Costin Roe Consulting

Value in Engineering and Management

Stormwater Management Plan

Proposed Cochlear Global Headquarters
University Avenue
Macquarie University

Prepared For:
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1 INTRODUCTION

1.1 Background

In response to The Macquarie Park Corridor Master Plan 2004 which has been adopted by the City of Ryde, Macquarie University has developed the Campus Development Plan 2004. This plan outlines the strategic opportunities for growth and development the University is to undertake over the next 40 years. The development is to include the upgrading of the Universities buildings and infrastructure and the release of land for commercial ventures.

CRI Australia have been commissioned by Cochlear Ltd to provide project management for the proposed development of their new Global headquarters on a parcel of land that Macquarie University has earmarked for commercial ventures in line with their Campus Development Plan 2004.

1.2 Scope

Costin Roe Consulting Pty Ltd has been commissioned by CRI Australia to prepare this report in support of a proposed Part 3A Major Project Application for Development to be lodged over the site.

The report provides a summary of the design principles and planning objectives for stormwater management for the project. It should be noted that drawings developed for this report are conceptual only, and not a detailed design. Details provided are subject to adjustment as the design is developed to completion.

1.3 Authority Jurisdiction

The site falls within the boundaries of the City of Ryde LGA and therefore the concept stormwater design is to be based on the guidelines of the City of Ryde document, *'CITY OF RYDE, DEVELOPMENT CONTROL PLAN 2006, Section 8.2, Stormwater Management'*.

1.4 Existing Site Conditions

The site occupies an approximate area of 3.0 hectares in the southern corner of Macquarie University. It is currently occupied by a large asphalt car park located in the centre and eastern portion of the site, the Waratah occasional care centre to the south, and the Gumnut Cottage day care facility located to the west. The site falls from the north east to the south west with an average slope of 5%.

1.5 Existing Stormwater Drainage System

The existing site stormwater drainage system comprises of several piped systems and overland flow measures.

Stormwater that is collected on the building roofs of the two child care facilities and external areas associated with them is collected via gutters and pits and conveyed via pipes underground where the flows are discharged directly to University Creek.

Stormwater run-off is collected at the entrance to the car park via two inlet pits located on the eastern and western sides of the entrance. These pits are connected to a Ø600 trunk drainage line that conveys collected run-off from the western portion of University Avenue and car parks W1, W2, and C1. This Ø600 pipe passes through the site, discharging freely to university creek.

Stormwater run-off collected in the car park area sheet flows from the north-west toward the south-east toward a large grassed earth mound. This mound directs the run-off toward an energy dissipater at its eastern end, where it then discharges directly to university creek.

A grassed swale located in the north west of the site collects sheet flows generated from a grassed area to the north of Gumnut Cottage. The swale directs these flows from the west to the east to a small headwall and Ø300 pipe. The pipe runs through the site to the south east. It was unable to be determined where the pipe discharges too, it is assumed that it connects into the Ø600 pipe passing through the site.

The only observed stormwater treatment measures (STM) for the treatment of gross pollutants, sediments, free oils and grease and nutrients were those of grated inlet pits for the capture of gross pollutants.

A plan of the existing stormwater drainage system is located in Appendix A

1.6 Proposed Stormwater Drainage System

The proposed stormwater drainage system for the development is to consist of a minor and major system to safely and efficiently convey collected stormwater run-off from the development. The minor system is to consist of a piped drainage system, with the major system consisting of defined overland flow paths. The drainage system is to remain separate from the Universities infrastructure and is to maintain its own discharge point to University Creek. Water quality and re-use are to be considered in the design to ensure that the detrimental effects of pollution are mitigated and that the demand on potable water resources is reduced.

As part of the Universities infrastructure works and to also provide a developable site for the proposed construction the University is to relocate the existing drainage lines running through the site to be within the University Avenue road reserve. These works are to be completed prior to the commencement of construction.

A plan of the concept stormwater drainage design is located in Appendix B.

A plan of the proposed finished levels is located in Appendix C.

2 HYDROLOGY

2.1 General Design Principles

The design of the stormwater system for this site will be based on relevant national design guidelines, Australian Standard Codes of Practice, the standards of the City of Ryde and accepted engineering practice.

Runoff from buildings will generally be designed in accordance with AS 3500.3 National Plumbing and Drainage Code Part 3 – Stormwater Drainage.

