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Civil Engineering Report

Northern Rivers Flood Recovery – Richmond River High Campus Redevelopment

Prepared for NSW Department of Education / 20 June 2025

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Contents

Rev	Date	Prepared By	Approved By	Remarks
01	14/06/24	CG	GC	100% Concept Design
02	25/07/24	CG	GC	Minor amendments as per TSA comments
03	6/12/24	CG	-	Draft for 50% Schematic Design
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1.0 Introduction

The Department of Education (the department) is the landowner, and proponent pursuant to Section 5.1 of the *Environmental Planning and Assessment Act 1979* (the Act). The activity will be determined by the Reconstruction Authority (RA) under the Ministerial powers in Section 68 of the NSW Reconstruction Authority Act 2022 (RA Act).

This Civil Engineering Report has been prepared to support a Review of Environmental Factors (REF) for the rebuild of Richmond River High Campus (the activity) (RRHC). The REF has been prepared to support an approval for the RRHC development under Section 68 of the NSW Reconstruction Authority Act 2022 (RA Act).

The activity will be carried out at Dunoon Road, North Lismore, also known as 163 and 170 Alexandra Parade, North Lismore (the site).

The purpose of this report is to address the civil engineering design of the RRHC redevelopment including stormwater quantity, overland flow, stormwater quality, pavements, and earthworks design. The relevant requirements of the Lismore City Council Development Control Plan and engineering specifications as well as SINSW's 'Educational Facilities Standards and Guidelines' (EFSG) will be addressed.

1.1 Guidance Documents

The following documents have been reviewed and referenced in preparing this report:

- Lismore City Council Development Control Plan 2012
- Blue Book – Managing Urban Stormwater Soils and Construction (Landcom NSW)
- Australian Rainfall and Runoff 2019
- NSW Department of Education: Educational Facilities Standard and Guidelines, 2022
- 'Preliminary Geotechnical Investigation' report by JK Environments (JKE) (22 Nov 2024).
- 'Surface and Groundwater Impact Assessment' (SGIA) report by JK Environments (JKE) (10 Dec 2024).

2.0 Existing Site

2.1 Site Description

The site is located at Dunoon Road, North Lismore, also known as 163 and 170 Alexandra Parade, North Lismore. The site comprises of three separate lots, located to the north of Alexandra Parade, with Dunoon Road running parallel to the eastern boundary of the site.

The site is legally described as:

- Lot 1 DP 539012
- Lot 2 DP 539012
- Lot 1 DP 376007

The site area is approximately 33.53 hectares. The proposed activity will be undertaken mainly within the southeastern portion of the site. The site is outlined in Figure 1.

Figure 1: Aerial image of site (Source: Nearmap)

2.2 Existing topography

The site topography is varied. The eastern portion of the site is generally flat (gradient approx. 1V:200H) and the western portion is relatively steep (gradient approx. 1V:2H). The levels vary from approx. RL 100m at the western site boundary to approx. RL 8m to the eastern site boundary. An existing dam is located to the west of the site at approx. RL 34m and a surface area of approx. 0.1 ha. Stormwater generally flows from the west to the east towards existing culverts under Dunoon Road. Two existing residual dwellings are located around the centre of the site at approx. RL 25m.

2.3 Existing Services

A Before You Dig Australia (BYDA) enquiry as well as a site survey have been assessed to identify known in-ground assets that may impact the proposed activity. Based on the BYDA, some of the existing services on site identified include (but not limited to):

- Sewer line runs through the site parallel to the eastern boundary.
- Telecom lines from Dunoon Road to the existing dwellings.
- Overhead electrical lines from Alexandra Parade to the existing dwellings.

Refer to 'Building Services Infrastructure Report' prepared by LCI Consultants for further details.

2.4 Geotechnical Conditions

Existing geotechnical conditions of the site are documented in the "Further Geotechnical Investigation" report by JK Geotechnics (dated June 2024). The general findings of the report are listed below:

- Evidence of slope stability (landsliding) encountered with boreholes drilled within the western portion of the site and the area of the proposed activity.
- Topsoil was encountered from the surface ranging depths from 0.1 to 0.5m and generally 0.1 to 0.3m thick.
- Alluvial clay of high plasticity and high strength was identified within the lower, eastern portion of the site.
- Colluvial and residual clays of high plasticity identified in the western portion of the site. Colluvial clays were of stiff to very stiff strength with basalt gravels, cobbles and boulders. Residual clays was very still to hard strength with basalt gravels.
- Weathered basalt was encountered at depths ranging 1.5m to 11.4m below ground level (approx. RL 20.25 to RL 5.75m).
- Depth of competent bedrock increases towards the eastern portion of the site.
- Test results indicate natural clays are of high plasticity and have a high potential of shrink-swell movement with changes in moisture content.
- CBR tests generally returned values of 1.5% to 2.5%.

Conditions of existing groundwater on the site are documented in the "SGIA" report by JKE (dated 10 December 2024). The general findings of the report are listed below:

- Groundwater generally flows in a down gradient towards the lower eastern portion of the site. Groundwater levels generally grade down towards the east.
- The groundwater at the site is generally non-aggressive to mildly aggressive towards buried concrete and non-aggressive towards buried steel. Management measures should be implemented as outlined in the JKE Salinity Management Plan (SMP).
- Report indicates that groundwater is likely to be intercepted during excavation activities. JKE understands that dewatering during construction will be required.
- The SIGA has identified that the groundwater is impacted by heavy metals, turbidity and microbial organisms.

