BROWN

Concept Stormwater Management Plan

Rosewood Accommodation Village at
Rosewood Street, Blackwater

October 2013
B12209.W-01A

Prepared for Qantac Pty Ltd

Water & Environment

Smart Consulting

COMMERCIAL IN CONFIDENCE

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Issue	Date	Issue Details	Author	Checked	Approved
A	29/10/2013	For EDQ Approval	IP/CS	MS (RPEQ)	RPEQ 4485

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1. Introduction

Brown Consulting (Qld) Pty Ltd has been commissioned by Qantac Pty Ltd to prepare a Concept Stormwater Management Plan (SWMP) to support a Material Change of Use (MCU) application for the proposed Rosewood Accommodation Village at Rosewood Street, Blackwater. It is understood that this report will be lodged with the MCU application to the Economic Development Queensland (EDQ).

This report provides a concept stormwater quantity and quality management strategy for the site and is consistent with relevant local and state guidelines.

1.1 Scope of this Report

The scope of this report is to address the following items associated with the development:

- Hydrological Analysis to demonstrate the Management of Stormwater Quantity is generally in accordance with Central Highland Regional Council (CHRC);
- Management of Stormwater Quality through the incorporation of Stormwater Quality Improvement Devices (SQIDs) to meet the Water Quality Objectives (WQOs) as outlined in the Department of Environment and Resource Management (DERM) *Urban Stormwater Quality Planning Guidelines* (2010) and the *State Planning Policy 4/10* for *Healthy Waters (SPP 4/10)*; and
- Frequent Flow Management and Waterway Stability design objectives as required by the *Urban Stormwater Quality Planning Guidelines* (2010).

The layout of the development is shown on the Proposed Layout Plan by Andre Melville Building Design Pty Ltd (Drawing No. 12-110-MCU-02-L Site Plan Option 7 dated 24/09/13) presented in **Appendix A.** For clarity and consistency, the abovementioned Rosewood Accommodation Village will here in be referred to as "the site".

2. Site Characteristics

2.1 Location

The site is located within the township of Blackwater which is located within the previous Duaringa Shire Council local government area. Duaringa Shire Council has now been amalgamated into the Central High Regional Council (CHRC). The site has an area of 7.4ha and it is located at the end of Rosewood Street with the real property descriptions of Lot 1 SP 246036. **Figure 2.1** below shows the approximate location of the site.

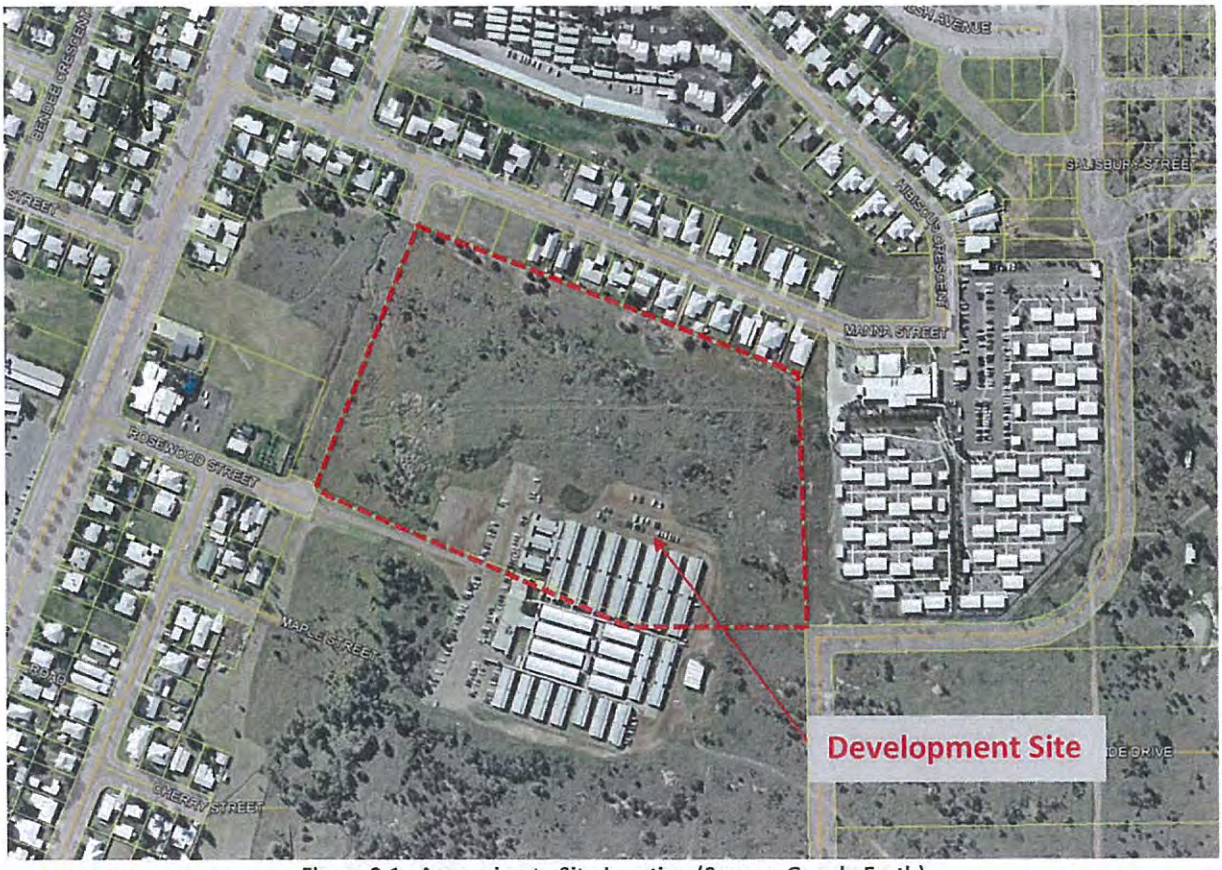


Figure 2.1: Approximate Site Location (Source: Google Earth)

2.2 Existing Topography and Drainage

Site investigation was undertaken through desktop analysis as well as a site inspection. The site is positioned at the downstream end of a larger catchment draining to an existing culvert under Rosewood Street. This external catchment has an average slope of 1.2% falling from the south to north direction.

Under existing conditions runoff enters the western part of the site through a culvert under the existing accommodation village driveway extending from Rosewood Street. Runoff also enters the site on the eastern side of the accommodation village.

Within the western part of the site runoff is conveyed to a 1200mm diameter Reinforced Concrete Pipe (RCP) located at Bloodwood Street. Runoff from the eastern part of the site eventually discharges to a vegetated flow path within the eastern neighbouring accommodation village (Lot 2 on SP246036). Refer to Drawing No. **B12209.W-SK01** in **Appendix G** for the external catchment boundaries and drainage pipes.

The 1200mm diameter RCP and the urban drainage network in Blackwater township discharges into Blackwater Creek before ultimately discharging into the Mackenzie River just downstream from the Bedford Weir. The site is not flood

impacted as detailed in the Duaringa Shire Planning Scheme *Flood Hazard Overlay Map No.ND-6* (2011) as shown in **Appendix B** of this report.

2.3 Existing and Proposed Land Uses

The existing site is partially occupied by an existing accommodation village. A plan of the existing camp and its location is provided in **Appendix A**. The recent documentation *ULDA Blackwater Urban Development Area: Development Scheme* (2011) classifies the site as larger scale non-resident worker accommodation.

Another existing accommodation village is located to the east of the subject site. Under existing conditions, runoff from the eastern part of the subject site discharges to this neighbouring accommodation village site.

It is understood that the existing accommodation village on site will be relocated and refurbished to the proposed development site. The proposed development site is shown in **Appendix A**. The proposed development includes a maximum accommodation yield of 809 rooms with additional areas consisting of recreational, hospitality and office spaces.

3. Stormwater Quantity

3.1 Hydrological Analysis

The proposed Accommodation Village development will increase the impervious surfaces within its catchment and therefore has the potential to increase peak discharges to downstream properties. The Queensland Rational Method (QRM) calculation in accordance the *Queensland Urban Drainage Manual (QUDM,* 2013*)* has been used to determine the peak flows to Bloodwood Street under both existing and proposed development scenarios.

Peak flows were calculated for all standard Average Recurrence Intervals (ARI) using Intensity Frequency Duration (IFD) data from for the former Emerald and Duaringa Shire Council area sourced from the *Capricorn Municipal Development Guidelines (CMDG) - Stormwater Drainage Designs Guidelines* (2012).

3.1.1 Catchment Delineation

The catchment to the point of discharge at Bloodwood Street were delineated based on the site survey data and the proposed development layout. The total catchment area contributing flows to Bloodwood Street has delineated to be 47.4ha, of which 5.8ha is the development site. Refer to Drawing **No. B12209.W-SK01** in **Appendix G** for existing catchment delineation. In the post development scenario the entire Accommodation Village is proposed to discharge to Bloodwood Street with an increase catchment of 48.5ha. Refer to Drawing **No. B12209.W-SK02** in **Appendix G** for developed catchment delineation.

3.1.2 Time of Concentration

The time of concentration (tc) is an input parameter to derive the relevant rainfall intensity to adopt in the Rational Method calculation. Overland sheet flow combined with concentrated flow travel time was used to calculate the tc.