Overall site runoff and stormwater management will generally be designed in accordance with the Institution of Engineers, Australia publication "Australian Rainfall and Runoff" (1988 Edition), Volumes 1 and 2 (AR&R).

2.2 Runoff Models

In accordance with the recommendations and standards of the City of Ryde the calculation of the runoff from storms of the design ARIs will be calculated with the catchment modelling software DRAINS.

2.3 Minor System Design

The minor stormwater drainage system has been designed to accommodate the 1 in 50-year ARI storm event (Q50), this results in the piped system being able to convey all stormwater runoff up to and including the Q50 event.

2.4 Major System Design

The major system has been designed to cater for storms up to and including the 1 in 100-year ARI storm event (Q100). The major system employs the use of defined overland flow paths to safely convey excess run-off off the site.

2.5 Catchment Areas

The catchment for the drainage design involves the stage 1 development. A catchment is plan located in Appendix D.

2.6 On-site Detention

The City of Ryde in common with many other local authorities in the Sydney region adopts the principles of On-site Detention (OSD) to ensure the cumulative effect of development does not have a detrimental effect on the existing stormwater infrastructure and watercourses located within their LGA . The City of Ryde document *'CITY OF RYDE, DEVELOPMENT CONTROL PLAN 2006, Section 8.2, Stormwater Management'* states the design objective for an OSD device is to ensure peak flow rates from the site do not increase from the 5 year to the 100 year ARI storm event for all durations. The detailed sizing of the OSD device is to be carried out using the DRAINS modelling software to ensure this objective is achieved. Preliminary sizing of the device has resulted in an approximate volume of 500m³.

2.7 Discharge

The site currently discharges to university creek through several pipe outlets and an energy dissipater as previously mentioned. The proposed system will discharge to university creek via one outlet. This outlet is to be designed in accordance with the recommendations of '*SOILS AND CONSTRUCTION, Managing Urban Stormwater*, *Volume 1, 4th Edition, March 2004, LANDCOM'*. This outlet will ensure that scouring and erosion of the banks of University creek does not occur. This is achieved by the energy dissipater reducing the flow velocity and energy of the discharged flow.

3 HYDRAULICS

3.1 General Requirements

Hydraulic calculations will be carried out to ensure that all surface and subsurface drainage systems comply with or exceed the required standard.

In accordance with the recommendations and standards of the City of Ryde the hydraulic calculations will be calculated with the catchment modelling software DRAINS.

A Diagram of the model is located in Appendix E.

3.2 Drainage

The spacing of inlets within hardstand areas and along access roads will be such that the depth of flow, for the Major System design storm runoff, will not exceed the top of the roadway kerb (150mm above gutter invert).

3.3 Public Safety

For all areas subject to pedestrian traffic, the product (dV) of the depth of flow d (in metres) and the velocity of flow V (in metres per second) will be limited to 0.25, for all storms up to the 100-year ARI.

3.4 Overland Flow

Overland flow paths are to be provided to contain the 1 in100 year ARI storm event, and are to be designed to not exceed the details as noted in section 3.2.

3.5 Freeboard

The finished floor level of the development is to maintain a minimum freeboard of 300mm in extreme storm events, therefore ensuring safety to the occupants and limiting damage to property.

4 WATER QUALITY CONTROLS

4.1 Background

There is a need to target pollutants that are present in the stormwater so as to minimise the adverse impact these pollutants could have on the receiving waters of University Creek.

4.2 Proposed Stormwater Treatment Measures

The proposed STM's for the site are to consist of grated inlets, a gross pollutant trap (GPT) and a filtration unit. Through the combination of these STM's a treatment train is achieved in treating the collected stormwater run-off.

The STM's are to be sized to treat the run-off collected by the hardstand areas only as properly managed roof water generally does not need to be treated for pollutants.

The grated inlets are to act as a primary treatment in trapping large litter objects such as bottles, plastic bags etc. The GPT is to act as a primary and secondary treatment by removing gross pollutants, sediments, free oils and grease and some nutrients. The filtration unit is to act as a secondary and tertiary treatment by further removing remaining sediments, nutrients and free oils and grease from the collected stormwater run-off.

4.3 Water Quality Modelling

Water quality modelling using the software MUSIC has been undertaken to measure the effectiveness of the STM's. As previously mentioned in section 4.2 the STM's are to treat run-off generated by the hardstand only and therefore the modelling reflects this. A diagram of the model is located in Appendix F.