3.0 Proposed Activity Description

The proposed activity comprises the relocation and rebuild of the Richmond River High Campus from its existing temporary location alongside The Rivers Secondary College Lismore High Campus at East Lismore to the site at 163 and 170 Alexandra Parade, North Lismore.

The school will be delivered in one stage. A detailed description of the proposal is as follows:

1. Demolition of existing features including existing buildings, cattle drinking well, cattle sheds, and wire fencing, and removal of trees to accommodate school development.
2. Construction of new 3 storey buildings on the southeastern portion of the site for the proposed public secondary school including:
    a. General and Specialist Learning Spaces, and Workshops.
    b. Administration, and Staff facilities.
    c. Library, Hall, and Movement Studio.
    d. Construction, Hospitality, and Agricultural Learning Facilities.
    e. Amenity, Plant, Circulation, and Storage areas.
    f. Outdoor Learning Spaces and play spaces.
3. Landscaping including tree planting.
4. Public domain works comprising:
    - Access road off Dunoon Road, comprising a separate shared bicycle/pedestrian pathway, and internal access roundabout.
    - Kiss and ride drop-off and pick up zones.
    - Bus transport arrangements with a separate bus zone.
5. Outdoor spaces including assembly zones, agricultural spaces, sports fields, games courts, dancing circles, yarning and dancing circles, seating and shade structures.
6. On-site carparking, including accessible spaces and provision for EV charging spaces.

Figure 2 indicates the scope of works.

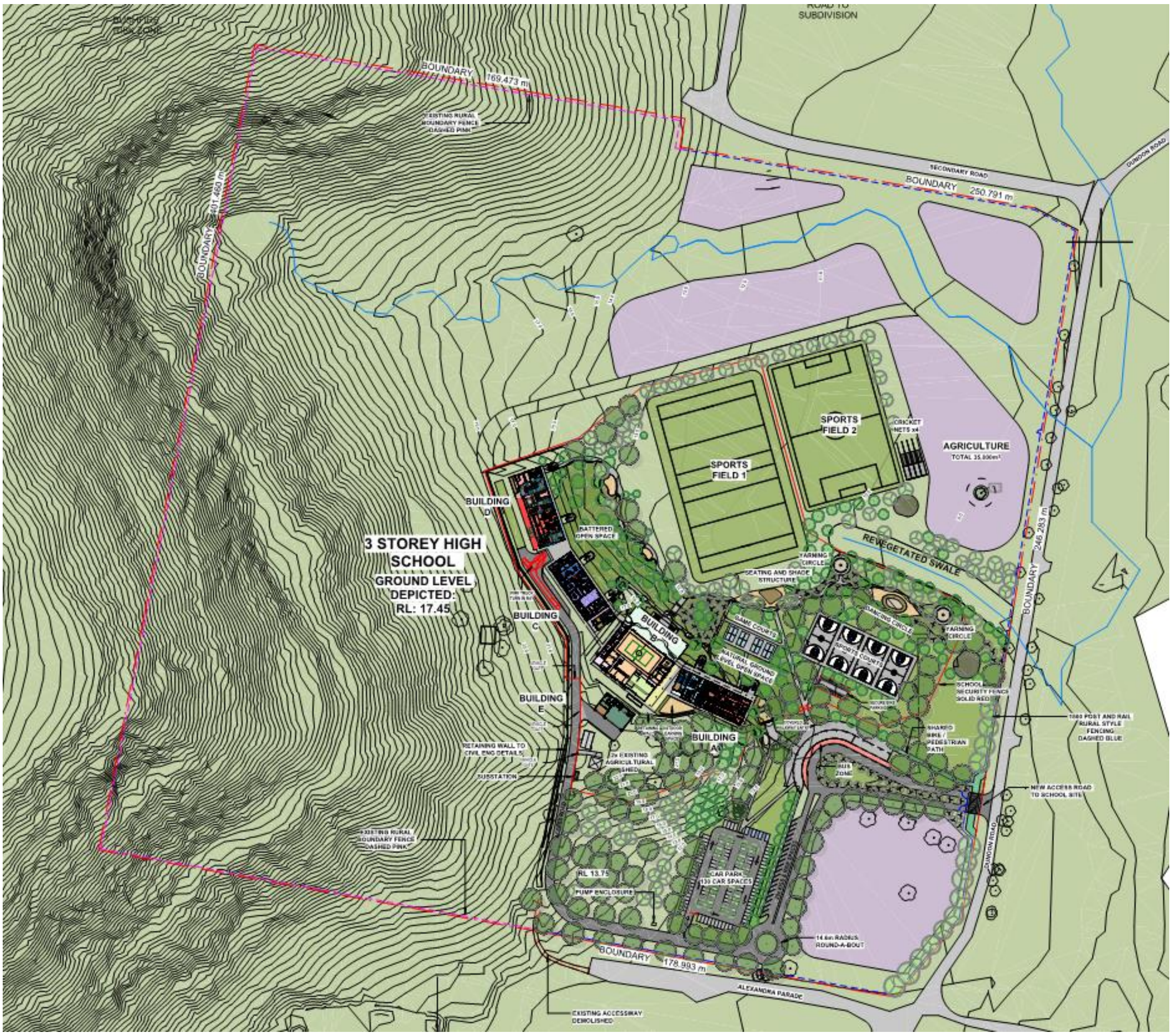


Figure 2: Overall Site Context Plan (source: EJE Architects)

4.0 Stormwater

4.1 Stormwater Quantity

4.1.1 Existing Stormwater

Based on received survey data, the existing site area is 33 ha and primarily pervious grassed paddocks. The site currently drains towards the east and off site via existing drainage culverts under Dunoon Road. There is no existing stormwater infrastructure onsite.

