

CIVIL ENGINEERING REPORT FOR STATE SIGNIFICANT DEVELOPMENT APPLICATION SSD 7155 MOD 3

**PRESTONS INDUSTRIAL ESTATE
LOT 33 DP408207
YARRUNGA STREET
PRESTONS NSW**

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1 INTRODUCTION

1.1 Introduction

Logos Property proposes to develop Lot A and Lot B in DP 408207, and Lot 35 in DP 2359, located in an industrial site on the western side of Bernera Road between Kurrajong Road and Yarrunga Street, Prestons, NSW. Previous applications for development have been granted over part of the land under NSW Department of Planning and the Environment (DP&E) under SSD 7155 dated 16 February 2016, and construction of two of the buildings (Building 2 & 5) approved under this application have been completed. The Mod 3 Development Application includes for an amended masterplan layout to Building 1B (formerly referred to as Building 1 in the previous application) and for a proposed workshop facility for Volvo (Building 1A).

1.2 Scope

Costin Roe Consulting Pty Ltd has been commissioned by Logos Property to prepare this Engineering Report in support of the proposed SSD 7155 Modification 3 to be lodged over the site.

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

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

The engineering objectives for the development are to create a site which, based on the proposed architectural layout, responds to the topography and site constraints, to provide an appropriate and economical stormwater management system which incorporates best practice in water sensitive urban design consistent with the requirements of council's water quality objectives and the Stormwater Management Strategy for the Preston Industrial Estate approved under the original SSD 7155 application.

A set of drawings have been prepared to show the civil elements of a proposed industrial development, modifications to Building 1B and to incorporate as constructed elements relating to the works completed on Buildings 2 and 5. The drawings include proposed finished levels, retaining walls, stormwater drainage layout and water quantity and quality requirements for the development relating to Building 1A and 1B. These drawings are for development approval only and subject to change during detail design.

1.3 Authority Jurisdiction

The consent authority is The NSW Department of Planning & Environment as the development is considered a State Significant Development (SSD). However, as the subject site is located within Liverpool City Council (LCC) local government area, the engineering and policy requirements of LCC have also been considered in the design.

The NSW Department of Planning & Environment has provided Secretary's Environmental Assessment Requirements (SEAR's) dated 11 September 2015, Ref: SSD7155. In addition to providing a general summary of civil engineering aspects of the project, this report addresses the Soil and Water components of the SEAR's including flooding impacts, surface water management, on-site detention and treatment, details of erosion and sediment control, details of proposed cut and fill works and measures to minimise the extent of cut to fill and details of any fill to be imported to site.

1.4 Differences Between the Mod 3 Current Application and SSD 7155

This application is for an amendment to SSD 7155 to suit layout changes to the Masterplan approved in the original application dated 16 February 2016. The main component of the amendment is for an adjustment to the previously approved lot and building layout for Building 1B. Some minor amendments to other components of the design will be apparent due to this change. This section of the report provides a summary of the engineering components of the development which will change from, or remain consistent with, the approved SSD7155 development.

Summary of design elements is as follows:

- Development Layout

The development layout differs from the previously approved development application in that the building layout for Building 1B has been adjusted. The overall plan area has increased due to the purchase of additional land after the original application was approved. Subsequently, the configuration of the loading docks, hardstand and car park areas have been amended to suit the larger site area.

- Stormwater Management

The Stormwater Management strategy will remain generally consistent with the previously approved development application in terms of providing water quantity management to maintain pre- and post-development flow rates, and water quality management measures which meet councils load based pollution reduction values. On-site detention tanks will be provided for each development lot however the system locations and volumes have been adjusted from the previous application as discussed in subsequent sections of this report.

Stormwater quality management was previously proposed to be met by the use of a treatment train consisting of a Humegard & Humeceptor in series. Since the original development approval, the substitution of the originally approved treatment train was made with an equivalent system offered by SPEL in their Stormceptor and SPEL Ecoceptor. Thus, was discussed and agreed with Liverpool City Council as part of the formal approval of the drainage system as required of the consent under Condition C14. Please refer to **Appendix H** for the council approval relating to the water quality devices.

- Flooding

Previous applications were affected by flooding and overland flow from upstream residential catchments to the south and south-east of the estate. Management of

these upstream flows required a trunk drainage system and overland flow path between Kurrajong Road and Bernera Road. This system has now been constructed and no modifications are required as part of this application.

Additional flood consideration on the north-west corner of the property, in and around the intersection of Kookaburra Road North, and Yarrunga Street is required. This flooding is related to flooding from Cabramatta Creek and a minor overland flow path and twin 600mm culverts located on the north-west corner of the site. Allowance for a small realignment of the existing open channel and maintaining flood compensation for filling over currently flood affected land has been made, as discussed in more detail in **Section 5** of this report.

- Roadworks

No changes are proposed to the approved works in Yarrunga Street from the western boundary of Building 1B and the Bernera Road intersection are required as part of the modification. However, due to the increased site area which encompasses additional frontages along Yarrunga Street to the Kookaburra Road North, and frontages Kookaburra Road North, additional road construction works are proposed. These works will encompass half road construction along the remaining extent of Yarrunga Street and along Kookaburra Road North (for the extent of the western site boundary of Lot 1A). The proposed roadworks will be discussed in the subsequent sections of this report.

2 SITE CHARACTERISTICS

2.1 Site Description

The site areas for Buildings 1A and 1B are approximately 3.0Ha and 5.6Ha respectively. The proposed total site area is rectangular in shape and is zoned to General Industrial land under the Liverpool City Council LEP as shown in **Figure 2.1**. Since the approval of the previous masterplan, an additional 1.0Ha has been acquired to form part of the Building 1B site area. The total proposed site area comprises approximately 37% of the overall masterplan site area of 23.4Ha.

The site is bounded on the north by Yarrunga Street, on the east by constructed Warehouse 2, on the south by undeveloped land and Kookaburra Road North on the west. The adjacent Lots 3 and 5, to the east and south east of Building 1B, have now been constructed as per the approval by NSW Department of Planning and the Environment (DP&E) under SSD 7155 dated 16 February 2016.



Figure 2.1 Locality Plan

Infrastructure works including bulk earthworks and stormwater management measures have been completed on part of the land as part of the construction works for Lots 34 and 43 in DP2359.

Access to the site is currently available off Yarrunga Street, approximately 400m from the intersection with Bernera Road.

The site is located within the bounds of Liverpool City Council (LCC), therefore the engineering requirements of the LCC apply.

2.2 Proposed Development

The proposed development on Lots A & B in DP408207 is for a single-level workshop and office space (Warehouse 1A) for Volvo. Office space is provided for the warehouse at the north-east corner of the building. Associated passenger vehicle car parks are located in the immediate vicinity of the office. Truck circulation areas are located on the eastern and western sides of the warehouse.

The proposed development on Lot 35 in DP2359 is for a single level warehouse with an ancillary office on the north-east corner of the building for a speculative tenant. Hardstand areas for truck circulation are proposed on the southern side of the warehouse building and car parking areas are proposed along the eastern portion of the site.

An indicative layout of the development has been produced by Axis Architecture and can be seen in **Figure 2.2** below.

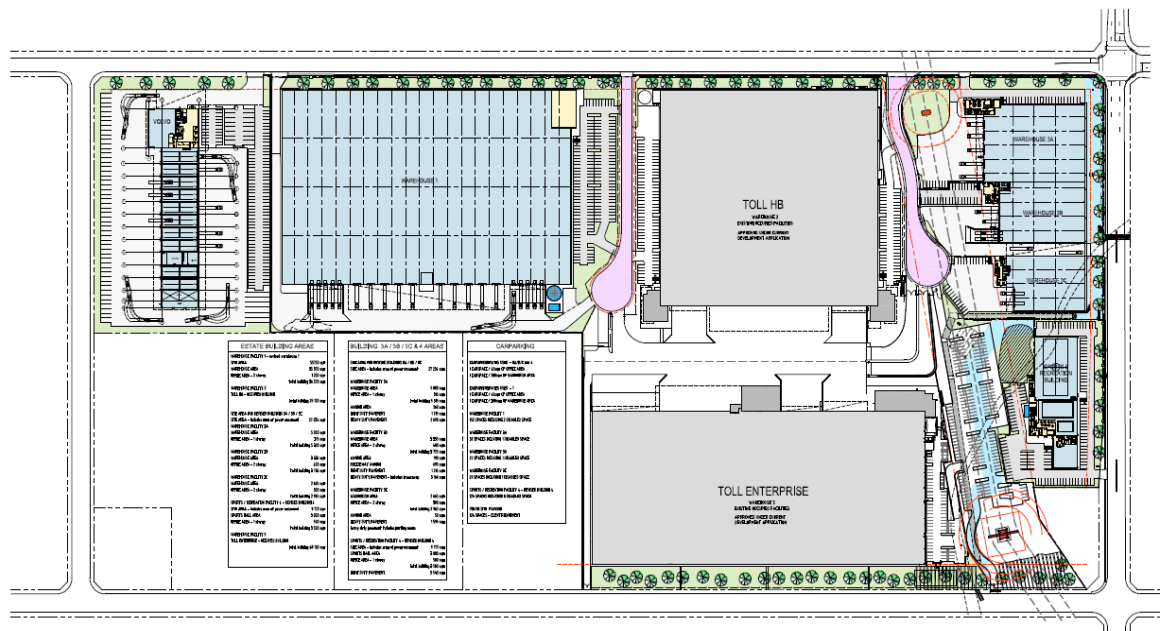


Figure 2.2. Development Layout

The development will include the following engineering components:

- Stormwater drainage system based on a major/ minor design philosophy;
- Management of stormwater quality using a treatment train approach to pollutant loads on a developed catchment in accordance with councils load based pollutant reduction percentages; and
- Management of stormwater quantity by reducing post developed flow to pre-developed over the range of storms between the 1 in 2-year Average Recurrence Interval (ARI) to the 1 in 100-year ARI as per council policy.

3 ROADS AND ACCESS

3.1 Introduction

The proposed development also proposes the half road construction of 71.55m of Yarrunga Street. The half road construction will be a continuation from the previously approved and constructed half road width and will extend up to the proposed driveway into the development.

A functional layout of the proposed roadworks has been produced for the development and is presented in drawing **Co8753.15-C70** and can be found in **Appendix A**.

3.2 Road Widths

The proposed half road construction of Yarrunga Street is to be constructed with a cross section as nominated in **Table 3.1** below. The carriageway is measured from the existing centreline of the road.

Road Type	Carriageway	Verge (Pedestrian Footpath)	Total Road Reserve	Number of lanes
Yarrunga Street (Half Road)	13.0m Half road construction at 6.5m	3.558m	20.115m	1 travelling/ 1 parking

Table 3.1. Proposed Estate Road Cross Section

The propose road will have a concrete kerb and gutter and carriageway surface finished with asphaltic concrete.

3.3 Road Alignment

The proposed alignment for the half road construction of Yarrunga will be designed to meet Council requirements. The layout and levels will remain consistent with the existing built form on Yarrunga Street with road widening to facilitate the required cross-sectional dimensions and the construction of kerb and gutter and drainage system to collect run off from the road reserve and also provide in-ground drainage connections for a portion of the development site which will be consistent with existing catchment breakdowns.

The horizontal alignment will be designed to meet Council standards. Minimum horizontal radii in accordance with Council's engineering guidelines are to be provided.

In accordance with the Council standards, a minimum longitudinal grade of 1% and a maximum of 6% will be generally provided. Where change of grade is in excess of 0.6%, a vertical curve in accordance with the RMS Road Design Guide for a design speed of 60km/h will be provided.

4 SITE WORKS

4.1 Bulk Earthworks

Bulk earthworks have been performed over the estate as per the original approval documentation. These works included part of the proposed Building 1B site, whose current level was benched during the construction of the warehouse and distribution facilities for Toll on Lots 34 and 43 of DP2359. Currently a large flat building pad has been benched as part of the above-mentioned earthworks.

Bulk earthworks will be required for Building 1A and additional earthworks will be required for Building 1B to accommodate a cut to fill balance of earthworks for the entire development.

The objective for the site will be to provide large flat building pads, facilitate site access, to drain the stormwater system via gravity, keep building levels above the 1 in 100-year ARI flood level (with appropriate freeboards) and to perform a cut to fill balance of earthworks.

All geotechnical testing and inspections performed during the earthworks operations will be undertaken to Level 1 geotechnical control, in accordance with AS 3798-1996.

High level earthworks and volume estimates have been completed to a level of detail to enable general pad levels to be set and to obtain an order of magnitude cut and fill volume estimate. These have been shown on drawing **Co8753.15-C230, C235 and C236 of Appendix A.**

The earthworks volume estimates are as follows:

Cut	- 98,250 m ³
Fill	+ 125,250 m ³
Detailed Excavation	- 6,300 m ³
Cut Bulking	- 3,900 m ³
Import from adjacent site	- 17,500 m ³
Balance	- 650 m³ (Approx. cut and fill achieved)

The existing surface levels and the proposed levels are as shown on drawing **Co8753.15-C250 of Appendix A.**

4.2 Erosion and Sediment Control

Soil Erosion and Sediment Control measures including sedimentation basins will also be provided for the development during the construction phase. All Soil and Sediment Control measures will be performed in accordance with Liverpool City Council requirements and Landcom Managing Urban Stormwater, Soils and Construction (1998) – The Blue Book.

Earthworks over the site will be relatively small when compared to large scale development or mining activity. The effect on groundwater is expected to be minor as a result of these works.

4.3 Embankment Stability

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

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

Stability of batters and reinstatement of vegetation shall be in accordance with the submitted drawings and the Soil and Water Management Plan in Section 7.

4.4 Supervision of Earthworks

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

4.5 Retaining Walls

The civil engineering objective is to minimise retaining walls within the constraints of the architectural layout and allowable grading (as per AS2890.1 and AS2890.2) through paved areas and batters in landscaped areas.

Retaining walls have been constructed as part of the estate infrastructure works approved under SSD7155. Numerous retaining walls are proposed for Buildings 1A and 1B.

For Building 1A, retaining will be required along the north which will extend around the proposed flood storage zone and continue along the west boundary, transitioning from a wall in fill to a wall in cut. Retaining will also be required for a portion along the south boundary adjacent to the existing road and along the eastern boundary and around the proposed carpark to the east of the warehouse.

Retaining will be required for Building 1B around the north-west corner of the building, for a portion along the southern boundary and along the eastern carpark, adjacent to the access road.

The proposed method of construction will be reinforced concrete masonry, masonry faced reinforced earth retaining, pile and shot-crete, or other concrete or masonry type construction.

Location and indicative heights of retaining walls are shown on drawing **Co8753.15-C250**.

5 STORMWATER MANAGEMENT

5.1 Hydrologic Modelling and Analysis

5.1.1 General Design Principles

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

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

Overall site runoff and stormwater management will generally be designed in accordance with the Institution of Engineers, Australia publication “Australian Rainfall and Runoff” (1987 Edition), Volumes 1 and 2 (AR&R).

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

5.1.2 Minor/ Major System Design

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

5.1.3 Rainfall Data

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

5.1.4 Runoff Models

In accordance with the recommendations and standards of Liverpool City Council, the calculation of the runoff from storms of the design ARI has been calculated with the catchment modelling software DRAINS.

The design parameters for the DRAINS model are to be based on the recommendations as defined by council and parameters for the area and are as follows:

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

Table 5.1. DRAINS Parameters

5.2 Hydraulics

5.2.1 General Requirements

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

5.2.2 Freeboard

The calculated water surface level in open junctions of the piped stormwater system will not exceed a freeboard level of 150mm below the finished ground/ grate level, for the peak runoff from the Minor System runoff.

The calculated water surface for the peak runoff from the Major System runoff will not exceed a freeboard level of 300mm below the finished floor level of the building/ development pads.

5.2.3 Public Safety

For all areas subject to pedestrian traffic, the product (dV) of the depth of flow d (in metres) and the velocity of flow V (in metres per second) will be limited to 0.4, for all storms up to the 100-year ARI.

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

5.2.4 Inlet Pit Spacing

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

5.2.5 Overland Flow

Dedicated flow paths have been designed to convey all storms up to and including the 100-year ARI. These flow paths will convey stormwater from the site to the detention systems prior to discharge

5.3 **Site Drainage**

5.3.1 Existing Site Drainage

Lot A has an existing flow path and culvert present in the north-west corner of the site. A 600mm diameter RCP and 300mm diameter RCP discharge onto the site from Kookaburra Road North. This appears to take flow from site to the west of Kookaburra Road North and from Kookaburra Road reserve and catchments to the south and south-east. Drainage infrastructure, including lot connections, trunk drainage and overland flow paths, and detailed building systems have been completed in association with Building 2 and 5 construction works. Flows are conveyed through the property to Yarrunga Street to a twin 600mm diameter culvert under Yarrunga Street to final discharge to Cabramatta Creek.

Drainage infrastructure, including lot connections, trunk drainage and overland flow paths, and detailed building systems have been completed in association with Building 3 and 5 construction works.

5.3.2 Proposed Site Drainage

Detailed stormwater systems will be required to be constructed for Buildings 1A and 1B.

As per general engineering practice and the guidelines of LCC, the proposed stormwater drainage system for the development will comprise a minor and major system to safely and efficiently convey collected stormwater run-off from the development to the legal point of discharge.

The minor system is to consist of a piped drainage system which has been designed to accommodate the 1 in 20-year ARI storm event (Q20). This results in the piped system being able to convey all stormwater runoff up to and including the Q20 event. This meets the requirements of LCC and is the minimum recommended capacity for an industrial development.

The major system will be designed to cater for storms up to and including the 1 in 100-year ARI storm event (Q100). The major system will employ the use of defined overland flow paths, such as roads and open channels, to safely convey excess run-off from the site.

The design of the stormwater system for this site will be based on relevant national design guidelines, Australian Standard Codes of Practice, the standards of LCC and accepted engineering practice. Runoff from buildings will generally be designed in accordance with AS 3500.3 National Plumbing and Drainage Code Part 3 – Stormwater Drainage. Overall site runoff and stormwater management will generally be designed in accordance with the Institution of Engineers, Australia publication “Australian Rainfall and Runoff” (1988 Edition), Volumes 1 and 2 (AR&R).

Stormwater Management is required to be provided for water quantity and quality in accordance with the requirements of LCC DCP and as per the items included in Liverpool City Council pre-development application minutes dated 30 October 2014 and further meeting with Liverpool City Council held between Liverpool Council, DBL Property and Costin Roe Consulting on 15 October 2015.

Further discussion on the Stormwater Management Strategy is provided in **Section 5** and **6** of this report. Reference to drawing **Co8753.15-C240** shows the proposed drainage layout.

5.3.3 Site Discharge

Discharge from the site is proposed at three locations which correspond to the catchment breakdowns as approved in the original SSD7155 approval documentation.

The first discharge point conveys flows for a catchment of 2.465Ha from part of site 1B, through a stub provided as part of the infrastructure works, off Yarrunga Street. The stub is located along the northern boundary of the site.

The second and third discharge points will be connecting into proposed road drainage infrastructure and are located at the north- west corner of site 1B and further downstream, to the north of site 1A. A catchment of 2.780Ha from site 1B and a catchment area of 2.863Ha from site 1A will be directed towards discharge points 2 and 3 respectively.

Reference to drawing **Co8753.15-C240** shows the proposed discharge points.

5.4 Flooding

Lot A is affected by flooding from Cabramatta Creek and as identified in Council’s Flood Planning Maps and the *Cabramatta Creek Floodplain Management Study and Plan, October 2004 (Cabramatta Study)* and *Cabramatta Creek Flood Study and Basin Strategy Review (2011)*. These studies are publicly available documents which are available for download from the Liverpool City Council website from the following link:

<http://www.liverpool.nsw.gov.au/environment/water-and-waterways/flood-management#CabramattaCreekRiskManagementStudyandPlan>

Cabramatta Creek is located some 250m to the west of the development and is subject to flash flooding and overland flow. A local overland flow path, which provides conveyance from local catchments is also present on the north-west corner of the site as

an open channel. Review of the *Cabramatta Creek Flood Study and Basin Strategy, September 2011*, produced by Bewsher Consulting Pty Ltd for Liverpool City Council and replicated on councils ePlanning Portal, shows that the Q100 ARI flood extent extends along a portion of Yarrunga Road, to the north-west of Site 1A from the creek line some 250m to its intersection with Kookaburra Road North.

Overland flow, as noted above, from the undeveloped sites to the south and west of Kookaburra Road North also contributes to the flow through the north-west corner of Site 1A.

With the filling required over Site 1A to suit the requirements of the development, a portion of the overland flow path through the site will be compromised. To account for the area lost for the overland flow, a dedicated flood storage and conveyance area has been proposed to be provided along the north-western site boundary, adjacent to Kookaburra Road North.

Figure 3.1 shows the 1 in 100-year and PMF flood extents, and flood risk zones as defined by LCC, based on the results of the 2011 Bewsher Consulting flood assessment. It can be seen that the north-west corner site is locally affected by the 1 in 100-year event, and to a larger extent by the PMF storm.

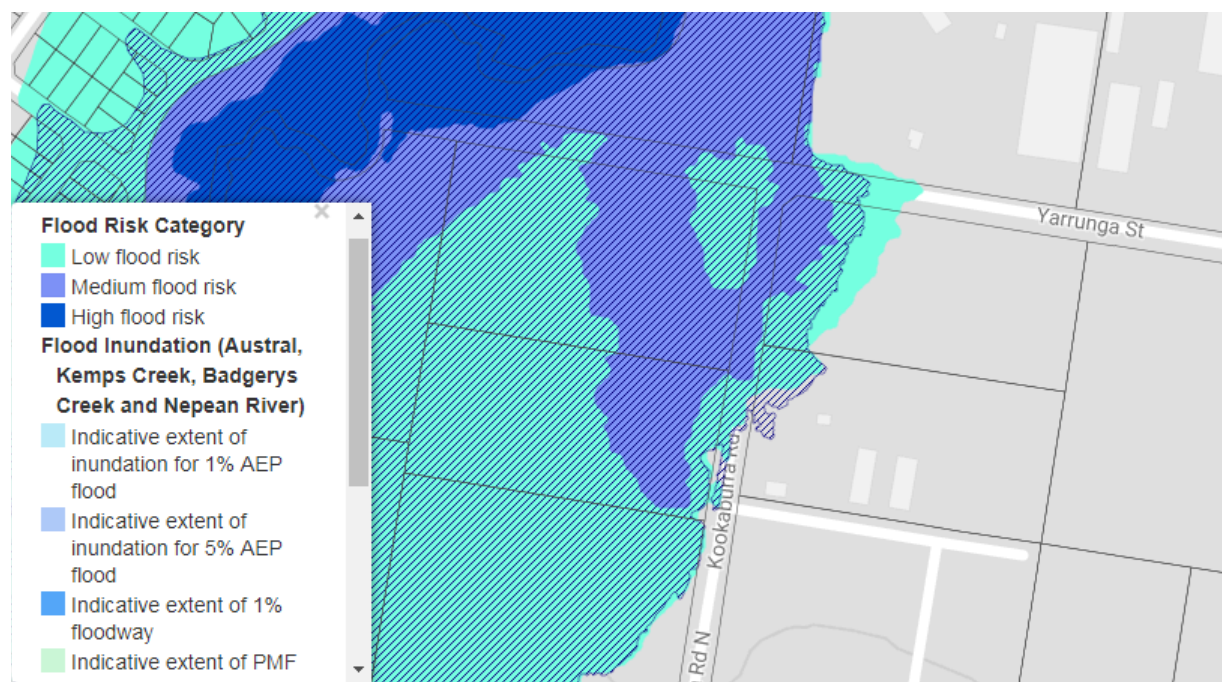


Figure 3.1. 1:100 yr/ PMF Flood (Source: LCC ePlanning 5 July 2017)

The area impacted by the 1 in 100-year event in **Figure 3.1** coincides with the flow path mentioned in earlier sections. Review of **Figure 3.1** confirms the site to be within the medium and low flood risk categories.

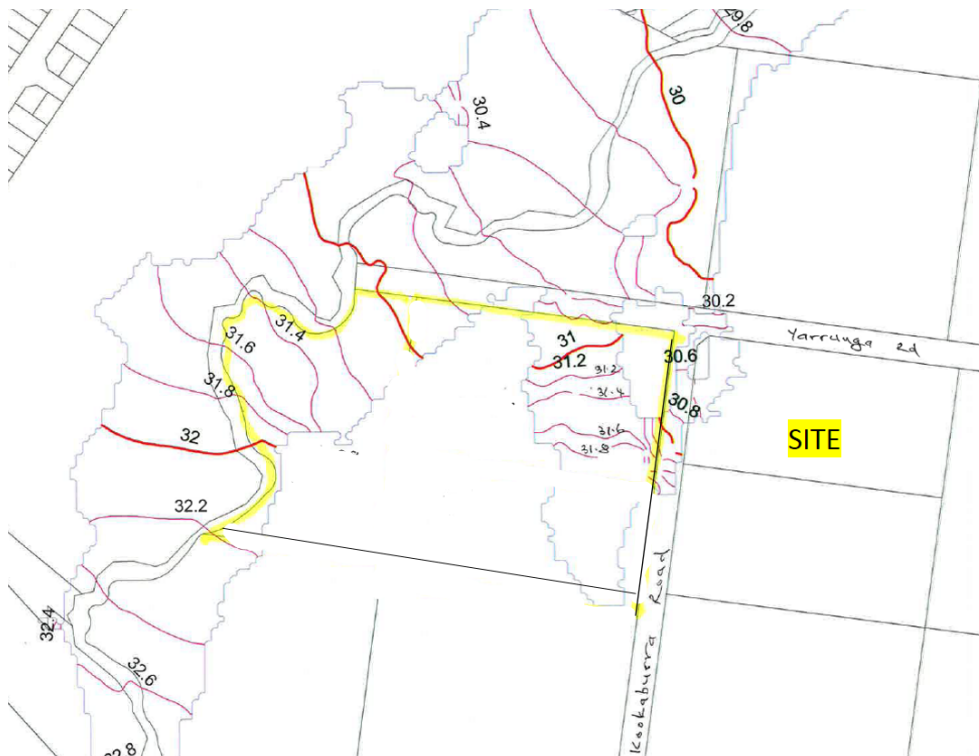


Figure 3.2. 1 in 100-year Flood Levels (Source: LCC 2017)

Figure 3.2 shows the 1 in 100-year ARI design event flood levels as provided by Liverpool City Council, derived from the 2011 Bewsher Flood Assessment. This shows flood levels to be in the range of RL 30.2m to RL 30.8m. In terms of flood planning requirements, the proposed Volvo facility will be sited at RL 36.0m which is well above the minimum flood planning level of 31.3m (which equates to the 1 in 100-year ARI plus 500mm freeboard).

