

Concept Civil Engineering Report

Lismore Hospital Car Park – Uralba
Street and Dalziell Street, Lismore

80815106



Prepared for
Lismore Hospital
5 January 2015

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1 Background Information

This document presents the Concept Civil Engineering report for submission to NSW Department of Planning and Infrastructure to support the Development Application for the proposed multistorey car park between Uralba Street and Dalziell Street, Lismore.

2 Site Context

The Lismore Hospital Car Park development consists of five separate lots that will be consolidated as part of the development works. Total site area is approximately 4,840m².

The two northern lots fronting Uralba Street are currently occupied by specialist medical practices. The three southern lots fronting Dalziell Street are residential and house residential dwellings. Buildings and improvements currently located on the five lots will be demolished as part of the proposed works.

The development site is bound to the:

- North by Uralba Street
- East by a specialist medical practice fronting Uralba Street and a residential lot fronting Dalziell Street
- South by Dalziell Street
- West by a specialist medical practice fronting Dalziell Street and a specialist medical practice fronting Uralba Street

The site grades relatively steeply at 15% from north to south. Uralba Street grades to the west toward Wilsons River at approximately 2% grades while Dalziell Street grades to the west at approximately 6% grade.

Uralba Street defines the crest of the local catchment and thus the development site is not subject to external catchment flows. Public stormwater is located in Uralba Street and Dalziell Street and discharges to the west of the development site.

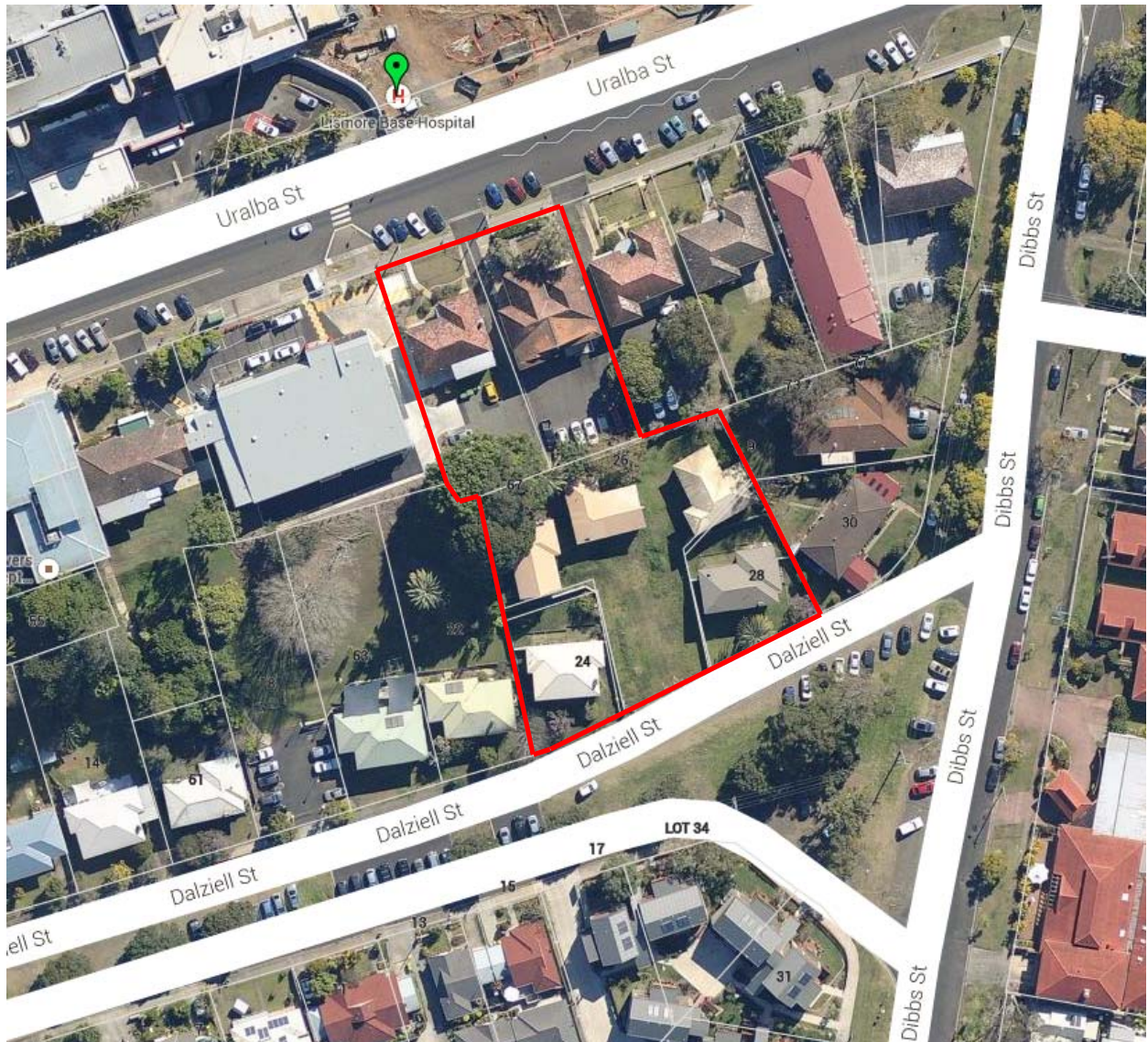
The site is serviced by potable water, sewer, electrical and communication services. Adjustment to a selection of these services may be required as part of the proposed development. Refer Section 11 of this report.

