



A Division of Danisman Pty Ltd

Blackwater Accommodation Village  
for the  
Compass Group

Stormwater Management Report



COMPASS  
GROUP

2298-00-019-001

03 May 2012

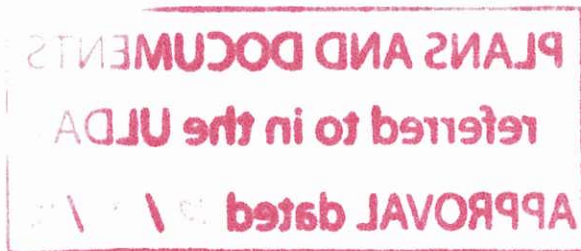
**PLANS AND DOCUMENTS**

**referred to in the ULDA**

**APPROVAL dated 12 / 9 / 12**

## Project Brief

|                    |                                                                                                                                                                                                                                                                                   |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Job Number         | 2298                                                                                                                                                                                                                                                                              |
| Client             | Compass Group (Australia) Pty Ltd                                                                                                                                                                                                                                                 |
| Project            | Blackwater Accommodation Village                                                                                                                                                                                                                                                  |
| Report Brief       | Compass Group intends to develop an Accommodation Village in Blackwater. This Stormwater Management Report has been prepared in support of the Development Application submitted to the Urban Land Development Authority by Murray and Associates on behalf of the Compass Group. |
| Client Contact     | Colin Richardson                                                                                                                                                                                                                                                                  |
| Client Address     | 5 Palmer Place, Murarrie, QLD, 4127                                                                                                                                                                                                                                               |
| Document Reference | 2298-00-019-001                                                                                                                                                                                                                                                                   |



## Document Status

| REV | DATE       | DESCRIPTION                                   | BY  | REVIEW |
|-----|------------|-----------------------------------------------|-----|--------|
| A   | 01/03/2012 | Issued to Client.                             | GJP | TS     |
| B   | 16/03/2012 | Updated to incorporate amended village layout | GJP | TS     |
| C   | 03/05/2012 | Updated to incorporate amended village layout | GJP | TS     |
|     |            |                                               |     |        |



## Disclaimer

This document has been produced on behalf of, and for the exclusive use of the nominated recipient, and is issued for the purposes of the proposed works only. Wave Solutions accepts no responsibility or liability whatsoever in respect to use of this document by any third party.

The information contained within the document is confidential and subject to copyright.

This document shall not be copied, transmitted or divulged to other parties without the prior written consent of Wave Solutions' duly authorised representative.

## CONTENTS

|      |                                                                                        |    |
|------|----------------------------------------------------------------------------------------|----|
| 1    | INTRODUCTION .....                                                                     | 1  |
| 2    | SCOPE OF THIS REPORT .....                                                             | 1  |
| 3    | DESCRIPTION OF THE DEVELOPMENT .....                                                   | 1  |
| 4    | SITE DESCRIPTION .....                                                                 | 2  |
| 5    | GEOLOGY AND SUBSOIL CONDITIONS .....                                                   | 2  |
| 6    | GOVERNING GUIDELINES .....                                                             | 3  |
| 7    | FLOODING .....                                                                         | 3  |
| 8    | STORMWATER MANAGEMENT .....                                                            | 3  |
| 9    | STORMWATER DETENTION .....                                                             | 4  |
| 9.1  | Methodology .....                                                                      | 4  |
| 9.2  | Pre-Development Flows .....                                                            | 4  |
| 9.3  | Post-Development Flows.....                                                            | 6  |
| 9.4  | Stormwater Detention.....                                                              | 7  |
| 10   | STORMWATER QUALITY .....                                                               | 9  |
| 10.1 | Rationale.....                                                                         | 9  |
| 10.2 | Pollutants .....                                                                       | 9  |
| 10.3 | Water Quality Objectives .....                                                         | 9  |
| 10.4 | Construction Phase .....                                                               | 10 |
| 10.5 | Stormwater Quality Modelling.....                                                      | 10 |
| 10.6 | Water Quality Treatment .....                                                          | 12 |
| 10.7 | Mitigated Post-development Results .....                                               | 13 |
| 11   | REFERENCES .....                                                                       | 13 |
|      | Appendix 1: Site Plan Prepared by Jeff Freeman Architects                              |    |
|      | Appendix 2: Drawing 2298-00-000-C-101: Stormwater Catchment Plan                       |    |
|      | Appendix 3: Drawing 2298-00-000-C-102: Conceptual Stormwater Drainage Layout           |    |
|      | Appendix 4: Drawing 2298-00-000-C-103: Detention and Bio-filtration Layout and Details |    |
|      | Appendix 5: Music Layout Diagram and Results                                           |    |

## 1 INTRODUCTION

Compass Group (Australia) Pty Ltd (Compass) has decided to develop an accommodation village in Blackwater in Central Queensland.

