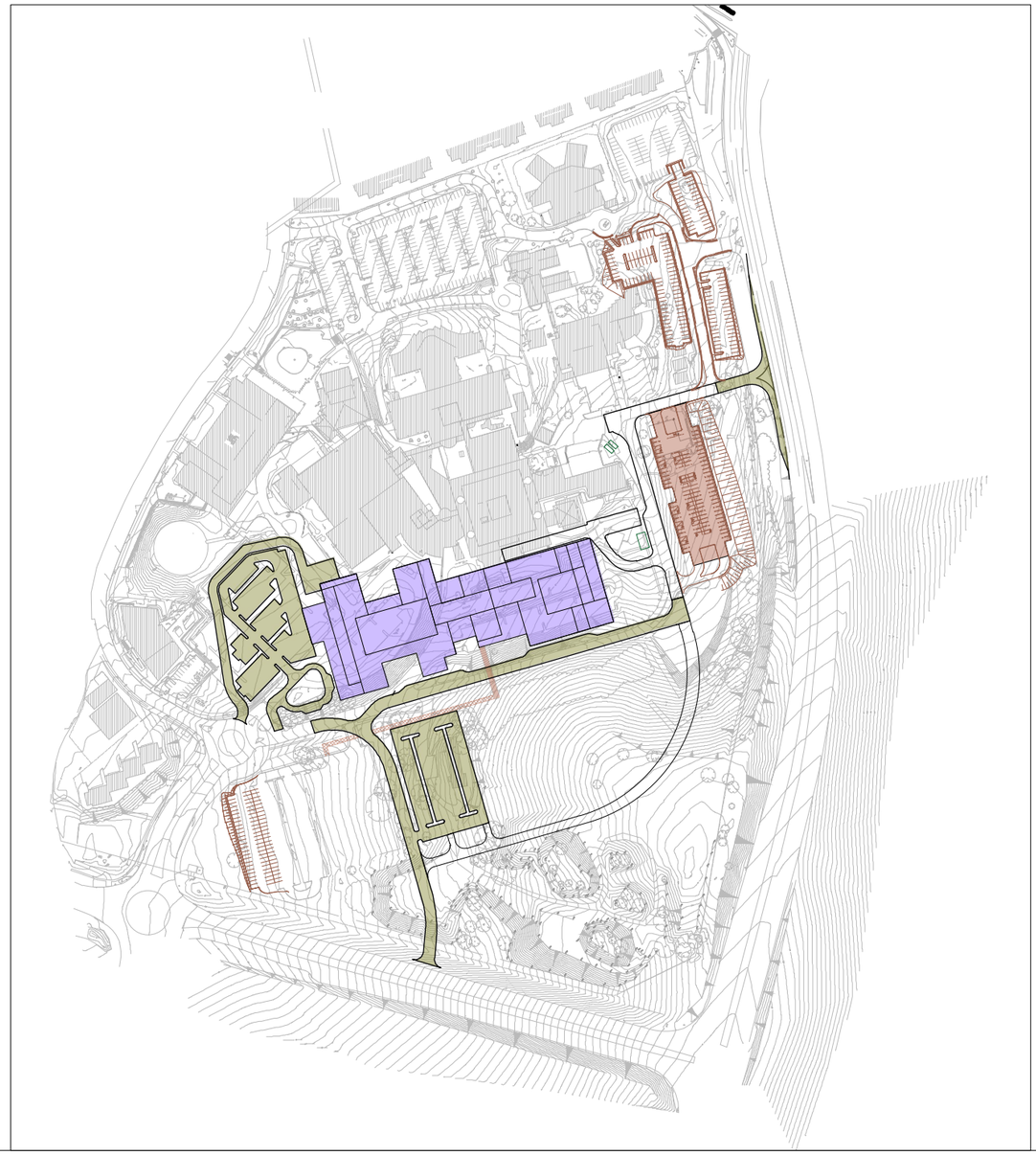

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02	40% ISSUE FOR INFORMATION	MD	25/05/18
01	ISSUE FOR INFORMATION	MD	21/05/18

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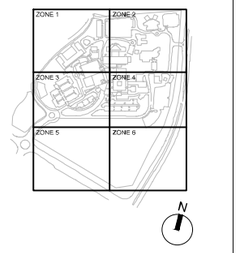

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PROJECT NAME
CAMPBELLTOWN HOSPITAL REDEVELOPMENT

DESCRIPTION
COVER SHEET AND DRAWING LIST

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DRAWN BY	CHECKED BY
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PROJECT NUMBER	REVISION DATE
5582	21/05/2018

