RobertBirdGroup

Stormwater Management Plan

North Ryde Station Urban Activation Precinct

State Significant Development Application in respect of Lot 4 in DP 1131774 and Lot 160 in DP 1136651

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1.0 Introduction

1.1 Purpose of Document

This Stormwater Management Plan (SWMP) has been prepared by Robert Bird Group (RBG) who have been engaged by Urban Growth NSW (UG NSW) to provide civil engineering design in respect of Lot 4 in DP 1131774 (Station Site North) and Lot 160 in DP 1136651 (Station Site South), being part of the North Ryde Station Urban Activation Precinct (UAP). In this report the land contained in both lots is referred to as the "Site".

The purpose of this document is to address the management of stormwater and water sensitive urban design (WSUD) to support a State Significant Development Application (SSDA) for the Site. The SSDA seeks consent for subdivision, road opening, and road and infrastructure works. In this report the proposed works are referred to as the "Roadworks".

This report presents the investigation and analyses results for the proposed stormwater management systems for the Site.

The following Director General's Requirements (DGRs) are addressed in this report:

- Water Quality – This SWMP provides water quality and quantity targets for discharges from the site and outlines proposed water quality treatment measures for the public road reserve and development controls for future lot development;
- Integrated Water Management – Section 3.0 of this SWMP is intended to constitute and Integrated Water Management Plan as required by Section 4.4 of the North Ryde Station DCP 2013;
- Erosion and Sediment Control Plan – Section 3.4 of this SWMP addresses construction stage water management considerations, including an erosion and sediment control plan as required by Section 6.3.4 of Part 4.5 of the Ryde DCP; and,
- Flooding –Section 2.4 of this SWMP demonstrates that the development is compatible with the flood hazard of the land. Consideration is given to the Macquarie Park Flood Plain Risk Management Study and Plan (Bewsher 2011) which identifies flood hazards within Macquarie Park. The proposed development shall not have adverse impacts on existing flood behaviour with post-development flows limited to the pre-development conditions (Storm Consulting 2012, p 8).

1.2 The North Ryde Station Urban Activation Precinct

The NSW Government's Urban Activation Precinct (UAP) Programme identifies areas considered to have wider social, economic or environmental significance for the community or to have development significance important to the future planning objectives of the NSW Government. The Site forms part of the North Ryde Station UAP.

The North Ryde Station UAP (NRSUAP) is located within the Macquarie Park Corridor, a predominately commercial area that lies between the M2 Motorway and Epping Road, North Ryde. The NRSUAP is divided into three sites: Lot 101 in DP 1131776 (the M2 Site), Station Site North, and Station Site South. This report relates only to Station Site North and Station Site South and not to other areas of the NRSUAP.

1.3 References and Inputs

Various investigations and assessments were prepared in support of the rezoning for the North Ryde Station UAP. Project documentation referenced in preparation of this SWMP includes:

- Hydrology, Flooding and WSUD Report, Storm Consulting, October 2012.
- Water, Wastewater, and Gas Servicing Strategy Report, LandPartners, November 2012.
- Preliminary Geotechnical Investigation Report, Douglas Partners, November 2012.
- Phase 2 Contamination Report, Douglas Partners, November 2012.
- Site survey, Whelans 2011.
- North Ryde Station Precinct: Planning Report, NSW Government, January 2013.
- North Ryde Station Precinct: Development Control Plan, NSW Government, December 2013 (DCP 2013).
- North Ryde Station Urban Activation Precinct: Finalisation Report, Planning and Infrastructure, NSW Government, July 2013.

Other reference documentation includes:

- Concept Servicing Strategy Report, RBG, February 2014.
- Civil Design Report, RBG, February 2014.
- Managing Urban Stormwater: Soils & Construction, 4th Edition, Landcom.
- TIDC Development Sites Report of Impacts on Epping to Chatswood Rail Line, Doc#PR_6437, August 2008;
- TIDC ECRL Underground Infrastructure Guidelines, Doc#20007300/PO-4532, May 2008;
- City of Ryde Development Control Plan 2010 (DCP 2010)
- Macquarie Park Floodplain Risk Management Study & Plan, Bewsher April 2010 (Bewsher 2010).
- Macquarie Park Floodplain Risk Management Study & Plan, Bewsher January 2011 (Bewsher 2011)

2.0 Site Characteristics

2.1 Location

The Site is located within the City of Ryde local government area at the southern end of the Macquarie Park Corridor. Comprising of a total area of approximately 3.061 hectares. The Site is bound by the M2 Motorway to the west and south, Delhi Road to the north, and the Riverside Corporate Park to the east. Refer Figure 2.1 for a Site Locality Plan.

Station Site North is adjacent to the North Ryde Railway Station and its service buildings. Access to the Site is via Road 38 (sign posted as "Leighton Way") which connects to the existing traffic signals on Delhi Road.

Figure 2.1 – Locality Plan

2.2 Topography and Drainage

Survey level information shows that Delhi Road forms a local ridge with land falling away to the north and south. Station Site North slopes in a southerly direction from RL 60 to RL 55. A crib retaining wall along a section of the northern boundary provides grade separation between Delhi Road and Station Site North.

Station Site South slopes in a southerly direction from RL 55 to RL 48. The Site ultimately drains to the M2 Motorway. Existing drainage networks are located within the Site. Refer Section 2.5 for further details on existing drainage infrastructure.

2.3 Riparian Features

The site appears to have no riparian features within 500m of the Site and hence no further consideration of waterway corridor issues has been documented in this SWMP.

2.4 Flooding

The impact of flooding at the Site is documented in the report *Macquarie Park Flood Plain Risk Management Study and Plan,* April 2010 (Bewsher 2010) and January 2011 (Bewsher 2011) undertaken by Bewsher Consulting. Flood risk to the North Ryde Station UAP is also addressed in the report *Hydrology, Flooding and WSUD Strategy Report* undertaken by Storm Consulting (Storm 2012).

The Bewsher 2011 Report provides flood mapping for Porters Creek and Lane Cove catchments, including flood levels and extents. The Bewsher reports were sourced from the Ryde City Council website.

Due to the site being located along a local ridgeline and the boundary between the Porters Creek and Lane Cove drainage catchments, flooding of the Site from external catchment overland flows is not expected.

The flood risk assessment conducted by Bewsher did not identify flood risk zones within Station Site North. Refer Figure 2.2 which is an extract of the flood risk precincts map from the Bewsher Report. The flood risk mapping does indicate medium flood risk on Delhi Road external to the site.

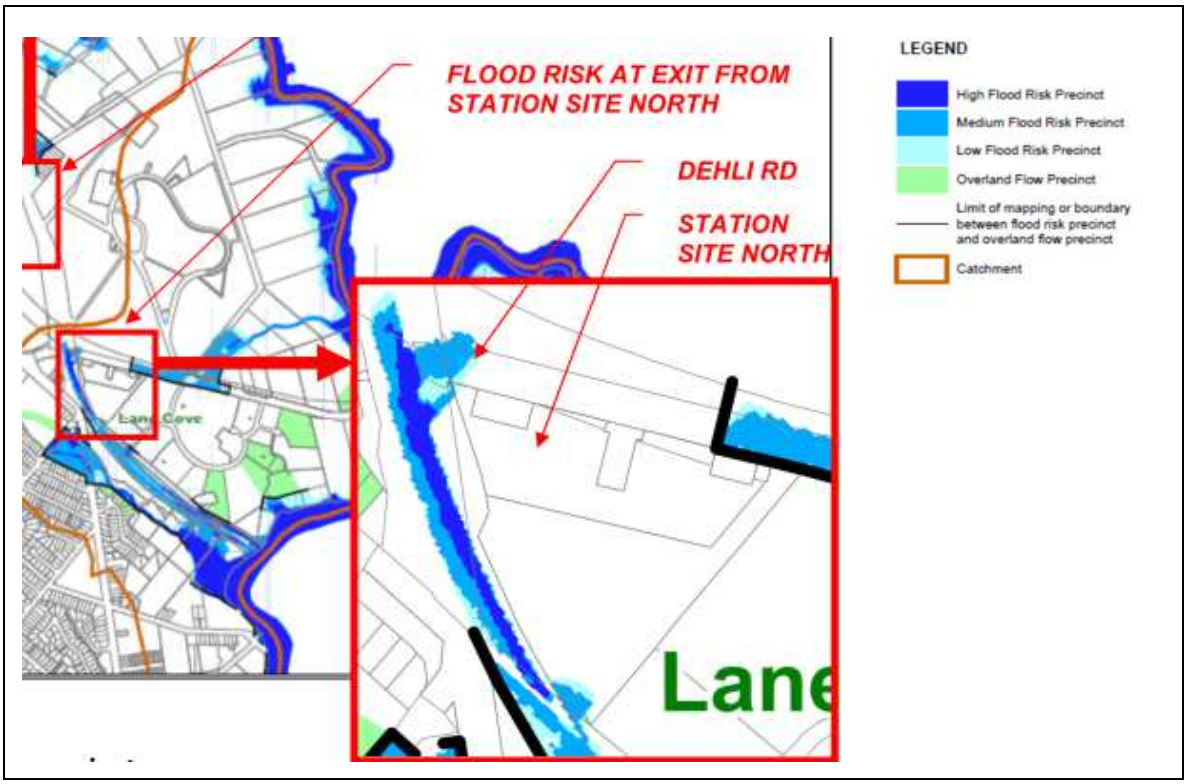

Figure 2.2- Flood Risk Precincts
(Extract from Storm 2012 Report. Flood risk mapping from Bewsher 2011 Report)

The Bewsher 2011 Report indicates localised flooding from the 100 year ARI storm event in an area within Station Site North (refer Figure 2.3). It is believed that the geospatial data used in the flood modelling may have included a localised depression in this area, possibly as a result of onsite ECRL construction activities at the time.

From review of survey information and from site inspections, this is not an area that would be susceptible to flooding as it is at the top of the catchment and on a significant grade with overland flow routes to the south. Surface water runoff will be managed by the proposed stormwater drainage systems.

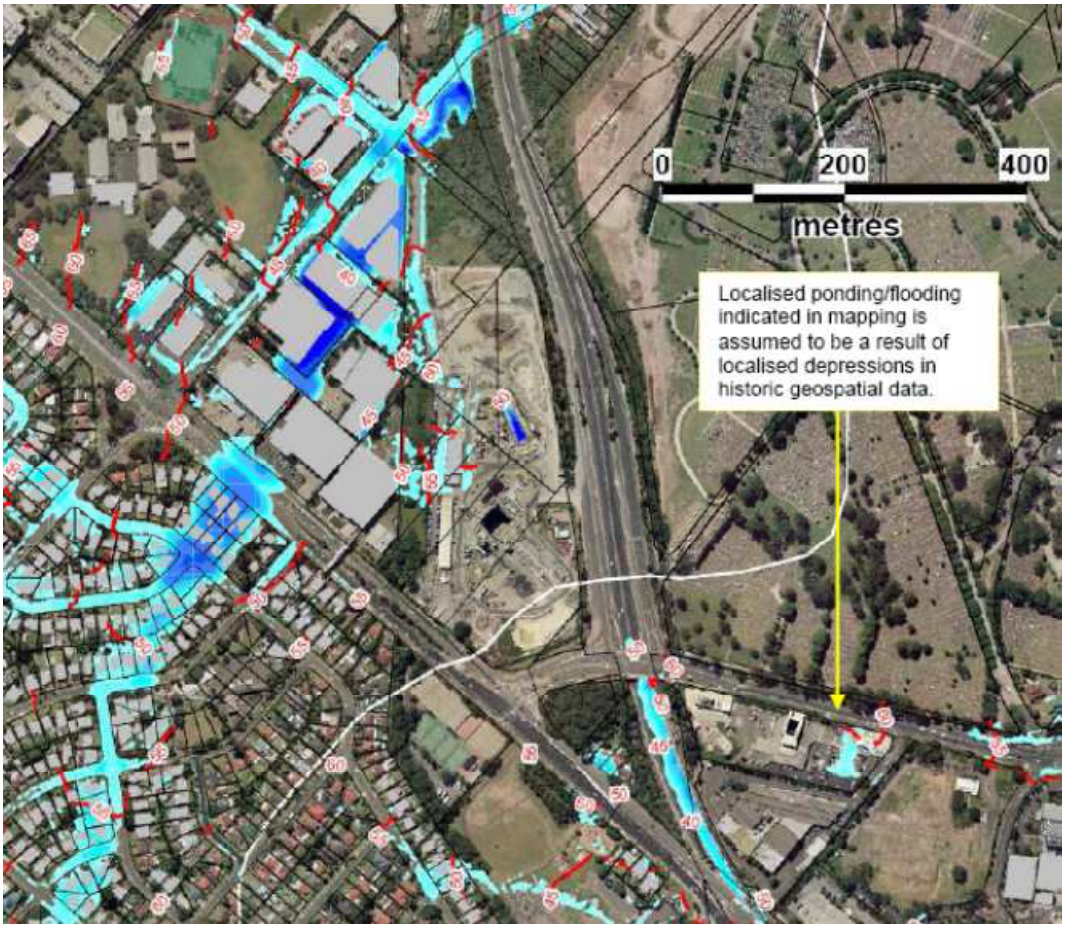

Figure 2.3 – Extract from Bewsher 2010, Figure 8.5 Simulation of 100yr ARI Flood

2.5 Existing Stormwater Infrastructure

Existing stormwater networks are located within the Site. Based on site survey (Whelans 2011) the following existing stormwater infrastructure is located within Station Site North:

- Surface inlet pits within the car park and in-ground stormwater pipe network connecting to a discharge point approximately mid block along the southern boundary of Station Site North.
- Dish drains run North to South either side of the North Ryde Station, collecting local runoff and presumably collecting groundwater seepage from the crib retaining wall. Surface inlet pits collect flows from the dish drains.
- A drainage easement is provided over the stormwater drainage network downstream of the dish drains.