Site geotechnical investigations are currently being undertaken. Based upon geological conditions encountered as part of the main hospital works off Uralba Street, it is expected that rock will be encountered as part of the proposed bulk earthworks excavations.

The site is entirely above the Wilsons River flood extents, including the low flood risk area, as presented in Lismore Council's DCP, Part A, Chapter 8, Map 1.

Aerial photography of the existing site is presented in Figure 2-1.

Figure 2-1 Existing site (Source – Nearthmap 2014)



3 Proposed Development

The proposed development will consist of staged construction of a nine (9) storey car park.

Stage 1 works include:

- Demolition works;
- Bulk earthworks for the lower portion of the site (fronting Dalziell Street);
- Construction of a seven (7) storey car park fronting Dalziell Street;
- Construction of a tiered, on grade car park off Uralba Street;
- Construction of water quality treatment and on site detention;
- Augmentation to Uralba Street kerbs, medians etc;
- Construction of entry/exit off Uralba Street;
- Construction of exit to Dalziell Street.

Stage 2 works include:

- Demolition of tiered, on grade car park constructed during Stage 1;
- Minor regrading of the former on grade car park;
- Construction of six (6) storey car park fronting Uralba Street;
- Minor adjustment to water quality and on site detention;

Due to the grade of the development site the proposed car park includes a total of nine (9) storeys in height, comprising seven (7) storeys fronting Dalziell Street and six (6) storeys fronting Uralba Street. Refer to the architect's drawings for further details and interconnectivity between the car park storeys.

A maximum cut depth of approximately 6m is proposed to facilitate the car park construction. The development will generate excess spoil that will be disposed off site.

Concept engineering drawings showing the staged multistorey car park construction are listed in Appendix A.

4 Geotechnical Conditions

Site geotechnical investigations are currently being undertaken.

Based upon geological conditions encountered as part of the main hospital works off Uralba Street, it is expected that rock will be encountered as part of the proposed bulk earthworks excavations.

Results of the geotechnical investigations will be reported separately.

5 Earthworks

As part of the concept civil engineering design a 12D earthworks model has been developed to estimate earthworks volumes and batter extents associated with the car park construction.

Drawing 80815106-CI-120 presents the concept bulk earthworks plan for the car park works.

A maximum cut depth of approximately 6m is proposed to facilitate the car park construction. The development will generate excess spoil that will be disposed off site. Stage 1 of the car park includes approximately 7,000m³ of cut works with minimal fill works proposed.

Classification of the cut material will be undertaken by the geotechnical engineer.

The Stage 2 car park works will include minor regarding of the Stage 1 on grade car park off Uralba Street. Only small volumes of material export, if any, are expected as part of the Stage 2 construction.

6 Stormwater and Water Sensitive Urban Design

Stormwater design and water sensitive urban design, including the preparation of computer models, is discussed in detail in the Integrated Water Cycle Management Plan prepared by Cardno and included in Appendix B.