Overland Sheet flow travel time was derived using the Friends Equation (*Equation 4.5* of *QUDM,* 2013), and the concentrated flow travel time was determined using average velocity of 1m/s along the travel path. These values were based on existing site slopes, surface roughness and length of flow path.

A tc of 50 minutes was calculated for both the existing and developed cases. Detailed calculations for tc are presented in **Appendix D**.

3.1.3 Runoff Coefficients

The Coefficient of Runoff (C_{10}) values for the Existing and Developed Scenarios were was calculated based on requirements in *Table 4.05.3(b)* of the *QUDM* (2013) as outlined under the *CMDG Stormwater Design Guidelines* (2012). Existing fraction impervious was based on aerial imagery with identified impervious areas presented in Drawing **No B12209.W-SK01** in **Appendix G**.

For the Existing Scenario, a C_{10} value of 0.63 has been adopted based on a fraction impervious of 12%. For the Developed Scenario a C_{10} value of 0.64 was adopted based on a fraction impervious value of 17%.

3.1.4 Peak Flows

Using the catchment area, rainfall intensities for the adopted time of concentration and adopted runoff coefficients, the calculated peak flows for each design storm were determined, and are presented in **Table 3.1** below. Detailed Rational Peak Flows Calculations area presented **Appendix C**.

Table 3.1: Rational Method Peak Flows

ARI	Existing Peak Flow (m^3/s)	Developed Peak Flow (m^3/s)	Increase in Peak Flows (%)
1	2.58	2.69	4.3%
2	3.52	3.67	4.3%
5	4.95	5.16	4.3%
10	5.84	6.09	4.3%
20	7.05	7.35	4.3%
50	9.05	9.43	4.3%
100	10.52	10.97	4.3%

The results indicate that peak flows to Bloodwood Street increase as a result of the proposed Accommodation Village, however the increases are marginal (less than 5%). Such small increases in peak flow are not expected to cause actionable nuisance to downstream or adjoining properties. Therefore on site peak flow mitigation is not proposed.

3.2 Stormwater Drainage

Consideration has been given to the management flows within the site. Stormwater drainage pipes and vegetated swales are proposed for conveying runoff. Hydrological and Hydraulic analysis has been undertaken to determine preliminary design for the proposed pipes and swales. This has involved the following components:

- Identifying the appropriate study areas for the proposed swales, including contributing sub catchments and proposed land uses;
- Hydrological Analysis using the QRM to calculate post-development peak flows to the proposed swales; and
- Hydraulic Analysis using the Manning's Equation to determine preliminary swale sizes to convey major 100 year ARI flows, generally in accordance with the *CDMG Stormwater Guidelines* (2012).

Note that the minor design storm for the site is the 5 year ARI storm event as outlined in *Table D5.04.2* of the guidelines.

3.2.1 Preliminary Swale Design

A swale is proposed along the northern boundary of the site. Hydrological analysis using the QRM calculation has been undertaken to determine the 100 Year ARI post-development peak flows of the swale to convey runoff from the entire site along the northern boundary of the site. Outflows from the swale is proposed to be collected via a drainage pit and piped to the existing lawful point of discharge at Bloodwood Street. The QRM calculation is presented in **Appendix D** and the sub-catchment delineation is presented in Drawing No. **B12209.W-SK02** in **Appendix G**. The peak flow to the swale is summarised in **Table 3.2** below. Refer to Drawing No. **B12209.W-SK03** in **Appendix G** for the swale details and location.

Table 3.2: Site Catchment Characteristics

Parameters	Swale
Contributing Sub-Catchments	**Entire Site**
Sub-Catchment Ares (ha)	7.33
t_c (minutes)	10
C_{10}	0.75
100 Year ARI Flow (m^3/s)	4.05

The Manning's Equation has been used to determine the preliminary sizing of the swales. It should be noted that there is a sub-catchment within the site (Catchment B) from which runoff is piped directly to Bloodwood Street via a 750mm diameter RCP. The Manning's Equation calculation for the swale sizing is presented in **Table 3.3.**

Table 3.3: Swale Calculation

Parameters	Swale
100 Year ARI Flow (m^3/s)	4.05
*Less Pipe Capacity	1.00
Design Flow (m^3/s)	3.05
Longitudinal Slope (%)	0.8
Base Width (m)	7
Side Batters	1 in 3
Manning's n	0.06
Swale Depth (m)	0.5
Top Width (m)	10
Flow Velocity (m/s)	0.79

Refer Drawing No. **B12209.W-SK03** in **Appendix G** for the concept stormwater drainage plan. The QRM and Manning's Equation calculations are presented in **Appendix D** and **E** respectively.

3.2.2 Pipe Drainage

Site sub-catchment B conveys flows to a 750mm diameter RCP within the eastern car park. Pipe drainage has been proposed in this location to allow the installation of Bio-Retention Pods within the car park area.

Table 3.4: Sub-Catchment B Characteristics

Parameters	
Contributing Sub-Catchments	Catchment B
Sub-Catchment Ares (ha)	1.91
t_c (minutes)	10
C_{10}	0.75
100 Year ARI Flow (m^3/s)	1.06

The proposed 750mm pipe at a grade of 0.8% will have a capacity 1.00 m^3/s; flows above this capacity will overflow into the swale. Refer to **Appendix D** for pipe capacity calculations.

3.2.3 External Catchment Flow Diversion

External catchment flows from the south of the site are to be diverted away from the site for all standard events.

Current external flows entering the western side of the site via the culverts under the driveway off Rosewood Street shall be diverted away from the site via an overland flow path alongside Rosewood Street. The diverted flows will be discharged to the existing overland flow channel adjacent to the site via a culvert and thereafter into the existing 1200mm diameter RCP at Bloodwood Street.

A 1500mm diameter pipe is proposed underneath Rosewood Street. This is preliminary sizing only and subject to detailed design. Consent will be sought from the adjoining property owners for the construction of the stormwater drainage outlet within their property.

The external flows along the eastern portion of the Rosewood Street extension will drain via an overland flowpath along the future road reserve. The overland flow path will connect to where runoff from the neighbouring accommodation village (Lot 2 on SP246036) discharges its runoff to. Therefore downstream of the future road reserve and neighbouring accommodation the flow regime will not change from existing conditions.

Refer to Drawing No. **B12209.W-SK02** in **Appendix G** for external catchment flow diversion details.

4. Stormwater Quality

Development of the Workers Accommodation Village may increase the stormwater pollutants that are exported from the subject site. A treatment train comprised of suitable Stormwater Quality Improvement Devices (SQID's) is proposed to intercept and capture pollutants so that the potential impacts external to the subject site will be adequately mitigated to achieve the required Water Quality Objectives (WQO's).

This section discusses:

- The identification of key stormwater pollutants associated with the proposed development;
- The Water Quality Objectives (WQO's) identified for the catchment;
- Modelling to determine the impacts to stormwater quality from Workers Accommodation Village;
- Proposed measures to mitigate the increase in pollutant export; and
- Modelling of the proposed measures and comparison to the identified WQOs.

4.1 Pollutants of Concern

Typical key pollutants expected to be generated during the operational (post-construction) phase of the planned development are listed as follows, with those presented in capitals being the key pollutants to be targeted for treatment:

- LITTER
- SEDIMENT
- Oxygen demanding substances (possibly present)
- NUTRIENTS (N & P)
- Pathogens / Faecal coliforms
- Hydrocarbons
- HEAVY METALS (associated with fine sediments)
- Surfactants
- Organochlorines & organophosphates
- Thermal pollution
- pH altering substance

Only the key pollutants will be further addressed in this report; however, the treatment train developed will adequately mitigate the other pollutant loads. As heavy metals will predominately be associated with fine sediment, controls proposed to reduce total suspended solids will also adequately reduce loads of heavy metals.

4.2 Water Quality Objectives

The load reduction WQO's presented **Table 4.1** below has been adopted from *Table 2.2* of the *Urban Stormwater Quality Planning Guidelines (2010)* in accordance with *State Planning Policy for Health Waters (SPP4/10)* specified for the Central Highlands Regional Council.

Table 4.1: Load Reduction Water Quality Objectives (WQO's)

Pollutant	Total Suspended Solids	Total Phosphorus	Total Nitrogen	Gross Pollutants
Load Reduction Target	85%	70%	45%	90%

4.3 Stormwater Quality Management Strategy

To mitigate the increase in pollutants generated by the Rosewood Accommodation Village a treatment train of SQIDs are proposed. The treatment train utilises the following SQIDs:

- Vegetated Swale: The major vegetated swale has been incorporated in the stormwater treatment train. Coarse and some fine sediment will be removed through interception by vegetation along the banks and invert of the vegetated swales before discharging to the Bio-Retention Basin.

- Bio-Retention Pods: Bio-Retention pods are proposed in the eastern car park area. These pods will trap fine and coarse sediment and reduce nutrient concentrations, before discharging to stormwater drainage infrastructure. Refer to Bio-Retention Pod locations on Drawing No. **B12209.W-SK03** in **Appendix G.**
- Bio-Retention Basin: A Bio-Retention Basin is proposed for the site at the northwestern corner to treat runoff from the major swale.

