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Value in Engineering and Management

CIVIL ENGINEERING REPORT FOR S75W AMENDMENT TO AN APPROVED DEVELOPMENT

PROPOSED DEVELOPMENT AT LOT 62 DP 1090695 LENORE LANE ERSKINE PARK NSW

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1 INTRODUCTION

1.1 Background

XAct Solutions, on behalf of Logos Group, propose to construct a warehouse and office facility for Super Retail Group at Lot 62 DP 1090695, Lenore Lane, Erskine Park, NSW.

Works involve construction of a large single level warehouse with ancillary offices, truck circulation and loading areas and associated parking.

Lot 62 is subject to a development approval, 08_0016 dated 12 July 2012, under Part 3A of the NSW *Environmental Planning and Assessment Act 1979*.

1.2 Scope

Costin Roe Consulting Pty Ltd has been commissioned by XAct Solutions to prepare this Engineering Report in support of the proposed application for S75w Amendment to Approved Development 08_0016 for the site.

This report provides a summary of the design principles and planning objectives for the following civil engineering components of the project:

- Earthworks & Retaining Walls;
- Stormwater Management including stormwater quantity and quality; and
- Erosion Control.

The engineering objectives for the development are to create a site which, based on the proposed architectural layout, responds to the topography and site constraints and to provide an appropriate and economical stormwater management system which incorporates best practice in water sensitive urban design and is consistent with the requirements of council's water quality objectives.

The current architectural layout differs from the original development approved under Part 3A however the general engineering objectives, particularly stormwater management, will remain consistent with the approved design.

A set of drawings have been prepared to show the proposed finished levels, retaining walls, stormwater drainage layout, water quantity and water quality requirements for the development. These drawings are conceptual only and subject to change during detail design.

1.3 Authority Jurisdiction

The consent authority is The NSW Department of Planning and Infrastructure as the proposal is an amendment to a Major Project Approval. However as the subject site is located within Penrith City Council area, the requirements of the Penrith City Council (PCC) also apply.

1.4 Proposed Development

The proposed development is for a single level warehouse distribution facility for Super Retail Group. The development will include ancillary office space, car parking areas and truck loading/ circulation areas.

2 SITE CHARACTERISTICS

2.1 Location

The proposed development is located in the suburb of Erskine Park on Lot 62 DP 1090695, Lenore Lane as shown in Figure 2.1.

The site is bounded by an existing industrial development to the east, Lenore Lane to the south, industrial land to the west and residential development to the north.

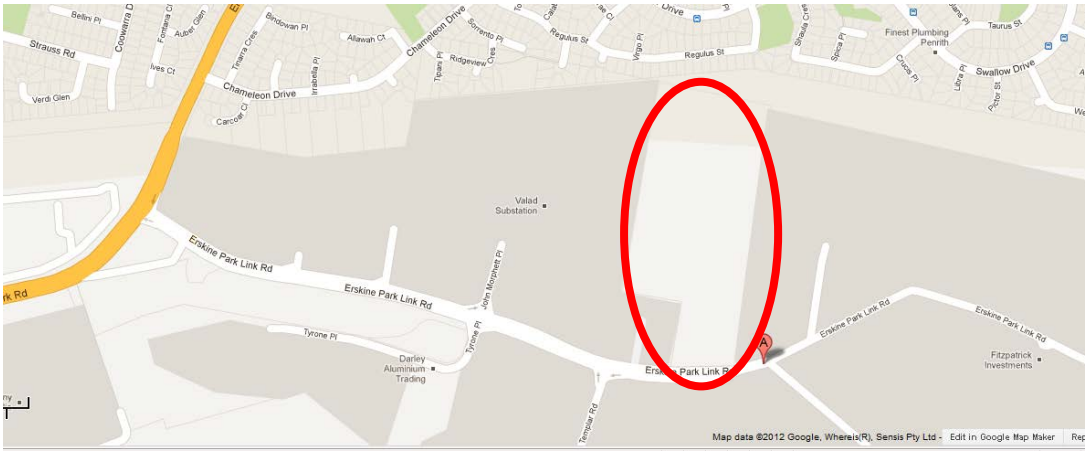


Figure 2.1. Locality Map

2.2 Topography & Description

The site is has been cut and filled to its current levels based on the design for the currently approved development. The cut to fill site comprises a large level pad at approximately RL 63.40m. The site has a total area of 13.49 Ha however the total development area is 11.0 Ha.

The northern portion of the site is burdened by a wide easement for electricity transmission. High voltage transmission lines associated with this easement are present. The land is also affected by a 20m landscaping setback fronting Lenore Lane.

The pre-existing site comprises undeveloped rural land. The sites natural gradient drops 15m from the high point in the north-west corner and the headwall draining the site at the south west corner. A spur type ridge was located in the northern portion of the site which head in a north-west to south-east direction. A number of localised depressions and dams were also present in the south and south-west of the site. The highest elevation is approximately RL 70.5m (AHD) and the lowest at RL 55.5m.

2.3 Existing Stormwater Drainage

Existing formalised drainage on the site is limited and is generally confined to the southern portion of the site adjacent to Lenore Lane where a pipe culvert is present. The culvert which drains the site crosses the neighbouring site's driveway on the south-west corner and discharges into an open swale fronting Lenore Lane and conveys stormwater flows overland to second large culvert system prior to discharge on the opposite side of Lenore Lane.

2.4 Proposed Stormwater Drainage System

As per general engineering practice and the guidelines of PCC, the proposed stormwater drainage system for the development will comprise 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 which has been designed to accommodate the 1 in 20-year ARI storm event (Q20). This results in the piped system being able to convey all stormwater runoff up to and including the Q20 event. The major system through new paved areas 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 from the site.

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 PCC 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).