It is the intention of Compass to construct a village that can accommodate 452 persons. The village will operate as a standalone commercial enterprise. Compass will develop and operate the village.

The Urban Land Development Authority (ULDA) is responsible for planning and assessing development applications in the area where the development will take place.

Murray and Associates will be responsible for preparing a development application for the subject site.

Wave Solutions (Wave) has been appointed by Compass to prepare a stormwater management report that can be submitted to the ULDA in support of their development application.

## 2 SCOPE OF THIS REPORT

The purpose of this report is to investigate the effects of the proposed development on the stormwater drainage characteristics of the site and to propose appropriate measures to mitigate any detrimental effect that the development may cause.

This Stormwater Management Report addresses the following matters:

- Potential flooding of the site;
- Stormwater management within the development;
- Stormwater detention; and
- Stormwater quality management.

## 3 DESCRIPTION OF THE DEVELOPMENT

The village will be a fully self contained establishment comprising 428 standard rooms, 24 staff rooms, an administrative office, a kitchen/dining facility, a wet mess, 6 laundries, a gymnasium, a recreation facility, communal spaces, a maintenance and bulk store and ablution facilities.

A site layout detailing the abovementioned facilities has been prepared by Jeff Freeman Architects and is included in this report as Appendix 1.



## 4 SITE DESCRIPTION

The site is located on the eastern side of Blackwater, a town situated some 823 km north-west of Brisbane and approximately 197 km west of Rockhampton. The proposed development is located on Lot 6 on SP243869. The longitude and latitude of the site are approximately 148° 53' 44" East and 23° 34' 50" South (approximately 55,693,480m E and 7,390,895m S). The locality of the site is shown on Figure 1 below.



Figure 1: Locality Map

The total area of the site is approximately 3.097 hectares. It is bound in the north, east and south by undeveloped land, and in the west by Rangeview Accommodation Village.

The site is presently undeveloped and covered by trees, shrubs and grass. There are three existing buildings and two small dams on the site.

The site generally slopes from south-west to north-east. The elevation varies between approximately 172.2 metre AHD in the north-eastern corner and approximately 174.5 metre AHD in the south-western corner of the site. The site slopes at approximately 0.75% towards the north-eastern corner. There are no streams traversing the site.

Access to the site will be gained from the future Henderson Street.

## 5 GEOLOGY AND SUBSOIL CONDITIONS

According to the Geological Survey of Queensland's 1:250,000 Series Duaringa Sheet the area where the site is located is underlain by the late to middle Eocene aged Duaringa Formation, typically comprising "mudstone, sandstone, conglomerate, siltstone, oil shale, lignite and basalt".



## 6 GOVERNING GUIDELINES

ULDA Guideline No 13 has been consulted to identify appropriate Engineering Standards and Guidelines.

The Queensland Urban Drainage Manual (QUDM) was used as the primary guideline with regard to stormwater quantity, management and detention and Water Sensitive Urban Design: Technical Design Guidelines for South East Queensland was used as the primary guideline with regard to stormwater quality.

## 7 FLOODING

It has been assumed that stormwater generated within catchment areas of the developments that are about to take place south of the site will be discharged from those developments in a north-eastern direction.

There are no natural waterways that traverse the site and no flood lines apply to the site.

## 8 STORMWATER MANAGEMENT

Stormwater runoff originating from roofs and land within the development area will be intercepted and discharged as described below.

Stormwater pipelines, open channels and associated stormwater drainage infrastructure will be designed to accommodate the minor storm. The major storm will be discharged overland towards the detention basin that will be constructed adjacent to the eastern boundary of the site.