4.1.2 Proposed Stormwater Design

Stormwater quantity controls are outlined in the Lismore City Council Development Control Plan (DCP) – Chapter 22 – Water Sensitive Design. Stormwater discharge is to be conveyed primarily to Council's street network on Dunoon Road.

Stormwater is to be conveyed through the site by new stormwater drainage inlet pits and pipes, as well as grassed swales, and release at the site low points along the eastern boundary. Overland flow paths are designed to cater for increased frequency of discharge and not have a detrimental impact on onsite or downstream locations.

The existing overland drainage paths through the site is to be retained to ensure that overland flows from the upslope to the west can flow towards the receiving waters to the east of the site. This primarily consists of the existing overland flow path which runs west-east through the northern area of the site which is retained in the current layout (as shown in Figure 3).

The existing discharge points at the existing two culverts on Dunoon Road are to be retained. A third discharge outlet is proposed to connect to an existing culvert beneath Dunoon Road via existing table drain on the northern side of Alexandria Parade. All stormwater from the proposed activity will be directed to those existing discharge points (as shown in Figure 3).

Roof catchments are to be collected through the use of gutters and downpipes, documented by the hydraulic engineer, and directed to inground drainage pits and pipes and to inground on site detention tanks.

No changes to public domain stormwater infrastructure are proposed. Capacity of existing culvert crossings under Dunoon Road are to be determined at detailed design stage.

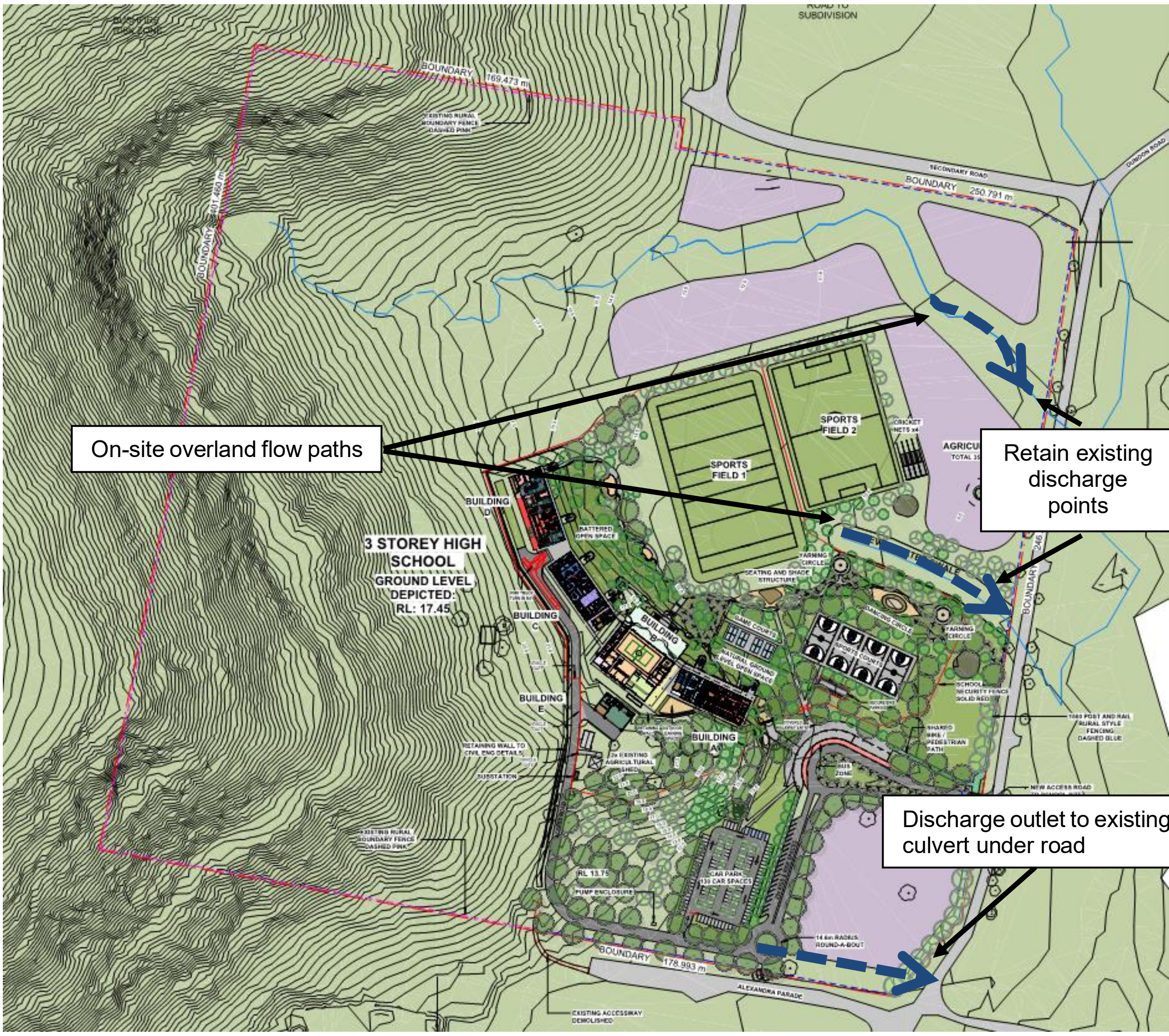


Figure 3: On site overland flow paths and points of discharge (source: EJE Architects)

4.1.3 Onsite Stormwater Detention

Onsite stormwater detention (OSD) is required as the proposed site's impervious area increases from existing conditions. Chapter 22 of the Lismore City Council DCP states post-development discharge for the 1-yr and 10-yr ARI design storms must be limited to pre-development discharges (see Figure 4). For the 100-yr ARI, there must be adequate flow paths to accommodate post-development diversions of stormwater (see Figure 4).