Downstream of Station Site North, within Station Site South is the following stormwater infrastructure:

- An existing stormwater pipeline runs from the centre of Station Site North, drains in a westerly direction across Station Site South, and then parallel to the M2 Motorway, to the southern corner of Station Site South.
- The drainage network in Station Site South discharges to a pit located south of the site within the M2 Motorway corridor. Survey information of the network downstream of Station Site South has not been obtained. Historic design documentation refers to the downstream pipe as a 900mm diameter.
- A drainage easement is provided over the stormwater network between the Station Site North discharge location and pit within the M2 Motorway corridor.

2.6 Existing Geotechnical Conditions

A preliminary geotechnical investigation of the Site was prepared by Douglas Partners (2012) to provide an assessment of the existing geotechnical conditions. The following site specific geotechnical profile was prepared by Douglas Partners.

Unit	Material	Description
1	Filling	Shallow filling to depths of 0.15m to 0.2m.
2	Shaly Clay/ Clayey Shale	Hard shaly clay or clayey shale was encountered to depths of 2.0m to 6.5m.
3	Shale, Siltstone and Sandstone (Mittagong Formation)	Extremely low to high strength shale, siltstone and sandstone to depths of 10.8m to 13.6m.
4	Sandstone (Hawkesbury Sandstone)	Medium to high strength, fine and medium grained sandstone below approximately RL 50m was proven to depths of 40.05m to 45m with some carbonaceous silty laminate and siltstone bands at various depths.

Table 2.1 – Station Site North Geotechnical Model (Douglas Partners, 2012)

The investigation also noted that Station Site North is in close proximity to the Epping to Chatswood Rail Line (ECRL), and as such the effects of the development on the ECRL are to be considered for works within the 1st and 2nd Reserve Zones (refer TIDC ECRL Underground Infrastructure Protection Guidelines for more details on ECRL protection requirements).

Rock is generally close to the surface in the site, and accordingly it is suggested that future structures are founded on rock.

No groundwater was encountered during the Douglas Partners Site Investigation, however during site investigations conducted at the time of the ECRL construction, groundwater levels were recorded at a high of RL 47.3m within Station Site North. Only minor, periodic inflows are expected into any basement excavations, and it is expected that such inflows could be readily managed in the short and long term by the use of a normal “sump-and-pump” drainage system.

2.7 Contamination Investigation Findings

Douglas Partners has undertaken contamination investigations for the Site.

The Phase 1 Contamination Assessment determined that although the site has a history of land uses which have the potential to cause contamination, there is generally a low potential for contamination. The Limited Phase 2 Contamination Assessment identified low level contamination and concluded that the site is suitable for the proposed residential, commercial and recreational uses.

3.0 Integrated Water Management Plan

This section is intended to constitute an Integrated Water Management Plan for the Site as required by the Section 4.4 of the North Ryde Station DCP and has been developed based on the following guidelines:

- Hydrology, Flooding & WSUD Report, North Ryde Station Precinct, Storm Consulting 2012;
- Landcom WSUD Guidelines; and,
- City of Ryde Stormwater Management Technical Manual (DCP 2010).

A water sensitive urban design (WSUD) approach has been adopted for the Site to mitigate any water quality issues on downstream receiving environments. WSUD management principles that have been adopted for this project include:

- Safe conveyance of stormwater;
- Management of runoff quantities from the site in a manner which replicates pre-development conditions;
- Water quality treatment of runoff, in order to minimise adverse impacts on downstream waterways;
- Source control, and
- Incorporating stormwater management measures in to the streetscape.

In order to suit the staged delivery of the NRSUAP two strategies have been adopted to deliver an Integrated Water Management Plan. These strategies were detailed as part of the Storm 2012 Report, Section 8.0: *Integrated Water Cycle Management Plan.* The two strategies consist of:

- Public Realm Strategy; and,
- Lot- Based Strategy.

3.1 Public Realm Strategy

For this report, the Public Realm is defined as the proposed road reserve area of Station Street and Road 38 in respect of the development application for Station Site North. This road reserve area is referred to hereafter as the “Roadworks”.

The WSUD strategy and targets for the Roadworks will be achieved through treating stormwater runoff via a combination of streetscape bio-retention and stormwater pit litter baskets, in order to reduce pollutant loads prior to discharging into the existing network.

3.1.1 Environmental and Water Quality Objectives

Environmental and water quality objectives for the public realm were set out in the Storm 2012 Report. The target objectives for the Roadworks are as follows:

Objective
Achieve stormwater pollutant load reductions (as compared to untreated urban stormwater) of: o 90% reduction in the post development mean annual load of gross pollutants; o At least 85% reduction in the post development mean annual load of total suspended solids (TSS); o At least 60% reduction in the post development mean annual load of total phosphorus (TP); and o At least 45% reduction in the post development mean annual load of total nitrogen (TN)
100% of all impervious surfaces within the public realm to drain through WSUD features prior to entering stormwater network
Specify indigenous species with zero or low water/irrigation requirements (other than for bio-retention systems whereby species are specified as appropriate for the system).

3.1.2 Public Realm Stormwater Management

Stormwater Quantity

No public realm detention or retention is proposed as part of the Roadworks. Stormwater quantity management is to be addressed as part of the Lot-Based Strategies.

The DCP 2010 requires that lot-based detention is to be provided for future lot development proportional to the land area developed. It is also envisaged that lot-based retention will also be provided by future lot developers in order to meet water conservation targets, with the collection of lot runoff being used for non-potable water usage such as irrigation. Refer Section 3.2.1 for details of the proposed development controls related to water conservation.

Stormwater Quality

The primary stormwater management strategy for the Roadworks is 'Source Control'. Source control consists of the treatment of stormwater runoff via bio-retention. The proposed treatment elements for public realm include:

- Streetscape bio-retention in the form of lined bio-retention tree pits; and,
- In-ground water quality treatment devices

These elements shall be designed such that they integrate with the streetscape, whilst still achieving their treatment functions, and shall be installed as part of the Roadworks.

3.2 Lot- Based Strategy

Future lot developers will be required to meet the water management controls and targets set out in the development controls tabulated in Section 3.2.1.

In accordance with the 2013 DCP Stormwater Management Section 4.4, the following Stormwater Management objectives are outlined:

a) Provide for a Precinct-wide approach to stormwater management;
b) Reduce stormwater discharge from the site; and,
c) Improve stormwater quality and minimise water consumption through implementation of water sensitive urban design measures

The 2013 DCP also stipulates that the objectives and performance standards for water cycle outcomes that are to be achieved during construction and operation of the project be consistent with the stormwater management provisions in the Ryde DCP 2010.

3.2.1 Proposed Development Controls

Proposed development controls were set out in the Storm 2012 Report. The following development controls are proposed to be applied to the NRSUAP in order for future development to realise the Lot-Based Stormwater Management Strategies and Objectives.

Development Controls for Water Quality and Flow Management

Development Control	Reference
For pollutant load reduction requirements refer to **Section 4.4**.	City of Ryde WSUD DCP
Maintain 1 year ARI peak discharge to pre-development magnitude	City of Ryde WSUD DCP
100% of all impervious surfaces within the public domain to drain through WSUD features prior to entering stormwater network	Sustainability Target

Table 3.2.1 – Water quality and flow management

Development Controls for Water Conservation

Development Control	Reference
Reduce the Precinct's potable water needs by 50% through the use of efficient fixtures and appliances and precinct scale initiatives such as alternative water supplies for non-potable end uses	Sustainability Target
Reduce potable water demand in residential buildings by at least 50% from BASIX baseline for an average household	Minimum requirement for Residential Buildings: 40% reduction from BASIX benchmark for an average household, equivalent to 107kL/dwelling/year.
Reduce potable water demand in commercial buildings by at least 75% from NABERS baseline, matching a minimum of NABERS water 4.5 stars	Sustainability Target
Reduce potable water demand in retail buildings to achieve a 4.0 star NABERS water rating	Sustainability Target
Water use within public open space (for uses such as irrigation, pools, water features etc.) should be supplied from sources other than potable mains water (e.g. stormwater, greywater or wastewater) to meet 80% water use demand	City of Ryde WSUD DCP

Table 3.2.2 – Water Conservation

Development Controls for Stormwater Management

Development Control	Reference
All developments where there is more than one resident unit proposed on the site, the design must provide for the maximum discharge rate and the minimum storage volume appropriate for the catchment area, based on a minimum of 65% impervious development of the site area. On site stormwater detention must be provided in underground tanks to minimise the impact on the streetscape. These should not be located under the driveway. Surface storage will not be permitted in the front setback, however a small portion of the storage may be provided on the surface of the driveway.	City of Ryde DCP 2010, Part 8.2 – Stormwater Management
Sufficient storage shall be provided to ensure peak flow rates at any point within the downstream drainage system do not increase as a result of the development during storms from the 5-year to the 100-year ARI storm events of all durations.	City of Ryde DCP 2010, Part 8.2 – Stormwater Management
Stormwater runoff from all new impervious areas should be routed through the on-site detention facility. It is not necessary to route runoff from pervious surfaces (grassed surfaces) through the detention system, however, where this does occur, the detention system shall be suitably sized to account for this inflow.	City of Ryde DCP 2010, Part 8.2 – Stormwater Management
Runoff entering the site from upstream properties should be directed around the on-site detention system unless the basin has been sized to accept this flow.	City of Ryde DCP 2010, Part 8.2 – Stormwater Management

Table 3.2.3 – Stormwater Management

3.3 Concept Stormwater Drainage System

The concept stormwater drainage system for the Site includes the following:

- Stormwater runoff from the streets/footpaths is collected in bio-retention tree pits;
- In-ground stormwater drainage network within the road corridor, sized to cater for lot and road runoff.
- Lot runoff collected, treated, and detained (in accordance with the proposed development controls) prior to discharging to stormwater networks within the road corridor
- Discharge to the existing discharge connection point being a stormwater pit to the south of Station Site South.

Figure 3.1 details the proposed overland flow paths, discharge point, and piped stormwater drainage for the site. Figure 3.1 also indicates the proposed connection along Road 38 to the southern corner of Station Site South.

Sections 4.0 and 5.0 of this SWMP detail the assessments and modelling undertaken to demonstrate how the Public Realm Stormwater Management Objectives will be met.