Water quality and re-use are to be considered in the design, throughout new paved areas, to ensure that any increase in the detrimental effects of pollution are mitigated, PCC Water Quality Objectives are met and that the demand on potable water resources is reduced.

Plans of the proposed stormwater drainage layout can be found on drawings **Co11888.00-C41** through **C45** and are located in **Appendix A**.

The objectives for the management of stormwater quantity and quality for the proposed S75w Application are consistent with the management proposed under the current Major Project Approval. Section 5 of this report discusses the proposed water quantity management and Section 6 discusses the proposed water quality management. The means to which these objectives are achieved differ in approach as follows:

- Water Quantity – The S75w system consolidates the multiple above ground and tanked on-site detention system proposed in the Major Project Approval into a

tank and above ground basin system. This simplifies construction and increases the operational capacity of the facility which was subject to ponding in truck circulation areas which were proposed for on-site detention storage. The objectives of attenuating the post development flows to less than pre development flows are consistent for both systems.

- Water Quality – The S75w system proposes the use of an end-of-line proprietary stormwater quality improvement device (SQID) to perform the water quality management for the development whereas the Major Project Approval was based on the use of a gross pollutant trap and bioretention basin. The objectives for pollution reduction are consistent for both systems and the proposed SQID is accepted by Penrith City Council as meeting the objectives for stormwater quality improvement.

3 SITE WORKS

3.1 Bulk Earthworks

Bulk earthworks will be performed to facilitate the construction of the warehouse. The objective for the site is to perform a cut to fill balance for the development.

As discussed previously the site has been cut and filled to its current configuration which contains a large single pad at approximate level of 63.4m. This work was performed several years ago under Penrith City Council Development Approval No. 07/1527.01 dated 25 March 2008. The architectural layout for the current development comprises a larger footprint than the previously approved development and additional cut will be required through the northern portion of the site. In order to accommodate the additional cut volume, without exporting material, it is proposed to increase the earthworks pad level by 400mm from RL 63.40m to RL 63.80m.

Allowing for a 200mm structural zone for the facility floor from the proposed earthwork level of RL 63.80m will result in a finished floor level of RL 64.00m. This is 400mm higher than the previously approved finished floor level of 63.60m.

Soil Erosion and Sediment Control measures including sedimentation basins will also be provided for the development – please refer to the Soil and Water Management Plan in Section 5 of this report.

3.2 Embankment Stability

To assist in maintaining embankment stability permanent batters slopes will be no steeper than 3 horizontal to 1 vertical while temporary batters will be no steeper than 2 horizontal to 1 vertical. This is in accordance with the recommended maximum batter slopes for residual clays and shale which are present in the area.

Permanent batters will also be adequately vegetated or turfed which will assist in maintaining embankment stability.

Stability of batters and reinstatement of vegetation shall be in accordance with the submitted drawings and the Soil and Water Management Plan in Section 5.

3.3 Supervision of Earthworks

All geotechnical testing and inspections performed during the earthworks operations will be undertaken to Level 1 geotechnical control, in accordance with AS3798-1996.

4 STORMWATER HYDROLGICAL MODELLING AND ANALYSIS

4.1 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, Penrith City Council 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" (1987 Edition), Volumes 1 and 2 (AR&R).

Storm events for the 2 to 100 Year ARI events have been assessed.

4.2 Minor/ Major System Design

The piped stormwater drainage (minor) system has been designed to accommodate the 20-year ARI storm event (Q20). Overland flow paths (major) which will convey all stormwater runoff up to and including the Q100 event have also been provided which will limit major property damage and any risk to the public in the event of a piped system failure.

4.3 Rainfall Data

Rainfall intensity Frequency Duration (IFD) data used as a basis for ILSAX modelling for the 2 to 100 Year ARI events, was taken from *The Bureau of Meteorology Online IFD Tool*.

4.4 Runoff Models

Calculation of the runoff from storms of the design ARI will be calculated with the catchment modelling software DRAINS.

The design parameters for the ILSAX model are to be based on typical values and parameters for the area and are as follows:

Model	Model for Design and analysis run	Rational method	
	Rational Method Procedure	ARR87	
	Soil Type-Normal	3.0	
	Paved (Impervious) Area Depression Storage	1	mm
	Supplementary Area Depression Storage	1	mm
	Grassed (Pervious) Area Depression Storage	5	mm
AMC	Antecedent Moisture Condition (ARI=1-5 years)	2.5	
AMC	Antecedent Moisture Condition (ARI=10-20 years)	3.0	
AMC	Antecedent Moisture Condition (ARI=50-100 years)	3.5	
	Sag Pit Blocking Factor (Minor Systems)	0	
	On Grade Pit Blocking Factor (Minor Systems)	0	
	Sag Pit Blocking Factor (Major Systems)	0.5	
	On Grade Pit Blocking Factor (Major Systems)	0.2	
	Minor Storm Pit Freeboard	150	mm

Table 4.1: DRAINS ILSAX Parameters

4.5 Hydraulics

4.5.1 General Requirements

Hydraulic calculations will be carried out utilising DRAINS modelling software during the detail design stage to ensure that all surface and subsurface drainage systems perform to or exceed the required standard.

4.5.2 Freeboard

The calculated water surface level in open junctions of the piped stormwater system will not exceed a freeboard level of 150mm below the finished ground level, for the peak runoff from the Minor System runoff. Where the pipes and junctions are sealed, this freeboard would not be required.

4.5.3 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 0.4, for all storms up to the 100-year ARI.

For other areas, the dV product will be limited to 0.6 for stability of vehicular traffic (whether parked or in motion) for all storms up to the 100-year ARI.

4.5.4 Inlet Pit Spacing

The spacing of inlets throughout the site will be such that the depth of flow, for the Major System design storm runoff, will not exceed the top of the kerb (150mm above gutter invert).