7 Erosion and Sediment Control

Concept Erosion and Sediment Control Plans and Details have been prepared in accordance with Landcom's publication Managing Urban Stormwater – Soils and Construction, Volume 1 (2004) and are presented on Drawings 80815106-CI-150 and -151.

8 Flood Risk

As part of the preparation of the Development Application documentation Cardno have reviewed Lismore Council's DCP, Part A, Chapter 8, Map 1 to confirm flood risk to the development site.

Based upon Lismore Council's flood mapping, the proposed development site is entirely above the Wilsons River flood extents, including the low flood risk area.

9 Road System Design

To minimise impacts to westbound through traffic it is proposed to construct a left turn lane adjacent to the southern kerb of Uralba Street. The left turn lane will be formed by removing a small number of on street parking spaces and constructing a concrete median. Refer to Drawing 80815106-CI-110. Eastbound traffic on Uralba Street will utilise the existing roundabout at the intersection with Dibbs Street to perform a U-turn and the utilise the left turn lane noted above.

The multistorey car park will be accessible for entry and exit movements from Uralba Street while an exit only will be provided to Dalziell Street.

Turning paths for movements into and out of the proposed car park have been checked against the B99 passenger vehicle profile as per AS2890.1. Internal turning paths within the car park have been checked by the traffic consultant (Taylor Thomson and Whitting).

Impacts to existing parking and the surrounding road network due to the proposed development are discussed in the Traffic and Parking report prepared by Taylor Thomson and Whitting.

10 Retaining Systems

Landscaped batters will be utilised where possible to manage level differences on the site. Where the resulting batter grade is considered to be too steep, a structural retaining system will be utilised.

Types of retaining systems will be determined during the detailed design phase but may include one or more of the following elements:

- Cantilevered block or insitu concrete walls
- Infill blockworks walls (between car park levels)
- Contiguous pile walls possibly with temporary ground anchors

Further assessment of the retaining systems will be undertaken following completion of the geotechnical investigations (refer Section 4 of this report).

Typical site sections that include locations of indicative batters and structural retaining systems are presented on Drawing 80815106-CI-130.

11 Utilities

Known public utilities are shown on the concept civil engineering drawings, drawing series 80815106-CI-100. Utilities have been located from the detailed site survey prepared by Newton Denny Chappelle and Dial Before You Dig plans.

An existing sewer is located in the rear of the lots fronting Uralba Street. Access to the sewer will not be possible following the construction of the Stage 2 works (construction of multistorey car park off Uralba Street). It will be necessary to concrete encase the existing sewer to make it maintenance free prior to the construction of the Stage 2 car park off Uralba Street.

Utilities exist in the northern verge of Dalziell Street and include sewer and telecommunications assets.

The proposed multistorey car park will be piered to rock and will transfer loads below the existing sewer and telecommunications assets. Maintenance operations on the existing utilities will not be impeded by the car park. As such, no adjustments to existing utility assets off Dalziell Street are proposed as part of the car park works.

A 1.5m wide Easement for Drainage exists over part of the site fronting Dalziell Street. The construction of the Stage 1 multistorey car park will impact this easement and any stormwater assets contained within. It is proposed to intercept and collect stormwater from the easement and discharge the water to the Dalziell Street via a kerb adaptor. The concept arrangement for the diversion is shown on Dwg 80815106-CI-C110.

12 Response to SEARs

The following is a summary of the civil engineering responses to the Secretary's Environmental Assessment Requirements (SEAR's) dated 19 Decemeber 2014 for the Lismore Hospital Redevelopment Stage 3B proposal.