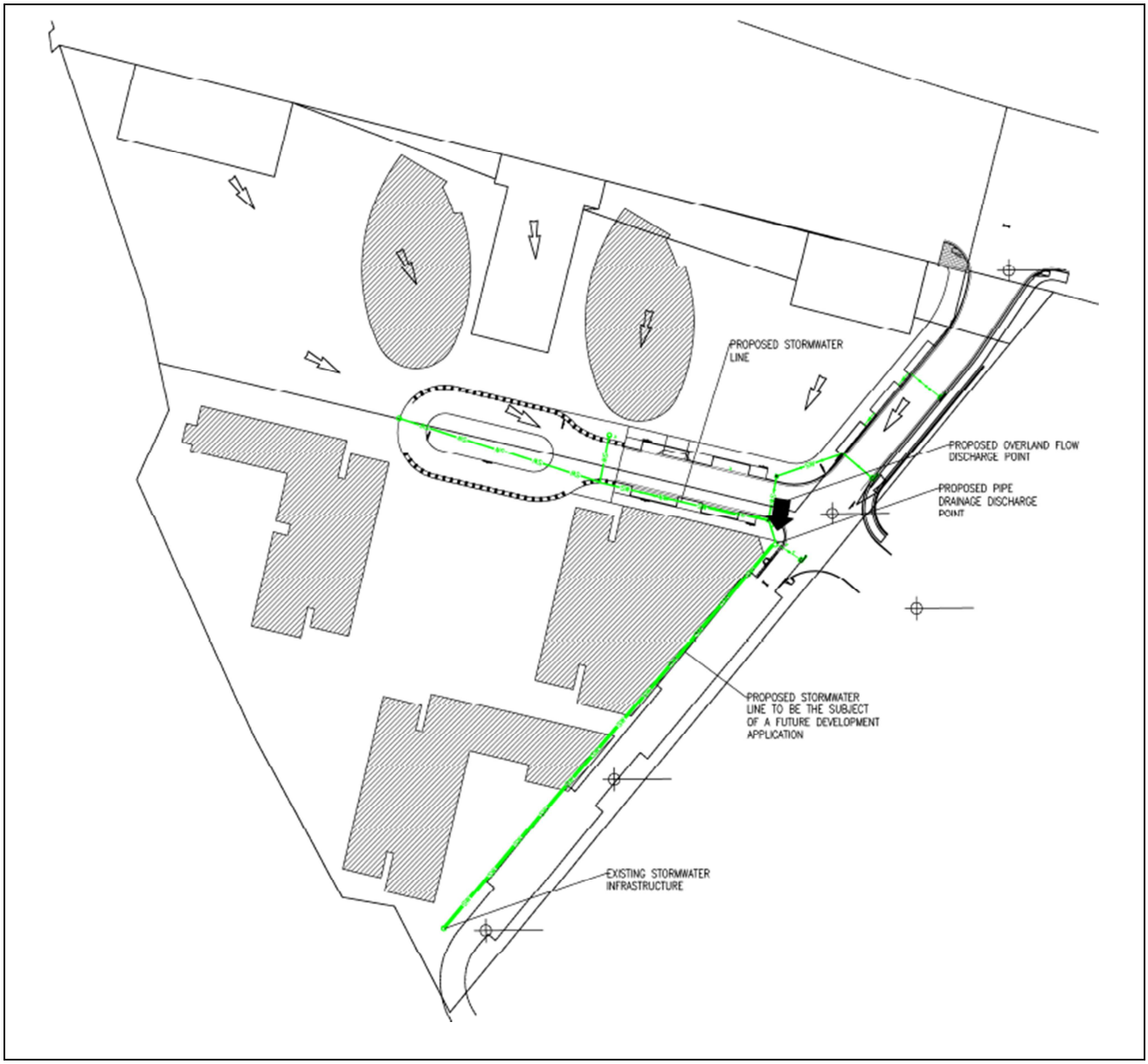

Figure 3.1 – Concept Stormwater Drainage Plan

3.4 Construction Stage

Prior to construction commencing on the Roadworks, a Water Management Plan, including erosion and sediment control measures, is to be implemented in accordance with the City of Ryde's specifications, Section 6.3.4 Part 4.5 of the Ryde DCP 2010, and the Landcom guideline *Managing Urban Stormwater: Soils and Construction.*

3.4.1 Pre-construction

Before construction activities begin, the following measures are to be implemented:

- Sedimentation fences constructed to the perimeter of the constructed area;
- Designation of areas for plant and construction material storage;
- Diversion of upstream stormwater runoff around disturbed areas of the development;
- Stabilisation of disturbed areas;
- Monitoring of stormwater quality discharging from the development and maintenance of systems to ensure controls are effective;
- Drainage structure protection devices installed to existing stormwater inlet structures within the site, and within the road ways adjacent to the site; and
- Education of site personnel to the sediment and erosion control measures implemented on site.

3.4.2 During and Post-construction

During and Post-construction following measures are to be implemented:

- WSUD elements are to be protected from flowing stormwater by adopting surface protection measures
- Construction activities to be confined to designated construction areas;
- Regular inspection and maintenance of the erosion control measures. Following rainfall events of more than 20mm, inspection of erosion control measures and removal of collected material shall be undertaken. Replacement of any damaged equipment shall be performed immediately; and
- Monitoring of water quality impacts from construction activities.

3.4.3 Erosion and Sediment Control Plan

A preliminary erosion and sediment control plan (ESCP) has been prepared for the Roadworks. The ESCP is based on site survey data and geotechnical information. Reference is given to the Landcom guideline – Managing Urban Stormwater Runoff: Soils and Construction.

The Preliminary Geotechnical Report indicates that 'natural site soils are of high plasticity clays with a relatively high potential for movement with changes in moisture content'. As such, Type F soil category has been adopted for design (as per Landcom report).

The erosion and sediment control measures proposed for Station Site North include:

- A sediment basin with sediment storage volume, discharge connections to the existing in-ground stormwater network.
- Sediment fences around stockpiles and construction zones where soils are exposed.

- Catch drains/bunds to collect construction site runoff and convey flows to the settling basin
- A primary collection point (PCP) in the works zone to collect works zone runoff. Discharge line to the settling basin.
- Sediment protection devices on existing and proposed inlet pits i.e. filter socks.

Vehicular access shall be provided to the sediment basin to enable regular maintenance and sediment removal.

Soil management measures shall be in accordance with City of Ryde Council DCP 2010 Section 6.3.4.

Preliminary Erosion and Sediment Control drawings are included in Appendix A.

4.0 Stormwater Quantity Assessment

Stormwater runoff quantity has been considered for the entire Station Site North catchment, including the proposed Public Realm road reserve areas of Station Street and Road 38 (the Roadworks in respect of the development application). The stormwater quantity assessment for Station Site South shall be the subject of a separate submission (by others).

4.1 Stormwater Quantity Modelling Approach

Stormwater runoff quantity has been modelled for three scenarios, including (1) the existing conditions; (2) Roadworks developed, and (3) Post-development with lot-based detention. Consideration in each scenario has been given to the peak flows for both the pre-development and post-development conditions in accordance with the relevant council guidelines and standards.

The intention for the Public Realm works is to ensure the post-development peak flows do not exceed the pre-development peak flows. For future lot development, peak flows will be reduced through the implementation of lot-based detention. These detention basins have been approximately sized using the City of Ryde's WSUP DCP guidelines, however these post development flows have only been modelled to indicate the scale of flow reduction that could be expected. It will be the responsibility of the future lot developer to design and provide detention systems.

A major/minor storm drainage philosophy has been adopted for Station Site North. The minor design storm considered is the 20 year ARI and will be conveyed in stormwater drainage pipes. The major storm event is 100 year ARI with excess stormwater runoff safely discharging within the roads and overland flows paths

Due to the total catchment being greater than 10,000 sq. m. the flow rates have been calculated using the modelling software DRAINS, with the results of the various scenarios summarised in the following sections.

A summary of the IFD data taken from Bureau of Meteorology website is presented in Table 4.1.

ARI (years)	**20**	**100**
6 Minute Rainfall Intensity (mm/hr)	185	238
10 Minute Rainfall Intensity (mm/hr)	153	198
1 Hour Rainfall Intensity (mm/hr)	65.4	85.9
12 Hour Rainfall Intensity (mm/hr)	15.1	20.4
24 Hour Rainfall Intensity (mm/hr)	10.0	13.6
72 Hour Rainfall Intensity (mm/hr)	4.91	6.67

Table 4.1 – Rainfall Intensities for North Ryde Station

4.2 Existing Conditions

For the DRAINS analysis, the Station Site North was split into sub-catchments and the percentage of impervious areas was estimated. The stormwater network was modelled based on information from site survey data, and the peak discharge flows from the site were calculated for the minor and major storm events. Results from this analysis are included in Table 4.2.

4.3 Roadworks – Station Street and Road 38

As the existing site is a paved car park, the proposed Roadworks for Station Site North result in no change in the surface conditions (percentage of impervious area) within the catchment. As such it is assumed to have a negligible effect on the existing scenario peak discharge. Refer Section 4.5 for the results of the hydraulic modelling.

The Station Street and Road 38 stormwater network is designed to accommodate the peak design flows.

4.4 Post-Development with Lot Based Detention

The stormwater management section of the Ryde DCP 2010 specifies that sufficient storage and on-site underground detention basins be implemented for each lot within the North Ryde Station UAP.

For the analysis of the post-development scenario, detention storage was modelled for the future lot area. Results from this analysis are detailed in Section 4.5. This is an indicative analysis only, as final lot configurations and detention tank sizing will be the responsibility of future lot developers in accordance with the Site development controls.

4.5 Comparison between Modelled Scenarios

Table 4.2 below summarises the results of the scenario modelling.

The analysis of the Existing Condition scenario and Roadworks scenario indicates a minor reduction in peak discharges for the Roadworks scenario. This minor reduction in peak flow is a result of re-routing of catchment flows to the new network proposed in Station Street and Road 38.

The analysis of the Existing Condition scenario and Post-Development scenario indicates a significant reduction in stormwater discharge from the site as a result of the lot-based detention. These flows are indicative only and subject to lot development design by future developers.

	Scenario 1: Existing Conditions	**Scenario 2: Roadworks**	**Scenario 3: Post Development**
Peak Discharge (Q_{20})	0.576 m^3/s	0.491 m^3/s	0.396 m^3/s
Peak Discharge (Q_{100})	0.762 m^3/s	0.709 m^3/s	0.478 m^3/s

Table 4.2 – Peak Discharge Flows for the 20 Year and 100 Year ARI Storms

4.6 Legal Point of Discharge

The legal point of discharge for the site is proposed to be at the south-eastern corner of Station Site North on Road 38. From this point it shall be conveyed south across Station Site South and discharge to an existing pit within the M2 Motorway corridor (the pit that currently receives Station Site North flows).

5.0 Stormwater Quality Assessment

Stormwater quality modelling has been undertaken for the proposed Public Realm road reserve areas of Station Street and Road 38 (the "Roadworks" in respect of the development application for Station Site North) in order to quantify the WSUD measures required to meet the Water Quality Objectives as set out in Section 3.1.1. The stormwater quality assessment for Station Site South shall be the subject of a separate submission (by others).

For the purposes of modelling, it has been assumed that discharges from the private domain (Lot-Based Strategies) will meet the minimum water quality targets. The design of the Lot-based WSUD measures is not within the scope of this SWMP.

The software package "MUSIC" was used to assess the effectiveness of the treatment devices intended for the Roadworks compared with two other land use scenarios. The three land use scenarios analysed in this study are:

- Pre-settlement ("natural") conditions;
- Post-development with no treatment measures; and
- Post-development with treatment measures.

Details of the MUSIC modelling exercise and results from that analysis are summarised in the following sections.

Water quality control was undertaken using a *treatment train* approach. All stormwater runoff from the Roadworks is filtered through either the streetscape bio-retention systems, or where bio-retention is not practical, though a proprietary in-ground treatment device (such as an Enviropod, or similar), to reduce the total pollutant loads, before entering the stormwater reticulation system and discharging from the site.

5.1 Pollutants of Concern

The key pollutants expected to be generated from Station Site North are listed below. It should be noted that site pollutants are not limited to these listed, more so, this provides a guide to the pollutants that are typically generated in sites similar to this.

- Litter;
- Sediment;
- Nutrients (Nitrogen and Phosphorus);
- Hydrocarbons (including oil and grease);
- Heavy Metals (often associated with fine sediments); and
- Surfactants (for example, detergents from car washing).

It is also important to consider the pollutants that are generated during the construction phase of the development. Typical construction phase pollutants and the sources of such pollutants are provided in Table 5.1. Measures to mitigate these pollutants have been discussed in more detail in the Section 3.4.

Pollutant	Source
Litter	Paper, construction packaging, food packaging, cement bags, off-cuts
Sediment	Unprotected exposed soils and stockpiles during earthworks and building
Hydrocarbons	Fuel and oil spills, leaks from construction equipment
Toxic Materials	Cement slurry, asphalt prime, solvents, cleaning agents, washwaters
pH Altering Substructures	Cement slurry and washwaters

Table 5.1 – Pollutants Typically Generated During the Construction Phase

5.2 Water Quality Objectives

The target pollutant removal rates (as noted in Section 3.1.1) are summarised in Table 5.2.