Bio-Retention systems utilise a sandy loam soil based media to filter runoff. Sediment particles and suspended solids are trapped within vegetation and on the surface of the filter media while roots of the vegetation remove dissolved nutrients (nitrogen and phosphorus) through the biological uptake process. Subsoil drainage provided below the filter media allows for the treated runoff to discharge from the Bio-Retention basin or the Bio-Retention Pods.

A diversion bund will divert major flows within the swale away from the basin directly to the legal point of discharge.

The subsequent sections discuss the MUSIC modelling undertaken to demonstrate the effectiveness of the proposed treatment train.

4.4 MUSIC Modelling Methodology

Water quality modelling of the proposed site has been undertaken using the Model for Urban Stormwater Improvement Conceptualisation (MUSIC) Version 5.1.16, developed by the Cooperative Research Centre for Catchment Hydrology (CRCCH). MUSIC enables the user to conceptualise the transfer of pollutants through a stormwater drainage system and provides an aid in quantifying the effectiveness of the proposed stormwater quality treatment train. MUSIC only provides quantitative modelling for Total Suspended Solids (TSS), Total Phosphorous (TP), Total Nitrogen (TN) and Gross Pollutants (GP).

With the proposed SQIDs included. The MUSIC model was setup in accordance with Water by Design *MUSIC Modelling Guidelines* (2010).

Modelling of the site has been undertaken to determine the effectiveness of the proposed SQIDs. The MUSIC Model file data is provided below. The layouts and detailed MUSIC inputs are presented in **Appendix F.**

- **Site:** Rosewood Mining Accommodation Village
- **Model:** B12209.W_Developed.sqz

4.4.1 Meteorological Data

Six minute pluviographic data was sourced from the Bureau of Meteorology (BOM) for Emerald DPI Field Station (Station No. 35147). Based on the mean annual rainfall over the station's entire data period and the occurrence of continuous recorded rainfall periods within the data, a 10 year period from the 1st January 1984 to 31st December 1993 was selected and adopted for modelling in MUSIC. The mean annual rainfall for this period is 573mm.

Monthly evapotranspiration data for the 10 year period was sourced from Bureau of Meteorology's *Climatic Atlas of Australia EVAPOTRANSPIRATION* (2001) and entered into the MUSIC Model. The mean annual evapotranspiration for the modelled period is 1,621mm.

4.4.2 Source Nodes

Source nodes represent sub-catchments defined for MUSIC modelling purposes. The sub-catchments are shown in Drawing No. **B12209.W-SK03** in **Appendix G.** The sub-catchments were then split into roof, road and ground source nodes as required by the split catchment approach in accordance the *MUSIC Modelling Guidelines* (2010). **Table 4.1** below outlines the split catchments used for MUSIC modelling.

Table 4.1: Source Node Data

Source Node	Surface Type	Area (ha)	Fraction Impervious
A Road/Carparking	Road	0.810	100%
A Roof	Roof	0.894	100%
A Ground	Ground	1.775	6%
B Road/Carparking	Road	1.041	100%
Roof to Swale	Roof	0.787	100%
Ground to Swale	Ground	2.018	5%
Total		**7.325**	**51%**

Base and Storm flow pollutant concentrations and soil properties have been adopted from *Table 3.7 & 3.8* of the *MUSIC Modelling Guidelines* (2010) assuming "Urban Residential" land use type. It is believed that "Urban Residential" land use type most accurately resembles the intent use of the proposed mining accommodation camp.

Stochastic generation estimation and serial autocorrelation set to zero has also been adopted. Refer to **Appendix F** for detailed MUSIC model set up details.

4.4.3 Drainage Links

No routing has been adopted for all drainage links within each model. It is believed this assumption will produce results that are more conservative.

4.4.4 Treatment Nodes

4.4.4.1 Swale Node

The swale dimensions were based on the requirements from the water quantity strategy **Section 3.2.1**. The swale was modelled by using the effective length at a conservative measure of approximately 50% of the actual swale length. **Table 4.2** below indicates presented parameters adopted.

Table 4.2: Swale Parameters

Parameters	Swale
Swale Discharge Location	Bio-Retention Basin A
Effective Length (m)	140
Bed Slope (%)	0.8
Top Width (m)	10
Bottom Width (m)	7
Depth (m)	0.5
Vegetation Height	0.2

4.4.4.2 Bio-Retention Node

Two Bio-Retention treatment nodes were utilised in MUSIC to model the Bio-Retention Basin and Bio-Retention Pods proposed. The treatment node configuration is outlined in **Table 4.3** below. It should be noted that the Orthophosphate and Total Nitrogen content in filter media has been adopted from Healthy Waterways *Interim MUSIC Bio-Retention Treatment Node* (2013) document.

Table 4.3: Bio-Retention Node Parameters

Parameter	Bio-Retention Basin A	Bio Pods
Surface Area (m^2)	500	480
Filter Area (m^2)	500	480
Ponding Depth (m)	0.3	0.2
Filter Depth (m)	0.4	0.4
Filter Media Type	Sandy Loam	Sandy Loam
Filter Median Particle Diameter (mm)	0.45	0.45
Saturated Hydraulic Conductivity of Filter Media (mm/hr)	200	200
TN Content of Filter Media (mg/kg)	400	400
Orthophosphate Content of Filter Media (mg/kg)	50	50
Overflow Weir (m)*	50	48

* Overflow weir has been conservatively modelled as 10% of the filter area

4.5 MUSIC Modelling – Results

Results from modelling the proposed development treatment train in MUSIC are presented in **Table 4.3** below.

Table 4.4: MUSIC Results

Pollutant	Achieved Reduction (%)	WQO (%)	Objective Achieved?
Total Suspended Solids (TSS)	93	85	Yes
Total Phosphorus (TP)	70	70	Yes
Total Nitrogen (TN)	59	45	Yes
Gross Pollutants (GP)	100	90	Yes

The above results indicate that the treatment train development will achieve the required WQO's. Refer to **Appendix F** for details of the MUSIC Modelling.

5. Waterway Stability and Frequent Flow Management

The requirements of Waterway Stability and Frequent Flow Management in SEQ *Regional Plan 2009-2031 Implementation Guidelines No.7 - Water Sensitive Urban Design* under SPP4/10 are presented below.

As demonstrated in **Section 4** the increase in the 1 Year ARI peak flows are less than 5% as a result of the development. Furthermore, runoff is discharged into the existing urban drainage network within Blackwater township before discharging into Blackwater Creek. The development is not expected to cause channel bed and bank erosion in the receiving waterway.

As Blackwater Creek already has altered hydrology through previous developments, compliance with either the Waterway Stability or Frequent Flow Management objectives is not required.

6. Conclusion

Brown Consulting (Qld) Pty Ltd has undertaken a Stormwater Quantity and Quality Management Plan for the proposed Rosewood Workers Accommodation Village located in Blackwater QLD.

The outcomes of the Stormwater Quantity and Quality investigations are outlined below.

- The proposed Stormwater Quantity Strategy has been developed through analysis of the site and external catchments. Analysis of the external catchment draining to the discharge point Bloodwood Street has indicated that the increase in peak flows for all ARI storms is less than 5%. Since this has resulted in low peak flow increases to it is considered reasonable that no peak flow mitigation is necessary.
- External catchment flows from the south of the site are to be diverted away from the site for all standard events either through a pipe diversion to the existing overland channel to the west of the site and via the future road reserve to the east.
- Through hydrological and hydraulic analysis of the worker accommodation both piped drainage and a swale is proposed to convey site flows. Through hydraulic analysis the pipes and swale were sized to convey runoff up to 100 year ARI peak flow.
- The proposed Stormwater Quality Management Strategy comprising of the Vegetated Swale, Bio-Retention Basin and Bio-Retention Pods have been modelled in MUSIC to demonstrate the water quality pollutant mitigation in accordance with *Urban Stormwater Quality Planning Guidelines* (2010).
- Design objectives of Waterway Stability and Frequent Flow Management under SPP4/10 have been considered and is not deemed applicable for this development.

7. Recommendations

On this basis it is recommended that this Concept Stormwater Management Plan be approved and the design strategies within be incorporated into detailed design. Detailed design may result in changes to the stormwater management proposal but the design objectives will be maintained.