Table 12-1 Summary of civil engineering responses to SEARs

SEAR	Detailed Description of Requirement	Response
6 - Ecologically Sustainable Development (ESD)	Include a description of the measures that would be implemented to minimise consumption of resources, water (including WSUD) and energy.	Cardno have prepared concept MUSIC model for the proposed works demonstrating compliance with Lismore Council's WSUD requirements. Refer to the Integrated Water Management Plan included in Appendix B. Resource efficiency will be reduced through passive design, efficient design of lighting and ventilation systems, as well as material efficiency and water conservation. The development will consider energy efficiency and Greenhouse Gas emission reduction in design and operation through utilising such measures as maximising natural lighting in the car park to avoid artificial lighting, durable and energy efficient LED lighting, occupancy sensors for lighting in infrequently used areas, maximising natural ventilation, daylight harvesting through PE sensors, selection of high efficiency fans and pumps and installation of variable speed drives to maximise performance efficiency of motors.
9 - Sediment, Erosion and Dust Controls	Detail measures and procedures to minimise and manage the generation and offsite transmission of sediment, dust and fine particles.	Cardno have prepared concept erosion and sediment controls and details in accordance with Landcom's Managing Urban Stormwater – Soils and Construction, Volume 1 (2004). Refer Drawings 80814106-CI-150 and -151.
10 - Utilities	Address the existing capacity and any augmentation requirements of the development for the provision of utilities including staging of infrastructure through the preparation of an infrastructure Management Plan.	Known public utilities are shown on the concept civil engineering drawings, drawing series 80815106-C1-100 as located from existing survey and Dial Before You Dig plans. Some existing service utilities will require adjustment as part of the proposed development. Concrete encasing will be required to the northern sewer to render it maintenance free as the Stage 2 multistorey car park will be constructed over it.
13 - Drainage	Provide details of the drainage associated with the proposal, including stormwater drainage, drainage infrastructure and OSD, which shall be designed in accordance with Lismore City Council and must avoid any adverse impacts on downstream properties	Cardno have prepared a concept drainage design in accordance with Lismore City Council's DCP, Northern Rivers Local Government Handbook of Stormwater Drainage, AS3500 and Australian Rainfall and Runoff. The proposed car park development will reduce or maintain stormwater flows for the 1 year through to 100 year design storm events and will have no negative downstream impact. Refer to the Integrated Water Management Plan included in Appendix B.

Appendix A

CONCEPT CIVIL ENGINEERING DRAWING LIST FOR DEVELOPMENT APPLICATION APPROVAL

Drawing Number	Drawing Title
80815106-CI-100	Cover Sheet
80815106-CI-110	General Arrangement Plan – Stage 1
80815106-CI-111	General Arrangement Plan – Stage 2
80815106-CI-120	Bulk Earthworks Plan
80815106-CI-125	On Site Detention and Water Quality Plan
80815106-CI-130	Typical Sections – Sheet 1
80815106-CI-131	Typical Sections – Sheet 1
80815106-CI-150	Erosion and Sediment Control Plan
80815106-CI-151	Erosion and Sediment Control Details
80815106-CI-190	Turning Paths

Appendix B

CONCEPT INTEGRATED WATER MANAGEMENT PLAN

Integrated Concept Water Management Plan

Lismore Hospital Car Park – Uralba Street and Dalziell Street, Lismore

80815106

Prepared for
Lismore Hospital

9 December 2014



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Appendix B Lismore City Council Asset Information

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1 Background Information

This document presents the Concept Integrated Water Management Plan for submission to NSW Department of Planning and Infrastructure to support the Development Application for the proposed multistorey car park between Uralba Street and Dalziell Street, Lismore.

This Integrated Water Management Plan has been prepared in accordance with the requirements of Lismore City Council's Development Control Plan – Part A, Chapter 22 – Water Sensitive Design.

2 Site Context

The Lismore Hospital Car Park development consists of five separate lots that will be consolidated as part of the development works. Total site area is approximately 4,840m².

The two northern lots fronting Uralba Street are currently occupied by specialist medical practices. The three southern lots fronting Dalziell Street are residential and house residential dwellings. Buildings and improvements currently located on the five lots will be demolished as part of the proposed works.

The development site is bound to the:

- North by Uralba Street
- East by a specialist medical practice fronting Uralba Street and a residential lot fronting Dalziell Street
- South by Dalziell Street
- West by a specialist medical practice fronting Dalziell Street and a specialist medical practice fronting Uralba Street

The site grades relatively steeply at 15% from north to south. Uralba Street grades to the west toward Wilsons River at approximately 2% grades while Dalziell Street grades to the west at approximately 6% grade.

Uralba Street defines the crest of the local catchment and thus the development site is not subject to external catchment flows. Public stormwater is located in Uralba Street and Dalziell Street and discharges to the west of the development site.

The site is serviced by stormwater, potable water, sewer, electrical and communication services. Adjustment to a selection of these services will be required as part of the proposed development. Existing Lismore Council assets are included in Appendix B.

