# PACLIB GROUP

## MAJOR PROJECT APPLICATION FOR PRINTING WAREHOUSE & DISTRIBUTION FACILITY

119-145 LENORE DRIVE, ERSKINE PARK
(LOT 62 DP 1090695)

## STORMWATER MANAGEMENT STRATEGY REPORT

ISSUE A

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## Revision Table

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# SECTION A – GENERAL

# 1. INTRODUCTION

## 1.1. Brief

S&G Consultants Pty Ltd (SGCE) have been engaged by Paclib Group (PACLIB) to prepare a stormwater management plan for the proposed industrial development at 119-145 Lenore Drive, Erskine Park.

The development is considered major works and will be subject to an Environmental Assessment under the Act. The Client has provided the requirements of the relevant authorities including the Department of Planning, Council and the RTA. This report describes how the site stormwater management addresses these requirements.

This report has been prepared by Samer El Haddad, Director of SGCE. Samer has the following qualifications:

Bachelor Degree in Civil Engineering;

Masters Degree in Engineering Management;

Chartered Member of the Institution of Engineers, Australia (MIEAust CPEng No.2247040); and

Member of the National Professional Engineering Register – NPER 3 – Civil.

## 1.2. Background

SGCE have been engaged to prepare a stormwater management plan to address the key issue designated as "Soils & Water" under the Director-General's requirements.

The following tasks were carried out:

- A site visit was undertaken to ascertain on-site conditions;
- Supplied documents were reviewed;
- Liaison with Penrith City Council (PCC) to determine the stormwater design parameters;
- An internal stormwater design was prepared in accordance with the requirements of PCC; and
- This report has been compiled.

At the time of this report, a development consent has been granted by PCC for Stage 1 bulk earthworks on the site. The bulk earthworks have been completed.

This report has been structured as follows:

- Section A – General: this section describes the brief and provides an overview of the development;
- Section B – Stormwater Management: this section addresses the quantity of stormwater discharge from the site and the provision of On-Site Stormwater Detention. It also addresses the requirements for stormwater quality discharge from the site by providing temporary and permanent measures to treat the runoff;
- Section C – Summary: this section summarises the objectives of the stormwater management plan; and
- Section D – Appendices.

## 1.3. Limitations

This report is intended solely for Paclib Group as the sole Client of SGCE and no liability will be accepted for use of the information contained in this report by other parties than this client.

This report is limited to visual observations and to the information including the referenced documents made available at the time when this report was written.

This report outlines the stormwater strategy adopted for the proposed development and is only adequate for the EA application. This report and the accompanying drawings should not be used for construction purposes.

## 1.4. Reference Documents

The following documents provided by the Client have been referenced in the stormwater management plan.

1. Copy of letter from the NSW Government Department of Planning reference S08/00119 including the Director-General's requirements;
2. Copy of letter from Penrith City Council dated 7 November 2008 outlining Council's requirements;
3. Copy of letter from the RTA reference RDC 08M1451 dated 22 October 2008;
4. Survey drawing ref. 70326_ljm prepared by Lovegrove Oxley Consultants dated 31/05/2007;
5. Architectural drawing ref. 080225 – DA dated 12/03/2009;
6. Managing Urban Stormwater: Treatment Techniques – 1997 (NSW EPA);
7. Managing Urban Stormwater: Source Control – 1998 (NSW EPA);
8. Managing Urban Stormwater: Soils & Construction – 2004(LANDCOM); and
9. Penrith City Council – DCP 2008 draft issue dated June 2008 (Part C3).

## 1.5. Site Description

The site is located on the uphill side of Lenore Drive in Erskine Park. The site is currently vacant in its natural state. Electrical transmission overhead lines cross the northern part of the site, burdened with a wide easement.

Refer to Figure 1 below for site location.

The site is bordered by Lenore Drive to the South and adjoining properties to the other boundaries.

The site has a total area of 13.49ha. The site's natural gradient drops 15m between the highest north western corner and the headwall draining the site at the south western corner and offers a ridge in the centre of the site in a north-south direction. Localised depressions and natural dams exist on the eastern and western boundaries of the site.

The development area is 10.53ha. Reference should be made to the site plan prepared by the Paclib Group.

## 1.6. Existing Drainage System

The site is currently drained through a pipe culvert crossing under the neighbouring site's driveway on the south west corner. The pipe discharges into an open swale fronting Lenore Drive and discharges into a large culvert system crossing to the other side of Lenore Drive.