4.5.5 Overland Flow

Dedicated flow paths have been designed to convey all storms up to and including the 100-year ARI. These flow paths will convey stormwater from the site to the detention basin adjacent to Lenore Lane and trunk drainage system.

4.6 External Catchments and Flooding

There are no external catchments being directed through the development site. For this reason, only flows from the development site have been considered in the sizing of the stormwater system for the development.

5 WATER QUANTITY MANAGEMENT

5.1 General Design Principles

Penrith City Council (in common with many other local authorities) adopts the principles of Water Quantity Management, also known as "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 downstream from the particular site.

Section 3.3.3 of Councils DRAFT stormwater management policy requires that "*it will be necessary to demonstrate that there will be no increase in runoff from the site as result of the development for all storms up to and including the 100 year Average Recurrence Interval (ARI) event for all storm durations*".

5.2 Methodology

A hydrological analysis was undertaken to estimate the impact of the development of the site on peak flows at the downstream extent of the site. Modelling of stormwater runoff quantity was considered for the pre-existing (natural) case and for the operational phase of the development.

In order to assess the existing and operational phase peak discharges from the development site, a DRAINS hydrological model was used to estimate peak flows from catchments on the site for various storm durations for Q2 year ARI to Q100 year ARI events.

Although the site between Lot 62 and Lenore Lane is subject to separate future development application the water quantity requirements for this site have been allowed for in our assessment.

5.3 Existing & Post Development Peak Flows

Table 5.2 shows the existing and developed flows at the downstream boundary (adjacent to the culvert crossing at the site discharge point adjacent to Lenore Lane).

ARI	Design Storm Duration	Peak Flow (m3/s)		
		Undeveloped	Developed	
		Site	Site (no atten.)	**Site (+ atten.)**
2	30	0.510	2.18	**0.502**
	60	0.743	1.855	**0.548**
	120	0.768	2.112	**0.566**
20	30	1.9	4.079	**0.747**
	60	2.18	3.333	**1.58**
	120	2.32	3.743	**1.69**
100	30	2.91	5.002	**2.19**
	60	3.05	4.163	**2.81**
	120	3.08	4.664	**3.04**

Table 5.2. Q2, Q20 & Q100 ARI Peak Flows from Development

The post development (with site attenuation) flows can be seen to be lower than the pre-developed flows. The required detention storage for the development site is discussed in the following section.

5.4 Proposed Water Quantity Management

As previously discussed, detention storage on the development site is required to reduce local outflows. The proposed site layout allows for provision of two OSD systems configured in series. The ultimate discharge location will be to the culvert adjacent to Lenore Lane via piped stormwater outlets for minor system storm events and overland flow via overflow weirs during major system events.

The proposed OSD systems are an underground tank (OSD1) located in the car park and an open basin (OSD2) located within the 20m landscape setback area adjacent to Lenore Lane. In accordance with PCC requirements, the depth of water in the open basin will

be limited to 1200mm. We note that temporary batters for the basin are proposed which extend past the 20m setback zone however the required storage and top water level is contained within the 20m setback zone. The final configuration of levels beyond the 20m setback zone is subject to a separate development application and design.

A number of combinations of storages and outlet arrangements have been trialled. The adopted arrangement assumes the following basin configuration and the proposed layout can also be observed on drawings **Co11888.00-C41** through **C45**.

ARI	Duration (mins)	Peak Flow (m3/s)				Depth (mm)	Storage (m3)
		No Atten.	With attenuation				
			Low	High	Total		
2	120	1.78	0.634	-	0.634	1240	1050
20	120	3.14	0.828	0.991	1.819	2500	2100
100	120	3.92	0.862	2.22	3.052	2740	2300

Table 5.3 OSD 1 Characteristics (Post Developed)

ARI	Duration (mins)	Peak Flow (m3/s)				Depth (mm)	Storage (m3)
		No Atten.	With attenuation				
			Low	High	Total		
2	120	2.112	0.566	-	0.566	790	700
20	120	3.743	0.627	1.07	1.69	1050	1000
100	120	4.664	0.666	2.83	3.04	1200	1200

Table 5.4 OSD 2 Characteristics (Post Developed)

The hydrologic analysis shows that, with the provision of the two on-site detention basins detailed above, the peak flow from the site are reduced following development and hence the requirements of PCC have been met.

6 STORMWATER QUALITY CONTROLS

6.1 Regional Parameters

There is a need to provide design which incorporates the principles of Water Sensitive Urban Design (WSUD) and to target pollutants that are present in the stormwater so as to minimise the adverse impact these pollutants could have on receiving waters and to also meet the requirements specified by Penrith City Council.

PCC have nominated, in Section C3 of their *DCP 2010*, the requirements for stormwater quality to be performed on a catchment wide basis. These are presented in terms of annual percentage pollutant reductions on a developed catchment and are as follows:

Gross Pollutants	70%
Total Suspended Solids	80%
Total Phosphorus	45%
Total Nitrogen	45%
Free Oil and Grease	90%

6.2 Proposed Stormwater Treatment System

Roof, hardstand, car parking, roads and other extensive paved areas are required to be treated by the Stormwater Treatment Measures (STM's). The STM's shall be sized according to the whole catchment area of Lot 62. The STM's for the development shall be based on a treatment train approach as discussed in the NSW EPA document *Managing Urban Stormwater: Treatment Techniques* to ensure that all of the objectives above are met.

Components of the treatment train for the development are as follows:

- Primary and tertiary treatment to parking, hardstand and roof areas is to be performed via Tumblemate TSFM system; and
- Secondary treatment will be performed via trash screens and sump within the tanked OSD1 system and settling within the open basin OSD2 system.
- Tertiary treatment of a portion of the roof will also be performed via the proposed rainwater reuse tanks. This has not been included in the MUSIC model.