Site geotechnical investigations are currently being undertaken. Based upon geological conditions encountered as part of the main hospital works off Uralba Street, it is expected that rock will be encountered as part of the proposed bulk earthworks excavations.

The site is entirely above the Wilsons River flood extents, including the low flood risk area, as presented in Lismore Council's DCP, Part A, Chapter 8, Map 1.

Aerial photography of the existing site is presented in Figure 2-1.

Figure 2-1 Existing site (Source – Nearthmap 2014)



3 Proposed Development

The proposed development will consist of staged construction of a nine (9) storey car park.

Stage 1 works include:

- Demolition works;
- Bulk earthworks for the lower portion of the site (fronting Dalziell Street);
- Construction of a seven (7) storey car park fronting Dalziell Street;
- Construction of a tiered, on grade car park off Uralba Street;
- Construction of water quality treatment and on site detention;
- Augmentation to Uralba Street kerbs, medians etc;
- Construction of entry/exit off Uralba Street;
- Construction of exit to Dalziell Street.

Stage 2 works include:

- Demolition of tiered, on grade car park constructed during Stage 1;
- Minor regrading of the former on grade car park;
- Construction of six (6) storey car park fronting Uralba Street;
- Minor adjustment to water quality and on site detention;

Due to the grade of the development site the proposed car park includes a total of nine (9) storeys in height, comprising seven (7) storeys fronting Dalziell Street and six (6) storeys fronting Uralba Street. Refer to the architect's drawings for further details and interconnectivity between the car park storeys.

A maximum cut depth of approximately 6m is proposed to facilitate the car park construction. The development will generate excess spoil that will be disposed off site.

Concept engineering drawings showing the staged multistorey car park construction are listed in Appendix A.

4 Summary of Water Sensitive Urban Design Objectives and Performance Criteria

Water sensitive urban design (WSUD) objectives and performance criteria are specified in Lismore Council's DCP, Part A.

Under the DCP, the proposed car park and associated works are classified as 'Major Development' as site areas exceeds 2,500m² and impervious area exceeds 300m².

Major developments require the preparation of a Water Management Plan which is the purpose of this report.

Objectives and performance criteria are presented in Table 1 of Council's DCP and summarised below in Tables 4-1 to 4-3.

Table 4-1 Performance criteria for potable water consumption

Component	Performance Criteria
Reticulated water consumption	40% reduction in the consumption of potable water compared to baseline

Table 4-2 Performance criteria for stormwater quality

Component	Performance Criteria
Total Suspended Solids (TSS)	75% reduction in the mean annual load compared to baseline
Total Phosphorus (TP)	65% reduction in the mean annual load compared to baseline
Total Nitrogen (TN)	40% reduction in the mean annual load compared to baseline
Gross Pollutants	90% reduction in the mean annual load compared to baseline

Table 4-3 Performance criteria for stormwater quantity

Component	Performance Criteria
Flow rates (environmental flows)	Limit post-development flow to pre-development flow for the 1 year ARI storm event
Flow rates (infrastructure protection)	Limit post-development flow to pre-development flow for the 10 year ARI storm event and confirm capacity of existing overland flow paths to convey the 100 year ARI storm event

5 Reticulated Water Consumption

The proposed car park development includes landscaping at the Uralba Street and Dalziell Street frontages as well as the eastern and western boundaries. These landscape areas will require watering during establishment and during the operation of the car park.

As noted in Table 4-1, Council's DCP requires a 40% reduction in the consumption of potable water compared to the base line.

5.1 Existing Site Potable Water Demand

The site is currently occupied by two (2) specialist medical practices and five (5) residential dwellings on three (3) separate lots (refer Figure 2-1). As previously noted, the medical practices and residential dwellings will be demolished as part of the proposed development.

An estimate of existing potable water demand has been prepared for the medical practices and residential dwellings.

The medical practices have a combined floor area of approximately 357m². Existing potable water demand was estimated with reference to NABERS bench marks for office and public buildings. Based upon the existing building being unlikely to exceed a 3-star NABERS rating, total estimated average daily water usage is 1.02kL/day.

Existing potable water demand from the five (5) residential dwellings was estimated with reference to the Draft New South Wales MUSIC Modelling Guidelines, August 2010. Indoor and outdoor water usage is estimated at 1.03kL/day/dwelling. Total potable water demand from the five (5) existing dwellings is therefore estimated at 5.15kL/day.

