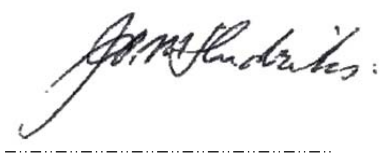
HENDRIKS HOUSE Pty Ltd (Caboolture)
PO Box 60, Morayfield 4506
ABN: 99 062 194 861
Ph: 07 5497 9899
Fax: 07 5498 6692
Email: admin@hendrikshouse.com.au

STORMWATER MANAGEMENT REPORT

PROPOSED RESIDENTIAL DEVELOPMENT

JONDAR INVESTMENTS PTY LTD

60 ALICE STREET, DONNYBROOK



J.P.M Hendriks RPEQ 1238

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REV	DATE	DESCRIPTION	AUTHOR	APPROVER	SIGNATURE
A	23/11/16	Issued for Approval	RS	MH	
B	16/12/16	Bio-retention Amended	RS	MH	
C	17/01/17	RFI Amendments	RS	MH	
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1.0 INTRODUCTION

The owner, Jondar Investments Pty Ltd, of Lot 212 D3121, 60 Alice Street, Donnybrook, has a development approval with Moreton Bay Regional Council to construct a residential development on the site (DA/25407/2011/VEXTCH/1). The subject site is proposed to be reconfigured into 19 residential allotments plus park area. The report is to accompany the Operational Works Application with some changes required since the original Stormwater Quantity and Quality Report 3255 Rev 1 dated 29 November 2011 also prepared by Hendriks/House. The aim of this report is to provide Council with site based stormwater management report addressing:

- Stormwater quantity report with calculations demonstrating non-worsening of downstream properties.
- Establish the required performance criteria for the proposed stormwater system.
- The legal point of discharge in accordance with QUDM and Councils Design Manual.
- Impact of overland flow through the site as identified in the Flood Check Report.
- Preliminary minimum floor levels as identified in the Flood Check Report.

The stormwater quality section has been prepared to provide a site based Stormwater Management Plan in accordance with the *State Planning Policy 2014*, *SPP14 – Water Quality 2014* & in guidance with *Moreton Bay Regional Council Planning Scheme February 2016.* The proposed design is based the following publications:

- Water by Design (Healthy Waterways Partnership) publications including:
    - WSUD Technical Design Guidelines for South East Queensland
    - Bio-retention Technical Design Guidelines
    - 'Water Sensitive Urban Design—Deemed to Comply Solutions for Queensland—Stormwater Quality Management 2009'.
- Queensland Water Quality Guidelines 2009
- Queensland Urban Drainage Manual (QUDM), Provisional 2013

Information addressed in relation to Stormwater Quality issues include:

- Site assessment information, catchment details & potential impacts of the development.
- Detail calculations for the design of treatment measures to achieve pollutant reductions that meet local water quality objectives.
- Details of the proposed erosion and sediment control measures.
- Ten-year metrological data (Dayboro PO Station 40063) to be used with MUSIC modelling.
- Actual Impervious area to be adopted in MUSIC modelling.

The report is based on topographical maps and DNRM contours at 0.1m intervals as well as site survey along the Alice Street frontage.

2.0 SITE DESCRIPTION

2.1 General

The subject site is situated in Donnybrook, with Pumicestone Passage 440m to the north and 360m to the east. The north-eastern property is operated by Donnybrook Bowls Club and the eastern boundary is a municipal recreational park. The site is 1.44 hectares, currently a rural type property with one existing single residential dwelling located towards the northern boundary which will be demolished as part of the development. The balance of the site has good grass cover, with clumps of established trees. The location of the proposed development is shown in Figure 2.1 below.

Figure 2.1: Aerial view of proposed development (Google Earth 2016)

The site is divided into two (2) catchments with two separate discharge points. The pre-development catchment layout for the site and all external catchments are shown in Appendix A on drawing 3255/C2, which includes site contours and existing stormwater infrastructure. The discharge points for each catchment are noted on the drawings as OUT/1 and OUT/2. Pre-development catchment conditions are referenced as follows:

- **Catchment A1 (East):** Catchment A1 is located along the top of a ridge and therefore there is only a small contributing external catchment, approximately 963m², which traverses the North-West boundary of the site. The catchment generally grades to the centre of the allotment and discharges in a north-easterly direction towards the adjacent municipal park. A grassed open drain is located along the western boundary of the municipal park and flows in a northerly direction through the Donnybrook Bowls Club. Culverts are located across

Amy Street and Esplanade North (north of the development site) which collects the open drain flow and discharges the runoff directly into the Pumicestone Passage.

- **Catchment A2 (North):** Catchment A2 is a small internal catchment which flows to the northern boundary into the adjacent property as sheet flow.

3.0 PROPOSED DEVELOPMENT

It is proposed to develop the site into 19 urban residential allotments. Access to all allotments will be via the proposed new road, intersecting with Alice Street. The following items shall be designed as part of the Operational Works for the development:

- New internal road 6.0m wide with stormwater piped system discharging to bio-retention basin located in Lot 500.
- Bio-retention basin designed with an overflow field inlet piped to the existing open drain located in adjacent Park.
- Filling of allotment to required flood levels with concrete sleeper retaining wall to site boundaries.

The proposed site layout is included in Appendix A on drawings 3255/C5, C6 (Stage 2) & C3 (Stage 3). It is proposed to develop the site in 3 stages as follows:

- Stage 1: Lot 10 (filling and retaining walls) with road widening to Alice Street;
- Stage 2: Internal Road to Northern Lot 500 boundary including additional road widening to Alice Street and bio-retention basin completion;
- Stage 3: Completion of internal road to northern property boundary.

4.0 FLOOD CHECK DEVELOPMENT REPORT

Moreton Bay Regional Council provides information from Council's Regional Flood Database relating to new development works as a Flood Check Development Report. This report nominates calculated/anticipated Flood and Storm Tide levels relevant to the 2100 planning horizon. Council's Planning Scheme Overlays within the Flood Check Development Report indicate the property is:

- Located within Council's Flooding Planning area and the future 1% AEP flood event needs to be considered.;
- Located within Council's Coastal Planning Area and the future 1% AEP storm tide event and Tidal Inundation needs to be considered;
- Unaffected by the Overland Flow Planning Scheme Overlay;

The property is located in the Pumicestone Passage catchment. The future 1% flood levels and future 1% storm tide levels applicable to the property are shown in Table 4.1 & 4.2 below.

Type of Future Flooding	AEP	Minimum Property Flood Level (m AHD)	Maximum Property Flood Level (m AHD)	Maximum Building Flood Level (m AHD)	Data Reliability
Flood	**1%**	2.7	3.4	-	A
Storm Tide	**1%**	3.6	3.6	3.6	A

Table 4.1: Future Flood Extent

Defined Flood Level (m AHD)	Freeboard (mm)	Flood Planning Level (m AHD)
3.6	300	**3.9**

Table 4.2: Future Storm Tide Extent

The finished floor level of all habitable rooms needs to achieve the minimum Flood Planning Level of RL.3.9m AHD. The finished ground level of all allotments will need to be a minimum of the Defined Flood Level RL.3.6m AHD as per Council Flood Check Report which states:

> *"For residential buildings, the finished floor levels of all habitable rooms need to achieve the Flood Planning Level.* ***For new allotments, if filling is permitted on the lot, the Defined Flood Level may apply to the finished ground level****."*

Refer to Extension to Relevant Period & Change to Development Approval DA/25407/2011/VEXTCH/2 which states:

> *" Develop the finished land surface level of the subject land to satisfy the minimum development level requirements of Moreton Bay Regional Council Planning Scheme current at the time of development. All earthworks construction must comply with Council's superseded Caboolture Shire Planning Scheme requirements, relevant Australian Standards and construction best practice. "*

5.0 LAWFUL POINT OF DISCHARGE

Discussions have been held with the owners of the adjacent property to the west with a view to obtaining joint approvals to discharge unattenuated stormwater through the Donnybrook Bowls Club existing open drainage channel. The Donnybrook District Bowls Club has granted permission to register an easement in favour of Council, for stormwater and drainage purposes, over the open drain channel located along the western side of the Bowls Club boundary. Refer to letter of permission attached in Appendix B.

6.0 STORMWATER QUANTITY MODELLING

Stormwater runoff will increase from the proposed site as a result of the increase in impervious areas from a pre-development fraction of 0.0 to a post-development fraction impervious of 0.6, as indicated in MBRC Stormwater Management Integrated Design Policy – Appendix C. The stormwater catchment areas for the pre-development site and post-development site are shown in Appendix A on drawings 3255/SMP02.

6.1 Methodology

The pre-development and post-development peak discharge is calculated using the Rational Method. IFD charts are sourced from the Bureau of Meteorology using co-ordinates of the site; 27°00'10"S & 153°04'06" were obtained from Google Earth. Raw data from these charts are used to determine rainfall intensity.

6.2 Pre-development Stormwater Peak Flows

The time of concentration (t_c) of a catchment is defined as the time required from the start of a design storm for surface runoff to collect and flow from the most remote part of the catchment to legal point of discharge. It is assumed that for a given design storm frequency the peak flow at the catchment outlet will result from a storm of duration equal to the time of concentration. All detailed Rational Method calculations are shown in Appendix C.

The proposed pre-development catchment stormwater runoff hydrology is shown on drawing 3255/C02 in Appendix A. The total pre-development catchment area is defined by site catchments (EXT1, A1 & A2) referring to the two (2) separate legal points of discharge. The time of concentration for both catchments is as follows:

Catchment A1: The longest flow path, 85 metres, starts at the top of external catchment EXT1 as overland flow to the existing natural channel. The grade of the overland flow path is 1.0% determined from LIDAR contours. The surface cover is consistent with a Horton's 'n' roughness of 0.045 for an average grassed surface typical of the site. Friend's equation has been used to calculate the time of concentration of 21.1 minutes for overland sheet flow. The flow continues as channel flow for approximately 50m. Using QUM Figure 4.8, channel flow is 1.0min with a natural channel multiplier of Δ3 for a total channel time of 3.0 minutes. Total time of concentration for catchment A1 is **24 minutes.**

Catchment A2: The longest flow path, 73 metres, starts at the top of catchment A2 as overland flow to the northern property boundary. The grade of the overland flow path is 0.8% determined from LIDAR contours. The surface cover is consistent with a Horton's 'n' roughness of 0.045 for an average grassed surface typical of the site. Friend's equation has been used to calculate the time of concentration of **21 minutes** for catchment A2.

Coefficient of Discharge

The fraction impervious (fi) for the pre-development catchments is 0.00 as previously discussed. The 1 hour rainfall intensity for the 10 year ARI (10% AEP) at the locality is 67.18mm/hr. The 10 year discharge co-efficient (C10) value from QUDM Table 4.5.3 for a fraction impervious of 0.00 and rainfall intensity of 68.85mm/hr is 0.66.

The Rational Method has been used to determine the existing stormwater runoff for each catchment. Discharges for each sub-catchment have been calculated the Rational Formula as outlined below and peak flow rates are summarised in Table 6.1. Detailed Pre-development flow rate calculations have been shown in Appendix B.

Sub-catchment	OUT1 Pre-development Flow Rate (m3/s)	OUT2 Pre-development Flow Rate (m3/s)
Q100	0.498	0.069
Q50	0.429	0.059
Q20	0.335	0.046
Q10	0.278	0.038
Q5	0.236	0.033
Q2	0.168	0.023
Q1	0.124	0.017

Table 6.1: Pre Development Peak Flow Rates

6.3 Post Development Stormwater Peak Flows

The post-development catchment layout and stormwater infrastructure required for the development of the site is shown in Appendix A on drawing 3255/SMP02. Allotments within catchment B1, will be regraded to the new internal road, directly discharging to the bio-retention basin via a new piped stormwater system. Catchment B2 is the park/bio-retention area. A field inlet will be provided for the external catchment EXT1 and will also be piped along to the bio-retention basin. The flow from the bio-retention basin will be discharged unattenuated into the open drainage channel, located in the municipal park.

Allotments 9, 10 & 11 (catchment B3) will be graded towards Alice Street. The runoff will flow along the new kerb & channel (Alice Street) and discharge unattenuated directly into the open drainage channel located along the western boundary of existing Municipal Park.

It is proposed to eliminate the post-development sheet flow to the neighbouring property to the North (OUT2) by grading allotments to the new internal road. **All post-development flow will be discharged unattenuated into the existing open drain as previously discussed with Moreton Bay Regional Council.** The existing open drain flows to the North directly into the Pumicestone Passage via dedicated stormwater drainage easements.

Rational Method Calculations

The post development peak stormwater discharge will be calculated using the Rational Method. Rational Method calculations are summarised in Appendix B. All post-development catchments and are shown in Appendix A on drawing 3255/SMP02.

The longest flow path starts at the top of the external catchment EXT1 for 42 metres as overland flow to a proposed field inlet in the new road reserve area. The flow continues as piped flow for a further 85 metres through the bio-retention basin area and flows to the existing open drain. Discharges for each sub-catchment have been calculated the Rational Formula as outlined below and post development peak flow rates are shown in Table 6.2.

$$Q_{y\ peak} = (2.78 \times 10^{-3}) \times F_y \times [\Sigma\ (C_{yi} \times A_i)] \times {}^{t}I_y\ (m^3/s)$$

Sub-catchment	OUT1 Post-development Flow Rate (m3/s)
Q100	0.749
Q50	0.646
Q20	0.504
Q10	0.419
Q5	0.356
Q2	0.254
Q1	0.187

Table 6.2: Post Development Unattenuated Peak Flow Rates

The post-development stormwater sheet flow to the northern neighbouring property (OUT2) is removed as a result of the development.

Existing Open Drain Discharge Capacity

The existing concrete lined open drain along the western boundary of the Donnybrook Bowls Club currently services a catchment of approximately 18.75 hectares. The time of concentration is approximately 60 minutes for the catchment. The pre-development peak flowrates within the drain have been calculated at 4.763m³/s with post-development flowrates as a result of the development of 4.873m³/s. Similarly, the Q10 flowrates pre and post development are 2.634m³/s and 2.695m³/s, respectively.

The existing drain is 3.0m wide in total with a 2.0m wide base. The capacity of the existing drain is 3.0m³/s and therefore the drain is presently undersized for major storm events and has more than likely been designed for a minor storm event. Further investigation and detailed survey of the drain would be required to accurately assess flow within the channel if required by Council. The minor storm flow as a result of the development will be contained within the existing drain.

Existing Culverts Amy Street

The existing concrete lined open drain flows across Amy Street via 3 No. ø750 diameter stormwater pipes. The pipes are 38 metres in length with a 0.5% grade. The capacity of the existing pipes is approximately 2.36m³/s, which is slightly undersized for the pre-development as well as the post-development expected flows.

7.0 STORMWATER QUALITY MODELLING

As part of the development approval, required Water Quality Objectives must be achieved during the construction phase of the development as well as during the operational phase of the site.

7.1 Stormwater Quality During Construction

Silt fences and check dams are to be erected prior to construction and maintained for the duration of construction until landscaping and grassed areas are established. These will filter most of the suspended solids and gross pollutants and reduce flow velocities to a reasonable level to avoid scouring during construction. The access route into the site will be stabilised prior to construction

commencing. An Erosion and Sediment Management Plan will be prepared in conjunction with operational works approvals indicating the minimum required measures.

7.2 Post Construction Stormwater Quality

The stormwater post development has been analysed using MUSIC modelling to determine the total suspended solids (TSS), Phosphorus (TP), Nitrogen (TN) and Gross Pollutants (GP) discharging to the existing open drain.

7.3 Source Nodes

The MUSIC source nodes for the development catchments B1 to B3 have been classified as 'Urban residential split catchment' and used for modelling purposes. Source node parameters used were obtained from MUSIC Modelling Guidelines Version 1.0 - 2010, Table 3.8 for an Urban residential type runoff generator. Each catchment is split into roof source node, road source node and ground level source node. The number of lots with regards to the area of the site is approximately 11 dwellings/hectare. Roof areas are calculated within roof source node catchment as 250m²/lot as per MUSIC Table 3.3. The area of each surface type within the relevant catchment is measured from development layout plans and are summarised in Table 7.1 below.

