STORMWATER MANAGEMENT PLAN

FOR

MACQUARIE UNIVERSITY ARTS PRECINCT

PROPOSED NEW ARTS PRECINCT BUILDING

REPORT NO. R01790-SWMP
REVISION B

AUGUST 2017

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PROJECT DETAILS

Property Address: Macquarie University

Development Proposal: Proposed New Arts Precinct Building

REPORT CERTIFICATION

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DOCUMENT CONTROL

REVISION	ISSUE DATE	ISSUED TO	ISSUED FOR
A	JULY 17	Capital Insight	INFORMATION
		Council	APPROVAL
B	AUGUST 17	Capital Insight	INFORMATION
		Council	APPROVAL

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1. INTRODUCTION

This Stormwater Management Plan & Report has been prepared in accordance with City of Ryde Development Control Plan to support the Development Application for the proposed development at Macquarie University.

Due to the nature of this development, this report addresses the requirements of Condition C04 & Commitments SOC5, SOC9 & SOC12 of the State Significant Development (SSD) Application. It also addresses requirements KI-01, KI-06, KI-09 & KI-11 of the Secretary's Environmental Assessment Requirements (SEARs).

The scope of this report includes a comprehensive assessment of the stormwater management requirements for the proposed development. Accordingly, this report includes findings of the assessment and proposes a best practice stormwater management strategy.

The report describes the principles and operation of the proposed stormwater systems as well as the primary components of the drainage system. As further assessment is required under the conditions of consent, the final stormwater system layout may need to be revised in the future during the application for a Construction Certificate.

The following information and documents were used for this investigation:

- Concept Civil Engineering Drawings for the Development Application submission prepared by C&M Consulting Engineers;
- Architectural Drawings by Budden Nangle Michael & Hudson Artitects
- Ryde Local Environment Plan (LEP) 2014
- City of Ryde Development Control Plan (DCP) 2014
- The City of Ryde Water Sensitive Urban Design – MUSIC Modelling Guidelines (2009)
- City of Ryde – Macquarie Park Floodplain Risk Management Study and Plan (2010)
- "Australian Runoff Quality – A Guide to Water Sensitive Urban Design", Engineers Australia (2006)
- "Australian Rainfall and Runoff – A Guide to Flood Estimation", Institute of Engineers, Australia (1987)
- Australian Standard AS3500.3 – Plumbing and drainage – Part 3: Stormwater drainage

1.1 The Site

The site is located within the Macquarie University campus at North Ryde (Refer to **Figure 1**).

Figure 1 - Aerial Photo of Existing Site
(Source: maps.six.nsw.gov.au)

The proposed development involves the refurbishment of existing buildings and the construction of a new building with associated civil works.

1.2 Key Issues

The key issues to be addressed in this report include:

- **Water Quantity** – Increases in impervious areas as a result of development (such as roofs, driveways, etc) has the potential to increase stormwater flows from the site during storm events. To avoid impacting on the site and downstream properties, the site stormwater system must be designed to safely convey flows through the site and within the capacity of the downstream drainage system.

- **Water Quality** – Urban developments have the potential to increase gross pollutants, sediments and nutrient concentrations in storm water runoff. To limit the impact on the downstream water quality, pollution control measures will be provided within the sites stormwater management system prior to discharging into the drainage network.

2. RELEVANT GUIDELINES

2.1 Design Guidelines

The site based stormwater management and planning elements are to be designed and constructed in accordance with the following:

Water Quantity

Guidelines: City of Ryde DCP (2014) – Part: 8.2 – Stormwater and Floodplain Management

City of Ryde DCP – Part: 8.2 – Stormwater Management Technical Manual (2015)

The proposed development increases the total impervious area of the existing area and therefore may increase the flow and discharge rate of flow to the downstream waterway. Therefore, on-site detention (OSD) is required to maintain the existing discharge flows.

Water Quality

Guidelines: City of Ryde DCP (2014) – Part: 8.2 – Stormwater and Floodplain Management

The main objective for stormwater quality is to minimise the impacts on downstream water bodies.

City of Ryde has adopted a stormwater management policy that incorporates "best practice" principles of Water Sensitive Urban. The site specific council water quality targets are outlined in Table 1 below:

Table 1 - Water Quality Reduction Targets

PARAMETERS	CRITERIA
Gross Pollutants	90% reduction of the average annual load
Suspended Solids	85% reduction of the average annual load
Total Phosphorus	65% reduction of the average annual load
Total Nitrogen	45% reduction of the average annual load

2.2 Objectives and Targets

The objective is to provide stormwater controls that ensure the proposed development does not adversely impact on the quantity or quality of stormwater flows within, adjacent to and downstream of the site.

Compatible with the legislation, policy and requirements, the objectives and targets for stormwater management are as provided in Table 2.

Table 2 - Stormwater Management Objectives

STORMWATER MANAGEMENT	OBJECTIVES	TARGET
Quantity	▪ The existing runoff flow regimes for the full storm events should be maintained, and provide safe conveyance system for the major storm events.	▪ Limit post development flow from the proposed development site to less than or equal to the pre-development flows.
Quality	▪ The full range of typical urban stormwater pollutants shall meet Council requirements	▪ Runoff from site to achieve minimum reductions in total pollutant loads in accordance with Council's requirements

2.3 Overall Strategies

The proposed stormwater management strategies to manage runoff and ensure no detriment to the receiving environments have been divided into short and long term strategies in Table 3 below:

Table 3 - Stormwater Management Strategies

STRATEGY	DESCRIPTION
Short Term Strategies	Short term strategies generally refer to the control of soil and water erosion during the construction phase. The primary risk occurs while soils are exposed during construction works when suspended sediments and associated pollutants can be washed into downstream waterways. Strategies to prevent this potential degradation include the adequate provision of sediment and erosion control measures which should be documented prior to commencement of works in a Soil and Water Management Plan (SWMP). These controls will limit the movement of sediment in disturbed areas, and will be designed to remove sediment from runoff prior to discharge from the site.
Long Term Strategies	Long term strategies to maintain stormwater quality discharged from the site include utilisation of a number of permanent treatment measures to remove pollutants effectively. The water quality requirements will be addressed through a rainwater reuse tank and downstream filter cartridges to further polish the phosphorus and nitrogen removal rates.

This report addresses the long term impacts of the development. For short term effects (i.e. during the construction phase) water quality control is achieved by implementing the measures in the Sedimentation & Erosion Control Plans to be included with the Construction Certificate Application.

3. STORMWATER QUANTITY CONTROL

3.1 Introduction

The main criterion for the stormwater quantity control is to ensure that the post-development design flows do not exceed the capacity of the downstream drainage network or cause erosion/detriment to natural waterways.

3.2 Proposed Drainage System

The drainage system for the proposed development will be designed to collect the majority of concentrated flows from impermeable surfaces such as access ways, parking areas and buildings. Where possible (and practical), runoff from pervious areas will also be collected.

The drainage system proposed for the development includes:

- A pipe network system to collect minor storm runoff from areas;
- A rainwater tank with overflow into the OSD
- An on-site detention (OSD) storage tank with orifice control;

A reduced set of concept civil engineering drawings is included in Appendix A.

3.2.1 Rainwater Tank Requirements

It is proposed that a rainwater tank with a minimum volume of 30kL be provided and connected for non-potable water usage. The overflows from this proposed rainwater tank will be directed into the on-site stormwater detention (OSD)

3.2.2 On-Site Stormwater Detention Requirements

On-site detention is required for the development of the site as per Council's DCP and technical specification. The requirements for the OSD design is that the post-development flows not exceed the pre-development flows from the site.

DRAINS modelling has been undertaken for the proposed site restricting the post-development flows to the pre-development flows for all storms up to and including the 1% AEP peak flow. This modelling showed that a minimum OSD volume of 38.8m^3 would be required.

The DRAINS layout and results for the minor (20% AEP) and major (1% AEP) storms are attached as Appendix B.

4. WATER QUALITY CONTROL

4.1 Introduction

The quality of runoff from a catchment depends upon many factors such as land use, degree of urbanisation, population density, sanitation, waste disposal practices, landform, soil types, and climate. Pollutants typically transported by runoff include litter, sediment, nutrients, oil, grease, and heavy metals. Whilst these pollutants have a negative impact on the receiving water quality, suspended solids and nutrients cause the highest detrimental impact to the environment. Litter, oils, and other surfactants have an aesthetic impact.

Activity within a catchment during urbanisation includes the disturbance of vegetation, removal of topsoil, land shaping, road construction, installation of services, and building works. It is during this phase that the sediment movement is greatest and is estimated that the sediment production levels may be up to 6 times higher than under the existing conditions. However, once development is completed, the sediment loading may return to the existing level depending on land management practices.

As with all development projects, soil erosion during the construction phase presents a potential risk to water quality. The primary risk occurs while soils are exposed during earthworks when suspended sediment and associated pollutants can be washed into downstream watercourses.

This section of the report addresses the long term impacts of the development on water quality. For short term effects (i.e. during the construction phase) water quality control is achieved by implementing the measures in the Sedimentation & Erosion Control Plans to be included with future Construction Certificate submissions.

4.2 Water Quality Control Measures

There are number of measures that can reduce pollutant loadings, however, each different type has its own effectiveness in reducing pollutant loadings that depends on land use type, topography and the target control.

The adopted Treatment Train will provide the most efficient and manageable measures, suited to the subject development setting, surrounded by residential environmentally sensitive areas.

The measures proposed for the redevelopment are summarised in Table 4.

Table 4 - Water Quality Control Measures

MEASURES	DESCRIPTIONS
Gross Pollutant Traps	▪ An EnviroPod is a catch basin insert installed inside inlet pits. It is effective in removing trash, debris and other pollutants from runoff. ▪ EnviroPods proposed for the project utilise a 200 micron filter system. ▪ These filter baskets will be installed in indicated pits for the proposed development.
Rainwater Tank	▪ Rainwater tanks are effective in the removal of pollutant loads at source. The pollutant removal process occurs by harvesting runoff for reuse, thereby limiting the nutrients that are discharged into the waterways. ▪ It is proposed to provide a rainwater reuse tank for with a minimum effective volume of $30m^3$ plumbed for non-potable water use.
Filter Cartridges	▪ *StormFilter* is a proprietary device containing multiple cartridge units in a single system thereby suitable for larger catchments ▪ One of the advantages of using *StormFilter* is that the cartridges come with various filtration media available to target site-specific pollutants ▪ Each cartridge consists of Perlite/Zeolite media ▪ There will be total of 8 x 690mm standard cartridges within the OSD tanks respectively as detailed in the engineering drawings.

In addition to the above measures for pollutant control, natural vegetated buffers will be maintained along the edges of roads, accesses, and areas of activity, which will further reduce pollutants to meet reduction targets. This added benefit has not been included in the modelling hence contributing to the conservative nature of the modelling and assessment.

4.3 Strategy Effectiveness

The effectiveness of the proposed water quality measures have been assessed using numerical modelling. The results were assessed against the established WSUD requirements to determine the effectiveness of the proposed strategy.

4.4 Water Quality Modelling

4.4.1 *MUSIC Program*

The water quality model adopted for this project is the MUSIC (Model for Urban Stormwater Improvement Conceptualisation Version 6) water quality numerical model developed by the MUSIC Development Team of the Cooperative Research Centre for Catchment Hydrology (CRCCH). MUSIC is an event basis model, and will simulate the performance of a group of stormwater management measures, configured in series or in parallel to form a "treatment train".

The MUSIC User Manual suggests that the time-step should not be greater than the time of concentration of the smallest sub-catchment, but consideration should also be given to the smallest detention time of treatment nodes in the system. To accurately model the performance of the treatment nodes, a 6-minute time step was chosen.

The MUSIC model was generated using the historical 6-minute rainfall and monthly evapotranspiration data for Sydney Airport (BOM Station No. 66037) for a period of 10 years from 1988 to 1998.

Catchment characteristics were defined by the roof areas, communal open space and balconies with generally impervious characteristics to replicate the catchment for the development condition.

The MUSIC model layout (01790_Mac Uni_RevC.sqz) is shown in Appendix D of this report.

4.4.2 *Event Mean Concentration*

MUSIC uses different event mean concentrations (EMC) to determine the pollutant loads generated by different land uses. The standard EMCs adopted within MUSIC were based on research undertaken by Duncan (1999) through the CRCCH and the results are reproduced in Australian Runoff Quality – A Guide to Water Sensitive Urban Design (ARQ).