Thus, total potable water demand from the existing medical practices and residential dwellings is estimated at 6.18kL/day.

5.2 Proposed Site Potable Water Demand

The site includes landscaped areas that may be irrigated during establishment and operation of the car park. There is no water demand from the proposed multi-storey car park structure.

The daily irrigation demand was estimated based upon the following:

- Landscape area to be irrigated = 1,450m² (30% of site area)
- Irrigation rate = 20mm/m² per week

Daily irrigation demand is estimated at 4.14kL/day.

5.3 Summary of Potable Water Demands

Based upon the above, Table 5-1 presents a summary of existing and proposed site potable water demands.

Table 5-1 Existing and developed site potable water demands

Existing Site Potable Water Demand	Developed Site Potable Water Demand
6.18kL/day	4.14kL/day

The above table demonstrates the potable water demand from the proposed development is less than that from the existing site. As such, it is not proposed to install rainwater tanks or similar to further reduce demand on the potable water network. This is considered to meet Council's requirement for 40% reduction in baseline potable water demand.

6 Stormwater Quality

In order to assess water quality and potable water demand, a MUSIC computer model was developed to demonstrate compliance with Council's DCP.

Performance criteria for potable water consumption and stormwater quality is specified in Council's DCP and discussed in Section 4 of this report.

A summary of performance criteria are presented in Table 4-1 and 4-2 below.

6.1.1 Base Information

The MUSIC model was prepared in computer model Version 6.0 (Build 1.547) in accordance with the Draft NSW MUSIC Modelling Guidelines, August 2010 prepared by BMT WBM Pty Ltd for the Sydney Metropolitan Management Authority.

Meteorological stations near the development site were reviewed in reference to distance from the development site, completeness of data record, dates of data record and type of data record.

Historical pluviograph data was taken from Meteorology Station Number 058131 at Alstonville Tropical Fruit Research Station. The station is approximately 17km from the development site with the rainfall record approximately 98% complete.

Over 47 years of historical rainfall data was analysed in 6 minutes time steps from February 1963 to May 2011. The average annual rainfall over this period was 1,721mm.

Daily evapotranspiration data from Grafton was analysed over the same 47 year time period noted above.

6.1.2 Source Nodes

Pollutant loads for source nodes were adopted from Table 3-9 and 3-10 of the NSW MUSIC Modelling Guidelines.

Stochastic pollutant generation was selected.

6.1.3 Treatment Nodes

Two treatments nodes are proposed as part of the water cycle treatment train:

1. Humeceptor (secondary treatment)
2. Humes Jellyfish (tertiary treatment)

Due to the short retention time of the on-site detention storage this element of the water cycle was not modelled as a treatment node in the MUSIC model.

6.1.3.1 *Humeceptor (secondary treatment)*

A Humeceptor secondary treatment device is proposed for the development to target suspended solids and hydrocarbons/oil.

Sizing of the device has been undertaken by Humes with a STC2 device proposed.

6.1.3.2 *Humes Jellyfish (tertiary treatment)*

A Humes 'Jellyfish' stormwater treatment device is proposed to treat stormwater runoff following discharge from the Humeceptor. The Jellyfish product is relatively new to Humes and provides effective treatment over a very small footprint.

The Jellyfish is available in a number of configurations. The Jelly Fish treatment node within the MUSIC model was provided by Humes. A Jelly Fish model JF1000-1-1 was selected to provide suitable treatment of stormwater.

6.1.4 **Results**

Results of the MUSIC model show the nominated treatment train exceed the pollutant removal targets outlined in Lismore Council's DCP. Table 6-3 presents a summary of the MUSIC model results.

Table 6-1 Summary of MUSIC model results

Element	Minimum Reduction	Achieved Reduction	Comments
Total Suspended Solids (TSS)	75%	90.2%	Treatment exceeds minimum
Total Phosphorus (TP)	65%	66.5%	Treatment exceeds minimum
Total Nitrogen (TN)	40%	51.6%	Treatment exceeds minimum
Gross Pollutants	90%	95.9%	Treatment exceeds minimum

The above results demonstrate compliance with the minimum reduction in potable water demand and pollutant load reduction as required by Lismore Council's DCP.