Discussion with council regarding development and filling within flood affected areas have been made and council have advised that filling of land within the low and medium risk zones would be acceptable given no net loss of flood storage is able to be occur as a result of filling, and that suitable conveyance capacity is also maintained. The area which is subject to the PMF (low risk) would be also require consideration to flood evacuation during the PMF event. It is noted that evacuation would be available through Yarrunga Street to higher ground which is outside the PMF flood zone.

The proposed design allows for the realignment of the existing open channel to be located adjacent to the boundary, and allows for a storage of 1050m³ to be maintained, per the pre-developed conditions, following filling of a portion of flood affected land. Refer to drawing **CO8753.16-C240** for details on the flood storage zone.

Overall it is considered that the requirements of LCC have been met in relation to flood planning, no net loss of flood storage and no effect on upstream downstream or adjacent properties.

6 WATER QUANTITY MANAGEMENT

Liverpool City Council requires water quantity management, or stormwater detention, to be provided to limit the runoff discharged from private property into the underground piped drainage system to pre-developed flow and to assist in mitigating the increased stormwater runoff generated by development.

Attenuation of stormwater runoff from the development is proposed to be managed via a detention tanks provided in strategic locations for each of the development lots. As discussed with Liverpool Council the objective is to attenuate stormwater flow from the development to pre-developed flows.

Sizing of the basin systems has been completed using DRAINS modelling software in accordance with the Liverpool City Council Policy for the 1 in 2-year ARI to 1 in 100-year ARI storms for various durations. The modelling accounts for the drainage system provided for the adjacent sites on Lots 34 and 43.

Table 7.1 provides details for the pre-and post-development flows and storage for the total detention system. The critical storm duration for the 1in 2 year, 1in 20 year and 1 in 100-year ARI storms is 2 hours and flows and storage information are provided for this storm.

ARI	Pre-developed Flow (m ³ /s)	Post Developed Flow (m ³ /s)	
		Un-attenuated	Attenuated
2	1.63	2.21	1.61
20	3.08	3.72	2.42
100	3.91	4.65	3.29

Table 7.1. Site and Detention Hydrology

Indicative locations of the three (3) detention systems can be found on drawing **Co8753.15-C240**. These have been shown as detention tanks on the planning application drawings. The final arrangement of tanks would be confirmed in detail design stage, ensuring the flow arrangements of **Table 7.1** are achieved. Indicative hydrological and storage arrangements are shown below.

ARI	Post Developed Flow (m³/s)				Storage (m³)
	Un-attenuated	Attenuated			
		Low Flow	High Flow	Total	
2	0.751	0.555	0	0.555	164
20	1.260	0.850	0	0.850	292
100	1.580	1.010	0.045	1.055	378

Table 7.2. Detention Tank 1

ARI	Post Developed Flow (m³/s)				Storage (m³)
	Un-attenuated	Attenuated			
		Low Flow	High Flow	Total	
2	0.729	0.532	0	0.532	164
20	1.230	0.801	0	0.801	300
100	1.540	0.900	0.263	1.160	358

Table 7.3. Detention Tank 2

ARI	Post Developed Flow (m³/s)				Storage (m³)
	Un-attenuated	Attenuated			
		Low Flow	High Flow	Total	
2	0.646	0.460	0	0.460	160
20	1.090	0.679	0	0.679	285
100	1.360	0.775	0.193	0.963	353

Table 7.3. Detention Tank 3

The modelling has shown that, with the provision of a total storage volume of 1120m³ contained in three modelled systems, stormwater flows from the development will be attenuated to predevelopment flows. Detention storage will be fully active and will be provided as underground tanks, and where available as above ground basins in open space and conservation areas. The proposed detention system meets the policy requirements of Liverpool City Council.

7 STORMWATER QUALITY CONTROLS

7.1 Regional Parameters

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

Liverpool City Council have nominated, in *Section 6.4 of Part 1 of their DCP 2008*, the requirements for stormwater quality to be performed on a catchment wide basis. These are presented in terms of annual percentage pollutant reductions on a developed catchment and are as follows:

Gross Pollutants	90%
Total Suspended Solids	80%
Total Phosphorus	45%
Total Nitrogen	45%
Total Hydrocarbons	90%

7.2 Proposed Stormwater Treatment System

Developed impervious areas including roof, hardstand, car parking, roads and other extensive impervious areas are required to be treated by the Stormwater Treatment Measures (STM's). The STM's shall be sized according to the whole catchment area of the development. The STM's for the development shall be based on a treatment train approach to ensure that all of the objectives above are met.

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

- Treatment of stormwater on the development is to be performed via the provision of a treatment train of proprietary systems;
- Primary treatment will be completed via Gross Pollutant Trap (GPT). The proposed GPT is the SPEL Ecoceptor;
- Tertiary treatment is to be performed via the SPEL Stormceptor separation system;
- It is noted that stormwater from the upstream catchments will bypass treatment systems and undeveloped areas are not included in the modelling; and
- A portion of the future building roof will also provide a level of treatment via rainwater reuse and settlement within rainwater tanks. Indicative locations and sizes of rainwater tanks has been included in the modelling of the development and shown on drainage layout plans.

7.3 Stormwater Quality Modelling

7.3.1 Introduction

The MUSIC modelling software was chosen to model water quality. This model has been released by the Cooperative Research Centre for Catchment Hydrology (CRCCH) and is a standard industry model for this purpose. MUSIC (the Model for Urban Stormwater Improvement Conceptualisation) is suitable for simulating catchment areas of up to 100 km² and utilises a continuous simulation approach to model water quality.

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

The pollutant retention criteria set out in Councils DCP and nominated in **Section 7.1** of this report were used as a basis for assessing the effectiveness of the selected treatment trains.

The MUSIC model “8753.15 Prestons DA2 Rev1.sqz” was set up to examine the effectiveness of the water quality treatment train and to predict if council requirements have been achieved. The layout of the MUSIC model is presented in **Appendix B**.

7.3.2 Rainfall Data

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

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

7.3.3 Rainfall Runoff Parameters

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

7.3.4 Pollutant Concentrations & Source Nodes

Pollutant concentrations for source nodes are not available from Liverpool City Council. The source nodes used are based on the land use parameters defined by Liverpool City Council and are shown as per the **Table 7.1**:

Flow Type	Surface Type	TSS (log ₁₀ values)		TP (log ₁₀ values)		TN (log ₁₀ values)	
		Mean	Std Dev.	Mean	Std Dev.	Mean	Std Dev.
Baseflow	Roof	1.20	0.17	-0.85	0.19	0.11	0.12
	Roads	1.20	0.17	-0.85	0.19	0.11	0.12
	Landscaping	1.20	0.17	-0.85	0.19	0.11	0.12
Stormflow	Roof	1.30	0.32	-0.89	0.25	0.30	0.19
	Roads	2.43	0.32	-0.30	0.25	0.34	0.19
	Landscaping	2.15	0.32	-0.60	0.25	0.30	0.19

Table 7.1. Pollutant Concentrations

The MUSIC model has been setup with a treatment train approach based on the pollutant concentrations in **Table 7.1** above and the catchments shown on drawing **Co8753.15-C142** in **Appendix A**.

7.3.5 Treatment Nodes

Gross Pollutant Trap and Hydrodynamic Separation device treatment nodes have been used in the modelling of the development as provided by the suppliers of the products based on testing completed by the product manufacturers. Detention basin nodes were also introduced to the model using typical parameters contained in MUSIC modelling guidelines.

Gross Pollutant Trap (SPEL Ecoceptor)

Parameter	Value	
Treatable Flow	0.34m ³ /s (6-month ARI flow)	
<u>Pollutant Reductions</u>		
TSS	50	%
TP	30	%
TN	24	%
GP's	95	%

Hydrodynamic Separator (SPEL Stormceptor)

Parameter	Value	
Treatable Flow	0.34m ³ /s (6-month ARI flow)	
<u>Pollutant Reductions</u>		
TSS	87	%
TP	30	%
TN	30	%
GP's	100	%

7.3.6 Results

Table 7.2 shows the results of the MUSIC analysis. The reduction rate is expressed as a percentage and compares the post-development pollutant loads without treatment versus post-development loads with treatment.

	Source	Residual Load	% Reduction	Target Met
Total Suspended Solids (kg/yr)	13100	1080	91.7	Y
Total Phosphorus (kg/yr)	25.4	9.42	62.9	Y
Total Nitrogen (kg/yr)	154	84.3	45.4	Y
Gross Pollutants (kg/yr)	1780	120	93.3	Y

Table 7.2. MUSIC analysis results

The model results indicate that, through the use of the STM's in the treatment train, pollutant load reductions for Total Suspended Solids, Total Phosphorous, Total Nitrogen and Gross Pollutants will meet the requirements of Part 1 of Liverpool City Councils DCP 2008 on an overall catchment basis.

7.3.7 Modelling Discussion

MUSIC modelling has been performed to assess the effectiveness of the selected treatment trains and to ensure that the pollutant retention requirements of Part 1 of Councils DCP 2008 have been met.

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

Hydrocarbon removal cannot easily be modelled with MUSIC software. The proposed distribution/ storage facility would be expected to produce low source loadings of hydrocarbons. Potential sources of hydrocarbons would be limited to leaking engine sumps or for accidental fuel spills/leaks and leaching of bituminous pavements (car parking only). The potential for hydrocarbon pollution is low and published data from the CSIRO indicates that average concentrations from Industrial sites are in the order of 10mg/L and we would expect source loading from this site to be near to or below this concentration. Hydrocarbon pollution will be treated by the treatment train of propriety devices described above and based on the manufacturers testing would achieve a 90% reduction of this pollutant.

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

7.4 Stormwater Harvesting

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

Rainwater harvesting will be required for the development in order to meet Liverpool Council Policy and NSW Department of Planning and The Environment requirements with the aim being to reduce overall demand by providing re-use for non-potable applications. Internal uses include such applications as toilet flushing while external applications will be used for irrigation.

As individual building uses have not yet been defined as part of this application, sizing of rainwater tanks has not been undertaken. These would be defined in future detail design and development applications based on a water balance assessment as outlined in Council Policy and the document Managing Urban Stormwater: Harvesting and Reuse – 2006 (NSW DEC).

In general terms, the rainwater harvesting systems are expected to comprise an in-line tank for the collection and storage of rainwater. At times when the rainwater storage tank is full rainwater can pass through the tank and continue to be discharged via gravity into the stormwater drainage system. Rainwater from the storage tank will be pumped for distribution throughout the development in a dedicated non-potable water reticulation system. This however would be, as noted, subject to future detail design.

7.5 Maintenance and Monitoring

It is important that each component of the water quality treatment train is properly operated and maintained. In order to achieve the design treatment objectives, an indicative maintenance schedule has been prepared (refer to **Table 7.3** below) to assist in the effective operation and maintenance of the various water quality components.

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

Table 7.3. Indicative Maintenance Schedule

MAINTENANCE ACTION	FREQUENCY	RESPONSIBILITY	PROCEDURE
SWALES/ LANDSCAPED AREAS			
Check density of vegetation and ensure minimum height of 150mm is maintained. Check for any evidence of weed infestation	Six monthly	Maintenance Contractor	Replant and/or fertilise, weed and water in accordance with landscape consultant specifications
Inspect swale for excessive litter and sediment build up	Six monthly	Maintenance Contractor	Remove sediment and litter and dispose in accordance with local authorities' requirements.
Check for any evidence of channelisation and erosion	Six monthly/ After Major Storm	Maintenance Contractor	Reinstate eroded areas so that original, designed swale profile is maintained
Weed Infestation	Three Monthly	Maintenance Contractor	Remove any weed infestation ensuring all root ball of weed is removed. Replace with vegetation where required.
Inspect swale surface for erosion	Six Monthly	Maintenance Contractor	Replace top soil in eroded area and cover and secure with biodegradable fabric. Cut hole in fabric and revegetate.
OSD SYSTEM			
Check all items nominated for SWALES/ LANDSCAPED AREAS above	Refer to SWALES/ LANDSCAPED AREAS section above	Refer to SWALES/ LANDSCAPED AREAS section above	Refer to SWALES/ LANDSCAPED AREAS section above
Inspect and remove any blockage from orifice	Six Monthly	Maintenance Contractor/ Owner	Remove grate and screen to inspect orifice.
Inspect trash screen and clean	Six Monthly	Maintenance Contractor/ Owner	Remove grate and screen if required to clean it.
Inspect flap valve and remove any blockage.	Six Monthly	Maintenance Contractor/ Owner	Remove grate. Ensure flap valve moves freely

MAINTENANCE ACTION	FREQUENCY	RESPONSIBILITY	PROCEDURE
			and remove any blockages or debris.
Inspect pit sump for damage or blockage.	Six Monthly	Maintenance Contractor/ Owner	Remove grate & screen. Remove sediment/ sludge build up and check orifice and flap valve is clear.
Inspect storage areas and remove debris/ mulch/ litter etc likely to block screens/ grates.	Six Monthly	Maintenance Contractor/ Owner	Remove debris and floatable materials.
Check attachment of orifice plate and screen to wall of pit	Annually	Maintenance Contractor	Remove grate and screen. Ensure plate or screen mounted securely, tighten fixings if required. Seal gaps if required.
Check orifice diameter is correct and retains sharp edge.	Five yearly	Maintenance Contractor	Compare diameter to design (see Work-as-Executed) and ensure edge is not pitted or damaged.
Check screen for corrosion	Annually	Maintenance Contractor	Remove grate and screen and examine for rust or corrosion, especially at corners or welds.
Inspect overflow weir and remove any blockage	Six monthly	Maintenance Contractor/ Owner	Ensure weir is free of blockage.
Inspect walls for cracks or spalling	Annually	Maintenance Contractor	Remove grate to inspect internal walls, repair as necessary.
Check step irons	Annually	Maintenance Contractor	Ensure fixings are secure and irons are free from corrosion.
RAINWATER TANK			
Check for any clogging and blockage of the first flush device	Monthly	Maintenance Contractor	First flush device to be cleaned out
Check for any clogging and blockage of the tank inlet -	Six monthly	Maintenance Contractor	Leaves and debris to be removed from the inlet leaf/litter screen

MAINTENANCE ACTION	FREQUENCY	RESPONSIBILITY	PROCEDURE
leaf/litter screen			
Check the level of sediment within the tank	Every two years	Maintenance Contractor	Sediment and debris to be removed from rainwater tank floor if sediment level is greater than the maximum allowable depth as specified by the hydraulic consultant
INLET & JUNCTION PITS			
Inside of pits	Six Monthly	Maintenance Contractor	Remove grate and inspect internal walls and base, repair where required. Remove any collected sediment, debris, litter.
Outside of pits	Four Monthly/ After Major Storm	Maintenance Contractor	Clean grate of collected sediment, debris, litter and vegetation.
PROPRIETARY TREATMENT DEVICES (GPT AND HYDRODYNAMIC)			
Refer to Manufacturers Operation and Maintenance Manual	Annually	Maintenance Contractor	Refer to Manufacturers Operation and Maintenance Manual
STORMWATER SYSTEM			
General Inspection of complete stormwater drainage system	Bi-annually	Maintenance Contractor	Inspect all drainage structures noting any dilapidation in structures and carry out required repairs.

8 EROSION & SEDIMENT CONTROL PLAN

An erosion and sediment control plan (ESCP) is included in drawings **Co8753.15-C220 and C225**. These plans show the works can proceed without polluting receiving waters. A detailed plan will be prepared after development consent is granted and before works commence.

8.1 General Conditions

1. The ESCP is to be read in conjunction with the engineering plans, and any other plans or written instructions that may be issued by the site manager, council inspector or other authorised representative in relation to development at the subject site.
2. Contractors will ensure that all soil and water management works are undertaken as instructed in this report and constructed following the guidelines stated in Managing Urban Stormwater, Soils and Construction (1998) and Liverpool Council's specifications.
3. All subcontractors will be informed by the site manager of their responsibilities in minimising the potential for sedimentation and soil erosion.

8.2 Land Disturbance

1. Where practicable, the soil erosion hazard on the site will be kept as low as possible and as recommended in Table 8.1.

Land Use	Limitation	Comments
Construction areas	Limited to 5 (preferably 2) metres from the edge of any essential construction activity as shown on the engineering plans.	All site workers will clearly recognise these areas that, where appropriate, are identified with barrier fencing (upslope) and sediment fencing (downslope), or similar materials.
Temporary construction access	Limited to a maximum width of 5 metres	The site manager will determine and mark the location of these zones onsite. All site workers will comply with these restrictions.
Remaining lands	Entry prohibited except for essential management works	

Table 8.1. Limitations to access

8.3 Erosion & Sediment Control Conditions

1. Clearly visible barrier fencing shall be installed as shown on drawing **Co8753.15-C220** and elsewhere at the discretion of the site superintendent to ensure traffic control and prohibit unnecessary site disturbance. Vehicular access to the site shall be limited to only those essential for construction work and they shall enter the site only through the stabilised access points.
2. Soil materials will be replaced in the same order they are removed from the ground. It is particularly important that all subsoils are buried and topsoils (landscaped areas only) remain on the surface at the completion of works.
3. The construction program should be scheduled so that period of time from starting land disturbance to stabilisation is minimised.
4. Notwithstanding this, schedule works so that the duration from the conclusion of land shaping to completion of final stabilisation is less than 20 working days.
5. Land recently established with grass species will be watered regularly until an effective cover has properly established and plants are growing vigorously. Further application of seed might be necessary later in areas of inadequate vegetation establishment.
6. Where practical, foot and vehicular traffic will be kept away from all recently established areas
7. Earth batters shall be constructed in accordance with the Geotechnical Engineers Report or with as low a gradient as practical but not steeper than:
 - 2H:1V where slope length is less than 7 metres
 - 2.5H:1V where slope length is between 7 and 10 metres
 - 3H:1V where slope length is between 10 and 12 metres
 - 4H:1V where slope length is between 12 and 18 metres
 - 5H:1V where slope length is between 18 and 27 metres
 - 6H:1V where slope length is greater than 27 metres
8. All earthworks, including waterways/drains/spillways and their outlets, will be constructed to be stable in at least the design storm event of 1 in 2 year ARI (Q2).
9. During windy weather, large, unprotected areas will be kept moist (not wet) by sprinkling with water to keep dust under control. In the event water is not available in sufficient quantities, soil binders and/or dust retardants will be used or the surface will be left in a cloddy state that resists removal by wind.

8.4 Pollution Control Conditions

1. Stockpiles will not be located within 5 metres of hazard areas, including likely areas of high velocity flows such as waterways, paved areas and driveways.
2. Sediment fences will:
 - a) Be installed where shown on the drawings, and elsewhere at the discretion of the site superintendent to contain the coarser sediment fraction (including aggregated fines) as near as possible to their source.
 - b) Have a catchment area not exceeding 720 square metres, a storage depth (including both settling and settled zones) of at least 0.6 metres, and internal dimensions that provide maximum surface area for settling, and
 - c) Provide a return of 1 metre upslope at intervals along the fence where catchment area exceeds 720 square meters, to limit discharge reaching each section to 10 litres/second in a maximum 20 year t_c discharge.
3. Sediment removed from any trapping device will be disposed of in locations where further erosion and consequent pollution to down slope lands and waterways will not occur.
4. Water will be prevented from directly entering the permanent drainage system unless it is relatively sediment free (i.e. the catchment area has been permanently landscaped and/or likely sediment has been treated in an approved device). Nevertheless, stormwater inlets will be protected.
5. Temporary soil and water management structures will be removed only after the lands they are protecting are fully stabilised.

8.5 Waste Management Conditions

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

8.6 Site Inspection and Maintenance

1. A self-auditing program will be established based on a check sheet (refer **Appendix D**). A site inspection using the check sheet will be made by the site manager:
 - At least weekly;
 - Immediately before site closure; and
 - Immediately following rainfall events in excess of 5mm in any 24 hour period.

The self-audit will include:

- Recording the condition of every sediment control device;
- Recording maintenance requirements (if any) for each sediment control device;
- Recording the volumes of sediment removed from sediment retention systems, where applicable;
- Recording the site where sediment is disposed; and

- Forwarding a signed duplicate of the completed Check Sheet to the project manager/developer for their recording.
2. In addition, the site manager will be required to oversee the installation and maintenance of all soil and water management works on the site. The person shall be required to provide a short monthly written report to the superintendent. The responsible person will ensure that:
 - The plan is being implemented correctly;
 - Repairs are undertaken as required; and
 - Essential modifications are made to the plan if and when necessary.

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

3. Waste bins will be emptied as necessary. Disposal of waste will be in a manner approved by the Site Superintendent.
4. Proper drainage will be maintained. To this end, drains (including inlet and outlet works) will be checked to ensure that they are operating as intended, especially that:
 - No low points exist that can fill and overtop in a large storm event;
 - Areas of erosion are repaired (e.g. lined with a suitable material) and/or velocity of flow is reduced appropriately through construction of small check dams and installing additional diversion upslope; and
 - Blockages are cleared (these might occur because of sediment pollution, sand/soil/spoil being deposited in or too close to them, breached by vehicle wheels, etc.).
5. Sand/soil/spoil materials placed closer than 2 metres from hazard areas will be removed. Such hazard areas include areas of high velocity water flows (e.g. waterways and gutters), paved areas and driveways.
6. Recently stabilised lands will be checked to ensure that erosion hazard has been effectively reduced. Any repairs will be initiated as appropriate.
7. Excessive vegetation growth will be controlled through mowing or slashing.
8. All sediment detention systems will be kept in good working condition. In particular, attention will be given to:
 - a) Recent works to ensure they have not resulted in diversion of sediment laden water away from them;
 - b) Degradable products to ensure they are replaced as required; and
 - c) Sediment removal, to ensure the design capacity remains in the settling zone.
9. Any pollutants removed from sediment basins or litter traps will be disposed of in areas where further pollution to down slope lands and waterways should not occur.
10. Additional erosion and/or sediment control works will be constructed as necessary to ensure the desired protection is given to down slope lands and waterways, i.e.

make ongoing changes to the plan where it proves inadequate in practice or is subjected to changes in conditions at the work site or elsewhere in the catchment.

11. Erosion and sediment control measures will be maintained in a functioning condition until all earthwork activities are completed and the site fully stabilised.
12. Litter, debris and sediment will be removed from the gross pollutant traps and trash racks as required.

9 CONCLUSION

This Civil Engineering Details Report has been prepared in support of a modification to SSD7155 for layout changes to Warehouse 1B and a proposed workshop for Volvo at Yarrunga Street, Prestons.

A civil engineering strategy for the site has been developed which provides a best practice solution within the constraints of the existing landform and proposed development layout, the previously approved development under SSD7155 and the constructed Buildings 2 & 5. Within this strategy a stormwater quantity and quality management strategy has been developed to reduce both peak flows and pollutant loads in stormwater leaving this site. The stormwater management for the development has been designed in accordance with Liverpool City Council's Part 1 of DCP2008.

The stormwater layout for the development sites maintain the existing catchment breakdown and adopt the stormwater discharge points provided as part of the infrastructure works and adopt proposed new discharge points. A hydrological assessment has been undertaken which confirms local post development flows from the site will be less than pre-development flows and demonstrates that the site discharge would not adversely affect any land, drainage system or watercourse as a result of the development. A stormwater detention system comprising total active storage of 1120m³ is proposed to attenuate developed stormwater flows to pre-developed flows.

Flood immunity to the proposed facilities has been maintained in relation to flooding from Cabramatta Creek which is present on the north-west corner of the development. Flood storage has been maintained for the small realignment of the existing open channel also at the north-west corner of the development footprint.

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

During the operational phase of the development, a treatment train incorporating the use Stormwater Treatment Measures (STM's) comprising a proprietary treatment train of gross pollutant trap, detention tanks and vortech style hydrodynamic separation unit have been proposed to mitigate the increase in stormwater pollutant loads generated by the development. MUSIC modelling results indicate that the proposed STM are effective in reducing pollutant loads from the stormwater discharging from the site and that the provided treatment meet the requirements of Council's pollution reduction targets. Best management practices have been applied to the development to ensure that the quality of stormwater runoff is not detrimental to the receiving environment.

It is recommended the management strategies in this report be approved and incorporated into the future detailed design.