The EMC values used in the MUSIC models for this project were obtained from ARQ. Table 5 summarises the parameters used for the site.

Table 5 - EMC Parameters

LAND USE	MEAN BASE FLOW CONCENTRATION PARAMETERS Log10 (mg/l)			MEAN STORM FLOW CONCENTRATION PARAMETERS Log10 (mg/l)		
	TSS	TP	TN	TSS	TP	TN
Roof Areas	Not Applicable*Note 1			1.300	-0.890	0.300
Impervious Areas	Not Applicable*Note 1			2.150	-0.600	0.300
Driveways	Not Applicable*Note 1			2.430	-0.300	0.340
Landscaping	1.200	-0.850	0.110	2.150	-0.600	0.300

*Note 1 – Roof/Impervious areas consists of 100% impervious area so there is no base flow generated from this area

4.4.3 *Configuration*

Table 6 and 7 provide the treatment configurations used in the MUSIC model.

Table 6 - Catchment Areas

LAND USE	DEVELOPED CONDITIONS	
	AREA (m^2)	IMPERVIOUSNESS (%)
Roof	**2,882**	**100**
Impervious	**415**	**100**
Pervious	**43**	**0**
Total	**3340m^2**	**99%**

Table 7 - Stormwater Quality Improvement Devices (SQID)

STORMWATER QUALITY IMPROVEMENT DEVICE (SQID)	QUANTITY OF SQID
StormFilters	8 x 690mm Cartridges
Rainwater Tank	1 x 30kL Rainwater Tank
Gross Pollutant Traps	2 X Enviropods in nominated pits

4.4.4 *Results*

The results of the MUSIC modelling are summarised in Table 8. The total pollutant loads from the development are expressed in kilograms per year. The reduction rate is expressed as a percentage and compares the pollution from the post developed site to that of the existing developed state of the site.

Table 8 - Summary of MUSIC Model Results

PARA-METER	EXISTING SITE LOADS (KG/YR)	POST DEVELOPMENT WITH TREATMENT (KG/YR)	REDUCTION %	TARGET ACHIEVED
GP	79.4	0	100	Yes
TSS	143	17.8	87.6	Yes
TP	0.527	0.174	67	Yes
TN	6.8	3.52	48.2	Yes

GP = Gross Pollutants   TSS = Total Suspended Solids
TP = Total Phosphorus   TN = Total Nitrogen

In all instances, the proposed water quality control measures enabled the reduction targets to be achieved for all key stormwater pollutants. Therefore, by implementing the proposed treatment train measures within the proposed development there will be no detrimental effect on the quality of stormwater running off from the site.

5. FLOOD IMPACT ASSESSMENT

As per the City of Ryde – Macquarie Park Floodplain Risk Management Study and Plan (2010), the area adjacent to the site is subject to overland flow during a 1% AEP storm event (Refer to **Figure 2** below).

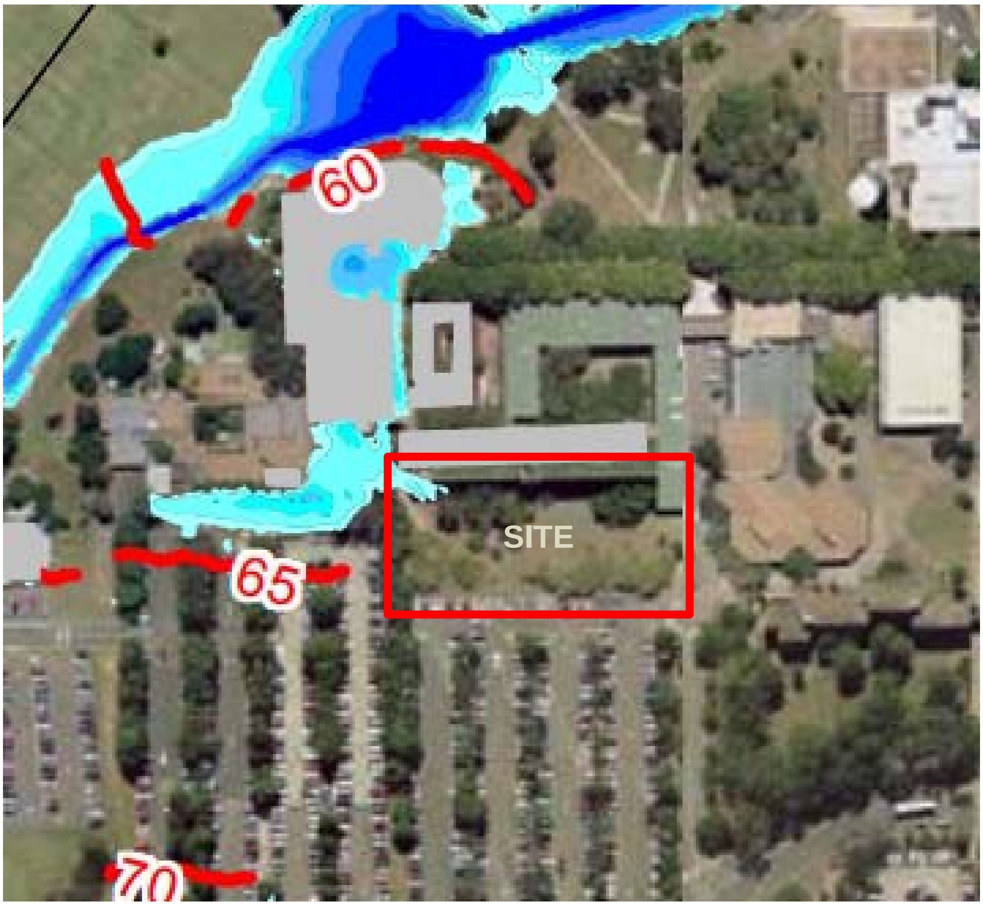


Figure 2 – Extract from 100 Year ARI Flood Model
(Source: Macquarie Park Floodplain Risk Management Study and Plan)

This is area, however, is not considered to be mainstream flooding. Rather it is localised flooding due to trapped low point adjacent to the site and issues with the local drainage network.

Since the 2010 study was published, Macquarie University has undertaken drainage amplification works to address the localised flooding issues associated with undersized pipes adjacent to the proposed development. A copy of the drainage amplification plans have been attached to this report as Appendix D.

Due to the aforementioned drainage amplification works, the overland flow issue has been resolved and the proposed development site is no longer affected by overland flow or localised flooding.

The proposed development therefore is not affected by flooding nor impacts the existing flooding regime at the University.

It should also be noted that in accordance with the Ryde LEP, the site is not within a Flood Planning Area (Refer to **Figure 3** below).

Figure 3 – Extract from Flood Planning Map
(Source: Ryde LEP)

6. RECOMMENDATIONS

The proposed development of the subject site could potentially lead to significant changes in water quantity as well as quality if a water sensitive urban design approach is not adopted as part of the development strategy. The traditional stormwater management and investigation that only considers impacts of flooding and flood mitigation is a thing of the past. Stormwater management practices must now also consider water quality, aquatic habitats, riparian vegetation, recreation, aesthetic and economic issues.

The key strategies to be adopted for this development include the following:

1. A pipe network system to collect minor storm runoff from surface areas which will minimise nuisance flooding;

2. A 30kL effective volume rainwater tank will be provided to allow rainwater reuse whilst providing an improvement of the quality of stormwater runoff and also providing a level of stormwater detention. The harvested rainwater will be plumbed for non-potable water use;

3. On-Site Detention will be provided for the development in the form of a detention tank with orifice and weir control and a minimum effective volume of 38.8m^3;

4. EnviroPods in the external surface inlet pits to form part of the water quality treatment train system that removes gross pollutants that are detrimental to the down stream waterways

5. 8 x standard 690mm StormFilter cartridges to polish stormwater prior to discharge to the downstream drainage network.

The results from the investigations and modelling for this project that have been summarised in this report indicate that the development with the proposed WSUD strategy and management can provide a safe and ecologically sustainable environment.

7. REFERENCES

- Concept Civil Engineering Drawings for the Development Application submission prepared by C&M Consulting Engineers;
- Ryde Local Environment Plan (LEP) 2014
- City of Ryde Development Control Plan (DCP) 2014
- The City of Ryde Water Sensitive Urban Design – MUSIC Modelling Guidelines (2009)
- City of Ryde – Macquarie Park Floodplain Risk Management Study and Plan (2010)
- "Australian Runoff Quality – A Guide to Water Sensitive Urban Design", Engineers Australia (2006)
- "Australian Rainfall and Runoff – A Guide to Flood Estimation", Institute of Engineers, Australia (1987)
- Australian Standard AS3500.3 – Plumbing and drainage – Part 3: Stormwater drainage
- Watercom – DRAINS Version 2017.09
- eWater – *MUSIC Version 6.2 (Build 1.0)*

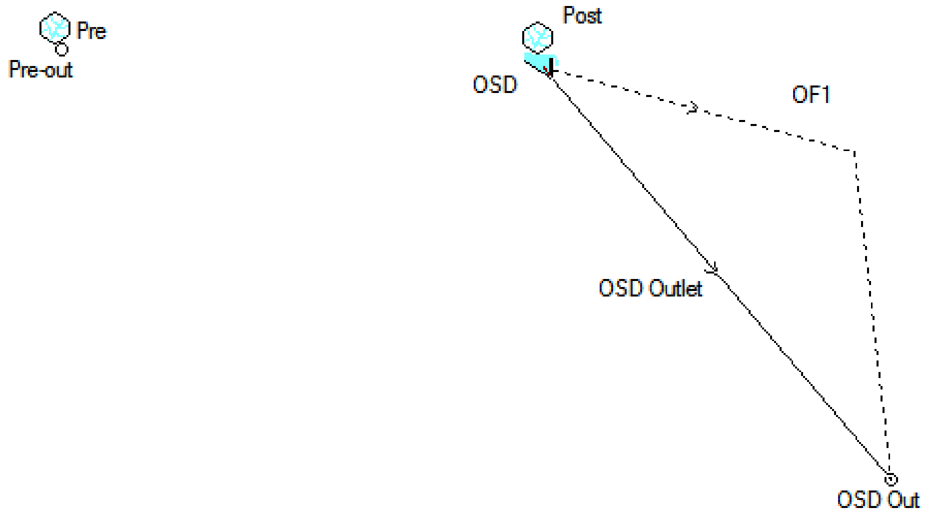
APPENDIX A

CONCEPT CIVIL ENGINEERING DRAWINGS

APPENDIX B

DRAINS LAYOUT & RESULTS

DRAINS MODEL SETUP



PIT / NODE DETAILS — Version 13

Name	Type	Family	Size	Ponding Volume (cu.m)	Pressure Change Coeff. Ku	Surface Elev (m)	Max Pond Depth (m)	Base Inflow (cu.m/s)	Blocking Factor	x	y	Bolt-down lid	id	Part Full Shock Loss	Inflow Hydrograph	Pit is
Pre-out	Node					100		0		255.266	-43.6		3		No	
OSD Out	Node					62		0		462	-151		11		No	

DETENTION BASIN DETAILS

Name	Elev	Surf. Area	Not Used	Outlet Typ	K	Dia(mm)	Centre RL	Pit Family	Pit Type	x	y	HED	Crest RL	Crest Leng	id
OSD	61.7	0.81		Orifice		260	61.9			375	-48	No			7
	61.9	0.81													
	61.99	36													
	63.5	36													
	64	36													

SUB-CATCHMENT DETAILS

Name	Pit or Node	Total Area (ha)	Paved Area %	Grass Area %	Supp Area %	Paved Time (min)	Grass Time (min)	Supp Time (min)	Paved Length (m)	Grass Length (m)	Supp Length (m)	Paved Slope(%) %	Grass Slope %	Supp Slope %	Paved Rough	Grass Rough	Supp Rough	Lag Time or Factor	Gutter Length (m)	Gutter Slope %	Gutter FlowFactor	Rainfall Multiplier
Pre	Pre-out	0.334	30	70	0	5	0	0	0	50	0	1	1	0	0.01	0.06	0	1.24E-294				
Post	OSD	0.334	99	1	0	5	0	0	0	10	0	1	1	0	0.01	0.06	0	1.38E-294				