It is proposed to grade Lot 9 towards the new internal road with the exception of batters to Alice Street. As a result, the roofwater for this lot will discharge into the new road and flow into the bio-retention basin along with lots 1 to 8 & 12 to 19. Lots 10 & 11 will discharge to the new kerb & channel in Alice Street.

The fraction impervious (%) applied to each of the above surface types are in accordance with MUSIC Table 3.5 for residential developments with 10 dwellings per hectare. These values are 60% for road reserve, 100% for roof areas and 30% for ground level surface types.

CATCHMENT ID	TOTAL CATCHMENT AREA (ha)	LAND USE	SURFACE TYPE	No. LOTS	FRACTION IMPERVIOUS	AREA (ha)
		Urban	ROOF	17	1.0	0.4125
B1	1.267	Residential	ROAD		0.6	0.3330
		Split	GROUND		0.3	0.5086
		Urban				
B2	0.038	Residential	GROUND		0.0	0.0380
		Split				
		Urban	ROOF	2	1.0	0.0625
B3	0.139	Residential	ROAD		0.6	0.0262
		Split	GROUND		0.3	0.0624
	1.443			19		

Table 7.1: MUSIC Model Source Nodes & Catchment Areas

The model will demonstrate the treatment train's effectiveness to treat the runoff generated within the developed subject site. Catchment EXT1 is excluded from MUSIC modelling as the area is outside the boundary of the proposed site development.

7.4 Rainfall Runoff Parameter Reporting Table

Rainfall runoff parameters have been applied to each of the source nodes above as per MUSIC modelling Guidelines for SEQ Table 3.7 for urban residential land use for all nodes. A summary of the parameters is shown in Table 7.2 below.

PARAMETER	URBAN RESIDENTIAL
Rainfall threshold (mm)	1
Soil storage capacity (mm)	500
Initial storage (% capacity)	10
Field capacity (mm)	200
Infiltration capacity coefficient 'a'	211
Infiltration capacity coefficient 'b'	5.0
Initial depth (mm)	50
Daily recharge rate (%)	28
Daily baseflow rate (%)	27
Daily deep storage (%)	0

Table 7.2: Catchment reporting table (Table 3.7 MUSIC Modelling Guidelines for SEQ 2009).

7.5 Pollutant Export Parameters

All source nodes have been modelled using split catchment surface types pollutant export parameters as per MUSIC Modelling Guidelines for SEQ 2009 Table 3.9. Urban Residential baseflow and stormflow TSS, TP & TN values are adopted for all catchments.

7.6 Treatment Train

The catchment source nodes, treatment nodes, junction & receiving nodes are shown for the MUSIC model treatment train in Appendix D.

It is proposed to collect runoff from the subject site by a network of stormwater pits and conveyed within a pipe system. Although the stormwater infrastructure is designed to cater for a 10 year ARI (Annual Recurrence Interval) storm, stormwater improvement devices are designed to a 3 month storm consistent with SEQ guidelines.

The stormwater pipe network discharges for catchments EXT1 & B1 via a small bio-retention area located in Lot 500. The bio-retention surface will be landscaped to promote longevity and improve treatment characteristics and is discussed in more detail below. Catchment B3 discharges to the new kerb and channel without any stormwater quality treatment, although some buffering of pervious areas will occur due to the turf requirements behind within the road reserve area.

Bio-retention Basin

The bio-retention basin has filter medium as specified in drawings 3255/C21 & C22 (Stage 2 Operational Works Drawings) in Appendix A. The modelled parameters were 0.45mm median filter particle diameter, saturated hydraulic conductivity of 180mm/hr, TN content 400mg/kg and orthophosphate content 30mg/kg. Seepage loss was modelled at 0mm/hr, to preclude loss of untreated runoff. The basins will be landscaped with suitable groundcover and clumping grasses to achieve a suitable drought tolerance, erosion resistance and treatment performance parameters.

The proposed bio-retention basin is designed with an extended detention depth of 300mm with a bio-filtration area of 125m^2 which excludes the area used for the discharge pit and energy dissipater at the stormwater inlet to the basin. A 0% grade to the bio-filtration areas ensure even distribution of pollutants over the device, and reduce 'sink hole' conditions. In response to Stage 1 approval dated 19th January 2017 which states -

> *"Stormwater Management Plan does not extend to the weir and spillway detail and do not form a part of the approved Stormwater Management Plan. The water level in the bio-basin must be established prior to finalising the bulk earthworks over the site."*

The spillway details and water level are now clearly shown as part of the Operational Works Drawings C21 & C22.

Bio-retention Locality	Surface Area At 50% of extended depth (m^2)	Filter Area (m^2)	Filter Depth (mm)	Extended Detention Depth (mm)
Bio-Basin 1	149	**125**	500	300

Table 7.3: Bio Retention Treatment Node Parameters

Maximum infiltration rate

The maximum infiltration rate reaching the perforated pipe system at the base of the bio retention filter media is estimated by using the hydraulic conductivity of the media and the head above the pipes and applying Darcy's equation

$Q_{max} = K_{sat} \times A \times ((h_{max} + d) / d)$

where

Q_{max} = maximum infiltration rate (m^3/s)

K_{sat} = hydraulic conductivity of the soil filter (m/s)

A = area of the ponding above the soil filter (m)

h_{max} = depth of pondage above the soil filter (m)

d = depth of filter media

Bio Retention:

$Q_{max} = 5 \times 10^{-5} \times 102 \times ((0.3 + 0.5) / 0.5)$

= 0.00816 m^3/s

Perforations inflow check

To ensure the perforated under-drainage system has sufficient capacity to collect and convey the maximum infiltration rate, it is necessary to determine the capacity for flows to enter the under-drainage system via perforations in the pipes. To do this, orifice flow can be assumed and the sharp edged orifice equation can be used. Firstly, the number and size of perforations needs to be determined (typically from manufacturer's specifications) and used to estimate the flow rate into the pipes using the maximum driving head (being the depth of the filtration media if no extended detention is provided or if extended detention is provided in the design then to the top of extended detention). It is conservative but reasonable to use a blockage factor to account for partial blockage of the perforations by the drainage layer media. A 50 % blockage of the perforation has been included in the calculations.

$Q_{perf} = B \times C_d \times A \times (2 \times g \times h)^{1/2}$

Where:

Q_{perf} = flow through perforations (m_3/s)

B = blockage factor (0.5)

C_d = orifice discharge coefficient (assume 0.61 for sharp edge orifice)

A = total area of the orifice (m_2)

g = gravity (9.81 m/s_2)

h = head above the perforated pipe (m)

Assume sub-surface drains with half of all pipes blocked

Slot Width = 1.5 mm

Slot Length = 7.5 mm

Number of Rows = 5

Diameter = 100 mm

Clear Opening = 2100 mm^2/m, Number of slots per meter = 2100/(1.5x7.5) = 186

Inlet capacity / m of pipe:

$Q_{perf} = B \times C_d \times A \times (2 \times g \times h)^{1/2}$

$= 0.5 \times 0.61 \times (0.0015 \times 0.0075 \times 186) * (2 \times 9.81*1.1)^{1/2} = 0.00296\ m^3/s/m$

Inlet capacity/m x total length = $0.00296 \times 60m = 0.178m^3/s > 0.008m^3/s$

Bio Retention Locality	Pipe Length (m)	Pondage Depth (m)	Maximum Infiltration Rate (m3/s)	Maximum Perforation Flow (m3/s)
Bio-retention	60	0.300	*0.008*	**0.178**

Table 7.4: Bio Retention Perforated Pipes - Perforation Flow Rates

The bio-retention perforated pipes have sufficient perforation capacity to pass flows. Parallel perforated pipes will be constructed at a spacing of 1.5m in 3 lengths of 15m. The 3 month anticipated flow to the basin is 0.077m²/s. The underdrain collector pipe will be an ø150mm diameter uPVC pipe laid at 0.5% with a maximum capacity of 0.108m²/s.

Construction schedule

Premature filter blockage, smothering of unestablished vegetation with silt and sediment generated during construction is a risk. To avoid this, the bio-filtration areas will be covered with a temporary suitable geofabric, covered with topsoil and temporary turf to protect the filter material. The basin will be surrounded with a silt fence to reduce the accumulation of sediment in the bio-retention. Following the completion of other construction activities, temporary measures can be removed, and permanent vegetation and ground cover can be installed. Initial watering will be required to be conducted at intervals recommended in SEQWater Healthy Waterways (2006) publication 6 times in the initial 2 weeks, 6 times in the subsequent 3 weeks, and then once a week for the following 5 weeks.

Maintenance requirements

The landscaped areas will require ongoing maintenance typical of any landscaped feature. Turf will require mowing and edging to ensure grass does not invade the gardens. Weeding (without the use of herbicides) will be required to be performed on a regular basis i.e. up to every month during growth periods. Depending on the plant species selected, watering may be required up to once a week during the established stage.

Pruning and general maintenance activities (fertilising, replacement of dead plants, disease control) should be performed as required by whoever is tasked with its maintenance.

Inflow pits will be required to be monitored for sediment collection, and cleaned when required. Following storm events, gross pollutants and debris will require collection and disposal. Accumulated sediment that may be smothering the vegetation may require removal if present. Erosion will have to be monitored and rectified as soon as identified. If there is evidence of blocking of the filter material, such as ponding, the material may require tilling or replacement.

Buffer Areas

Turf will be provided along the **full verge width** of the new internal road as well as behind the kerb & channel to Alice Street. The turf areas will assist with reducing suspended solids from the upstream impervious ground areas.

7.8 Treatment Train Effectiveness

The MUSIC model output is included in Appendix D. Output from MUSIC software indicate significant reductions in total suspended solids (TSS), Phosphorus (TP), Nitrogen (TN) and Gross Pollutants (GP)

discharged following the development of the site. The reductions comply with the *State Planning Policy 2014*, *SPP14 – Water Quality 2014* & MBRC Planning Scheme February 2016.

The MUSIC model has demonstrated that with the proposed treatment train, the stormwater runoff generated by the subject site will achieve pollutant removals at the legal point of discharge as summarised in Table 7.5 below.

RECEIVEING NODE	Flow (ML/yr)	TSS (kg/yr)	TP (kg/yr)	TN (kg/yr)	GP (kg/yr)
Inflow	11.9	1960	4.08	24.6	274
Outflow	11.5	407	1.24	12.9	26.7
% Reduction Required	-	80%	60%	45%	90%
% Reduction Achieved	**-**	**79.6%**	**69.5%**	**47.6%**	**90.3%**

Table 7.5: Treatment Train Effectiveness – Receiving Node

All stormwater from the site discharges to an existing fully grassed open drain as shown on drawing 3255/SMP01, which is located along the full length of the eastern boundary. The drain will assist in further reducing the suspended solids from the site. The drain has a base of 2.0m and a top width of approximately 6.0m. The grade of the drain is at 0.5%.

Attached in Appendix A are drawings showing the details of all stormwater quality improvement layout and devices as described.

7.9 Maintenance Record

A record of all maintenance checks for all stormwater controls onsite should be kept to evolve an appropriate maintenance routine to reflect the particular characteristics of the property. It will also allow management of the site to refine the maintenance frequencies listed in this report, which were based on generic devices located in typical urban environments.

The maintenance report will also provide verification that maintenance procedures are being carried out and create a chain of responsibility for maintenance. The maintenance report should include details of the following:

- The date of maintenance;
- The name of the persons performing the maintenance;
- What types of maintenance actions were performed for each water quality device, and; the environmental state of the device including an estimate of the type and weight of litter removed and the amount of sediment capture where appropriate.

8.0 CONCLUSIONS

Stormwater Quantity

The post development discharge from the site is unattenuated and directly flows to the existing open drainage channel in the adjoining property. Approval from the property owners has been granted as per attached letter in Appendix B. Minor stormwater runoff events are fully contained

within the existing channel. The proposed stormwater management plan has been designed in accordance with the *Planning Scheme Policy 4 Design and Development Manual and Policy 19 Stormwater.*