10 REFERENCES

- Managing Urban Stormwater: Harvesting and Reuse – 2006 (NSW DEC);
- Managing Urban Stormwater: Source Control – 1998 (NSW EPA);
- Managing Urban Stormwater: Treatment Techniques – 1997 (NSW EPA);
- Managing Urban Stormwater: Soils & Construction – 2004(LANDCOM);
- Liverpool City Council – DCP 2008 (Part 1); and
- Water Sensitive Urban Design – “Technical Guidelines for Western Sydney” by URS Australia Pty Ltd, May 2004

Appendix A

DRAWINGS BY COSTIN ROE CONSULTING

PROPOSED INDUSTRIAL DEVELOPMENT SSD7155 MOD 3 WAREHOUSE 1 AND VOLVO FACILITY 32 YARRUNGA STREET, PRESTONS NSW

DRAWING LIST

DRAWING NO. DRAWING TITLE
C08753.15-C210 DRAWING LIST & GENERAL NOTES

C08753.15-C220 EROSION & SEDIMENT CONTROL PLAN
C08753.15-C225 EROSION & SEDIMENT CONTROL DETAILS

C08753.15-C230 BULK EARTHWORKS PLAN
C08753.15-C235 BULK EARTHWORKS SECTIONS- SHEET 1
C08753.15-C236 BULK EARTHWORKS SECTIONS- SHEET 2

C08753.15-C240 STORMWATER DRAINAGE PLAN
C08753.15-C242 STORMWATER DRAINAGE CATCHMENT PLAN
C08753.15-C245 STORMWATER DRAINAGE DETAILS - SHEET 1
C08753.15-C246 STORMWATER DRAINAGE DETAILS - SHEET 2

C08753.15-C250 FINISHED LEVELS PLAN
C08753.15-C255 TYPICAL SECTIONS

C08753.15-C265 TYPICAL RETAINING WALL DETAILS

C08753.15-C270 ROADWORK FUNCTIONAL LAYOUT PLAN & TYPICAL SECTIONS
C08753.15-C275 ROADWORK DETAILS

GENERAL NOTES:

- THESE DRAWINGS SHALL BE READ IN CONJUNCTION WITH ALL ARCHITECTURAL AND OTHER CONSULTANTS' DRAWINGS AND SPECIFICATIONS AND WITH SUCH OTHER WRITTEN INSTRUCTIONS AS MAY BE ISSUED DURING THE COURSE OF THE CONTRACT. ANY DISCREPANCY SHALL BE REFERRED TO THE ENGINEER BEFORE PROCEEDING WITH THE WORK.
- ALL MATERIALS AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH THE RELEVANT AND CURRENT STANDARDS AUSTRALIA CODES AND WITH THE BY-LAWS AND ORDINANCES OF THE RELEVANT BUILDING AUTHORITIES EXCEPT WHERE VARIED BY THE PROJECT SPECIFICATION.
- ALL DIMENSIONS SHOWN SHALL BE VERIFIED BY THE BUILDER ON SITE. ENGINEER'S DRAWINGS SHALL NOT BE SCALED FOR DIMENSIONS. ENGINEER'S DRAWINGS ISSUED IN ANY ELECTRONIC FORMAT MUST NOT BE USED FOR DIMENSIONAL SETOUT. REFER TO THE ARCHITECT'S DRAWINGS FOR ALL DIMENSIONAL SETOUT INFORMATION.
- DURING CONSTRUCTION THE STRUCTURE SHALL BE MAINTAINED IN A STABLE CONDITION AND NO PART SHALL BE OVERSTRESSED. TEMPORARY BRACING SHALL BE PROVIDED BY THE BUILDER TO KEEP THE WORKS AND EXCAVATIONS STABLE AT ALL TIMES.
- UNLESS NOTED OTHERWISE ALL LEVELS ARE IN METRES AND ALL DIMENSIONS ARE IN MILLIMETRES.
- ALL WORKS SHALL BE UNDERTAKEN IN ACCORDANCE WITH ACCEPTABLE SAFETY STANDARDS & APPROPRIATE SAFETY SIGNS SHALL BE INSTALLED AT ALL TIMES DURING THE PROGRESS OF THE JOB.

FINISHED LEVELS PLAN NOTES:

- LEVELS DATUM IS A.H.D.
- ALL CONTOUR LINES & SPOT LEVELS INDICATE FINISHED PAVEMENT LEVELS U.N.O. ON PLAN.
- THE MAJOR CONTOUR INTERVAL IS 0.5m
- THE MINOR CONTOUR INTERVAL IS 0.1m.
- MINIMUM PAVEMENT GRADE IS TO BE 1:100 (1%)
- MAXIMUM PAVEMENT GRADE IS TO BE 1:20 (5%) IN CARPARKING AREAS AND 1:25 (4%) ELSEWHERE.
- MAXIMUM RAMP GRADES ARE TO BE 1:12 (8.3%) U.N.O. ON PLAN
- PROVIDE MINIMUM 3.0m LONG TRANSITION WHERE CHANGES GRADE EXCEED 1:20 (5%).
- PERMANENT BATTER SLOPES ARE TO HAVE A MAXIMUM GRADE OF 1V:3H.
- ALL BATTER SLOPE WITH GRADES AT OR EXCEEDING 1V:6H ARE TO BE TURFED IMMEDIATELY OR APPROPRIATE EROSION CONTROL IS TO BE PROVIDED TO THE SATISFACTION OF THE ENGINEER.
- THE ACCESS ROAD TO THE HARDSTAND AREA IS TO HAVE A CROSSFALL OF 2% AS INDICATED ON PLAN.
- ALL FOOTPATHS ARE TO FALL AWAY FROM THE BUILDING AT 25% NOMINAL GRADE.
- ALL PAVEMENTS ARE TO BE SET AT 50mm BELOW THE FINISHED FLOOR LEVEL OF THE WAREHOUSE AND OFFICE AREAS.

ELECTRONIC INFORMATION NOTES:

- THE ISSUED DRAWINGS IN HARD COPY OR PDF FORMAT TAKE PRECEDENCE OVER ANY ELECTRONICALLY ISSUED INFORMATION, LAYOUTS OR DESIGN MODELS.
- THE CONTRACTOR'S DIRECT AMENDMENT OR MANIPULATION OF THE DATA OR INFORMATION THAT MIGHT BE CONTAINED WITHIN AN ENGINEER-SUPPLIED DIGITAL TERRAIN MODEL AND ITS SUBSEQUENT USE TO UNDERTAKE THE WORKS WILL BE SOLELY AT THE DISCRETION OF AND THE RISK OF THE CONTRACTOR.
- THE CONTRACTOR IS REQUIRED TO HIGHLIGHT ANY DISCREPANCIES BETWEEN THE DIGITAL TERRAIN MODEL AND INFORMATION PROVIDED IN THE CONTRACT AND/OR DRAWINGS AND IS REQUIRED TO SEEK CLARIFICATION FROM THE SUPERINTENDENT.
- THE ENGINEER WILL NOT BE LIABLE OR RESPONSIBLE FOR THE POSSIBLE ON-GOING NEED TO UPDATE THE DIGITAL TERRAIN MODEL, SHOULD THERE BE ANY AMENDMENTS OR CHANGES TO THE DRAWINGS OR CONTRACT INITIATED BY THE CONTRACTOR.

NOTE:

DRAWINGS TO BE READ IN CONJUNCTION WITH ENGINEERING REPORT C08753.15-06.rpt, REVISION A, DATED 05.07.17.

SITE PREPARATION NOTES:

- ALL EARTHWORKS SHALL BE COMPLETED GENERALLY IN ACCORDANCE WITH THE GUIDELINES SPECIFIED BY THE GEOTECHNICAL REPORT.
- EXISTING LEVELS ARE BASED ON INFORMATION PROVIDED.
- STRIP ANY TOP SOIL OR DELETERIOUS MATERIAL AND DISPOSE OF FROM SITE OR STORE AS DIRECTED.
- COMPLETE CUT TO FILL EARTHWORKS TO ACHIEVE THE REQUIRED LEVELS AS INDICATED ON THE DRAWINGS WITHIN A TOLERANCE OF +0mm/-10mm THROUGH BUILDING PADS/PAVEMENTS AND +0mm/-20mm ELSEWHERE.
- PREPARE STEEP BATTERS TO RECEIVE FILL BY CONSTRUCTING BENCHING TO FACILITATE FILL PLACEMENT AND COMPACTION.
- AREAS TO RECEIVE FILL (THAT ARE NOT ON BENCED BATTERS) AND AREAS IN CUT SHALL BE PROOF ROLLED TO IDENTIFY ANY SOFT HEAVING MATERIAL. SOFT MATERIAL SHALL BE BOXED OUT AND REMOVED PRIOR TO FILL PLACEMENT.
- SITE WON FILL TO BE PLACED IN MAXIMUM 300mm LOOSE LAYERS AND COMPACTED TO 100% STANDARD AND WITHIN 2% OF OPTIMUM MOISTURE CONTENT.
- IMPORTED FILL SHALL BE PLACED IN MAXIMUM 300mm LOOSE LAYERS AND COMPACTED TO 100% STANDARD AND WITHIN 2% OF OPTIMUM MOISTURE CONTENT.
- MAXIMUM PARTICLE SIZE TO BE THE SMALLER OF 150mm OR HALF THE (LOOSE) LAYER THICKNESS AND/OR TWO THIRDS THE LAYER THICKNESS AFTER COMPACTION.
- ALL EARTHWORKS SHALL BE COMPLETED UNDER LEVEL 1 CONTROL IN ACCORDANCE WITH AS 3798-2007.
- PRIOR TO ANY EARTHWORKS, EROSION CONTROL AS OUTLINED IN THE EROSION AND SEDIMENTATION CONTROL PLAN SHALL BE COMPLETED.
- EXISTING ROCK, IF ANY, SHALL BE REMOVED BY HEAVY ROCK BREAKING OR RIPPING.
- MATCH EXISTING LEVELS AT BATTER INTERFACE.
- CONTRACTOR TO MATCH EXISTING LEVELS AT THE INTERFACE OF EARTHWORKS AND EXISTING SURFACE AT BATTER LOCATIONS OR WHERE NO RETAINING WALLS ARE PRESENT. ANY DISCREPANCY BETWEEN DESIGN AND EXISTING LEVELS TO BE REFERRED TO THE ENGINEER FOR DIRECTION OR ADJUSTMENTS TO DESIGN LEVELS.

STORMWATER DRAINAGE NOTES:

- ALL STORMWATER WORKS TO BE COMPLETED IN ACCORDANCE WITH AUSTRALIAN STANDARD AS3500.3:2003 PLUMBING AND DRAINAGE, PART 3: STORMWATER DRAINAGE.
- THE MINOR (PIPED) SYSTEM HAS BEEN DESIGNED FOR THE 1 IN 20 YEAR ARI STORM EVENT AND THE MAJOR (OVERLAND) SYSTEM HAS BEEN DESIGNED FOR THE 1 IN 100 YEAR ARI STORM EVENT.
- ALL FINISHED PAVEMENT LEVELS SHALL BE AS INDICATED ON FINISHED LEVELS PLANS C250.
- PIT SIZES SHALL BE AS INDICATED IN THE SCHEDULE WHILE PIPE SIZES AND DETAILS ARE PROVIDED ON PLAN.
- EXISTING STORMWATER PIT LOCATIONS AND INVERT LEVELS TO BE CONFIRMED BY SURVEY PRIOR TO COMMENCING WORKS ON SITE.
- ALL STORMWATER PIPES Ø375 OR GREATER SHALL BE CLASS 2 REINFORCED CONCRETE WITH RUBBER RING JOINTS UNLESS NOTED OTHERWISE.
- ALL PIPES UP TO AND INCLUDING Ø300 TO BE uPVC GRADE S8 UNO.
- PIPE CLASS NOMINATED ARE FOR IN-SERVICE LOADING CONDITIONS ONLY. CONTRACTOR IS TO MAKE ANY NECESSARY ADJUSTMENTS REQUIRED FOR CONSTRUCTION CONDITIONS.
- ALL CONCRETE PITS GREATER THAN 1000mm DEEP SHALL BE REINFORCED USING N12-200 EACH WAY CENTERED IN WALL AND BASE. LAP MINIMUM 300mm WHERE REQUIRED. ALL CONCRETE FOR PITS SHALL BE Fc' 25 MPA. PRECAST PITS MAY BE USED WITH THE APPROVAL OF THE ENGINEER.
- IN ADDITION TO ITEM 6 ABOVE, ALL CONCRETE PITS GREATER THAN 3000mm DEEP SHALL HAVE WALLS AND BASE THICKNESS INCREASED TO 200mm.
- PIPES SHALL BE LAID AS PER PIPE LAYING DETAILS. PARTICULAR CARE SHALL BE TAKEN TO ENSURE THAT THE PIPE IS FULLY AND EVENLY SUPPORTED. RAM AND PACK FILLING AROUND AND UNDER BACK OF PIPES AND PIPE FAUCETS, WITH NARROW EDGED RAMPERS OR OTHER SUITABLE TAMPING DETAILS.
- WHERE PIPE LINES ENTER PITS, PROVIDE 2m LENGTH OF STOCKING WRAPPED SLOTTED Ø100 uPVC TO EACH SIDE OF PIPE.
- ALL SUBSOIL DRAINAGE LINES SHALL BE Ø100 SLOTTED uPVC WITH APPROVED FILTER WRAP LAID IN 300mm WIDE GRANULAR FILTER UNLESS NOTED OTHERWISE. LAY SUBSOIL LINES TO MATCH FALLS OF LAND AND/OR 1 IN 200 MINIMUM. PROVIDE CAPPED CLEANING EYE (RODDING POINT) AT UPSTREAM END OF LINE AND AT 30m MAX. CTS. PROVIDE SUBSOIL LINES TO ALL PAVEMENT/ LANDSCAPED INTERFACES, TO REAR OF RETAINING WALLS (AS NOMINATED BY STRUCTURAL ENGINEER) AND AS SHOWN ON PLAN.
- ALL PIPE GRADES 1 IN 100 MINIMUM UNO.
- PROVIDE STEP IRONS IN PITS DEEPER THAN 1000mm.
- MIN. 600 COVER TO PIPE OBVERT BENEATH ROADS & MIN. 400 COVER BENEATH LANDSCAPED AND PEDESTRIAN AREAS.
- PIT COVERS IN TRAFFICABLE PAVEMENT SHALL BE CLASS D 'HEAVY DUTY'. THOSE LOCATED IN NON-TRAFFICABLE AREAS SHALL BE CLASS B 'MEDIUM DUTY' U.N.O.
- PROVIDE CLEANING EYES (RODDING POINTS) TO PIPES AT ALL CORNERS AND T-JUNCTIONS WHERE NO PITS ARE PRESENT.
- DOWN PIPES (DP) TO BE AS PER HYDRAULIC ENGINEERS DETAILS WITH CONNECTOR TO MATCH DP SIZE U.N.O. ON PLAN. PROVIDE CLEANING EYE AT GROUND LEVEL.
- PIPE LENGTHS NOMINATED ON PLAN OR LONGSECTIONS ARE MEASURED FROM CENTER OF PITS TO THE NEAREST 0.5m AND DO NOT REPRESENT ACTUAL LENGTH. THE CONTRACTOR IS TO ALLOW FOR THIS.

EROSION CONTROL NOTES

ALL CONTROL WORK INCLUDING DIVERSION BANKS AND CATCH DRAINS, V-DRAINS AND SILT FENCES SHALL BE COMPLETED DIRECTLY FOLLOWING THE COMPLETION OF THE EARTHWORKS.

- SILT FENCES AND SILT FENCE RETURNS SHALL BE ERECTED CONVEX TO THE CONTOUR TO POND WATER.
- HAY BALE BARRIERS AND GEOTEXTILE FENCES ARE TO BE CONSTRUCTED TO TOE OF BATTER, PRIOR TO COMMENCEMENT OF EARTHWORKS, IMMEDIATELY AFTER CLEARING OF VEGETATION AND BEFORE REMOVAL OF TOP SOIL.
- ALL TEMPORARY EARTH BERM, DIVERSION AND SILT DAM EMBANKMENTS ARE TO BE MACHINE COMPACTED, SEEDED AND MULCHED FOR TEMPORARY VEGETATION COVER AS SOON AS THEY HAVE BEEN FORMED.
- CLEAR WATER IS TO BE DIVERTED AWAY FROM DISTURBED GROUND AND INTO THE DRAINAGE SYSTEM.
- THE CONTRACTOR IS RESPONSIBLE FOR MAINTAINING AND PROVIDING ON GOING ADJUSTMENT TO EROSION CONTROL MEASURES AS REQUIRED DURING CONSTRUCTION.
- ALL SEDIMENT TRAPPING STRUCTURES AND DEVICES ARE TO BE INSPECTED AFTER STORMS FOR STRUCTURAL DAMAGE OR CLOGGING. TRAPPED MATERIAL IS TO BE REMOVED TO A SAFE, APPROVED LOCATION.
- ALL FINAL EROSION PREVENTION MEASURES INCLUDING THE ESTABLISHMENT OF GRASSING ARE TO BE MAINTAINED UNTIL THE END OF THE DEFECTS LIABILITY PERIOD.
- ALL EARTHWORKS AREAS SHALL BE ROLLED ON A REGULAR BASIS TO SEAL THE EARTHWORKS.
- ALL FILL AREAS ARE TO BE LEFT WITH A BUND AT THE TOP OF THE SLOPE AT THE END OF EACH DAY'S EARTHWORKS. THE HEIGHT OF THE BUND SHALL BE A MINIMUM OF 200mm.
- ALL CUT AND FILL SLOPES ARE TO BE SEEDED AND HYDROMULCHED WITHIN 10 DAYS OF COMPLETION OF FORMATION.
- AFTER REVEGETATION OF THE SITE IS COMPLETE AND THE SITE IS STABLE IN THE OPINION OF A SUITABLY QUALIFIED PERSON ALL TEMPORARY WORK SUCH AS SILT FENCE, DIVERSION DRAINS ETC SHALL BE REMOVED.
- ALL TOPSOIL STOCKPILES ARE TO BE SUITABLY COVERED TO THE SATISFACTION OF THE SITE MANAGER TO PREVENT WIND AND WATER EROSION.
- ANY AREA THAT IS NOT APPROVED BY THE CONTRACT ADMINISTRATOR FOR CLEARING OR DISTURBANCE BY THE CONTRACTOR'S ACTIVITIES SHALL BE CLEARLY MARKED AND SIGN POSTED, FENCED OFF OR OTHERWISE APPROPRIATELY PROTECTED AGAINST ANY SUCH DISTURBANCE.
- ALL STOCKPILE SITES SHALL BE SITUATED IN AREAS APPROVED FOR SUCH USE BY THE SITE MANAGER. A 6m BUFFER ZONE SHALL EXIST BETWEEN STOCKPILE SITES AND ANY STREAM OR FLOW PATH. ALL STOCKPILES SHALL BE ADEQUATELY PROTECTED FROM EROSION AND CONTAMINATION OF THE SURROUNDING AREA BY USE OF THE MEASURES APPROVED IN THE EROSION AND SEDIMENTATION CONTROL PLAN.
- ACCESS AND EXIT AREAS SHALL INCLUDE SHAKE-DOWN OR OTHER METHODS APPROVED BY THE SITE MANAGER FOR THE REMOVAL OF SOIL MATERIALS FORM MOTOR VEHICLES.
- THE CONTRACTOR IS TO ENSURE RUNOFF FROM ALL AREAS WHERE THE NATURAL SURFACE IS DISTURBED BY CONSTRUCTION, INCLUDING ACCESS ROADS, DEPOT AND STOCKPILE SITES, SHALL BE FREE OF POLLUTANTS BEFORE IT IS EITHER DISPERSED TO STABLE AREAS OR DIRECTED TO NATURAL WATERCOURSES.
- THE CONTRACTOR SHALL PROVIDE AND MAINTAIN SLOPES, CROWNS AND DRAINS ON ALL EXCAVATIONS AND EMBANKMENTS TO ENSURE SATISFACTORY DRAINAGE AT ALL TIMES. WATER SHALL NOT BE ALLOWED TO POND ON THE WORKS UNLESS SUCH PONDING IS PART OF AN APPROVED ESCP / SWMP.

RETAINING WALL NOTES:

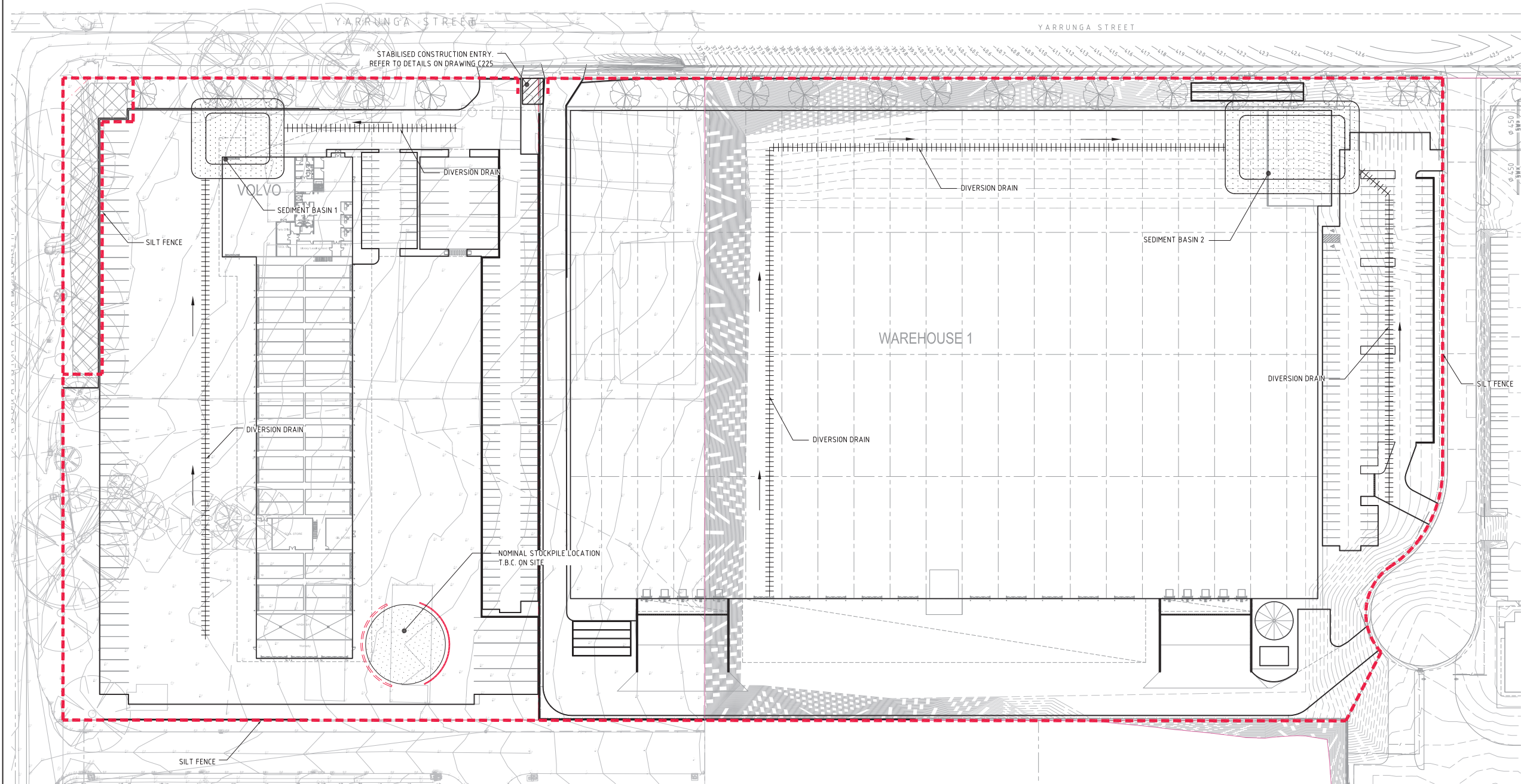
- ALL COMPONENTS AND INSTALLATION SHALL COMPLY WITH AS4678 AND THE STANDARDS REFERRED TO THEREIN.
- MINIMUM BEARING CAPACITY OF FOUNDATION TO BE AS FOLLOWS:
 - H MAX. 2.0m = 100 kPa
 - H MAX. 3.5m = 150 kPa
 - H MAX. 5.0m = 200 kPa
- BEFORE COMMENCEMENT OF CONSTRUCTION THE FOUNDATION SHALL BE INSPECTED AND VERIFIED BY A QUALIFIED GEOTECHNICAL ENGINEER.
- WHERE MINIMUM BEARING IS NOT ACHIEVABLE OR NOT MEETING DESIGN REQUIREMENT, THE FOUNDATION MATERIAL IS TO BE EXCAVATED AND REPLACED WITH APPROVED MATERIAL PLACED IN ACCORDANCE WITH THE FILLING SPECIFICATION TO A MINIMUM COMPACTION OF 100% SMD AND PLACED WITHIN 2% OF OMC. MINIMUM SURCHARGE LOADS TO BE APPLIED AS FOLLOWS U.N.O. ON PLAN:
 - LIVE LOAD = 20 kPa
 - DEAD LOAD = 5 kPa
 - CONSTRUCTION TRAFFIC LIVE LOAD = 10 kPa
- MINIMUM WALL EMBEDMENT AT THE TOE OF THE WALL TO BE 300MM MINIMUM UNLESS NOTED OTHERWISE.
- DESIGN LIFE OF STRUCTURE IS TO BE 100 YEARS.
- TIED WALLS ARE TO BE TEMPORARILY PROPPED AT TOP UNTIL SUCH TIME THE TOP OF WALL IS TIED TO THE SLAB AND 28-DAY CONCRETE STRENGTH HAS BEEN ACHIEVED.
- CONSTRUCTION EQUIPMENT WEIGHING MORE THAN 500KG STATIC WEIGHT IS TO BE KEPT BACK 15m FROM THE REAR FACE OF THE WALL FACING UNITS. COMPACTION OF THE SELECT FILL MATERIAL WITHIN THE 1.5m STRIP ADJACENT TO THE WALL SHALL BE ACHIEVED BY LIGHT MECHANICAL TAMPERS (VIBRATING PLATE, TRENCH COMPACTOR OR SIMILAR) TO GIVE THE SAME DENSITY AS IN THE REMAINDER OF THE SELECT FILL.
- ALL DESIGN AND CONSTRUCT WALL SYSTEM TO BE COMPLETED IN ACCORDANCE WITH THESE NOTES.