Pollutants	Target Pollutant Removal Rates
Gross Pollutants	90%
Total Suspended Solids (TSS)	85%
Total Phosphorus (TP)	60%
Total Nitrogen (TN)	45%

Table 5.2 – Target Pollutant Removal Rates

5.3 Assessment Methodology (MUSIC)

MUSIC, or Model for Urban Stormwater Improvement Conceptualisation, is a modelling tool for urban stormwater systems that predicts the performance of stormwater management systems. MUSIC can measure the expected pollutant levels across various catchment areas and can be used to estimate the long-term annual average stormwater volume generated by a catchment. In this case the software will be used to find the volumes of the expected stormwater over our catchments areas and simulate the effectiveness of the treatment devices in achieving the required minimum WSUD targets.

For this model, the Roadworks has been separated into sub-catchment areas with appropriate WSUD devices individually treating each sub-catchment. This simulates the stormwater runoff from the road reserve sub-catchments as passing through either the streetscape bio-retention or an in-ground treatment device (i.e. Enviropod), before entering the stormwater drainage system and discharging from the site.

The City of Ryde Council's *Water Sensitive Urban Design Music Modelling Guidelines* outlines the preferred rainfall and evapotranspiration datasets to be used when undertaking stormwater quality assessments in the North Ryde area. The parameters used in this assessment are in accordance with those guidelines and are discussed in the following sub-sections.

5.3.1 Rainfall

Council requires all stormwater quality modelling in MUSIC to use rainfall data from the Sydney Airport AMO station. The modelling period is recommended to be from 1988 to 1998 with a rainfall interval of 6 minutes. The recommended rainfall data for Station Site North is summarised in Table 5.3.

Rainfall Station	Modelling Period	Annual Rainfall (mm)
066037 – Sydney Airport AMO	1988 to 1998	1087

Table 5.3 – Recommended 6 Minute Rainfall Station

5.3.2 Potential Evapotranspiration Data

Local Potential Evapotranspiration (PET) data was not available for Station Site North, hence average monthly data from Sydney has been used. Average Sydney PET is suitable for use in modelling water quality and hydrology as discussed in the Council's MUSIC guidelines. A summary of the monthly PET for the Sydney region is summarised in Table 5.4.

Month	J	F	M	A	M	J	J	A	S	O	N	D
PET (mm)	180	135	128	85	58	43	43	58	88	127	152	163

Table 5.4 – Monthly Evapotranspiration data for Sydney

5.3.3 Soil Properties

The following soil characteristics are recommended in the Council's MUSIC guidelines:

Parameter	Units	Urban	Non-Urban
Impervious Area Parameters			
Rainfall Threshold	mm	1.4	1.4
Pervious Area Parameters			
Soil Capacity	mm	170	210
Initial Storage	%	30	30
Field Capacity	mm	70	80
Infiltration Capacity Coefficient a		210	175
Infiltration Capacity Coefficient b		4.7	3.1
Groundwater Properties			
Initial Depth	mm	10	10
Daily Recharge Rate	%	50	35
Daily Baseflow Rate	%	4	20
Deep Seepage	%	0	0

Table 5.5 – Soil Properties for MUSIC Source Nodes

5.3.4 Pollutant Generation

The pollutant parameters that have been adopted for this model are outlined in Table 5.6. They align with the comprehensive literature review undertaken by Duncan et.al. (1999) and forms the basis for the default values of event mean concentrations in MUSIC for Total Suspended Solids (TSS), Total Phosphorus (TP) and Total Nitrogen (TN).

Land Use Category		Log_{10}TSS (mg/L)		Log_{10}TP (mg/L)		Log_{10}TN (mg/L)	
		Base Flow	Storm Flow	Base Flow	Storm Flow	Base Flow	Storm Flow
General Urban Residential Industrial Commercial	Mean Std Dev	1.20 0.17	2.15 0.32	-0.85 0.19	-0.60 0.25	0.11 0.12	0.30 0.19
Forest/Natural	Mean Std Dev	0.78 0.17	1.60 0.32	-1.52 0.19	-1.10 0.25	-0.52 0.12	-0.05 0.19
Road Areas	Mean Std Dev	- -	2.43 0.32	- -	-0.30 0.25	- -	0.34 0.19
Roof Areas	Mean Std Dev	- -	1.30 0.32	- -	-0.89 0.25	- -	0.30 0.19

Table 5.6 –Pollutant Generation for MUSIC Source Nodes

5.4 Pre-Development Model

A Roadworks area of 3,760m^2 has been modelled, which includes Station Street and Road 38 road reserves. For the pre-development scenario, "natural" conditions were modelled in MUSIC Refer to Figure 5.1 for the simple network diagram developed in MUSIC. The network uses the Forest/Natural pollution generation data in Table 5.6, and zero percent impervious area has been assumed. By modelling the "natural" conditions an assessment on the overall impact of urbanisation can be undertaken. The annual pollutant loads have been presented in Table 5.7.

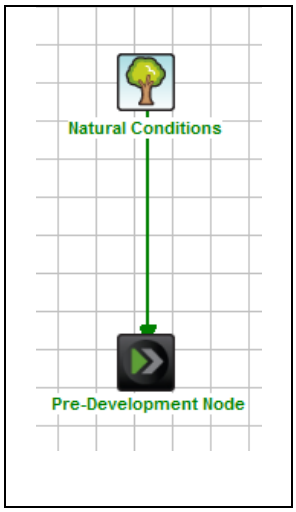

Figure 5.1 – MUSIC Pre-Development Network Diagram

5.5 Post-Development Model (Without Treatment Devices)

The proposed scenario with no treatment was modelled to enable the impact that the development has on pollutant loads. Each 'Road' node has been assumed to have an impervious area percentage of 100%. The MUSIC network diagram for the post-development model without treatment devices is presented in Figure 5.2 and the annual pollutant results summarised in Table 5.7.

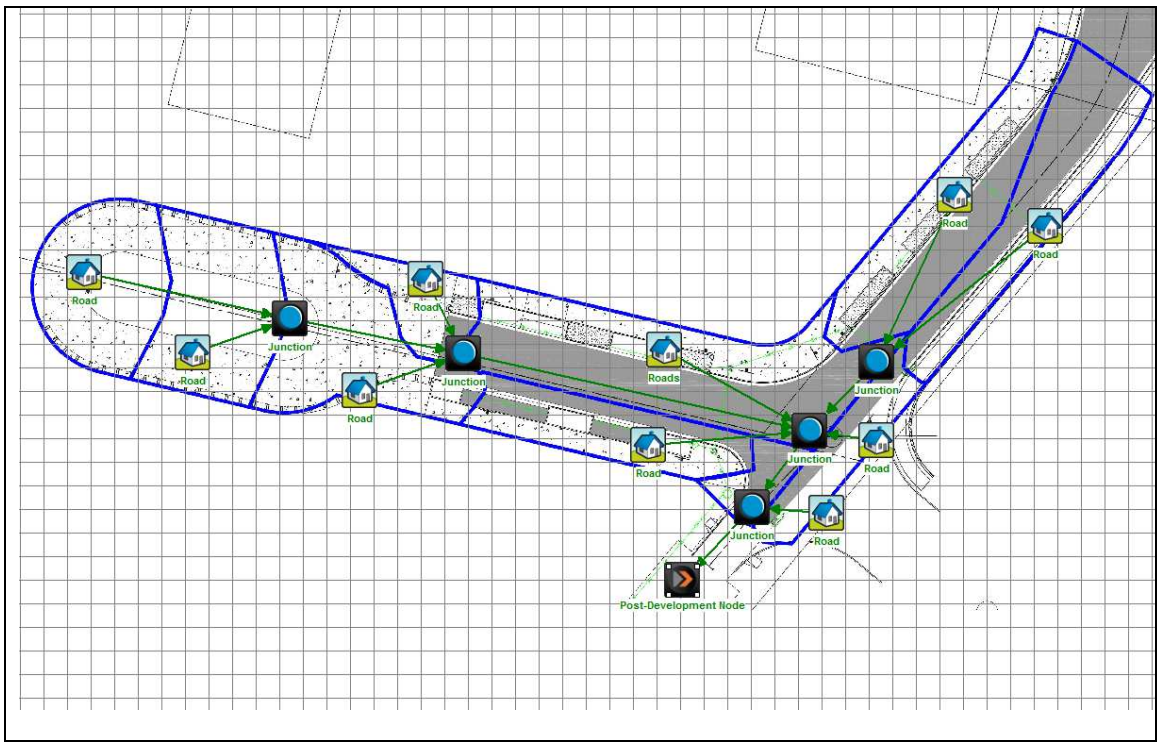

Figure 5.2 – MUSIC Treatment Train Diagram (No Treatment)

5.6 Post-Development Model (With Treatment Devices)

A post development (with treatment devices) scenario has been modelled using MUSIC with similar parameters and assumptions to those discussed in Section 5.5.

For Station Site North Roadworks it is proposed that water quality treatment measures include a combined total of 227m^2 of streetscape bio-retention and two Enviropods filter baskets (or similar). This system is designed such that each sub-catchment area passes through the WSUD device before entering the proposed stormwater infrastructure. As previously mentioned, it is the responsibility of the future lot developers to meet water quality targets for areas outside the Public Domain, and select appropriate treatment devices, for each lot. No external catchments contribute to the site.

The MUSIC network diagram is displayed in Figure 5.3.The streetscape bio-retention is explained in greater detail in Section 5.6.1 including the node properties for the MUSIC model.

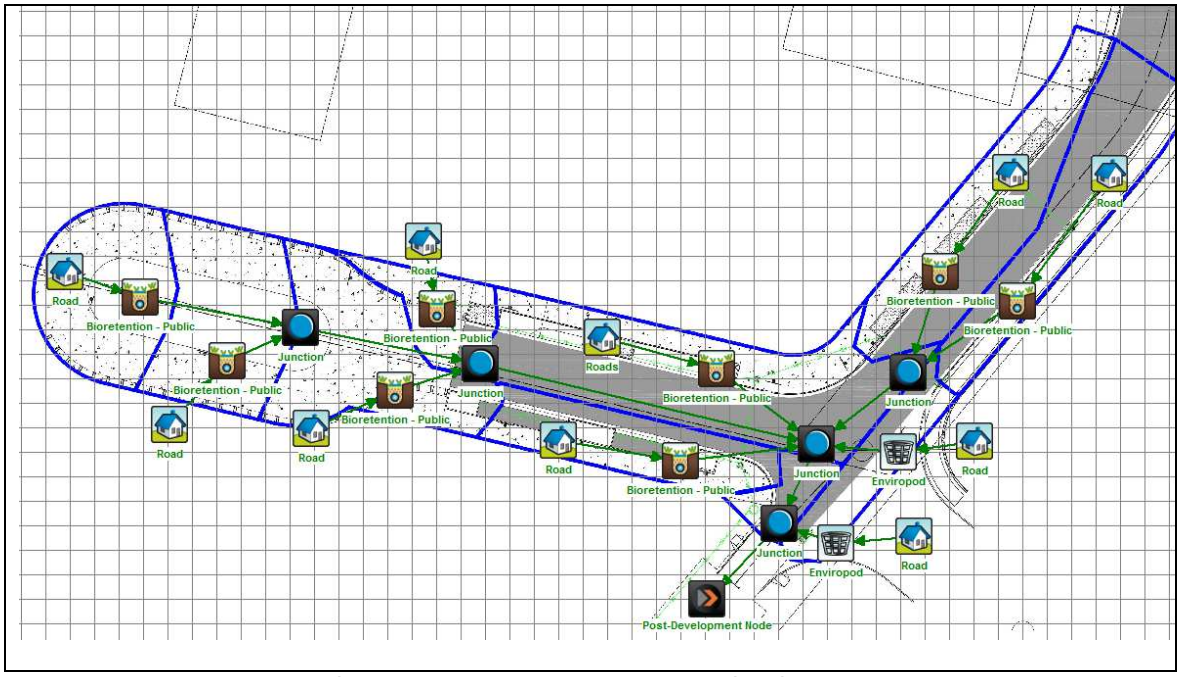

Figure 5.3 – MUSIC Treatment Train Diagram

5.6.1 Streetscape Bio-Retention Treatment

Bio-retention treatment facilitates the removal of pollutants from local catchments, by capturing runoff in the bio-retention areas that remove pollutants via plants (nutrient uptake) and filter media. They are effective in reducing the concentration of suspended solids (TSS), phosphorus (TP) and nitrogen (TN).