The pollutant removal efficiencies of the GPT have been provided by CDS technologies and are located in Appendix G. These pollutant removal efficiencies have been adopted for the MUSIC model.

Stormwater360 have provided a MUSIC node to model the filtration unit. The node treatment efficiencies are based upon testing and field monitoring conducted by Stormwater360. An overview describing how the node has been developed can be found in Appendix H.

	Sources	Residual Load	% Reduction
Total Suspended Solids (kg/yr)	1.93E3	280.00	85.50
Total Phosphorus (kg/yr)	3.87	1.10	71.60
Total Nitrogen (kg/yr)	27.30	18.10	33.60
Gross Pollutants (kg/yr)	224.00	0.68	99.70

Table 3: MUSIC analysis results

It can be seen from the results of the MUSIC analysis that the proposed STM's significantly reduce the amount of pollutants present in the collected fun-off before discharging to University Creek. This reduction in pollutants ensures that the detrimental effects of pollutants on the receiving waters of University Creek are minimised.

5 MAINTENANCE AND MONITORING

The STM's are to be inspected at 3 month intervals for the first year of operation and at 4 month intervals for the second year of operation, details of the type and amount of pollutants are to be logged, with the details kept on site. Upon completion of the first two years of operation a maintenance schedule will be able to be established based on the recommendations of the manufacturer and the logged data, with cleaning and removal of trapped pollutants from the devices occurring at a maximum time of 6 month intervals.

6 WATER SENSITIVE URBAN DESIGN

The principles of water sensitive urban design involve matching closely the post development run-off regime in quantity and quality to that of pre-development conditions, reducing the amount of water between the catchment in both water supply import and wastewater export, and optimising the use of rainwater that falls within the catchment. The following methods have been employed to meet these objectives.

6.1 Rainwater Reuse

A rainwater re-use tank is to be employed to provide a source of water for non-potable re-use such as water for the use of toilet flushing, irrigation, and washing purposes. This re-use of water will significantly reduce the importation of water to the site. The detailed sizing of the tank is to be carried out by Hyder consulting, with a preliminary size of 350m³ being indicated.

6.2 Permeable Pavements

Permeable paving is to be used in the eastern hardstand area of the site. This permeable paving will reduce the run-off volumes from the site and assist in removing sediments and attached pollutants present in the run-off

Through the implementation of the rainwater tank, permeable pavement, water quality control measures (GPT and filtration Unit) and on-site detention system the development is able to achieve the principles of water sensitive urban design. The water quality control measures and permeable paving effectively reduce the pollutants associated with the collected stormwater run-off. The on-site detention and permeable paving reduce the run-off volumes to those of the state of nature conditions, therefore closely matching the pre-development run-off regime in terms of the quantity of stormwater run-off leaving the site. The rain water re-use tank will reduce the import quantity of water required to service the site by supplying an on-site source of water for non-potable uses.

REFERENCES

Institution of Engineers Australia, *"Australian Rainfall & Runoff, 1988"*

City of Ryde, *"City of Ryde Development Control Plan 2006, Section 8.2, Stormwater Management"*

Australian Standards, *"AS 3500.3.2003, Plumbing and drainage, Part 3: Stormwater Drainage"*