LOCALITY PLAN
NOT TO SCALE

FOR DEVELOPMENT APPLICATION

DRAWING LIST UPDATED 28.09.17 ISSUED FOR DEVELOPMENT APPLICATION 21.07.17 ISSUED FOR INFORMATION 10.07.17 ISSUED FOR INFORMATION 05.07.17 AMENDMENTS	28.09.17 C B A	D C B A	AMENDMENTS	DATE	ISSUE	AMENDMENTS	DATE	ISSUE	ARCHITECT AXIS ARCHITECTURAL 4/112 CRONULLA STREET CRONULLA NSW 2230	CLIENT LOGOS PROPERTY SUITE 02, LEVEL 12 167 MACQUARIE STREET SYDNEY NSW 2000	PROJECT PROPOSED DEVELOPMENT 32 YARRUNGA ROAD PRESTONS NSW	DESIGNED MW	DRAWN TW	DATE MAY 17	CHECKED AD	SIZE A3	SCALE AS SHOWN	CAD REF C08753.15-C210	Costin Roe Consulting Pty Ltd. Consulting Engineers Level 1, 8 Widdowall Street Wahah Bay, Sydney NSW 2000 Tel: (02) 8551-7899 Fax: (02) 8541-3721 email: mail@costinroe.com.au	PRECISION | COMMUNICATION | ACCOUNTABILITY	DRAWING TITLE DRAWING LIST & GENERAL NOTES
																				DRAWING No C08753.15-C210	ISSUE 0



LEGEND:

- DENOTES SILT FENCE WITH CATCH DRAIN
- DENOTES SILT FENCE

SEDIMENTATION BASIN NOTE:

FOR SEDIMENT & EROSION CONTROL DETAILS REFER TO DRAWING C08753.15-C225.

SEDIMENTATION BASIN SIZING BASED ON RECOMMENDATIONS OF 'SOILS AND CONSTRUCTION, MANAGING URBAN STORMWATER-THE BLUE BOOK'. CAPACITY BASED UPON 5 DAY RAINFALL DEPTH AT 85th PERCENTILE INTENSITY (32.2mm).

APPROXIMATE AREA OF DISTURBED SITE = 2.89 Ha

SEDIMENTATION BASINS TO COLLECT RUN-OFF IN EXTREME RAINFALL EVENTS. COLLECTED RUN-OFF TO BE ASSESSED BY A QUALIFIED LABORATORY FOR DOUSING RATES OF ALUM OR GYPSUM TO ENSURE COAGULATION OF SEDIMENTS PRIOR TO WATER BEING DISCHARGED TO COUNCIL STORMWATER SYSTEM.

EACH BASIN IS TO HAVE A MARKER PLACED AS PER THE DETAIL TO INDICATE WHEN SEDIMENT IS TO BE REMOVED. REMOVED SEDIMENT IS TO BE CLASSED AND DEWATERED PRIOR TO REMOVAL FROM SITE.

ALLOWANCE TO BE MADE DURING BENCHING OF SITE TO ENSURE RUN-OFF IS DIRECTED TO SEDIMENTATION BASINS.

NOTES:

1. ASSUME TYPE D SOIL (CLAY/SILTY CLAY)
2. ASSUME GROUP D SOIL (HIGH PLASTICITY AND SHRINK/SWELL PROPERTIES)

SOIL TYPE ASSESSED FROM THE GEOTECHNICAL REPORT PROVIDED BY GROUND TECHNOLOGIES TITLED GTE549-GEOTECH DATED 27.10.15.

SEDIMENT BASIN 1:

- CATCHMENT AREA = 3.0ha
- REQUIRED BASIN VOLUME = 728m³
- BASE DIMENSION (LxB) = 16m x 20m
- TOP DIMENSION (LxB) = 25m x 29m
- MAX SIDE SLOPE = 1V:3H
- DEPTH = 1.5m
- PROVIDED BASIN VOLUME = 763m³

SEDIMENT BASIN 2:

- CATCHMENT AREA = 5.57ha
- REQUIRED BASIN VOLUME = 1351m³
- BASE DIMENSION (LxB) = 20m x 33m
- TOP DIMENSION (LxB) = 29m x 42m
- MAX SIDE SLOPE = 1V:3H
- DEPTH = 1.5m
- PROVIDED BASIN VOLUME = 1387m³



EROSION AND SEDIMENT CONTROL PLAN

1:500

NOTE:

REFER TO DRAWING C08753.15-C210 FOR EROSION & SEDIMENT CONTROL NOTES



FOR DEVELOPMENT APPLICATION

ISSUED FOR DEVELOPMENT APPLICATION			21.07.17			C			ARCHITECT			AXIS ARCHITECTURAL			CLIENT			LOGOS PROPERTY			PROJECT			PROPOSED DEVELOPMENT			Costin Roe Consulting Pty Ltd.			DRAWING TITLE		
ISSUED FOR INFORMATION			10.07.17			B			4/112 CRONULLA STREET			167 MACQUARIE STREET			SUITE 02, LEVEL 12			32 YARRUNGA ROAD			Level 1, 8 Widdowall Street			Wahah Bay, Sydney NSW 2000			PRECISION | COMMUNICATION | ACCOUNTABILITY			EROSION AND SEDIMENT CONTROL PLAN		
ISSUED FOR INFORMATION			05.07.17			A			CRONULLA NSW 2230			SYDNEY NSW 2000			DESIGNED			DRAWN			DATE			MAY 17			C08753.15-C220			C08753.15-C220		
AMENDMENTS			DATE			ISSUE			AMENDMENTS			DATE			ISSUE			AMENDMENTS			DATE			ISSUE			AMENDMENTS			DATE		



TYPICAL SILT FENCE DETAIL
N.T.S.
PROVIDE 1m RETURNS AT 30m INTERVALS
TYPICAL



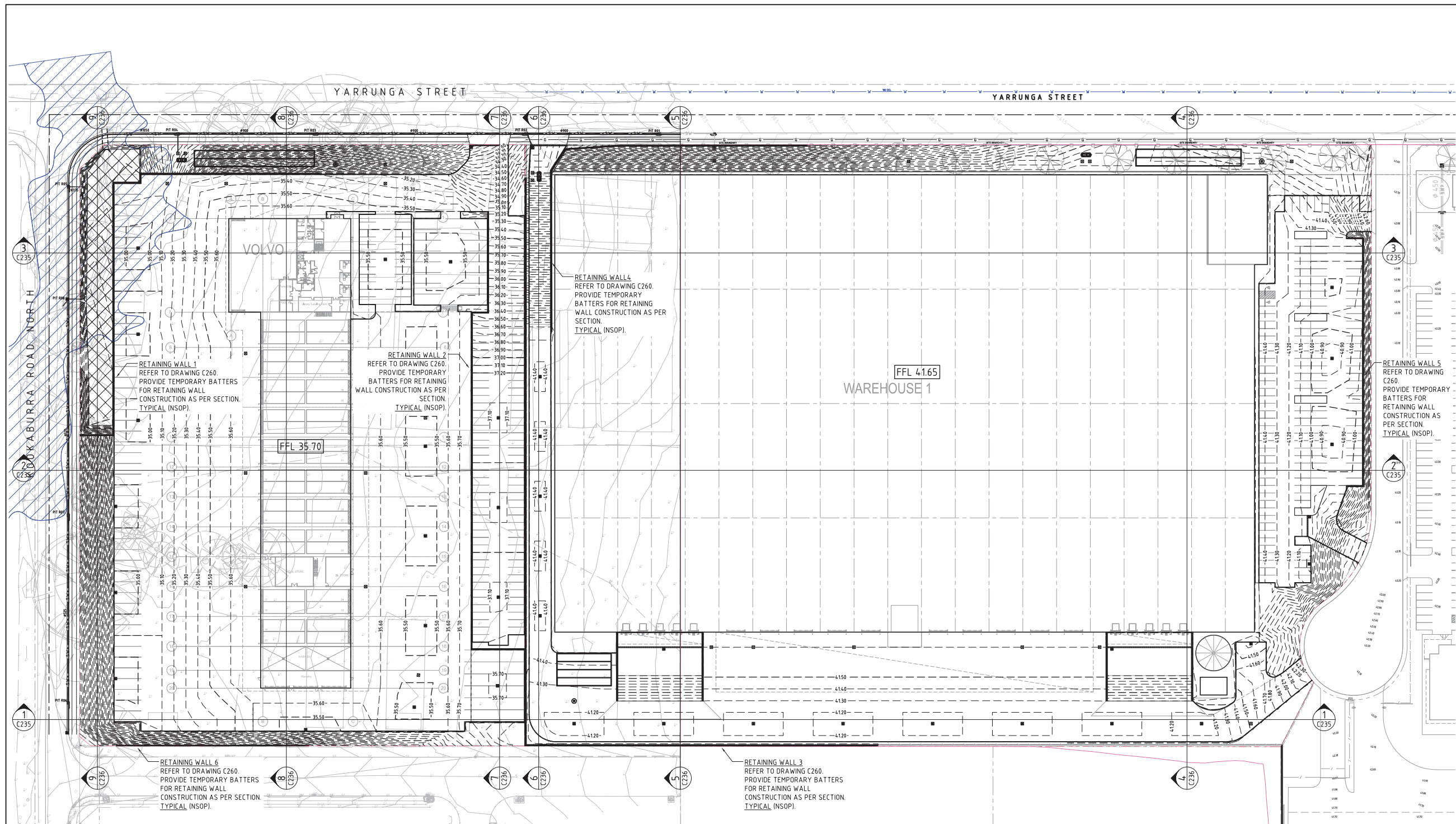
1. PLACE ALL STOCKPILES IN LOCATIONS MORE THAN 5m FROM EXISTING VEGETATION, ROADS & HAZARD AREAS.
2. CONSTRUCT ON THE CONTOUR AS LOW, FLAT ELONGATED MOUNDS. SIDE SLOPE TO BE 1 V: 2 H MAX.
3. WHERE THERE IS SUFFICIENT AREA, TOPSOIL STOCKPILES SHALL BE LESS THAN 2m IN HEIGHT.
4. WHERE STOCKPILES ARE TO BE IN PLACE FOR MORE THAN 10 DAYS, STABILISE USING WOOD CHIP MULCH - 16 TONNE/ha.
5. CONSTRUCT SILT FENCE WITH CATCH DRAIN ON UPSLOPE SIDE TO DIVERT WATER AROUND STOCKPILES & SILT FENCE ONLY 1 TO 2m DOWNSLOPE AS SHOWN.



- TYPICAL SEDIMENT CONTROL BASIN SECTION
SCALE 1:50



-
- 200mm 0 500 1000 1500 2000mm
SCALE 1:20 AT A0 SHEET SIZE
- 500mm 0 1 2 3 4 5m
SCALE 1:50 AT A0 SHEET SIZE
- 2m 0 5 10 15 20 25m
SCALE 1:250 AT A0 SHEET SIZE



LEGEND

LEVELS DATUM IS AHD.

— 75.00 — — EXISTING CONTOUR

— 73.00 — — B.E.L. CONTOUR (MAJOR 0.5m)

— 73.10 — — B.E.L. CONTOUR (MINOR 0.1m)

PAVEMENT
BASE/SUBBASE COURSES
SUBGRADE

PAVEMENT FFL
DEPTH OF PAVEMENT. REFER TO STRUCTURAL PLANS FOR DETAILS.
NOMINATED B.E. LEVEL

NOMINATED B.E.L. DETAIL
N.T.S.

EARTHWORKS VOLUMES ESTIMATE

PRELIMINARY BULK EARTHWORKS VOLUMES BASED ON A NOMINAL TOPSOIL STRIP OF 100mm OVER UNDEVELOPED SITE AREA:

CUT	= - 98,250 m ³
FILL	= +125,250 m ³
DETAILED EXCAVATION	= - 6,300 m ³
CUT BULKING	= - 3,900 m ³
IMPORT FROM ADJACENT SITE	= - 17,500 m ³
BALANCE	= - 650 m ³ (EXPORT)

EARTHWORKS VOLUMES ARE APPROXIMATE ONLY. NO ALLOWANCE HAS BEEN MADE FOR DELETERIOUS MATERIAL, EROSION & SEDIMENT CONTROL, RETAINING WALL EXCAVATION OR COMPACTION OF FILLED SOILS.

ALLOWANCES FOR STRUCTURE

	DEPTH OF PAVEMENT
WAREHOUSE	300mm
HARDSTAND	300mm
CARPARK	300mm
LANDSCAPING	100mm

SITE PREPARATION NOTES:

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- STRIP ANY TOP SOIL OR DELETERIOUS MATERIAL AND DISPOSE OF FROM SITE OR STORE AS DIRECTED.
- COMPLETE CUT TO FILL EARTHWORKS TO ACHIEVE THE REQUIRED LEVELS AS INDICATED ON THE DRAWINGS WITHIN A TOLERANCE OF +0mm/-10mm THROUGH BUILDING PADS/PAVEMENTS AND +0mm/-20mm ELSEWHERE.
- PREPARE STEEP BATTERS TO RECEIVE FILL BY CONSTRUCTING BENCHING TO FACILITATE FILL PLACEMENT AND COMPACTION.
- AREAS TO RECEIVE FILL (THAT ARE NOT ON BENCHED BATTERS) AND AREAS IN CUT SHALL BE PROOF ROLLED TO IDENTIFY ANY SOFT HEAVING MATERIAL. SOFT MATERIAL SHALL BE BOXED OUT AND REMOVED PRIOR TO FILL PLACEMENT.
- REFER TO TOPSOIL PREPARATION NOTES FOR AREAS AFFECTED BY EXISTING TOPSOIL MOUND/BORROW PIT.
- SITE WON FILL TO BE PLACED IN MAXIMUM 300mm LOOSE LAYERS AND COMPACTED TO 100% STANDARD AND WITHIN 2% OF OPTIMUM MOISTURE CONTENT.
- IMPORTED FILL SHALL BE PLACED IN MAXIMUM 300mm LOOSE LAYERS AND COMPACTED TO 100% STANDARD AND WITHIN 2% OF OPTIMUM MOISTURE CONTENT.
- MAXIMUM PARTICLE SIZE TO BE THE SMALLER OF 150mm OR HALF THE (LOOSE) LAYER THICKNESS AND/OR TWO THIRDS THE LAYER THICKNESS AFTER COMPACTION.
- ALL EARTHWORKS SHALL BE COMPLETED UNDER LEVEL 1 CONTROL IN ACCORDANCE WITH AS 3798-2007.
- PRIOR TO ANY EARTHWORKS, EROSION CONTROL AS OUTLINED IN THE EROSION AND SEDIMENTATION CONTROL PLAN SHALL BE COMPLETED.
- EXISTING ROCK, IF ANY, SHALL BE REMOVED BY HEAVY ROCK BREAKING OR RIPPING.
- MATCH EXISTING LEVELS AT BATTER INTERFACE.
- CONTRACTOR TO MATCH EXISTING LEVELS AT THE INTERFACE OF EARTHWORKS AND EXISTING SURFACE AT BATTER LOCATIONS OR WHERE NO RETAINING WALLS ARE PRESENT. ANY DISCREPANCY BETWEEN DESIGN AND EXISTING LEVELS TO BE REFERRED TO THE ENGINEER FOR DIRECTION OR ADJUSTMENTS TO DESIGN LEVELS.

LEVELS NOTE:

LEVELS SHOWN TO BE ±500mm FROM THOSE SHOWN. FINAL LEVELS SUBJECT TO MINOR VARIATIONS TO SUIT DETAILED DESIGN.



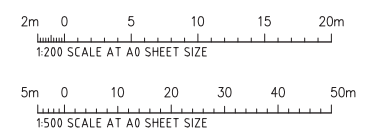
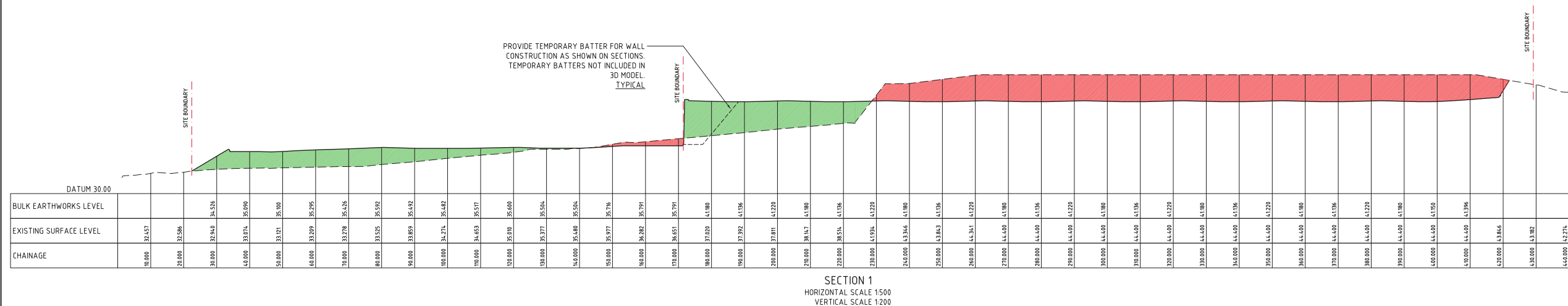
BULK EARTHWORKS PLAN
1:500

FOR DEVELOPMENT APPLICATION

ISSUED FOR DEVELOPMENT APPLICATION		28.09.17	A	AMENDMENTS		DATE	ISSUE	AMENDMENTS		DATE	ISSUE
ARCHITECT		AXIS ARCHITECTURAL		CLIENT		LOGOS PROPERTY		PROJECT		PROPOSED DEVELOPMENT	
4/112 CRONULLA STREET		167 MACQUARIE STREET		SUITE 02, LEVEL 12		SYDNEY NSW 2000		32 YARRUNGA ROAD		PRESTONS NSW	
COSTIN ROE CONSULTING PTY LTD.		Level 1, 8 Windmill Street		Wahah Bay, Sydney NSW 2000		Tel: (02) 8551-7899 Fax: (02) 8541-3721		email: mail@costinroe.com.au		CAD REF: C08753.15-C230	
DESIGNED		DRW	TW	DATE	MAY '17	CHECKED	SIZE	SCALE	AS SHOWN	DRAWING TITLE	
PRECISION		COMMUNICATION		ACCOUNTABILITY		DRAWING No		C08753.15-C230		ISSUE	
										A	

LEVELS DATUM IS AHD.

----- - EXISTING SURFACE LEVEL PROFILE



Costin Roe Consulting

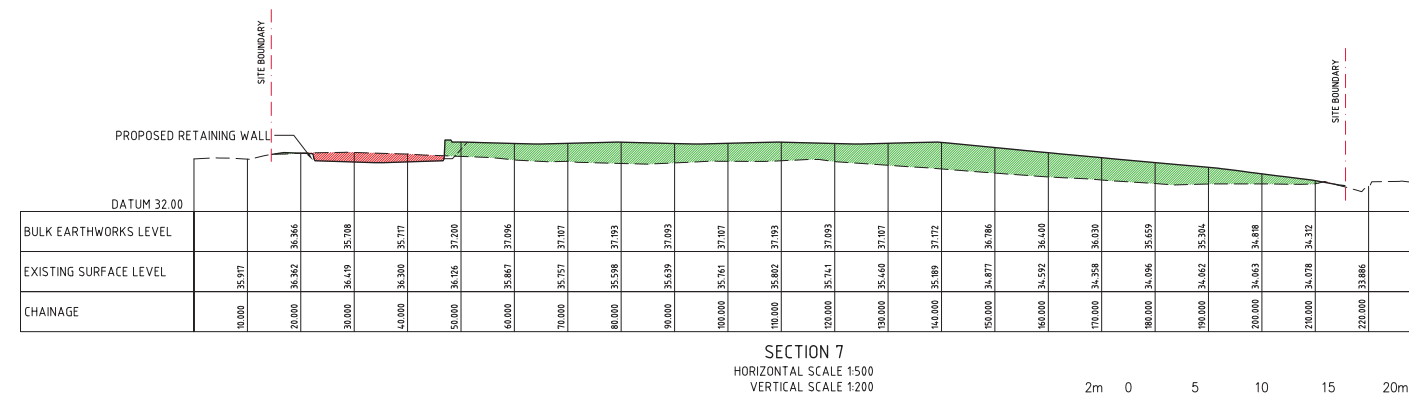
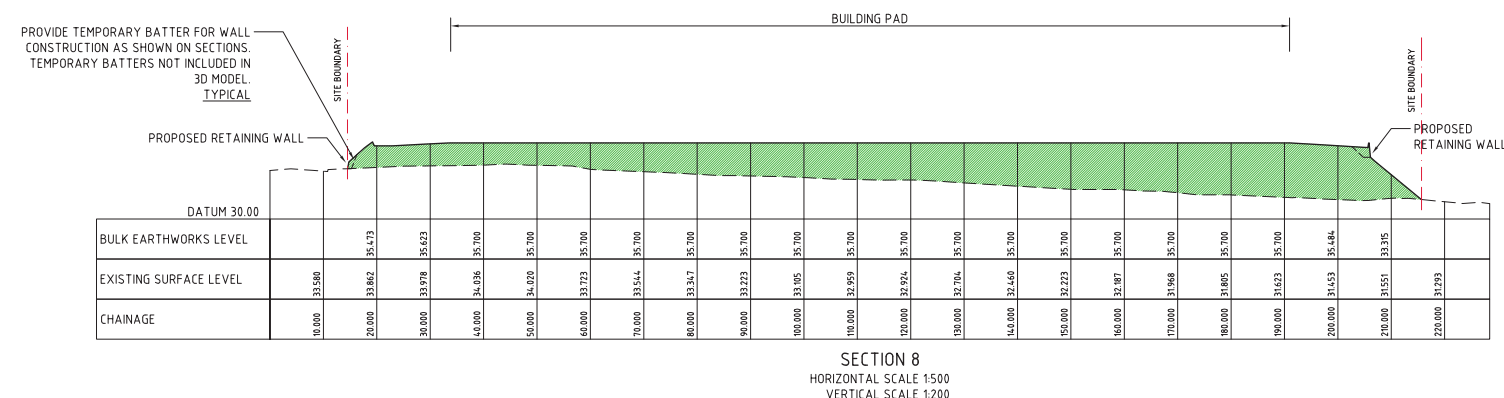
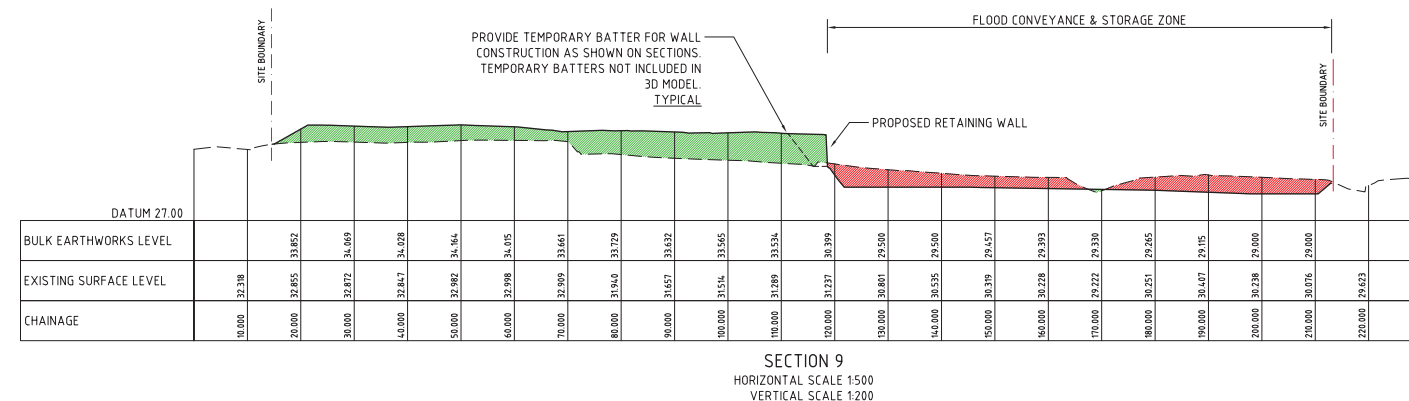
DRAWING TITLE
BULK EARTHWORKS SECTIONS
SHEET 1

PRECISION | COMMUNICATION | ACCOUNTABILITY

DRAWING No	C08753.15-C235	ISSUE	A
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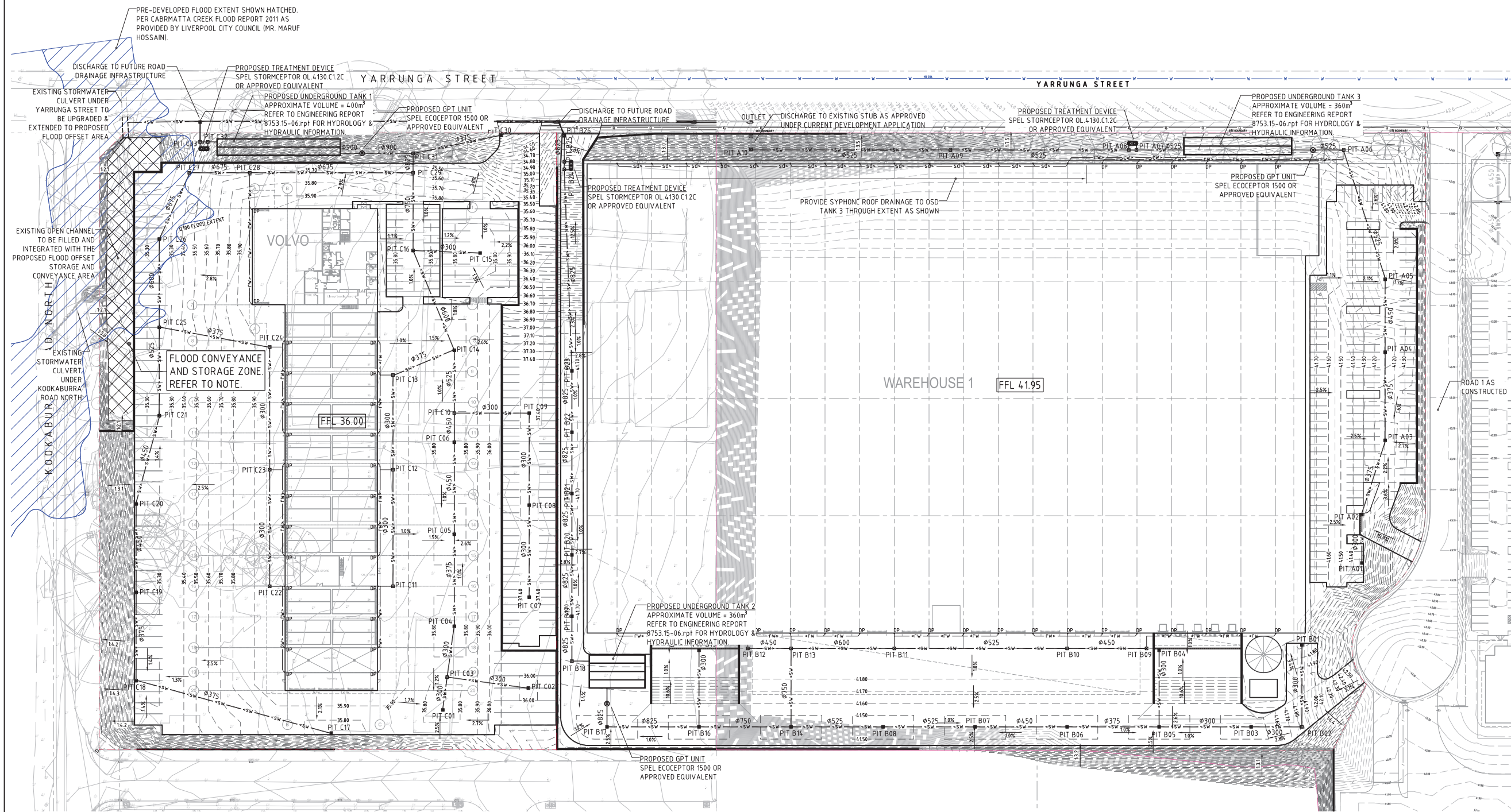
LEVELS DATUM IS AHD

— - - - - BULK EARTHWORKS LEVEL PROFILE
- - - - - EXISTING SURFACE LEVEL PROFILE



FOR DEVELOPMENT APPLICATION

[illegible]



LEGEND:

LEVELS DATUM IS AHD.