8. References

» Capricorn Municipal Development Guidelines Technical Reference Group (2012), *Capricorn Municipal Development Guidelines – Stormwater Drainage Design D5;*

» Central Highlands Regional Council (CHRC), *Central Highlands Strategic Framework Future Directions for Land Use Planning 2031*;

» Department of Environment and Resource Management (2010), *Urban Stormwater Quality Planning Guidelines 2010;*

» Department of Environment and Resource Management (2010), *State Planning Policy 4/10 Healthy Waters Guideline*;

» Duaringa Shire Council (2011), *Planning Scheme for Duaringa Shire*;

» Healthy Waterways (2006), *Water Sensitive Urban Design Technical Design Guidelines for South East Queensland*;

» Institution of Engineers, Australia (1987), *Australian Rainfall and Runoff*;

» Urban Land Development Authority (ULDA) (2011), *Blackwater Urban Development Area, Development Scheme*;

» Urban Land Development Authority (ULDA) (2011), *Engineering Standards , ULDA Guideline No.13;* and

» Urban Land Development Authority (ULDA) (2012), *Non-Resident Worker Accommodation, ULDA Guideline No.3.*

9. Disclaimer

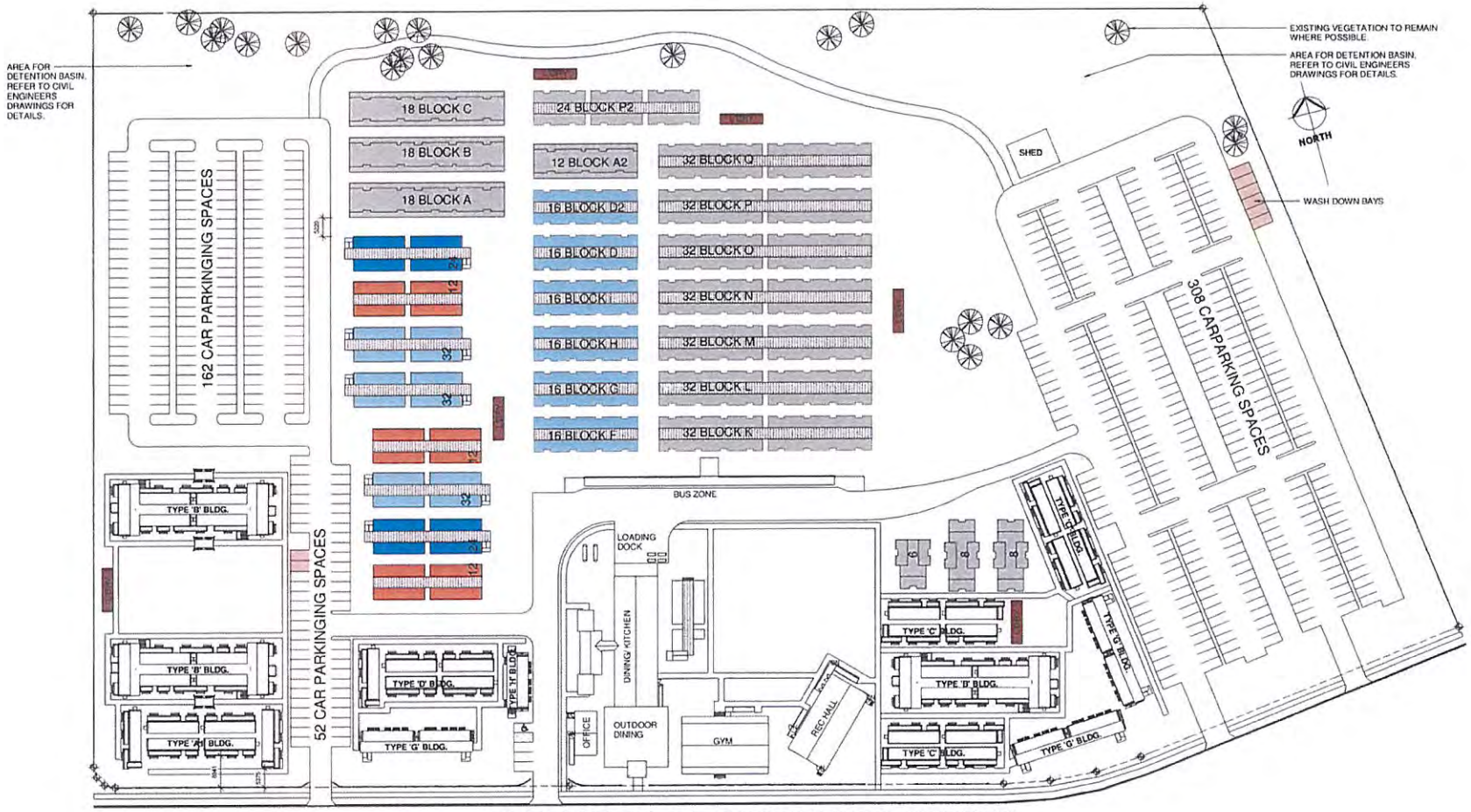
This report has been prepared on behalf of and for the exclusive use of Qantac Pty Ltd and is subject to and issued in accordance with the agreement between Brown Consulting (QLD) Pty Ltd.

Our investigation and analysis has been specifically catered for the particular requirements of Qantac Pty Ltd and may not be applicable beyond this scope. For this reason, any other third parties are not authorised to utilise this report without further input and advice from Brown Consulting (QLD) Pty Ltd.

Brown Consulting (QLD) Pty Ltd accepts no liability or responsibility whatsoever for the report in respect of any use of or reliance upon this report by any third party.

The investigation and analysis has relied on information provided by others. We accept no responsibility for accuracy of material supplied by others. The accuracy of the investigation, analysis and report is dependent upon the accuracy of this information.

Appendix A: Architectural Drawings



EXTENSION OF ROSEWOOD STREET

SITE PLAN
1 : 500 @ A1

SITE INFO

809	ROOMS
526	CAR PARKS
8	CAR WASH SPACES

NOT FOR CONSTRUCTION

NOTE:
- VERIFY ALL DIMENSIONS ON SITE.
- NEVER DIMENSION TAKE PRESEDENCE OVER SCALED DIMENSIONS.

PROJECT : PROPOSED RELOCATION OF ACCOMMODATION VILLAGE
CLIENT : QANTAC
LOCATION : ROSEWOOD STREET, BLACKWATER QLD,

ANDRE MELVILLE BUILDING DESIGN & DRAFTING SERVICES
P.O BOX 1979, AITKENVALE, QLD, 4814
Ph: 0488 081 535
E MAIL: admin@ambd.com.au
www.ambd.com.au
QBSA No: 1222804

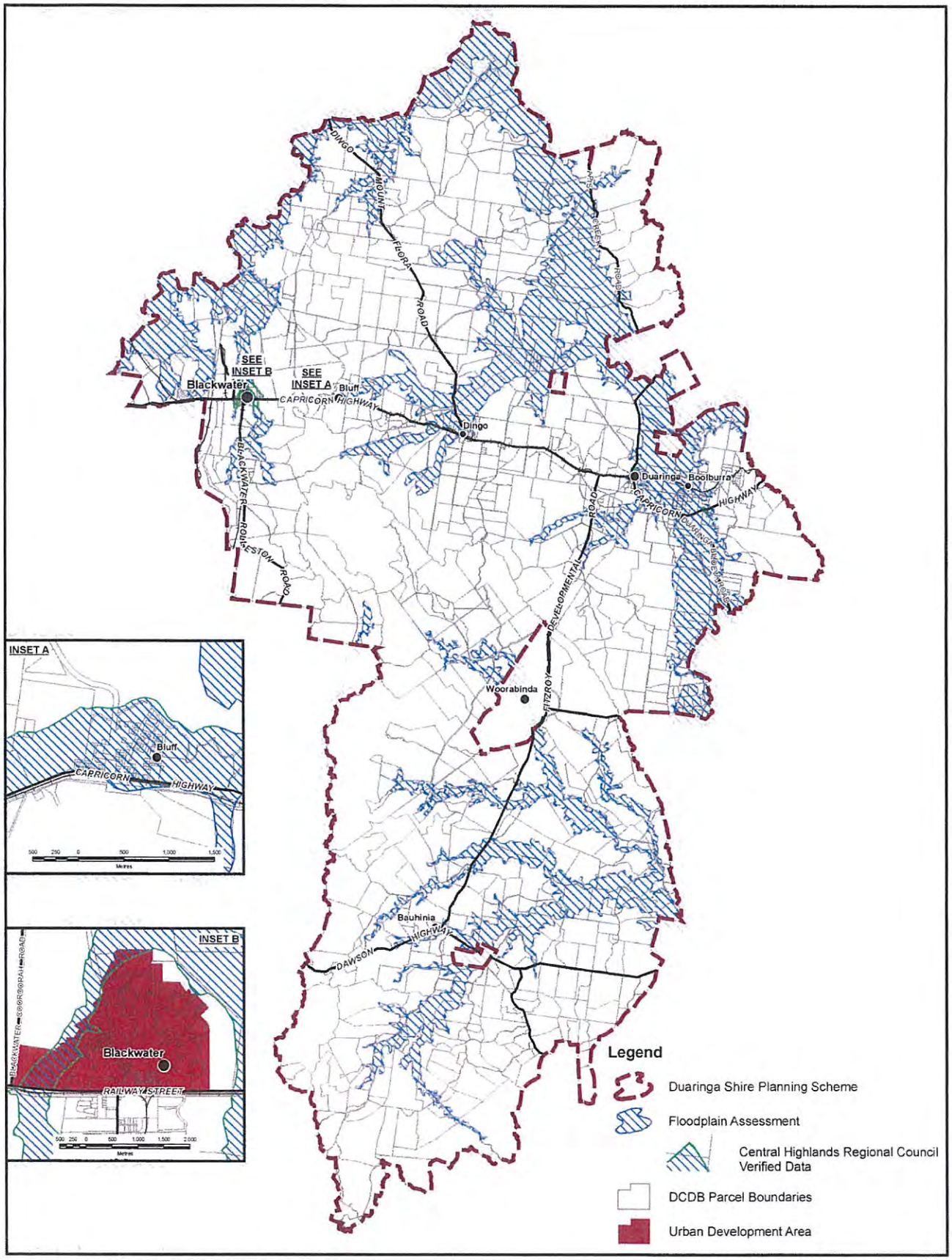
No.	Description	Date
7	REV 07 BUILDING FOOTPRINTS, MOVED SITE LAYOUT	27/09/13
6	REVISED BUILDING LAYOUT	25/09/13
5	PRESENTATION ISSUE	24/09/13
4	REVISED SITE - OPTION 6	19/9/13
3	REVISED SITE - OPTION 5	04/9/13
2	REVISED SITE - OPTION 4	27/8/13
1	REVISED SITE - OPTION 3	21/8/13