Macquarie University, *"Campus Development Plan 2004, 29 April 2004"*

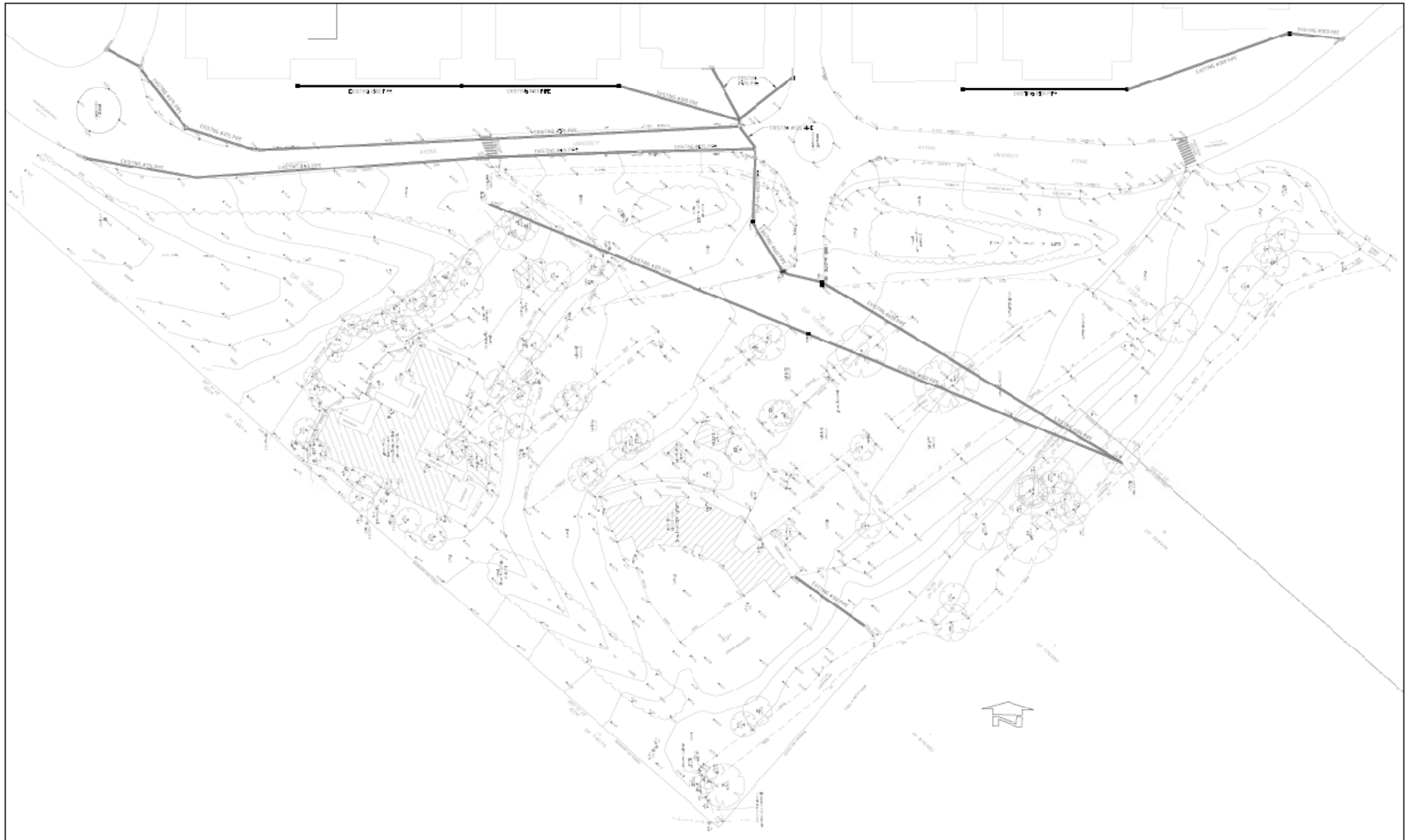
Landcom, *"Managing Urban Stormwater: Soils and Construction, Volume 1, 4th Edition, March 2004"*

Upper Parramatta River Catchment Trust, *"Water Sensitive Urban Design, Technical Guidelines for Western Sydney, May 2004"*

7 APPENDICIES

Appendix A	-	Existing Site & Stormwater Drainage Plan
Appendix B	-	Concept Stormwater Drainage Plan
Appendix C	-	Proposed Finished Levels Plan
Appendix D	-	Concept Stormwater Drainage Catchment Plan
Appendix E	-	DRAINS diagram
Appendix F	-	MUSIC diagram
Appendix G	-	CDS pollutant removal efficiencies
Appendix H	-	Stormfilter pollutant removal efficiencies