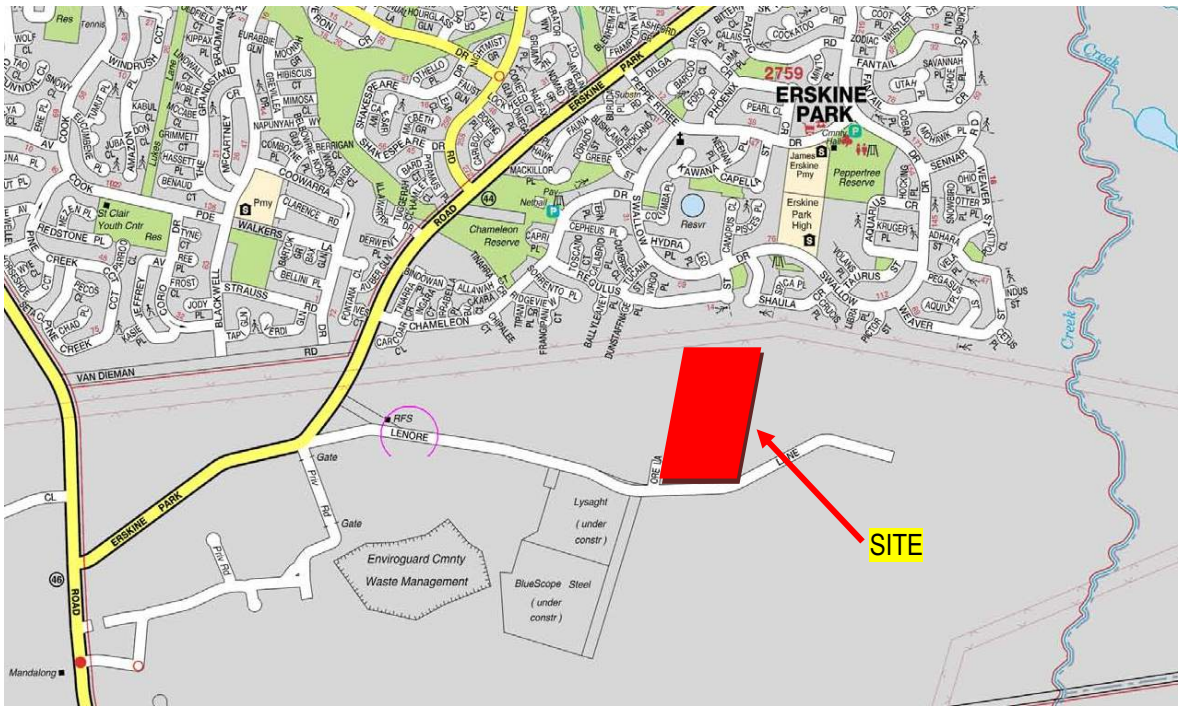



Figure 1 Locality Map

## 1.7. Development Description

The proposed industrial development covers approximately 48% of the site area. The area within and north of the electrical easement is to remain in its current natural state.

The development includes three (3) warehouses, truck loading areas and parking bays, and on-ground car parking facilities. The entire development will remain under one (1) title.

It is proposed to develop warehouse 1 at RL:59.80 and warehouses 2 & 3 at RL:63.60 (±500mm).

The site is affected by 20m landscaping setback fronting Lenore Drive.

Figure 2 below is a site plan indicating the layout of the proposed development.