- SGGP, SINGLE GRATED GULLY PIT
- SJP, SEALED JUNCTION PIT
- KIP, KERB INLET PIT
- GD, GRATED DRAIN (300Wx200D UNO)
- SW, DRAINAGE PIPE LINE
- EXISTING PIPE LINE
- IN-GROUND ROOFWATER LINE
- SYPHONIC ROOF DRAINAGE LINE
- DOWNPIPE LOCATION (INDICATIVE)

- 50.00 - FINISHED PAVEMENT CONTOUR (MAJOR)
0.5m INTERVALS
- 50.10 - FINISHED PAVEMENT CONTOUR (MINOR)
0.1m INTERVALS
- 1.0% - FALL DIRECTION AND % GRADE

FLOOD CONVEYANCE & STORAGE ZONE NOTE:

- FILLING OF FLOOD AFFECTED LAND TO BE MADE WITHIN THE MEDIUM RISK FLOOD ZONE (I.E. WITHIN THE Q100 ARI FLOOD LEVEL & LOW HYDRAULIC HAZARD).
- FLOOD COMPENSATION TO BE PROVIDED AS A MINIMUM TO ENSURE NO NET LOSS OF EXISTING FLOOD PLAIN STORAGE DUE TO FILLING WITHIN FLOOD AFFECTED LAND.
- MINIMUM FLOOD STORAGE OF 1050m³ TO BE MAINTAINED WITHIN THE PROPOSED FLOOD CONVEYANCE & STORAGE ZONE.
- REFER TO SECTION 5.4 OF ENGINEERING REPORT C087535-06.rpt FOR CALCULATION & CONFIRMATION OF FLOOD STORAGE ZONES.



STORMWATER DRAINAGE PLAN

1:500

PIT SCHEDULE-NETWORK A

PIT No.	GRATE RL	TYPE	SIZE	COMMENT
PIT A01	4125	S.G.G.P.	900x900	
PIT A02	4135	S.G.G.P.	900x900	
PIT A03	4110	S.G.G.P.	900x900	
PIT A04	4110	S.G.G.P.	900x900	
PIT A05	4125	S.G.G.P.	900x900	
PIT A06	4225	S.J.P.	900x900	
PIT A07	4231	S.J.P.	900x900	
PIT A08	4231	S.J.P.	900x900	
PIT A09	4120	S.J.P.	900x900	
PIT A10	4040	S.J.P.	900x900	

PIT SCHEDULE-NETWORK B

PIT No.	GRATE RL	TYPE	SIZE	COMMENT
PIT B01	4165	S.G.G.P.	900x900	
PIT B02	4180	S.J.P.	900x900	
PIT B03	4140	S.G.G.P.	900x900	
PIT B04	4060	S.G.G.P.	900x900	
PIT B05	4140	S.G.G.P.	900x900	
PIT B06	4140	S.G.G.P.	900x900	
PIT B07	4140	S.G.G.P.	900x900	
PIT B08	4140	S.G.G.P.	900x900	
PIT B09	4190	S.J.P.	900x900	
PIT B10	4190	S.J.P.	900x900	
PIT B11	4190	S.J.P.	900x900	
PIT B12	4190	S.J.P.	900x900	
PIT B13	4190	S.J.P.	1050x1050	
PIT B14	4140	S.G.G.P.	1050x1050	
PIT B15	4060	S.G.G.P.	900x900	
PIT B16	4140	S.G.G.P.	900x1200	
PIT B17	4140	S.G.G.P.	1200x1200	
PIT B18	4170	S.J.P.	1200x1200	
PIT B19	4165	S.G.G.P.	1200x900	
PIT B20	4165	S.G.G.P.	1200x900	
PIT B21	4165	S.G.G.P.	1200x900	
PIT B22	4165	S.G.G.P.	1200x900	
PIT B23	4165	S.G.G.P.	1200x900	
PIT B24	3555	S.J.P.	1200x900	
PIT B25	3530	S.J.P.	1200x900	
PIT B26	3485	S.G.G.P.	1200x900	

PIT SCHEDULE-NETWORK C

PIT No.	GRATE RL	TYPE	SIZE	COMMENT
PIT C 01	35.70	S.G.G.P.	900x900	
PIT C 02	35.95	S.G.G.P.	900x900	
PIT C 03	35.85	S.J.P.	900x900	
PIT C 04	35.70	S.G.G.P.	900x900	
PIT C 05	35.70	S.G.G.P.	900x900	
PIT C 06	35.70	S.G.G.P.	900x900	
PIT C 07	37.35	S.G.G.P.	900x900	
PIT C 08	37.35	S.G.G.P.	900x900	
PIT C 09	37.35	S.G.G.P.	900x900	
PIT C 10	35.80	S.J.P.	900x900	
PIT C 11	35.95	S.J.P.	900x900	
PIT C 12	35.95	S.J.P.	900x900	
PIT C 13	35.95	S.J.P.	900x900	
PIT C 14	35.70	S.G.G.P.	1050x900	
PIT C 15	35.70	S.G.G.P.	900x900	
PIT C 16	35.70	S.G.G.P.	1050x900	
PIT C 17	35.70	S.G.G.P.	900x900	
PIT C 18	35.20	S.G.G.P.	900x900	
PIT C 19	35.20	S.G.G.P.	900x900	
PIT C 20	35.20	S.G.G.P.	900x900	
PIT C 21	35.20	S.G.G.P.	900x900	
PIT C 22	35.95	S.J.P.	900x900	
PIT C 23	35.95	S.J.P.	900x900	
PIT C 24	35.95	S.J.P.	900x900	
PIT C 25	35.20	S.G.G.P.	900x900	
PIT C 26	35.20	S.G.G.P.	1050x900	
PIT C 27	35.45	S.J.P.	1050x1050	
PIT C 28	35.67	S.J.P.	1200x1200	
PIT C 29	35.68	S.J.P.	1200x1200	
PIT C 30	33.80	S.G.G.P.	1200x1200	
PIT C 31	34.55	S.J.P.	1200x1200	
PIT C 32	30.65	S.J.P.	1200x1200	
PIT C 33	30.25	S.J.P.	1200x1200	

NOTE:

REFER TO DRAWING C08753.15-C210 FOR STORMWATER DRAINAGE NOTES.

5m 0 10 20 30 40 50m
1:500 SCALE AT A0 SHEET SIZE

FOR DEVELOPMENT APPLICATION

ISSUED FOR DEVELOPMENT APPLICATION	21.07.17	D
ISSUED FOR INFORMATION	10.07.17	C
ISSUED FOR INFORMATION	05.07.17	B
ISSUED FOR INFORMATION	27.06.17	A
AMENDMENTS	DATE	ISSUE

AMENDMENTS	DATE	ISSUE
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ARCHITECT
AXIS ARCHITECTURAL
4/112 CRONULLA STREET
CRONULLA NSW 2230

CLIENT
LOGOS PROPERTY
SUITE 02, LEVEL 12
167 MACQUARIE STREET
SYDNEY NSW 2000

PROJECT
PROPOSED DEVELOPMENT
32 YARRUNGA ROAD
PRESTONS NSW



Costin Roe Consulting Pty Ltd.
Consulting Engineers
Level 1, 8 Widdowall Street
Wahah Bay, Sydney NSW 2000
Tel: (02) 8551-7899 Fax: (02) 8541-3721
email: mail@costinroe.com.au

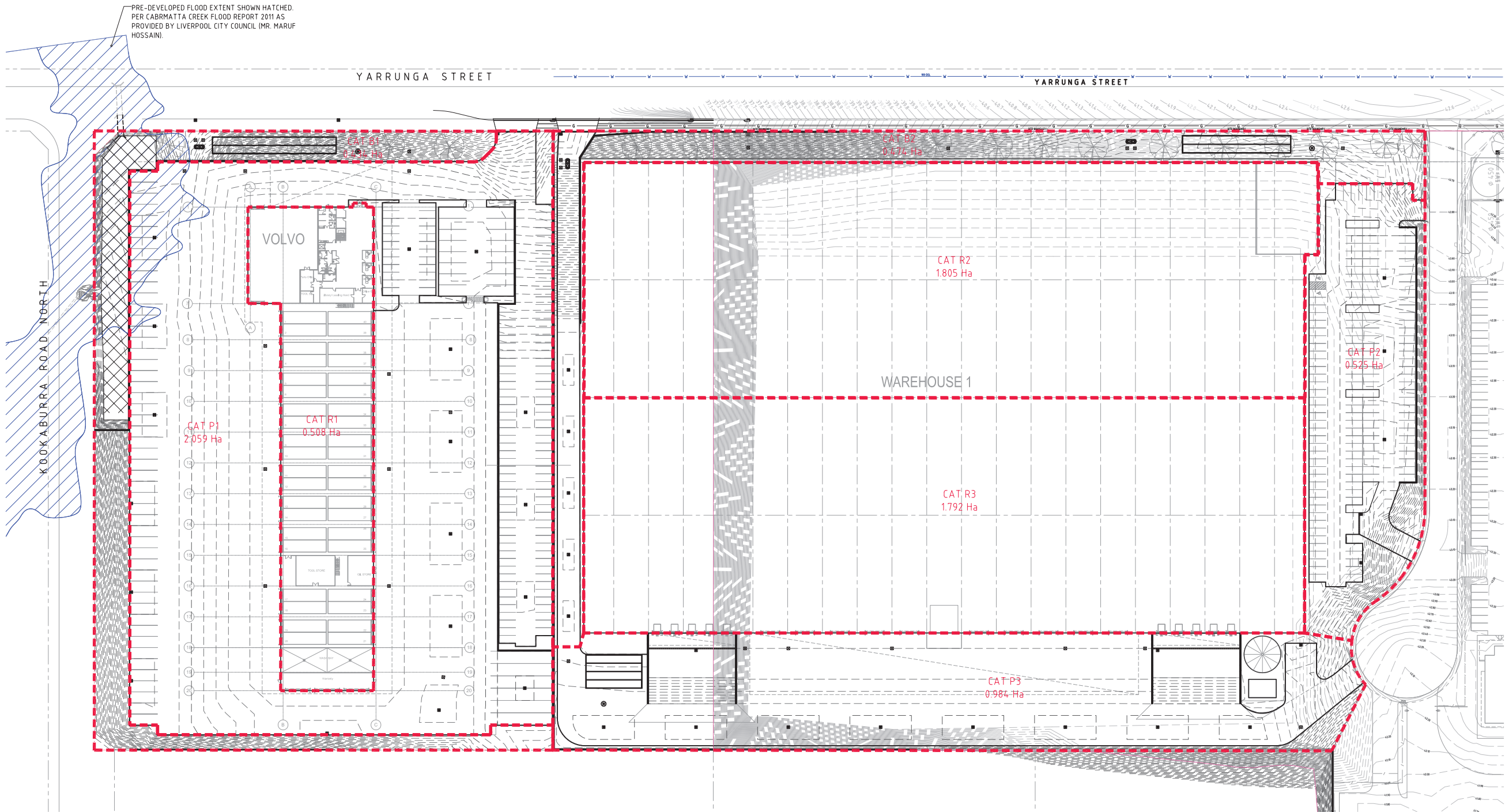
Costin Roe Consulting

PRECISION | COMMUNICATION | ACCOUNTABILITY

DRAWING TITLE
STORMWATER DRAINAGE PLAN

DRAWING NO
C08753.15-C240

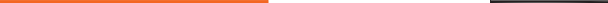
ISSUE
D



STORMWATER DRAINAGE CATCHMENT PLAN
1:500

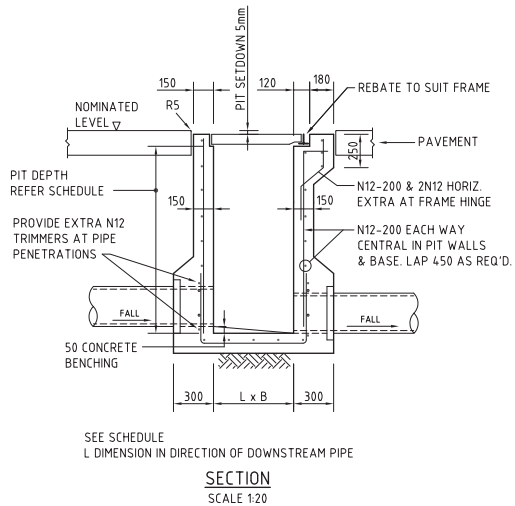
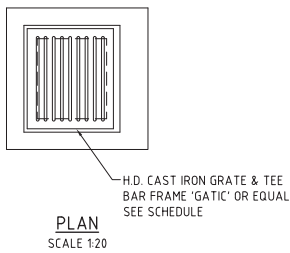
5m 0 10 20 30 40 50m
1:500 SCALE AT A0 SHEET SIZE

FOR DEVELOPMENT APPLICATION

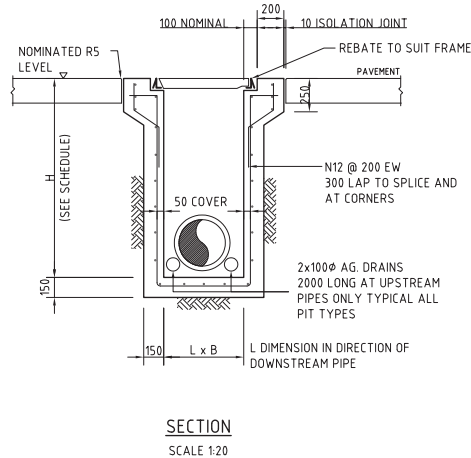
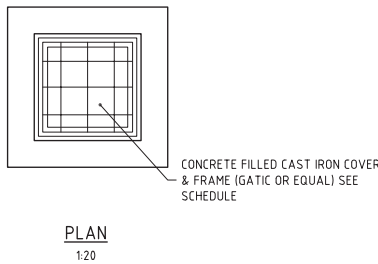
										ARCHITECT AXIS ARCHITECTURAL 4/112 CRONULLA STREET CRONULLA NSW 2230										CLIENT LOGOS PROPERTY SUITE 02, LEVEL 12 167 MACQUARIE STREET SYDNEY NSW 2000										PROJECT PROPOSED DEVELOPMENT 32 YARRUNGA ROAD PRESTONS NSW																				Costin Roe Consulting Pty Ltd. Consulting Engineers Level 1, 8 Windmill Street Wahia Bay, Sydney NSW 2000 Tel: (02) 8551-7889 Fax: (02) 8541-3721 email: mail@costinroe.com.au ©																				DRAWING TITLE STORMWATER DRAINAGE CATCHMENT PLAN																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				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COSTIN ROE CONSULTING

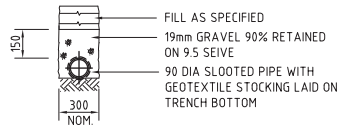
PRECISION | COMMUNICATION | ACCOUNTABILITY



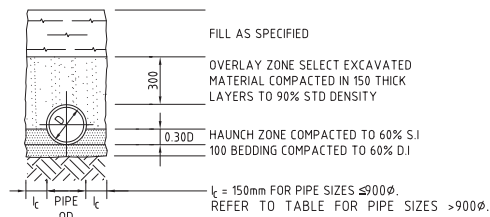
SINGLE GRATED GULLY PIT - SGGP



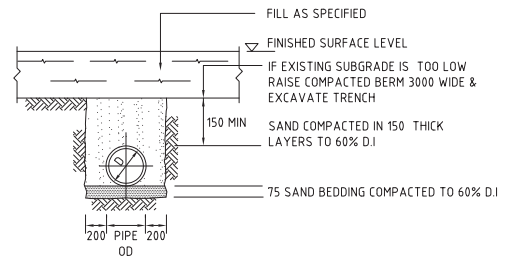
SEALED JUNCTION PIT - SJP



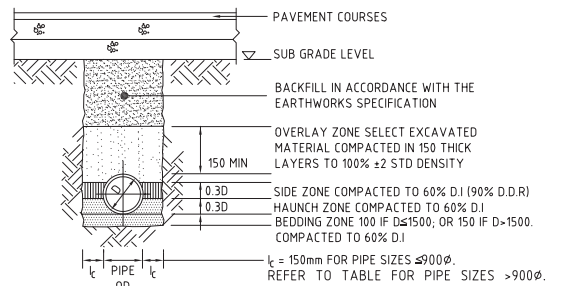
SUPPORT TO AG DRAIN



TYPE H1 SUPPORT TO CONCRETE PIPES AT LANDSCAPED AREAS



SUPPORT TO uPVC PIPES



TYPE HS2 SUPPORT TO CONCRETE PIPES UNDER PAVEMENT

D ≤ 1350, MAX FILL = 4.0m
D > 1350, MAX FILL = 3.0m

BEDDING & HAUNCH MATERIAL GRADING	
SIEVE SIZE	WEIGHT PASSING(%)
19	100
2.36	100 TO 50
0.60	90 TO 20
0.30	60 TO 10
0.15	25 TO 0
0.075	10 TO 0

SIDE ZONE MATERIAL GRADING	
SIEVE SIZE	WEIGHT PASSING(%)
75	100
9.5	100 TO 50
2.36	100 TO 30
0.60	50 TO 15
0.075	25 TO 0

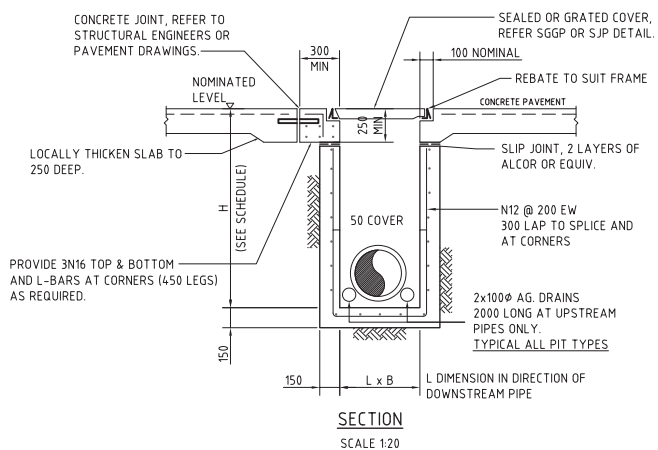
SELECT FILL MATERIAL IN ACCORDANCE WITH TABLE 1 AS 3725

SIDE ZONE WIDTH	
PIPE SIZE	ℓ (mm)
≤900φ	150
1050φ	175
1200φ	200
1350φ	225
1500φ	250
1650φ	275
1800φ	300

REFER TO ENGINEER FOR TRENCH WIDTHS FOR PIPE SIZES GREATER THAN 1800φ

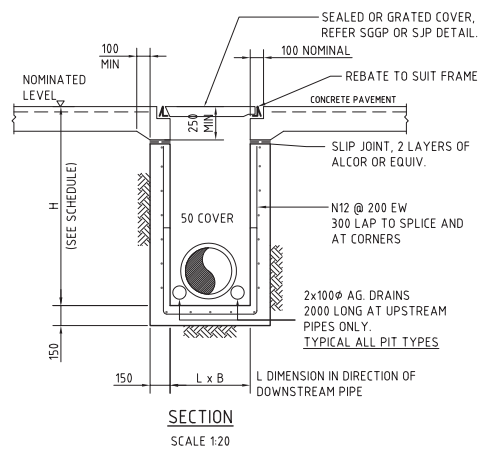
PIPE LAYING DETAILS

SCALE 1:20



SJP/CIS & SGGP/CIS (CAST IN SLAB) PIT DETAIL
GRATE/COVER SUPPORT
CAST-INTO PAVEMENT SLAB

(ADOPT IN CONCRETE PAVEMENT FOR SGGP's & SJP's, WHERE PITS ARE LOCATED IN THE CORNER OF SLAB PANELS OR ADJACENT TO SLAB PANEL JOINTS)



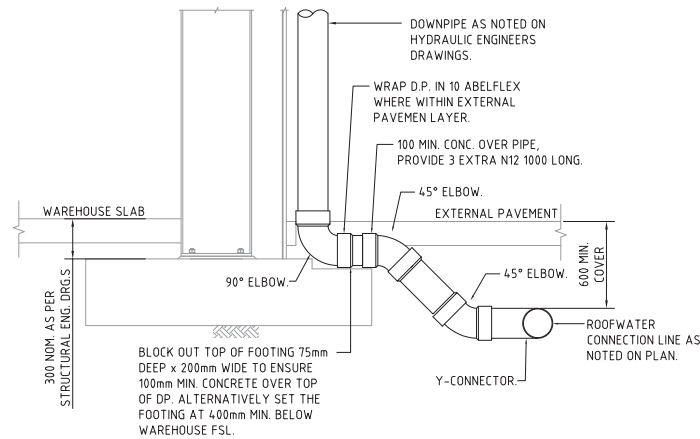
SJP/CIS & SGGP/CIS (CAST IN SLAB) PIT DETAIL
GRATE/COVER SUPPORT
CAST-INTO PAVEMENT SLAB

(ADOPT IN CONCRETE PAVEMENTS FOR SGGP's & SJP's, WHERE JOINTS ARE NOT LOCATED WITHIN PROXIMITY OF THE GRATE)

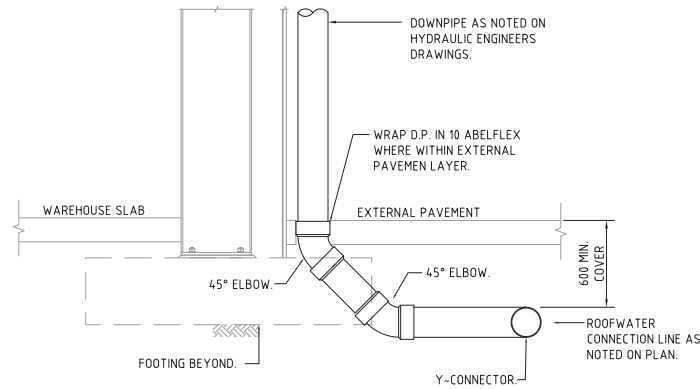
200mm 0 500 1000 1500 2000mm
SCALE 1:20 AT A0 SHEET SIZE