6.3 Stormwater Quality Modelling

6.3.1 Introduction

The MUSIC model was chosen to model water quality. This model has been released by the Cooperative Research Centre for Catchment Hydrology (CRCCH) and is a standard industry model for this purpose. MUSIC (the Model for Urban Stormwater Improvement Conceptualisation) is suitable for simulating catchment areas of up to 100 km^2 and utilises a continuous simulation approach to model water quality.

By simulating the performance of stormwater management systems, MUSIC can be used to predict if these proposed systems and changes to land use are appropriate for their catchments and are capable of meeting specified water quality objectives (CRC 2002). The water quality constituents modelled in MUSIC and of relevance to this report include Total Suspended Solids (TSS), Total Phosphorus (TP) and Total Nitrogen (TN).

The pollutant retention criteria set out in Part R of BCC's DCP2006 and nominated in Section 5.1 of this report were used as a basis for assessing the effectiveness of the selected treatment trains.

The MUSIC model "*11888.00_Rev1.sqz*" was set up to examine the effectiveness of the water quality treatment train and to predict if PCC requirements have been achieved. The layout of the MUSIC model is presented in Appendix B.

6.3.2 Rainfall Data

Six minute pluviographic data for the nearby Liverpool (Whitlam) weather station was sourced from the Bureau of Meteorology (BOM) as nominated below. Evapo-transpiration data for the period was sourced from the Sydney Monthly Areal PET data set supplied with the MUSIC software.

Input	**Data Used**
Rainfall Station	67035 Liverpool (Whitlam)
Rainfall Period	1 January 1967 – 31 December 1976 (10 years)
Mean Annual Rainfall (mm)	857
Evapotanspiration	Sydney Monthly Areal PET
Model Timestep	6 minutes

6.3.3 Rainfall Runoff Parameters

Parameter	**Value**
Rainfall Threshold	1.40
Soil Storage Capacity (mm)	170
Initial Storage (% capacity)	30
Field Capacity (mm)	70
Infiltration Capacity Coefficient a	210
Infiltration Capacity exponent b	4.7
Initial Depth (mm)	10
Daily Recharge Rate (%)	50
Daily Baseflow Rate (%)	4
Daily Seepage Rate (%)	0

6.3.4 Pollutant Concentrations & Source Nodes

Pollutant concentrations for source nodes are based on parameters adopted by the adjacent LGA Blacktown City Council land use parameters as per the Table 6.1.:

Flow Type	Surface Type	TSS (log_{10} values)		TP (log_{10} values)		TN (log_{10} values)	
		Mean	Std Dev.	Mean	Std Dev.	Mean	Std Dev.
Baseflow	Roof	1.20	0.17	-0.85	0.19	0.11	0.12
	Roads	1.20	0.17	-1.11	0.48	0.14	0.12
Stormflow	Roof	1.30	0.32	-0.89	0.25	0.30	0.19
	Roads	2.43	0.32	-0.30	0.25	0.34	0.19

Table 6.1. Pollutant Concentrations

The MUSIC model has been setup with a treatment train approach based on the pollutant concentrations in Table 6.1 above and the catchments shown on drawing Co11888.00-C40.

6.3.5 Treatment Nodes

Buffers, rainwater tank and Tumblemate nodes have been used in the modelling of the development.

6.3.6 Results

Table 6.2 shows the results of the MUSIC analysis. The reduction rate is expressed as a percentage and compares the post-development pollutant loads without treatment versus post-development loads with treatment.

	Source	Residual Load	% Reduction
Flow (ML/yr)	66.8	66.8	0.0
Total Suspended Solids (kg/yr)	11300	2200	80.5
Total Phosphorus (kg/yr)	22.8	8.28	63.7
Total Nitrogen (kg/yr)	153	80.7	47.1
Gross Pollutants (kg/yr)	1760	175	90.0

Table 5.2. MUSIC analysis results

The model results indicate that, through the use of the STM's in the treatment train, pollutant load reductions for Total Suspended Solids, Total Phosphorous, Total Nitrogen and Gross Pollutants will meet the requirements of C3 of PCC's DCP 2010 on an overall catchment basis.

6.3.7 Modelling Discussion

MUSIC modelling has been performed to assess the effectiveness of the selected treatment trains and to ensure that the pollutant retention requirements of C3 of PCC's DCP2010 have been met.

The MUSIC modelling has shown that the proposed treatment train of SQID's will provide stormwater treatment which will meet BCC requirements in an effective and economical manner.

Hydrocarbon removal cannot be modelled with MUSIC software. Although the end use of this site is not known it would be expected to be a distribution or storage facility with low source loadings of hydrocarbons. Potential sources of hydrocarbons would be limited to leaking engine sumps or for accidental fuel spills/leaks and leaching of bituminous pavements (car parking only). The potential for hydrocarbon pollution is low and published data from the CSIRO indicates that average concentrations from Industrial sites are in the order of 10mg/L and we would expect source loading from this site to be near to or below this concentration. Hydrocarbon pollution would also be limited to surface areas which will be treated via bio-retention swales which are predicted to achieve a 90% reduction of this pollutant.

Given the expected low source loadings of hydrocarbons and removal efficiencies of the treatment devices we consider that the requirements of the Penrith City Council have been met.

6.4 Stormwater Harvesting

6.4.1 Introduction

Stormwater harvesting refers to the collection of stormwater from the developments internal stormwater drainage system for re-use in non-potable applications. Stormwater from the stormwater drainage system can be classified as either rainwater where the flow is from roof areas only, or stormwater where the flow is from all areas of the development.