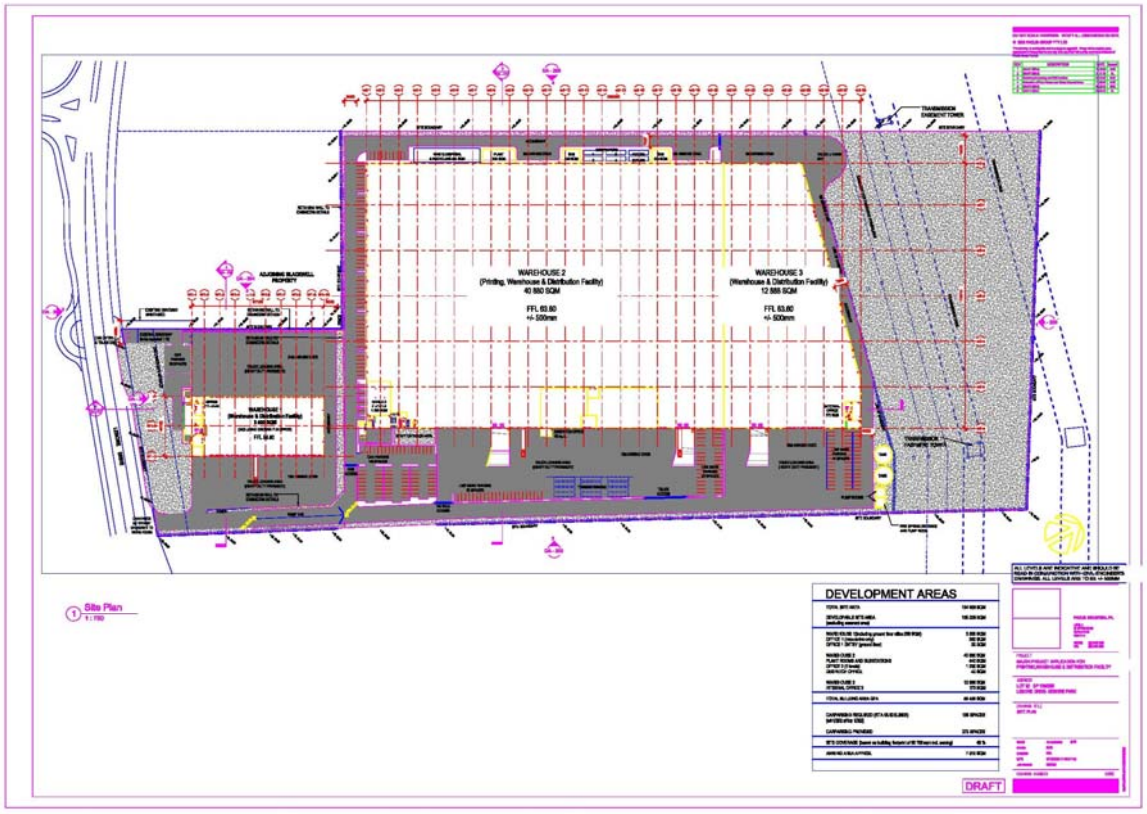



Figure 2 Site Plan

# SECTION B – STORMWATER MANAGEMENT

# 2. AUTHORITIES' REQUIREMENTS

## 2.1. Penrith City Council – DCP 2008

Part C3 of Penrith City Council's DCP 2008 outlines the requirements for water management. In summary, the controls are as follows:

- Recycle water for non-drinking uses. A minimum water reuse tank of 100,000 litres is recommended;
- Water quality modelling required for medium size lot – level 2 (10-50ha);
- Pollution retention criteria are shown in Table 1 below;
- Adequate stormwater detention to ensure that for all rainfall events up to and including the 1-100 year Average Recurrence Interval (ARI) event, new developments do not increase stormwater peak flows in any downstream areas;
- Erosion and sediment control plan must be submitted to Council for approval; and
- An On-Site Detention Systems report is required for developments above 2 hectares.

Table 1 Pollution Retention Criteria

| Pollutant | Description | Retention Criteria |
|---|---|---|
| Litter | All Anthropogenic material (cans, bottles, wrapping, etc) | 70% of material ≥5mm diameter |
| Coarse Sediment | Coarse sand (≥0.5mm) | 80% of the load for particles ≤0.5mm diameter |
| Nutrients | Total Phosphorus & Total Nitrogen | 45% retention of the load for each |
| Fine Particles | Fine sand (≥0.05mm) | 50% of the load for particles ≤0.1mm diameter |
| Free Oil & Grease | Free floating viscous liquids ≥ 150µm that do not emulsify in aqueous solutions | 90% of the load with no visible discharges |

# 3. ON-SITE STORMWATER DETENTION

## 3.1. Sizing

The On-Site Detention (OSD) system has been sized using DRAINS model. DRAINS is runoff routing software package which allows the stormwater runoff to be simulated and pre-development runoff compared to post-development runoff for all storms up to and including the 100-year ARI storm event.

The development has been divided into two areas as follows:

Small area (warehouse 1) = 1.57ha; and

Large area (warehouses 2 & 3) = 8.99ha.

The sizing of the OSD has been carried out in such a manner to reduce the peak flows generated by the proposed development to pre-developed natural state flows for 5, 20 & 100-year ARI storm events.

The following catchment parameters have been used in the DRAINS model:

Table 2 Catchment Parameters

| Description | Pre-development | Post-development |
|---|---|---|
| Surface roughness | 0.15 | 0.014 |
| % impervious | 0 | 90 |

The results of the DRAINS simulations are included in the design drawings and reproduced hereafter. The results indicate that the provision of OSD systems will mitigate the impact of the development on the peak flows discharging from the site.

Table 3 DRAINS OSD Simulations Results – Large Area

| 5-YEAR ARI | | | | |
|---|---|---|---|---|
| CATCHMENT | AREA (ha) | UNCONTROLED FLOW (m3/s) | OSD VOLUME (m3) | CONTROLED FLOW (m3/s) |
| PRE-DEVELOPED | 8.99 | 0.388 | - | 0.388 |
| POST-DEVELOPED | 8.821 | 1.756 | 2290 | 0.336 |
| OSD BYPASS | 0.169 | 0.050 | - | 0.050 |
| 20-YEAR ARI | | | | |
| CATCHMENT | AREA (ha) | UNCONTROLED FLOW (m3/s) | OSD VOLUME (m3) | CONTROLED FLOW (m3/s) |
| PRE-DEVELOPED | 8.99 | 0.724 | - | 0.724 |
| POST-DEVELOPED | 8.821 | 2.519 | 3138.3 | 0.528 |
| OSD BYPASS | 0.169 | 0.069 | - | 0.069 |
| 100-YEAR ARI | | | | |

| CATCHMENT | AREA (ha) | UNCONTROLED FLOW (m3/s) | OSD VOLUME (m3) | CONTROLED FLOW (m3/s) |
|---|---|---|---|---|
| PRE-DEVELOPED | 8.99 | 1.216 | - | 1.216 |
| POST-DEVELOPED | 8.821 | 3.368 | 3893.1 | 0.838 |
| OSD BYPASS | 0.169 | 0.085 | - | 0.085 |