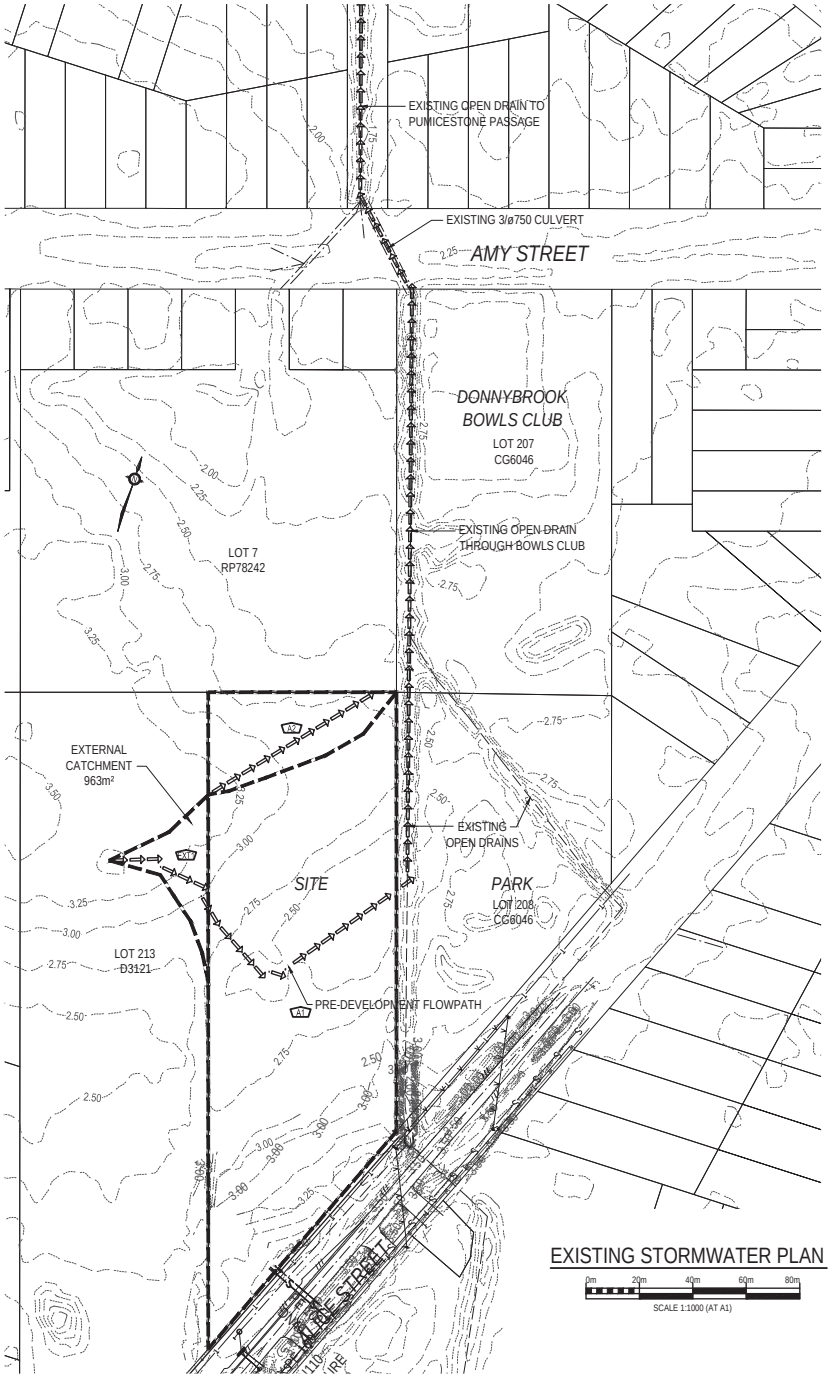
Stormwater Quality

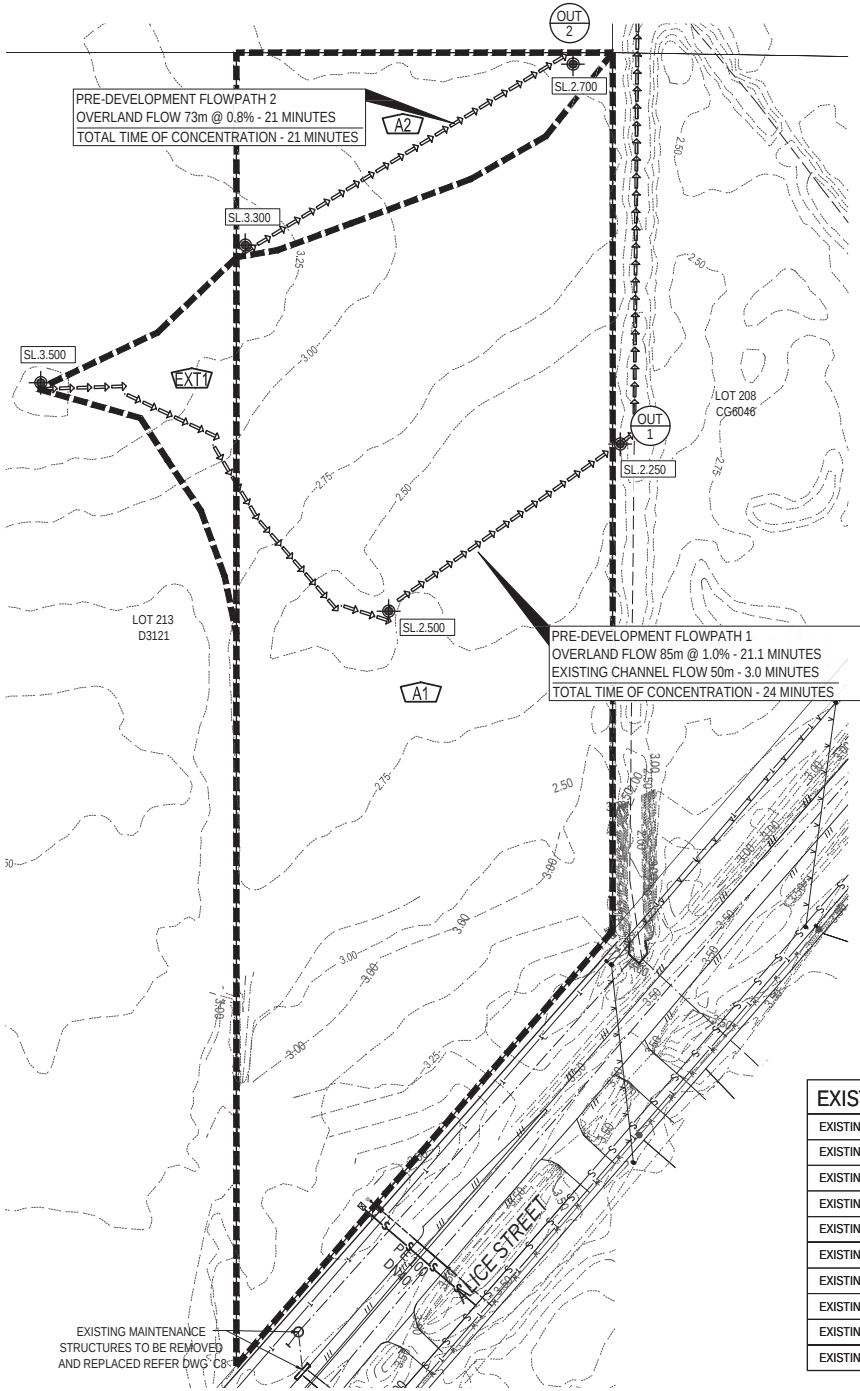
Output from MUSIC software indicate significant reductions in total suspended solids (TSS), Phosphorus (TP), Nitrogen (TN) and Gross Pollutants (GP) discharged from the site following the development. Stormwater quality improvement issues have been addressed in accordance with SPP14.

APPENDIX A

Drawing Index

- 3255/C2 Pre-development Catchment Plan
- 3255/C5 (Stage 2) Roadworks & Stormwater Drainage Plan
- 3255/C6 (Stage 2) Roadworks & Stormwater Drainage Plan
- 3255/C20(Stage 2) Stormwater Long Sections
- 3255/C3 (Stage 3) Roadworks & Stormwater Drainage Plan
- 3255/SMP02 Stormwater Post-development Catchment Plan
- 3255/C21 Bio-retention Basin Plan
- 3255/C22 Bio-retention Basin Cross Sections





CATCHMENT ID	FRACTION IMPERVIOUS	CATCHMENT AREA (ha)
EXT1	0.00	0.096
A1	0.00	1.267
A2	0.00	0.176
		1.539

PRE-DEVELOPMENT SITE PLAN

0m 10m 20m 30m 40m
SCALE 1:500 (AT A1)

EXISTING SERVICES LEGEND	
EXISTING STORMWATER DRAINAGE	
EXISTING KERB & CHANNEL	
EXISTING ROAD CENTRELINE	
EXISTING FENCING	
EXISTING SUBSOIL DRAIN	
EXISTING SEWERAGE RETICULATION	S S S
EXISTING WATER RETICULATION	W W W
EXISTING TELSTRA	T
EXISTING ELECTRICITY UNDERGROUND	E
EXISTING ELECTRICITY OVERHEAD	V V V

REVISION			
A	18/11/16	ISSUED FOR APPROVAL	RS

DATE	DESIGNED
NOV 2016	RS
DRAWN	CHECKED
RS	JPMH
APPROVED	
R.P.E.Q. 1238	

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Ph. (07) 54 97 9899 Fax. (07) 54 98 6692
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P.O. BOX 60 MORAYFIELD, 4506.

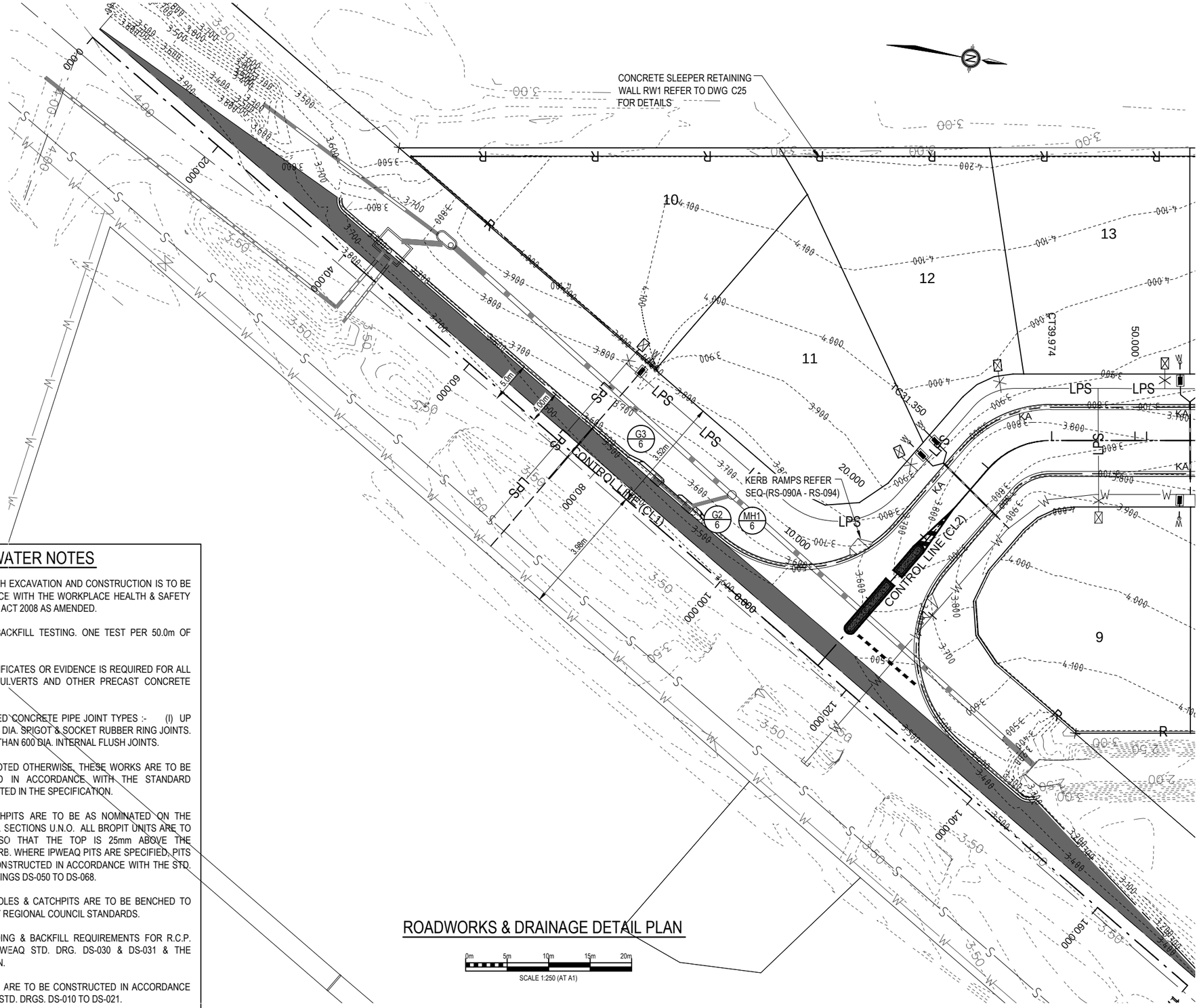
CLIENT: JONDAR INVESTMENTS PTY LTD

PROJECT: RESIDENTIAL SUBDIVISION 60 ALICE STREET, DONNYBROOK

SUBJECT: PRE-DEVELOPMENT PLAN

JOB No. 3255
DWG No. C2
REVISION A
ORIGINAL SIZE A1

Plot: 16 Dec, 2016 - 09:54



ROADWORKS & DRAINAGE DETAIL PLAN

STORMWATER NOTES

1. ALL TRENCH EXCAVATION AND CONSTRUCTION IS TO BE IN ACCORDANCE WITH THE WORKPLACE HEALTH & SAFETY REGULATIONS ACT 2008 AS AMENDED.

2. TRENCH BACKFILL TESTING. ONE TEST PER 50.0m OF TRENCH.

3. TEST CERTIFICATES OR EVIDENCE IS REQUIRED FOR ALL PIPES, BOX CULVERTS AND OTHER PRECAST CONCRETE PRODUCTS.

4. REINFORCED CONCRETE PIPE JOINT TYPES :- (I) UP TO & INCL. 600 DIA. SPIGOT & SOCKET RUBBER RING JOINTS. (2) GREATER THAN 600 DIA. INTERNAL FLUSH JOINTS.

5. UNLESS NOTED OTHERWISE, THESE WORKS ARE TO BE CONSTRUCTED IN ACCORDANCE WITH THE STANDARD DRAWINGS LISTED IN THE SPECIFICATION.

6. ALL CATCHPITS ARE TO BE AS NOMINATED ON THE LONGITUDINAL SECTIONS U.N.O. ALL BROPIT UNITS ARE TO BE PLACED SO THAT THE TOP IS 25mm ABOVE THE ADJACENT KERB. WHERE IPWEAQ PITS ARE SPECIFIED, PITS ARE TO BE CONSTRUCTED IN ACCORDANCE WITH THE STD. IPWEAQ DRAWINGS DS-050 TO DS-068.

7. ALL MANHOLES & CATCHPITS ARE TO BE BENCHED TO MORETON BAY REGIONAL COUNCIL STANDARDS.

8. FOR BEDDING & BACKFILL REQUIREMENTS FOR R.C.P. REFER TO IPWEAQ STD. DRG. DS-030 & DS-031 & THE SPECIFICATION.

9. MANHOLES ARE TO BE CONSTRUCTED IN ACCORDANCE WITH IPWEAQ STD. DRGS. DS-010 TO DS-021.

10. ROOFWATER CONNECTIONS TO THE KERB & CHANNEL SHALL BE 2 No. GALVANISED STEEL KERB ADAPTERS FOR EACH PROPERTY.

PROPOSED SERVICES LEGEND

EXISTING CONTOURS	3.0
DESIGN CONTOURS	3.0
PROPOSED STORMWATER DRAINAGE	
PROPOSED SWALE DRAIN INVERT	
KERB ADAPTER	KA
STORMWATER CATCHMENT	
PROPOSED STORMWATER MANHOLE	G2 3
PROPOSED STORMWATER HEADWALL	HW 3
PROPOSED IPWEAQ STORMWATER FIELD INLET	F1 1
PROPOSED STANDARD IPWEAQ LIP IN LINE ON GRADE GULLY PIT LIP IN LINE SAG GULLY PIT	
PROPOSED ROAD CENTRELINE	
TYPE 'M3' KERB & CHANNEL	
600mm CHANNEL INVERT	
TYPE 'M4' KERB	
PROPOSED EDGE OF BITUMEN	
PROPOSED ROAD WIDENING	
PROPOSED STREET PRINT	
PROPOSED CONCRETE FOOTPATH	
CONCRETE SLEEPER RETAINING WALL	
SEMI-TRANSPARENT POOL TYPE FENCE	F1
TIMBER PALING FENCE 1.8m HIGH	F2
ACOUSTIC FENCE AS DETAILED	F3
PARK BOLLARD & SLIP RAIL	
PROPOSED SEWERAGE RETICULATION	LPS
PROPOSED WATER RETICULATION	W
PROPOSED TELSTRA	
PROPOSED ELECTRICITY	

REVISION				
A	31/03/17	ISSUED FOR APPROVAL	BJF	
B	01/08/17	CHAINAGE CL1 ADDED	BJF	

DATE FEB 2017 | DESIGNED BJF | DRAWN BJF | CHECKED JPMH | APPROVED ..... R.P.E.Q. 1238

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E-MAIL. admin@hendrikshouse.com.au
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P.O. BOX 60 MORAYFIELD, 4506.
CONSULTING ENGINEERS