FOR DEVELOPMENT APPLICATION

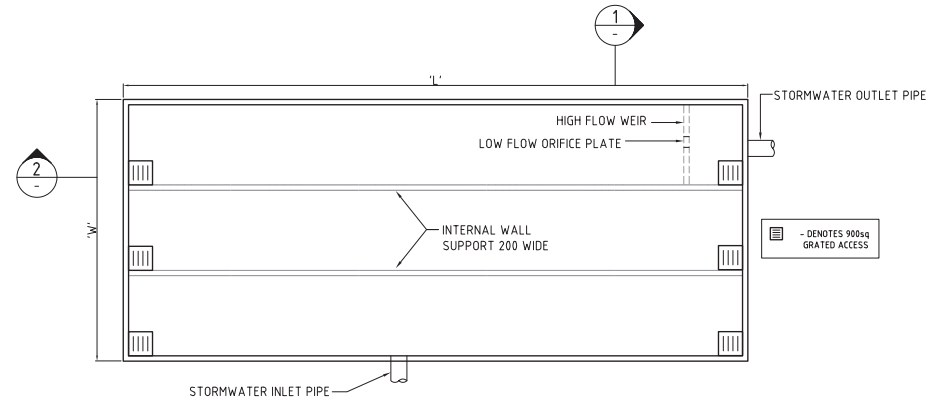
ISSUED FOR DEVELOPMENT APPLICATION			21.07.17			B			ARCHITECT			CLIENT			PROJECT			COSTIN ROE CONSULTING PTY LTD.			DRAWING TITLE		
ISSUED FOR INFORMATION			05.07.17			A			AXIS ARCHITECTURAL			LOGOS PROPERTY			PROPOSED DEVELOPMENT			Consulting Engineers			STORMWATER DRAINAGE DETAILS		
AMENDMENTS			DATE			ISSUE			4/112 CRONULLA STREET			SUITE 02, LEVEL 12			32 YARRUNGA ROAD			Level 1, 8 Windmill Street			SHEET 1		
AMENDMENTS			DATE			ISSUE			CRONULLA NSW 2230			167 MACQUARIE STREET			PRESTONS NSW			Wahah Bay, Sydney NSW 2000			C08753.15-C245		
AMENDMENTS			DATE			ISSUE			SYDNEY NSW 2000			T: (02) 8551-7899 Fax: (02) 8541-3721			DESIGNED			email: mail@costinroe.com.au			PRECISION | COMMUNICATION | ACCOUNTABILITY		
AMENDMENTS			DATE			ISSUE			CHECKED			SIZE			SCALE			C08753.15-C245			ISSUE		
AMENDMENTS			DATE			ISSUE			DRAWN			AS SHOWN			C08753.15-C245			C08753.15-C245			B		



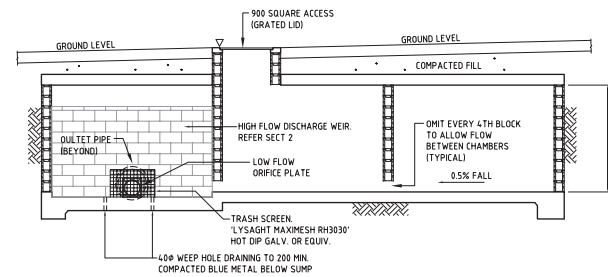
DOWNPIPE TURN-UP DETAIL A
(AT FOOTING LOCATION)
SCALE 1:20



DOWNPIPE TURN-UP DETAIL B
(CLEAR OF FOOTING)
SCALE 1:20

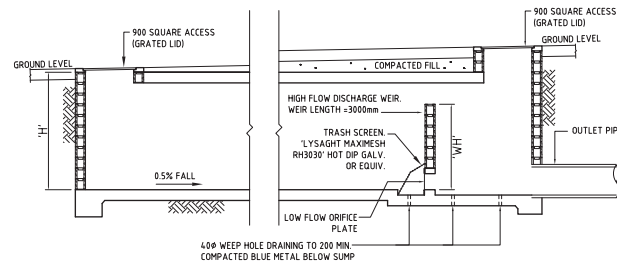


TYPICAL OSD TANK PLAN
SCALE 1:100

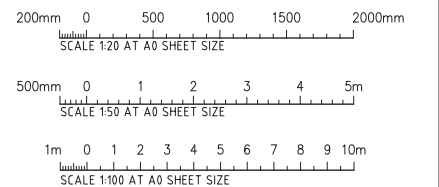


SECTION 1:50 : TYPICAL THRU' TANK

NOTE: REFER TO DRAWINGS DA240 FOR THE LOCATIONS OF STORMWATER DETENTION TANKS 1, 2 & 3 AND ENGINEERING REPORT C08753.15-06.rpt SECTION 6 FOR HYDRAULIC & HYDROLOGY PERTAINING TO DETENTION SYSTEMS 1, 2 & 3.

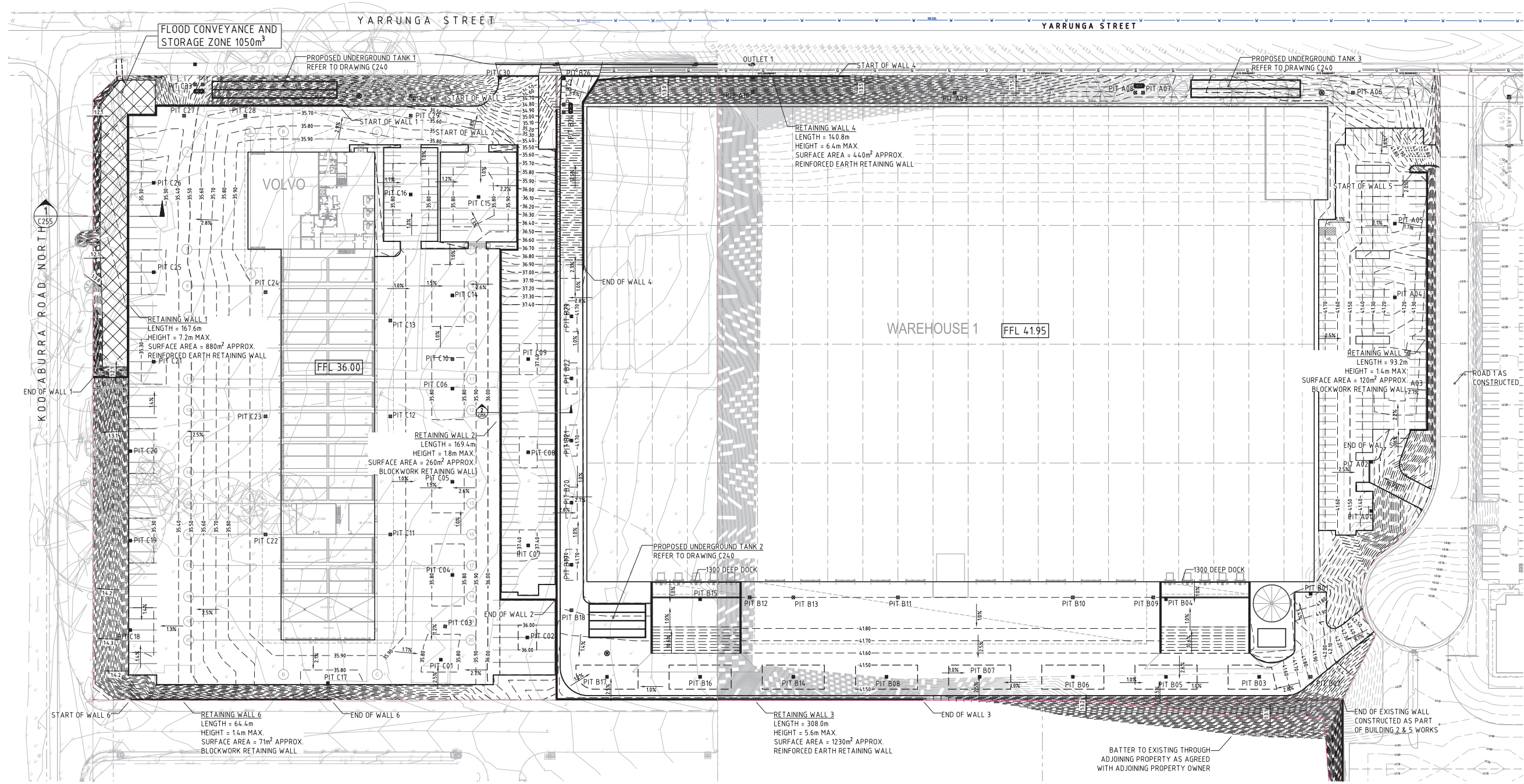


SECTION 2:50 : TYPICAL THRU' TANK



FOR DEVELOPMENT APPLICATION

ISSUED FOR DEVELOPMENT APPLICATION			21.07.17			B			ARCHITECT			LOGOS PROPERTY			PROPOSED DEVELOPMENT			Costin Roe Consulting Pty Ltd.			DRAFTING TITLE		
ISSUED FOR INFORMATION			05.07.17			A			4/112 CRONULLA STREET			SUITE 02, LEVEL 12			32 YARRUNGA ROAD			Consulting Engineers			STORMWATER DRAINAGE DETAILS		
AMENDMENTS			DATE			ISSUE			CRONULLA NSW 2230			167 MACQUARIE STREET			PRESTONS NSW			Level 1, 8 Widdowall Street			SHEET 2		
AMENDMENTS			DATE			ISSUE			AMENDMENTS			AMENDMENTS			AMENDMENTS			Tel: (02) 8551-7899 Fax: (02) 8541-3721			DRAWING No		
AMENDMENTS			DATE			ISSUE			AMENDMENTS			AMENDMENTS			AMENDMENTS			email: mail@costinroe.com.au			C08753.15-C246		
AMENDMENTS			DATE			ISSUE			AMENDMENTS			AMENDMENTS			AMENDMENTS			PRECISION | COMMUNICATION | ACCOUNTABILITY			ISSUE		
AMENDMENTS			DATE			ISSUE			AMENDMENTS			AMENDMENTS			AMENDMENTS						B		



LEGEND:
LEVELS DATUM IS AHD.

- SGGP, SINGLE GRATED GULLY PIT
- SJP, SEALED JUNCTION PIT
- KIP, KERB INLET PIT
- GD, GRATED DRAIN (300Wx200D UNO)
- 50.00 - FINISHED PAVEMENT CONTOUR (MAJOR) 0.5m INTERVALS
- 50.10 - FINISHED PAVEMENT CONTOUR (MINOR) 0.1m INTERVALS
- 1.0% - FALL DIRECTION AND % GRADE

 **FINISHED LEVELS PLAN**
1:500

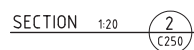
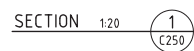
LEVELS NOTE:
LEVELS SHOWN TO BE ±500mm FROM THOSE SHOWN.
FINAL LEVELS SUBJECT TO MINOR VARIATIONS TO SUIT
DETAILED DESIGN.

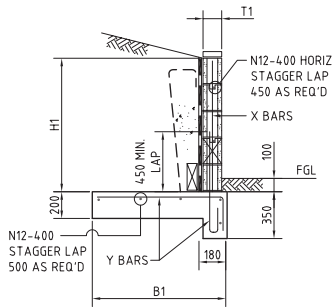
NOTE:
REFER TO DRAWING C08753.15-C210 FOR FINISHED
LEVELS NOTES.



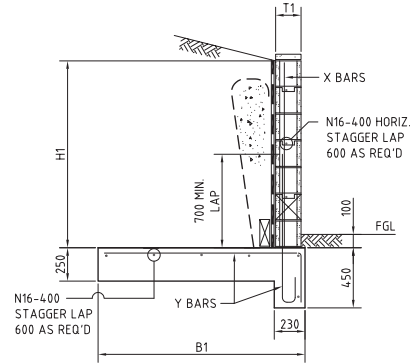
FOR DEVELOPMENT APPLICATION

ISSUED FOR DEVELOPMENT APPLICATION			ARCHITECT			CLIENT			PROJECT			Costin Roe Consulting Pty Ltd.		
ISSUED FOR INFORMATION			AXIS ARCHITECTURAL			LOGOS PROPERTY			PROPOSED DEVELOPMENT			Consulting Engineers		
ISSUED FOR INFORMATION			4/112 CRONULLA STREET			SUITE 02, LEVEL 12			32 YARRUNGA ROAD			Level 1, 8 Widdowall Street		
ISSUED FOR INFORMATION			CRONULLA NSW 2230			SYDNEY NSW 2000			PRESTONS NSW			Wahah Bay, Sydney NSW 2000		
AMENDMENTS			DESIGNED			CHECKED			CAD REF:			Tel: (02) 8551-7899 Fax: (02) 8541-3721		
DATE			DATE			DATE			C08753.15-C250			email: mail@costinroe.com.au		
ISSUE			AMENDMENTS			AMENDMENTS			PRECISION | COMMUNICATION | ACCOUNTABILITY			DRAWING TITLE		
21.07.17			D			21.07.17			FINISHED LEVELS PLAN			DRAWING No		
05.07.17			B			21.07.17			C08753.15-C250			ISSUE		
27.06.17			A			27.06.17			1			1		

[illegible]



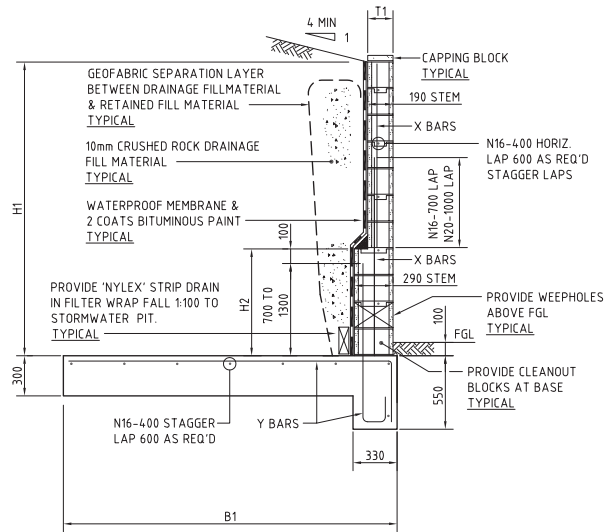
WALL WITH SINGLE STEM OF 140 BLOCK
1:20 SCALE



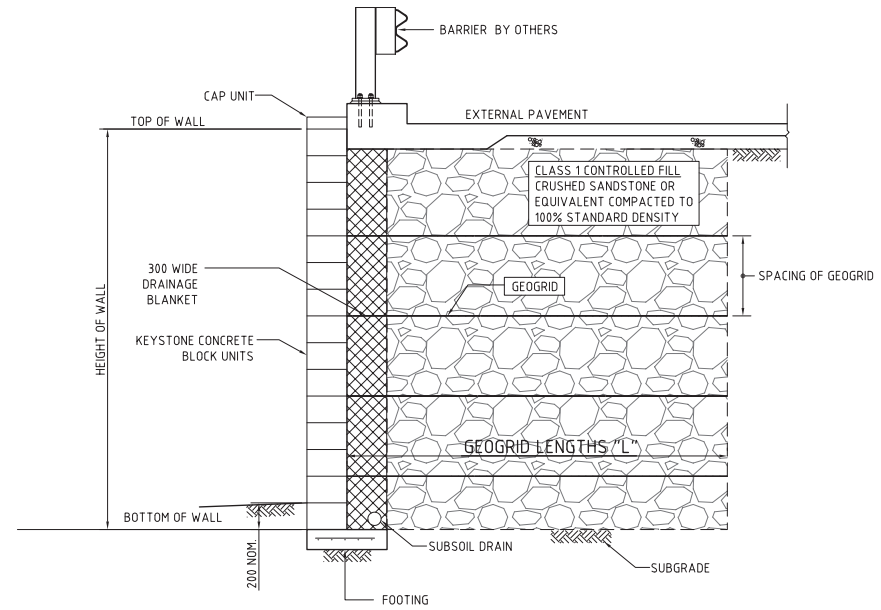
WALL WITH SINGLE STEM OF 190 BLOCK
1:20 SCALE

NOTE :
ALL BLOCK CORES TO BE FULLY GROUTED.
NOTES SHOWN ARE TYPICAL FOR ALL WALLS.
ALL BASE KEYS TO BE POURED AGAINST
UNDISTURBED NATURAL GROUND.

CONCRETE QUALITY					
ELEMENT	SUMP	AGGREGATE	CEMENT	ADDMIXTURE	F _Y (MPa)
CORE FILL	230	10	GP	NIL	20

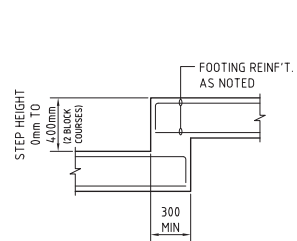


WALL WITH THIN STEM OF 190 BLOCK AND
THICK STEM OF 290 BLOCK
1:20 SCALE

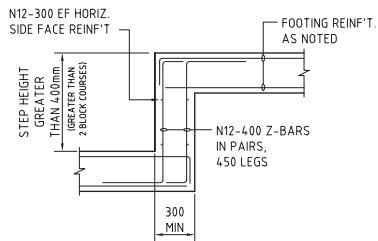


REINFORCED EARTH RETAINING WALL
SCALE 1:20

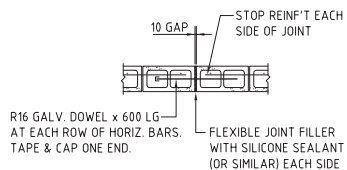
RETAINING WALL TYPE 1 SPECIFICATIONS FOR 1 IN 4 BACKFILL OR 5kPa SURCHARGE :					
RETAINED HEIGHT H1	290 STEM HEIGHT H2	BASE WIDTH B1	(THIN) STEM THICKNESS T1	REINF'T. X BARS	REINF'T. Y BARS
3400	1400	3600	190	N16-200	N20-200
3200	1200	3300	190	N16-200	N20-200
3000	1000	3000	190	N16-200	N16-200
2800	1000	2800	190	N16-400	N16-200
2600	1000	2500	190	N16-400	N16-200
2400	800	2300	190	N16-400	N16-400
2200	800	2100	190	N16-400	N16-400
2000	N/A	1800	190	N16-400	N16-200
1800	N/A	1600	190	N16-400	N16-400
1600	N/A	1400	190	N16-400	N16-400
1400	N/A	1200	190	N16-400	N16-400
1200	N/A	1000	140	N12-400	N12-400
1000	N/A	900	140	N12-400	N12-400
800	N/A	800	140	N12-400	N12-400
600	N/A	600	140	N12-400	N12-400



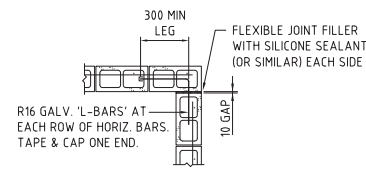
TYPICAL WALL FOOTING STEPS
1:20



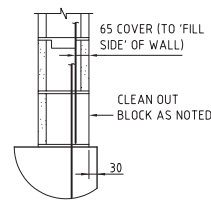
TYPICAL WALL FOOTING STEPS
1:20



VERTICAL JOINT DETAIL
1:20 SCALE



CORNER DETAIL
1:20 SCALE



WALL VERTICAL REINF'T DETAIL
TYPICAL
NOT TO SCALE

200mm 0 500 1000 1500 2000mm
SCALE 1:20 AT A0 SHEET SIZE

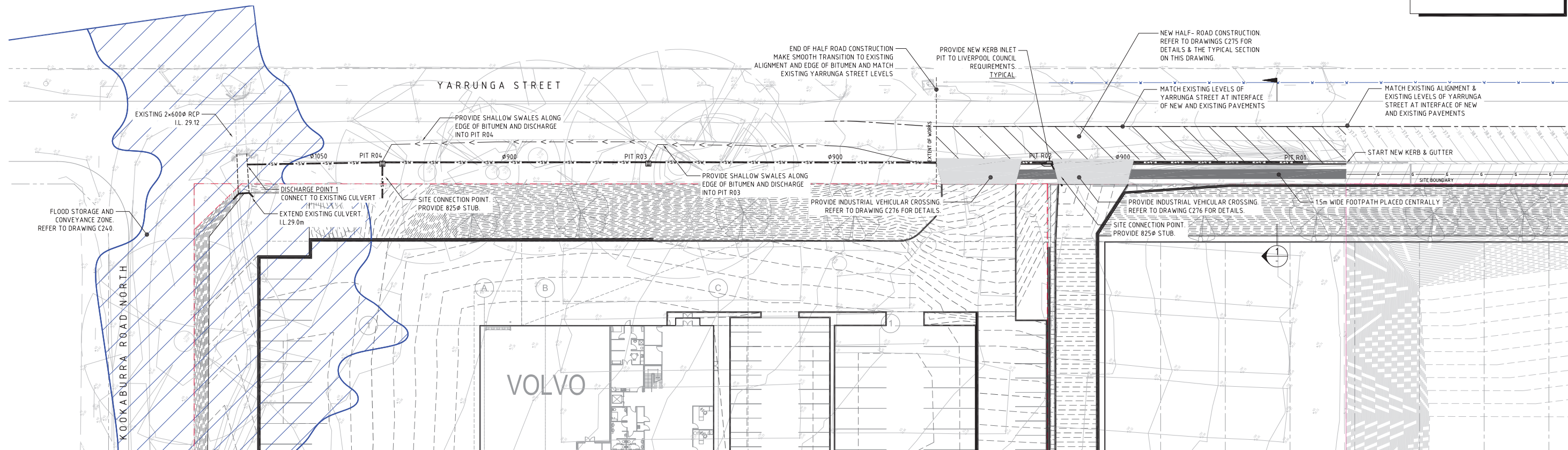
FOR DEVELOPMENT APPLICATION

ISSUED FOR DEVELOPMENT APPLICATION			21.07.17			C			ARCHITECT			CLIENT			PROJECT			COSTIN ROE CONSULTING PTY LTD.			DRAWING TITLE		
ISSUED FOR INFORMATION			14.07.17			B			AXIS ARCHITECTURAL			LOGOS PROPERTY			PROPOSED DEVELOPMENT			Consulting Engineers			TYPICAL RETAINING WALL DETAILS		
ISSUED FOR INFORMATION			05.07.17			A			4/112 CRONULLA STREET			SUITE 02, LEVEL 12			32 YARRUNGA ROAD			Level 1, 8 Widdowall Street			DRAWING No		
AMENDMENTS			DATE			ISSUE			CRONULLA NSW 2230			167 MACQUARIE STREET			PRESTONS NSW			Wahah Bay, Sydney NSW 2000			C08753.15-C265		
AMENDMENTS			DATE			ISSUE			AMENDMENTS			AMENDMENTS			AMENDMENTS			Tel: (02) 8551-7899 Fax: (02) 8541-3721			PRECISION | COMMUNICATION | ACCOUNTABILITY		
AMENDMENTS			DATE			ISSUE			AMENDMENTS			AMENDMENTS			AMENDMENTS			email: mail@costinroe.com.au ©			ISSUE		

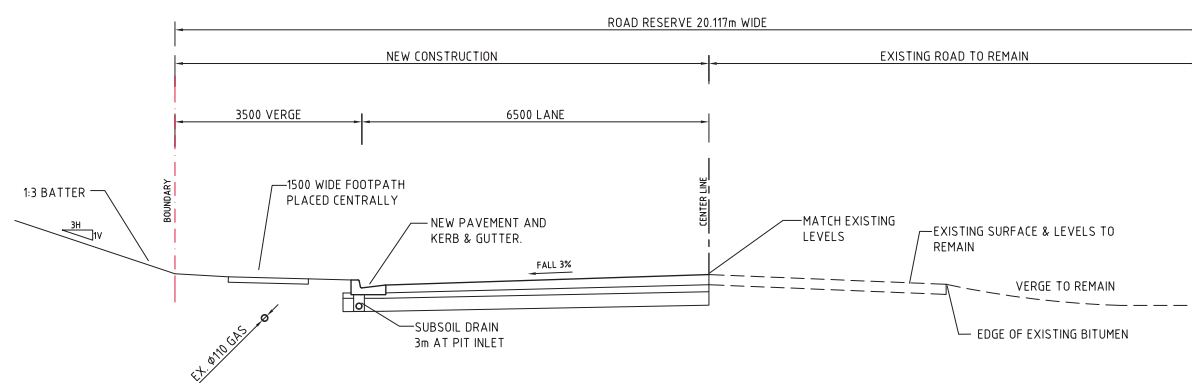
LEGEND:
LEVELS DATUM IS AHD.