DESIGNED AM
DRAWN AM
DATE MAY 2013
SCALE A1 1 : 500
ISSUED 24/09/13

SITE PLAN - OPTION 7

12-116 - MCU - 02 - L

Appendix B: Flood Hazard Overlay Duaringa Shire Planning Scheme



FLOOD HAZARD OVERLAY
- FLOODPLAIN ASSESSMENT
DUARINGA SHIRE PLANNING SCHEME
OVERLAY MAP NO. ND - 6

N

Scale 1:750,000

10 5 0 10 20 30 40

Kilometres

Original Size is A3

Digital Cadastral Database (DCDB) supplied by the Department of Environment and Resource Management November 2011.

Appendix C: Total Catchment Hydrology

Existing Catchment Rosewood Accomodation Village

File: H:\B12\200-249\B12209.W\Stormwater\RATIONAL\[B12209.W Rational Method Calculations.xlsx]Existing Catchment
Date: 24/10/2013
Job: B12209.W
By: IP
Locality: CHRC
IFD Ref: IFD_CHRC
IFD Source: CMDG Stormwater Drainage Design D5 Fig D5.04.07 (March 2012)

Time of Concentration Calculations

Reference	Equation Type / Method	Area (ha)	Length (m)	Av. Slope (%)	Pipe Diameter (mm)	Velocity (m/s)	Wetted Area (m^2)	Wetted Perimeter (m)	Hydraulic Radius R	Roughness (Mannings/ Hortons)	Sub Total (mins)	tc (min)
Table 4.06.1 QUDM	QUDM Standard Inlet Times	47.4		1.0							0	0
4.06.6 QUDM	Overland Sheet Flow - Friends Equation		200	1.0						0.045	28.1	
4.06.8 QUDM	Kerb and Channel Flow		0	1.0							0.0	
4.06.3 a(iii) QUDM	Assumed Pipe Flow Velocity		70			2.0					0.6	
4.06.3 a(iv) QUDM	Assumed Channel Velocity		1296			1.0					21.6	
4.06.09 QUDM	Pipe Flow Time		0	1.0	600		0.3	1.9	0.150	0.013	0.0	50.3
		Flow Path	1566								Adopted tc	50.3

C10 VALUE

Enter Fraction Impervious	Development Category	f_i	$1I_{10}$ (mm/hr)
Table 5.04.2 QUDM		0.12	61.1

C10
0.63
Adopted C10 0.63

C10 Based on QUDM as outlined in CDMG guidelines

Flow Calculations (QUDM 4.03.1)

			tc (min)	50.3
ARI	Cy	$^{tc}I_y$	A (ha)	Q (m3/s)
1	0.50	39	47.400	2.58
2	0.53	50	47.400	3.52
5	0.59	63	47.400	4.95
10	0.63	71	47.400	5.84
20	0.66	81	47.400	7.05
50	0.72	95	47.400	9.05
100	0.75	106	47.400	10.52

Develoepd Rosewood Accomodation Village

File: H:\B12\200-249\B12209.W\Stormwater\RATIONAL\[B12209.W Rational Method Calculations.xlsx]Developed Catchment
Date: 24/10/2013
Job: B12209.W
By: IP
Locality: CHRC
IFD Ref: IFD_CHRC
IFD Source: CMDG Stormwater Drainage Design D5 Fig D5.04.07 (March 2012)

Time of Concentration Calculations

Reference	Equation Type / Method	Area (ha)	Length (m)	Av. Slope (%)	Pipe Diameter (mm)	Velocity (m/s)	Wetted Area (m^2)	Wetted Perimeter (m)	Hydraulic Radius R	Roughness (Mannings/Hortons)	Sub Total (mins)	tc (min)
Table 4.06.1 QUDM	QUDM Standard Inlet Times	48.5		1.0							0	0
4.06.6 QUDM	Overland Sheet Flow - Friends Equation		200	1.0						0.045	28.1	
4.06.8 QUDM	Kerb and Channel Flow		0	1.0							0.0	
4.06.3 a(iii) QUDM	Assumed Pipe Flow Velocity		70			2.0					0.6	
4.06.3 a(iv) QUDM	Assumed Channel Velocity		1280			1.0					21.3	
4.06.09 QUDM	Pipe Flow Time		85	0.8	1200		1.1	3.8	0.300	0.013	0.5	50.5
		Flow Path	1635								Adopted tc	50.5

C10 VALUE

Enter Fraction Impervious	Development Category	f_i	$1I_{10}$ (mm/hr)
Table 5.04.2 QUDM		0.17	61.1

C10
0.64
Adopted C10 0.640

C10 Based on QUDM as outlined in CDMG guidelines

Flow Calculations (QUDM 4.03.1)

			tc (min)	50.5
ARI	Cy	$^{tc}I_y$	A (ha)	Q (m3/s)
1	0.51	39	48.498	2.69
2	0.54	50	48.498	3.67
5	0.61	63	48.498	5.16
10	0.64	71	48.498	6.09
20	0.67	81	48.498	7.35
50	0.74	95	48.498	9.43
100	0.77	106	48.498	10.97

Appendix D: Onsite Hydrology

Catchment B, Rosewood Accomodation Village

File: H:\B12\200-249\B12209.W\Stormwater\RATIONAL\[B12209.W Rational Method Calculations.xlsx] Swale Entire Site
Date: 24/10/2013
Job: B12209.W
By: IP
Locality: CHRC
IFD Ref: IFD_CHRC
IFD Source: CMDG Stormwater Drainage Design D5 Fig D5.04.07 (March 2012)

Time of Concentration Calculations

Reference	Equation Type / Method	Area (ha)	Length (m)	Av. Slope (%)	Pipe Diameter (mm)	Velocity (m/s)	Wetted Area (m^2)	Wetted Perimeter (m)	Hydraulic Radius R	Roughness (Mannings/ Hortons)	Sub Total (mins)	tc (min)
Table 4.06.1 QUDM	QUDM Standard Inlet Times	1.907		1.0							Roof	5
4.06.6 QUDM	Overland Sheet Flow - Friends Equation		0	1.0						0.045	0	
4.06.8 QUDM	Kerb and Channel Flow		190	1.0							4.8	
4.06.3 a(iii) QUDM	Assumed Swale Flow onsite		32			1.0					0.5	
4.06.3 a(iv) QUDM	Assumed Channel Velocity		0			2.0					0.0	
4.06.09 QUDM	Pipe Flow Time		0	0.8	750		0.4	2.4	0.188	0.013	0.0	5.3
		Flow Path	220								Adopted tc	10.3

C10 VALUE

Enter Fraction Impervious	Development Category	f_i	I_{10} (mm/hr)		C10
Table 5.04.2 QUDM		0.51	61.1		0.753
		Weighted Average of Site		Adopted C10	0.753

Flow Calculations (QUDM 4.03.1)

			tc (min)	10.3
ARI	Cy	$^{tc}I_y$	A (ha)	Q (m3/s)
1	0.60	79	1.907	0.25
2	0.64	102	1.907	0.35
5	0.72	129	1.907	0.49
10	0.75	146	1.907	0.58
20	0.79	168	1.907	0.70
50	0.87	198	1.907	0.91
100	0.90	220	1.907	1.06

Catchment B Pipe Flow Calculations (pipe flowing full)

Concrete	Dia (m)	0.75	Area =	0.442 m^2
	Grade (m/	0.008		
	Flow (m^3	**0.996**	Vel =	2.25 m/s calculated

Entire Site Rosewood Accomodation Village

File: H:\B12\200-249\B12209.W\Stormwater\RATIONAL\[B12209.W Rational Method Calculations.xlsx] Swale Entire Site
Date: 24/10/2013
Job: B12209.W
By: IP
Locality: CHRC
IFD Ref: IFD_CHRC
IFD Source: CMDG Stormwater Drainage Design D5 Fig D5.04.07 (March 2012)

Time of Concentration Calculations

Reference	Equation Type / Method	Area (ha)	Length (m)	Av. Slope (%)	Pipe Diameter (mm)	Velocity (m/s)	Wetted Area (m^2)	Wetted Perimeter (m)	Hydraulic Radius R	Roughness (Mannings/ Hortons)	Sub Total (mins)	tc (min)
Table 4.06.1 QUDM	QUDM Standard Inlet Times	7.325		1.0						Roof	5.0	5
4.06.6 QUDM	Overland Sheet Flow - Friends Equation			1.0						0.045	0.0	
4.06.8 QUDM	Kerb and Channel Flow			1.0							0.0	
4.06.3 a(iii) QUDM	Assumed Pipe Flow Velocity					1.0					0.0	
4.06.3 a(iv) QUDM	Assumed Channel Velocity					1.0					0.0	
4.06.09 QUDM	Pipe Flow Time			1.0	600		0.3	1.9	0.150	0.013	0.0	
										Adopted Tc Same as Catchment B	Adopted tc	10.3