In accordance with Council's MUSIC guidelines the properties detailed in Figure 5.4 have been adopted for modelling the bio-retention nodes. It is noted that the surface area and filtration area is variable dependant on the catchment size and sizing limitations.

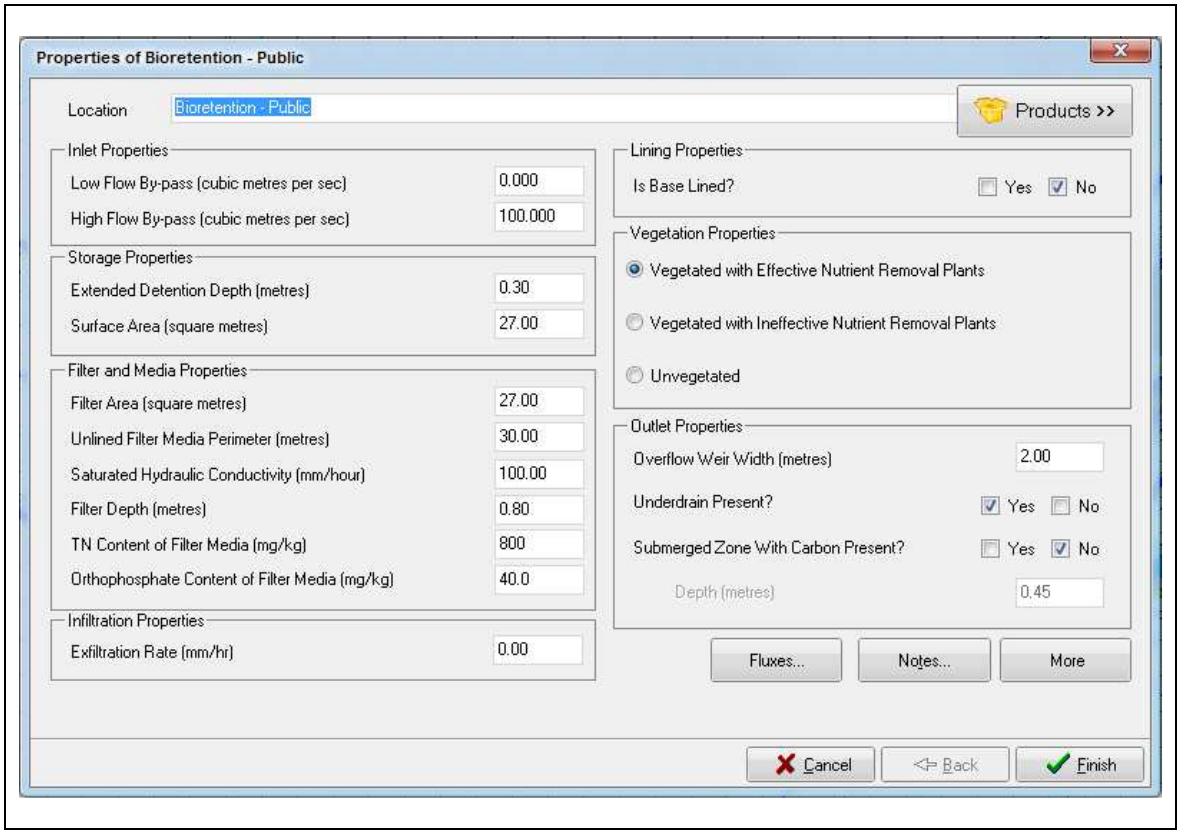

Figure 5.4 – Bio-retention Properties for MUSIC

5.6.2 Stormwater360 Enviropod

The Stormwater360 Enviropod is a cost-effective and easily maintained gully pit insert that is effective at removing significant portions of litter, debris, and other pollutants from urban runoff. In this proposed treatment train two (2) Enviropods have been modelled to treat sub-catchment areas where bio-retention is not practical. Stormwater360 have specific MUSIC nodes for their proprietary in-ground treatment devices, including the enviropod which has been used for simulating these proprietary products in the model.

Other proprietary devices may be substituted subject to demonstrating they meet the required water quality treatment requirements.

5.7 Water Quality Treatment Train Performance

The MUSIC model was used to evaluate the performance of the water quality treatment devices for a range of rainfall conditions over an eleven year period (1988-1998). The results for the proposed treatment arrangement are summarised in Table 5.7.

Pollutant	Pre-Devel.	Post-Devel. (No treatment)	Post-Devel. (with treatment devices)	Percentage Reduction	Water Quality Objective Required
Flow (ML/yr)	1.46	3.49	2.91	0%	-
Gross Pollutants (kg/yr)	0.0	90.0	0.0	**100%**	90%
Total Suspended Solids (kg/yr)	28.2	90.7	14.0	**85%**	85%
Total Phosphorus (kg/yr)	0.071	0.531	0.205	**62%**	60%
Total Nitrogen (kg/yr)	0.726	7.7	2.43	**69%**	45%

Table 5.7 – WSUD Performance Summary

These results demonstrate that the proposed WSUD treatment arrangement for the Roadworks provides adequate pollution reduction rates to stormwater runoff and meet the minimum Water Quality Objectives for the project.

The concept stormwater management plan is included in **Appendix A**.

5.8 Maintenance of Water Quality Treatment Devices

Water quality treatment devices require regular maintenance. A detailed maintenance plan is to be developed following final selection of the treatment devices to be installed. An indicative maintenance plan is provided below.

- **Bio-retention**
  - Routine inspection (3-6 monthly after rain), cleaning and maintenance of the bio-retention systems, check overflow structures/drainage pipes, removal of debris and sediment;
  - Inspection of filter media porosity (3-6 Monthly after rain). Check for accumulation of impermeable layer. Remove sediment and scarify.

- **Stormwater360 Enviropods**
  - In accordance with the manufacturer's technical manual and owner's manual;
  - Periodic (6 monthly) inspection, cleaning and removal of any gross pollutants and coarse sediment that is deposited in the device.

6.0 Stormwater Drainage Concept

This section summarises the Station Site North stormwater drainage concept and details how the post development system is to operate.

A major/minor storm drainage philosophy has been adopted for Station Site North. The minor design storm modelled is the 20 year ARI, which will be conveyed in stormwater drainage pipes. The major storm event is 100 year ARI with excess stormwater runoff safely discharging within the roads and overland flows paths.

Lot generated flows will pass through WSUD treatment devices in order to the project water quality objectives. Peak flows from lots will be reduced through on-site detention. Design of lot WSUD and detention will be by future lot developers in accordance with the DCP 2010 and project requirements (refer Section 3.2 for details).

The stormwater from the lot-developments will discharge to the stormwater reticulation network in Station Street and ultimately discharge into the existing stormwater infrastructure at the southern corner of Station Site South.

Within the Public Realm, stormwater runoff will be directed to streetscape bio-retention and in-ground treatment devices (such as Enviropods) before entering the stormwater network in Station Street and Road 38. MUSIC modelling has demonstrated that water quality targets can be reached by a combination of 227m^2 of streetscape bio-retention and two Enviropods. Proprietary treatment devices have been selected for the sub-catchment areas that were not practical to service with bio-retention. A schematic of the overall stormwater drainage concept is provided in Figure 6.1.

The site discharge point is proposed at the south-eastern corner of the site on Road 38, where a stormwater drainage line will run south and eventually join the existing infrastructure at the southern corner of Station Site South.

The proposed drainage system will collect flows from existing drainage infrastructure servicing the North Ryde Station (being the dish drains running both sides of the exposed station box). This existing drainage network (and easement) is to remain until the proposed stormwater drainage within Station Street and Road 38 (complete through Station Site South) is commissioned.

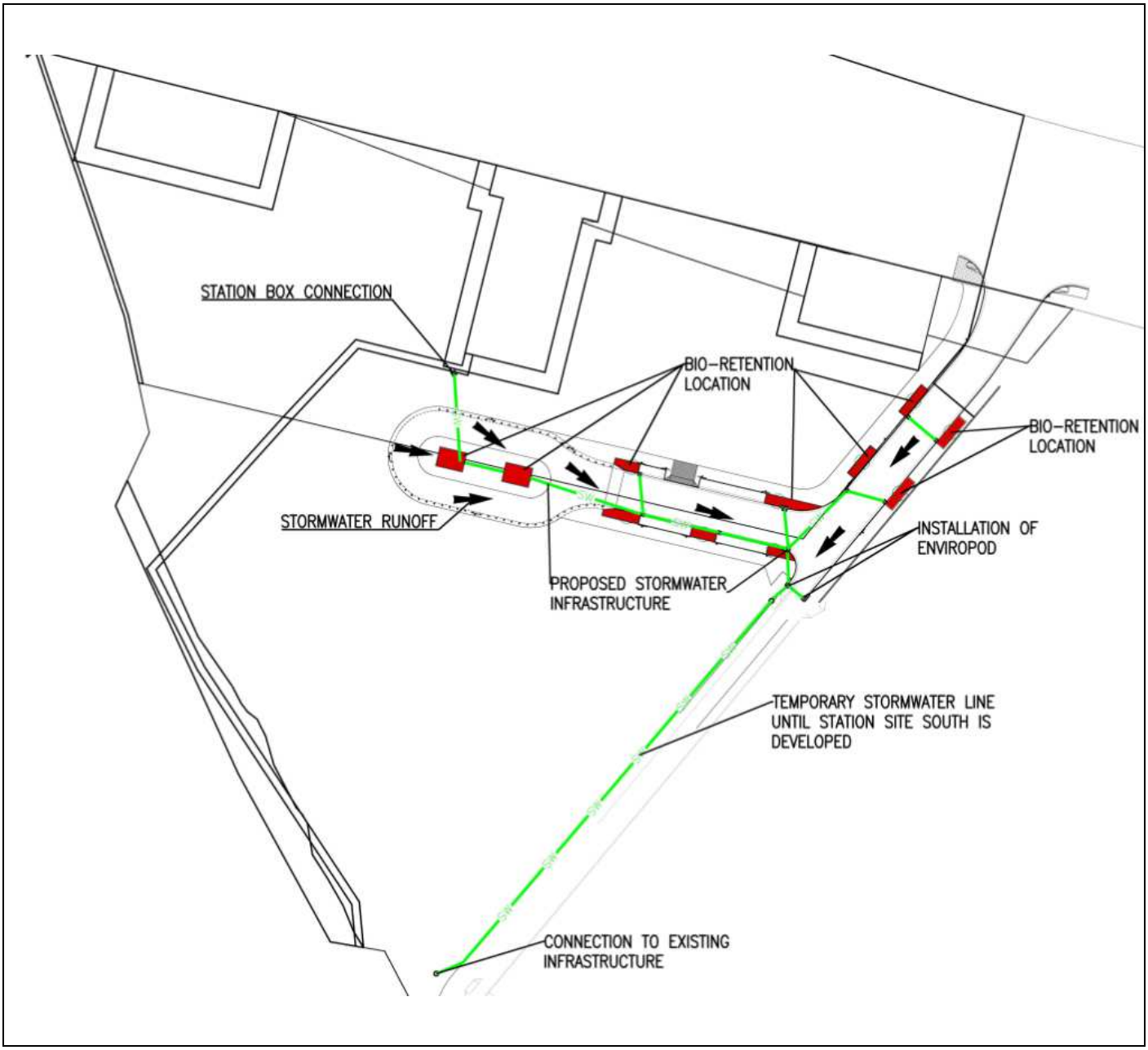

Figure 6.1 – Stormwater Concept Diagram

7.0 Stormwater Quality Monitoring Programme

Although stormwater from this development will discharge to the existing stormwater system and eventually into the Lane Cove River, the stormwater quality management proposed for Station Site North are based on best practice guidelines and therefore no stormwater quality monitoring has been proposed. The proposed measures for stormwater quality are reasonably common and well understood, and their effectiveness has been demonstrated at numerous sites throughout New South Wales.