It is proposed that stormwater drainage be planned and designed for the following ARI's:

- For the Major Storm Event System: Design ARI = 100 years; and
- For the Minor Storm Event System: Design ARI = 10 years. This is in accordance with Table 7.02.1 of the Queensland Urban Drainage Manual.

A conceptual layout of stormwater drainage infrastructure has been prepared and is shown on Drawing 2298-00-000-C-102. Refer to Appendix 3. Stormwater catchment areas are shown on Drawing 2298-00-000-C-101, included as Appendix 2.

Stormwater generated within Catchment Area A will be accommodated on the parking area road surface until it is collected by entry pits. It will then flow through an underground pipe system until it is discharged to the detention basin.

Stormwater runoff originating from roofs and land within Catchment Area B2 and C2 will discharge to the detention basin via surface flow.

Stormwater intercepted by roadway areas in Catchment Area B1, C1 and D will be collected by entry pits and be discharged eastward via an underground pipeline system. Stormwater originating from roofs in these areas will flow via downpipes to this underground pipeline system. Entry pits installed along the pipeline routes will collect stormwater originating from land in Catchment Areas B1 and C1.

Stormwater quality improvement devices will be employed to treat the stormwater as described in Section 10 of this report. These devices will include rainwater tanks, vegetated swales, EnviroPods and a bio-filtration basin.

Stormwater detention is addressed in Section 9 of this report.

It is proposed that stormwater be discharged from the north-eastern corner of the site in a north-eastern direction towards Blackwater Creek.

## 9 STORMWATER DETENTION

### 9.1 Methodology

It is proposed to use stormwater detention to ensure that there is “no worsening” effects on downstream properties as a result of increased stormwater flow resulting from an increase of impervious areas and channelling of stormwater flow. This is achieved by detaining increased stormwater runoff on-site, thereby ensuring that any post-development flow discharged does not exceed the pre-development flow.

The method used to size a detention basin as described in Section 5 of the Queensland Urban Drainage Manual (QUDM) has been used to size the detention basin required. Detention volumes were calculated for 1, 2, 5, 10, 20, 50 and 100 year return periods.

The Rational Method has been used to calculate the pre-development and post-development flows. Refer to Sections 9.2 and 9.3 of this report. The method used to size the detention basin is described in Section 9.4 of this report.

### 9.2 Pre-Development Flows

#### 9.2.1 Catchment Area

The stormwater catchment area of the development is 3.097 ha. The area is shown on Drawing 2298-00-000-C-101, included as Appendix 2.



### 9.2.2 Runoff Coefficients

The runoff coefficients used have been calculated in accordance with Section 4.05 of the Queensland Urban Drainage Manual. The coefficients are shown in Table 1 below.

*Table 1: Runoff Coefficients: Pre-development*

|                 | C <sub>1</sub> | C <sub>2</sub> | C <sub>5</sub> | C <sub>10</sub> | C <sub>20</sub> | C <sub>50</sub> | C <sub>100</sub> |
|-----------------|----------------|----------------|----------------|-----------------|-----------------|-----------------|------------------|
| C <sub>10</sub> | 0.60           | 0.60           | 0.60           | 0.60            | 0.60            | 0.60            | 0.60             |
| F <sub>y</sub>  | 0.80           | 0.85           | 0.95           | 1.00            | 1.05            | 1.15            | 1.20             |
| C <sub>y</sub>  | 0.48           | 0.51           | 0.57           | 0.60            | 0.63            | 0.69            | 0.72             |

### 9.2.3 Time of Concentration

The time of concentration for overland sheet flow has been calculated in accordance with Section 4.06.6 of the Queensland Urban Drainage Manual. Friend's Equation has been used. The formula is as follows:

$$t = (107nL^{0.333})/S^{0.2}$$

Where t = Overland sheet flow travel time (minutes)

L = Overland sheet flow path length (m)

n = Horton's surface roughness factor

S = Slope of surface (%)

The time of concentration, calculated as set out above, is 23.1 minutes.

### 9.2.4 Rainfall Intensities

The rainfall intensities in Table 2 below have been calculated in accordance with the Australian Government Bureau of Meteorology Intensity Frequency Duration (IFD) information for the Blackwater area.