PIPE DETAILS

Name	From	To	Length (m)	U/S IL (m)	D/S IL (m)	Slope (%)	Type	Dia (mm)	I.D. (mm)	Rough	Pipe Is	No. Pipes	Chg From	At Chg	Chg (m)	Rl (m)	Chg (m)	RL (m)	etc (m)
OSD Outlet	OSD	OSD Out	3	61.7	61.67	1	Concrete, u	375	375	0.013	NewFix	1	OSD	0					

DETAILS of SERVICES CROSSING PIPES

Pipe	Chg (m)	Bottom Elev (m)	Height of S (m)	Chg (m)	Bottom Elev (m)	Height of S (m)	Chg (m)	Bottom Elev (m)	Height o (m)	etc etc

CHANNEL DETAILS

Name	From	To	Type	Length (m)	U/S IL (m)	D/S IL (m)	Slope (%)	Base Wid (m)	L.B. Slop (1:?)	R.B. Slope (1:?)	Mannin n	Depth (m)	Roofed

OVERFLOW ROUTE DETAILS

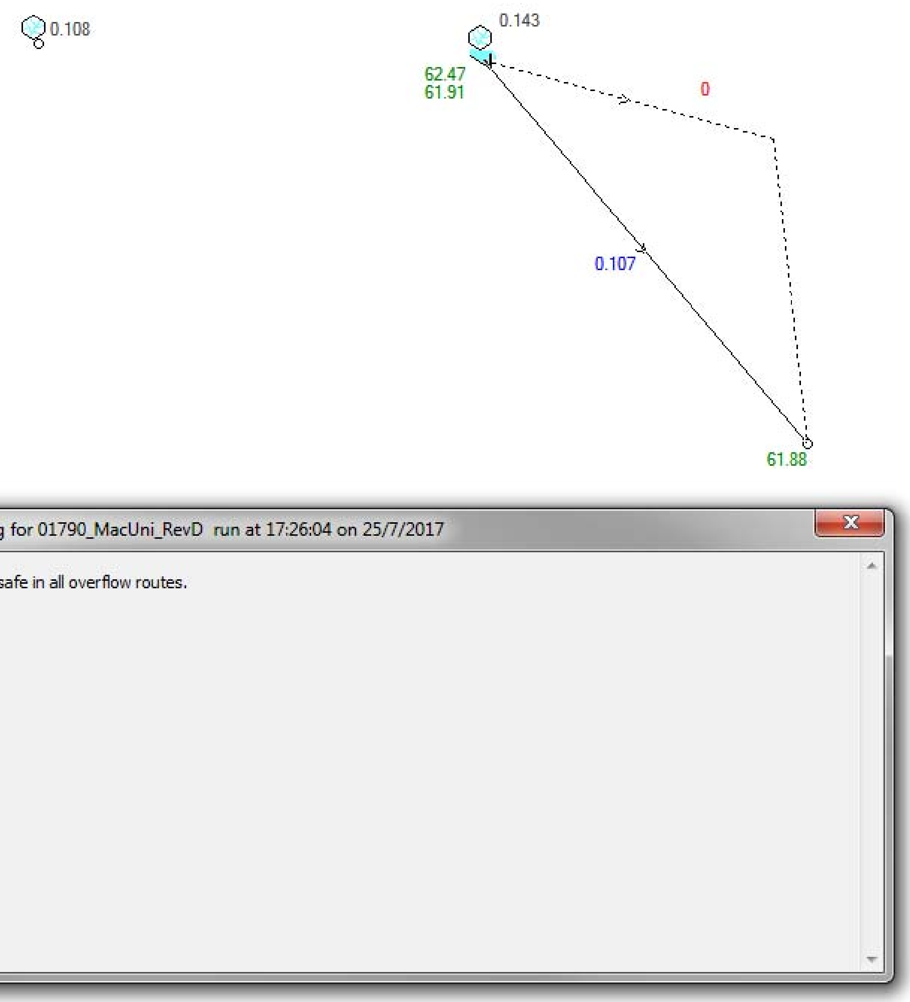
Name	From	To	Travel Time (min)	Spill Level (m)	Crest Length (m)	Weir Coeff. C	Cross Section	Safe Dept Major Stc (m)	SafeDep Minor St (m)	Safe DxV (sq.m/sec)	Bed Slope (%)	D/S Area Contributing %		id
OF1	OSD	OSD Out	0.1	63.15	1.8	1.7	4 m wide p	0.3	0.15	0.4	0.01	0		361

PIPE COVER DETAILS

Name	Type	Dia (mm)	Safe Cover	Cover (m)	
OSD Outlet	Concrete, u	375	0.6	-0.08	Unsafe

This model has no pipes with non-return valves

DRAINS RESULTS – MINOR STORM (20% AEP)



DRAINS results prepared from Version 2017.09

PIT / NODE DETAILS				Version 8			
Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
OSD Out	61.88		0				

SUB-CATCHMENT DETAILS							
Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
Pre	0.108	0.043	0.066	5	9.3	0	AR&R 5 year, 25 minutes storm, average 79.0 mm/h, Zone 1
Post	0.143	0.141	0.001	5	3.54	0	AR&R 5 year, 25 minutes storm, average 79.0 mm/h, Zone 1

Outflow Volumes for Total Catchment (0.43 impervious + 0.24 pervious = 0.67 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runof cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 5 year, 5 minutes stc	85.73	60.10 (70.1%)	50.99 (92.2%)	9.12 (30.0%)
AR&R 5 year, 10 minutes s	132.49	101.75 (76.8%)	81.15 (95.0%)	20.60 (43.8%)
AR&R 5 year, 15 minutes s	167	132.21 (79.2%)	103.41 (96.0%)	28.81 (48.6%)
AR&R 5 year, 20 minutes s	195.95	158.01 (80.6%)	122.08 (96.6%)	35.93 (51.7%)
AR&R 5 year, 25 minutes s	219.88	178.10 (81.0%)	137.52 (97.0%)	40.58 (52.0%)
AR&R 5 year, 30 minutes s	240.48	195.29 (81.2%)	150.80 (97.2%)	44.49 (52.1%)
AR&R 5 year, 45 minutes s	290.58	237.95 (81.9%)	183.12 (97.7%)	54.83 (53.2%)
AR&R 5 year, 1 hour storm	329.99	271.37 (82.2%)	208.54 (98.0%)	62.84 (53.6%)
AR&R 5 year, 1.5 hours sto	391.78	323.10 (82.5%)	248.39 (98.3%)	74.71 (53.7%)
AR&R 5 year, 2 hours storr	440.88	363.98 (82.6%)	280.06 (98.5%)	83.93 (53.6%)
AR&R 5 year, 3 hours storr	519.02	429.66 (82.8%)	330.46 (98.7%)	99.20 (53.8%)

PIPE DETAILS					
Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm
OSD Outlet	0.107	1.67	61.912	61.882	AR&R 5 year, 25 minutes storm, average 79.0 mm/h, Zone 1

CHANNEL DETAILS			
Name	Max Q (cu.m/s)	Max V (m/s)	Due to Storm

OVERFLOW ROUTE DETAILS								
Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
OF1	0	0	0.091	0	0	0	0	

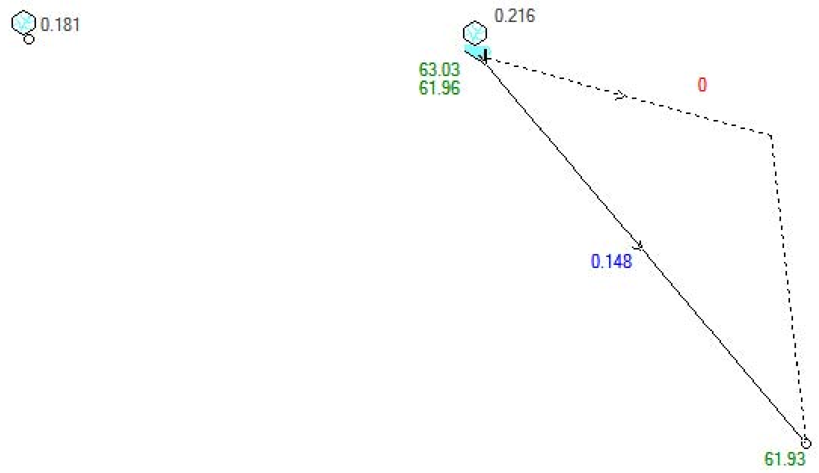
DETENTION BASIN DETAILS					
Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level
OSD	62.47	18.8	0.107	0.107	0

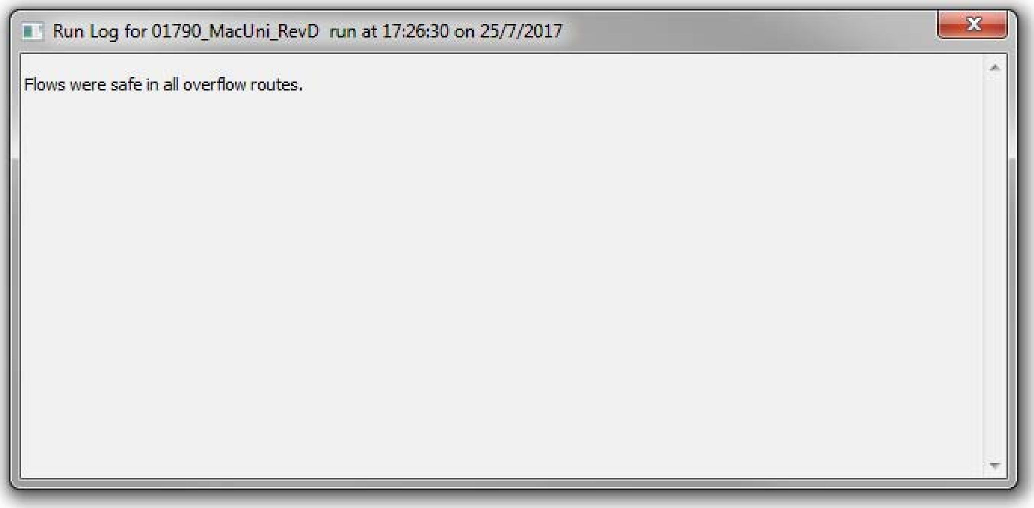
CONTINUITY CHECK for AR&R 5 year, 25 minutes storm, average 79.0 mm/h, Zone 1

Node	Inflow (cu.m)	Outflow (cu.m)	Storage Change (cu.m)	Difference %
Pre-out	71.98	71.98	0	0
OSD	106.12	106.06	0.06	0
OSD Out	106.06	106.06	0	0

Run Log for 01790_MacUni_RevD run at 17:21:16 on 25/7/2017
Flows were safe in all overflow routes.