For the purposes of this development, we refer to a rainwater harvesting system, where benefits of collected stormwater from roof areas over a stormwater harvesting system can be made as rainwater is generally less polluted than stormwater drainage.

Rainwater harvesting is proposed for this development with re-use for non-potable applications. Internal uses include such applications as toilet flushing while external applications will be used for irrigation. The aim is to reduce the water demand for the development and to satisfy the requirements of PCC DCP2010.

In general terms the rainwater harvesting system will be an in-line tank for the collection and storage of rainwater. At times when the rainwater storage tank is full rainwater can pass through the tank and continue to be discharged via gravity into the stormwater drainage system. Rainwater from the storage tank will be pumped for distribution throughout the development in a dedicated non-potable water reticulation system.

Rainwater tanks have been sized with reference to the NSW Department of Environment and Conservation document *Managing Urban Stormwater: Harvesting and Reuse*, using a simple water balance analysis to balance the supply and demand, based on the below base water demands and the requirement of PCC DCP2010 Part C3 to provide a reduction in non-potable water demand with a minimum 100,000 litre rainwater tank.

6.4.2 Internal Base Water Demand

Indoor water demand has been based on each employee using 15 litres of potable water per day for toilet flushing which is typical of an office environment which uses energy efficient flushing devices. As the proposed building populations are not currently known these have been based on 1 person every 350m2 for warehouse areas and 1 person every 30m2 for office areas.

These rates give the following internal non-potable demand:

Proposed Development 175 People 2.625 kL/day

6.4.3 External Base Water Demand

External water consumption within each landscaping system varies depending upon the nature of the irrigation system, species of planting, and the prevailing climate. For this development, the base case outdoor potable water demand has been modelled using a simple rainwater balance. The proposed irrigation system will be a drip fed system with application rates averaging 10 l/m2 (i.e. 10 mm/m2). For the purposes of our analysis the average of this application rate has been used, in conjunction with the application regime shown in Table 6.3, to determine the monthly and total yearly demand.

Month	**No. of Applications**
January	12
February	12
March	10
April	9
May	8
June	4
July	4
August	4
September	8
October	9
November	10
December	12

Table 6.3. External Irrigation Application Schedule

The above regime for the landscaped area for the site gives the following yearly outdoor water demands:

Proposed Development Area=4000m^2 4080 kL/year

6.4.4 Rainwater Tank Sizing

The use of rainwater reduces the mains water demand and the amount of stormwater runoff. By collecting the rainwater run-off from roof areas, rainwater tanks provide a valuable water source suitable for flushing toilets and landscape irrigation.

Rainwater tanks have been designed, using a simple water balance calculation to balance the supply and demand, based on the calculated base water demands and proposed roof catchment areas. Allowances in the calculation have been made for efficiency of collection, absorption/ evaporation losses and the like.

Tank	Roof Catchment to Rainwater Tank (m2)	Tank Size (kL)	Predicted Demand Reduction (%)
	6500	100	80

Table 6.4. Rainwater Reuse Requirements

The water balance calculation, results summarised in Table 6.4, predicts that the requirements of PCC DCP2010 (min. tank size of 100,000 litres and reduction in non-potable water demand) will be met for the development with the provision a 100kL.

6.5 Maintenance and Monitoring

It is important that each component of the water quality treatment train is properly operated and maintained. In order to achieve the design treatment objectives, an indicative maintenance schedule has been prepared (refer to **Table 5.5** below) to assist in the effective operation and maintenance of the various water quality components.

Note that inspection frequency may vary depending on site specific attributes and rainfall patterns in the area. In addition to the below nominated frequency it is recommended that inspections are made following large storm events.

Table 5.5. Indicative Maintenance Schedule

MAINTENANCE ACTION	FREQUENCY	RESPONSIBILITY	PROCEDURE
SWALES/ LANDSCAPED AREAS			
Check density of vegetation and ensure minimum height of 150mm is maintained. Check for any evidence of weed infestation	Six monthly	Maintenance Contractor	Replant and/or fertilise, weed and water in accordance with landscape consultant specifications
Inspect swale for excessive litter and sediment build up	Six monthly	Maintenance Contractor	Remove sediment and litter and dispose in accordance with local authorities' requirements.
Check for any evidence of channelisation and erosion	Six monthly/ After Major Storm	Maintenance Contractor	Reinstate eroded areas so that original, designed swale profile is maintained
Weed Infestation	Three Monthly	Maintenance Contractor	Remove any weed infestation ensuring all root ball of weed is removed. Replace with vegetation where required.
Inspect swale surface for erosion	Six Monthly	Maintenance Contractor	Replace top soil in eroded area and cover and secure with biodegradable fabric. Cut hole in fabric and revegetate.
RAINWATER TANK			
Check for any clogging and blockage of the first flush device	Monthly	Maintenance Contractor	First flush device to be cleaned out
Check for any clogging and blockage of the tank inlet - leaf/litter screen	Six monthly	Maintenance Contractor	Leaves and debris to be removed from the inlet leaf/litter screen
Check the level of sediment within the tank	Every two years	Maintenance Contractor	Sediment and debris to be removed from rainwater tank floor if sediment level is greater than the maximum allowable depth as specified by the