*Table 2: Rainfall Intensities: Pre-development*

| 1 Year | 2 Years | 5 Years | 10 Years | 20 Years | 50 Years | 100 Years |
|--------|---------|---------|----------|----------|----------|-----------|
| 63.6   | 82.0    | 104.2   | 117.4    | 135.6    | 160.4    | 179.6     |

### 9.2.5 Pre-development Flows

Table 3 below lists the pre-development flows for ARI 1 year to 100 years, calculated using the Rational Method formula. Peak flows are in m<sup>3</sup>/sec.

*Table 3: Pre-development Flows*

| 1 Year                  | 2 Years                 | 5 Years                 | 10 Years                | 20 Years                | 50 Years                | 100 Years               |
|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| 0.263 m <sup>3</sup> /s | 0.360 m <sup>3</sup> /s | 0.511 m <sup>3</sup> /s | 0.606 m <sup>3</sup> /s | 0.735 m <sup>3</sup> /s | 0.952 m <sup>3</sup> /s | 1.112 m <sup>3</sup> /s |

## 9.3 Post-Development Flows

### 9.3.1 Catchment Area

The catchment area is 3.097 ha as described in Section 9.2.1 of this report. Refer to Drawing 2298-00-000-C-101, included as Appendix 2.

### 9.3.2 Runoff Coefficients

As per the pre-development scenario, the runoff coefficients used have been calculated in accordance with Section 4.05 of the Queensland Urban Drainage Manual. The coefficients are listed in Table 4 below.

*Table 4: Runoff Coefficients: Post-development*

|                 | C <sub>1</sub> | C <sub>2</sub> | C <sub>5</sub> | C <sub>10</sub> | C <sub>20</sub> | C <sub>50</sub> | C <sub>100</sub> |
|-----------------|----------------|----------------|----------------|-----------------|-----------------|-----------------|------------------|
| C <sub>10</sub> | 0.88           | 0.88           | 0.88           | 0.88            | 0.88            | 0.88            | 0.88             |
| F <sub>y</sub>  | 0.80           | 0.85           | 0.95           | 1.00            | 1.05            | 1.15            | 1.20             |
| C <sub>y</sub>  | 0.70           | 0.75           | 0.84           | 0.88            | 0.92            | 1.00            | 1.00             |

### 9.3.3 Time of Concentration

The time of concentration has been calculated in accordance with Sections 4.06.5 and 4.06.7 of the Queensland Urban Drainage Manual. The calculated time of concentration is 7.0 minutes.



### 9.3.4 Rainfall Intensities

As per the pre-development scenario, the rainfall intensities in Table 5 below have been calculated in accordance with the Australian Government Bureau of Meteorology Intensity Frequency Duration (IFD) information for the Blackwater area.

*Table 5: Rainfall Intensities: Post-development*

| 1 Year | 2 Years | 5 Years | 10 Years | 20 Years | 50 Years | 100 Years |
|--------|---------|---------|----------|----------|----------|-----------|
| 93.47  | 120.90  | 154.30  | 175.80   | 203.30   | 241.60   | 271.00    |

### 9.3.5 Post-development Flows

Table 6 below lists the post-development flows for ARI 1 year to 100 years, calculated using the Rational Method formula. Peak flows are in m<sup>3</sup>/sec.

*Table 6: Post-development Flows*

| 1 Year                  | 2 Years                 | 5 Years                 | 10 Years                | 20 Years                | 50 Years                | 100 Years               |
|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| 0.566 m <sup>3</sup> /s | 0.778 m <sup>3</sup> /s | 1.110 m <sup>3</sup> /s | 1.331 m <sup>3</sup> /s | 1.616 m <sup>3</sup> /s | 2.078 m <sup>3</sup> /s | 2.331 m <sup>3</sup> /s |

## 9.4 Stormwater Detention

Four estimation procedures were used to calculate the required detention basin volume, viz. the Culp, Boyd, Carroll and Basha equations. The applicable formulas are:

Culp:  $V_s/V_i = r(1+2r)/3$

Boyd:  $V_s/V_i = r$

Carroll:  $V_s/V_i = r(3+5r)/8$

Basha:  $V_s/V_i = r(2+r)/3$

The basin volume was calculated for the 1, 2, 5, 10, 20, 50 and 100 year ARI's. The calculated detention basin volumes are listed in Table 7 below, and are in cubic metres.