C10 VALUE

Enter Fraction Impervious	Development Category	f_i	I_{10} (mm/hr)		C10
Table 5.04.2 QUDM		0.51	61.1		0.753
				Adopted C10	0.753

Flow Calculations (QUDM 4.03.1)

			tc (min)	10.3
ARI	Cy	$^{tc}I_y$	A (ha)	Q (m3/s)
1	0.60	79	7.325	0.97
2	0.64	102	7.325	1.33
5	0.72	129	7.325	1.88
10	0.75	146	7.325	2.24
20	0.79	168	7.325	2.70
50	0.87	198	7.325	3.48
100	0.90	220	7.325	4.05

Appendix E: Swale Calculation

Major Swale

MANNING'S WATER SURFACE EXTENT CALCULATION

Filename: H:\B12\200-249\B12209.W\Stormwater\RATIONAL\[B12209.W-Mannings Calc of Proposed Swales.xl
Date: 27.09.2013
By: IP

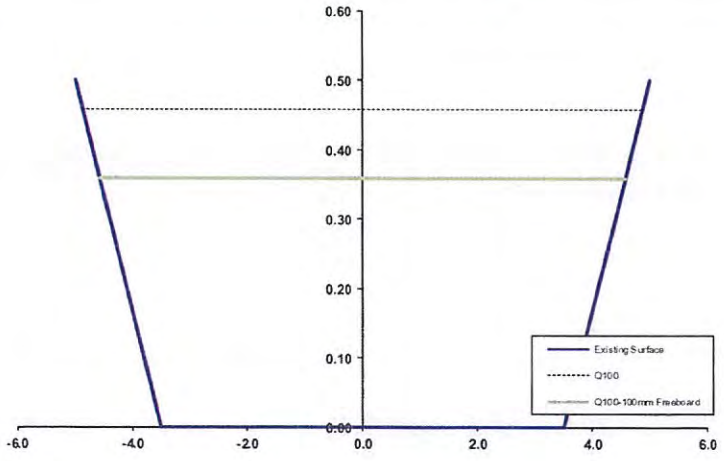
Manning's calculation as per Equation 4.2.3 of Australian Rainfall and Runoff (1987)

Parameters	1.5
Slope	0.8%
Base Width (m)	7
Top Width (m)	10.0
Depth (m)	0.5
Batter Slope 1:	3
Mannings	0.06

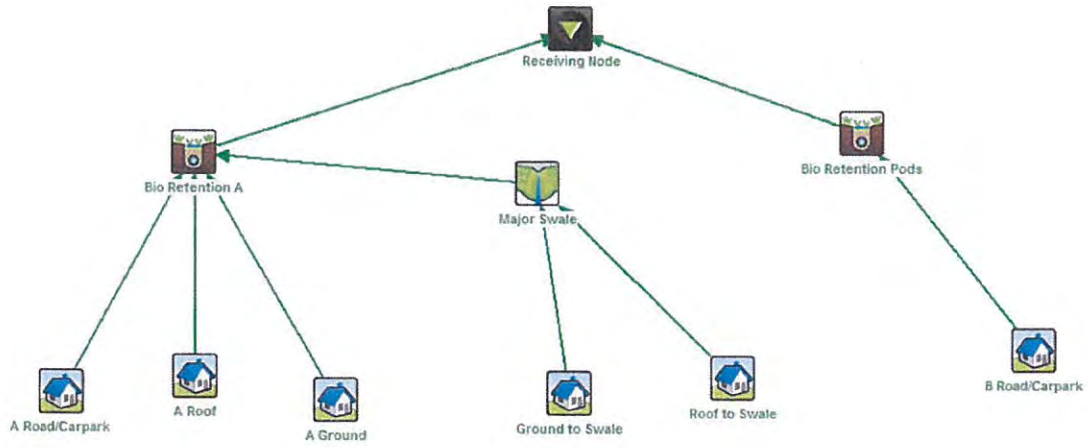
Rosewood Accomodation Village
Preliminary Swale Design

CROSS SECTION DETAILS				Q100		
POINT	CH	Z	n	wA	wP	n x wA
1	-5.000	0.500				
2	-3.500	0.000	0.060	0.32	1.45	0.02
3	0.000	0.000	0.060	1.61	3.50	0.10
4	3.500	0.000	0.060	1.61	3.50	0.10
5	5.000	0.500	0.060	0.32	1.45	0.02
				wA	wP	n x wA
			TOTAL	3.84452546	9.902635311	0.230671528
	S (m/m)					
	0.008			R	n	Q
				0.38823256	0.060	3.05

Q100 Flow (m^3/s)	3.05
Depth of Flow (m)	0.46
Swale Capacity (m^3/s)	3.05
Vel (m/s)	0.79



Appendix F: MUSIC



Job No: B12209.W

Site: Rosewood Workers Accommodation Village
Date : 24/10/2013
By: CS

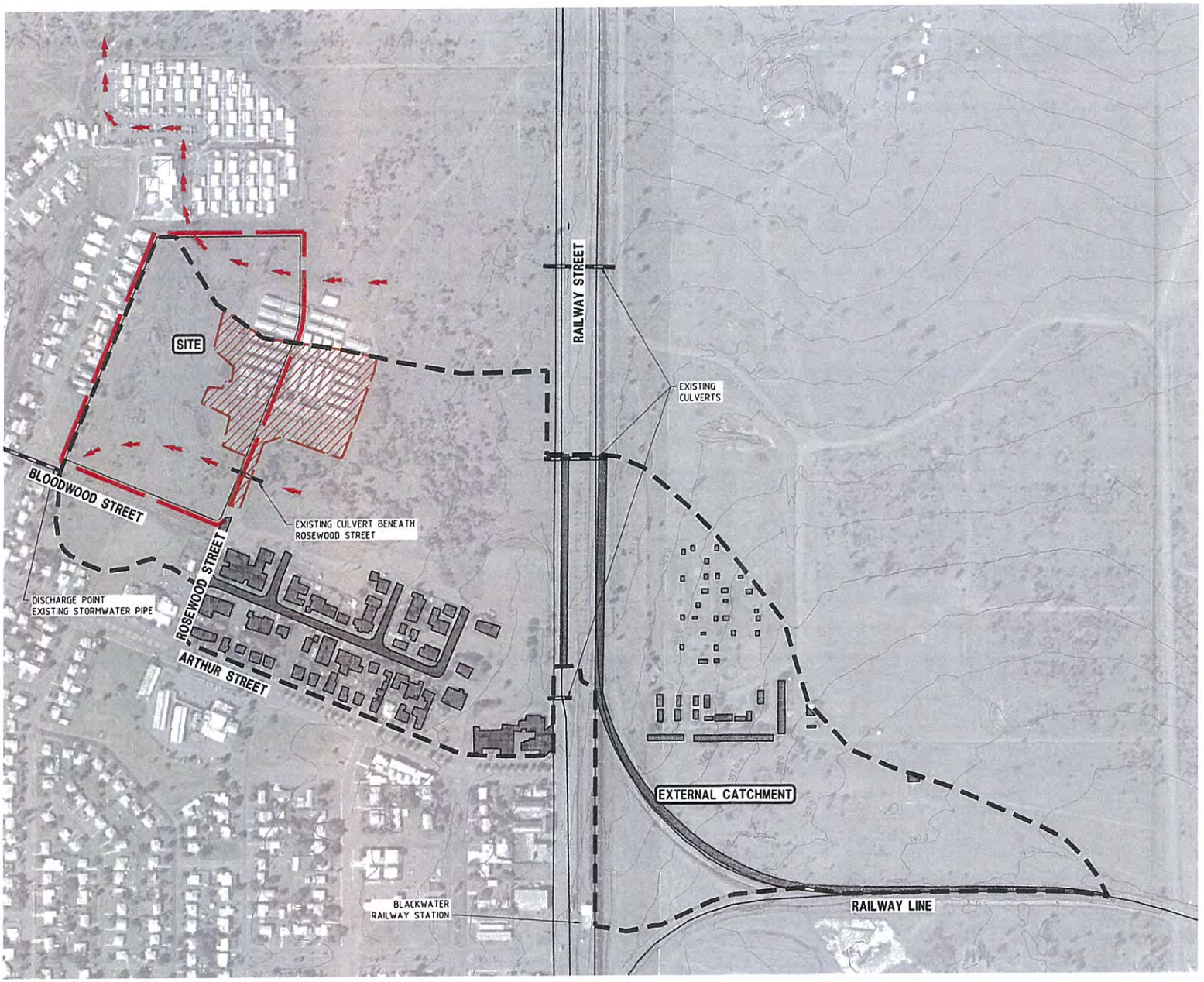
Surface Type	A (ha)	B (ha)	Fraction Impervious
Road	0.810	1.041	100%
Roof	0.894	0.787	100%
Ground - Dirt	1.677	1.918	0%
Ground - Concrete Footpath	0.098	0.100	100%
	Note B Ground and Road now modelled "to Swale"		
Measured from CADm2	34790	38462	