DRAINS RESULTS – MAJOR STORM (1% AEP)





DRAINS results prepared from Version 2017.09

PIT / NODE DETAILS				Version 8			
Name	Max HGL	Max Pond HGL	Max Surface Flow Arriving (cu.m/s)	Max Pond Volume (cu.m)	Min Freeboard (m)	Overflow (cu.m/s)	Constraint
OSD Out	61.93		0				

SUB-CATCHMENT DETAILS							
Name	Max Flow Q (cu.m/s)	Paved Max Q (cu.m/s)	Grassed Max Q (cu.m/s)	Paved Tc (min)	Grassed Tc (min)	Supp. Tc (min)	Due to Storm
Pre	0.181	0.064	0.117	5	6.98	0	AR&R 100 year, 15 minutes storm, average 1
Post	0.216	0.214	0.002	5	2.25	0	AR&R 100 year, 5 minutes storm, average 24

Outflow Volumes for Total Catchment (0.43 impervious + 0.24 pervious = 0.67 total ha)

Storm	Total Rainfall cu.m	Total Runoff cu.m (Runoff %)	Impervious Runo cu.m (Runoff %)	Pervious Runoff cu.m (Runoff %)
AR&R 100 year, 5 minutes st	136.38	111.06 (81.4%)	83.66 (95.1%)	27.40 (56.6%)
AR&R 100 year, 10 minutes s	213.76	183.16 (85.7%)	133.57 (96.9%)	49.59 (65.4%)
AR&R 100 year, 15 minutes s	270.54	235.56 (87.1%)	170.19 (97.5%)	65.37 (68.1%)
AR&R 100 year, 20 minutes s	318.41	279.66 (87.8%)	201.07 (97.9%)	78.59 (69.5%)
AR&R 100 year, 25 minutes s	356.27	313.68 (88.0%)	225.48 (98.1%)	88.20 (69.7%)
AR&R 100 year, 30 minutes s	394.12	348.29 (88.4%)	249.90 (98.3%)	98.39 (70.3%)
AR&R 100 year, 45 minutes s	480.97	427.28 (88.8%)	305.91 (98.6%)	121.37 (71.1%)
AR&R 100 year, 1 hour storm	547.75	487.94 (89.1%)	348.99 (98.8%)	138.95 (71.5%)
AR&R 100 year, 1.5 hours stc	661.32	591.72 (89.5%)	422.24 (99.0%)	169.48 (72.2%)
AR&R 100 year, 2 hours storı	748.18	670.39 (89.6%)	478.26 (99.1%)	192.12 (72.3%)
AR&R 100 year, 3 hours storı	903.79	811.60 (89.8%)	578.64 (99.3%)	232.96 (72.6%)

PIPE DETAILS					
Name	Max Q (cu.m/s)	Max V (m/s)	Max U/S HGL (m)	Max D/S HGL (m)	Due to Storm
OSD Outlet	0.148	1.78	61.964	61.936	AR&R 100 year, 25 minutes storm, average 128 mm/h, Zone 1

CHANNEL DETAILS			
Name	Max Q (cu.m/s)	Max V (m/s)	Due to Storm

OVERFLOW ROUTE DETAILS								
Name	Max Q U/S	Max Q D/S	Safe Q	Max D	Max DxV	Max Width	Max V	Due to Storm
OF1	0	0	0.302	0	0	0	0	

DETENTION BASIN DETAILS					
Name	Max WL	MaxVol	Max Q Total	Max Q Low Level	Max Q High Level
OSD	**63.03**	**38.8**	0.148	0.148	0

CONTINUITY CHECK for AR&R 100 year, 15 minutes storm, average 162 mm/h, Zone 1

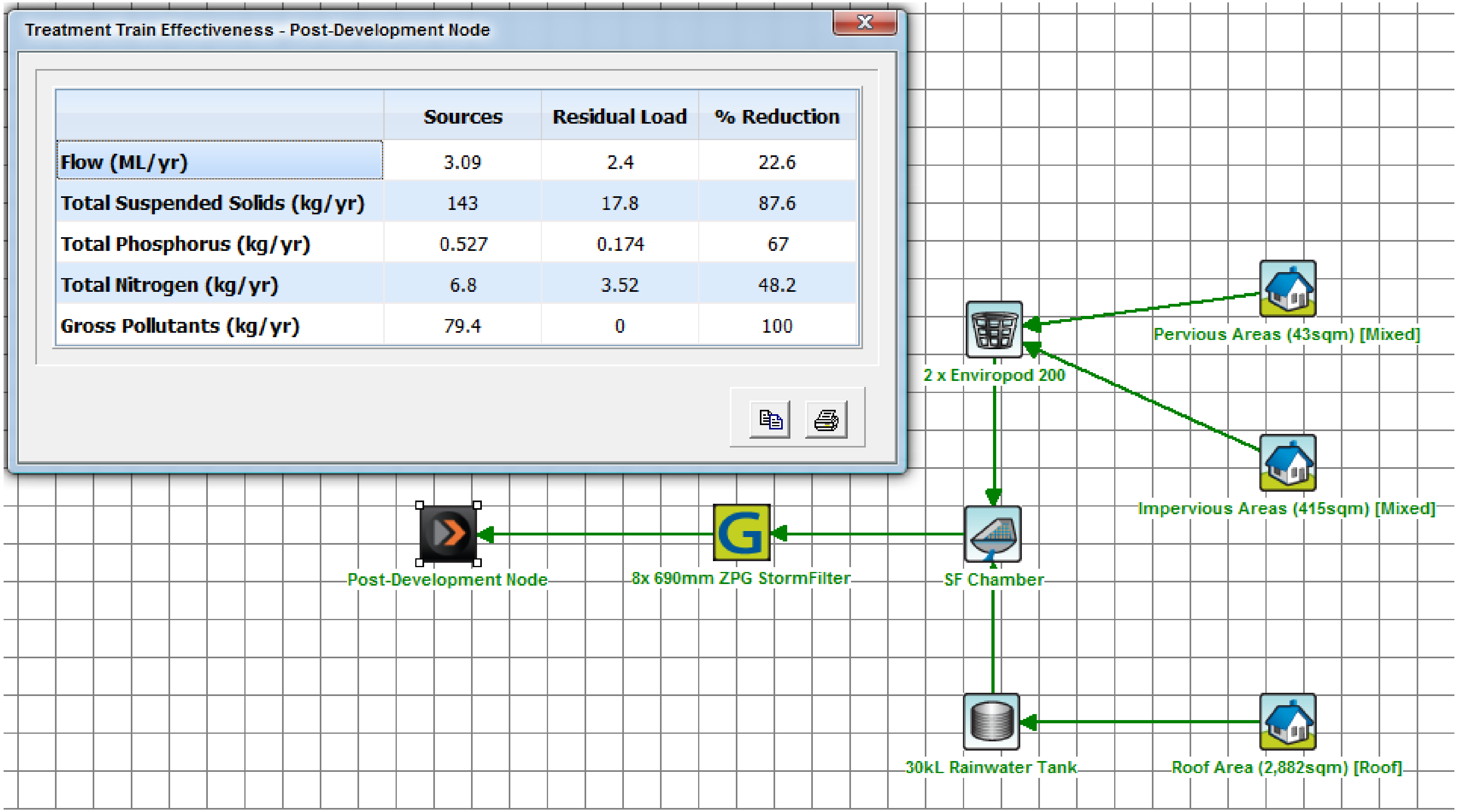
Node	Inflow (cu.m)	Outflow (cu.m)	Storage Change (cu.m)	Difference %
Pre-out	104.01	104.01	0	0
OSD	131.55	131.49	0.06	0
OSD Out	131.49	131.49	0	0

Run Log for 01790_MacUni_RevD run at 17:20:45 on 25/7/2017
Flows were safe in all overflow routes.

APPENDIX C

MUSIC MODEL LAYOUT & RESULTS

MUSIC MODEL LAYOUT & RESULTS



Treatment Train Effectiveness - Post-Development Node

	Sources	Residual Load	% Reduction
Flow (ML/yr)	3.09	2.4	22.6
Total Suspended Solids (kg/yr)	143	17.8	87.6
Total Phosphorus (kg/yr)	0.527	0.174	67
Total Nitrogen (kg/yr)	6.8	3.52	48.2
Gross Pollutants (kg/yr)	79.4	0	100

APPENDIX D

DRAINAGE AMPLIFICATION WORKS

MACQUARIE UNIVERSITY
ARCHIVE ROOM FLOOD INVESTIGATION

GENERAL NOTES

1. Contractor must verify all dimensions and existing levels on site prior to commencement of works. Any discrepancies to be reported to the Engineer .
2. Strip all topsoil from the construction area. All stripped topsoil shall be disposed of off-site unless directed otherwise.
3. Make smooth connection with all existing works.
4. Compact subgrade under buildings and pavements to minimum 98% standard maximum dry density in accordance with AS 1289 5.1.1. Compaction under buildings to extend 2m minimum beyond building footprint.
5. All work on public property, property which is to become public property, or any work which is to come under the control of the Statutory Authority is to be carried out in accordance with the requirements of the relevant Authority. The Contractor shall obtain these requirements from the Authority. Where the requirements of the Authority are different to the drawings and specifications, the requirements of the Authority shall be applicable.
6. For all temporary batters refer to geotechnical recommendations.

REFERENCE DRAWINGS

1. These drawings have been based from, and to be read in conjunction with the following Consultants drawings. Any conflict to the drawings must be notified immediately to the Engineer.

Consultant	Dwg Title	Dwg No	Rev	Date
LAND LOCKLEY TITLE SOLUTIONS	PLAN DETAILS	315250ta	1	24.03.10
MACQUARIE UNIVERSITY BUILDING & GROUND SERVICES	POWER DATA SERVICES	E02–E03	A	SEP 2003

SURVEY AND SERVICES INFORMATION

SURVEY

Origin of levels : SSM24943
Datum of levels : A.H.D. AUSTRALIAN HEIGHT DATUM
Coordinate system : MGA
Survey prepared by : LAND LOCKLEY TITLE SOLUTIONS
Setout Points : CONTACT THE SURVEYOR

Taylor Thomson Whitting does not guarantee that the survey information shown on these drawings is accurate and will accept no liability for any inaccuracies in the survey information provided to us from any cause whatsoever.

UNDERGROUND SERVICES – WARNING

The locations of underground services shown on Taylor Thomson Whittings drawings have been plotted from diagrams provided by service authorities. This information has been prepared solely for the authorities own use and may not necessarily be updated or accurate.

The position of services as recorded by the authority at the time of installation may not reflect changes in the physical environment subsequent to installation.

Taylor Thomson Whitting does not guarantee that the services information shown on these drawings shows more than the presence or absence of services, and will accept no liability for inaccuracies in the services information shown from any cause whatsoever.

The Contractor must confirm the exact location and extent of services prior to construction and notify any conflict with the drawings immediately to the Engineer/Superintendent.

The contractor is to get approval from the relevant state survey department, to remove any survey mark. This includes but is not limited to; State Survey Marks (SSM), Permanent Marks (PM), cadastral reference marks or any other survey mark which is to be removed or adjusted in any way.
Taylor Thomson Whitting plans do not indicate the presence of any survey mark. The contractor is to undertake their own search.

PAVEMENT LEGEND

80mm Thickness asphaltic concrete (AC10) on
150mm Compacted thickness fine crushed rock (DGB20) on
200mm Compacted thickness fine crushed rock (DGS40)

NOTE

Asphaltic concrete shall conform to AS2150 and the specification

PIT SCHEDULE

Note: Grate size does not necessarily reflect pit size, refer pit type details, shown on detail sheets – **C04**

Type	Description	Cover (Clear Opening)	Number
A	Kerb inlet pit 900 lintel	450 x 900 Class C galvanised mild steel grate hinged to frame	5,6
B	Surface inlet pit	900 x 900 Class C galvanised mild steel grate hinged to frame	2,3,4,8
	Junction pit	900 x 900 Class C cast iron cover with concrete infill	7
C	Existing Headwall	Existing Headwall, modified to suit pipe	1

STORMWATER DRAINAGE NOTES

1 Stormwater Design Criteria :
(A) Average recurrence interval –
1:100 years for roof drainage to first external pit
1:20 years for paved and landscaped areas
(B) Rainfall intensities –
Time of concentration: 6 minutes
1:100 years = 232.3 mm/hr
1:20 years = 182.9 mm/hr
(C) Runoff coefficients –
Roof areas: C_{100} = 1.00
Roads and paved areas: C_{20} = 0.95
Landscaped areas: C_{20} = 0.54

2. Pipes 300 dia and larger to be reinforced concrete Class "2" approved spigot and socket with rubber ring joints U.N.O.
3. Pipes up to 300 dia shall be sewer grade uPVC with solvent welded joints.
4. Equivalent strength VCP or FCP pipes may be used subject to approval.
5. Precast pits may be used external to the building subject to approval by Superintendent
6. Enlargers, connections and junctions to be manufactured fittings where pipes are less than 300 dia.
7. Where subsoil drains pass under floor slabs and vehicular pavements, unslotted uPVC sewer grade pipe is to be used.
8. Grates and covers shall conform with AS 3996–2006, and AS 1428.1 for access requirements.
9. Pipes are to be installed in accordance with AS 3725. All bedding to be type H2 U.N.O.
10. Care is to be taken with levels of stormwater lines. Grades shown are not to be reduced without approval.
11. All stormwater pipes to be 150 dia at 1.0% min fall U.N.O.
12. Subsoil drains to be slotted flexible uPVC U.N.O.
13. Adopt invert levels for pipe installation (grades shown are only nominal).

CONCRETE NOTES

EXPOSURE CLASSIFICATION :

CONCRETE

Place concrete of the following characteristic compressive strength f'c as defined in AS 1379.