MAINTENANCE ACTION	FREQUENCY	RESPONSIBILITY	PROCEDURE
			hydraulic consultant
INLET & JUNCTION PITS			
Inside Pit	Six Monthly	Maintenance Contractor	Remove grate and inspect internal walls and base, repair where required. Remove any collected sediment, debris, litter.
Outside of Pit	Four Monthly/ After Major Storm	Maintenance Contractor	Clean grate of collected sediment, debris, litter and vegetation.
STORMWATER SYSTEM			
General Inspection of complete stormwater drainage system	Bi-annually	Maintenance Contractor	Inspect all drainage structures noting any dilapidation in structures and carry out required repairs.
OSD TANK			
Inspect and remove any blockage from orifice	Six Monthly	Maintenance Contractor/ Owner	Remove grate and screen to inspect orifice.
Inspect trash screen and clean	Six Monthly	Maintenance Contractor/ Owner	Remove grate and screen if required to clean it.
Inspect flap valve and remove any blockage.	Six Monthly	Maintenance Contractor/ Owner	Remove grate. Ensure flap valve moves freely and remove any blockages or debris.
Inspect pit sump for damage or blockage.	Six Monthly	Maintenance Contractor/ Owner	Remove grate & screen. Remove sediment/ sludge build up and check orifice and flap valve is clear.
Inspect storage areas and remove debris/ mulch/ litter etc likely to block screens/ grates.	Six Monthly	Maintenance Contractor/ Owner	Remove debris and floatable materials.
Check attachment of orifice plate and screen to wall of pit	Annually	Maintenance Contractor	Remove grate and screen. Ensure plate or screen mounted securely, tighten fixings if required. Seal gaps if required.

MAINTENANCE ACTION	FREQUENCY	RESPONSIBILITY	PROCEDURE
Check orifice diameter is correct and retains sharp edge.	Five yearly	Maintenance Contractor	Compare diameter to design (see Work-as-Executed) and ensure edge is not pitted or damaged.
Check screen for corrosion	Annually	Maintenance Contractor	Remove grate and screen and examine for rust or corrosion, especially at corners or welds.
Inspect overflow weir and remove any blockage	Six monthly	Maintenance Contractor/ Owner	Ensure weir is free of blockage.
Inspect walls for cracks or spalling	Annually	Maintenance Contractor	Remove grate to inspect internal walls, repair as necessary.
Check step irons	Annually	Maintenance Contractor	Ensure fixings are secure and irons are free from corrosion.

7 EROSION & SEDIMENT CONTROL PLAN

An erosion and sediment control plan (ESCP) is shown on drawings Co11888.00-C20 and C21. These are conceptual plans only providing sufficient detail to clearly show that the works can proceed without undue pollution to receiving waters. A detailed plan will be prepared once consent is given and before works start.

7.1 General Conditions

1. The ESCP will be read in conjunction with the engineering plans, and any other plans or written instructions that may be issued in relation to development at the subject site.

2. Contractors will ensure that all soil and water management works are undertaken as instructed in this specification and constructed following the guidelines stated in Managing Urban Stormwater, Soils and Construction (1998) and PCC specifications.

3. All subcontractors will be informed of their responsibilities in minimising the potential for soil erosion and pollution to down slope areas.

7.2 Land Disturbance

1. Where practicable, the soil erosion hazard on the site will be kept as low as possible and as recommended in Table 1

Land Use	Limitation	Comments
Construction areas	Limited to 5 (preferably 2) metres from the edge of any essential construction activity as shown on the engineering plans.	All site workers will clearly recognise these areas that, where appropriate, are identified with barrier fencing (upslope) and sediment fencing (downslope), or similar materials.
Access areas	Limited to a maximum width of 5 metres	The site manager will determine and mark the location of these zones onsite. They can vary in position so as to best conserve existing vegetation and protect downstream areas while being considerate of the needs of efficient works activities. All site workers will clearly recognise these boundaries.
Remaining lands	Entry prohibited except for essential management works	

Table 1 Limitations to access

7.3 Erosion Control Conditions

1. Clearly visible barrier fencing shall be installed as shown on the plan and elsewhere at the discretion of the site superintendent to ensure traffic control and prohibit unnecessary site disturbance. Vehicular access to the site shall be limited to only those essential for construction work and they shall enter the site only through the stabilised access points.

2. Soil materials will be replaced in the same order they are removed from the ground. It is particularly important that all subsoils are buried and topsoils remain on the surface at the completion of works.

3. Where practicable, schedule the construction program so that the time from starting land disturbance to stabilisation has a duration of less than six months.

4. Notwithstanding this, schedule works so that the duration from the conclusion of land shaping to completion of final stabilisation is less than 20 working days.

5. Land recently established with grass species will be watered regularly until an effective cover has properly established and plants are growing vigorously. Further application of seed might be necessary later in areas of inadequate vegetation establishment.

6. Where practical, foot and vehicular traffic will be kept away from all recently established areas

7. Earth batters shall be constructed in accordance with the Geotechnical Engineers Report or with as law a gradient as practical but not steeper than:

    - 2H:1V where slope length is less than 7 meters
    - 2.5H:1V where slope length is between 7 and 10 meters
    - 3H:1V where slope length is between 10 and 12 meters
    - 4H:1V where slope length is between 12 and 18 meters
    - 5H:1V where slope length is between 18 and 27 meters
    - 6H:1V where slope length is greater than 27 meters

8. All earthworks, including waterways/drains/spillways and their outlets, will be constructed to be stable in at least the design storm event.

9. During windy weather, large, unprotected areas will be kept moist (not wet) by sprinkling with water to keep dust under control. In the event water is not available in sufficient quantities, soil binders and/or dust retardants will be used or the surface will be left in a cloddy state that resists removal by wind.

7.4 Pollution Control Conditions

1. Stockpiles will not be located within 5 meters of hazard areas, including likely areas of high velocity flows such as waterways, paved areas and driveways.

2. Sediment fences will:

   a) Be installed where shown on the drawings, and elsewhere at the discretion of the site superintendent to contain the coarser sediment fraction (including aggregated fines) as near as possible to their source.

   b) Have a catchment area not exceeding 720 square meters, a storage depth (including both settling and settled zones) of at least 0.6 meters, and internal dimensions that provide maximum surface area for settling, and

   c) Provide a return of 1 meter upslope at intervals along the fence where catchment area exceeds 720 square meters, to limit discharge reaching each section to 10 litres/second in a maximum 20 year t_c discharge.