Table 4 DRAINS OSD Simulations Results – Small Area

| 5-YEAR ARI | | | | |
|---|---|---|---|---|
| CATCHMENT | AREA (ha) | UNCONTROLED FLOW (m3/s) | OSD VOLUME (m3) | CONTROLED FLOW (m3/s) |
| PRE-DEVELOPED | 1.57 | 0.129 | - | 0.129 |
| POST-DEVELOPED | 1.32 | 0.406 | 236.1 | 0.104 |
| OSD BYPASS | 0.25 | 0.024 | - | 0.024 |
| 20-YEAR ARI | | | | |
| CATCHMENT | AREA (ha) | UNCONTROLED FLOW (m3/s) | OSD VOLUME (m3) | CONTROLED FLOW (m3/s) |
| PRE-DEVELOPED | 1.57 | 0.240 | - | 0.240 |
| POST-DEVELOPED | 1.32 | 0.549 | 337.7 | 0.152 |
| OSD BYPASS | 0.25 | 0.040 | - | 0.040 |
| 100-YEAR ARI | | | | |
| CATCHMENT | AREA (ha) | UNCONTROLED FLOW (m3/s) | OSD VOLUME (m3) | CONTROLED FLOW (m3/s) |
| PRE-DEVELOPED | 1.57 | 0.373 | - | 0.373 |
| POST-DEVELOPED | 1.32 | 0.673 | 430.8 | 0.232 |
| OSD BYPASS | 0.25 | 0.058 | - | 0.058 |

## 3.2. Configuration

### 3.2.1. Small Area – Warehouse 1

The On-Site Detention (OSD 4) for the warehouse 1 and the associated open areas and car parking facilities is provided as a combination of below and above ground surface storage in the hardstand areas and the car park. The total volume provided is 593m$^3$ with a volume of 417m$^3$ stored on the surface.

An underground OSD component is also provided to cater for minor storm events and prevent frequent ponding in the open areas. A 176m$^3$ structural tank is provided under the car parking area.

The discharge from the OSD system is made to the open landscaped area fronting Lenore Drive through a headwall and an energy dissipater device to control the erosion of soil.

### 3.2.2. Large Area – Warehouses 2 & 3

The OSD system for the large area including warehouses 2 & 3 has been divided into individual OSDs, with each OSD associated to a catchment area dischargiing directly into the relative OSD system. The outflows from these OSD systems are then combined into one (1) discharge point into the open landscaped area.

Below is a description of each OSD system in the large area.

#### *3.2.2.1. Sub- Area 1- Access Way South & West*

The OSD for this catchment is a multiple number of above ground surface storage areas identified as OSD 1A to OSD 1N on the drawings. The system covers a catchment area of 9491.4m$^2$. The area includes the access way and the footpath areas on both sides.

Inlet pits are provided at 20m intervals with crests in the middle rising 100mm above the pits. This will achieve a minimum grade across the access way of 1%.

A total volume of 419.6m$^3$ has been provided for Sub-Area 1.

The outflow from the OSD is controlled by a number of discharge control pits.

#### *3.2.2.2. Sub-Area 2 – WH2 Loading Area*

This sub-area encompasses OSD 2, 2A & 2B. The total catchment area is 7624.2m$^2$. The area includes also the truck parking area and eastern access way fronting Warehouse 2.

Inlet pits are provided at 20m intervals with crests in the middle rising 100mm above the pits. This will achieve a minimum grade across the access way of 1%.

The OSD volume provided for this area is 383.9m$^3$. A depth of 200mm above the pits is required to achieve the storage volume.

The outflow from the OSD is controlled by a number of discharge control pits. Reference should be made to the drawings under Appendix 1.

#### *3.2.2.3. Sub-Area 3 – WH3 Loading Area*

The catchment area draining into the above ground surface storages OSD 6 & OSD 8 provided in the car parking area and the loading area of Warehouse 3 is 7876.6m$^2$. The area includes the fire tanks/pump rooms area and the access way fronting Warehouse 3.

Inlet pits are provided at 20m intervals with crests in the middle rising 100mm above the pits. This will achieve a minimum grade across the access way of 1%.

The OSD volume provided for this area is 380.8m$^3$. A depth of 200mm above the pits is required to achieve the storage volume.

The outflow from the OSD is controlled by the discharge control pits (DCP 6 & DCP 8) for both systems.

#### *3.2.2.4. Sub-Area 4 – Access Way North*

The catchment area draining into the above ground surface storage OSD 7 provided in the access way north of the warehouses is 3103.4m$^2$. The area includes a small roof area of warehouse 3, the access way and the footpath areas on both sides.

Inlet pits are provided at 20m intervals with crests in the middle rising 100mm above the pits. This will achieve a minimum grade across the access way of 1%.

The OSD volume provided for this area is 139.4m$^3$ at a depth of 200mm above the pits.