Location	AS 1379 f'c MPa at 28 days	Specified Slump	Nominal Agg. Size
Kerb & Gutter	S32	80	20
Pits		80	20

1. Use Type 'GP' cement, unless otherwise specified.
2. All concrete shall be subject to project assessment and testing to AS 1379.
3. Consolidate by mechanical vibration. Cure all concrete surfaces as directed in the Specification.
4. For all falls in slab, drip grooves, reglets, chamfers etc. refer to Architects drawings and specifications.
5. Unless shown on the drawings, the location of all construction joints shall be submitted to Engineer for review.
6. No holes or chases shall be made in the slab without the approval of the Engineer.
7. Conduits and pipes are to be fixed to the underside of the top reinforcement layer.
8. Slurry used to lubricate concrete pump lines is not to be used in any structural members.
9. All slabs cast on ground require sand blinding with a Concrete Underlay

FORMWORK

1. The design, certification, construction and performance of the formwork, falsework and backpropping shall be the responsibility of the contractor. Proposed method of installation and removal of formwork is to be submitted to the superintendent for comment prior to work being carried out.

CONCRETE FINISHING NOTES

1. All exposed concrete pavements are to be broomed finished.
2. All edges of the concrete pavement including keyed and dowelled joints are to be finished with an edging tool.
3. Concrete pavements with grades greater than 10 % shall be heavily broomed finished.
4. Carborundum to be added to all stair treads and ramped crossings U.N.O.

SITEWORKS NOTES

1. All basecourse material to comply with RTA specification No 3051 and compacted to minimum 98% modified standard dry density in accordance with AS 1289 5.2.1.
2. All trench backfill material shall be compacted to the same density as the adjacent material.
3. All service trenches under vehicular pavements shall be backfilled with an approved select material and compacted to a minimum 98% standard maximum dry density in accordance with AS 1289 5.1.1

BOUNDARY AND EASEMENT NOTE

The property boundary and easement locations shown on Taylor Thomson Whitting drawing's have been based from information received from : **Land Lockley Title Solutions**

Taylor Thomson Whitting makes no guarantees that the boundary or easement information shown is correct.
Taylor Thomson Whitting will accept no liabilities for boundary inaccuracies. The contractor/builder is advised to check/confirm all boundaries in relation to all proposed work prior to the commencement of construction. Boundary inaccuracies found are to be reported to the superintendent prior to construction starting.

KERBING NOTES

Includes all kerbs, gutters, dish drains, crossings and edges.

1. All kerbs, gutters, dish drains and crossings to be constructed on minimum 75mm granular basecourse compacted to minimum 98% modified maximum dry density in accordance with AS 1289 5.2.1.
2. Expansion joints (EJ) to be formed from 10mm compressible cork filler board for the full depth of the section and cut to profile. Expansion joints to be located at drainage pits, on tangent points of curves and elsewhere at 12m centres except for integral kerbs where the expansion joints are to match the joint locations in slabs.
3. Weakened plane joints to be min 3mm wide and located at 3m centres except for integral kerbs where weakened plane joints are to match the joint locations in slabs.
4. Broomed finished to all ramped and vehicular crossings, all other kerbing or dish drains to be steel float finished.
5. In the replacement of kerbs –
Existing road pavement is to be sawcut 900mm from lip of gutter. Upon completion of new kerbs, new basecourse and surface is to be laid 900mm wide to match existing materials and thicknesses.
Existing allotment drainage pipes are to be built into the new kerb with a 100mm dia hole.
Existing kerbs are to be completely removed where new kerbs are shown.

REINFORCEMENT NOTES

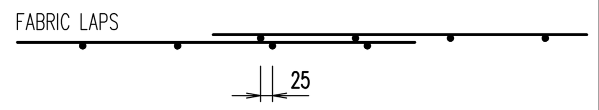
1. Fix reinforcement as shown on drawings. The type and grade is indicated by a symbol as shown below. On the drawings this is followed by a numeral which indicates the size in millimetres of the reinforcement.

N. Hot rolled ribbed bar — grade D500N
R. Plain round bar — grade R250N
SL. Square mesh — grade 500L
RL. Rectangular mesh — grade 500L

Provide bar supports or spacers to give the following concrete cover to all reinforcement unless otherwise noted on drawings.

Slabs – 40 top, 40 bottom,
Walls – 40 generally.

2. Cover to reinforcement ends to be 50 mm u.n.o.
3. Provide N12–450 support bars to top reinforcement as required , Lap 450. U.N.O.
4. Maintain cover to all pipes, conduits, reglets, drip grooves etc
5. Laps in reinforcement shall be made only where shown on the drawings unless otherwise approved. Lap lengths shall be 40 bar dia. unless noted otherwise.
6. All cogs to be standard cogs unless noted otherwise.
7. Fabric end and side laps are to be placed strictly in accordance with the manufacturers requirements to achieve a full tensile lap. Fabric shall be laid so that there is a maximum of 3 layers at any location.



TENDER NOTES

1. These drawings are preliminary drawings issued for tender as an indication of the extent of works only. They are not a complete construction set of drawings.
2. To determine the full extent of work, these drawings shall be read in conjunction with the architectural drawings and other contract documents.
Allow for all items shown on architectural and other drawings as not all items are shown on the structural/civil works drawings.
3. Should any ambiguity, error, omissions, discrepancy, inconsistency or other fault exist or seem to exist in the documents, immediately notify in writing to the Superintendent.
4. Rates shown on the drawings are for the final structure/civil works in place and do not allow for any wastage, rolling margins, over supply or fabrication requirements. etc.

SURVEY LEGEND

+18.48	Surface level
19	Contour
	Kerb line
	Batter
	Retaining wall
SW	Stormwater drainage line
T	Telecommunications line
G	Gas line
W	Water main
S	Sewer line
EASEMENT FOR ______(__m WIDE)	Easement
/	Fence
	Tree to be removed/be retained
	Boundary
SGN	Sign
H	Hydrant
MH	Manhole
G	Gas
SV	Stop Valve
W	Water
TEL	Telstra
TRAP	Trap
	Gully
	Grate
S	Sewer Manhole
E	Energy Australia (Electricity)
ELP	Electric Light Pole
TB	Telephone Box
PKM	Parking Meter
PM 1234	Permanent Mark
BM 51.10	Bench Mark
LB	Letter Box
BOL	Bollard
SEAT	Seat
BIN	Bin
KO	Kerb Outlet

SITEWORKS LEGEND

F22.20	Finished surface level
F22.00	Finished contour
KO	Kerb only
IL10.00 / 600 ø '2' / 1.25% / Q=345 L/s / IL9.65	Stormwater pit, flow direction and line with Invert level upstream, Pipe size and class, Pipe grade, Flow (Litres per second), Invert level downstream
	Subsoil drainage line (100 dia)
FP	Flushing point
DP	Down pipe
	Concrete encased stormwater line
	Grass catch drain
	Overland flow path

CIVIL DRAWING LIST

Drawing No	Drawing Title
C01	NOTES AND LEGENDS SHEET
C02	SITEWORKS PLAN
C03	EROSION & SEDIMENT CONTROL PLAN
C04	DETAILS SHEET
C05	SECTIONS SHEET

Rev	Description	Eng	Draft	Date
C	ISSUE FOR CONSTRUCTION	NB	MS	15.11.10
B	RE ISSUE FOR TENDER	SB	MS	09.09.10
A	ISSUE FOR TENDER	SB	MS	27.07.10

Project
MACQUARIE UNIVERSITY ARCHIVE ROOM FLOOD INVESTIGATION

Sheet Subject
NOTES AND LEGENDS SHEET

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Scale : A1 | Drawn MS | Authorised

Job No 101138 | Drawing No C01 | Revision C

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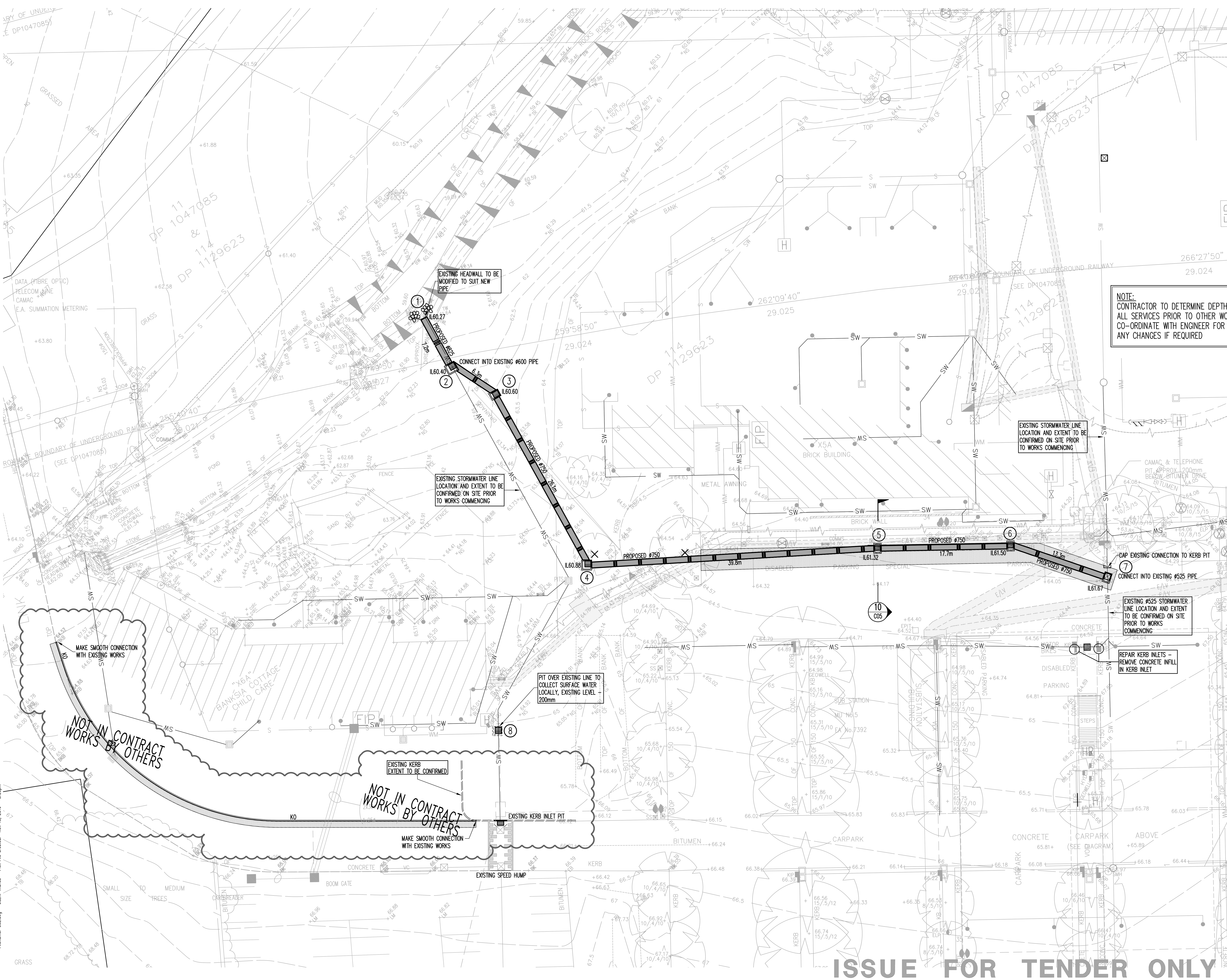

FOR NOTES AND LEGENDS REFER TO DRAWING No C01.