8.0 Summary

This SWMP demonstrates that under the proposed plan, stormwater management for the site addresses the relevant DGRs, including

- Water quality – water quality targets for discharges from the site are addressed, including water quality treatment measures.
- Erosion and Sediment Control Plan – an erosion and sediment control plan has been prepared as required by Section 6.3.4 of Part 4.5 of the Ryde DCP.
- Integrated Water Management Plan – an Integrated Water Management Plan has been outlined in Section 3.0 of this SWMP.
- Flooding –This report demonstrates that the development is compatible with the flood hazard of the land.

Appendix A
Civil Design Drawings

DELHI ROAD

ECRL SERVICES BUILDING (REFER NOTE 7)

NORTH RYDE STATION (REFER NOTE 7)

ECRL SERVICES BUILDING (REFER NOTE 7)

10355 PPPL

INSTALL SHAKER GRID & WASHDOWN FACILITY AT CONSTRUCTION ACCESS POINTS. FINAL LOCATION TO SUIT CONTRACTOR'S REQUIREMENTS.

STOCKPILE

STOCKPILE

PROPOSED DISCHARGE CONNECTION TO EXISTING STORMWATER NETWORK

S B

PRIMARY SEDIMENT BASIN
SETTLING ZONE VOLUME = 100m³
SEDIMENT STORAGE VOLUME = 50m³

STATION SITE SOUTH

STATION SITES DEVELOPMENT ULTIMATE DISCHARGE POINT

TEMPORARY STORMWATER LINE. REFER SUMP FOR DETAILS.

NOTE:
1. EROSION AND SEDIMENT CONTROL SHALL BE CONSTRUCTED, MAINTAINED AND DESIGNED IN ACCORDANCE WITH:
   A. RYDE COUNCIL REQUIREMENTS;
   B. LANDCOM – MANAGING URBAN STORMWATER: SOIL AND CONSTRUCTION, 4th EDITION, MAR 2004.
2. FINAL DESIGN AND SIZING OF BASINS TO SUIT STAGING PLAN AND TEMPORARY CATCHMENTS. PRELIMINARY DESIGN ASSUMES 0.8HA CONTRIBUTING.
3. REFER GEOTECHNICAL REPORT ADP–1207–GEO–4008 FOR GEOTECHNICAL INFORMATION AND EARTHWORKS REQUIREMENTS.
4. REFER TCA "ECRL PROTECTION GUIDELINES" FOR LIMITATIONS AND CONSTRAINTS FOR WORKS IN VICINITY OF ECRL.
5. THIS CONSTITUTES A CONCEPT EROSION AND SEDIMENT CONTROL PLAN ONLY, DETAILED CONTROLS TO BE PROVIDED UPON CONFIRMATION OF STAGING AND DETAILED CIVIL WORKS.
6. CONTROLS TO BE COORDINATED WITH STATION SITE SOUTH.
7. SEDIMENT BASIN AND SUMP/ PUMP COMPONENTS TO BE REMOVED AT THE COMPLETION OF ROAD CONSTRUCTION.

LEGEND

- EARTH BANK WITH CATCH DRAIN
- PROPOSED SEDIMENT FENCE
- S B — SETTLING/SEDIMENTATION BASIN (LANDCOM DETAIL SD6–4)
- PROPOSED SHAKER GRID WITH WASH DOWN FACILITY
- PROVIDE TEMPORARY SANDBAGS AROUND PITS:
  1. AFTER PAVEMENT WORKS IF CONSTRUCTION IS STILL ONGOING UPSTREAM.
  2. TO EXISTING GRATED PITS DOWNSTREAM OF CONSTRUCTION WORKS.
- PROPOSED CONSTRUCTION VEHICLE ACCESS ROUTE
- 55.40 — PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- 55.0 — EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- PRIMARY COLLECTION POINT AND SUMP PUMP PRESSURE LINE

DO NOT SCALE DRAWINGS, USE FIGURED DIMENSIONS

REFER COVER SHEET FOR NOTES UNLESS NOTED OTHERWISE

SCALE 1:500

0 10 20 30 m

Rev.	Revision Description	By.	App.	Date
1	ISSUED FOR DEVELOPMENT APPROVAL	LAR	LWM	11.02.14
2	REVISION TO DEVELOPMENT APPROVAL DOCUMENTS	LAR	LWM	14.02.14

Rev.	Revision Description	By.	App.	Date

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Client

UrbanGrowth NSW

Title
EROSION & SEDIMENT CONTROL PLAN

Project
NORTH RYDE STATION SITE NORTH DEVELOPMENT APPROVAL

NOT FOR CONSTRUCTION

Date	Designer	Design Checker
14.02.14	L.RUSSELL	L.MELVILLE
Scale at A1	Drawn	Principal/Project Owner
AS SHOWN	S.MANANDHAR	R.LUCAS
Job Number	Drawing Number	Revision
13656	C1–01	2

GENERAL NOTES:

A1. THIS SOIL AND WATER MANAGEMENT PLAN IS TO BE READ IN CONJUNCTION WITH OTHER ENGINEERING PLANS RELATING TO THIS DEVELOPMENT.
A2. CONTRACTORS WILL ENSURE THAT ALL SOIL AND WATER MANAGEMENT WORKS ARE UNDERTAKEN AS INSTRUCTED IN THIS SPECIFICATION AND CONSTRUCTED FOLLOWING THE LANDCOM – MANAGING URBAN STORMWATER: SOIL AND CONSTRUCTION, 4th EDITION, MAR 2004.
A4. REFER GEOTECHNICAL REPORT ADP–1207–GEO–4008 FOR EARTHWORKS AND PARAMETERS.
A5. ALL SUBCONTRACTORS WILL BE INFORMED OF THEIR RESPONSIBILITIES IN REDUCING THE POTENTIAL FOR SOIL EROSION AND POLLUTION TO DOWNSLOPE AREAS.
A6. CONTRACTOR TO ENSURE EARTHWORKS AND CONSTRUCTION ACTIVITIES ARE IN ACCORDANCE WITH ECRL PROTECTION REQUIIREMENTS.

SEDIMENT BASIN CONSTRUCTION NOTES:

SB1. REMOVE ALL VEGETATION AND TOPSOIL FROM UNDER THE DAM WALL AND FROM WITHIN THE STORAGE AREA.
SB2. FORM A CUT OFF TRENCH UNDER THE CENTRELINE OF THE EMBANKMENT 600mm DEEP AND 1200mm WIDE EXTENDING TO A POINT ON THE GULLY WALL ABOVE THE RISER SILL LEVEL.
SB3. MAINTAIN THE TRENCH FREE OF WATER AND RECOMPACT THE MATERIALS WITH EQUIPMENT AS SPECIFIED IN THE SWMP TO 95% STANDARD PROCTOR DENSITY.
SB4. SELECT FILL ACCORDING TO THE DIRECTIONS OF THE SWMP THAT IS FREE FROM ROOTS, WOOD, ROCK, LARGE STONE OR FOREIGN MATERIAL.
SB5. PREPARE THE SITE UNDER THE EMBANKMENT BY RIPPING AT LEAST 100mm DEEP TO HELP BOND COMPACTED FILL TO EXISTING SUBSTRATE.
SB6. SPREAD FILL IN 100mm TO 150mm LAYERS AND COMPACT AT OPTIMUM MOISTURE CONTENT IN ACCORDANCE WITH THE SWMP.
SB7. INSTALL PIPE OUTLET WITH SEEPAGE COLLARS AS SPECIFIED IN SWMP.
SB8. FORM BATTER GRADES AT 2:1 UPSTREAM AND 3:1 DOWNSTREAM OR AS SPECIFIED IN SWMP.
SB9. INSTALL PIPE RISER AS SPECIFIED IN SWMP.
SB10. CONSTRUCT EMERGENCY SPILLWAY 300mm ABOVE SILL HEIGHT OF RISER PIPE.
SB11. REHABILITATE STRUCTURE IN ACCORDANCE WITH THE SWMP.
SB12. GEOTEXTILE TO BE REPLACED WITH THE SPECIFIED MATERIAL IF BASIN DOES NOT FREELY DRAIN WITHIN FOUR DAYS.
SB13. PLACE A "FULL OF SEDIMENT" MARKER TO SHOW WHEN LESS THAN DESIGN CAPACITY OCCURS AND SEDIMENT REMOVAL IS REQUIRED.

SITE MAINTENANCE NOTES:

SM1. THE CONTRACTOR WILL INSPECT THE SITE AT LEAST WEEKLY AND AT THE CONCLUSION OF EVERY STORM EVENT TO:
A) ENSURE THAT DRAINS OPERATE PROPERLY AND TO EFFECT AND NECESSARY REPAIRS.
B) REMOVED SPILLED SAND OR OTHER MATERIALS FROM HAZARD AREAS, INCLUDING LANDS CLOSER THAN 5 METRES FROM AREAS OF LIKELY CONCENTRATED OR HIGH VELOCITY FLOWS ESPECIALLY WATERWAYS AND PAVED AREAS.
C) REMOVED TRAPPED SEDIMENT WHENEVER THE DESIGN CAPACITY OF THAT STRUCTURES HAS BEEN EXCEEDED.
D) ENSURE REHABILITATION LANDS HAVE EFFECTIVELY REDUCED THE EROSION HAZARD TO INITIATE UPGRADING OR REPAIR AS NECESSARY.
E) CONSTRUCT ADDITIONAL EROSION AND OR SEDIMENT CONTROL WORKS AS MIGHT BECOME NECESSARY TO ENSURE THE DESIRED PROTECTION IS GIVEN TO DOWNSLOPE LANDS AND WATERWAYS. MAKE ONGOING CHANGES TO THE PLAN WHERE IT PROVES INADEQUATE IN PRACTICE OR IS SUBJECT TO CHANGES IN CONDITIONS ON THE WORK–SITE OR ELSEWHERE IN THE CATCHMENT.
F) MAINTAIN EROSION AND SEDIMENT CONTROL STRUCTURES IN A FULLY FUNCTIONING CONDITION UNTIL ALL EARTHWORK ACTIVITIES ARE COMPLETED AND THE SITE IS REHABILITATED.

SM2. THE CONTRACTOR WILL KEEP A LOGBOOK MAKING ENTRIES AT LEAST WEEKLY, IMMEDIATELY BEFORE FORECAST RAIN AND AFTER RAINFALL. ENTRIES WILL INCLUDE:
A) THE VOLUME AND INTENSITY OF ANY RAINFALL EVENTS.
B) THE CONDITION OF ANY SOIL AND WATER MANAGEMENT WORKS.
C) THE CONDITION OF VEGETATION AND ANY NEED TO IRRIGATE.
D) THE NEED FOR DUST PREVENTION STRATEGIES
THE LOGBOOK WILL BE KEPT ON–SITE AND MADE AVAILABLE TO ANY AUTHORISED PERSON UPON REQUEST. IT WILL BE GIVEN TO THE PROJECT MANAGER AT THE CONCLUSION OF THE WORKS.

SEDIMENT CONTROL NOTES:

SC1. SEDIMENT FENCES WILL BE INSTALLED AS SHOWN ON THE PLAN AND ELSEWHERE AT THE DISCRETION OF THE SITE CONTRACTOR TO CONTAIN SOIL AS NEAR AS POSSIBLE TO THEIR SOURCE.
SC2. SEDIMENT FENCES WILL NOT HAVE CATCHMENT AREAS EXCEEDING 900 SQUARE METRES AND HAVE A STORAGE DEPTH OF AT LEAST 0.6 METRES.
SC3. SEDIMENT REMOVED FROM ANY TRAPPING DEVICES WILL BE RELOCATED WHERE FURTHER POLLUTION TO DOWNSLOPE LANDS AND WATERWAYS CANNOT OCCUR.
SC4. STOCKPILES ARE NOT TO BE LOCATED WITHIN 5 METERS OF HAZARD AREAS INCLUDING AREAS OF HIGH VELOCITY FLOWS SUCH AS WATERWAYS, PAVED AREAS AND DRIVEWAYS.
SC5. WATER WILL BE PREVENTED FROM DIRECTLY ENTERING THE PERMANENT DRAINAGE SYSTEM UNLESS THE CATCHMENT AREA HAS BEEN PERMANENTLY LANDSCAPED AND/OR WATER HAS BEEN TREATED BY AN APPROVED DEVICE.
SC6. TEMPORARY SEDIMENT TRAPS WILL REMAIN IN PLACE UNTIL AFTER THE LANDS THEY ARE PROTECTING ARE COMPLETELY REHABILITATED.
SC7. ACCESS TO SITES SHOULD BE STABILIZED TO REDUCE THE LIKELIHOOD OF VEHICLES TRACKING SOIL MATERIALS ONTO PUBLIC ROADS AND ENSURE ALL–WEATHER ENTRY/EXIT.