 - KIP, KERB INLET PIT

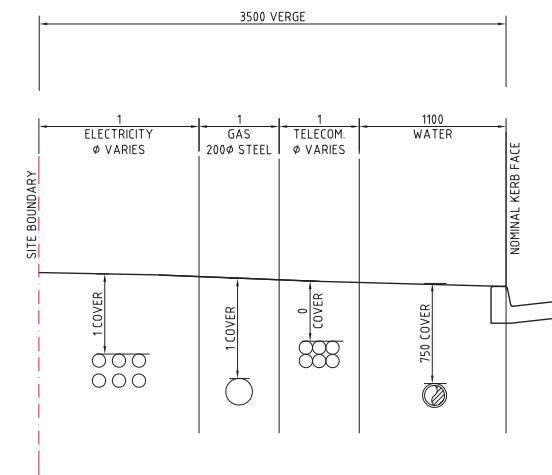
 - DRAINAGE PIPE LINE



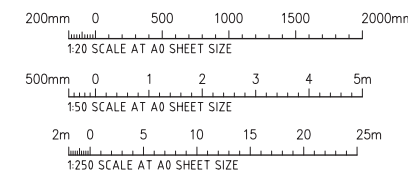
 **ROADWORK PLAN**
1:250



SECTION 150 

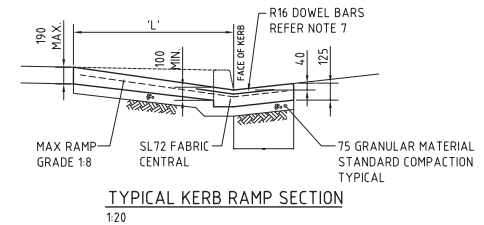
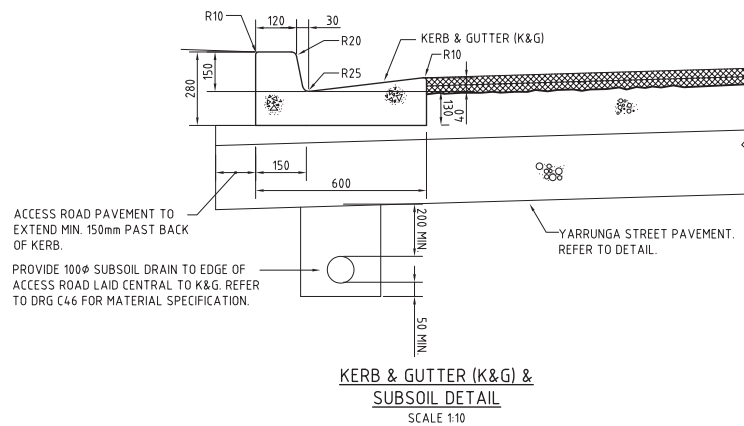
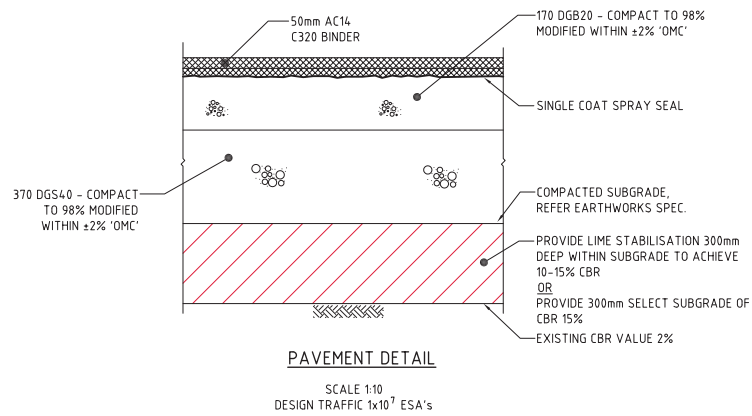
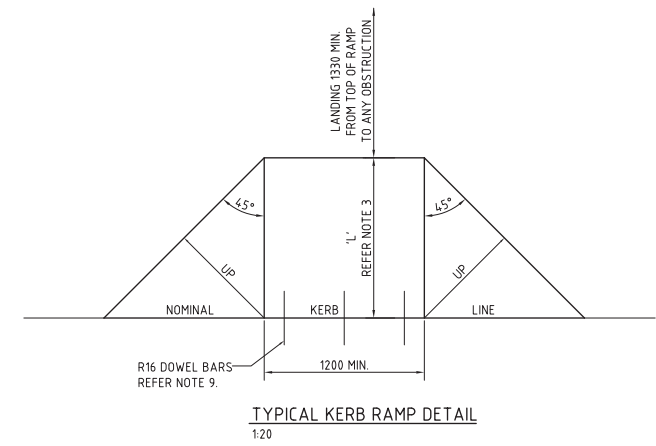
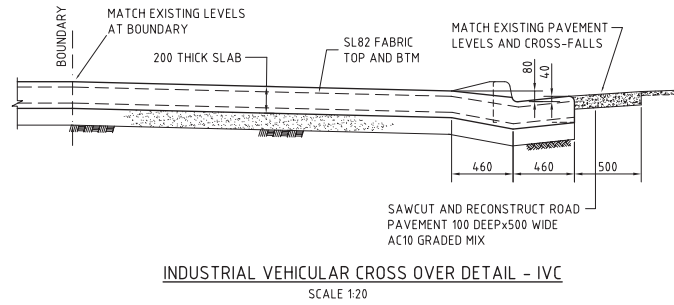
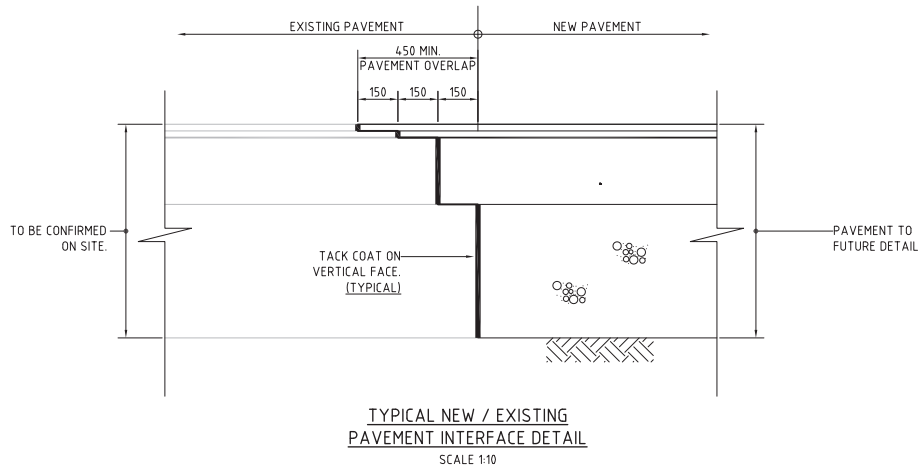


**TYPICAL SERVICES ARRANGEMENT
FOR 3500 WIDE VERGE**
SCALE 1:20
NOTE: SERVICES DEPTHS ARE ONLY INDICATIVE



FOR DEVELOPMENT APPLICATION

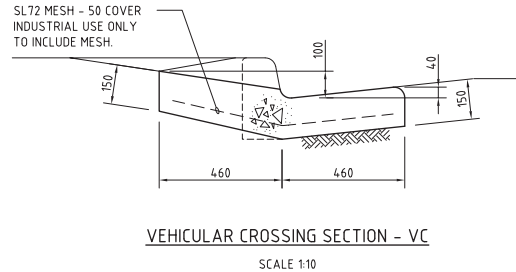
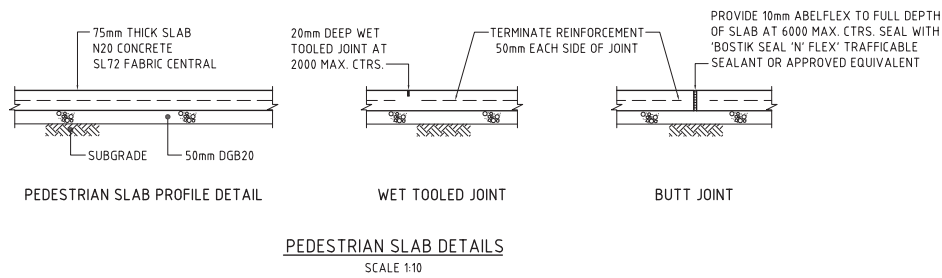
ISSUED FOR DEVELOPMENT APPLICATION			21.07.17			C			ARCHITECT			CLIENT			PROJECT			Costin Roe Consulting Pty Ltd.			DRAWING TITLE		
ISSUED FOR INFORMATION			10.07.17			B			AXIS ARCHITECTURAL			LOGOS PROPERTY			PROPOSED DEVELOPMENT			Consulting Engineers			ROADWORKS FUNCTIONAL LAYOUT		
ISSUED FOR INFORMATION			05.07.17			A			4/112 CRONULLA STREET			SUITE 02, LEVEL 12			32 YARRUNGA ROAD			Level 1, 8 Widdowill Street			PLAN & TYPICAL SECTIONS		
AMENDMENTS			DATE			ISSUE			CRONULLA NSW 2230			167 MACQUARIE STREET			PRESTONS NSW			Wahah Bay, Sydney NSW 2000			DRAWING No		
																		Tel: (02) 8551-7899 Fax: (02) 8541-3721			C08753.15-C270		
																		email: mail@costinroe.com.au			PRECISION | COMMUNICATION | ACCOUNTABILITY		
																					C		



KERB RAMP NOTES:

1. KERB RAMP SHALL BE CONSTRUCTED WHERE INDICATED ON PLAN IN ACCORDANCE WITH AS1428.1-2001.
2. DIMENSION 'L' TO BE CONFIRMED ON SITE MIN. 1200mm MAX. 1520mm.
3. MAX GRADIENT TO BE 1:8.
4. SPECIFIED STRENGTH OF CONCRETE SHALL BE $f'_{c}=25\text{MPa}$ AT 28 DAYS.
5. ROAD BASECOURSE TO EXTEND BENEATH KERB RAMP'S MIN. THICKNESS OF 50mm TO BE MAINTAINED.
6. CONCRETE TO HAVE BROOM FINISH AND ALL EDGES ABUTTING EXISTING STRUCTURES SHALL BE FINISHED WITH AN APPROVED EDGING TOOL.
7. WHERE KERB RAMP IS PLACED BETWEEN EXISTING CONCRETE FOOTPATH AND GUTTER INSTALL R16 GALV. DOWELS 600 LONG AT 450 CTRS. WITH BOND BREAKER TAPE AT ONE END.

CONCRETE QUALITY					
ELEMENT	SUMP	AGGREGATE (MAX. SIZE)	CEMENT TYPE	ADMIXTURE	F'_{c} (MPa)
FOOTWAY	80	20	GP	NIL	25

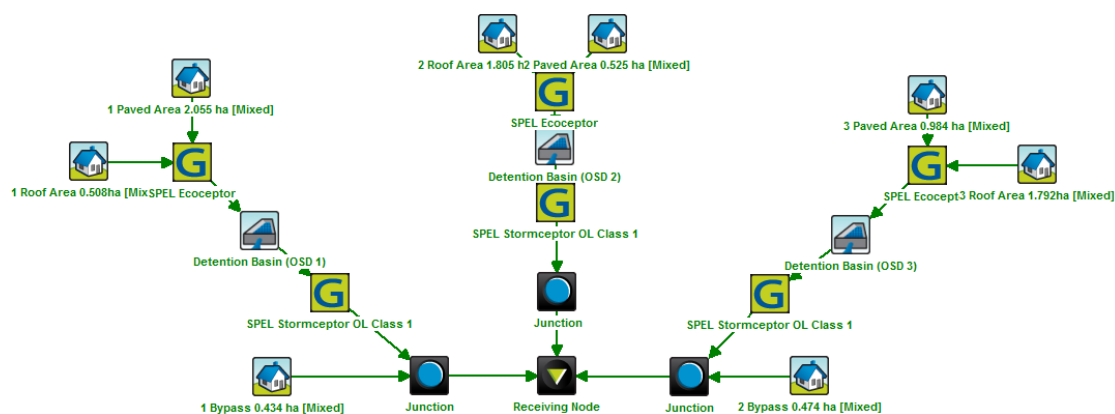


FOR DEVELOPMENT APPLICATION

ISSUED FOR DEVELOPMENT APPLICATION			21.07.17			B		
ISSUED FOR INFORMATION			05.07.17			A		
AMENDMENTS			DATE	ISSUE	AMENDMENTS	DATE	ISSUE	AMENDMENTS
ARCHITECT			AXIS ARCHITECTURAL			4/112 CRONULLA STREET		
CLIENT			LOGOS PROPERTY			SUITE 02, LEVEL 12		
PROJECT			PROPOSED DEVELOPMENT			32 YARRUNGA ROAD		
DESIGNED			DATE	CHECKED	SCALE	DATE	SCALE	DATE
MW			TW	MAY 17	A0	AS SHOWN	AS SHOWN	AS SHOWN
CAD REF:			C08753.15-C275			COSTIN ROE CONSULTING PTY LTD.		
Level 1, 8 Widdowall Street			Wahah Bay, Sydney NSW 2000			Tel: (02) 8551-7899 Fax: (02) 8541-3721		
email: mail@costinroe.com.au			PRECISION | COMMUNICATION | ACCOUNTABILITY			DRAWING TITLE		
ROADWORK DETAILS			DRAWING No			C08753.15-C275		
ISSUE			B					

Appendix B

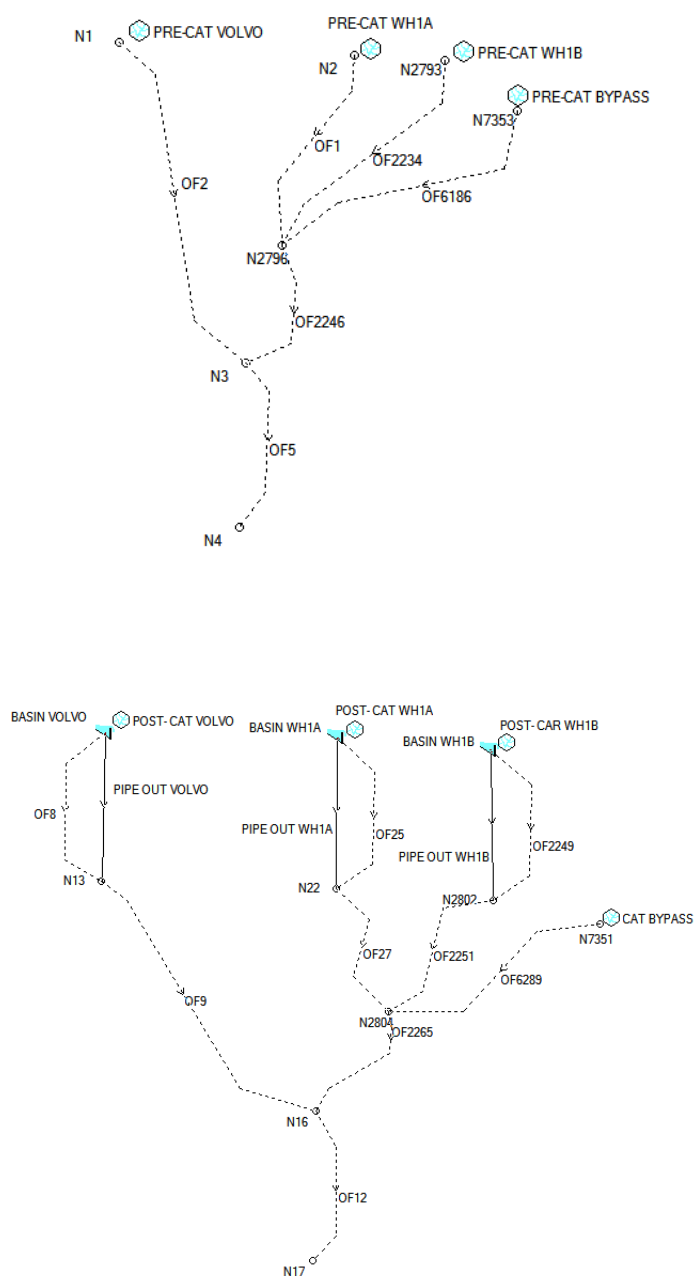
MUSIC MODEL CONFIGURATION



	Sources	Residual Load	% Reduction
Flow (ML/yr)	67.5	67.5	0
Total Suspended Solids (kg/yr)	13100	1080	91.7
Total Phosphorus (kg/yr)	25.4	9.42	62.9
Total Nitrogen (kg/yr)	154	84.3	45.4
Gross Pollutants (kg/yr)	1780	120	93.3

Appendix C

DRAINS MODEL CONFIGURATION



Appendix D

EROSION CONTROL CHECK SHEET

EROSION AND SEDIMENT CONTROL WEEKLY SITE INSPECTION SHEET

LOCATION

INSPECTION OFFICER **DATE**

SIGNATURE

Legend: ☐ OK ☐ Not OK N/A Not applicable

Item	Consideration	Assessment
1	Public roadways clear of sediment.	.....
2	Entry/exit pads clear of excessive sediment deposition.	.....
3	Entry/exit pads have adequate void spacing to trap sediment.	.....
4	The construction site is clear of litter and unconfined rubbish.	.....
5	Adequate stockpiles of emergency ESC materials exist on site.	.....
6	Site dust is being adequately controlled.	.....
7	Appropriate drainage and sediment controls have been installed prior to new areas being cleared or disturbed.	.....
8	Up-slope “clean” water is being appropriately diverted around/through the site.	.....
9	Drainage lines are free of soil scour and sediment deposition.	.....
10	No areas of exposed soil are in need of erosion control.	.....
11	Earth batters are free of “rill” erosion.	.....
12	Erosion control mulch is not being displaced by wind or water.	.....
13	Long-term soil stockpiles are protected from wind, rain and stormwater flow with appropriate drainage and erosion controls.	.....
14	Sediment fences are free from damage.	.....
15	Sediment-laden stormwater is not simply flowing “around” the sediment fences or other sediment traps.	.....
16	Sediment controls placed up-slope/around stormwater inlets are appropriate for the type of inlet structure.	.....
17	All sediment traps are free of excessive sediment deposition.	.....
18	The settled sediment layer within a sediment basin is clearly visible through the supernatant prior to discharge such water.	.....
19	All reasonable and practicable measures are being taken to control sediment runoff from the site.	.....
20	All soil surfaces are being appropriately prepared (i.e. pH, nutrients, roughness and density) prior to revegetation.	.....
21	Stabilised surfaces have a minimum 70% soil coverage.	.....
22	The site is adequately prepared for imminent storms.	.....
23	All ESC measures are in proper working order.	.....

Appendix G

WATER QUALITY TREATMENT SYSTEM DETAILS



SPEL Ecoceptor

In-Line Gross Pollutant Trap (GPT)

www.spel.com.au



Introduction

The SPEL Ecoceptor is a hydrodynamic in-line Gross Pollutant Trap (GPT) that has a unique treatment action producing low velocity conditions producing discharge water quality outcomes complying to statutory guidelines across Australia.

It separates and captures sediments, silt, total suspended solids, and oil and grease. Oil & grease rise to the "oil-capture" zone of the treatment chamber and are contained in all flow events.

Areas with a high fraction of impervious surfaces, including car parks, ports, streetscapes, roads, subdivisions and industrial estates that require stormwater treatment are ideal for the SPEL Ecoceptor. MUSIC node is available on request.

The one-piece, self-contained fibreglass construction, is lightweight and yet robust in strength making it simple and cost-effective when performing installations.

The SPEL Ecoceptor is delivered to site fully assembled saving on installation time and crane costs. The SPEL Ecoceptor fibreglass GPT can be installed in all types of trafficable zones, including vehicular truck (Class D).

The cylindrical shape of the SPEL Ecoceptor with its sloped cone-configured base ensures sediment accretes at the centre of the Ecoceptor's base facilitating easy and simple cleaning.

The poly/fibreglass construction ensures that oil and grease are removed without sticking to the sides of the internal walls.

Flow rates on standard units of up to 1400 LPS and can fit pipe sizes from 225mm to 1200mm (other sizes available on request.)



Maintenance

INSPECTION AND CLEANING

The regularity of inspections of the SPEL Ecoceptor is contingent on the features and properties of the catchment area.

SPEL recommends inspection of the Ecoceptor one month after installation to determine the volume of trapped silt and pollutants.

Information sourced can be useful in factoring the frequency of on-going inspections or cleaning operations.

In the event of excessive rain or an oil spill, an inspection is recommended immediately.

Ascertain silt depth and if build-up is evident, then a vacuum-loader truck should be engaged for the cleaning of the tank.

SPEL Ecoceptor cleaning procedure is simple, by simply lifting the external lid (two persons may be required), resting it securely in a safe manner and then inserting suction hose into the chamber.

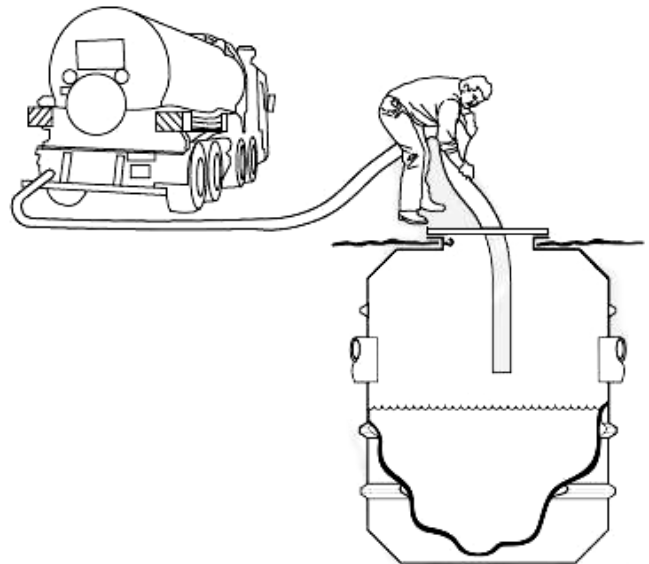
Ensure that the chamber is thoroughly cleaned of all refuse and debris before accessing the chamber - if required.

The chamber is cleaned by inserting the suction hose through the manhole at ground level.

Always commence cleaning from the inlet side of the chamber and ensure on completion of the cleaning operation that the lid is secured to its normal position (and locked if necessary) before departing the site.

IMPORTANT

SPEL Environmental takes safety seriously and recommends that prior to the entry of any of its devices, that maintenance personnel undertake relevant safety checks and use appropriate safety equipment. SPEL devices are considered confined spaces and should only be entered by appropriately trained and certified personnel with the necessary safety equipment.



SPEL ECOCEPTOR 1000 SERIES

1000

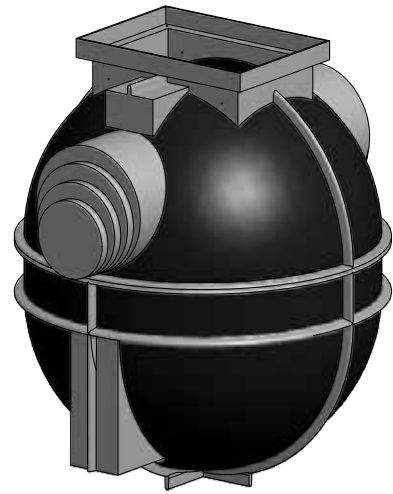
SELECTION CHART

Weight approximately 300kg each

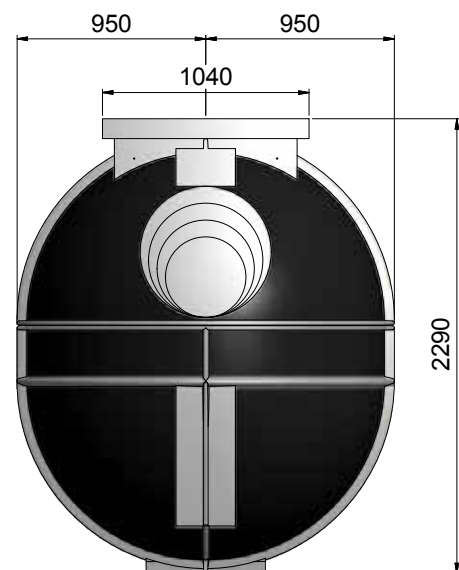
Model	E/102222	E/103030	E/103737	E/104545
Inlet (mm)	225	300	375	450
Outlet (mm)	225	300	375	450
Invert* Level (mm)	900	900	900	900
Overall* Height (mm)	2200	2200	2200	2200
Diameter (mm)	1900	1900	1900	1900
Manhole Opening (mm)	900 x 600	900 x 600	900 x 600	900 x 600
Manhole Quantity	1	1	1	1
Max Silt Capacity (Litre)	1200	1200	1200	1200
Max Hydrocarbon Capacity (Litre)	1200	1200	1200	1200
Max Capacity (Litre)	3500	3500	3500	3500

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PLAN



ELEVATIONS



ALL DIMENSIONS IN MM

[illegible]

SPEL ENVIRONMENTAL
INTEGRATED WATER SOLUTIONS

STORMWATER QUALITY IMPROVEMENT DEVICE

100 SILVERWATER RD, SILVERWATER
NSW. 2128.
PH: + 61 2 8705 0255
FAX: + 61 2 9630 0369
EMAIL: sales@spel.com.au
www.spel.com.au

TITLE:

SPEL - ECOCEPTOR
1000 SERIES
POLY

SIZE A4	CODE N/A	DWG No: SP11-10130	REV 0
SCALE N.T.S		DRAWN BY: P.LEE	SHEET 1 of 1
		DATE: 27/8/2012	

SPEL ECOCEPTOR 2000 SERIES

2000

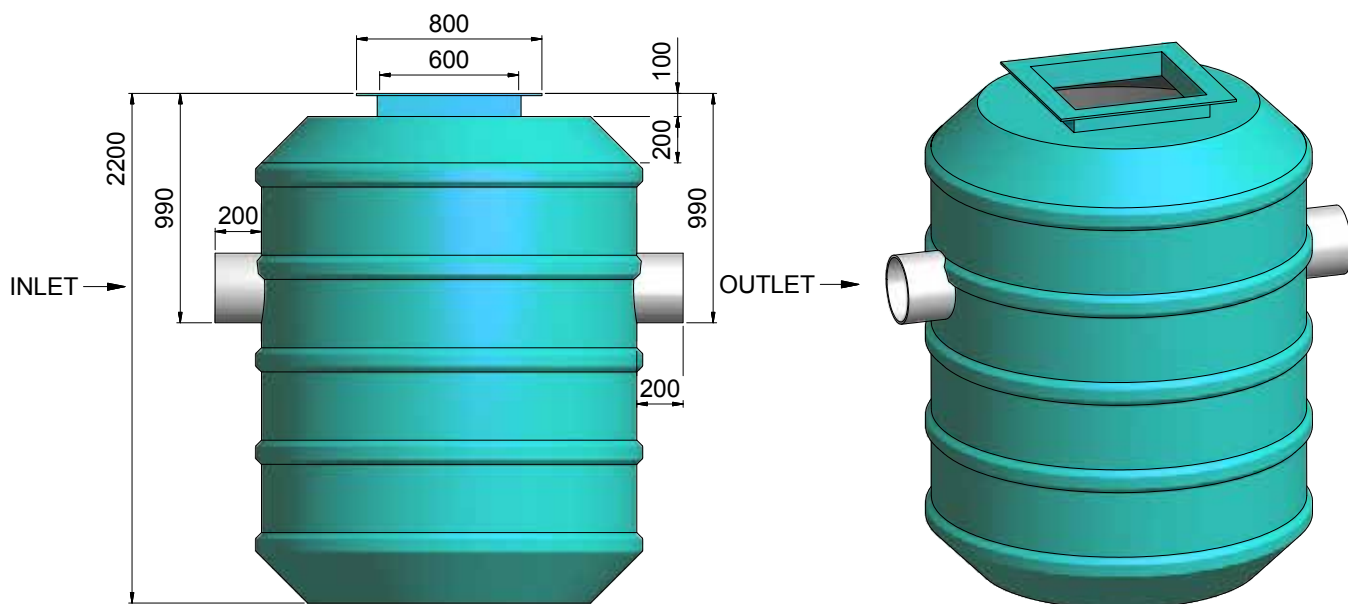
SELECTION CHART

Weight approximately 350kg each

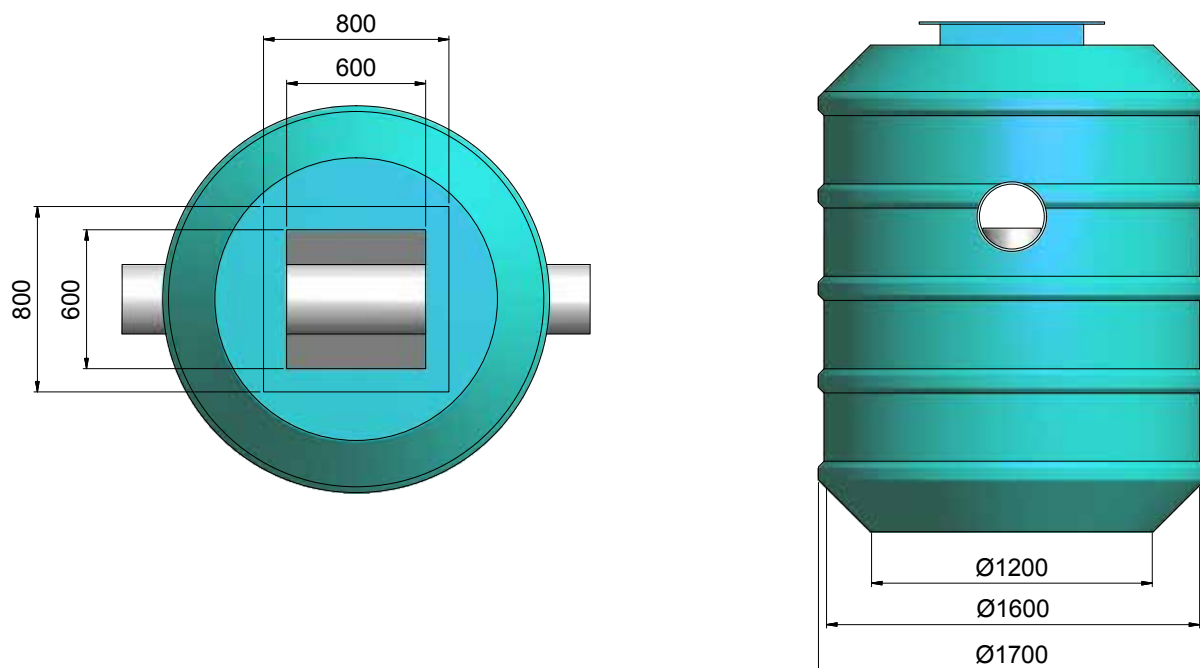
Model	E/202222	E/203030	E/203737	E/204545
Inlet (mm)	225	300	375	450
Outlet (mm)	225	300	375	450
Invert* Level (mm)	990	990	990	990
Overall* Height (mm)	2200	2200	2200	2200
Diameter (mm)	1800	1800	1800	1800
Manhole Opening (mm)	600 x 600	600 x 600	600 x 600	600 x 600
Manhole Quantity	1	1	1	1
Max Silt Capacity (Litre)	1200	1200	1200	1200
Max Hydrocarbon Capacity (Litre)	1200	1200	1200	1200
Max Capacity (Litre)	4400	4400	4400	4400

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ALL DIMENSIONS IN MM

DATE	REVISED	BY	TITLE: SPEL - ECOCEPTOR 2000 SERIES			
			SIZE A4	CODE N/A	DWG No: SP11-7410	REV 0
			SCALE N.T.S		DRAWN BY: P.LEE	SHEET 1 of 1
					DATE: 27/8/2012	

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STORMWATER QUALITY IMPROVEMENT DEVICE

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EMAIL: sales@spel.com.au
www.spel.com.au

SPEL ECOCEPTOR 4000 SERIES

4000

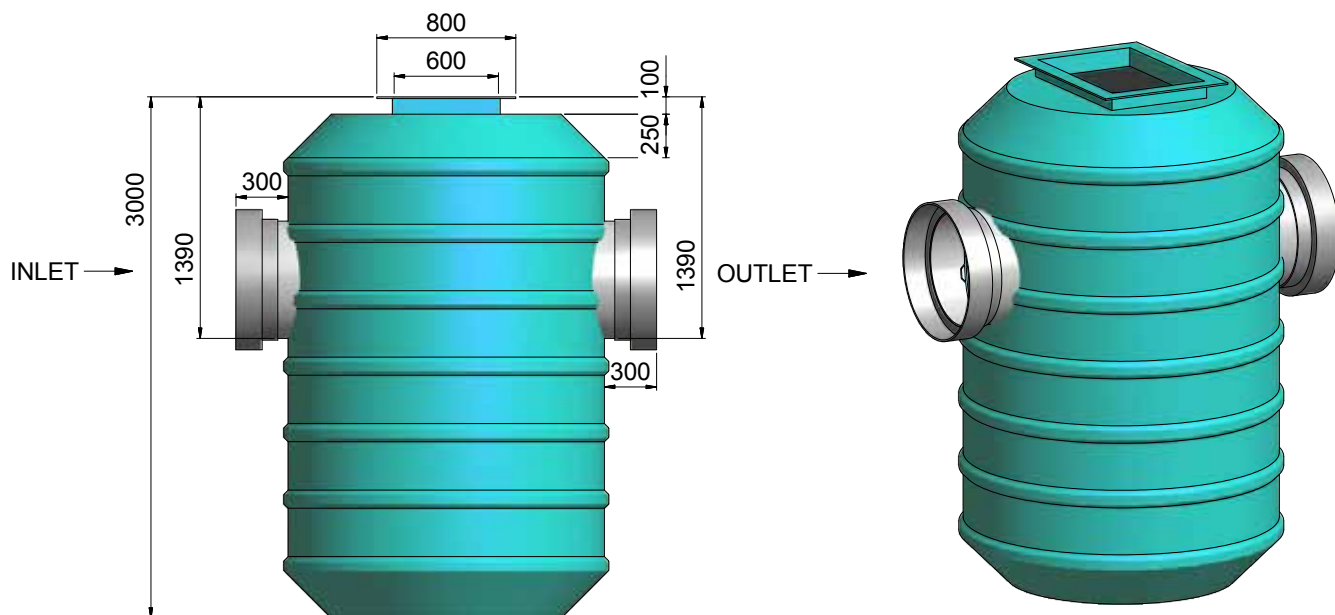
SELECTION CHART

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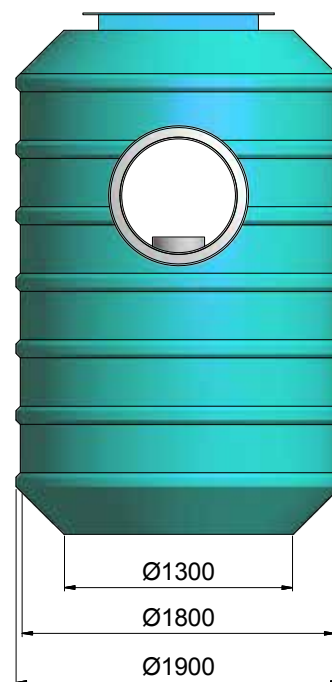
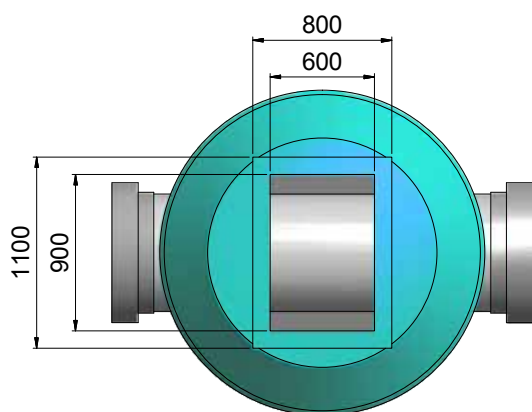
Model	E/403737	E/404545	E/405252	E/406060
Inlet (mm)	375	450	520	600
Outlet (mm)	375	450	520	600
Invert* Level (mm)	1390	1390	1390	1390
Overall* Height (mm)	3000	3000	3000	3000
Diameter (mm)	2000	2000	2000	2000
Manhole Opening (mm)	600 x 900	600 x 900	600 x 900	600 x 900
Manhole Quantity	1	1	1	1
Max Silt Capacity (Litre)	2500	2500	2500	2500
Max Hydrocarbon Capacity (Litre)	1500	1500	1500	1500
Max Capacity (Litre)	7600	7600	7600	7600

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SIZE A4	CODE N/A	DWG No: SP11-16010	REV 0
SCALE N.T.S	DRAWN BY: P.LEE	SHEET 1 of 1	DATE: 27/8/2012

SPEL ECOCEPTOR 6000 SERIES

6000

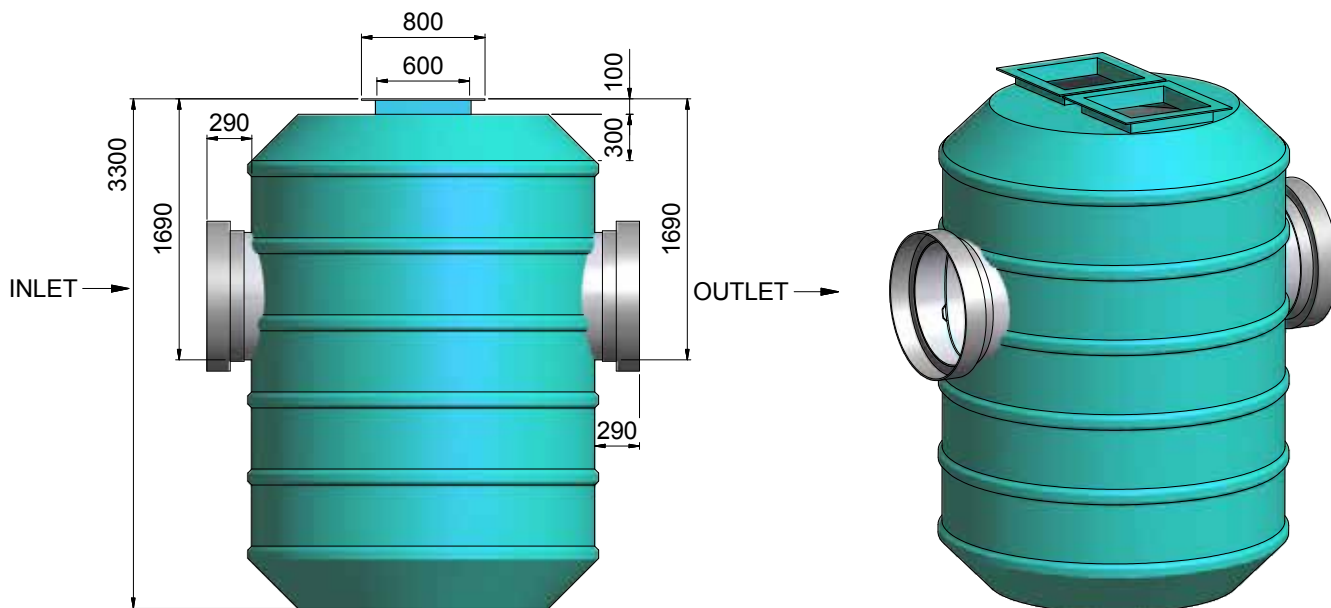
SELECTION CHART

Weight approximately 700kg each

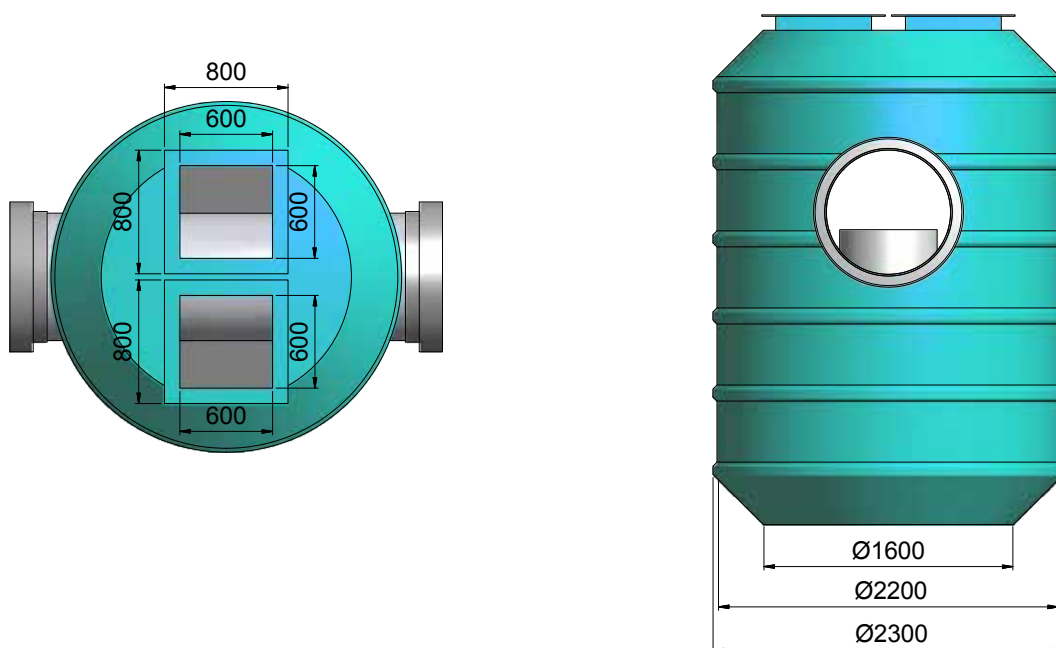
Model	E/606767	E/607575	E/609090
Inlet (mm)	675	750	900
Outlet (mm)	675	750	900
Invert* Level (mm)	1690	1690	1690
Overall* Height (mm)	3300	3300	3300
Diameter (mm)	2400	2400	2400
Manhole Opening (mm)	600 x 600	600 x 600	600 x 600
Manhole Quantity	2	2	2
Max Silt Capacity (Litre)	6000	6000	6000
Max Hydrocarbon Capacity (Litre)	2200	2200	2200
Max Capacity (Litre)	12500	12500	12500

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PLAN



ELEVATIONS



ALL DIMENSIONS IN MM

DATE	REVISED	BY

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INTEGRATED WATER SOLUTIONS

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TITLE:
SPEL - ECOCEPTOR
6000 SERIES

SIZE A4	CODE N/A	DWG No: SP11-15610	REV 0
SCALE N.T.S	DRAWN BY: P.LEE	SHEET 1 of 1	DATE: 27/8/2012



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Silverwater NSW 2128

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Canberra	61 2 6128 1000
Queensland	61 7 3271 6960
Victoria & Tasmania	61 3 5274 1336
South Australia	61 8 8275 8000
West Australia	61 8 9350 1000
Northern Territory	61 2 8705 0255
New Zealand	64 9 276 9045



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SPEL

STORMCEPTOR
CLASS 1

Subdivisions
Carparks
Roads
Wharfs
Airports
Industrial
Commercial

SPEL STORMWATER
TREATMENT
STORMCEPTOR CLASS 1

STORMWATER QUALITY IMPROVEMENT DEVICES
www.spelenvironmental.com.au

SPEL Stormceptor Class 1™

Reduction of:

Suspended solids (fine particulate),
Hydrocarbons, Nutrients, Heavy Metals

SPEL Stormceptor Class 1 takes stormwater treatment to a new dimension in Australia.

An accepted and proven performer in Europe, SPEL Class 1 has undergone rigorous testing to ensure it meets Australian conditions & complies with the objectives set by the regulating authorities.

SPEL Class 1 is suited as a secondary treatment performer, removing sediment, suspended solids, hydrocarbons and nutrients.

PARTICLE SIZE GRADING	TREATMENT MEASURES						HYDRAULIC LOADING QDES/AFACILITY
Gross Solids > 5000um	Gross Pollutant Trap						1,000,000 m ³ /yr 100,000 m ³ /yr
Coarse to medium sized particles 5000um-125um		Sedimentation Basin (Wet & Dry)	Grass Swales & Filter Strips				50,000 m ³ /yr 5000 m ³ /yr
Fine Particulates 125um-10um				Surface Flow Wetlands			2500 m ³ /yr 1000 m ³ /yr
Very Fine / Col-loidal Particulates 10um-0.45um					Infiltration Systems	Sub-Surface Flow Wetlands	500 m ³ /yr 50 m ³ /yr
Dissolved Particles < 0.45um							10 m ³ /yr

This ensures the tertiary biological treatment phase (if required) of a stormwater treatment chain is not encumbered with excessive pollutants and can realise long life with fewer maintenance frequencies.

At a glance

- ✓ >80% total suspended solids reduction
- ✓ >99.9% hydrocarbon reduction
- ✓ >45% Nutrients
- ✓ Independent university validation
- ✓ Complies with ANZECC 2000 Guidelines
- ✓ No scouring in tidal and flood
- ✓ Continual treatment in tidal conditions
- ✓ 2 chamber treatment system
- ✓ Filter media for fine particulate TSS & small hydrocarbons globules
- ✓ Installation in heavy-duty trafficable zones
- ✓ Minimum 12 monthly maintenance frequencies
- ✓ Low life cycle cost



Treatment Dynamics

The SPEL Stormceptor Class 1™ is a gravity, passive stormwater treatment device that treats stormwater through two chambers. Low velocity flow produces quiescent conditions enabling separation of the pollutants in all flow events. Contaminated water cannot flow directly across the surface before effective separation has taken place.

The unique **SPEL Stormceptor Class 1™** flow action in conjunction with the two internally sealed chambers and filter media ensures permanent quiescent conditions in the primary and secondary separation chamber, (no turbulence or agitation). Optimal treatment performance is maintained whilst the device is in 'bypass mode'.

No Scouring or Re-suspension

The **SPEL Stormceptor Class 1™** function ensures there is no scouring or re-suspension of separated pollutants. This makes it suitable for flood and tidal zones. The treatment process is maintained in such conditions.

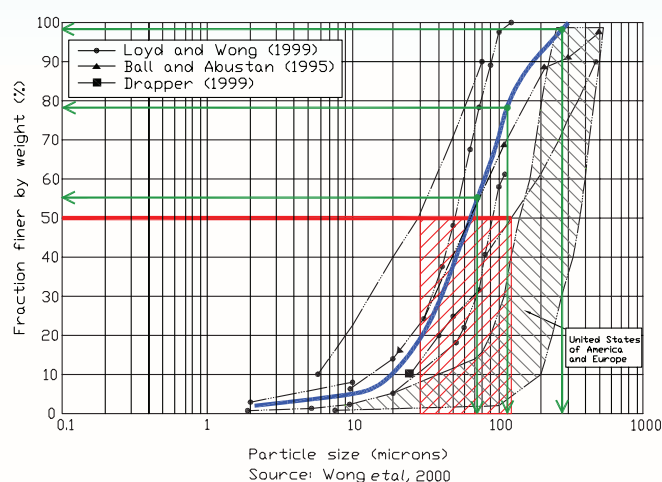


Treatment Water Quality

SPEL Stormceptor Class 1™ stormwater treatment devices have undergone rigorous and comprehensive tests in full scale flow conditions at the University of South Australia hydraulics Research Facility (UNISA) for suspended solids (TSS), Nutrients and Hydrocarbons.

Total Suspended Solids (Particle Size Distribution)

In depth investigation of particulate size (PSD) capture performance was developed by UNISA for assessment for typical stormwater TSS characteristics as shown in the figure below. The make-up of particulate size was weighted to the fine fraction 8um-125um that is typical of approximately 90% TSS load. This is stressed as the most accurate method in determining reduction as opposed to accumulative load analysis.



Above: Summary of particle size distributions from Australia stormwater quality studies (and comparison with typical US / European data).

Source: Wong et al, 2000. Red line shows the median particulate diameter (d50), which ranges in Australia from approximately 30 to 150um. Blue line represents approximate MUSIC inflow PSD mix on inflow load. <75um is approximately 55%, 75-125um is approximately 35%, >125um is approximately 10%.

TSS Reduction

- > 90% TSS (PSD >250um)
- > 87% TSS (PSD >125um)
- > 55% TSS (PSD 8-75um)

Table of TPH (BS EN 858.1 test procedure)

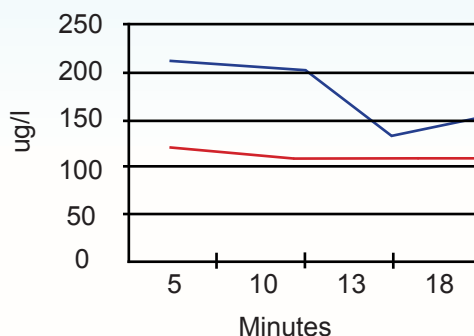
Hydrocarbon Fraction	EQL*	Inflow concentration (mg/L) Total 5699mg/L	Outlet samples TP fraction concentrations (mg/L)					Calculated means concentration (mg/L)
			1 t=27min	2 t=28min	3 t=29min	4 t=30min	5 t=31 min	
C6-C9	0.02	0.15	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C10-C14	0.04	125.43	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
C15-C28	0.10	5570.62	<0.10	<0.162	<0.10	<0.10	<0.10	<0.032
C29-C36	0.1	3.42	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10

TPH (Total Petroleum Hydrocarbons) Reduction

Tests were performed at the UNISA Research facility & at HR Wallingford UK with the device in flow mode, with the following results depicted in the table above. Test methodology was done to European Standard BS EN 85.1 Section 8.3 Reduction is in the order of no detection of TPH in discharge water translating to 'no visible trace' from an inflow concentration of >5,000ppm. Data expressed by competitors in terms of percentages are erroneous. Most claims are for a 98% reduction, which would make them non-compliant as discharge loads would range from 20ppm to 100ppm.

TP (Total Phosphorus) Reduction

Table above shows TP reduction remaining at constant average of 112ug/l in continual flow providing reduction >40%



TN (Total Nitrogen)

In-situ NATA tests show removal rates of TN > 45% (Particulate). Flow weighted tests at the UNISA showed reductions of 6% soluble. Recent study in Australia (Taylor et. al) shows that 80% of TN is in dissolved form, and that it doesn't vary between dry weather and storm conditions.

Heavy Metals

Site tests of cadmium, chromium, lead, aluminium and zinc show removal rates >90%.

Music Node

SPEL can provide a MUSIC node to engineers for design requirements.



SPEL STORMCEPTOR CLASS 1

WATER SENSITIVE URBAN DESIGN

www.spelenvironmental.com.au



SITE: Major CBD City Council.
APPLICATION: Stormwater from CBD (selected area).
POLLUTANTS: Petroleum hydrocarbons, road refuse, litter.
SITE AREA: 4ha
DISCHARGE: Swan River.
UNIT SUPPLIED: Stormceptor Class 1 : S.400/400.C1.2C
T.F.R.: 56 lps.
OPERATION: Unit has a working capacity of 20,270 litres and operation has been successfully operating since installation



SITE: Metropolitan City Council.
APPLICATION: Industrial and residential subdivision
POLLUTANTS: Sediment, hydrocarbons, nutrients.
SITE AREA: 21ha
DISCHARGE: Network of natural lakes.
UNIT SUPPLIED: Stormceptor Class 1 : S.400/750.C1.2C
T.F.R.: 108 lps.
UNIT SUPPLIED: Stormceptor Class 1 : S.500/515.C1.2C
T.F.R.: 220 lps.
OPERATION: The stormceptor's horizontally configured design satisfied the requirements of the high-water table terrain for the subdivision.



SITE: Car park & roof areas.
APPLICATION: General stormwater outfall from the total site.
POLLUTANTS: TSS,TP,TN,Hydrocarbons.
SITE AREA: 15ha.
DISCHARGE: City water supply catchment.
UNIT SUPPLIED: 5 x SPEL Stormceptor Class 1.
T.F.R.: Range from 8-100l/s.
OPERATION: Satisfied stringent NSW EPA water quality criteria. Devices installed upstream from infiltration basins.

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