Appendix A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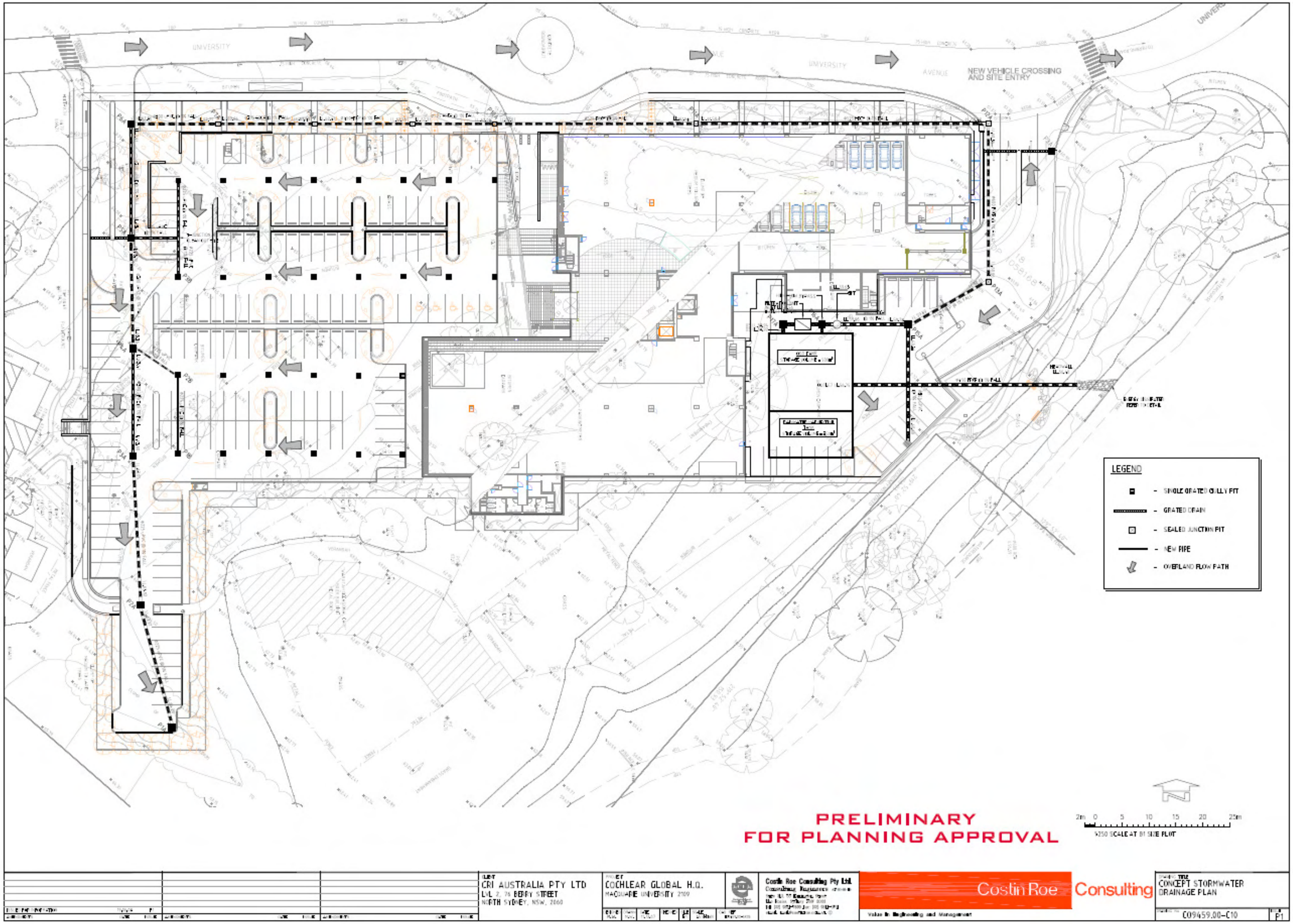
FOR PLANNING APPROVAL
CM AUSTRALIA PTY LTD
COCHLEAR GLOBAL H.Q.
MACQUARIE UNIVERSITY
Costin Roe Consulting
EXISTING SITE AND STORMWATER DRAINAGE PLAN
C09459.00-C25