The outflow from the OSD is controlled by a Discharge Control Pit (DCP 7) at the north eastern corner of WH3.

#### *3.2.2.5. Sub-Area 5 – WH 2 & WH 3 Roof Area*

The roof area of warehouses 2 & 3 draining into the underground OSD 5 provided under the main car parking area is 5.68ha. Sub-area 5 includes also the car parking area fronting the office building of WH2 and the southern access way adjoining the car park.

The underground structural tank provided has a maximum storage capacity of 2580m$^3$. The dimensions of the tank are noted on the drawings.

The outflow from the tank is controlled by an orifice plate. A high level overflow weir is provided in the main access driveway at RL62.50. The combined orifice and weir outflows are restricted to the Permissible Site Discharge (PSD) for the undeveloped state of the site.

# 4. STORMWATER QUALITY

## 4.1. Permanent Controls

The quality of the discharge from the site is controlled by PCC requirements and the Department of Planning.

Table 1 outlines the water quality requirements to reduce the impact of the development on the receiving water bodies.

It is proposed to use a train treatment approach to reduce the transfer of pollutants from the site. The following has been adopted for Lot 62 Lenore Drive:

- The roof runoff is separated from the surface runoff;
- A rainwater reuse tank, 100,000 litres capacity has been installed to capture the roof water for reuse in toilet flushing and irrigation of planter beds and landscaped areas;
- Gross pollutant traps have been provided to treat litter and other coarse sediments from the surface runoff prior to discharging into the bio-retention swale; and
- A bio-retention swale has been allowed for in the landscaped setback fronting Lenore Drive to treat fine particles.

The water quality discharge from the site has been checked using MUSIC software. The train treatment approach described above has been simulated in MUSIC and the results of the simulations have been included hereafter.

### 4.1.1. Gross Pollutant Traps

Two (2) gross pollutant traps (GPT) have been nominated to capture litter and coarse sediments prior to discharging into the bio-retention pond/swale.

The proposed GPTs are proprietary devices installed in the ground type CDS, which stands for Continuous Deflective Separation. It is proposed to use an offline device to treat the runoff from the large area and an online device for the small area.

The mechanism by which the CDS technology separates and retains gross pollutants is by first diverting the flow and associated pollutants in the stormwater drainage system away from the main flow stream of the pipe into a pollutant separation chamber.

The separation chamber consists of a containment sump in the lower section and an upper separation section. The pollutants are retained within the chamber by a perforated plate that allows water to pass through to the outlet pipe.

The water and associated pollutants contained within the separation chamber are kept in continuous motion by the energy generated by the incoming flow. This has the effect of preventing the separation plate from becoming blocked by the gross solids retained from the inflow. Heavier solids settle into the containment sump and much of the neutrally buoyant material eventually sinks while floating material accumulates at the water surface.

A maintenance schedule should be prepared and implemented to retain the efficiency of the GPT devices. Generally, the GPTs should be cleaned at regular intervals not exceeding 3 months and after every large storm event.

Figure 3 below shows some CDS units for both on-line and off-line options.