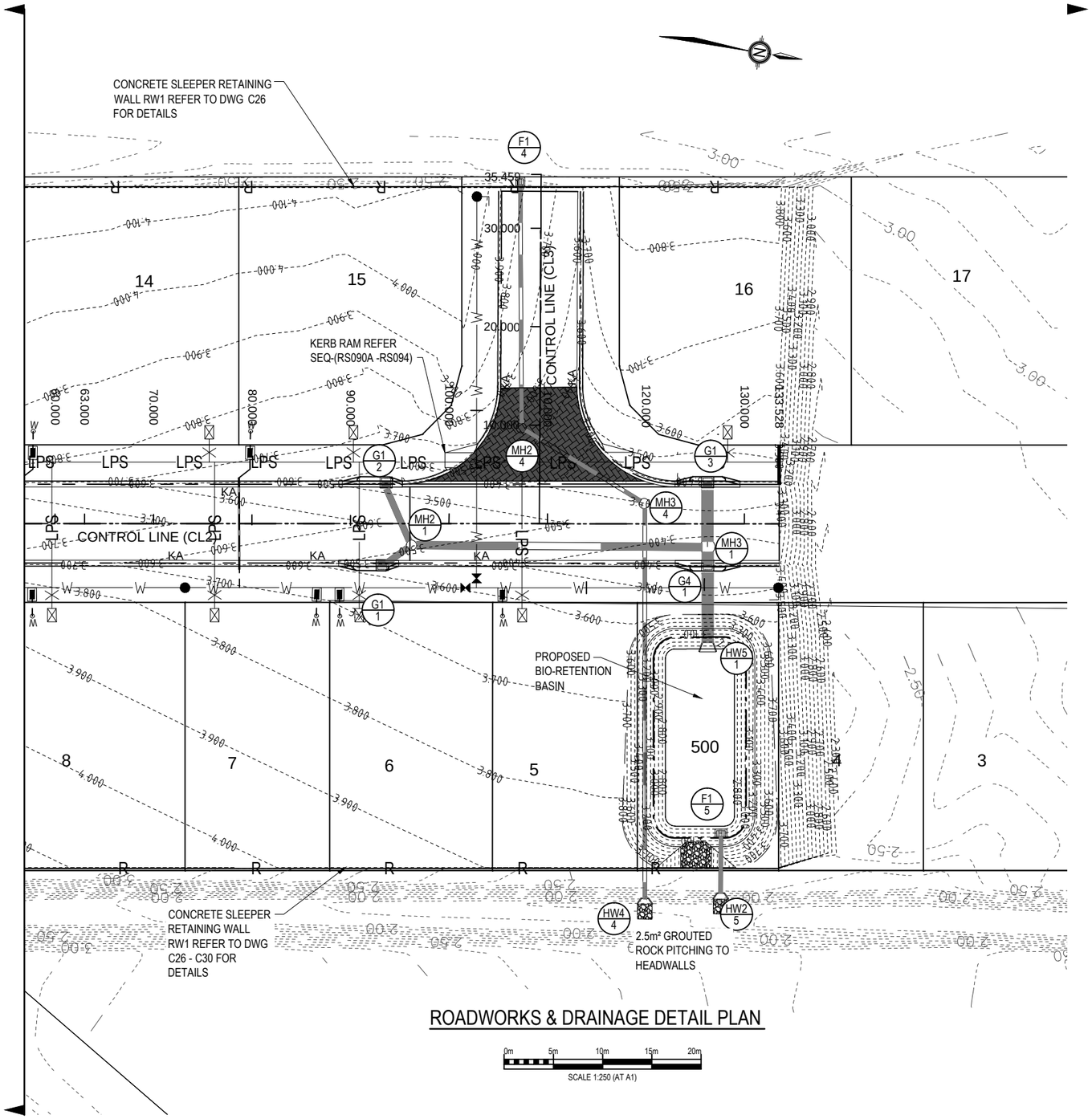
CLIENT: JONDAR INVESTMENTS PTY LTD

PROJECT: RESIDENTIAL SUBDIVISION 60 ALICE STREET STAGE 2

SUBJECT: ROAD WORKS AND DRAINAGE LAYOUT PLAN SHEET 1

JOB No. 3255 | DWG No. C5 | REVISION B | ORIGINAL SIZE A1

Plot:08 Aug, 2017 - 13:56



ROADWORKS & DRAINAGE DETAIL PLAN

0m 5m 10m 15m 20m

SCALE 1:250 (AT A1)

STORMWATER NOTES

1. ALL TRENCH EXCAVATION AND CONSTRUCTION IS TO BE IN ACCORDANCE WITH THE WORKPLACE HEALTH & SAFETY REGULATIONS ACT 2008 AS AMENDED.

2. TRENCH BACKFILL TESTING. ONE TEST PER 50.0m OF TRENCH.

3. TEST CERTIFICATES OR EVIDENCE IS REQUIRED FOR ALL PIPES, BOX CULVERTS AND OTHER PRECAST CONCRETE PRODUCTS.

4. REINFORCED CONCRETE PIPE JOINT TYPES :- (I) UP TO & INCL. 600 DIA. SPIGOT & SOCKET RUBBER RING JOINTS. (2) GREATER THAN 600 DIA. INTERNAL FLUSH JOINTS.

5. UNLESS NOTED OTHERWISE, THESE WORKS ARE TO BE CONSTRUCTED IN ACCORDANCE WITH THE STANDARD DRAWINGS LISTED IN THE SPECIFICATION.

6. ALL CATCHPITS ARE TO BE AS NOMINATED ON THE LONGITUDINAL SECTIONS U.N.O. ALL BROPIT UNITS ARE TO BE PLACED SO THAT THE TOP IS 25mm ABOVE THE ADJACENT KERB. WHERE IPWEAQ PITS ARE SPECIFIED, PITS ARE TO BE CONSTRUCTED IN ACCORDANCE WITH THE STD. IPWEAQ DRAWINGS DS-050 TO DS-068.

7. ALL MANHOLES & CATCHPITS ARE TO BE BENCHED TO MORETON BAY REGIONAL COUNCIL STANDARDS.

8. FOR BEDDING & BACKFILL REQUIREMENTS FOR R.C.P. REFER TO IPWEAQ STD. DRG. DS-030 & DS-031 & THE SPECIFICATION.

9. MANHOLES ARE TO BE CONSTRUCTED IN ACCORDANCE WITH IPWEAQ STD. DRGS. DS-010 TO DS-021.

10. ROOFWATER CONNECTIONS TO THE KERB & CHANNEL SHALL BE 2 No. GALVANISED STEEL KERB ADAPTERS FOR EACH PROPERTY.

PROPOSED SERVICES LEGEND

EXISTING CONTOURS	3.0
DESIGN CONTOURS	3.0
PROPOSED STORMWATER DRAINAGE	
PROPOSED SWALE DRAIN INVERT	
KERB ADAPTER	KA
STORMWATER CATCHMENT	
PROPOSED STORMWATER MANHOLE	G2 3
PROPOSED STORMWATER HEADWALL	HW 3
PROPOSED IPWEAQ STORMWATER FIELD INLET	F1 1
PROPOSED STANDARD IPWEAQ LIP IN LINE ON GRADE GULLY PIT LIP IN LINE SAG GULLY PIT	
PROPOSED ROAD CENTRELINE	
TYPE 'M3' KERB & CHANNEL	
600mm CHANNEL INVERT	
TYPE 'M4' KERB	
PROPOSED EDGE OF BITUMEN	
PROPOSED ROAD WIDENING	
PROPOSED STREET PRINT	
PROPOSED CONCRETE FOOTPATH	
CONCRETE SLEEPER RETAINING WALL	
SEMI-TRANSPARENT POOL TYPE FENCE	F1
TIMBER PALING FENCE 1.8m HIGH	F2
ACOUSTIC FENCE AS DETAILED	F3
PARK BOLLARD & SLIP RAIL	
PROPOSED SEWERAGE RETICULATION	LPS
PROPOSED WATER RETICULATION	W
PROPOSED TELSTRA	
PROPOSED ELECTRICITY	

STORMWATER LONGITUDINAL SECTIONS REFER DWG C20

REVISION				
A	31/03/17	ISSUED FOR APPROVAL	BJF	

DATE FEB 2017 | DESIGNED BJF | DRAWN BJF | CHECKED JPMH | APPROVED ..... R.P.E.Q. 1238

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Ph. (07) 54 97 9899 Fax. (07) 54 98 6692
E-MAIL. admin@hendrikshouse.com.au
6/260 MORAYFIELD ROAD, MORAYFIELD.
P.O. BOX 60 MORAYFIELD, 4506.

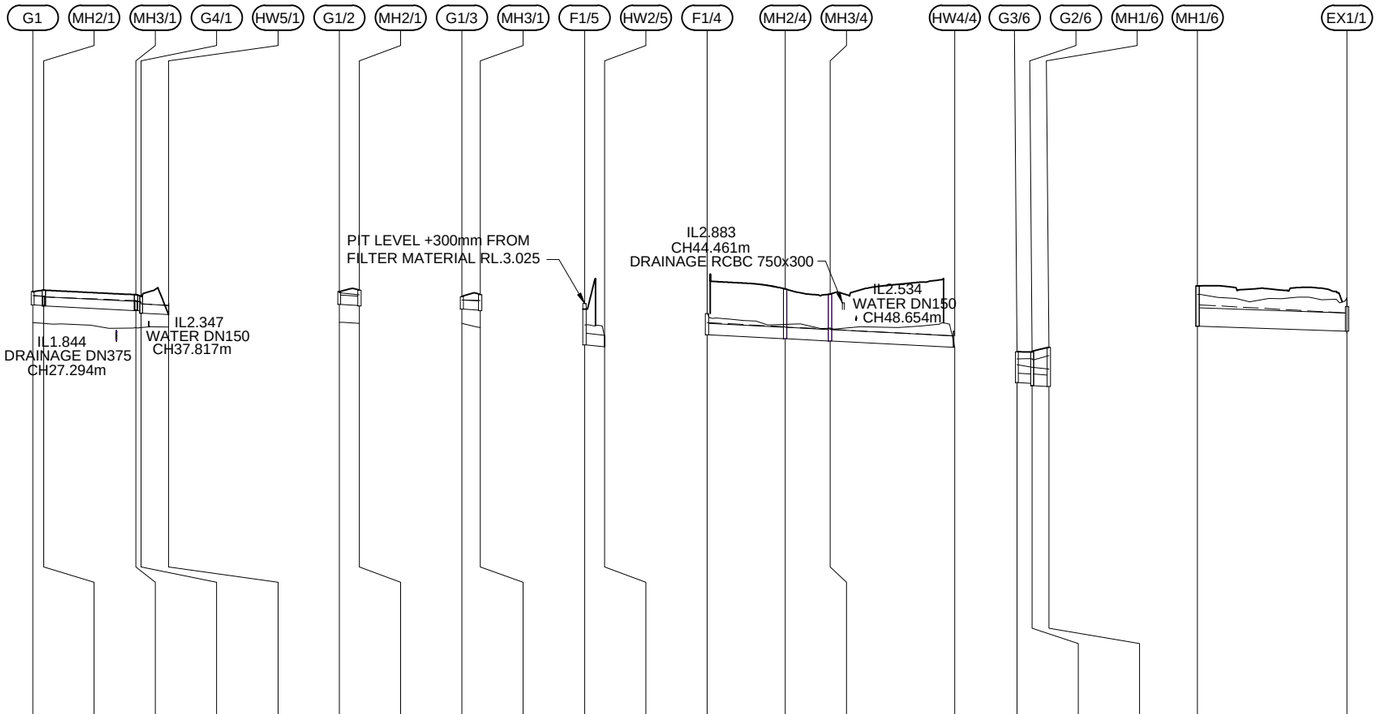
CLIENT: JONDAR INVESTMENTS PTY LTD

PROJECT: RESIDENTIAL SUBDIVISION 60 ALICE STREET STAGE 2

SUBJECT: ROADWORKS AND DRAINAGE LAYOUT PLAN SHEET2

JOB No. 3255 | DWG No. C6 | REVISION A | ORIGINAL SIZE A1

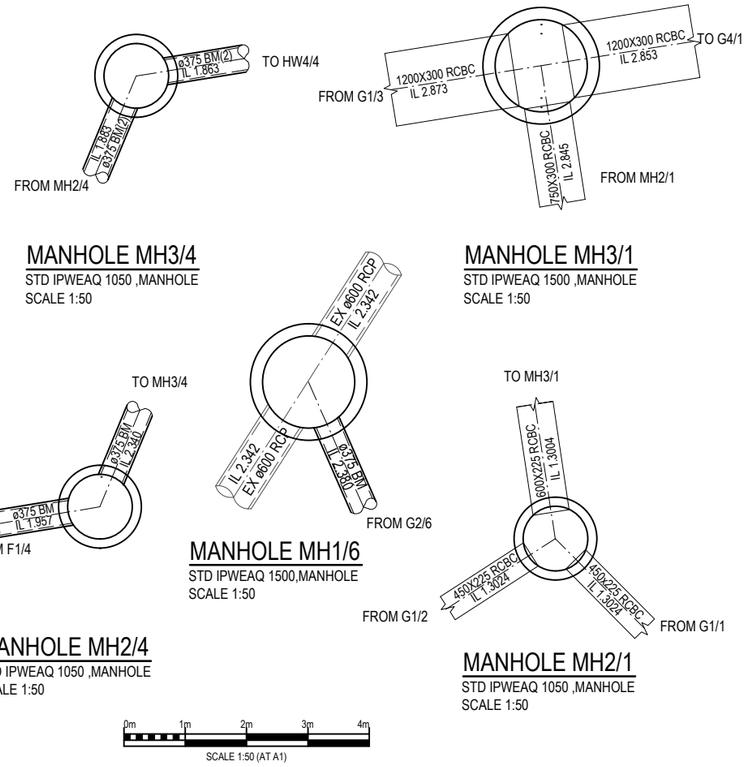
Plot:08 Aug, 2017 - 13:55



DRAINAGE LINE REFERENCE			1						2				3				5				EXT						6				EXIST LINE					
PIPE (CLASS)			RCBC		RCBC		RCBC		RCBC				RCBC				BMAX				BMAX	BMAX	BMAX				BMAX	BMAX			BMAX					
PIPE DIAMETER (mm)			600x300		750x300		1200x300		1200x300				1200X300				375				375	375	375				300	375			600					
PIPE GRADE (VinH)			1in200		1in200		1in200		1in200				1in200				1in100				1in200	1in200	1in200				1in200	1in200			1in300					
DATUM RL			-15.000						-15.000				-15.000				-15.000				-15.000						-15.000									
DEPTH TO INVERT FROM DESIGN SURFACE	0.439	0.497	0.517	0.526	0.526	0.484	0.559	0.000	0.000	0.423	0.497	0.517	0.404	0.506	0.526	1.280	0.375	0.375	0.677	1.606	1.626	1.509	1.529	0.375	1.008	1.021	1.096	1.274	1.314	1.314		0.812	0.812			
HYDRAULIC GRADE LINE Q10	3.34	3.32	3.30	3.18	3.15	3.14	3.07	3.03		3.44	3.37		3.20	3.18		3.20	3.20		2.46	2.33	2.31	2.26	2.24	2.04	3.09	3.01	3.01	2.95	3.04			2.78					
INVERT LEVEL	3.042	3.024	3.004	2.853	2.853	2.845	2.770	2.725	2.725	3.056	3.024	3.004	2.903	2.873	2.853	1.739	1.673	1.673	2.084	1.957	1.937	1.883	1.863	1.660	2.509	2.484	2.409	2.38	2.342	2.342		2.180	2.180			
DESIGN SURFACE LEVEL	3.480		3.521		3.380		3.329		3.100	3.479		3.521	3.308		3.380	2.725		2.048	2.761		3.563		3.392		2.035	3.517		3.505		3.656	3.656		2.992	2.992			
EXISTING SURFACE LEVEL	2.467		2.441		2.299		2.300		2.319	2.470		2.441	2.434		2.299	2.386		2.000	2.761		2.406		2.282		1.660	3.279		3.281		3.384	3.384		2.120	2.120			
CHAINAGE	0.000	3.590	3.590	30.065	33.655	34.704	35.358	35.959	44.317	-6.551	-6.551	-0.000	0.000	6.000	6.000	0.000	6.576	6.576	0.000	25.488	25.488	34.646	40.134	40.661	80.795	0.000	0.970	4.970	9.446	10.416	45.247	48.739	93.986			

STORMWATER PIT SCHEDULE

Pit Name	TYPE	EASTING	NORTHING
G1/1	MBRC LIP IN LINE '(on Grade); 3.6m Lintel	506790.209	7013252.187
MH2/1	MANHOLE 1050mm DIA	506787.735	7013254.789
MH3/1	MANHOLE 1050mm DIA	506783.127	7013284.498
G4/1	MBRC LIP IN LIN'(Sag); 3.6m Lintel	506784.81	7013284.759
HW5/1	HEADWALL	506793.663	7013286.133
G1/2	MBRC LIP IN LINE '(on Grade); 3.6m Lintel	506782.143	7013251.378
MH2/1	MANHOLE 1050mm DIA	506787.735	7013254.789
G1/3	MBRC LIP IN LIN'(Sag); 3.6m Lintel	506777.198	7013283.579
MH3/1	MANHOLE 1500mm DIA	506783.127	7013284.498
F1/5	600x600 Domed inlet Grate	506811.789	7013289.156
HW2/5	HEADWALL	506818.279	7013290.216
F1/4	600x600 Grated Field Inlet	506749.061	7013259.8
MH2/4	MANHOLE 1050mm DIA	506774.199	7013264.007
MH3/4	MANHOLE 1050mm DIA	506779.829	7013277.528
HW/4/4	HEADWALL	506819.977	7013283.966
MH3/6	MANHOLE 1500mm DIA	506807.067	7013161.93