LAND DISTURBANCE NOTES:

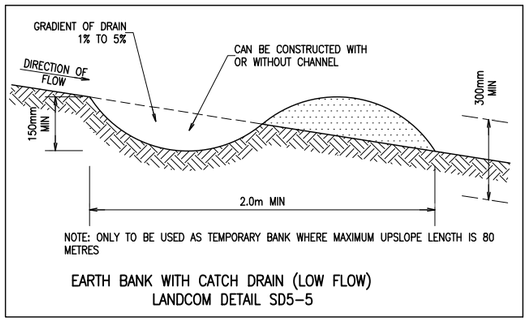
LD1. ACCESS AREAS ARE TO BE LIMITED TO A MAXIMUM WIDTH OF 10 METERS THE SITE MANAGER WILL DETERMINE AND MARK THE LOCATION OF THESE ZONES ON–SITE. ALL SITE WORKERS WILL CLEARLY RECOGNIZE THOSE BOUNDARIES THAT, WHERE APPROPRIATE, ARE IDENTIFIED WITH A BARRIER FENCING (UPSLOPE) AND SEDIMENT FENCING (DOWNSLOPE) OR SIMILAR MATERIALS.
LD2. ENTRY TO LANDS NOT REQUIRED FOR CONSTRUCTION OR ACCESS IS PROHIBITED EXCEPT FOR ESSENTIAL THINNING OF PLANT GROWTH.
LD3. WORKS ARE TO PROCEED IN THE FOLLOWING SEQUENCE:
A) INSTALL ALL BARRIER AND SEDIMENT FENCING WHERE SHOWN ON THE PLAN.
B) CONSTRUCT THE STABILISED SITE ACCESS.
C) CONSTRUCT DIVERSION DRAINS AS REQUIRED.
D) INSTALL MESH AND GRAVEL INLETS FOR ANY ADJACENT KERB INLETS.
E) INSTALL GEOTEXTILE INLET FILTERS AROUND ANY ON–SITE DROP INLET PITS.
F) CLEAR SITE AND STRIP AND STOCKPILE TOPSOIL IN LOCATIONS SHOWN ON THE PLAN.
G) UNDERTAKE ALL ESSENTIAL CONSTRUCTION WORKS ENSURING THAT ROOF AND/OR PAVED AREA STORMWATER SYSTEMS ARE CONNECTED TO PERMANENT DRAINAGE AS SOON AS PRACTICABLE.
H) GRADE LOT AREAS TO FINAL GRADES AND APPLY PERMANENT STABILISATION (LANDSCAPING) WITHIN 20 DAYS OF COMPLETION OF CONSTRUCTION WORKS.
I) REMOVE TEMPORARY EROSION CONTROL MEASURES AFTER THE PERMANENT LANDSCAPING HAS BEEN COMPLETED.
LD4. ENSURE THAT SLOPE LENGTHS DO NOT EXCEED 80 METRES WHERE PRACTICABLE. SLOPE LENGTHS ARE DETERMINED BY SILTATION FENCING AND CATCH DRAIN SPACING.

SOIL EROSION CONTROL NOTES:

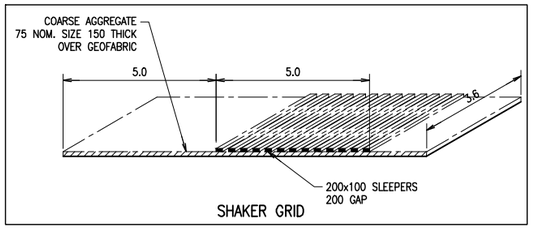
SE1. EARTH BATTERS WILL BE CONSTRUCTED WITH AS LOW A GRADIENT AS PRACTICABLE BUT NO STEEPER, UNLESS OTHERWISE NOTES, THAN THAT RECOMMENDED BY THE GEOTECHNICAL REPORT ADP–1207–GEO–4008
SE2. ALL WATERWAYS, DRAINS, SPILLWAYS AND THEIR OUTLETS WILL BE CONSTRUCTED TO BE STABLE IN AT LEAST THE 1:20 YEAR ARI, TIME OF CONCENTRATION STORM EVENT.
SE3. WATERWAYS AND OTHER AREAS SUBJECT TO CONCENTRATED FLOWS AFTER CONSTRUCTION ARE TO HAVE A MAXIMUM GROUNDCOVER C–FACTOR OF 0.05 (70% GROUND COVER) WITHIN 10 WORKING DAYS FROM COMPLETION OF FORMATION. FOOT AND VEHICULAR TRAFFIC WILL BE PROHIBITED IN THESE AREAS.
SE4. STOCKPILES AFTER CONSTRUCTION ARE TO HAVE A MAXIMUM GROUND–COVER C–FACTOR OF 0.1% (60% GROUND–COVER) WITHIN 10 WORKING DAYS FROM COMPLETION OF FORMATION.
SE5. ALL LANDS, INCLUDING WATERWAYS AND STOCKPILES DURING CONSTRUCTION ARE TO HAVE A MAXIMUM GROUND COVER C–FACTOR OF 0.15 (50% GROUND COVER) WITHIN 20 WORKING DAYS FROM INACTIVITY EVEN THOUGH WORKS MAY CONTINUE LATER.
SE6. PERMANENT REHABILITATION OF LANDS AFTER CONSTRUCTION WILL ACHIEVE A GROUND–COVER C–FACTOR OF LESS THAN 0.1 AND LESS THAN 0.05 WITHIN 60 DAYS. NEWLY PLANTED LANDS WILL BE WATERED REGULARLY UNTIL AN EFFECTIVE COVER IS ESTABLISHED AND PLANTS ARE GROWING VIGOROUSLY. FOLLOW–UP SEED AND FERTILISER WILL BE APPLIED AS NECESSARY.

WASTE CONTROL NOTES:

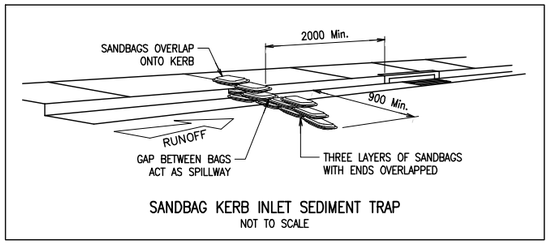
WC1. ACCEPTABLE BINS WILL BE PROVIDED FOR ANY CONCRETE AND MORTAR SLURRIES, PAINTS, ACID WASHING, LIGHTWEIGHT WASTE MATERIALS AND LITTER. CLEARANCE SERVICES WILL BE PROVIDED AT LEAST WEEKLY. DISPOSAL OF WASTE WILL BE IN A MANNER APPROVED BY THE SITE CONTRACTOR.
WC2. ALL POSSIBLE POLLUTANT MATERIALS ARE TO BE STORED WELL CLEAR OF ANY POORLY DRAINED AREAS, FLOW PRONE AREAS, STREAMBANKS, CHANNELS AND STORMWATER DRAINAGE AREAS. STORE SUCH MATERIALS IN A DESIGNATED AREA UNDER COVER WHERE POSSIBLE AND WITHIN CONTAINMENT BUNDS.
WC3. ALL SITE STAFF AD SUBCONTRACTORS ARE TO BE INFORMED OF THEIR OBLIGATION TO USE WASTE CONTROL FACILITIES PROVIDED.
WC4. ANY DE–WATERING ACTIVITIES ARE TO BE CLOSELY MONITORED TO ENSURE THAT WATER IS NOT POLLUTED BY SEDIMENT, TOXIC MATERIALS OR PETROLEUM PRODUCTS.
WC5. PROVIDE DESIGNATED VEHICULAR WASHDOWN AND MAINTENANCE AREAS WHICH ARE TO HAVE CONTAINMENT BUNDS.



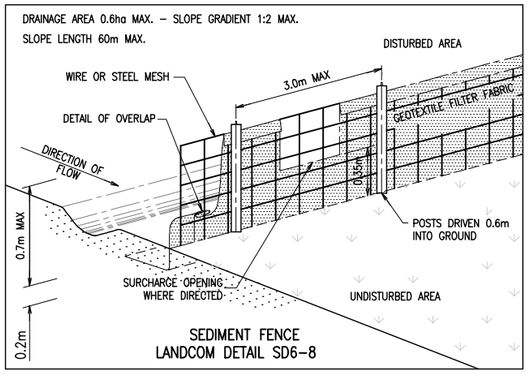
EARTH BANK WITH CATCH DRAIN (LOW FLOW)
LANDCOM DETAIL SD5–5



SHAKER GRID



SANDBAG KERB INLET SEDIMENT TRAP
NOT TO SCALE

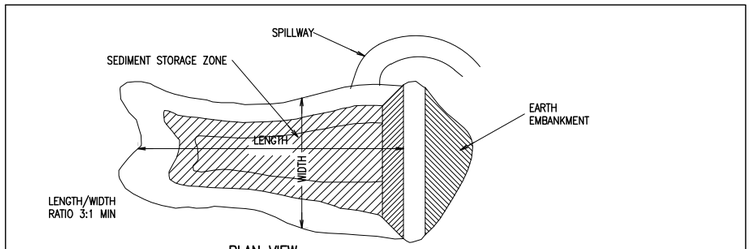


SEDIMENT FENCE
LANDCOM DETAIL SD6–8

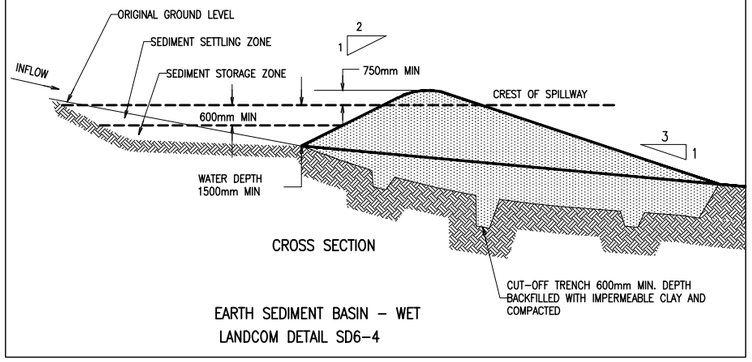
INSTALLATION

1. EXCAVATE A TRENCH 200mm DEEP.
2. DRIVE POSTS 500–700mm INTO GROUND AT A MAXIMUM SPACING OF 3.0m CENTRES.
3. PLACE AND FIX SUPPORT MESH (F52) TO POST.
4. LAY BIDIM GEOFABRIC (SF 2000) AGAINST THE SUPPORT MESH AND FIX BY TIE WIRE, STAPLES OR HOG RINGS.
5. PLACE BIDIM IN TRENCH AND BACKFILL WITH SOIL.

NOTE:
POSITION OF SEDIMENT FENCE AS DIRECTED BY MANAGING CONTRACTOR. FENCE TO REMAIN IN PLACE UNTIL EXCAVATION IS BELOW FOOTPATH LEVEL. PROVIDE 2mx2m TURFED AREA ON DOWNSTREAM SIDE OF FENCE AT SURCHARGE OPENINGS.

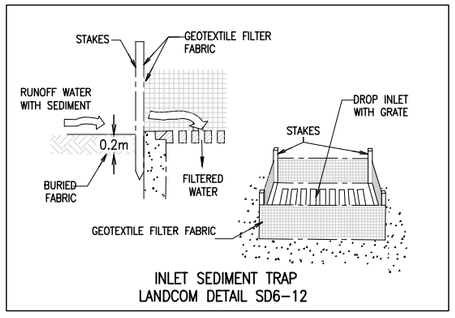


PLAN VIEW

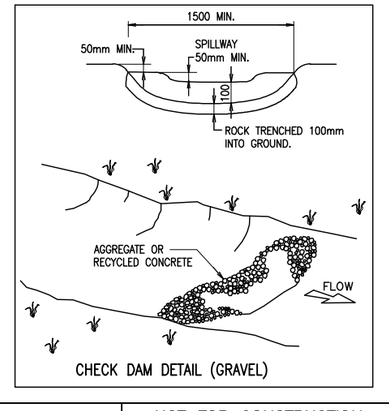


CROSS SECTION

EARTH SEDIMENT BASIN – WET
LANDCOM DETAIL SD6–4



INLET SEDIMENT TRAP
LANDCOM DETAIL SD6–12



CHECK DAM DETAIL (GRAVEL)

DO NOT SCALE DRAWINGS, USE FIGURED DIMENSIONS
REFER COVER SHEET FOR NOTES UNLESS NOTED OTHERWISE

Rev.	Revision Description	By.	App.	Date
1	ISSUED FOR DEVELOPMENT APPROVAL	LAR	LWM	11.02.14
2	REVISION TO DEVELOPMENT APPROVAL DOCUMENTS	LAR	LWM	14.02.14

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Client
URBAN GROWTH
UrbanGrowth NSW

Title
EROSION AND SEDIMENT NOTES AND DETAILS

Project
NORTH RYDE STATION SITE NORTH DEVELOPMENT APPROVAL

NOT FOR CONSTRUCTION

Date	Designer	Design Checker
14.02.14	L.RUSSELL	L.MELVILLE
Scale at A1	Drawn	Principal/Project Owner
AS SHOWN	S.MANANDHAR	R.LUCAS
Job Number	Drawing Number	Revision
13656	C1–10	2

DELHI ROAD

NORTH RYDE STATION

ECRL SERVICES BUILDING

EXISTING SLAB.