3. Sediment removed from any trapping device will be disposed in locations where further erosion and consequent pollution to down slope lands and waterways will not occur.

4. Water will be prevented from directly entering the permanent drainage system unless it is relatively sediment free (i.e. the catchment area has been permanently landscaped and/or likely sediment has been treated in an approved device). Nevertheless, stormwater inlets will be protected.

5. Temporary soil and water management structures will be removed only after the lands they are protecting are stabilised.

7.5 Waste Management Conditions

Acceptable bind will be provided for any concrete and mortar slurries, paints, acid washings, lightweight waste materials and litter. Clearance service will be provided at least weekly.

7.6 Site Inspection and Maintenance

1. A self-auditing program will be established based on a Check Sheet. A site inspection using the Check Sheet will be made by the site manager:

   - At least weekly.
   - Immediately before site closure.
   - Immediately following rainfall events in excess of 5mm in any 24 hour period.

The self audit will include:

- Recording the condition of every sediment control device
- Recording maintenance requirements (if any) for each sediment control device
- Recording the volumes of sediment removed from sediment retention systems, where applicable
- Recording the site where sediment is disposed
- Forwarding a signed duplicate of the completed Check Sheet to the project manager/developer for their information

2. In addition, a suitably qualified person will be required to oversee the installation and maintenance of all soil and water management works on the site. The person shall be required to provide a short monthly written report. The responsible person will ensure that:

   - The plan is being implemented correctly
   - Repairs are undertaken as required
   - Essential modifications are made to the plan if and when necessary

   The report shall carry a certificate that works have been carried out in accordance with the plan.

3. Waste bins will be emptied as necessary. Disposal of waste will be in a manner approved by the Site Superintendent.

4. Proper drainage will be maintained. To this end drains (including inlet and outlet works) will be checked to ensure that they are operating as intended, especially that,

   - No low points exist that can overtop in a large storm event
   - Areas of erosion are repaired (e.g. lined with a suitable material) and/or velocity of flow is reduced appropriately through construction of small check dams of installing additional diversion upslope.
   - Blockages are cleared (these night occur because of sediment pollution, sand/soil/spoil being deposited in or too close to them, breached by vehicle wheels, etc.).

5. Sand/soil/spoil materials placed closer than 2 meters from hazard areas will be removed. Such hazard areas include and areas of high velocity water flows (e.g. waterways and gutters), paved areas and driveways.

6. Recently stabilised lands will be checked to ensure that erosion hazard has been effectively reduced. Any repairs will be initiated as appropriate.

7. Excessive vegetation growth will be controlled through mowing or slashing.

8. All sediment detention systems will be kept in good, working condition. In particular, attention will be given to:

a) Recent works to ensure they have not resulted in diversion of sediment laden water away from them

b) Degradable products to ensure they are replaced as required, and

c) Sediment removal, to ensure the design capacity or less remains in the settling zone.

9. Any pollutants removed from sediment basins or litter traps will be disposed of in areas where further pollution to down slope lands and waterways should not occur.

10. Additional erosion and/or sediment control works will be constructed as necessary to ensure the desired protection is given to down slope lands and waterways, i.e. make ongoing changes to the plan where it proves inadequate in practice or is subjected to changes in conditions at the work site or elsewhere in the catchment.

11. Erosion and sediment control measures will be maintained in a functioning condition until all earthwork activities are completed and the site stabilised

12. Litter, debris and sediment will be removed from the gross pollutant traps and trash racks as required.

8 CONCLUSION

This Civil Engineering Details Report has been prepared to support the application for a S75w amendment to the previously approved Part 3A Development 08_0016 dated 12 July 2010 over Lot 62 Lenore Lane Erskine Park.

A civil engineering strategy for the site has been developed which provides a best fit solution within the constraints of the existing landform and proposed architectural layout. Within this strategy a stormwater quantity and quality management strategy has been developed to reduce both peaks flows and pollutant loads in stormwater leaving this site. The stormwater management for the development has been designed in accordance with the Penrith City Councils *Section C3 of DCP2010*.

The hydrological assessment showed that the local post development flows from the site will be less than pre-development flows hence this demonstrates that the site discharge would not adversely affect any land, drainage system or watercourse as a result of the development.

During the construction phase, a Sediment and Erosion Control Plan will be in place which ensures the downstream drainage system and receiving waters are protected from sediment laden runoff.

During the operational phase of the development, a treatment train incorporating the use of the proprietary Tumblemate system is proposed to mitigate the likely increase in stormwater pollutant load generated by the development. MUSIC modelling results indicate that the proposed SQIDs are effective in reducing pollutant loads in stormwater discharging from the site and meet the requirements of council pollutant based reductions. Best Management Practices have been applied to the development to ensure that the quality of stormwater runoff is not detrimental to the receiving environment.

It is recommended that the management strategies mentioned in this report be incorporated into the future detailed design. Detailed design may result in changes to the concept however design criteria will be followed.