STORMWATER LONGITUDINAL SECTIONS

SCALE 1:10 (Vert AT A1)
0m 0.2m 0.4m 0.6m 0.8m
0m 20m 40m 60m 80m
SCALE 1:1000 (Horz AT A1)

REVISION				
A	31/03/17	ISSUED FOR APPROVAL	BJF
B	08/08/17	FIELD INLET F1/5 AMENDED	RCS

DATE: FEB 2017 | DESIGNED: BJF
DRAWN: BJF | CHECKED: JPMH
APPROVED: ..... R.P.E.Q. 1238

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Ph. (07) 54 97 9899 Fax. (07) 54 98 6692
E-MAIL. admin@hendrikshouse.com.au
6/260 MORAYFIELD ROAD, MORAYFIELD.
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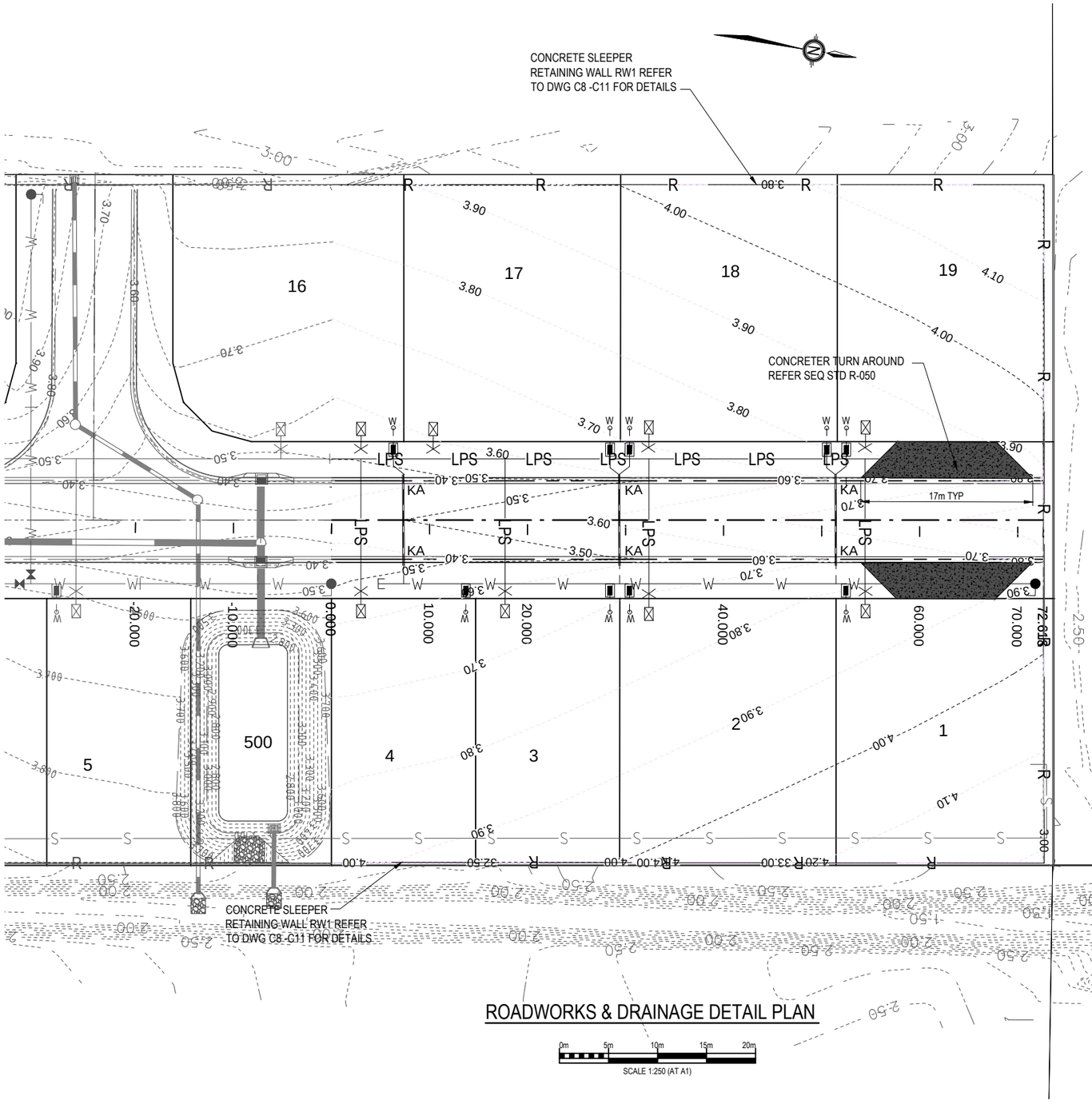
CLIENT: JONDAR INVESTMENTS PTY LTD

PROJECT: RESIDENTIAL SUBDIVISION 60 ALICE STREET STAGE 2

SUBJECT: STORM WATER LONGITUDINAL SECTION, SETOUT AND MANHOLE DETAILS

JOB No. 3255
DWG No. C20 | REVISION B
ORIGINAL SIZE A1

Plot:08 Aug, 2017 - 13:56



ROADWORKS & DRAINAGE DETAIL PLAN

0m 5m 10m 15m 20m

SCALE 1:250 (AT A1)

PROPOSED SERVICES LEGEND

EXISTING CONTOURS	3.0
DESIGN CONTOURS	3.0
PROPOSED STORMWATER DRAINAGE	
PROPOSED SWALE DRAIN INVERT	
KERB ADAPTER	KA
STORMWATER CATCHMENT	
PROPOSED STORMWATER MANHOLE	G2 3
PROPOSED STORMWATER HEADWALL	HW 3
PROPOSED IPWEAQ STORMWATER FIELD INLET	F1 1
PROPOSED STANDARD IPWEAQ LIP IN LINE ON GRADE GULLY PIT LIP IN LINE SAG GULLY PIT	
PROPOSED ROAD CENTRELINE	
TYPE 'M3' KERB & CHANNEL	
600mm CHANNEL INVERT	
TYPE 'M4' KERB	
PROPOSED EDGE OF BITUMEN	
PROPOSED ROAD WIDENING	
PROPOSED STREET PRINT	
PROPOSED CONCRETE FOOTPATH	
CONCRETE SLEEPER RETAINING WALL	
SEMI-TRANSPARENT POOL TYPE FENCE	F1
TIMBER PALING FENCE 1.8m HIGH	F2
ACOUSTIC FENCE AS DETAILED	F3
PARK BOLLARD & SLIP RAIL	
PROPOSED SEWERAGE RETICULATION	LPS
PROPOSED WATER RETICULATION	W
PROPOSED TELSTRA	
PROPOSED ELECTRICITY	

REVISION				
A	31/07/17	ISSUED FOR APPROVAL	BJF	

DATE FEB 2017 | DESIGNED BJF | DRAWN BJF | CHECKED JPMH | APPROVED ..... R.P.E.Q. 1238

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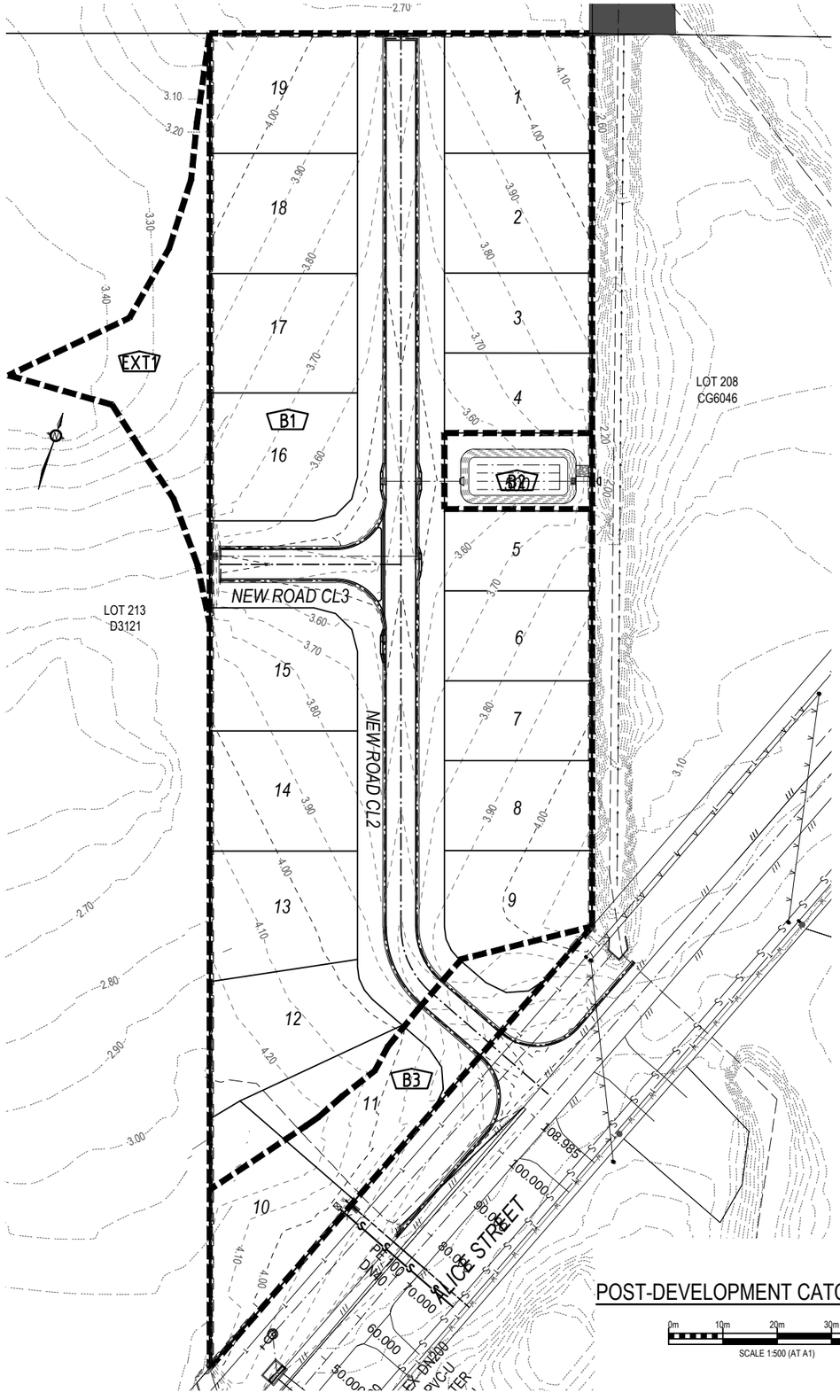
CLIENT: JONDAR INVESTMENTS PTY LTD

PROJECT: RESIDENTIAL SUBDIVISION 60 ALICE STREET STAGE 3

SUBJECT: DETAIL PLAN STAGE 3

JOB No. 3255 | DWG No. C3 | REVISION A | ORIGINAL SIZE A1

Plot 08 Aug, 2017 - 13:55



POST-DEVELOPMENT CATCHMENT PLAN

0m 10m 20m 30m 40m

SCALE 1:500 (AT A1)

CATCHMENT ID	TOTAL CATCHMENT AREA (ha)	LAND USE	SURFACE TYPE	No. LOTS	FRACTION IMPERVIOUS	AREA (ha)
		Urban	ROOF	17	1.0	0.4250
B1	1.267	Residential	ROAD		0.6	0.3330
		Split	GROUND		0.3	0.5086
		Urban				
B2	0.038	Residential	GROUND		0.0	0.0380
		Split				
		Urban	ROOF	2	1.0	0.0500
B3	0.139	Residential	ROAD		0.6	0.0262
		Split	GROUND		0.3	0.0624
	1.443			19		

PROPOSED SERVICES LEGEND

EXISTING CONTOURS	3.0
DESIGN CONTOURS	3.0
PROPOSED STORMWATER DRAINAGE	
PROPOSED SWALE DRAIN INVERT	
KERB ADAPTER	KA
STORMWATER CATCHMENT	
PROPOSED STORMWATER MANHOLE	G2 3
PROPOSED STORMWATER HEADWALL	HW 3
PROPOSED STANDARD IPWEAQ LIP IN LINE ON GRADE GULLY PIT	
PROPOSED STANDARD IPWEAQ LIP IN LINE SAG GULLY PIT	
PROPOSED IPWEAQ STORMWATER FIELD INLET	F1 1
PROPOSED ROAD CENTRELINE	
TYPE 'M3' KERB & CHANNEL	
600mm CHANNEL INVERT	
TYPE 'M6' KERB & CHANNEL	
PROPOSED STREET PRINT	
PROPOSED 1.5m CONCRETE FOOTPATH	
CONCRETE SLEEPER RETAINING WALL	
SEMI-TRANSPARENT POOL TYPE FENCE	F1 F1 F1
PARK BOLLARD & SLIP RAIL	
PROPOSED SEWERAGE RETICULATION	S S S
PROPOSED WATER RETICULATION	W W W
PROPOSED TELSTRA	T
PROPOSED ELECTRICITY	E

REVISION				
A	18/11/16	ISSUED FOR APPROVAL	RS	

DATE: NOV 2016 | DESIGNED: RS | DRAWN: RS | CHECKED: JPMH | APPROVED: R.P.E.Q. 1238

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(CABOOLTURE) PTY. LTD. A.C.N. 062 194 861
Ph. (07) 54 97 9899 Fax. (07) 54 98 6692
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Hendriks/House CONSULTING ENGINEERS

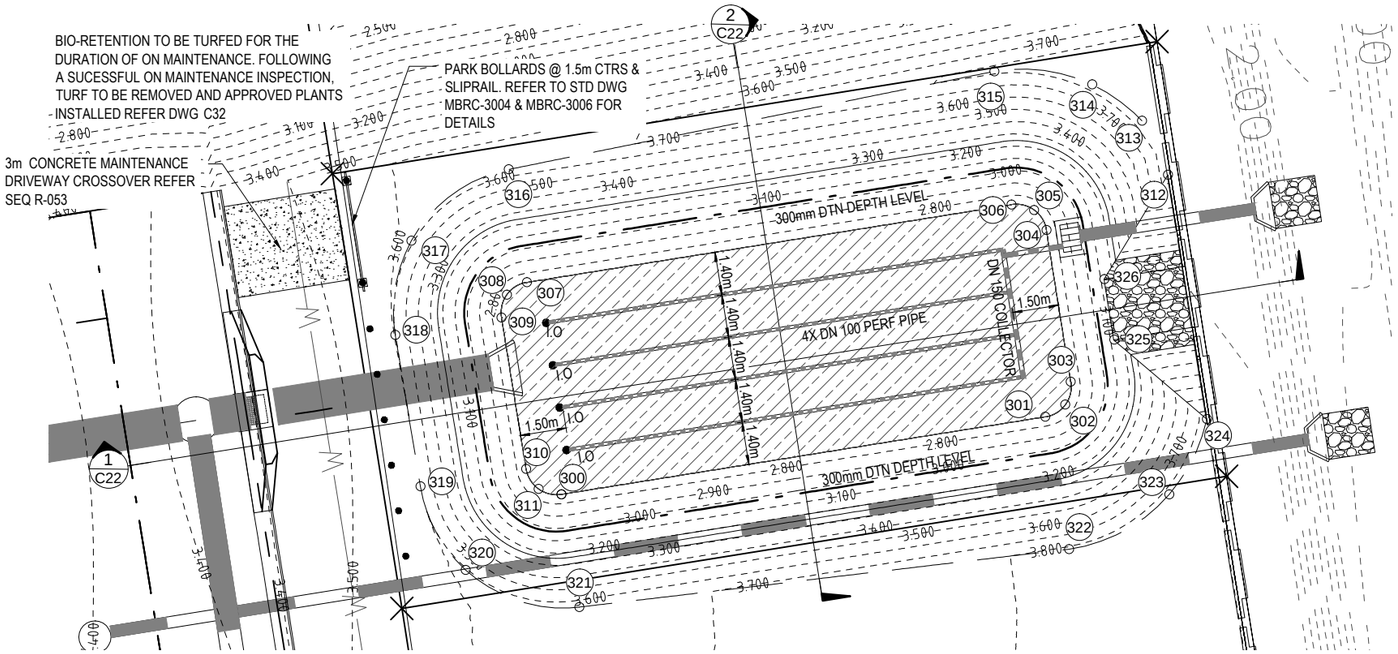
CLIENT: JONDAR INVESTMENTS PTY LTD

PROJECT: RESIDENTIAL SUBDIVISION 60 ALICE STREET, DONNYBROOK

SUBJECT: POST-DEVELOPMENT CATCHMENT PLAN

JOB No. 3255 | DWG No. SMP02 | REVISION A | ORIGINAL SIZE A1

Plot:08 Aug, 2017 - 13:54



BIO-RETENTION BASIN PLAN

0m 2m 4m 6m 8m

SCALE 1:100 (AT A1)