Three OSDs are proposed:

1. Inground OSD tank with 200m^3 storage volume located adjacent to the northeastern face of Building C.
2. Inground OSD tank with 140m^3 storage volume located in landscape area between Buildings A and B.
3. Above ground OSD tank located on western side of carpark with approx. storage volume of 500m^3.

Stormwater Quantity		
Flow rates (environmental protection)	Limit the post-development peak 1 year average recurrence interval (ARI) discharge from the site to the pre-development peak 1 year ARI discharge.	Reduce the likelihood of increased rates of bed and bank erosion and damage to benthic habitat in waterways
Flow rates (infrastructure protection)	Limit the post-development peak 10 year average recurrence interval (ARI) discharge from the site to the pre-development peak discharge for the same ARI and assess the capacity of existing flow paths to accommodate the post development 100 year average diversion of stormwater to a discharge location where the increased frequency of discharge will not have a detrimental impact on aquatic ecosystems. Reduce discharge from the site and provide necessary attenuation / infrastructure upgrade to ensure flow paths can accommodate anticipated flows.	Ensure that the development does not result in increased stormwater flows that exceed the capacity of the external stormwater drainage infrastructure and / or exacerbate overland flow problems

Figure 4: Stormwater Quantity Requirements (Lismore City Council DCP Chapter 22, 2012)

A detailed DRAINS model has been prepared to model pre-vs-post flows for the 1 exceedance per year (1EY) and 10% Annual Exceedance Probability (10% AEP) events. The 1 EY and 10% AEP have been adopted for the 1 year ARI and 10 year ARI events, as EY and AEP are the current terminology according to the latest ARR guidelines.

To limit post-development flows, three OSDs are proposed with the following detention volumes; 180m^3, 1435m^3 and 500m^3. Figure 5 to Figure 7 shows the model layout and the flow rates for the two design storms. In the 1 EY and 10%AEP model, the outflow from the OSD tank is lower than the pre-developed discharge as required.

In the case of the 100-yr ARI storm, the site and surrounding flow paths are inundated with flood water. A separate flooding assessment by TTW addresses this requirement.

Table 1: DRAINS Model Flow Results

Condition	Norther Outlet (m^3/s)	Southern Outlet (m^3/s)	Total (m^3/s)
Pre-Dev 1 YE	1.12	0.381	1.49
Post-Dev 1 YE	1.09	0.324	1.41
Pre-Dev 10% AEP	3.16	1.05	4.2
Post-Dev 10% AEP	2.96	0.818	3.73