7 Stormwater Quantity

In order to assess water quantity, a DRAINS computer model was developed to demonstrate compliance with Council's DCP.

Performance criteria for stormwater quantity is specified in Council's DCP and discussed in Section 4 of this report.

A summary of performance criteria are presented in Table 4.3.

Overland flow paths downstream of the development site are varied and complex. We have elected to provide on-site detention storage to limit the post-development discharge to no more than pre-development flows for the 100 year ARI storm event. In this way, flows from the development site discharged to the downstream overland flow network will not exceed existing flows.

7.1.1 Base Information

The DRAINS computer model was prepared in accordance with the requirements of Northern Rivers Local Government Specification 'D5 – Stormwater Drainage Design – Handbook of Stormwater Drainage Design. Rainfall data was adopted from Appendix A5 for Lismore City Council.

A DRAINS computer model (Version 2013.12) was developed to demonstrate compliance with Lismore Council's DCP. The DRAINS model was set up using the parameters specified in Appendix B of Council's Handbook including rainfall losses, soil type and antecedent moisture conditions.

7.1.2 Catchments

The existing site was modelled as a single catchment of 4,840m² with 50% imperviousness estimated from aerial photography. Time of concentration was estimated at 9 minutes from the Kinematic wave equation.

The developed site was assessed at 70% imperviousness with a time of concentration of 5 minutes.

7.1.3 On-Site Detention

The on-site detention storage is proposed as part of the Level 1 and Level 1L car park. On site detention storage will be partially provided by stormwater pits with additional above ground storage provided on the nominated car park levels.

Above ground storage will be limited to a maximum of 200mm in depth and surcharge and drain via pit grates.

The pit and pipe network that will collect surface water from the upper decks of the car park will be designed to convey the 100 year ARI storm event.

Discharge from the on-site detention will be controlled via an orifice plate and 4.5m wide weir, formed by a break in the southern kerb of Level 1L. The orifice plate will be located behind a trash rack constructed from Maximesh RH3030 and will include a lifting handle. Piped flows will discharge to an existing street pit in Dalziell Street. Overland flows will discharge to Dalziell Street.

7.1.4 Results

The DRAINS model shows that 72m³ on-site detention storage is required to restrict post development flows to no greater than predeveloped flows for a full range of storm events. Discharge from the OSD storage is controlled via a 197 mm diameter stainless steel, sharp edged orifice at centreline level RL22.20 mAHD.

Results of peak outflows from the DRAINS model are summarised in Table 7-1.

Table 7-1 Summary of DRAINS Peak Outflows

Storm Event	Predeveloped Flows	Developed Flows (With OSD)	Comments
1 year ARI (100% AEP)	81 L/s	81 L/s	Developed flows less than predeveloped
2 year ARI (50% AEP)	123 L/s	83 L/s	Developed flows less than predeveloped
5 year ARI (20% AEP)	172 L/s	86 L/s	Developed flows less than predeveloped
10 year ARI (10% AEP)	212 L/s	104 L/s	Developed flows less than predeveloped
20 year ARI (5% AEP)	247 L/s	187 L/s	Developed flows less than predeveloped
50 year ARI (2% AEP)	275 L/s	263 L/s	Developed flows less than predeveloped
100 year ARI (1% AEP)	303 L/s	302 L/s	Developed flows less than predeveloped

Thus the proposed on-site detention restricted flows from the developed site to less than those from the site predevelopment. Flows discharge from the developed site to the downstream overland flow network are restricted to less than those from the predeveloped site.

8 Tailored Ecological Protection Measures

There are no known or identified ecological habitats or species of particular significance in the vicinity of the site. The proposed development incorporates devices to reduce potable water consumption, improve water quality and restrict flows from the site to predevelopment levels thus protecting the downstream, receiving network.

9 Responsibility

Lismore Hospital will be responsible for the supervision, construction, establishment and commissioning of the proposed water sensitive design measures. The works will be undertaken by suitably qualified and experienced contractors, however, ultimate responsibility will lie with Lismore Hospital. Contractors that will work under the supervision of Lismore Hospital will be determined following approval of the Construction Certificate application (to be submitted following approval of the current Development Application).

10 Maintenance

Regular inspection and maintenance of water sensitive design measures is a critical factor in ensuring the proper ongoing operation of the devices.