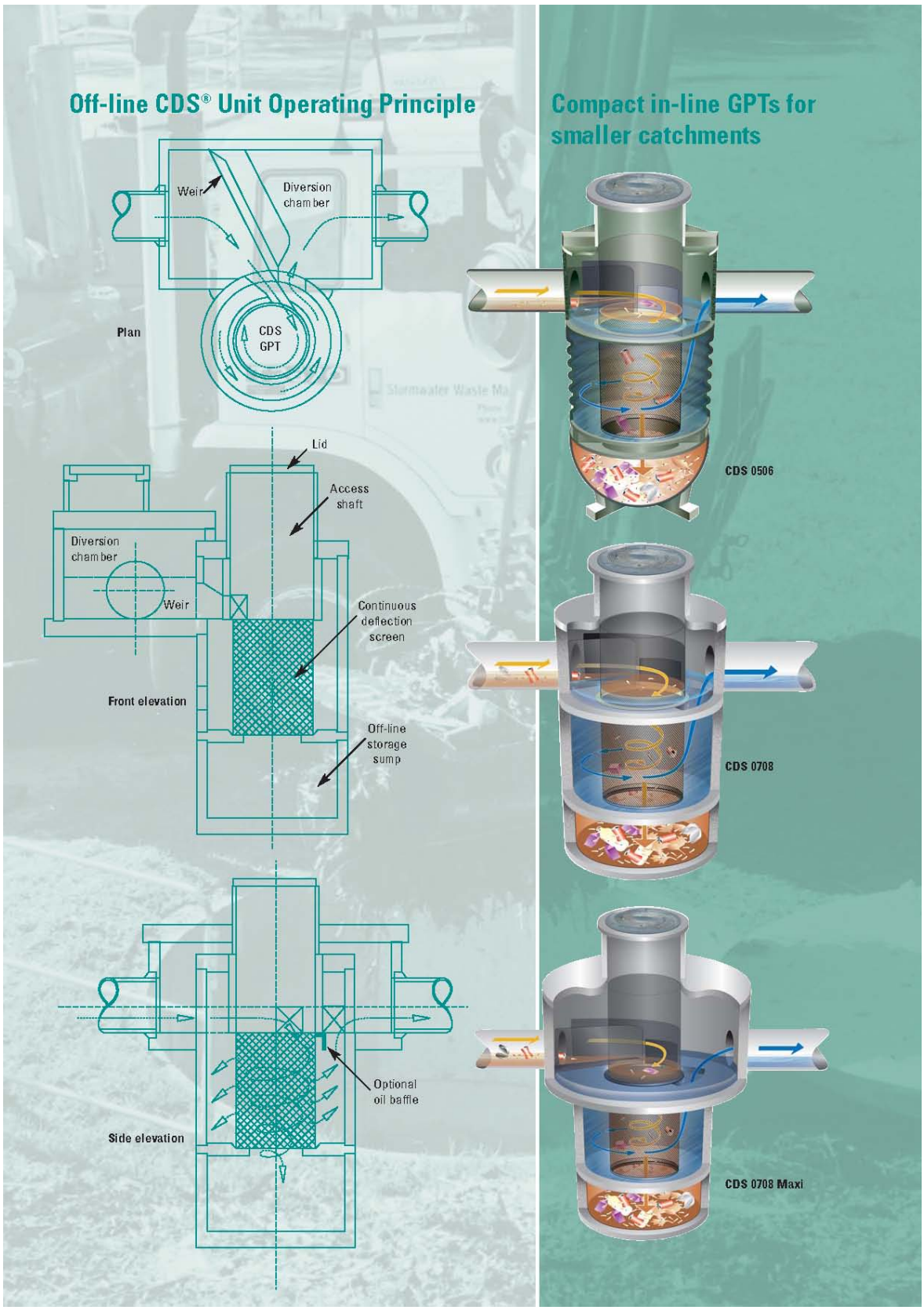



Figure 3 Typical CDS Units

### 4.1.2. Bio-Retention Swale

Bio-retention systems are essentially a surface and sub-surface water filtration system. They provide a number of functions including:

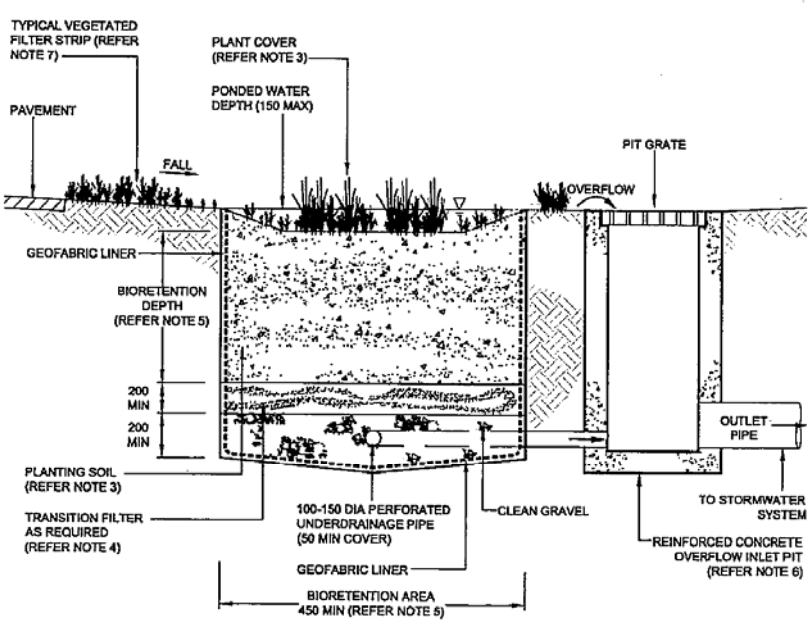
- Removing sediments and attached pollutants by filtering through surface vegetation and ground cover and through an underlying filter media; and
- Delaying runoff peaks by providing retention capacity and reducing flow velocities.

Bio-retention systems are most efficient in removing fine size sediments and attached pollutants (such as nutrients, free oils/grease and metals). They have high pollutant removal efficiencies for a wider range of contaminants due to enhanced filtration/biological processes associated with the surface vegetation.

Bio-retention systems have aesthetic benefits due to the surface vegetation and can be incorporated in landscape features.

The bio-retention swale is proposed within the 20m setback fronting Lenore Drive. The swale consists of a 10m wide base with banks battering to surface levels at the boundary and at the development side. The base is underlain with 1m deep filter media and subsoil drainage lines over an impervious liner covering the entire area of the swale.

The bio-retention system has an extended pond depth of 1m above the surface and is an on-line system capable of catering for the design flows. Figure 4 below shows a typical bio-retention system.