BIO BASIN SETOUT TABLE

POINT	EASTING	NORTHING	LEVEL	DESCRIPTION
300	506795.041	7013282.088	2.725	BIO- CT- R1.0
301	506810.824	7013284.615	2.725	BIO- TC- R1.0
302	506811.476	7013285.016	2.725	BIO-IP
303	506811.653	7013285.76	2.725	BIO-CT- R1.0
304	506810.863	7013290.698	2.725	BIO-TC-R1.0
305	506810.462	7013291.349	2.725	BIO-IP
306	506809.718	7013291.527	2.725	BIO-CT- R1.0
307	506793.919	7013288.997	2.725	BIO-TC-R1.0
308	506793.266	7013288.595	2.725	BIO-IP
309	506793.09	7013287.849	2.725	BIO-CT- R1.0
310	506793.895	7013282.914	2.725	BIO-TC-R1.0
311	506794.297	7013282.264	2.725	BIO-IP
312	506814.824	7013292.506	3.871	SPILL-IP
313	506813.978	7013294.265	3.861	BAT-IP
314	506811.845	7013295.653	3.845	BAT-IP
315	506809.166	7013295.873	3.82	BAT-IP
316	506793.329	7013292.679	3.657	BAT-IP
317	506790.154	7013290.352	3.617	BAT-IP
318	506789.628	7013287.284	3.602	BAT-IP
319	506790.444	7013282.351	3.599	BAT-IP
320	506791.924	7013279.627	3.611	BAT-IP
321	506795.628	7013278.415	3.655	BAT-IP
322	506811.597	7013280.304	3.82	BAT-IP
323	506814.866	7013282.086	3.844	BAT-IP
324	506816.1	7013284.54	3.87	SPILL-IP
325	506813.071	7013287.126	3.125	SPILL-IP
326	506812.739	7013289.098	3.125	SPILL-IP

BIO-FILTER MATERIAL GRADING

FILTER MATERIAL SHALL BE GRADED AND CAN BE SILICEOUS OR CALCAREOUS IN ORIGIN. THE FILTER MATERIAL SHALL BE EVENLY PLACED AND LIGHTLY COMPACTED. THE FILTER MATERIAL SHALL COMPLY WITH THE FOLLOWING CRITERIA.

MATERIAL

SANDY LOAM OR APPROVED EQUIVALENT WITH A HYDRAULIC CONDUCTIVITY OF 180mm/hr AND BE FREE FROM RUBBISH AND DETERIUS MATERIAL.

PARTICLE SIZE DISTRIBUTION

TYPICAL SOIL COMPOSITION:
CLAY & SILT < 3% (0.05-0.15mm)
VERY FINE SAND 5% - 30% (0.05-0.15mm)
FINE SAND 10% - 30% (0.15-0.025mm)
MEDIUM TO COARSE SAND 40% - 60% (0.25-1.0mm)
COARSE SAND 7% - 10% (1.0-2.0mm)
FINE GRAVEL (2.0-3.4mm)

ORGANIC MATTER CONTENT

LESS THAN 5% (w/w). AN ORGANIC CONTENT OF HIGHER THAN 5% IS LIKELY TO RESULT IN LEACHING OF NUTRIENTS. REFER AS4419-2003.

pH

AS SPECIFIED FOR 'NATURAL SOILS AND SOILS BLENDS' 5.5-4.5 (pH 1:5 IN WATER).

ELECTRICAL CONDUCTIVITY

AS SPECIFIED FOR 'NATURAL SOILS AND SOILS BLENDS' <1.25dS/m. REFER TO AS4419-2003.

PHOSPHORUS

SHALL BE <100mg/kg. SOILS WITH PHOSPHURUS CONCENTRATIONS >100mg/kg SHOULD BE TESTED FOR POTENTIAL LEACHING, WHERE PLANTS WITH MODERATE PHOSPHURUS SENSITIVITY ARE TO BE USED, PHOSPHORUS CONCENTRATIONS SHOULD BE <20mg/kg.

TRANSITIONAL LAYER

SHALL BE CLEAN WELL GRADED SAND OR COARSE SAND MATERIAL CONTAINING LITTLE OR NO FINES. THE GRADING OF THE TRANSITIONAL LAYER SHALL COMPLY WITH THE FOLLOWING CRITERIA.

% PASSING	1.4mm	100%
	1.0mm	80%
	0.7mm	44%
	0.5mm	8.4%

THE TRANSITIONAL LAYER SHALL HAVE A HYDRAULIC CONDUCTIVITY OF 180mm/hr.

DRAINAGE LAYER

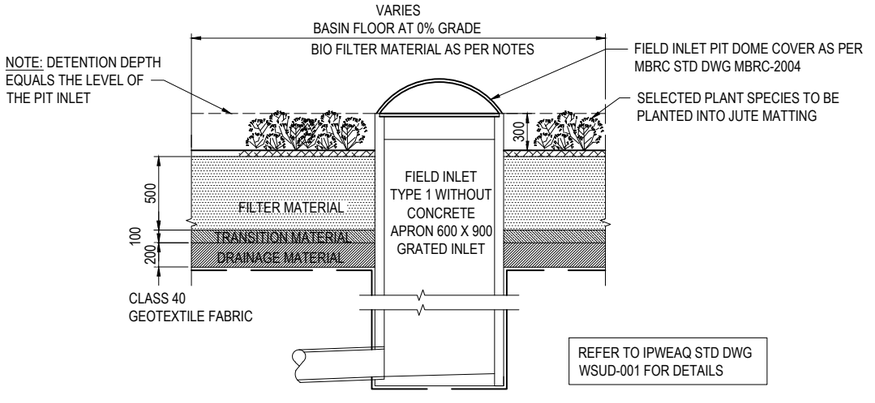
SHALL BE CLEAN FINE GRAVEL (2.0-5.0mm WASHED SCREENINGS). MINIMUM HYDRAULIC CONDUCTIVITY OF 3500mm/hr.

BIO-FILTER PARAMETERS

FILTER & MEDIA PROPERTIES	
EXTENDED DETENTION DEPTH (mm)	300
FILTER MATERIAL SURFACE AREA (sqm)	125
SATURATED HYDRAULIC CONDUCTIVITY (mm/hr)	180
FILTER DEPTH (mm)	500
TN CONTENT OF FILTER MATERIAL (mg/kg)	400
ORTHOPHOSPHATE CONTENT (mg/kg)	30

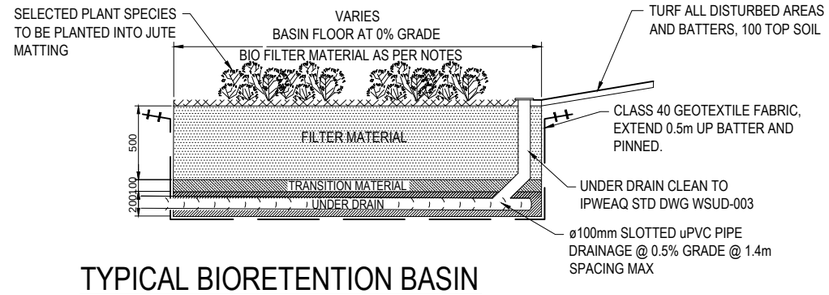
1. GENERAL DESIGN TO BE IN ACCORDANCE WITH 'WATER SENSITIVE URBAN DESIGN TECHNICAL GUIDELINES' (WATER BY DESIGN.

2. CONSTRUCTION TO BE IN ACCORDANCE WITH 'CONSTRUCTION AND ESTABLISHMENT GUIDELINES: SWALES, BIORETENTION SYSTEMS AND WETLANDS' (WATER BY DESIGN).



FIELD INLET DETAILS

SCALE NTS



TYPICAL BIORETENTION BASIN FILTER SECTION

NTS

REVISION				
A	31/03/17	ISSUED FOR APPROVAL	BJF	
B	01/08/17	BIO BASIN UPDATED	BJF	
C	08/08/17	BIO FILTER DEPTH AMENDED	RCS	

DATE FEB 2017 | DESIGNED ## | DRAWN ## | CHECKED JPMH | APPROVED ..... R.P.E.Q. 1238

HENDRIKS/HOUSE
(CABOOLTURE) PTY. LTD. A.C.N. 062 194 861
Ph. (07) 54 97 9899 Fax. (07) 54 98 6692
E-MAIL. admin@hendrikshouse.com.au
6/260 MORAYFIELD ROAD, MORAYFIELD.
P.O. BOX 60 MORAYFIELD, 4506.
CONSULTING ENGINEERS

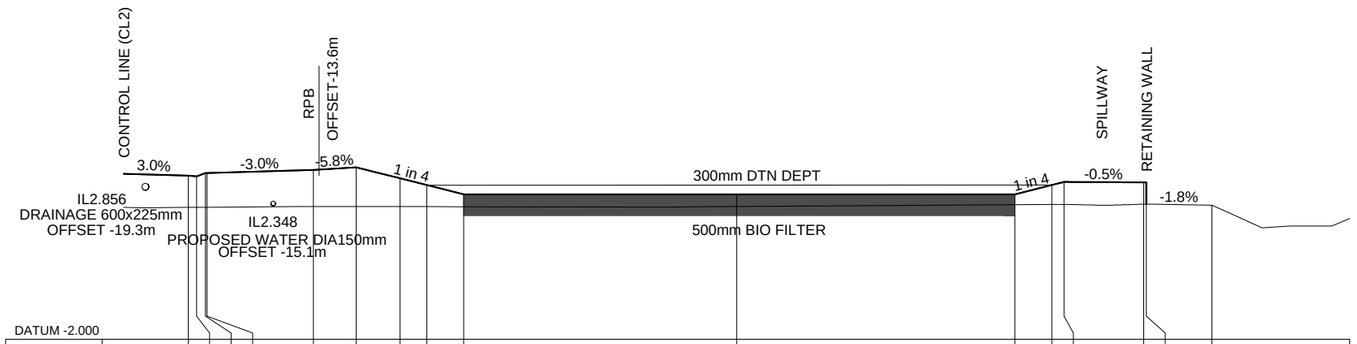
CLIENT: JONDAR INVESTMENTS PTY LTD

PROJECT: RESIDENTIAL SUBDIVISION 60 ALICE STREET STAGE 2

SUBJECT: BIO BASIN NOTES DETAIL SHEET 1

JOB No. 3255 | DWG No. C21 | REVISION C | ORIGINAL SIZE A1

Plot:08 Aug, 2017 - 13:53

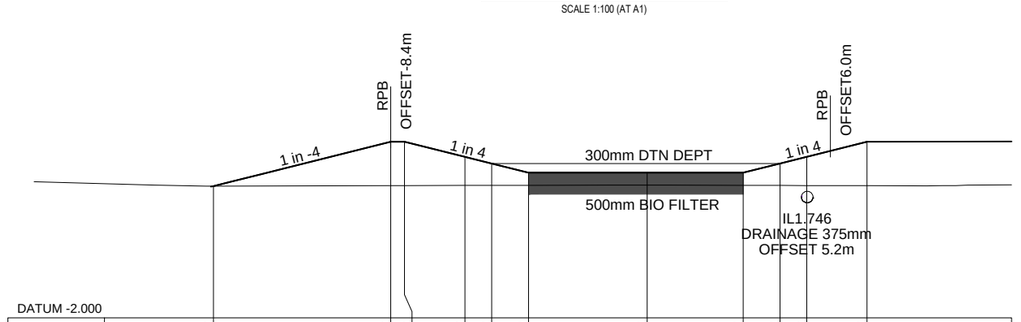


DATUM -2.000

DESIGN SURFACE	3.329	3.309	3.414	3.414	3.518	3.600	3.244	3.025	2.725	2.725	2.725	3.025	3.125	3.112	3.112	2.364								
NATURAL SURFACE	2.297	2.299	2.302	2.302	2.327	2.325	2.322	2.321	2.319	2.322	2.380	2.388	2.390	2.401	2.402	2.364								
OFFSET	-17.891	-17.621	-17.331	-17.281	-13.808	-12.407	-10.983	-10.107	-8.907	0.000	9.084	10.284	10.684	13.281	13.367	15.505								

SECTION 1
SCALE 1:100 C21

0m 2m 4m 6m 8m
SCALE 1:100 (AT A1)



DATUM -2.000

DESIGN SURFACE	2.288	3.734	3.738	3.244	3.025	2.725	2.725	2.725	3.025	3.244	3.735													
NATURAL SURFACE	2.288	2.304	2.305	2.311	2.313	2.317	2.322	2.315	2.312	2.310	2.304													
OFFSET	-14.147	-8.365	-7.916	-5.941	-5.065	-3.865	0.000	3.135	4.335	5.211	7.177													

SECTION 2
SCALE1:100 C21

0m 2m 4m 6m 8m
SCALE 1:100 (AT A1)

REVISION				
A	31/03/17	ISSUED FOR APPROVAL	BJF	
B	01/08/17	BIO BASIN SECTIONS UPDATED.		
C	08/08/17	BIO FILTER DEPTH AMENDED	RCS	

DATE FEB 2017 | DESIGNED BJF
DRAWN BJF | CHECKED JPMH
APPROVED ..... R.P.E.Q. 1238

HENDRIKS/HOUSE
(CABOOLTURE) PTY. LTD. A.C.N. 062 194 861
Ph. (07) 54 97 9899 Fax. (07) 54 98 6692
E-MAIL. admin@hendrikshouse.com.au
6/260 MORAYFIELD ROAD, MORAYFIELD.
P.O. BOX 60 MORAYFIELD, 4506.
CONSULTING ENGINEERS

CLIENT: JONDAR INVESTMENTS PTY LTD

PROJECT: RESIDENTIAL SUBDIVISION 60 ALICE STREET STAGE 2

SUBJECT: BIO BASIN SECTION SHEET 2

JOB No. 3255
DWG No. C22 | REVISION C
ORIGINAL SIZE A1

Plot 08 Aug, 2017 - 13:54

APPENDIX B

Donnybrook Bowls Club – Letter of Permission to Discharge Stormwater

DONNYBROOK & DISTRICT BOWLS CLUB INC.

Chairperson .....Val Guilfoyle
Secretary..... Julie Davis

Postal Address: PO Box 27
Donnybrook Q 4510
Ph. No.54988190
Fax: 54292202
Email: gjnuts@antmail.com.au

3 May 2016

Jondar Investments Pty Ltd
28 Troywood Cres
Buderim Q 4556

Dear Darryl,

The Donnybrook and District Bowls Club has had our monthly meeting and has voted in favour of granting permission for Jondar Investments Pty Ltd to register an easement in favour of council, for stormwater and drainage purposes, over the open drain channel located on the western side of the Donnybrook Bowls Club.

The Donnybrook Bowls Club land is located at Amy Street Donnybrook and is described as Lot 207 on Plan CG6046, Town of Donnybrook, Parish of Toorbul.

The Jondar land is located at 60 Alice Street, Donnybrook and is described as Lot 212 on D3121, Town of Donnybrook, Parish of Toorbul.

Jondar Investments Pty Ltd will pay for any legal, lodgement, survey, civil upgrades and associated fees to bring this easement into effect.