*Table 7: Calculated Detention Basin Volumes*

| Equation | 1 Year | 2 Years | 5 Years | 10 Years | 20 Years | 50 Years | 100 Years |
|----------|--------|---------|---------|----------|----------|----------|-----------|
| Culp     | 117    | 162     | 232     | 283      | 344      | 438      | 465       |
| Boyd     | 170    | 234     | 335     | 406      | 493      | 631      | 683       |
| Carroll  | 121    | 167     | 239     | 290      | 353      | 450      | 479       |
| Basha    | 144    | 198     | 284     | 344      | 419      | 534      | 574       |

The Queensland Urban Drainage Manual states that the above procedures may provide widely different results. The manual further states that Basha's equation produces a result closest to an average of the four methods. The results listed in Table 7 reinforce both these statements.

Based on Basha's equation, a detention basin volume of 574 m<sup>3</sup> is required. A volume of 580 m<sup>3</sup> detention basin has been provided. The proposed location of the detention basin is shown on Drawing 2298-00-000-C-102 (Appendix 3). Drawing 2298-00-000-C-103 (Appendix 4) shows a layout of the detention basin as well as typical sections through the basin.



## 10 STORMWATER QUALITY

### 10.1 Rationale

The underlying principle adopted in preparing this stormwater management plan is that the proposed development should not cause any detriments to the downstream environment. This principle also applies to the quality of stormwater that is discharged to the downstream areas.

### 10.2 Pollutants

Pollutants typically generated during the operational phase of a development of this nature include the following:

- Litter;
- Sediment;
- Oxygen demanding substances (organic and chemical matter);
- Nutrients (nitrogen and phosphorus)
- Hydrocarbons, including oil and grease
- Heavy metals, often associated with fine sediment; and
- Surfactants (e.g. detergents from washing of vehicles);

### 10.3 Water Quality Objectives

The design water quality objectives for the operational phase of the project are summarised in Table 8 below. These objectives are consistent with the stormwater pollutant reductions stipulated in the "Water Sensitive Urban Design Technical Design Guidelines for South East Queensland – Version 1"

*Table 8: Water Quality Objectives*

| Pollutant                    | Load Reduction |
|------------------------------|----------------|
| Total Suspended Solids (TSS) | 80%            |
| Total Phosphorus (TP)        | 60%            |
| Total Nitrogen (TN)          | 45%            |
| Gross Pollutants (GP)        | 100%           |

## 10.4 Construction Phase

Typical pollutants expected to be generated during the construction phase of the development include the following:

- Litter, such as paper, construction packaging, food packaging, cement bags and off-cuts;
- Sediment, emanating from unprotected exposed soils and stockpiles during earthworks and building work;
- Hydrocarbons, caused by fuel and oil spills and leaks from construction equipment;
- Toxic materials, such as cement slurry, asphalt prime, solvents, cleaning agents and wash water; and
- Alkaline substances, caused by cement slurry and wash water.

To minimise and mitigate potential impacts the following actions during the construction phase are proposed:

- Preserve the site in its undisturbed condition as far as possible until construction commences;
- Restrict work activities to designated working areas;
- Undertake all site clearance and earthworks in accordance with approved Erosion and Sediment Control Plans;
- Ensure proper stormwater control during construction;
- Continuous monitoring of erosion, sediment control and stormwater management measures during the construction phase; and
- Immediate action, should any failure of erosion, sediment control and stormwater management measures be discovered during the construction phase.

## 10.5 Stormwater Quality Modelling

Stormwater quality modelling has been undertaken using MUSIC (Model for Urban Stormwater Improvement Conceptualization) software. MUSIC is widely accepted as the industry standard for WSUD modelling.

The model layout is shown in Appendix 5.



Details of each catchment are shown in Table 9 below.

*Table 9: MUSIC Catchment Parameters*

| Catchment                         | Area (ha) | Percentage Impervious |
|-----------------------------------|-----------|-----------------------|
| Catchment Area A                  | 0.340     | 95%                   |
| Catchment Area B1 (Roadway zone)  | 0.255     | 90%                   |
| Catchment Area B1 (Building zone) | 0.625     | 70%                   |
| Catchment Area B2                 | 0.580     | 70%                   |
| Catchment Area C1 (Roadway zone)  | 0.347     | 90%                   |
| Catchment Area C1 (Building zone) | 0.223     | 70%                   |
| Catchment Area C2                 | 0.340     | 70%                   |
| Catchment Area D                  | 0.380     | 90%                   |

All roofs, roadway areas and concrete footpaths have been regarded as being 100% impervious.