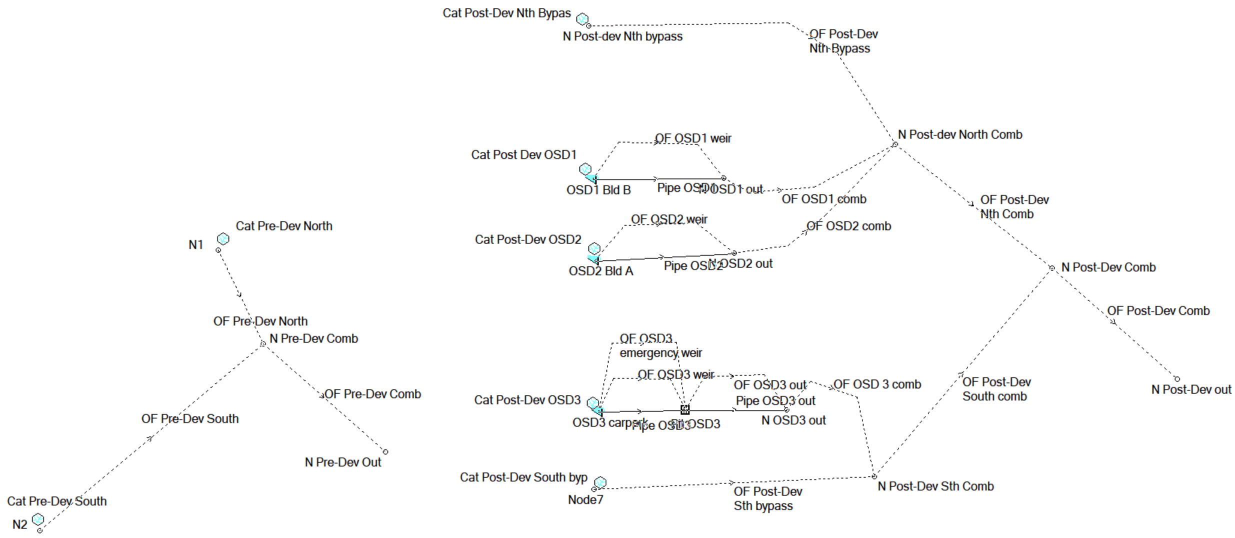


Figure 5: DRAINS Model Layout

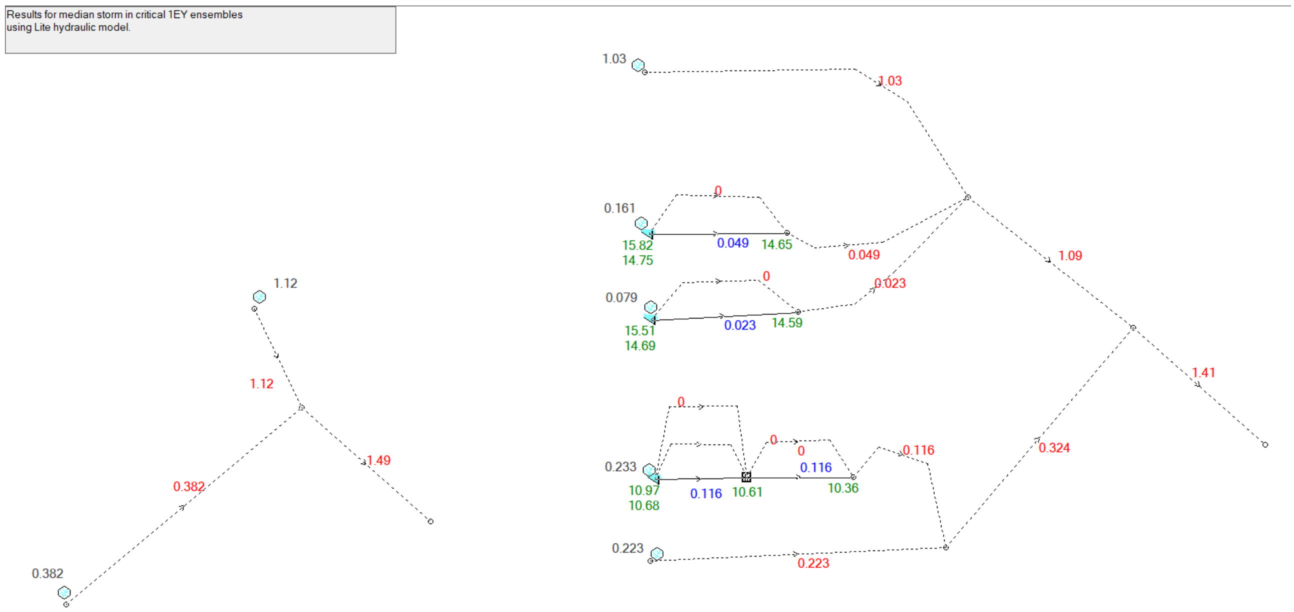


Figure 6: DRAINS Results (1YE)

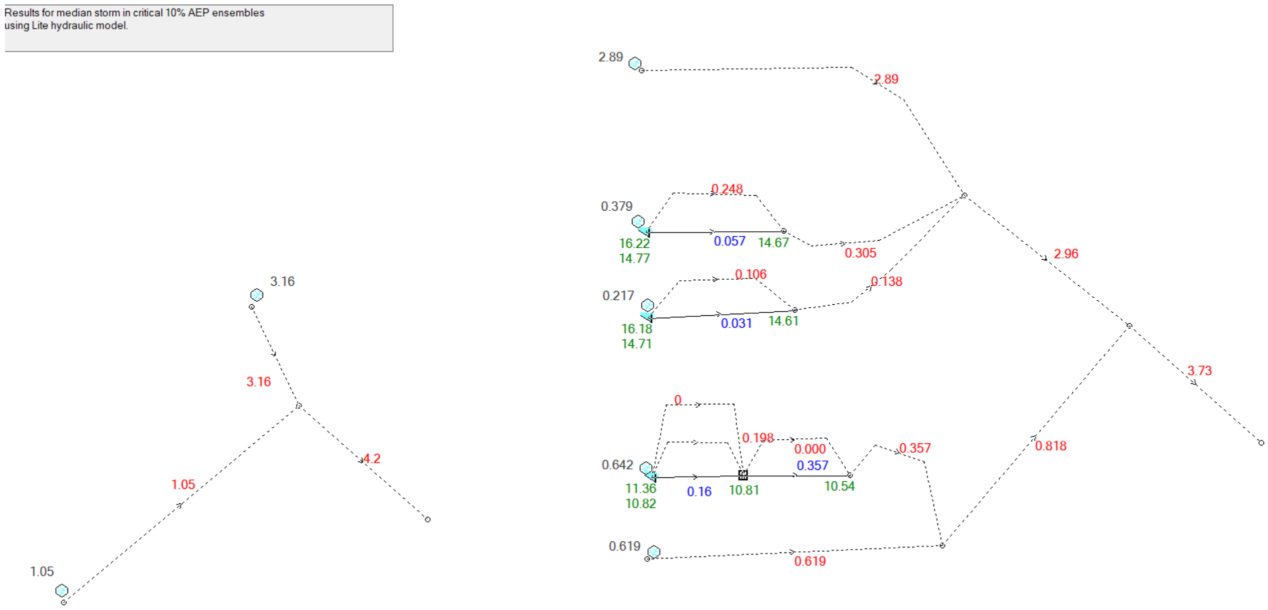


Figure 7: DRAINS Results (10%AEP)

4.2 Stormwater Quality

Stormwater quality treatment is required to comply with the requirements outlined in Chapter 22 – Water Sensitive Design of the Lismore City Council DCP, 2012. Water quality treatment devices must achieve the water quality targets outlined in Figure 8.

Stormwater Quality		
Total Suspended Solids	75% reduction in the mean annual load compared to baseline	Minimise the risk of water quality degradation in downstream waterways and thereby protect aquatic ecosystems
Total Phosphorus	65% reduction in the mean annual load compared to baseline	
Total Nitrogen	40% reduction in the mean annual load compared to baseline	
Gross Pollutants	90% reduction in the mean annual load compared to baseline	

Figure 8: Water quality targets (Lismore City Council DCP Chapter 22, 2012)

A detailed MUSIC model has been prepared to assess the required treatment devices to achieve Council's reduction targets. Figure 9 shows the layout of the MUSIC model and Figure 10 shows the results of the MUSIC model. It is evident in Figure 10 that all stormwater quality targets set out by Council have been achieved.