DRAWING STATUS
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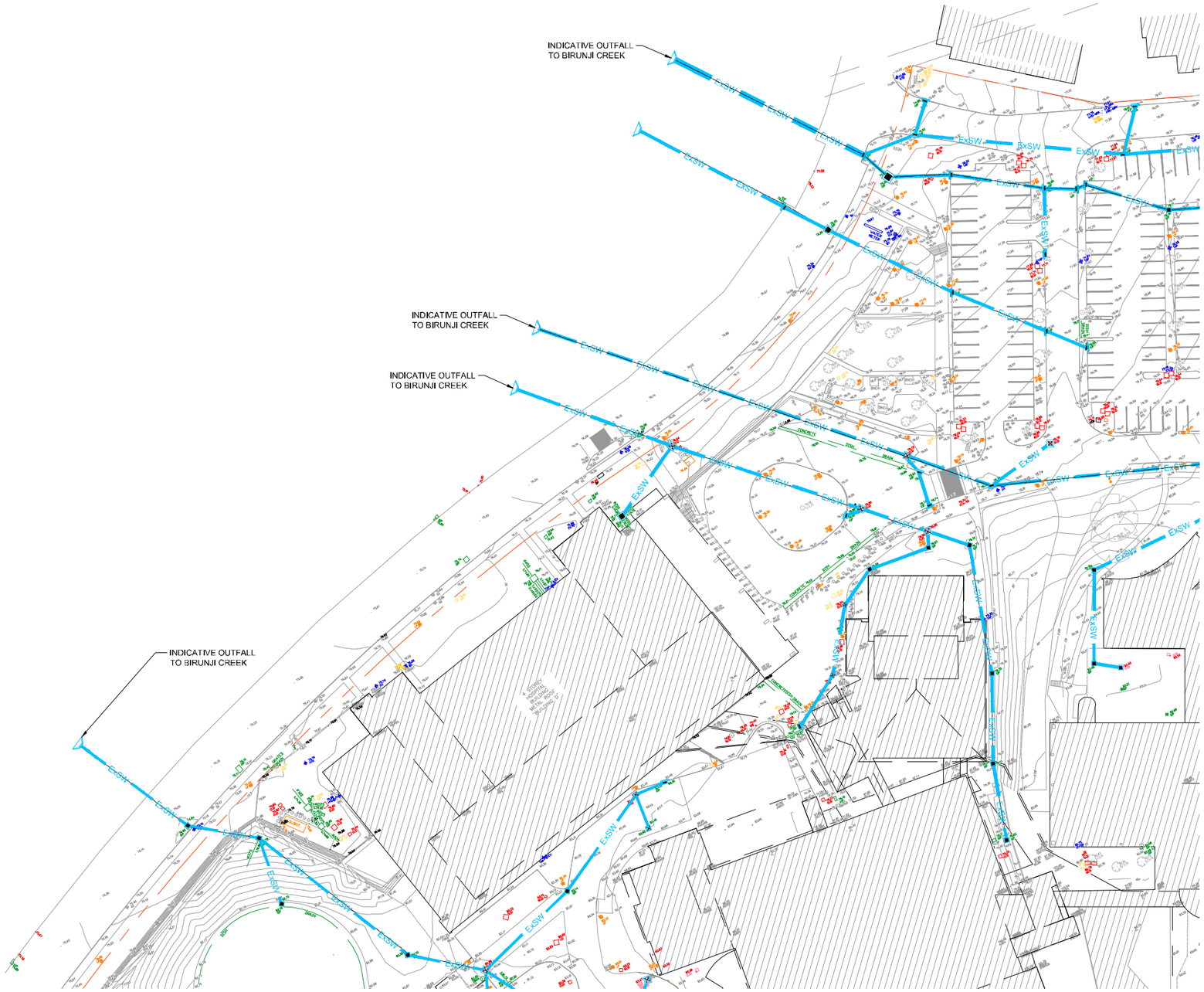
DRAWING NUMBER: CHR-ENS-CV-DWG-ZSW-0000 REV. 03



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- EXISTING SWALE
- EXISTING STORMWATER DRAIN TO BE DEMOLISHED
- SW — PROPOSED STORMWATER DRAIN
- EXISTING DRAINAGE PIT
- PROPOSED DRAINAGE PIT
- PROPOSED KIP
- OVERLAND FLOW DIRECTION
- PROPOSED WATER QUALITY MEASURES
- SITE BOUNDARY
- PROPOSED HEAD WALL
- PROPOSED SW CULVERT

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01	ISSUE FOR INFORMATION	MD	21/05/18