	Area (ha)	Fraction Impervious
A Ground	1.775	6%
Ground to Swale	2.018	5%

		Average Fraction Impervious
Total Site Area	7.325	51%

Results				
24/10/2013	Sources	Residual Load	% Reduction	
Flow (ML/yr)	20.1	18.6	7.2	
Peak Flow (m3/s)	0.5	1.5	-218	WQO
Total Suspended Solids (kg/yr)	4480.0	312.0	93	85
Total Phosphorus (kg/yr)	8.4	2.5	70	70
Total Nitrogen (kg/yr)	42.0	17.4	59	45
Gross Pollutants (kg/yr)	529	0	100	90

Appendix G: Drawings



NOTES:

1. LAYOUT OF THE PRELIMINARY STORMWATER QUALITY IMPROVEMENT DEVICES IS CONCEPTUAL ONLY AND PROVIDED AS A GUIDE FOR THE TREATMENT TRAIN AND IS SUBJECT TO DETAILED DESIGN

2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH BROWN CONSULTING REPORT NO. B12209.W-01A

CONCEPT PLAN ONLY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

FILE: B12209.W-SK01.dwg DATE: 24-10-2013 TIME: 15:51
User's: X_B12209.W_TITLE X_B12209.W_BASE USR: Tim Stewart

SHEET SIZE		GALCD	DRAWN	DATE
ANSI/ISO SHEETS	A	IP	TAS	29.10.13
	B			
	C			
	D			
	E			
	F			

AMENDMENT DETAILS

DESIGN CHECK

DRAWN CHECK

SCALE (METRES)
1:2500 50 0 50 100 A1
1:5000 A3

MICROFILM No.

PROJECT No. B12209.W

APPROVED
ANDREW McPHAIL RPEQ 6723
JEFF GRIFFITHS RPEQ 6175
BRENT THOMAS RPEQ 7862
FOR & ON BEHALF OF BROWN CONSULTING (QLD) PTY LTD

CLIENT: QANTAC PTY LTD

PROJECT: ROSEWOOD WORKERS ACCOMMODATION

BROWN Smart Consulting

CONSULT AUSTRALIA

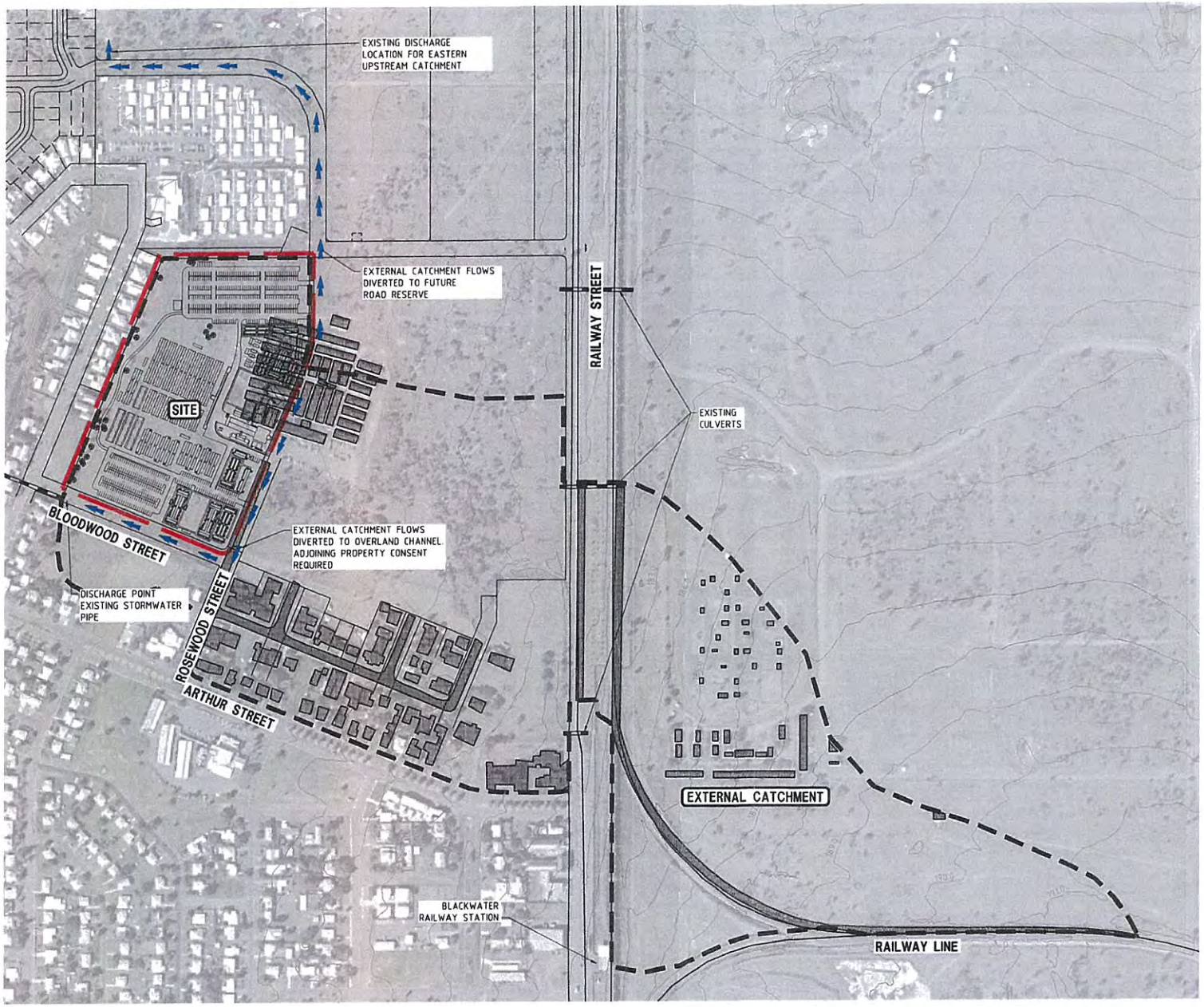
Brown Consulting (QLD) Pty Ltd
Level 6, 199 Grey Street, South Brisbane QLD Australia 4101
Telephone 07 3095 3444 Facsimile 07 3095 3400

Quality Endorsed Company ISO 9001 Lic 4084

DRAWING TITLE: EXISTING STORMWATER CATCHMENT PLAN

DRAWING NUMBER: B12209.W-SK01

ISSUE



NOTES:

1. LAYOUT OF THE PRELIMINARY STORMWATER QUALITY IMPROVEMENT DEVICES IS CONCEPTUAL ONLY AND PROVIDED AS A GUIDE FOR THE TREATMENT TRAIN AND IS SUBJECT TO DETAILED DESIGN.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH BROWN CONSULTING REPORT NO. B12209.W-01A.

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FILE: B12209.W-SK02.dwg DATE: 29-10-2013 TIME: 09:19
Xref's: X_B12209.W_TITLE X_B12209.W_BASE USR: Tim Stewart

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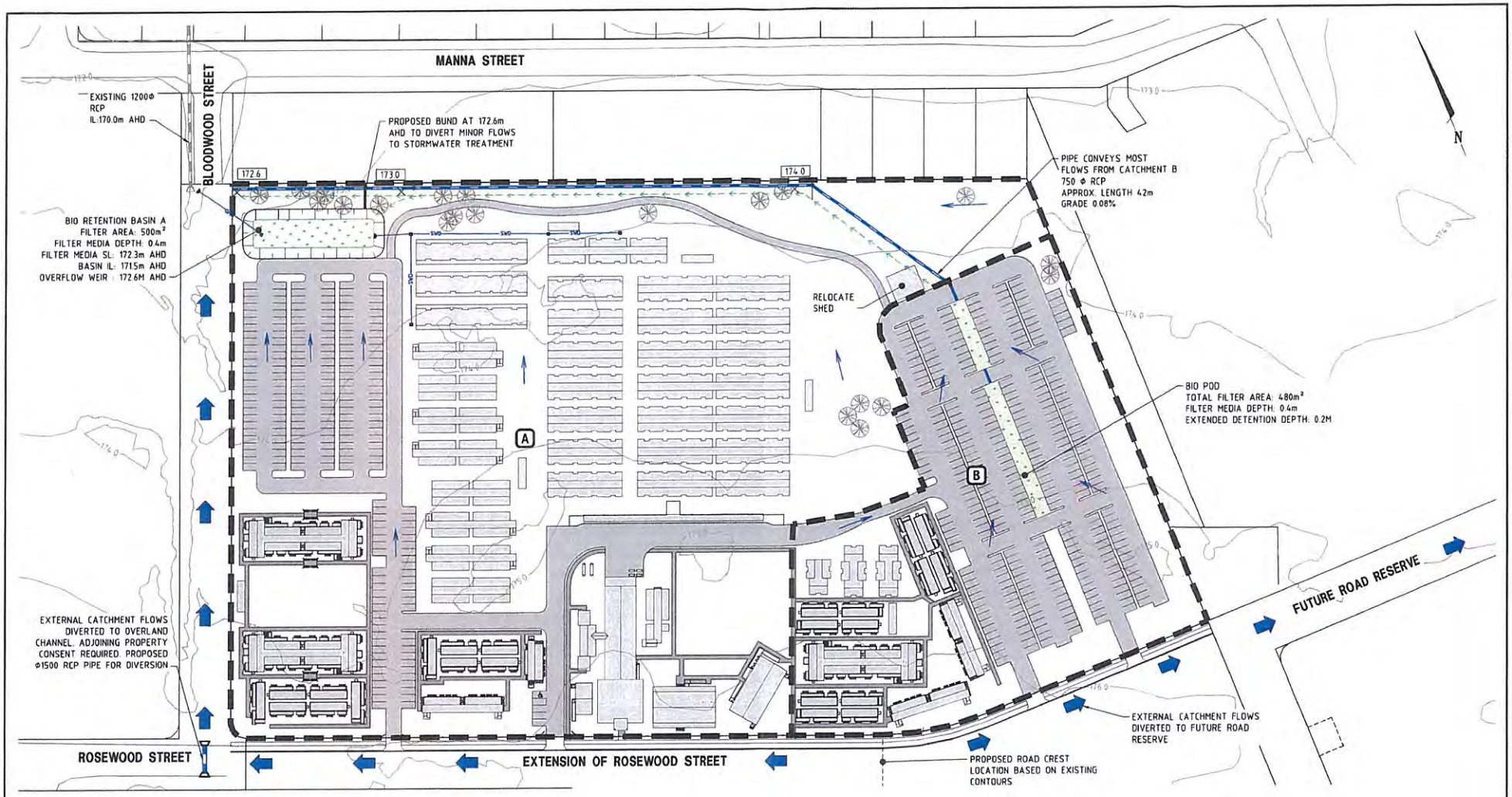
B				
C				
D				
E				
F				