Rev	Description	Eng	Draft	Date
C	ISSUE FOR CONSTRUCTION	NB	MS	15.11.10
B	RE ISSUE FOR TENDER	SB	MS	09.09.10
A	ISSUE FOR TENDER	SB	MS	27.07.10

Project
MACQUARIE UNIVERSITY ARCHIVE ROOM FLOOD INVESTIGATION

Sheet Subject
SITEWORKS PLAN

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EROSION AND SEDIMENT CONTROL LEGEND

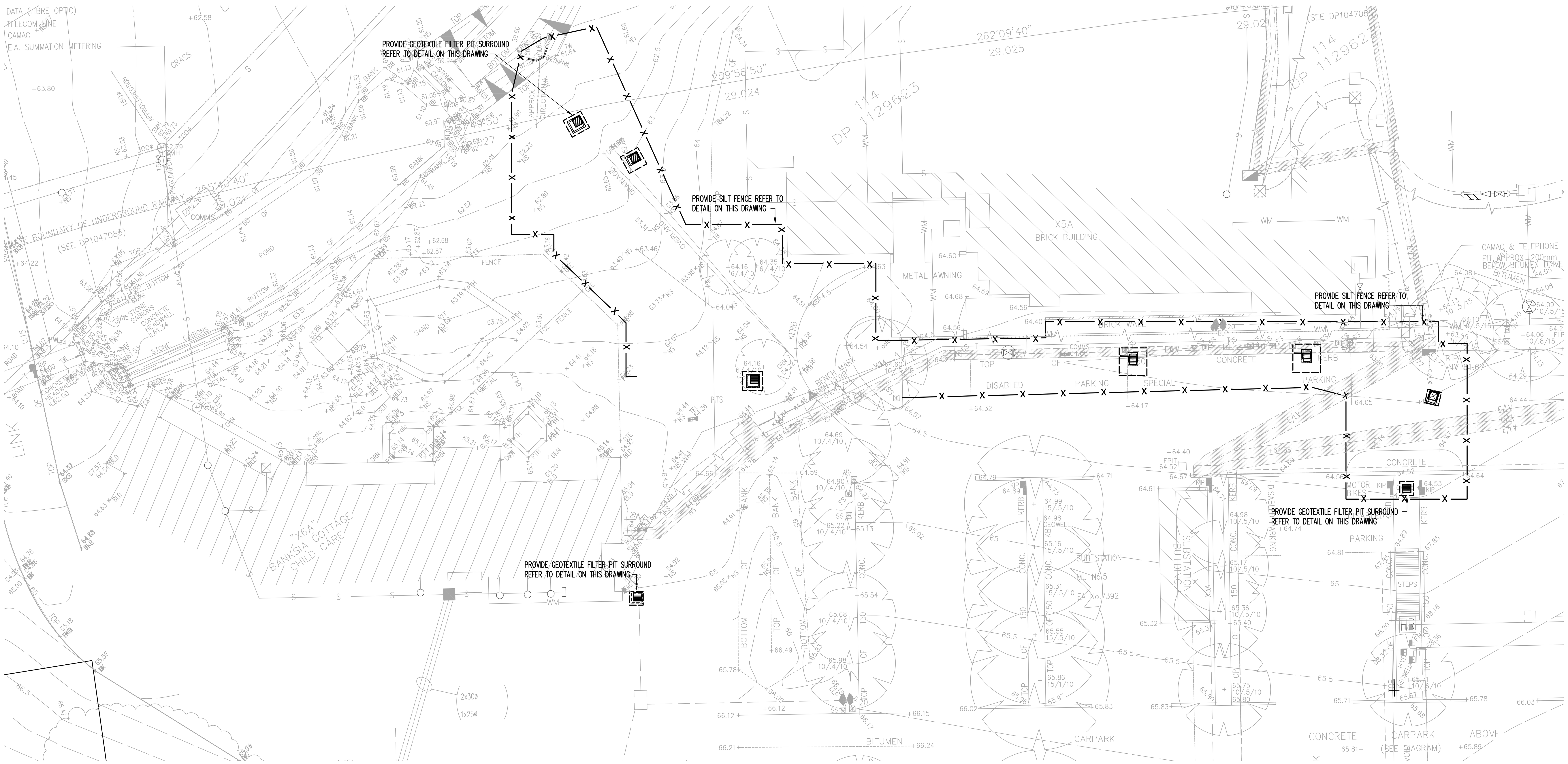
- Batter
- Siltation fence
- Stormwater pit with Geotextile filter surround
- Hay bale barriers
- Sandbag sediment trap
- Catch drain
- Overland flow path

EROSION AND SEDIMENT CONTROL NOTES

1. All work shall be generally carried out in accordance with
   (A) Local authority requirements,
   (B) EPA – Pollution control manual for urban stormwater,
   (C) Department of conservation and land management manual– "Urban Erosion & Sediment Control".
2. Erosion and sediment control **drawings and notes** are provided for the whole of the works. Should the Contractor stage these works then the design may require to be modified. Variation to these details may require to be approved by the relevant authorities. The erosion and sediment control **plan** shall be implemented and adopted to meet the varying situations as work on site progresses.
3. Maintain all erosion and sediment control devices to the satisfaction of the superintendent and the local authority.
4. When stormwater pits are constructed prevent site runoff entering the pits unless silt fences are erected around pits.
5. Minimise the area of site being disturbed at any one time.
6. Protect all stockpiles of materials from scour and erosion. Do not stockpile loose material in roadways, near drainage pits or in watercourses.
7. All soil and water control measures are to be put back in place at the end of each working day, and modified to best suit site conditions.
8. Control water from upstream of the site such that it does not enter the disturbed site.
9. All construction vehicles shall enter and exit the site via the temporary construction entry/exit.
10. All vehicles leaving the site shall be cleaned and inspected before leaving.
11. Maintain all stormwater pipes and pits clear of debris and sediment. Inspect stormwater system and clean out after each storm event.
12. Clean out all erosion and sediment control devices after each storm event.

Sequence Of Works

1. Prior to commencement of excavation the following soil management devices must be installed.
1.1. Construct silt fences below the site and across all potential runoff sites.
1.2. Construct temporary construction entry/exit and divert runoff to suitable control systems.
1.3. Construct measures to divert upstream flows into existing stormwater system.
1.4. Construct sedimentation traps/basin including outlet control and overflow.
1.5. Construct turf lined swales.
1.6. Provide sandbag sediment traps upstream of existing pits.
2. Construct geotextile filter pit surround around all proposed pits as they are constructed.
3. On completion of pavement provide sand bag kerb inlet sediment traps around pits.
4. Provide and maintain a strip of turf on both sides of all roads after the construction of kerbs.



PLAN
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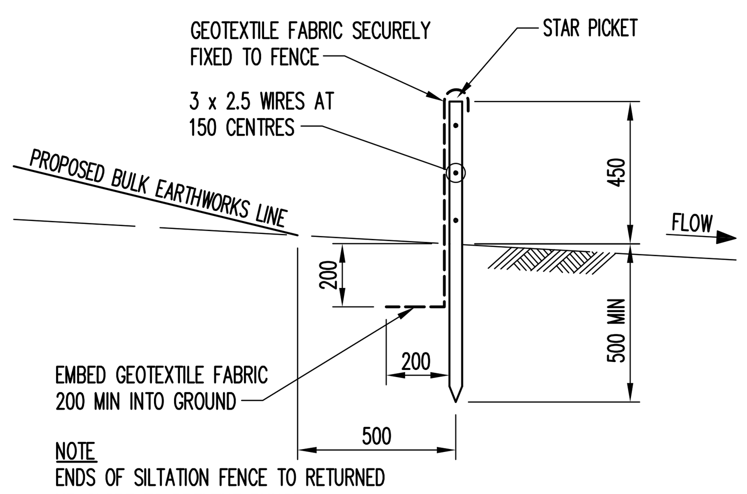

NOTE
ENDS OF SILTATION FENCE TO RETURNED UP SLOPE TO PREVENT RUNOFF

SILTATION FENCE DETAIL
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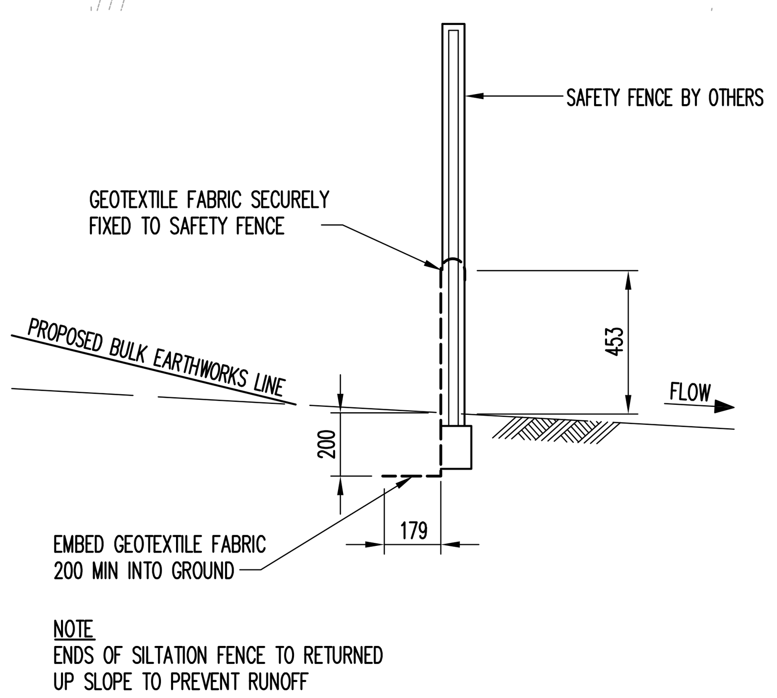

NOTE
ENDS OF SILTATION FENCE TO RETURNED UP SLOPE TO PREVENT RUNOFF

SILTATION FENCE DETAIL
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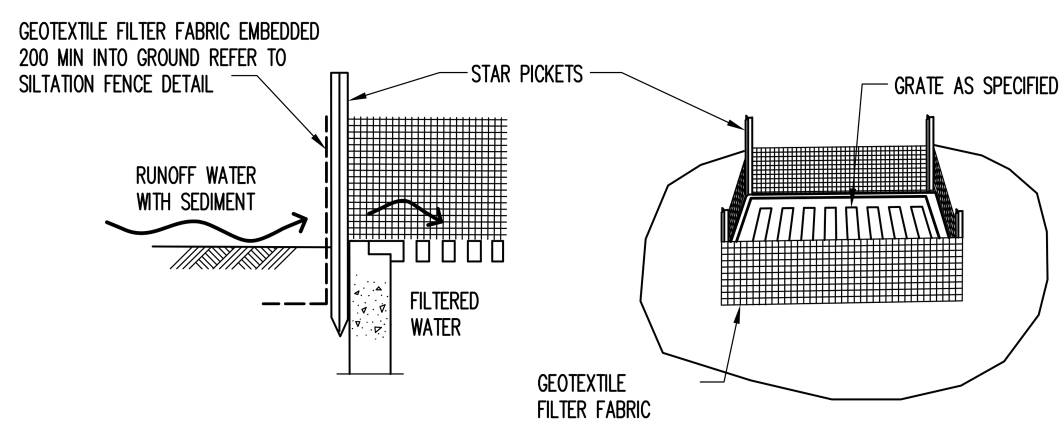
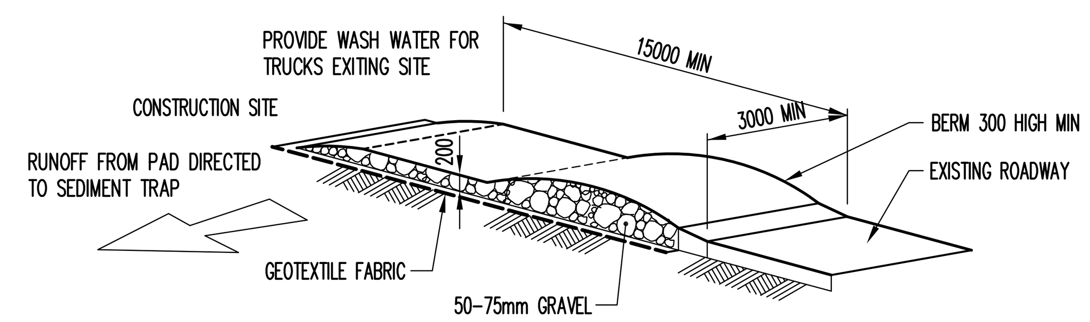


GEOTEXTILE FILTER PIT SURROUND
NTS



TEMPORARY CONSTRUCTION EXIT
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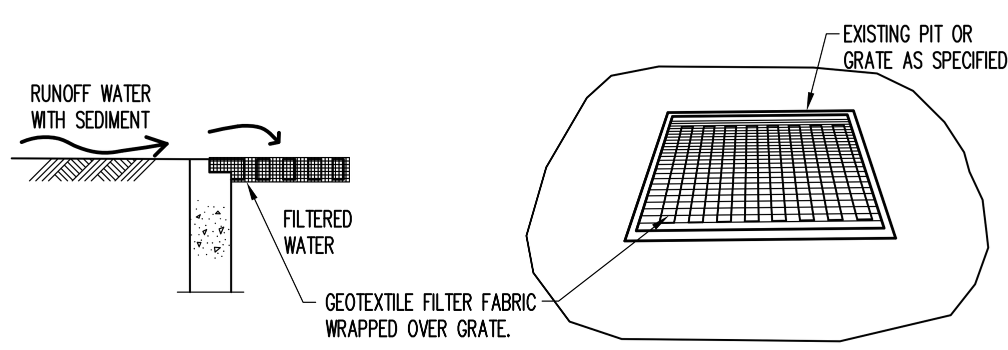