A brief summary of key maintenance activities is listed in Table 10-1.

Table 10-1 Summary of key maintenance activities

Element	Activity and Interval
Trash rack over orifice plate	Following significant storm events and at nominal 6 months intervals inspect trash rack and remove any accumulated debris.
Orifice plate	Following significant storm events and at nominal 6 months intervals inspect orifice plate (by removing trash rack) and remove any accumulated debris.
Stormwater grates, rainwater inlets from car park deck, grated drains etc	Following significant storm events and at nominal 6 months intervals inspect stormwater grates, rainwater inlets, grated drains etc and remove any accumulated debris. Note that debris may be on both sides of the grate for pits associated with the on-site detention storage.
Stormwater pits	Following significant storm events and at nominal 6 months intervals inspect stormwater pits and remove any accumulated debris that may be in the pit invert or impacting inlet or outlet pipes.
Humeceptor secondary treatment device	Following significant storm events and at nominal 6 months intervals undertake routine maintenance and clearing of the device in accordance with the manufacturer's recommendations.
Humes Jellyfish tertiary treatment device	Following significant storm events and at nominal 6 months intervals undertake routine maintenance and clearing of the device in accordance with the manufacturer's recommendations.

Note that the above intervals are indicative only. Following construction of the development intervals for the above key maintenance activities may be adjusted to suit required clearing intervals based upon actual accumulation of debris etc.

11 References

BMT WBM Pty Ltd, Draft New South Wales MUSIC Modelling Guidelines, August 2010

Humes, Humeceptor Design Summary, 3 November 2014

Humes, Humeceptor System Specifications, July 2012

Humes, Jelly Fish Technical Manual, Issue 2, January 2014

Lismore City Council, Development Control Plan, Part A, Chapter 22 – Water Sensitive Design

Northern Rivers Local Government, Aus-Spec Reference, D5 – Stormwater Drainage, Handbook of Stormwater Drainage Design, amended August 2013

Appendix A

CONCEPT CIVIL ENGINEERING DRAWING LIST FOR DEVELOPMENT APPLICATION APPROVAL

Drawing Number	Drawing Title
80815106-CI-100	Cover Sheet
80815106-CI-110	General Arrangement Plan – Stage 1
80815106-CI-111	General Arrangement Plan – Stage 2
80815106-CI-120	Bulk Earthworks Plan
80815106-CI-125	On Site Detention and Water Quality Plan
80815106-CI-130	Typical Sections – Sheet 1
80815106-CI-131	Typical Sections – Sheet 1
80815106-CI-150	Erosion and Sediment Control Plan
80815106-CI-151	Erosion and Sediment Control Details
80815106-CI-190	Turning Paths

Appendix B

LISMORE CITY COUNCIL ASSET INFORMATION




LEGEND

WATER	
STOP VALVE	
WATER RETICULATION	---X---
ROUS WATER	---X---
CANIABA VILLAGE (RECLAIMED)	---X---
HYDRANT	
WATER RETICULATION	---●---
ROUS WATER	---●---
CANIABA VILLAGE (RECLAIMED)	---●---
METER (BUSINESS)	
WATER RETICULATION	---■---
ROUS WATER	---■---
CANIABA VILLAGE (RECLAIMED)	---■---
AIR VALVE	
WATER RETICULATION	---▲---
ROUS WATER	---▲---
CANIABA VILLAGE (RECLAIMED)	---▲---
SEWER	
MANHOLE	○
RISING MAIN	---
JUNCTION	---
PUMP STATION	○
STORMWATER	
Headwall	○
End Structure	★
Stormwater Pit	●
Stormwater Easement	---
Public IAD	---
IAD	---
Stormwater Conduit	---
Browns Creek Conduit	---
SURVEY MARKS	
Survey Marks	★

Created on Monday, 27 October 2014
by LISMORE/michellaw

Map Scale:
1:3,711

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 <p>caring about Lismore's people, economy and environment</p>	<p>This map has been created for the purpose of showing basic locality information. Property boundary line network data is supplied by State Government. Any error should be reported to Lismore City Council (council@lismore.nsw.gov.au).</p>	<p>This map is a representation of the information currently held. While every effort has been made to ensure the accuracy of the product, we accept no responsibility for any errors or omissions.</p>