Stormwater quality targets are to be met through the use of the following devices:

- 30 x 690mm PSorb Ocean Protect Stormfilter Cartridges (or equivalent).
- 70 x Ocean Protect Oceanguard Pit inserts (or equivalent).
- Grass swales.
- 1 x 100m^2 bioretention basins.
- Bioretention swales.

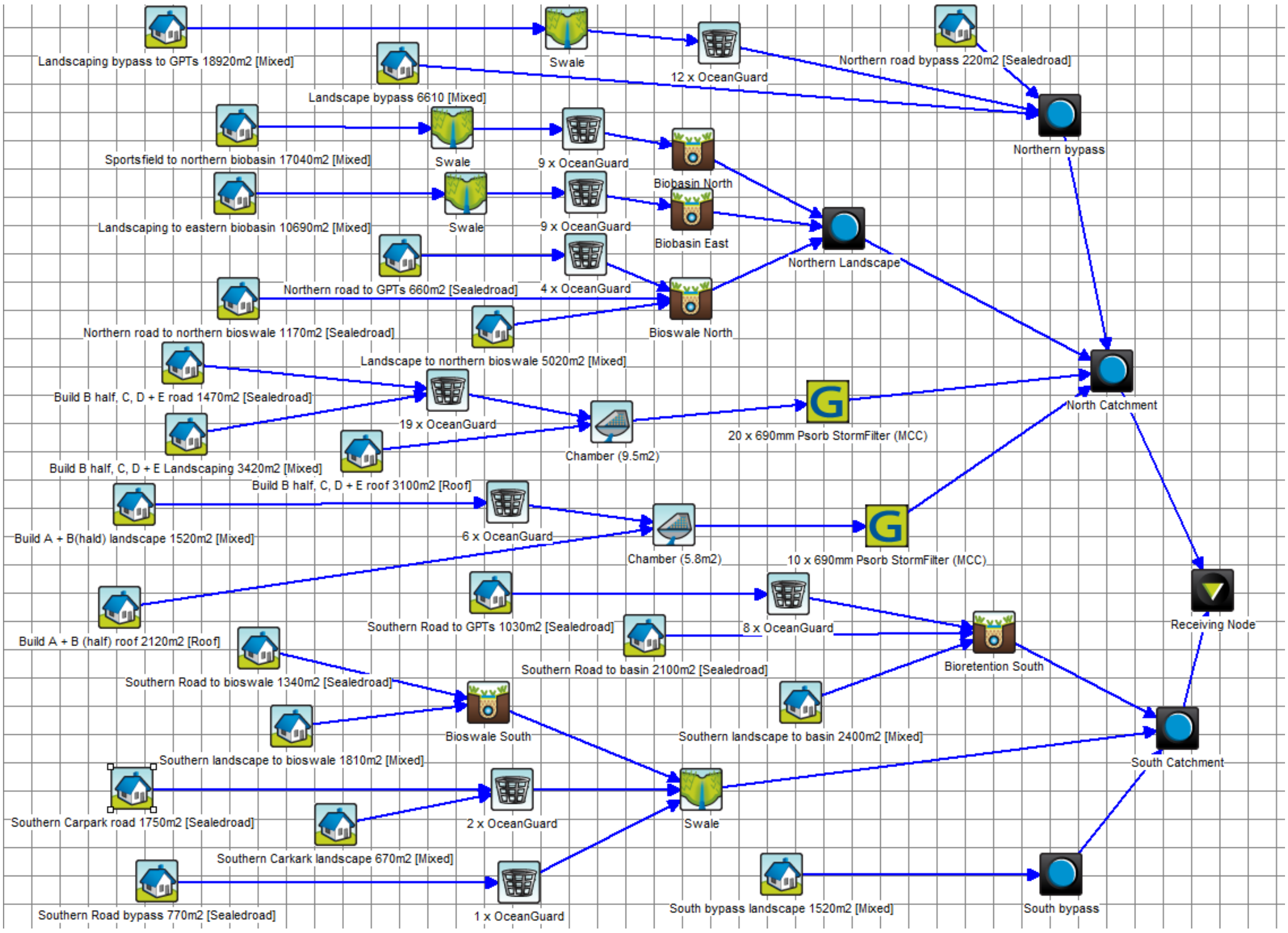
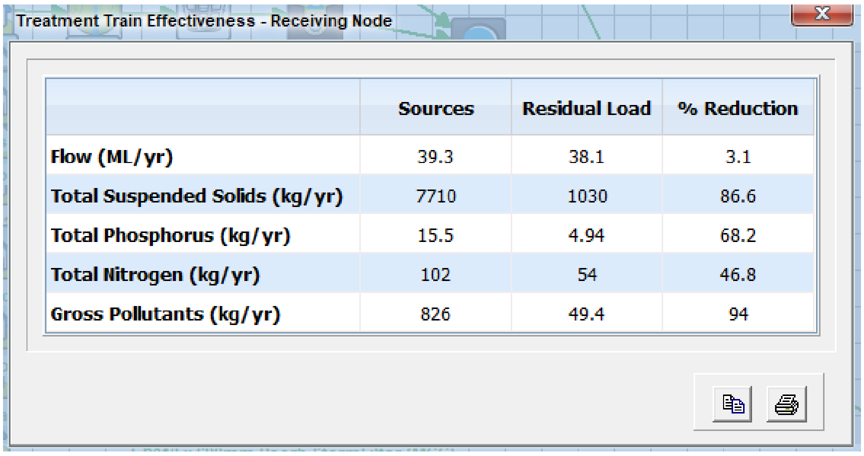