9 REFERENCES

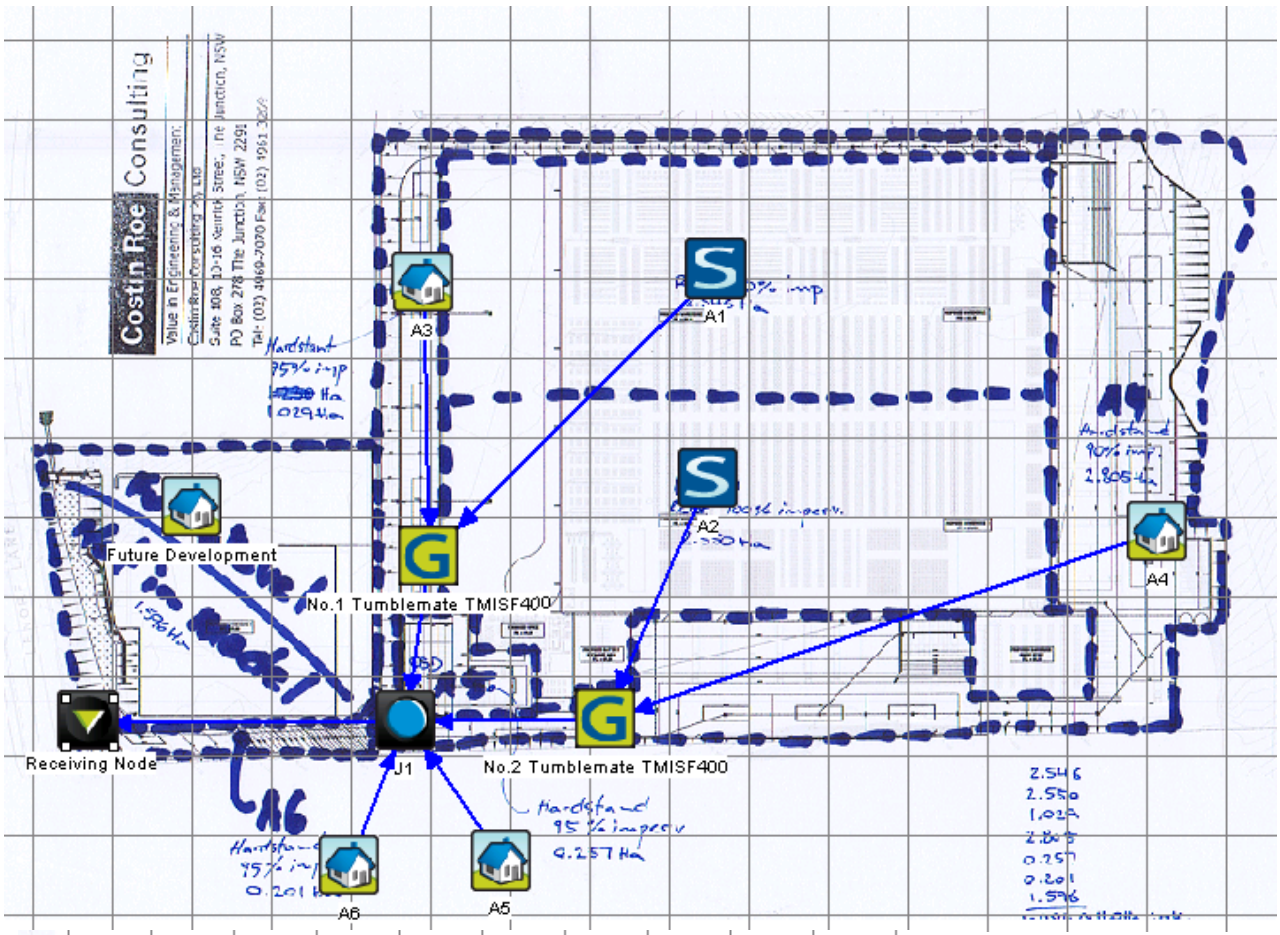
- Managing Urban Stormwater: Harvesting and Reuse – 2006 (NSW DEC);
- Managing Urban Stormwater: Source Control – 1998 (NSW EPA);
- Managing Urban Stormwater: Treatment Techniques – 1997 (NSW EPA);
- Managing Urban Stormwater: Soils & Construction – 2004(LANDCOM);
- Penrith City Council – DCP 2010 (Part C3); and
- Water Sensitive Urban Design – "Technical Guidelines for Western Sydney" by URS Australia Pty Ltd, May 2004

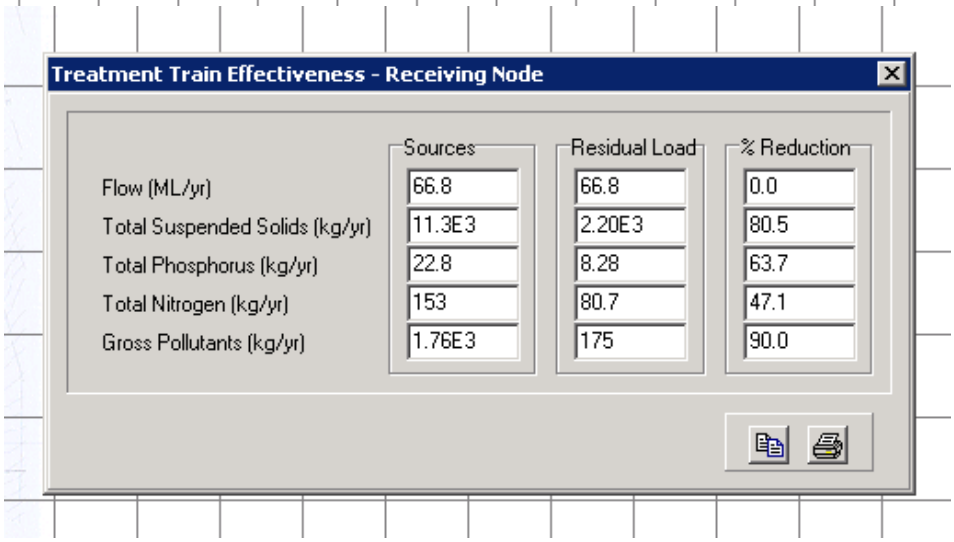
Appendix A

DRAWINGS BY COSTIN ROE CONSULTING

Appendix B

MUSIC MODEL CONFIGURATION





Appendix C

DRAINS MODEL CONFIGURATION