**NOTES**

1. THE BIORETENTION SYSTEM SHALL NOT BE USED FOR SEDIMENT CONTROL DURING CONSTRUCTION
2. PLANT SPECIES AND GROUND COVER SHALL BE IN ACCORDANCE WITH DESIGN SPECIFICATIONS DS4 AND DS9
3. PLANTING SOIL SHALL MEET THE MATERIAL, GRADING AND COMPACTION CRITERIA SPECIFIED IN THE TECHNICAL SPECIFICATION OF THE WORKS
4. TRANSITION FILTER LAYER REQUIREMENT TO BE ASSESSED BASED ON PLANTING SOIL - GRAVEL GRADING COMPATIBILITY IN ACCORDANCE WITH DESIGN SPECIFICATION DS4
5. BIORETENTION AREA AND DEPTH TO BE DESIGNED IN ACCORDANCE WITH DESIGN SPECIFICATIONS DS4
6. PITS AND GRATES IN ACCORDANCE WITH COUNCIL STANDARDS
7. VEGETATED FILTER STRIPS TO BE DESIGNED IN ACCORDANCE WITH DESIGN SPECIFICATIONS DS2

ALL DIMENSIONS IN MILLIMETRES UNLESS NOTED OTHERWISE

Figure 4 Typical Bio-Retention System

### 4.1.3. Modelling

As previously mentioned, a treatment train approach has been adopted to enhance the water quality discharge from the site. The efficiency of the treatment train has been checked using MUSIC software package. A diagram of the proposed treatment train extracted from the MUSIC package is shown below in Figure 5.

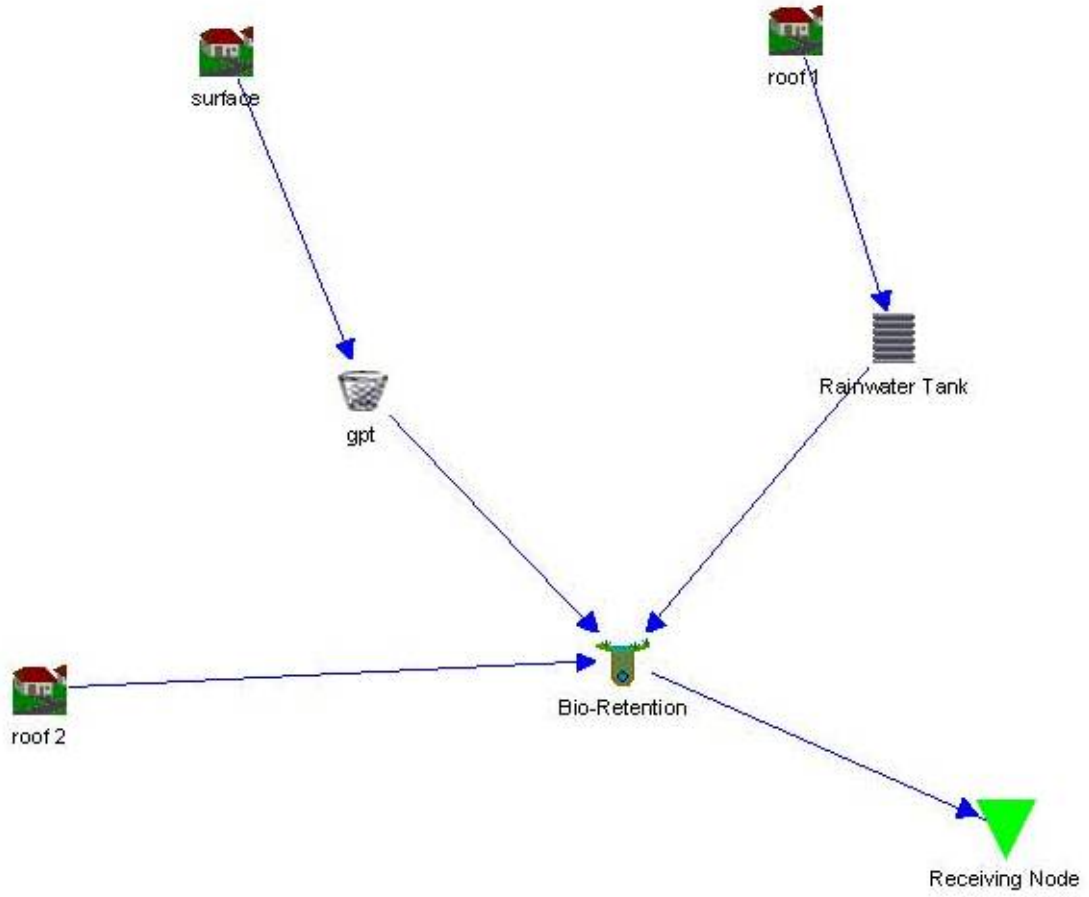



Figure 5 Treatment Train Diagram

The above diagram indicates the following:

- Roof 1 consists of half of the roof area of Warehouses 2 &3. The runoff from roof 1 passes through a rainwater reuse tank prior to discharging into the bio-retention system;
- Roof 2 is the remaining roof area of Warehouses 2 & 3 and Warehouse 1. The runoff from these roof areas discharge directly into the bio-retention system; and
- Surface is the remaining impervious areas on the site. The runoff from the external impervious areas pas through gross pollutant traps prior to discharging into the bio-retention system.