Yours sincerely

J K Davis

Julie Davis
Club Secretary
Donnybrook & District Bowls Club Inc.

APPENDIX C

Rational Method Calculations

RATIONAL METHOD FLOW CALCULATIONS

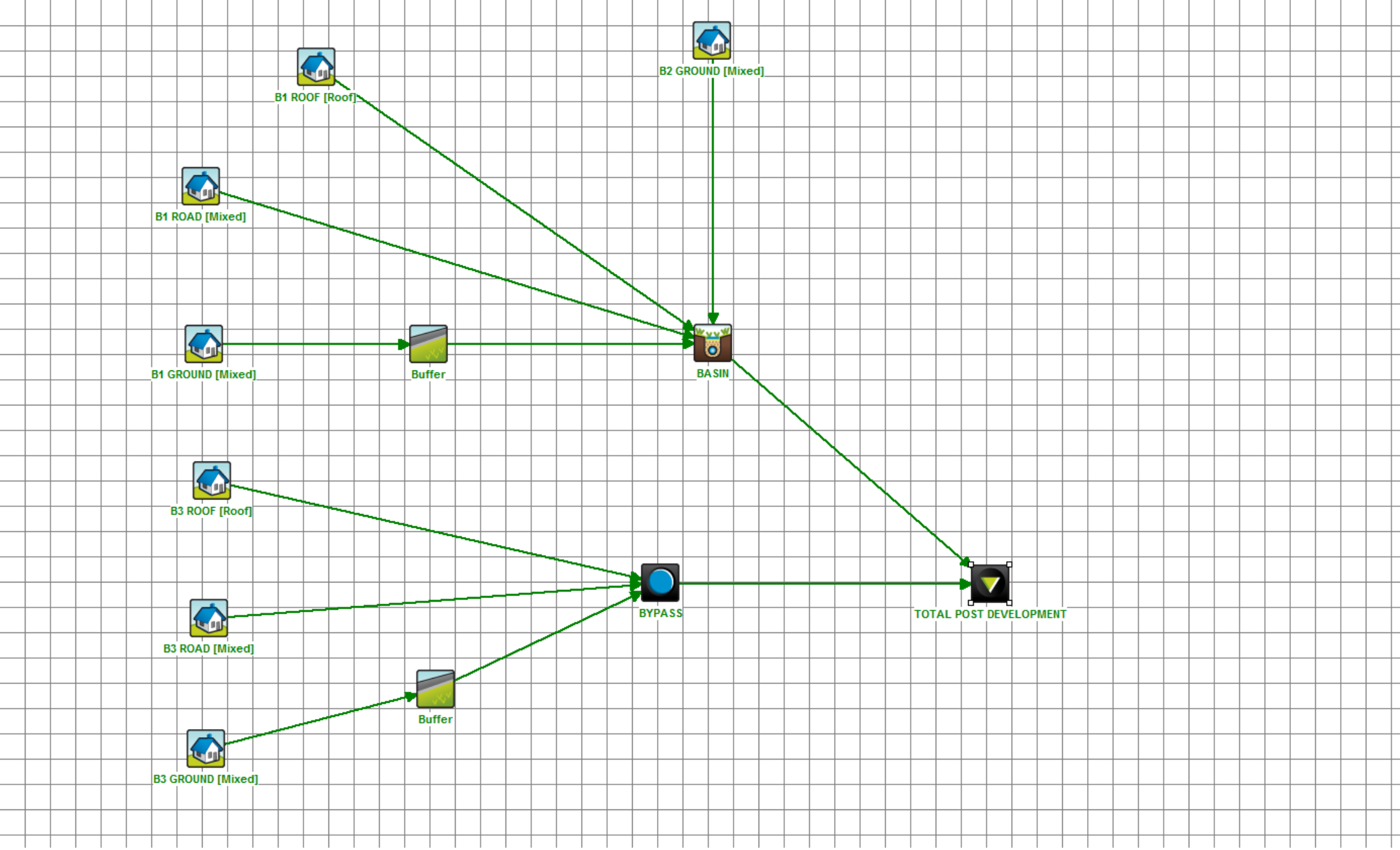
JOB NUMBER 4163

			TOTAL CATCHMENT TIME OF CONCENTRATION														Q100 DISCHARGE					Q50 DISCHARGE					Q20 DISCHARGE					Q10 DISCHARGE					Q5 DISCHARGE					Q2 DISCHARGE					Q1 DISCHARGE				
			OVERLAND				CHANNEL/PIPED				K & C																																									
LOCATION OF CRITICAL SECTION	SUB-AREAS CONTRIBUTING	DESCRIPTION	LENGTH	SLOPE	ROUGHNESS	TIME	LENGTH	SLOPE	Average expected velocity (m/s)	TIME	LENGTH	SLOPE	TIME	TOTAL TIME OF CONCENTRATION	FRACTION IMPERVIOUS	C10 value	TOTAL CATCHMENT AREA	RECURRENCE INTERVAL	RAINFALL INTENSITY	Fy ARI Freq fact	COEFFCIENT OF RUNOFF	Q100 DISCARGE	RECURRENCE INTERVAL	RAINFALL INTENSITY	Fy ARI Freq fact	COEFFCIENT OF RUNOFF	Q50 DISCHARGE	RECURRENCE INTERVAL	RAINFALL INTENSITY	Fy ARI Freq fact	COEFFCIENT OF RUNOFF	Q20 DISCHARGE	RECURRENCE INTERVAL	RAINFALL INTENSITY	Fy ARI Freq fact	COEFFCIENT OF RUNOFF	Q10 DISCHARGE	RECURRENCE INTERVAL	RAINFALL INTENSITY	Fy ARI Freq fact	COEFFCIENT OF RUNOFF	Q5 DISCHARGE	RECURRENCE INTERVAL	RAINFALL INTENSITY	Fy ARI Freq fact	COEFFCIENT OF RUNOFF	Q2 DISCHARGE	RECURRENCE INTERVAL	RAINFALL INTENSITY	Fy ARI Freq fact	COEFFCIENT OF RUNOFF	Q1 DISCHARGE
			m	(%)	n	min	m	%		min	m	%	min	min			ha	yrs	mm/hr			m3/s	yrs	mm/hr			m3/s	yrs	mm/hr			m3/s	yrs	mm/hr			m3/s	yrs	mm/hr			m3/s	yrs	mm/hr			m3/s	yrs	mm/hr			m3/s
PRE	EXT1	External Catchment West	85	1.00	0.045	21.1	50	0.50		3.0				24	0.000	0.660	0.096	100	166.15	1.20	0.792	0.035	50	149.38	1.15	0.759	0.030	20	127.68	1.05	0.693	0.024	10	111.34	1.00	0.660	0.020	5	99.35	0.95	0.627	0.017	2	79.09	0.85	0.561	0.012	1	61.83	0.80	0.528	0.009
PRE	A1	Site Catchment												24	0.000	0.660	1.267	100	166.15	1.20	0.792	0.463	50	149.38	1.15	0.759	0.399	20	127.68	1.05	0.693	0.311	10	111.34	1.00	0.660	0.259	5	99.35	0.95	0.627	0.219	2	79.09	0.85	0.561	0.156	1	61.83	0.80	0.528	0.115
		PRE DEVELOPMENT FLOW - OUT1																				**0.498**					**0.429**					**0.335**					**0.278**					**0.236**					**0.168**					**0.124**
PRE	A2	Site Catchment	73	0.82	0.045	20.9								21	0.000	0.660	0.176	100	177.02	1.20	0.792	0.069	50	159.21	1.15	0.759	0.059	20	136.14	1.05	0.693	0.046	10	118.77	1.00	0.660	0.038	5	106.05	0.95	0.627	0.033	2	84.50	0.85	0.561	0.023	1	66.07	0.80	0.528	0.017
		PRE DEVELOPMENT FLOW - OUT2																				**0.069**					**0.059**					**0.046**					**0.038**					**0.033**					**0.023**					**0.017**
POST	EXT1	External Catchment West	42	1.00	0.045	16.7	85	0.50		2.3				19	0.000	0.660	0.096	100	185.43	1.20	0.792	0.039	50	166.81	1.15	0.759	0.034	20	142.71	1.05	0.693	0.026	10	124.54	1.00	0.660	0.022	5	111.24	0.95	0.627	0.019	2	88.70	0.85	0.561	0.013	1	69.36	0.80	0.528	0.010
POST	B1	Urban Residential Runoff to Basin												19	0.600	0.800	1.211	100	185.43	1.20	0.960	0.599	50	166.81	1.15	0.920	0.516	20	142.71	1.05	0.840	0.403	10	124.54	1.00	0.800	0.335	5	111.24	0.95	0.760	0.284	2	88.70	0.85	0.680	0.203	1	69.36	0.80	0.640	0.149
POST	B2	Basin Catchment												19	0.000	0.660	0.044	100	185.43	1.20	0.792	0.018	50	166.81	1.15	0.759	0.015	20	142.71	1.05	0.693	0.012	10	124.54	1.00	0.660	0.010	5	111.24	0.95	0.627	0.008	2	88.70	0.85	0.561	0.006	1	69.36	0.80	0.528	0.004
POST	B3	Urban Residential Runoff to Alice Street												19	0.600	0.800	0.188	100	185.43	1.20	0.960	0.093	50	166.81	1.15	0.920	0.080	20	142.71	1.05	0.840	0.063	10	124.54	1.00	0.800	0.052	5	111.24	0.95	0.760	0.044	2	88.70	0.85	0.680	0.032	1	69.36	0.80	0.640	0.023
		POST DEVELOPMENT FLOW - OUT1																				**0.749**					**0.646**					**0.504**					**0.419**					**0.356**					**0.254**					**0.187**
POST	EXT2	Open Drain Catchment	267	1.90	0.045	27.2	660			33.0				60	0.150	0.690	18.750	100	103.74	1.20	0.828	4.474	50	93.03	1.15	0.794	3.845	20	79.22	1.05	0.725	2.989	10	68.85	1.00	0.690	2.474	5	61.20	0.95	0.656	2.089	2	48.36	0.85	0.587	1.477	1	37.70	0.80	0.552	1.084
POST	A1	Open Drain Catchment												60	0.000	0.660	1.267	100	103.74	1.20	0.792	0.289	50	93.03	1.15	0.759	0.249	20	79.22	1.05	0.693	0.193	10	68.85	1.00	0.660	0.160	5	61.20	0.95	0.627	0.135	2	48.36	0.85	0.561	0.095	1	37.70	0.80	0.528	0.070
		PRE DEVELOPMENT FLOW - CULVERT																				**4.763**					**4.093**					**3.182**					**2.634**					**2.224**					**1.573**					**1.154**
POST	EXT2	Open Drain Catchment	267	1.90	0.045	27.2	660			33.0				60	0.150	0.690	18.750	100	103.74	1.20	0.828	4.474	50	93.03	1.15	0.794	3.845	20	79.22	1.05	0.725	2.989	10	68.85	1.00	0.690	2.474	5	61.20	0.95	0.656	2.089	2	48.36	0.85	0.587	1.477	1	37.70	0.80	0.552	1.084
POST	SITE	Open Drain Catchment												60	0.600	0.800	1.443	100	103.74	1.20	0.960	0.399	50	93.03	1.15	0.920	0.343	20	79.22	1.05	0.840	0.267	10	68.85	1.00	0.800	0.221	5	61.20	0.95	0.760	0.186	2	48.36	0.85	0.680	0.132	1	37.70	0.80	0.640	0.097
		POST DEVELOPMENT FLOW - CULVERT																				**4.873**					**4.188**					**3.256**					**2.695**					**2.276**					**1.609**					**1.181**

APPENDIX D

MUSIC Stormwater Quality Modelling

- Catchment Node Layout & Links
- MUSIC Data Output


B1 ROOF [Roof]
B2 GROUND [Mixed]
B1 ROAD [Mixed]
B1 GROUND [Mixed]
Buffer
BASIN
B3 ROOF [Roof]
BYPASS
TOTAL POST DEVELOPMENT
B3 ROAD [Mixed]
Buffer
B3 GROUND [Mixed]

Source nodes
Location,B1 ROAD,B1 ROOF,B1 GROUND,B3 ROAD,B3 ROOF,B3 GROUND,B2 GROUND
ID,2,3,5,6,7,8,10
Node
Type,UrbanSourceNode,UrbanSourceNode,UrbanSourceNode,UrbanSourceNode,UrbanSourceNode,UrbanSourceNode,UrbanSourceNode
Zoning Surface Type,Mixed,Roof,Mixed,Mixed,Roof,Mixed,Mixed
Total Area (ha),0.333,0.425,0.508,0.026,0.05,0.062,0.038
Area Impervious
(ha),0.1998,0.425,0.153158208955224,0.0156,0.05,0.0186925373134329,0
Area Pervious
(ha),0.1332,0,0.354841791044776,0.0104,0,0.0433074626865671,0.038
Field Capacity (mm),200,200,200,200,200,200,200
Pervious Area Infiltration Capacity coefficient -
a,211,211,211,211,211,211,211
Pervious Area Infiltration Capacity exponent - b,5,5,5,5,5,5,5
Impervious Area Rainfall Threshold (mm/day),1,1,1,1,1,1,1
Pervious Area Soil Storage Capacity (mm),500,500,500,500,500,500,500
Pervious Area Soil Initial Storage (% of Capacity),10,10,10,10,10,10,10
Groundwater Initial Depth (mm),50,50,50,50,50,50,50
Groundwater Daily Recharge Rate (%),28,28,28,28,28,28,28
Groundwater Daily Baseflow Rate (%),27,27,27,27,27,27,27
Groundwater Daily Deep Seepage Rate (%),0,0,0,0,0,0,0
Stormflow Total Suspended Solids Mean (log
mg/L),2.43,1.3,2.18,2.43,1.3,2.18,2.18
Stormflow Total Suspended Solids Standard Deviation (log
mg/L),0.39,0.39,0.39,0.39,0.39,0.39,0.39
Stormflow Total Suspended Solids Estimation
Method,Stochastic,Stochastic,Stochastic,Stochastic,Stochastic,Stochastic,Stochastic
Stormflow Total Suspended Solids Serial Correlation,0,0,0,0,0,0,0
Stormflow Total Phosphorus Mean (log
mg/L),-0.3,-0.89,-0.47,-0.3,-0.89,-0.47,-0.47
Stormflow Total Phosphorus Standard Deviation (log
mg/L),0.31,0.31,0.31,0.31,0.31,0.31,0.31
Stormflow Total Phosphorus Estimation
Method,Stochastic,Stochastic,Stochastic,Stochastic,Stochastic,Stochastic,Stochastic
Stormflow Total Phosphorus Serial Correlation,0,0,0,0,0,0,0
Stormflow Total Nitrogen Mean (log mg/L),0.26,0.26,0.26,0.26,0.26,0.26,0.26
Stormflow Total Nitrogen Standard Deviation (log
mg/L),0.23,0.23,0.23,0.23,0.23,0.23,0.23
Stormflow Total Nitrogen Estimation
Method,Stochastic,Stochastic,Stochastic,Stochastic,Stochastic,Stochastic,Stochastic
Stormflow Total Nitrogen Serial Correlation,0,0,0,0,0,0,0
Baseflow Total Suspended Solids Mean (log mg/L),1,0,1,1,0,1,1
Baseflow Total Suspended Solids Standard Deviation (log
mg/L),0.34,0,0.34,0.34,0,0.34,0.34
Baseflow Total Suspended Solids Estimation
Method,Stochastic,Stochastic,Stochastic,Stochastic,Stochastic,Stochastic,Stochastic
Baseflow Total Suspended Solids Serial Correlation,0,0,0,0,0,0,0
Baseflow Total Phosphorus Mean (log mg/L),-0.97,0,-0.97,-0.97,0,-0.97,-0.97
Baseflow Total Phosphorus Standard Deviation (log
mg/L),0.31,0,0.31,0.31,0,0.31,0.31
Baseflow Total Phosphorus Estimation
Method,Stochastic,Stochastic,Stochastic,Stochastic,Stochastic,Stochastic,Stochastic
Baseflow Total Phosphorus Serial Correlation,0,0,0,0,0,0,0
Baseflow Total Nitrogen Mean (log mg/L),0.2,0,0.2,0.2,0,0.2,0.2
Baseflow Total Nitrogen Standard Deviation (log
mg/L),0.2,0,0.2,0.2,0,0.2,0.2
Baseflow Total Nitrogen Estimation
Method,Stochastic,Stochastic,Stochastic,Stochastic,Stochastic,Stochastic,Stochastic
Baseflow Total Nitrogen Serial Correlation,0,0,0,0,0,0,0
Flow based constituent generation - enabled,Off,Off,Off,Off,Off,Off,Off
Flow based constituent generation - flow file, , , , , , ,
Flow based constituent generation - base flow column, , , , , , ,
Flow based constituent generation - pervious flow column, , , , , , ,