GEOTEXTILE PIT FILTER
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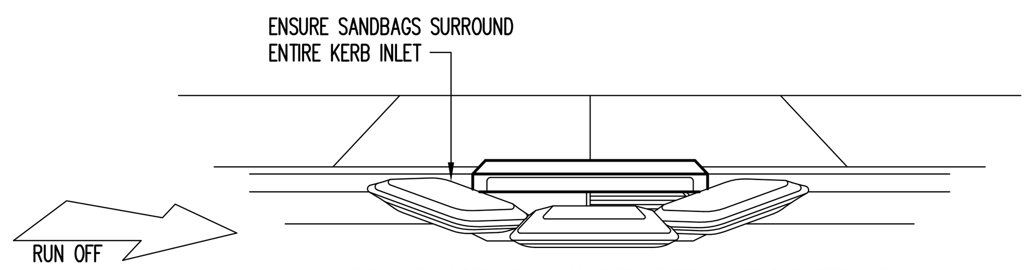
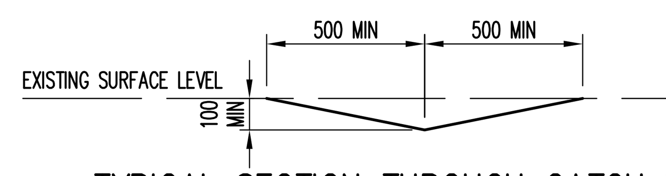


SANDBAG KERB INLET SEDIMENT TRAP
NTS



TYPICAL SECTION THROUGH CATCH DRAIN
SCALE 1: 20

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Rev	Description	Eng	Draft	Date
D	ISSUE FOR CONSTRUCTION	NB	MS	15.11.10
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Project
MACQUARIE UNIVERSITY ARCHIVE ROOM FLOOD INVESTIGATION

Sheet Subject
EROSION AND SEDIMENT CONTROL PLAN

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Job No 101138 | Drawing No C03 | Revision D

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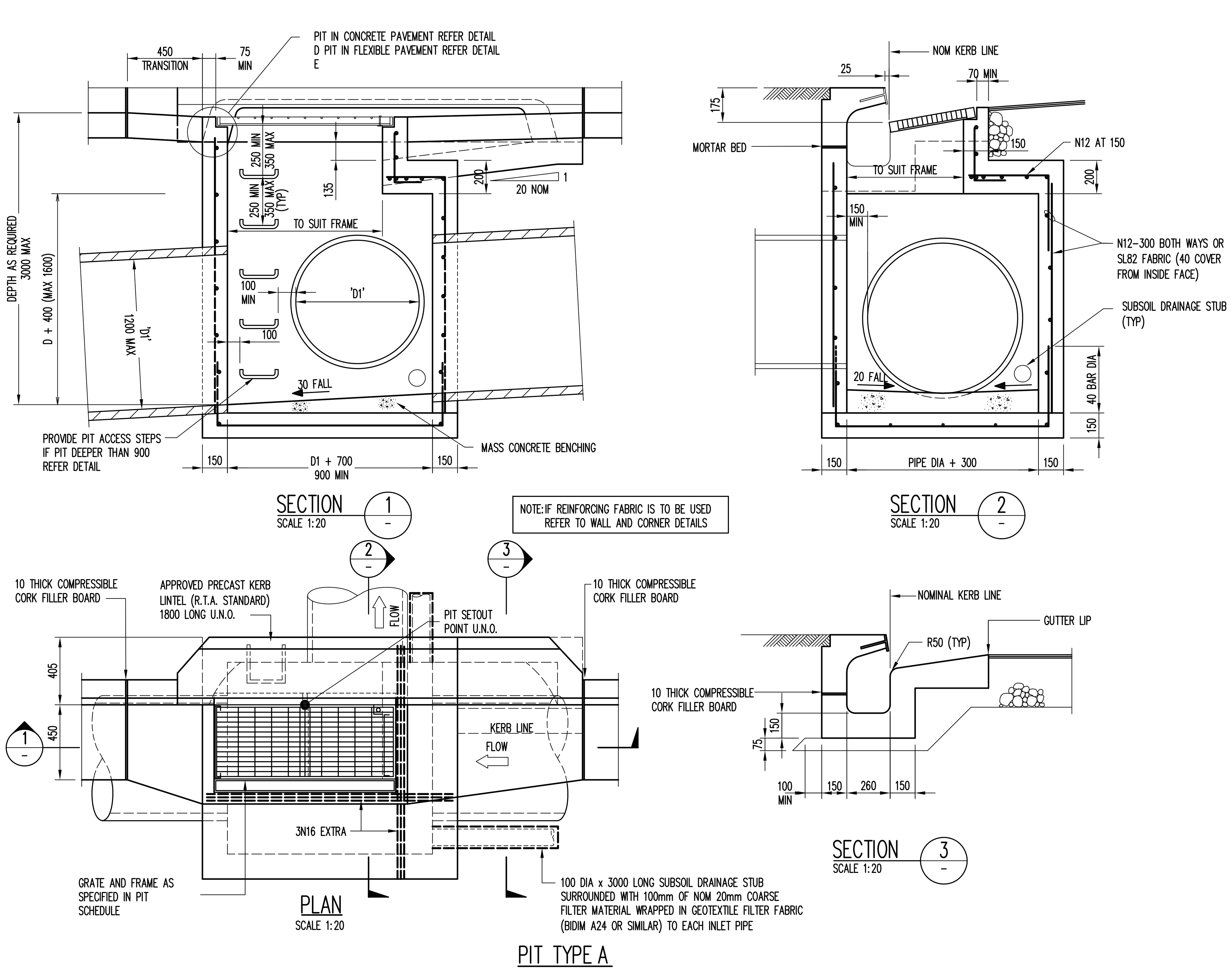