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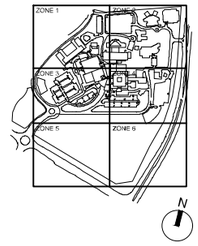

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PROJECT NAME
CAMPBELLTOWN HOSPITAL REDEVELOPMENT

DESCRIPTION
GENERAL STORMWATER PLAN - ZONE 1

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DRAWN BY	CHECKED BY
	PR

PROJECT NUMBER	REVISION DATE
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DRAWING STATUS
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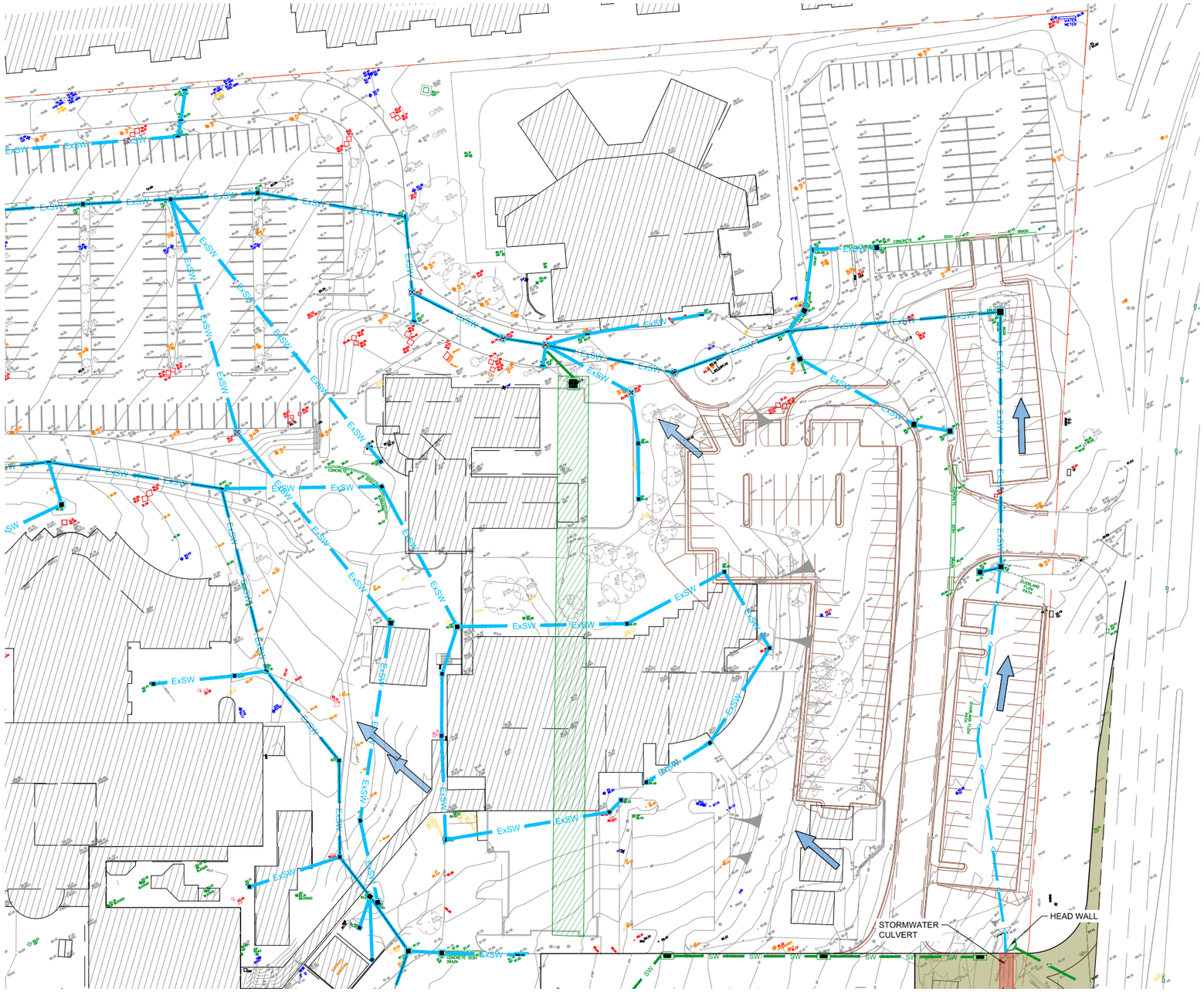

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- PROPOSED STORMWATER DRAIN
- EXISTING DRAINAGE PIT
- PROPOSED DRAINAGE PIT
- PROPOSED KIP
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- PROPOSED WATER QUALITY MEASURES
- SITE BOUNDARY
- PROPOSED HEAD WALL
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01	ISSUE FOR INFORMATION	MD	21/05/18