DESIGN CHECK
DRAWN CHECK
SCALE (METRES)
1:2500 50 0 50 100 A1
1:5000 A3
MICROFILM No.
PROJECT No. B12209.W
APPROVED
ANDREW McPHAIL RPEQ 4721
JEFF GRIFFITHS RPEQ 4175
BRENT THOMAS RPEQ 7862
FOR & ON BEHALF OF BROWN CONSULTING (QLD) PTY LTD

CLIENT: QANTAC PTY LTD
PROJECT: ROSEWOOD WORKERS ACCOMMODATION

BROWN Smart Consulting
CONSULT AUSTRALIA
Brown Consulting (QLD) Pty Ltd
Level 4, 199 Grey Street, South Brisbane QLD Australia 4101
Telephone 07 3895 3444 Facsimile 07 3895 3400
Quality Endorsed Company ISO 9001 LRS 4064

DRAWING TITLE: DEVELOPED STORMWATER CATCHMENT PLAN
DRAWING NUMBER: B12209.W-SK02
ISSUE



LEGEND

- EXISTING CONTOURS
- MUSIC CATCHMENT BOUNDARY
- EXISTING STORMWATER DRAINAGE
- CONCEPT SITE DRAINAGE
- PROPOSED PIPE DRAINAGE
- PROPOSED SWALE
- BIO-RETENTION FILTER AREA
- PROPOSED FOOTPATH AREA
- PROPOSED ROAD
- PROPOSED ROOF
- MUSIC CATCHMENT LABEL (A)
- EXTERNAL CATCHMENT FLOWS
- SITE FLOWS

NOTES:

1. LAYOUT OF THE PRELIMINARY STORMWATER QUALITY IMPROVEMENT DEVICES IS CONCEPTUAL ONLY AND PROVIDED AS A GUIDE FOR THE TREATMENT TRAIN AND IS SUBJECT TO DETAILED DESIGN.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH BROWN CONSULTING REPORT NO. B12209.W-01A.
3. SWALE AND PIPE DETAILS INCLUDING PIPE SIZES AND INVERT LEVELS ON THIS DRAWING IS CONCEPTUAL ONLY AND SUBJECT TO DETAILED DESIGN.

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FILE: B12209.W-SK03.dwg DATE: 29-10-2013 TIME: 13:43
Xref's: X_B12209.W_TITLE X_B12209.W_BASE USR: Tim Stevart

ISSUE	CAD/D	DRAWN	DATE	AMENDMENT DETAILS
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B				
C				
D				
E				
F				

DESIGN CHECK
DRAWN CHECK
SCALE (METRES)
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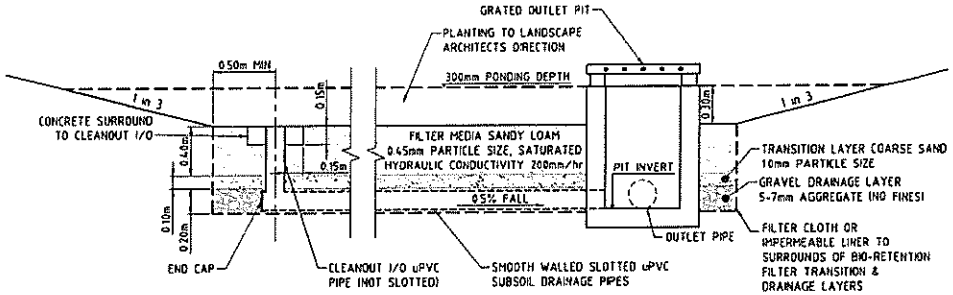
1:1500 A3
MICROFILM No.
PROJECT No. B12209.W
APPROVED ANDREW McPHAIL RPEQ 6921, JEFF GRIFFITHS RPEQ 6175, BRENT THOMAS RPEQ 7862
FOR & ON BEHALF OF BROWN CONSULTING (QLD) PTY LTD

CLIENT: QANTAC PTY LTD
PROJECT: ROSEWOOD WORKERS ACCOMMODATION

BROWN Smart Consulting
CONSULT AUSTRALIA
Brown Consulting (QLD) Pty Ltd
Level 6, 179 Grey Street, South Brisbane QLD Australia 4101
Telephone 07 3095 3444 Facsimile 07 3095 3400
Brisbane Gold Coast Melbourne Sydney Singapore Hamilton Island
Quality Endorsed Company ISO 9001 Lic 4084

DRAWING TITLE: STORMWATER QUALITY MANAGEMENT PLAN
DRAWING NUMBER: B12209.W-SK03
ISSUE



TYPICAL BIO-RETENTION BASIN DETAIL
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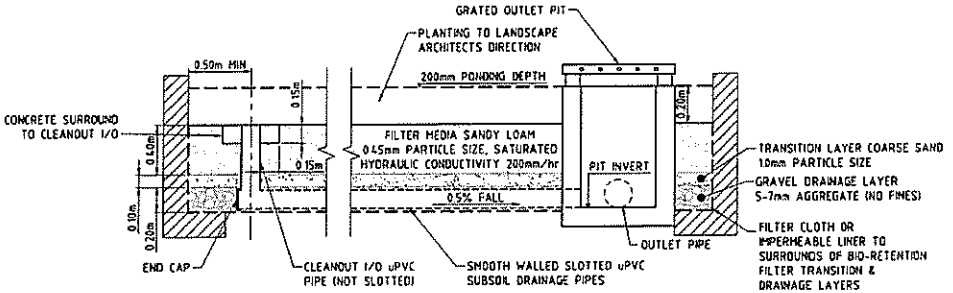
SCALE 1:40 (A3)



TYPICAL BIO POD DETAIL
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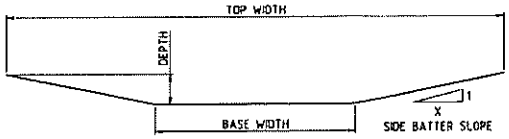

TYPICAL SWALE CROSS SECTION
NTS

VEGETATED SWALE DIMENSIONS

	AVERAGE SLOPE	BASE WIDTH (m)	TOP WIDTH (m)	DEPTH	SIDE BATTER SLOPES (1)
SWALE	0.5%	7	10	0.5	3

NOTES:

1. LAYOUT OF THE PRELIMINARY STORMWATER QUALITY IMPROVEMENT DEVICES IS CONCEPTUAL ONLY AND PROVIDED AS A GUIDE FOR THE TREATMENT TRAIN AND IS SUBJECT TO DETAILED DESIGN

2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH BROWN CONSULTING REPORT NO B12209.W-01A

3. SWALE AND PIPE DETAILS INCLUDING PIPE SIZES AND INVERT LEVELS ON THIS DRAWING ARE CONCEPTUAL ONLY AND SUBJECT TO DETAILED DESIGN

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PRINT SIZE	DRAWN	DESIGN	DATE	AMENDMENT DETAILS
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B				
C				
D				
E				
F				

DESIGN CHECK
DRAWN CHECK
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A1 A3
MICROFILM No.
PROJECT No. B12209.W
APPROVED
CLIENT: QANTAC PTY LTD
PROJECT: ROSEWOOD WORKERS ACCOMMODATION
BROWN Smart Consulting
DRAWING TITLE: SECTIONS
DRAWING NUMBER: B12209.W-SK04
ISSUE