Table 5 below indicates the efficiency of the proposed system to treat the runoff and provides comparison with the retention criteria by PCC. The results indicate that the proposed system is capable of meeting the targets for all pollutants except for the Total Nitrogen which is slightly below the recommended 45% load retention. However, the system is still considered viable and the best management practice for this site.

Table 5 Pollution Retention Efficiency

| Pollutant | Description | Retention Criteria | System Efficiency |
|---|---|---|---|
| Litter | All Anthropogenic material (cans, bottles, wrapping, etc) | 70% of material ≥5mm diameter | 100% |
| Coarse Sediment | Coarse sand (≥0.5mm) | 80% of the load for particles ≤0.5mm diameter | 100% |
| Nutrients | Total Phosphorus & Total Nitrogen | 45% retention of the load for each | 76.6% & 44.1% respectively |
| Fine Particles | Fine sand (≥0.05mm) | 50% of the load for particles ≤0.1mm diameter | 93% |
| Free Oil & Grease | Free floating viscous liquids ≥ 150µm that do not emulsify in aqueous solutions | 90% of the load with no visible discharges | 93% |

## 4.2. Construction Stage

### 4.2.1. Erosion and Sediment Control Plan

An Erosion and Sediment Control Plan (ESCP) has been prepared for the EA application. The implementation of the ESCP shall be in accordance with the guidelines of the NSW Department of Housing "Blue Book".

The ESCP outlines the erosion and sediment control processes for the duration of the project. Emphasis should be placed firstly on minimising erosion then on preventing movement of sediment.

The clearing of vegetation leaves the land surface susceptible to increased erosion. The eroded particles can be transported off site and into natural waterways causing siltation, loss of hydraulic capacity and environmental stress. The ESCP aims to minimise the extent of erosion of the site, restrict movement of soil particles and mitigate the impacts of the works on the natural environment.

The ESCP provides for the:

- Protection of disturbed ground through devices such as temporary vegetation, diversion banks and sediment fences;
- Early installation and progressive implementation of erosion controls;
- Early construction of permanent drainage structures, culverts, sediment basins traps and catch drains;
- Progressive revegetation of disturbed areas;
- Use of geotextile to stabilise disturbed surfaces during construction of culverts;
- Control of runoff from embankments through shaping of fill and construction of temporary windrows and batter drains.
- Implementation of erosion control measures at associated sites, including access tracks, roads, office/compound site and extraction sites.
- Progressive and continual implementation of temporary sediment controls;

- Diversion of runoff from disturbed areas to sediment control structures;
- Management of turbid water in basins after rain through flocculation or extraction and use for construction or dust suppression;
- Construction of temporary sediment traps at strategic locations;
- Routine maintenance of sediment control devices to ensure that they remain fully functional at all times.
- Removal of sediment from basins and other structures and placement in secure locations where further movement will not occur;
- Minimisation of transportation of mud and soil by vehicles onto Erskine Drive, through the use of shakers and wash-bays;
- Provision for regular inspections of the control measures by a trained personnel to review and update control measures. Inspections should be conducted weekly and immediately after every significant storm event;
- Dust control through progressive revegetation and application of water;
- A procedure to ensure that water is not released from basins until achieving the appropriate quality standard; and
- Meeting EPA requirements & the guidelines of the “Blue Book”.

# SECTION C – SUMMARY

# 5. EXECUTIVE SUMMARY

The development of Lot 62 Lenore Drive in the suburb of Erskine Park is subject to stormwater quantity and quality controls by the Department of Planning and Penrith City Council.

The site is currently in a natural state condition covering a total area of 13.49ha.

The proposed development consists of three industrial (3) warehouses incorporating a printing facility over a developable area of 10.53ha. The remaining area consists of an electrical transmission easement.

The stormwater management strategy for the development provides for an On-Site Detention System capable of reducing the discharge from the site to pre-development conditions. The OSD has been sized using a runoff routing model in DRAINS software. The OSD system consists of seven (7) individual OSDs detaining different catchment areas on site. Reference should be made to the drawings under Appendix 2 for OSD layout.

The water quality discharge from the site has been simulated using MUSIC model to determine if the proposed train treatment approach adopted is efficient in reducing the pollutant concentration below target values set by Penrith City Council.

The following treatment train approach has been adopted:

- A 100,000 litres capacity rainwater reuse tank has been installed to capture half the roof water of warehouses 2 & 3 for reuse in toilet flushing and irrigation of planter beds and landscaped areas;
- Gross pollutant traps have been provided to treat litter and other coarse sediments from the surface runoff prior to discharging into the bio-retention swale; and
- A bio-retention swale has been allowed for in the landscaped setback fronting Lenore Drive to treat fine particles.

The simulation results indicate that the system has sufficient efficiency to reduce the impact of the stormwater discharge onto the receiving system.

# SECTION D – APPENDICES

# APPENDIX 1

## Drawings