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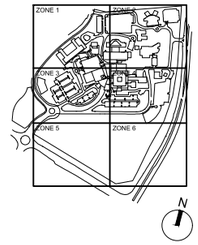

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PROJECT NAME
CAMPBELLTOWN HOSPITAL REDEVELOPMENT

DESCRIPTION
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PROJECT NUMBER	REVISION DATE
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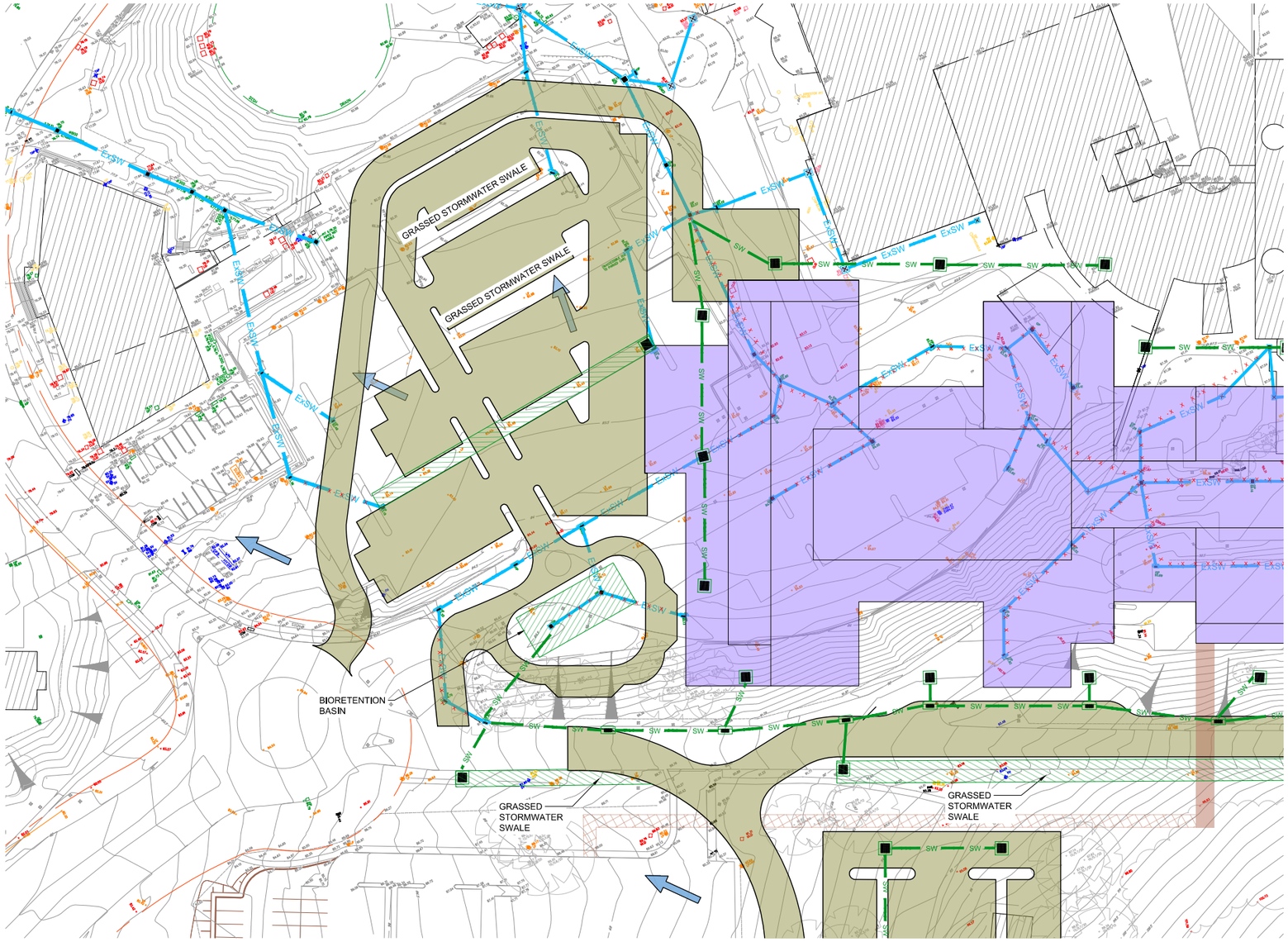

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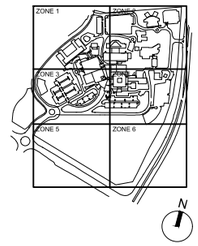