Appendix B


NEW VEHICLE CROSSING AND SITE ENTRY
LEGEND
- SINGLE GRATED GULLY PIT
- GRATED DRAIN
- SEALED JUNCTION PIT
- NEW PIPE
- OVERLAND FLOW PATH
PRELIMINARY
FOR PLANNING APPROVAL
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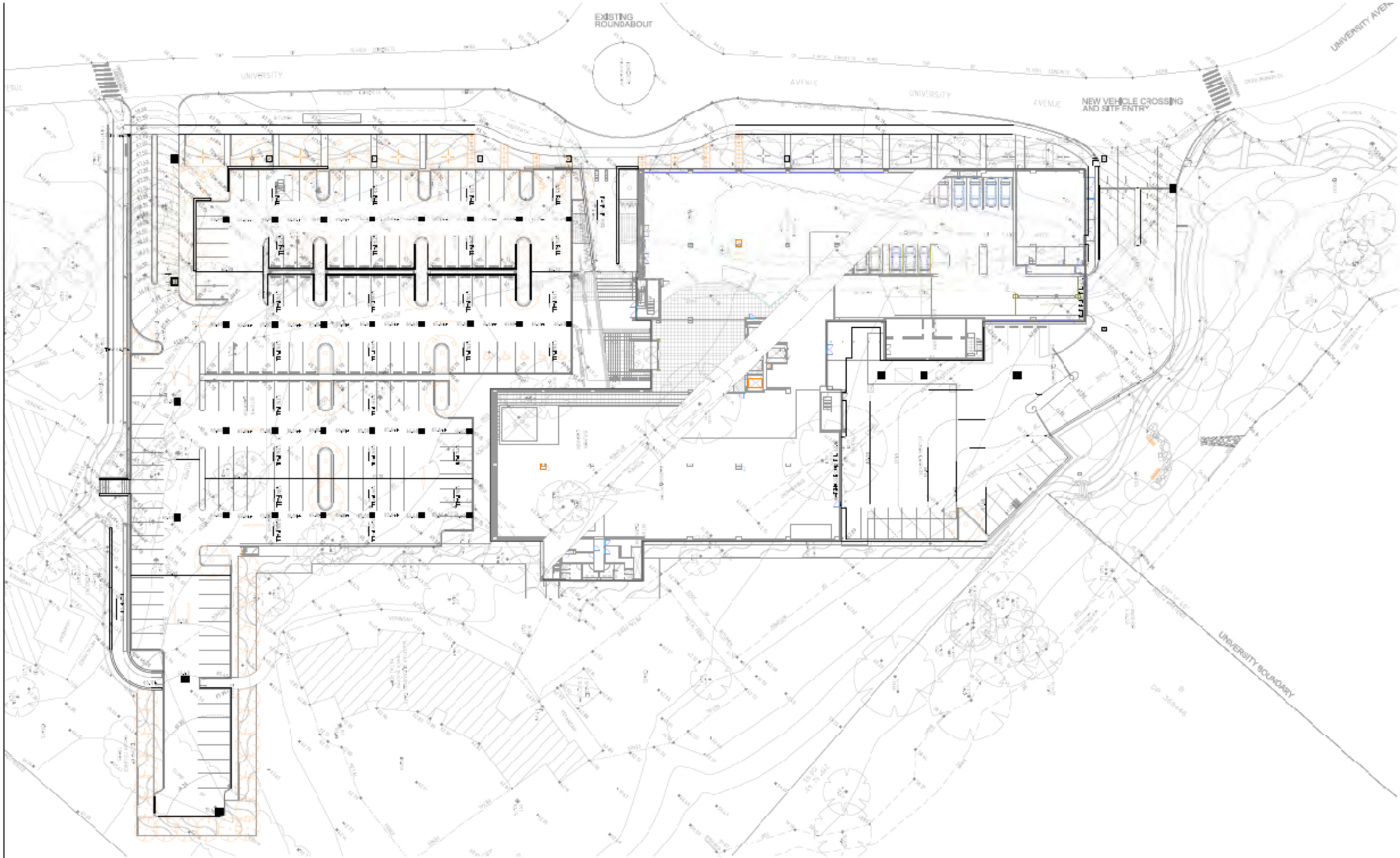
1:250 SCALE AT B1 SIZE PLOT
CLIENT
CRI AUSTRALIA PTY LTD
LVL 2, 76 BERRY STREET
NORTH SYDNEY, NSW, 2060
PROJECT
COCHLEAR GLOBAL H.Q.
MACQUARIE UNIVERSITY 2109
Costin Roe Consulting Pty Ltd.
Costin Roe Consulting
Value in Engineering and Management
DRAWING TITLE
CONCEPT STORMWATER DRAINAGE PLAN
C09459.00-C10
P1

Appendix C



PRELIMINARY
FOR PLANNING APPROVAL

2m 0 5 10 15 20 25m
1:250 SCALE AT B1 SIZE PLOT

CLIENT
CRI AUSTRALIA PTY LTD
LVL 15 BERRY STREET
NORTH SYDNEY NSW 2060

PROJECT
COCHLEAR GLOBAL H.Q
MACQUARIE UNIVERSITY

Costin Roe Consulting Pty Ltd

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Value in Engineering and Management