Flow based constituent generation - impervious flow column, , , , , , ,
Flow based constituent generation - unit, , , , , , ,
OUT - Mean Annual Flow (ML/yr),2.75,4.88,2.97,0.215,0.574,0.363,0.131
OUT - TSS Mean Annual Load (kg/yr),1.05E3,146,578,81.2,17.3,71.6,20.3
OUT - TP Mean Annual Load
(kg/yr),1.69,0.791,1.19,0.133,94.1E-3,0.144,45.3E-3
OUT - TN Mean Annual Load (kg/yr),5.60,10.2,6.13,0.445,1.19,0.750,0.256
OUT - Gross Pollutant Mean Annual Load
(kg/yr),67.7,111,68.2,5.28,13.1,8.33,0.00
Rain In (ML/yr),4.17467,5.32804,6.36857,0.32595,0.626828,0.777266,0.47639
ET Loss
(ML/yr),1.43308,0.448548,3.42375,0.111892,0.0527697,0.417861,0.348679
Deep Seepage Loss (ML/yr),0,0,0,0,0,0,0
Baseflow Out (ML/yr),0.14047,0,0.375008,0.0109676,0,0.0457687,0.040074
Imp. Stormflow Out
(ML/yr),2.29394,4.87949,1.74973,0.179106,0.574059,0.21355,0
Perv. Stormflow Out
(ML/yr),0.317075,0,0.846485,0.0247566,0,0.103311,0.0904567
Total Stormflow Out
(ML/yr),2.61101,4.87949,2.59621,0.203863,0.574059,0.316861,0.0904567
Total Outflow
(ML/yr),2.75148,4.87949,2.97122,0.21483,0.574059,0.36263,0.130531
Change in Soil Storage
(ML/yr),-0.009892,0,-0.0264085,-0.0007724,0,-0.0032231,-0.0028221
TSS Baseflow Out (kg/yr),1.9028,0,5.04015,0.148796,0,0.621221,0.545998
TSS Total Stormflow Out
(kg/yr),1045.57,145.881,573.307,81.0713,17.3352,71.005,19.7546
TSS Total Outflow
(kg/yr),1047.47,145.881,578.348,81.2201,17.3352,71.6262,20.3006
TP Baseflow Out (kg/yr),0.01927,0,0.0518355,0.0015178,0,0.0062867,0.0055184
TP Total Stormflow Out
(kg/yr),1.66647,0.790554,1.13838,0.131535,0.0941382,0.138113,0.0398102
TP Total Outflow
(kg/yr),1.68574,0.790554,1.19021,0.133053,0.0941382,0.1444,0.0453286
TN Baseflow Out (kg/yr),0.247763,0,0.66054,0.0193635,0,0.0806645,0.0703383
TN Total Stormflow Out
(kg/yr),5.35247,10.2231,5.4666,0.425561,1.19294,0.668902,0.185661
TN Total Outflow
(kg/yr),5.60023,10.2231,6.12714,0.444925,1.19294,0.749566,0.255999
GP Total Outflow (kg/yr),68.1627,110.962,69.4239,5.322,13.0543,8.47299,0

No Imported Data Source nodes

USTM treatment nodes
Location,BASIN,Buffer,Buffer
ID,4,11,12
Node Type,BioRetentionNodeV4,BufferNode,BufferNode
Lo-flow bypass rate (cum/sec),0, ,
Hi-flow bypass rate (cum/sec),100, ,
Inlet pond volume, , ,
Area (sqm),149,93.4626865671642,765.791044776119
Initial Volume (m^3), , ,
Extended detention depth (m),0.3, ,
Number of Rainwater tanks, , ,
Permanent Pool Volume (cubic metres), , ,
Proportion vegetated, , ,
Equivalent Pipe Diameter (mm), , ,
Overflow weir width (m),12.5, ,
Notional Detention Time (hrs), , ,
Orifice Discharge Coefficient, , ,
Weir Coefficient,1.7, ,
Number of CSTR Cells,3, ,
Total Suspended Solids - k (m/yr),8000, ,
Total Suspended Solids - C* (mg/L),20, ,
Total Suspended Solids - C** (mg/L), , ,
Total Phosphorus - k (m/yr),6000, ,
Total Phosphorus - C* (mg/L),0.13, ,
Total Phosphorus - C** (mg/L), , ,
Total Nitrogen - k (m/yr),500, ,
Total Nitrogen - C* (mg/L),1.4, ,
Total Nitrogen - C** (mg/L), , ,

Threshold Hydraulic Loading for C** (m/yr), , ,
Horizontal Flow Coefficient,3, ,
Reuse Enabled,Off,Off,Off
Max drawdown height (m), , ,
Annual Demand Enabled,Off,Off,Off
Annual Demand Value (ML/year), , ,
Annual Demand Distribution, , ,
Annual Demand Monthly Distribution: Jan, , ,
Annual Demand Monthly Distribution: Feb, , ,
Annual Demand Monthly Distribution: Mar, , ,
Annual Demand Monthly Distribution: Apr, , ,
Annual Demand Monthly Distribution: May, , ,
Annual Demand Monthly Distribution: Jun, , ,
Annual Demand Monthly Distribution: Jul, , ,
Annual Demand Monthly Distribution: Aug, , ,
Annual Demand Monthly Distribution: Sep, , ,
Annual Demand Monthly Distribution: Oct, , ,
Annual Demand Monthly Distribution: Nov, , ,
Annual Demand Monthly Distribution: Dec, , ,
Daily Demand Enabled,Off,Off,Off
Daily Demand Value (ML/day), , ,
Custom Demand Enabled,Off,Off,Off
Custom Demand Time Series File, , ,
Custom Demand Time Series Units, , ,
Filter area (sqm),125, ,
Filter perimeter (m),0.01, ,
Filter depth (m),0.5, ,
Filter Median Particle Diameter (mm), , ,
Saturated Hydraulic Conductivity (mm/hr),180, ,
Infiltration Media Porosity,0.35, ,
Length (m), , ,
Bed slope, , ,
Base Width (m), , ,
Top width (m), , ,
Vegetation height (m), , ,
Vegetation Type,Vegetated with Effective Nutrient Removal Plants, ,
Total Nitrogen Content in Filter (mg/kg),400, ,
Orthophosphate Content in Filter (mg/kg),30, ,
Is Base Lined?,Yes, ,
Is Underdrain Present?,Yes, ,
Is Submerged Zone Present?,No, ,
Submerged Zone Depth (m), , ,
B for Media Soil Texture,13,-9999,-9999
Proportion of upstream impervious area treated, ,0.8,0.8
Exfiltration Rate (mm/hr),0,0,0
Evaporative Loss as % of PET,100, ,
Depth in metres below the drain pipe, , ,
TSS A Coefficient, , ,
TSS B Coefficient, , ,
TP A Coefficient, , ,
TP B Coefficient, , ,
TN A Coefficient, , ,
TN B Coefficient, , ,
Sfc,0.61, ,
S*,0.37, ,
Sw,0.11, ,
Sh,0.05, ,
Emax (m/day),0.008, ,
Ew (m/day),0.001, ,
IN - Mean Annual Flow (ML/yr),10.7,0.363,2.97
IN - TSS Mean Annual Load (kg/yr),1.46E3,71.6,578
IN - TP Mean Annual Load (kg/yr),3.30,0.144,1.19
IN - TN Mean Annual Load (kg/yr),21.2,0.750,6.13
IN - Gross Pollutant Mean Annual Load (kg/yr),247,8.33,68.2
OUT - Mean Annual Flow (ML/yr),10.4,0.363,2.97
OUT - TSS Mean Annual Load (kg/yr),277,30.9,249
OUT - TP Mean Annual Load (kg/yr),0.923,94.5E-3,0.781
OUT - TN Mean Annual Load (kg/yr),10.6,0.630,5.15
OUT - Gross Pollutant Mean Annual Load (kg/yr),0.00,8.33,68.2
Flow In (ML/yr),10.729,0.362514,2.97073
ET Loss (ML/yr),0.336851,0,0

Infiltration Loss (ML/yr),0,0,0
Low Flow Bypass Out (ML/yr),0,0,0
High Flow Bypass Out (ML/yr),0,0.0725033,0.594038
Orifice / Filter Out (ML/yr),7.20597,0.290015,2.37615
Weir Out (ML/yr),3.18336,0,0
Transfer Function Out (ML/yr),0,0,0
Reuse Supplied (ML/yr),0,0,0
Reuse Requested (ML/yr),0,0,0
% Reuse Demand Met,0,0,0
% Load Reduction,3.16626,-0.00118616,0.0182447
TSS Flow In (kg/yr),1461.9,71.6263,578.35
TSS ET Loss (kg/yr),0,0,0
TSS Infiltration Loss (kg/yr),0,0,0
TSS Low Flow Bypass Out (kg/yr),0,0,0
TSS High Flow Bypass Out (kg/yr),0,14.3252,115.67
TSS Orifice / Filter Out (kg/yr),18.2025,16.5364,133.108
TSS Weir Out (kg/yr),259.23,0,0
TSS Transfer Function Out (kg/yr),0,0,0
TSS Reuse Supplied (kg/yr),0,0,0
TSS Reuse Requested (kg/yr),0,0,0
TSS % Reuse Demand Met,0,0,0
TSS % Load Reduction,81.0226,56.913,56.9849
TP Flow In (kg/yr),3.30141,0.144398,1.19022
TP ET Loss (kg/yr),0,0,0
TP Infiltration Loss (kg/yr),0,0,0
TP Low Flow Bypass Out (kg/yr),0,0,0
TP High Flow Bypass Out (kg/yr),0,0.0288792,0.238043
TP Orifice / Filter Out (kg/yr),0.16614,0.0656629,0.542835
TP Weir Out (kg/yr),0.756788,0,0
TP Transfer Function Out (kg/yr),0,0,0
TP Reuse Supplied (kg/yr),0,0,0
TP Reuse Requested (kg/yr),0,0,0
TP % Reuse Demand Met,0,0,0
TP % Load Reduction,72.0444,34.5267,34.3921
TN Flow In (kg/yr),21.2189,0.749538,6.12713
TN ET Loss (kg/yr),0,0,0
TN Infiltration Loss (kg/yr),0,0,0
TN Low Flow Bypass Out (kg/yr),0,0,0
TN High Flow Bypass Out (kg/yr),0,0.149902,1.22542
TN Orifice / Filter Out (kg/yr),4.51001,0.479922,3.92107
TN Weir Out (kg/yr),6.1008,0,0
TN Transfer Function Out (kg/yr),0,0,0
TN Reuse Supplied (kg/yr),0,0,0
TN Reuse Requested (kg/yr),0,0,0
TN % Reuse Demand Met,0,0,0
TN % Load Reduction,49.9936,15.9717,16.0049
GP Flow In (kg/yr),246.867,8.32646,68.2233
GP ET Loss (kg/yr),0,0,0
GP Infiltration Loss (kg/yr),0,0,0
GP Low Flow Bypass Out (kg/yr),0,0,0
GP High Flow Bypass Out (kg/yr),0,1.66529,13.6446
GP Orifice / Filter Out (kg/yr),0,0,0
GP Weir Out (kg/yr),0,0,0
GP Transfer Function Out (kg/yr),0,0,0
GP Reuse Supplied (kg/yr),0,0,0
GP Reuse Requested (kg/yr),0,0,0
GP % Reuse Demand Met,0,0,0
GP % Load Reduction,100,80,80.0001
PET Scaling Factor,2.1, ,

No Generic treatment nodes

Other nodes
Location,TOTAL POST DEVELOPMENT,BYPASS
ID,1,9
Node Type,ReceivingNode,JunctionNode
IN - Mean Annual Flow (ML/yr),11.5,1.15
IN - TSS Mean Annual Load (kg/yr),407,129
IN - TP Mean Annual Load (kg/yr),1.24,0.322
IN - TN Mean Annual Load (kg/yr),12.9,2.27
IN - Gross Pollutant Mean Annual Load (kg/yr),26.7,26.7

OUT - Mean Annual Flow (ML/yr),11.5,1.15
OUT - TSS Mean Annual Load (kg/yr),407,129
OUT - TP Mean Annual Load (kg/yr),1.24,0.322
OUT - TN Mean Annual Load (kg/yr),12.9,2.27
OUT - Gross Pollutant Mean Annual Load (kg/yr),26.7,26.7
% Load Reduction,2.83,265E-6
TSS % Load Reduction,79.3,24.0
TN % Load Reduction,47.6,5.01
TP % Load Reduction,69.5,13.4
GP % Load Reduction,90.3,-222E-12

Links
Location,Drainage Link,Drainage Link,Drainage Link,Drainage Link,Drainage Link,Drainage Link,Drainage Link,Drainage Link,Drainage Link,Drainage Link
Source node ID,3,2,10,7,6,8,11,5,12,4,9
Target node ID,4,4,4,9,9,11,9,12,4,1,1
Muskingum-Cunge Routing,Not Routed,Not Routed,Not Routed,Not Routed,Not Routed,Not Routed,Not Routed,Not Routed,Not Routed,Not Routed
Muskingum K, , , , , , , , , , ,
Muskingum theta, , , , , , , , , , ,
IN - Mean Annual Flow (ML/yr),4.88,2.75,0.131,0.574,0.215,0.363,0.363,2.97,2.97,10.4,1.15
IN - TSS Mean Annual Load (kg/yr),146,1.05E3,20.3,17.3,81.2,71.6,30.9,578,249,277,129
IN - TP Mean Annual Load (kg/yr),0.791,1.69,45.3E-3,94.1E-3,0.133,0.144,94.5E-3,1.19,0.781,0.923,0.322
IN - TN Mean Annual Load (kg/yr),10.2,5.60,0.256,1.19,0.445,0.750,0.630,6.13,5.15,10.6,2.27
IN - Gross Pollutant Mean Annual Load (kg/yr),111,67.7,0.00,13.1,5.28,8.33,8.33,68.2,68.2,0.00,26.7
OUT - Mean Annual Flow (ML/yr),4.88,2.75,0.131,0.574,0.215,0.363,0.363,2.97,2.97,10.4,1.15
OUT - TSS Mean Annual Load (kg/yr),146,1.05E3,20.3,17.3,81.2,71.6,30.9,578,249,277,129
OUT - TP Mean Annual Load (kg/yr),0.791,1.69,45.3E-3,94.1E-3,0.133,0.144,94.5E-3,1.19,0.781,0.923,0.322
OUT - TN Mean Annual Load (kg/yr),10.2,5.60,0.256,1.19,0.445,0.750,0.630,6.13,5.15,10.6,2.27
OUT - Gross Pollutant Mean Annual Load (kg/yr),111,67.7,0.00,13.1,5.28,8.33,8.33,68.2,68.2,0.00,26.7

Catchment Details
Catchment Name,3255 Alice Street Dayboro PO
Timestep,6 Minutes
Start Date,1/01/1980
End Date,31/12/1989 11:54:00 PM
Rainfall Station, 040063 DAYBORO
ET Station,User-defined monthly PET
Mean Annual Rainfall (mm), 1254
Mean Annual ET (mm), 1502