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PROJECT NAME
CAMPBELLTOWN HOSPITAL REDEVELOPMENT

DESCRIPTION
GENERAL STORMWATER PLAN - ZONE 3

Scale
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PROJECT NUMBER	REVISION DATE
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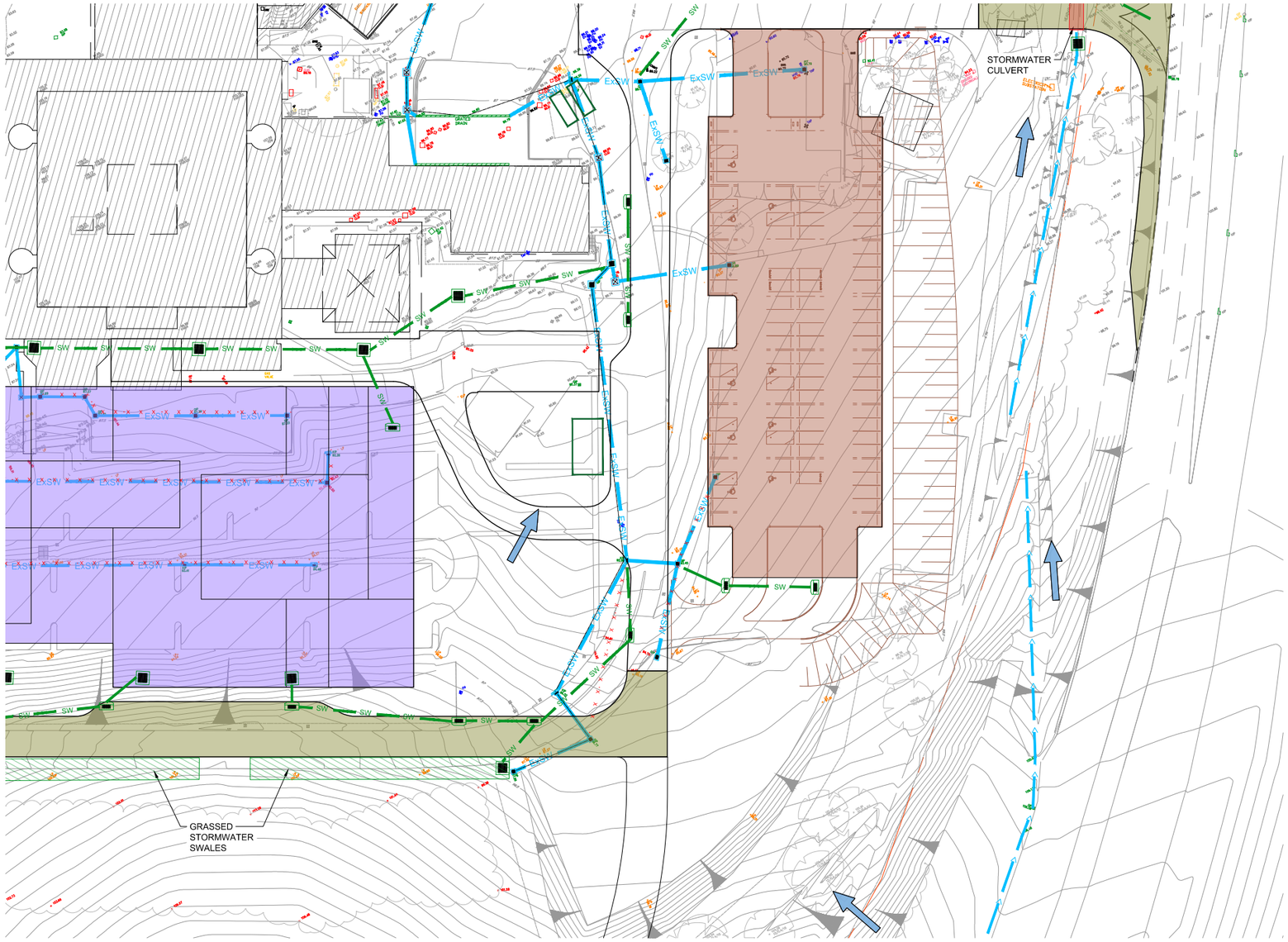

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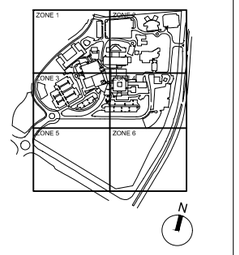

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PROJECT NAME
CAMPBELLTOWN
HOSPITAL REDEVELOPMENT

DESCRIPTION
GENERAL STORMWATER PLAN - ZONE 4

Scale
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PROJECT NUMBER	REVISION DATE
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