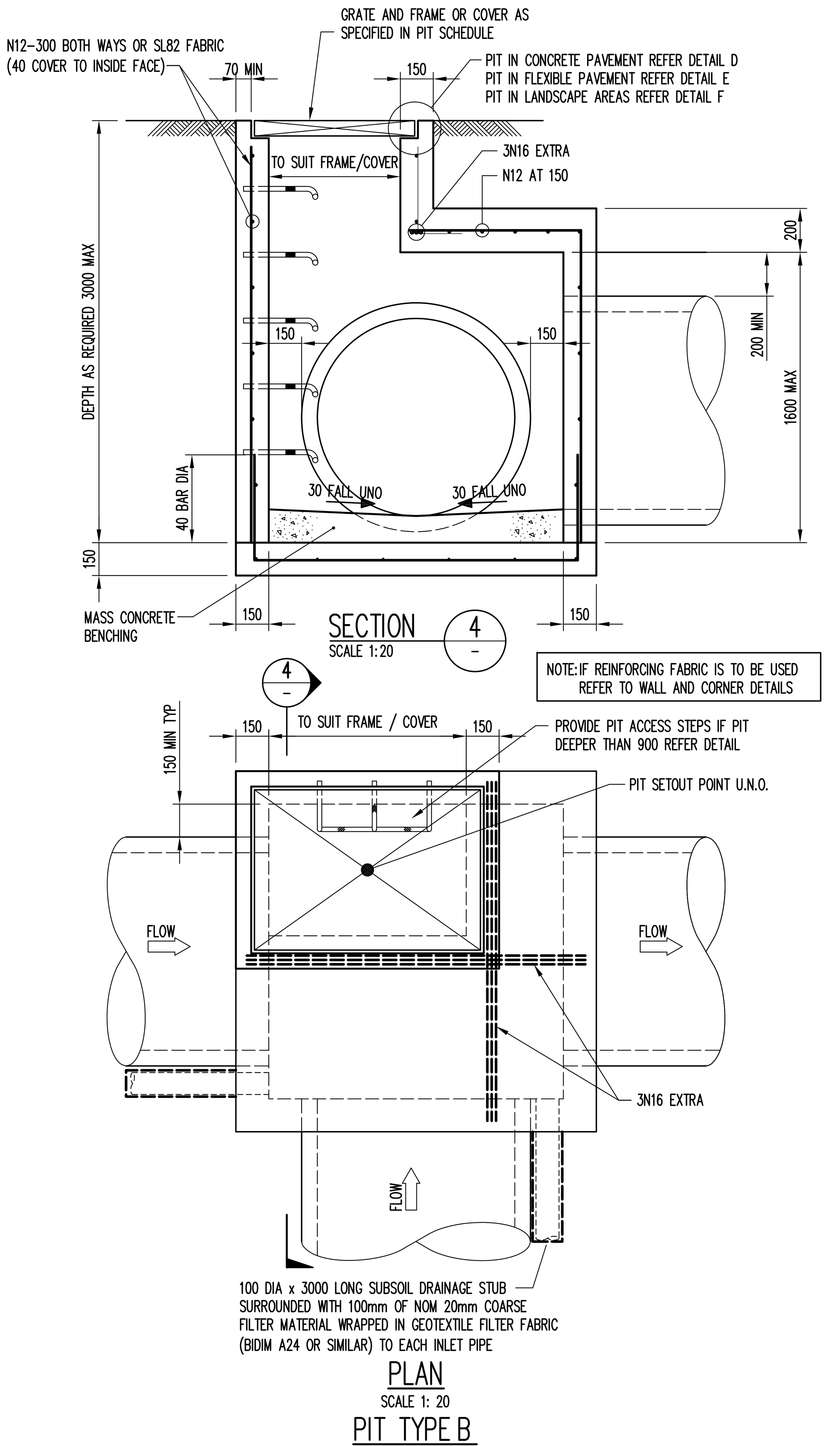

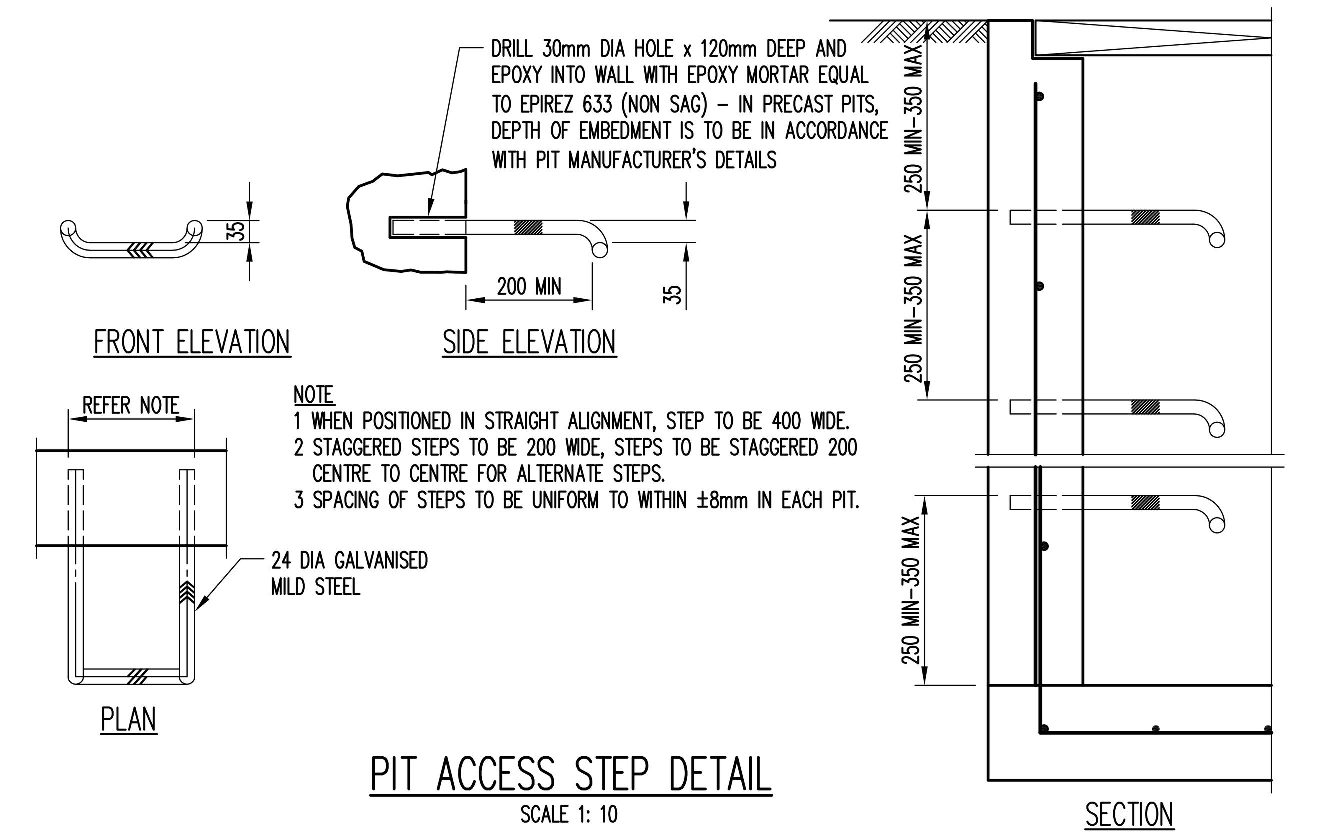

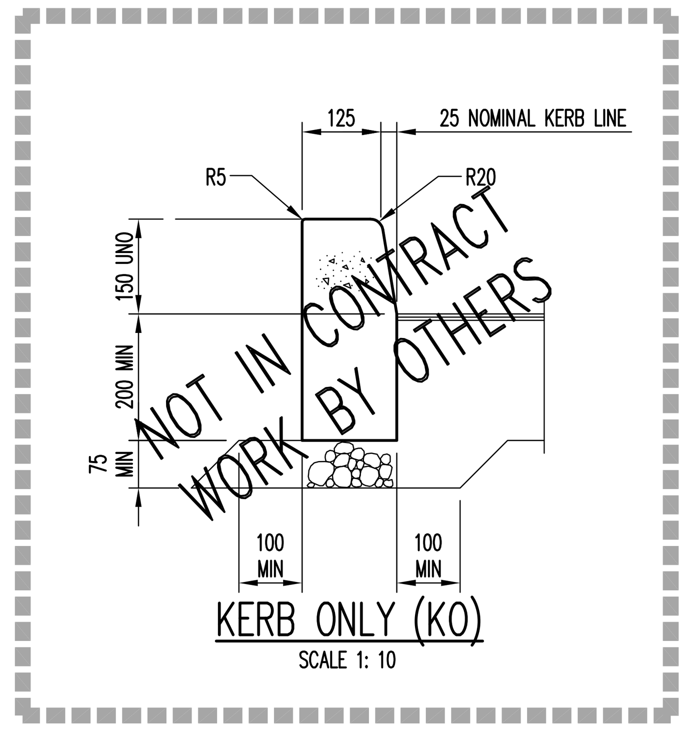

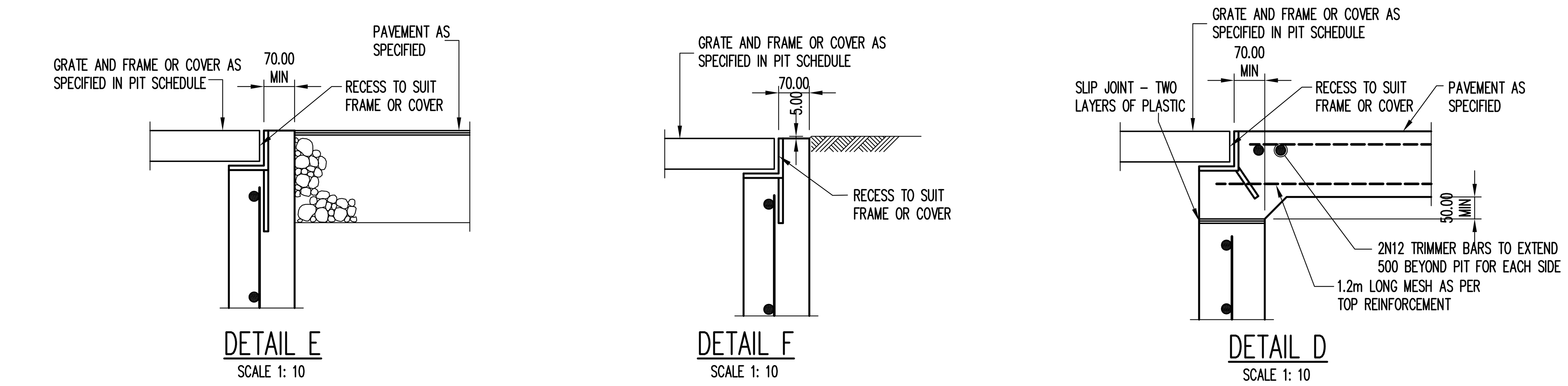

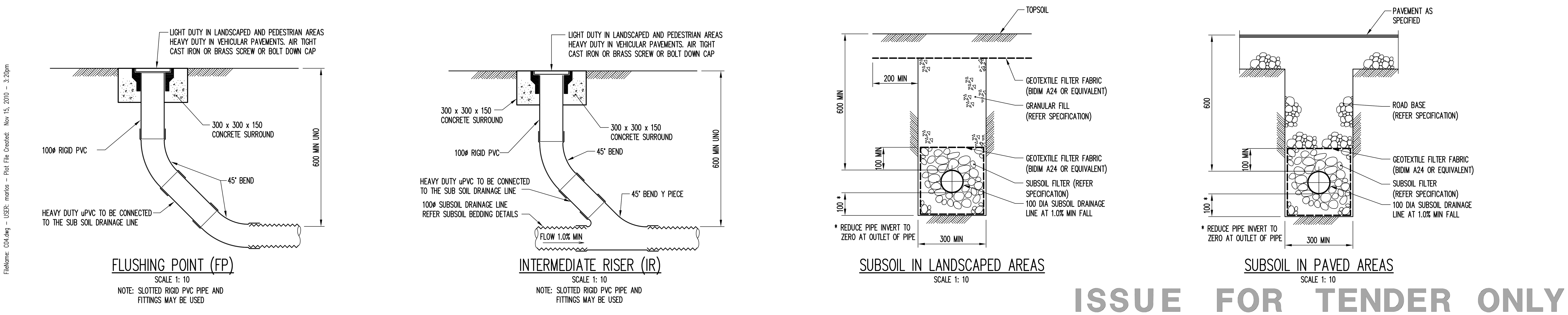

FOR NOTES AND LEGENDS REFER TO DRAWING No C01.

Rev	Description	Eng	Draft	Date
C	ISSUE FOR CONSTRUCTION	NB	MS	15.11.10
B	RE ISSUE FOR TENDER	SB	MS	09.09.10
A	ISSUE FOR TENDER	SB	MS	27.07.10

Project
MACQUARIE UNIVERSITY ARCHIVE ROOM FLOOD INVESTIGATION

Sheet Subject
DETAILS SHEET

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Scale : A1 AS SHOWN | Drawn MS | Authorised

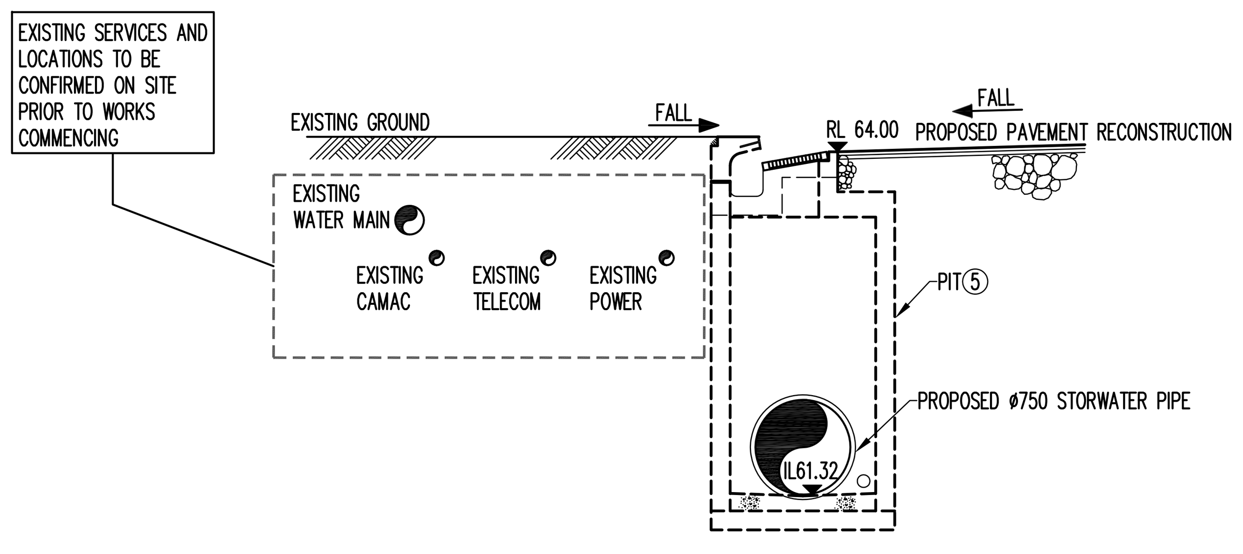
Job No 101138 | Drawing No C04 | Revision C

ISSUE FOR TENDER ONLY
NOT TO BE USED FOR CONSTRUCTION

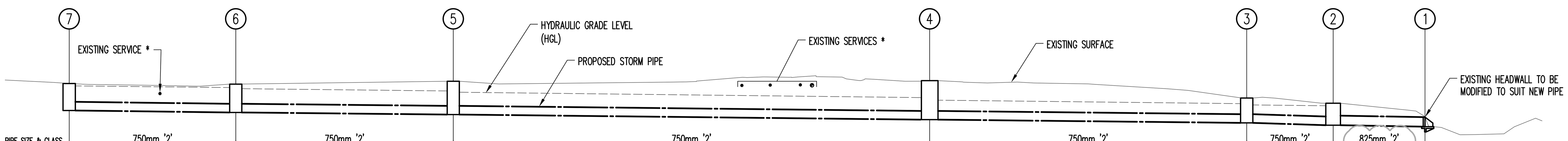
Plot File Created: Nov 15, 2010 - 3:20pm

FileName: C04.dwg - USER: marios - Plot File Created: Nov 15, 2010 - 3:20pm

A1 0 1 2 3 4 5 6 7 8 9 10



SECTION 10 C02
SCALE 1:50



DATUM R.L.57.00

PIPE SIZE & CLASS / FLOW & GRADE						
Pipe size & class	750mm '2'	750mm '2'	750mm '2'	750mm '2'	750mm '2'	825mm '2'
Flow & grade	1215 L/s @ 1.28%	1221 L/s @ 1.02%	1235 L/s @ 1.11%	1235 L/s @ 1.07%	1235 L/s @ 3.17%	2254 L/s @ 1.81%

	7	6	5	4	3	2	1
HYDRAULIC GRADE LEVEL (HGL)	63.867	63.738 / 63.693	63.459 / 63.353	62.927 / 62.718	62.439 / 62.335	62.267 / 61.270	61.071
SURFACE LEVEL	64.00	63.95	64.20	64.25	62.75	62.30	60.27
INVERT LEVEL	61.67	61.50 / 61.50	61.32 / 61.32	60.88 / 60.88	60.60 / 60.60	60.40 / 60.40	60.27
CHAINAGE	0.0	14.37	33.15	74.26	101.63	109.09	117.02

STORMWATER LONG SECTION
SCALE 1: 250

FOR NOTES AND LEGENDS REFER TO DRAWING No C01.

Rev	Description	Eng	Draft	Date
D	ISSUE FOR CONSTRUCTION	NB	MS	15.11.10
C	RE-ISSUE FOR TENDER	SB	MS	09.09.10
B	RE-ISSUE FOR TENDER	SB	MS	10.08.10
A	ISSUE FOR TENDER	SB	MS	27.07.10

Project
MACQUARIE UNIVERSITY ARCHIVE ROOM FLOOD INVESTIGATION

Sheet Subject
SECTION SHEET

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Job No 101138 | Drawing No C05 | Revision D

Plot File Created: Nov 15, 2010 - 3:20pm

FileName: C05.dwg - USER: marius - Plot File Created: Nov 15, 2010 - 3:20pm

NOTE: * CONTRACTOR TO PERFORM EXISTING SERVICES SEARCH PRIOR TO COMMENCEMENT OF WORKS. ENGINEER/SUPERINTENDANT TO BE NOTIFIED IF ANY CONFLICTS ARISE.

A1 0 1 2 3 4 5 6 7 8 9 10

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