DRAWING TITLE
FINISHED LEVELS PLAN

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ISSUE
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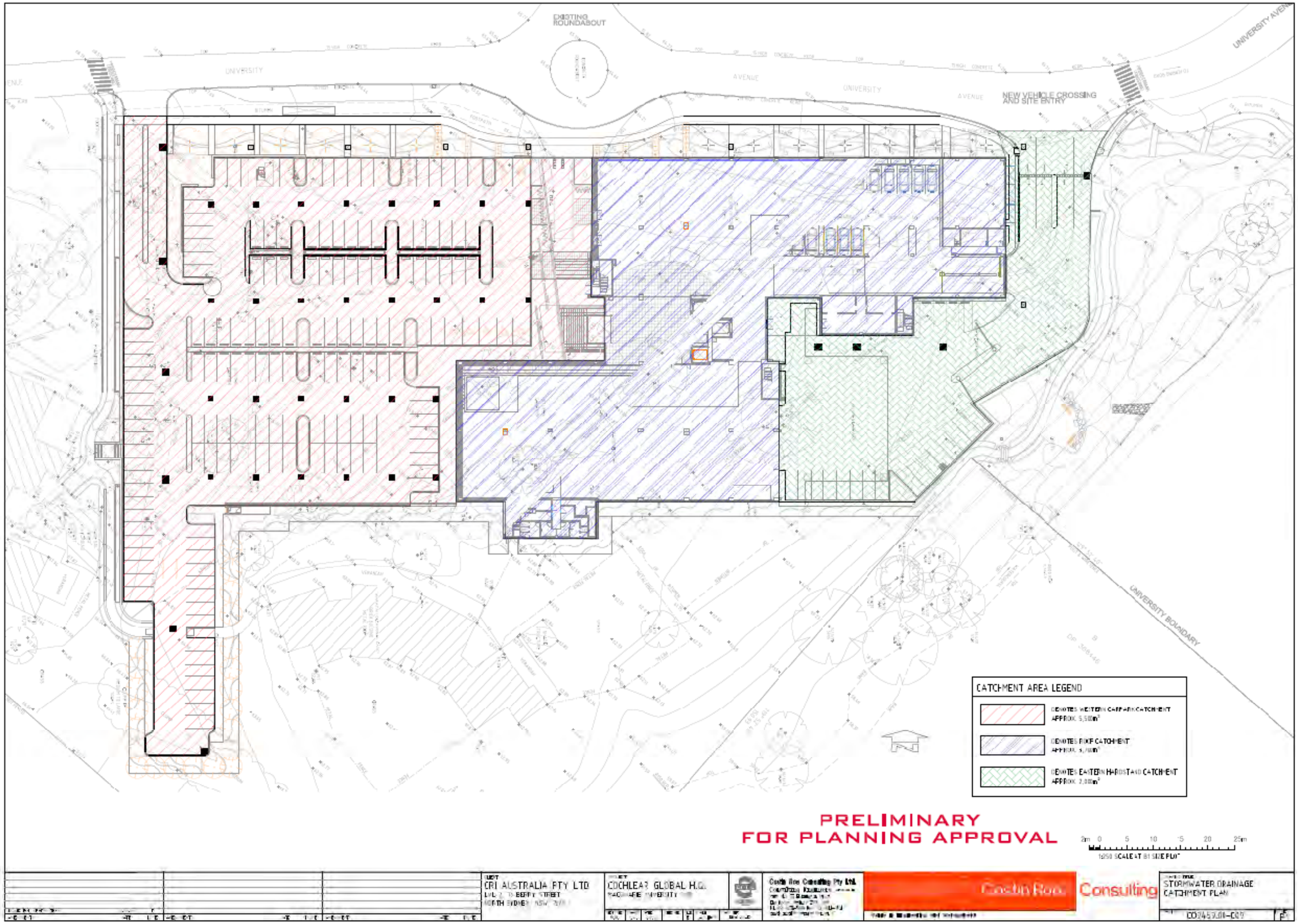
Appendix D


EXISTING ROUNDABOUT
UNIVERSITY AVENUE
NEW VEHICLE CROSSING AND SITE ENTRY
UNIVERSITY BOUNDARY
CATCHMENT AREA LEGEND
DENOTES WESTERN CATCHMENT
DENOTES RISE CATCHMENT
DENOTES EASTERN HARDSTAND CATCHMENT
PRELIMINARY
FOR PLANNING APPROVAL
1:250 SCALE AT B1 SIZE PLOT
CRI AUSTRALIA PTY LTD
COCHLEAR GLOBAL H.Q.
Castle Rock Consulting
STORMWATER DRAINAGE CATCHMENT PLAN