Figure 9: MUSIC Model Layout



Treatment Train Effectiveness - Receiving Node

	Sources	Residual Load	% Reduction
Flow (ML/yr)	39.3	38.1	3.1
Total Suspended Solids (kg/yr)	7710	1030	86.6
Total Phosphorus (kg/yr)	15.5	4.94	68.2
Total Nitrogen (kg/yr)	102	54	46.8
Gross Pollutants (kg/yr)	826	49.4	94

Figure 10: MUSIC Model Results

4.3 Operation and Maintenance

Regular maintenance of stormwater infrastructure, particularly the on-site detention tank and stormwater quality treatment devices will be required to ensure they function as intended for the design life. Access roads as shown on the overview plan will be utilised to ensure maintenance vehicles such as vacuum trucks are able to access the detention tank and stormwater quality devices. Pavements are to be able to accommodate maintenance vehicle loading.

The proposed OSD and water quality tanks are designed to have an adequate number of access hatches in accordance with Australian Standards and the local Council requirements. Tanks are located within outdoor areas to ensure access can be obtained for maintenance works.

4.4 Erosion and Sediment Control

During the construction stage of the project, an erosion and sediment control plan is to be implemented to prevent sediment laden stormwater from flowing into adjoining properties, bushland, roadways or receiving water bodies. Stormwater controls on site are detailed in erosion and sediment control plans which is in accordance with relevant regulatory authority guidelines including Landcom NSW's Managing Urban Stormwater, Soils and Construction ("Blue Book"). The proposed Erosion and Sediment Control Plan is included in Appendix A.

4.5 Integrated Water Management Plan

An Integrated Water Management Plan (IWMP) relating to civil items has been developed to ensure requirements put forward by the Department of Climate Change, Energy, the Environment and Water – Biodiversity, Conservation and Science (DCCEEW BCS) have been met.

- Existing surface water is currently captured by on-site stormwater infrastructure and connects to multiple outlets on the site. As the site is flat, much of the existing surface water ponds in localised catchments around site and either flows to Dunoon Road or infiltrates the pervious surfaces. Section 4.1.1 further addresses existing stormwater information for the site.
- The comparison in volumes and flows of existing and proposed stormwater is addressed in Section 4.1 of this report, showing that post-development flows are restricted for the design storms to pre-development levels. Flows at each specific stormwater intake point are also shown in the DRAINS model figures for the two design storms. Quality of stormwater discharges are addressed in Section 4.2 of this report, showing that stormwater pollutant levels are reduced to the required percentages set out by Lismore City Council.
- Water quality objectives are met as addressed in Section 4.2 of this report, showing that stormwater pollutant levels are reduced to the required percentages set out by Lismore City Council.
- In terms of mitigating effects of stormwater during construction, Section 4.4 of this report along with the Erosion and Sediment Control drawings in Appendix A outline measures to be taken to limit high flows and poor-quality stormwater runoff from the site. Section 4.1 and Section 4.2 of this report outlines the proposed stormwater strategy to mitigate volumes and flow rates to below pre-development levels and ensure the stormwater flowing from the site meets water quality requirements which have been stipulated for the project.

5.0

5.0 Civil Works

5.1 Pavement Design

Pavement thicknesses were designed in accordance with the recommendations provided in the geotechnical assessment by JKE (dated 22 November 2024).

9.9 Pavement Design

Due to the very low CBR values obtained from the laboratory testing, construction of pavements without subgrade improvement will be difficult to achieve. In this regard we consider that some options for pavement design and construction are as follows:

1. Provide an appropriate well, graded good quality ripper or crushed basalt select fill layer as part of the overall pavement thickness.

OR

2. Stabilise the subgrade to a depth of about 300 mm by the addition of lime.

OR

3. If rigid pavements are preferred a 150 mm lean-mix concrete subbase should be placed below the concrete base course such that an effective subgrade strength of 5% may be adopted.

Where a working platform and/or bridging layer is adopted then this layer may be included within the pavement design. Due to the highly reactive nature of the clay, a low-permeability capping layer should be incorporated within the pavement profile to limit moisture related movement. The capping layer should comprise a select fill or subbase material with a minimum thickness of the greater of 150 mm or 2.5 times the maximum particle size. The capping layer should extend at least 500 mm past the edge of the pavement, including kerb and gutter.

Figure 11: Pavement Recommendations (JKGeotechnics – 37635UORrpt 30 June 2025 Section 9.9)

Pavements have also been designed in accordance with the NSW Department of Education – Education Facilities Standards and Guidelines (EFSG) 2022 Section 0.02 – Civil Works. Figure 12 to Figure 13 outline the design requirements for pavements within education facilities. These guidelines have been addressed to inform the design of the internal pavements the site. Pavement types for the activity include concrete pedestrian pavement, vehicular asphaltic concrete and games courts.

Pavement Design

- All pavements to be designed for a 25-year life.
- All pavements trafficked by buses and trucks to be designed for a minimum 5 x 105 repetitions of a standard axle load, as defined by AUSTROADS.
- For other vehicular traffic areas design for 1.0 x 105 repetitions of a standard axle load, as defined by AUSTROADS.
- Allow for movements in the foundations caused by moisture variations and mine subsidence.
- Design rigid pavements so there is no vertical differential movement between panels at joints.
- For truck turning areas pavements shall be rigid in construction and finished with a reinforced concrete surface.
- For other areas pavements may be either flexible or rigid in construction. For flexible construction finish with a surface coat of asphaltic concrete.
- Breccia or dolerite is not to be used in road base or concrete mix.