STATION STREET

STATION SITE SOUTH

KERB BREAKOUTS TO TREE PITS

RETAINING WALL

EXTENT OF WORKS. PROVISION FOR FUTURE ROAD 38. FUTURE ROAD BY OTHERS.

FUTURE ROAD

600ø TEMPORARY STORMWATER LINE TO LEGAL POINT OF DISCHARGE. REFER FOR STATION SITE SOUTH DA FOR DETAILS.

ENVIROPODS OR APPROVED EQUIVALENT TO INLET PITS

LEGEND

- PROPOSED EXTENT OF AC
- PROPOSED FOOTPATH / SHARED ZONE
- PROPOSED BIO RETENTION
- PROPOSED VEHICLE CROSSING TO COUNCIL STANDARDS
- FUTURE BUILDING CONCEPT
- K&G — PROPOSED KERB & GUTTER
- DD — PROPOSED DISH DRAIN
- KO — PROPOSED KERB ONLY
- VC — PROPOSED VEHICLE CROSSING
- 55.0 — EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- 55.40 — PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- PROPOSED KERB RAMP
- PROPOSED STREET LIGHT POLE
- EXISTING TITLES / BOUNDARY
- EXISTING EASEMENT
- EXISTING RAIL TUNNEL STRATUM
- PROPOSED KERB INLET PIT
- PROPOSED SAG INLET PIT
- PROPOSED JUNCTION PIT
- SW — PROPOSED STORMWATER LINE
- SW — PROPOSED STORMWATER DIRECTION MARKER
- SW — EXISTING STORMWATER LINE
- SW — EXISTING SERVICE TO BE LOCATED AND DEMOLISHED

PRINT DRAWING IN COLOUR

DO NOT SCALE DRAWINGS, USE FIGURED DIMENSIONS

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SCALE 1:250

5 0 5 10m

Rev.	Revision Description	By.	App.	Date
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Web Site: www.robertbird.com

Client: URBAN GROWTH — UrbanGrowth NSW

Title: STORMWATER DRAINAGE PLAN

Project: NORTH RYDE STATION SITE NORTH DEVELOPMENT APPROVAL

NOT FOR CONSTRUCTION

Date	Designer	Design Checker
14.02.14	L.RUSSELL	L.MELVILLE
Scale at A1	Drawn	Principal/Project Owner
AS SHOWN	S.MANANDHAR	R.LUCAS
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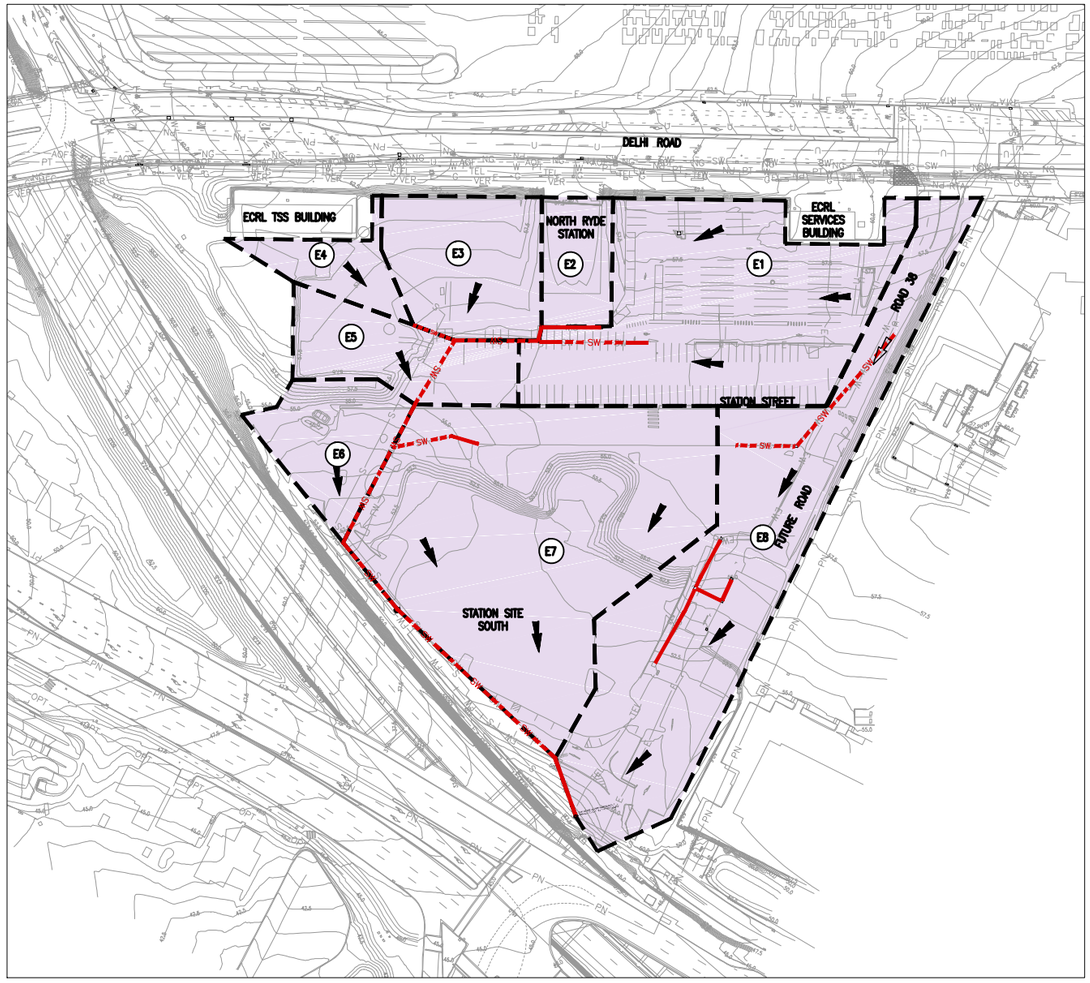
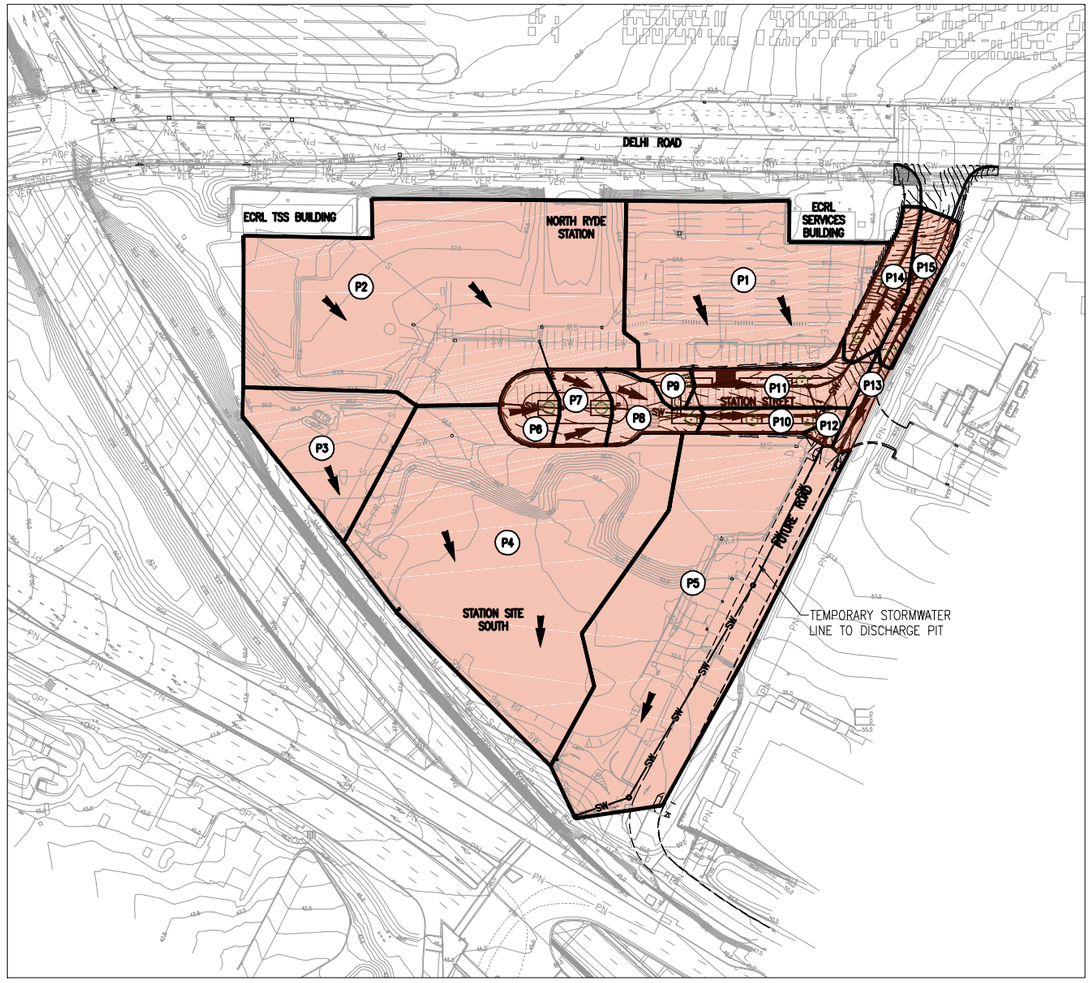
13656	C6-01	2



EXISTING STORMWATER CATCHMENT PLAN
SCALE 1:1000



PROPOSED STORMWATER CATCHMENT PLAN
SCALE 1:1000

EXISTING CATCHMENT TABLE

CATCHMENT	AREA (HA)
E1	0.626
E2	0.159
E3	0.239
E4	0.090
E5	0.153
E6	0.132
E7	0.789
E8	0.669

LEGEND

EXISTING CATCHMENT BOUNDARY

SW EXISTING STORMWATER LINE

E1 EXISTING CATCHMENT LABELS

NOTES:
- TOTAL CATCHMENTS:
  NORTH: 1.267HA
  SOUTH: 1.590HA
  TOTAL: 2.857HA

PROPOSED CATCHMENT TABLE

CATCHMENT	AREA (HA)	CATCHMENT	AREA (HA)
P1	0.385	P9	0.016
P2	0.717	P10	0.031
P3	0.160	P11	0.076
P4	0.719	P12	0.009
P5	0.596	P13	0.019
P6	0.038	P14	0.053
P7	0.043	P15	0.045
P8	0.046		

LEGEND

PROPOSED CATCHMENT BOUNDARY

SW EXISTING STORMWATER LINE

SW PROPOSED STORMWATER LINE

P1 PROPOSED CATCHMENT LABELS

PROPOSED JUNCTION PIT

PROPOSED KERB INLET PIT

NOTES:
- TOTAL CATCHMENTS:
  NORTH: 1.478HA
  SOUTH: 1.475HA
  TOTAL: 2.953HA

ASSUMPTIONS:
1. FOR STORMWATER INFRASTRUCTURE AND WSUD DETAIL REFER TO RBG SBSMP REPORT.
2. PERCENTAGE PERVIOUS/IMPERVIOUS FOR EACH CATCHMENT AREA HAS BEEN APPROXIMATED USING EXISTING SURVEY DATA AND SITE CONDITIONS.

PRINT DRAWING IN COLOUR

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SCALE 1:1000

10 0 10 20 30 40m

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