Figure 12: Pavement Requirements - all types (NSW Department of Education - Education Facilities Standards and Guidelines (EFSG) 2022 Section 0.02 – Civil Works)

For Rigid Construction

- For rigid method of construction finish with a reinforced concrete surface
- Concrete pavements for vehicles shall be a minimum 150mm thick and reinforced with not less than SL92 mesh at top and 100 mm thick road base
- Other concrete pavements shall be a minimum 100mm thick and reinforced with not less than SL72 mesh at top
- Provide a thicker pavement and heavier mesh as the design requires and to meet durability requirements for minimum cover to reinforcement

Figure 13: Pavement Requirements - Rigid Construction (NSW Department of Education - Education Facilities Standards and Guidelines (EFSG) 2022 Section 0.02 – Civil Works)

Based on the above, vehicular pavements will be designed for a minimum CBR of 5% with the condition that subgrade strengthening be undertaken as per JKG recommendations. Vehicular pavements are to be designed for minimum 1×10^5 DESA, except for pavements subject to bus and truck movements which are to be designed for a minimum 5×10^5 DESA with 25 year design life.

Pavement profile design is provided below:

- Internal access roads pavement (subject to bus and truck movements):
  - 40mm compacted thickness AC10 wearing course on prime (with seal if used for construction traffic), on
  - 150 mm compacted thickness DGB20 base, on
  - 215 mm compacted thickness DGS40 subbase, on
  - subgrade strengthening bridging layer as per geotechnical engineer recommendations to achieve 5% CBR.
- Carpark pavement:
  - 40mm compacted thickness AC10 wearing course on prime (with seal if used for construction traffic), on
  - 150 mm compacted thickness DGB20 base, on
  - 150 mm compacted thickness DGS40 subbase, on
  - subgrade strengthening bridging layer as per geotechnical engineer recommendations to

achieve 5% CBR.

- Footpath pavement:
  - 100mm thick concrete 20MPa with SL72 mesh minimum 40mm top cover, on
  - 100mm compacted thickness DGB20 base, on
  - Compacted subgrade
- Sealed sports courts pavement:
  - 25mm AC5, on
  - 25mm AC10, on
  - 100mm compacted thickness DBG20 base, on
  - Compacted subgrade.

5.2 Earthworks

A detailed cut and fill plan has been produced using the latest 3D survey and proposed levels, provided in Appendix A.

Bulk earthworks have incorporated results and recommendations as documented in the JK Geotechnical (JKG) report 37635UORrpt. Reference should be made to this report for construction requirements within zones of potential slope stability.

6.0 Mitigation Measures

Mitigation measures are outlined in Table 2.

Table 2: Mitigation measures

Mitigation Number and Name	Stage of implementation	Mitigation Measure	Reason for Mitigation Measure
Stormwater Quality Improvement Devices (SQIDs)	Stormwater during operation	Installation of 78x690mm PSorb Stormfilters, 130 x Ocean Protect Oceanguard Pit inserts and grassed swales to remove the quantity of gross pollutants, suspended solids, nitrogen and phosphorous to council water quality requirements or equivalent.	Improve stormwater quality.
On-Site Detention	Stormwater during operation	Installation of OSD to reduce flows from the developed site to less than pre-development flows for the 1 year and 10 year ARI design storms.	Reduce stormwater runoff.
Erosion and Sedimentation Control Plan	Stormwater during construction	Design of an erosion and sedimentation control plan to reduce the debris and pollution in surface stormwater runoff from the site in the construction phase.	Reduce stormwater runoff and improve quality in the construction phase.
Retain existing stormwater points of discharge	Stormwater during construction and operation	Construction of temporary channels to direct existing site upstream catchments to existing discharge locations on Dunoon Road. Stormwater design outlets directed towards existing points of discharge on Dunoon Road.	Mitigate impact on neighboring properties or environment by retaining existing stormwater paths from the site.

7.0 Evaluation of Environmental Impact

Regarding civil works as described in this report, the proposed activity will not have a significant impact on the environment through implementation of the following mitigation measures:

- Retention of existing stormwater points on discharge on Dunoon Road, to not redirect stormwater onto other properties or environments.
- On-site detention basins designed to mitigate stormwater flows to pre-development conditions to the standard as dictated by Lismore City Council guidelines, as described in section 4.1.
- Implementation of various on-site water quality treatments measures as described in section 4.2 to ensure stormwater flowing from the site meets water quality requirements to the standard as dictated by Lismore City Council guidelines.
- Implementation of sediment and erosion control measures taken to limit high flows and poor-quality stormwater runoff from the site during construction works.

8.0 Conclusion

This section summarises the key design developments on the site:

- Stormwater quantity has been designed in accordance with Lismore City Council and EFSG specifications and to support ESD initiatives proposed for the site. OSD is required for the site. The inground stormwater system has been designed using the hydraulic analysis program DRAINS in line with requirements outlined in by EFSG and the Lismore City Council DCP. Discharge from the site is provided in two locations at the existing culvert crossings under Dunoon Road.
- Stormwater water quality reduction targets of 90% GP, 75% TSS, 65% TP, and 40% TN have been achieved as demonstrated by the MUSIC modelling.
- An erosion and sediment control plan has been developed to manage stormwater runoff in the construction phase
- Pavement profiles have been designed in accordance with EFSG guidelines and geotechnical engineer's recommendations.
- Earthworks are to be done in accordance with recommendations by geotechnical engineer. Geotechnical engineer to provide recommendations for documented landslip following further investigations.

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Appendix A

Civil Engineering Drawings