MUSIC runoff generation parameters used during modelling are:

*Table 10: MUSIC Runoff Generation Parameters*

| Parameter                           | Urban Residential |
|-------------------------------------|-------------------|
| Field Capacity (mm)                 | 200               |
| Infiltration Capacity Coefficient a | 50                |
| Infiltration Capacity Coefficient b | 1                 |
| Rainfall Threshold (mm)             | 1                 |
| Soil Capacity (mm)                  | 400               |
| Initial Storage (%)                 | 10                |
| Daily Recharge Rate (%)             | 25                |
| Daily Drainage Rate (%)             | 5                 |
| Initial Depth (mm)                  | 50                |

MUSIC base concentration parameters used during modelling are shown in Table 11 below.

*Table 11: MUSIC Runoff Base Concentration Parameters*

| Land Use          | Parameters | TSS Log <sub>10</sub> mg/l |            | TP Log <sub>10</sub> mg/l |            | TN Log <sub>10</sub> mg/l |            |
|-------------------|------------|----------------------------|------------|---------------------------|------------|---------------------------|------------|
|                   |            | Base Flow                  | Storm Flow | Base Flow                 | Storm Flow | Base Flow                 | Storm Flow |
| Urban Residential | Mean       | 1.00                       | 2.18       | -0.97                     | -0.47      | 0.20                      | 0.26       |
|                   | Std Dev    | 0.34                       | 0.39       | 0.31                      | 0.31       | 0.20                      | 0.23       |

The mean annual loads generated by the development and the water quality objectives, based on the stipulated reduction percentages, are shown in Table 12 below.

*Table 12: Unmitigated Post-development Annual Loads*

| Indicator | Unmitigated Post-development Load (kg/yr) | Required Mitigated Post-development Annual Load (kg/yr) | Required Reduction (%) |
|-----------|-------------------------------------------|---------------------------------------------------------|------------------------|
| TSS       | 7,670                                     | 1,534                                                   | 80%                    |
| TP        | 14.8                                      | 5.9                                                     | 60%                    |
| TN        | 71.4                                      | 39.3                                                    | 45%                    |
| GP        | 737                                       | 0                                                       | 100%                   |

## 10.6 Water Quality Treatment

The water quality treatment measures incorporated in the design include rainwater tanks with a total capacity of 20 kl, vegetated swales, the installation of EnviroPods, or approved equivalent devices, into all stormwater entry pits and bio-filtration basins with a total filter surface area of 500 m<sup>2</sup>.

It is intended to use the rainwater stored in the rainwater tanks for irrigation purposes.

EnviroPod filters, which are inserted into stormwater entry pits to filter and remove pollutants before the water enters the underground drainage system, provide effective removal of total suspended solids and gross pollutants.

A bio-filtration basin, which will also fulfil a detention function, is proposed. The basin will have a top surface area of 580 m<sup>2</sup>, a filter surface area of 500 m<sup>2</sup> and a filter depth of 300 mm.

The proposed infrastructure is shown on Drawings 2298-00-000-C-102 and 103, included as Appendices 3 and 4 respectively.



## 10.7 Mitigated Post-development Results

Based on the water quality treatment proposed in Section 10.6 above, the mitigated post-development results, as determined by using MUSIC, are estimated to be as summarized in Table 13 below.

*Table 13: Mitigated Post-development Results*

| Indicator | Post-development Mitigated Load Achieved |       | % Reduction |          |
|-----------|------------------------------------------|-------|-------------|----------|
|           | kg/yr                                    | mg/l  | Required    | Achieved |
| TSS       | 567                                      | 0.729 | 80%         | 92.6%    |
| TP        | 3.29                                     | 0.035 | 60%         | 77.8%    |
| TN        | 39.3                                     | 0.748 | 45%         | 45.0%    |
| GP        | 0                                        | 0     | 100%        | 100%     |

## 11 REFERENCES

Australian Government, Bureau of Meteorology

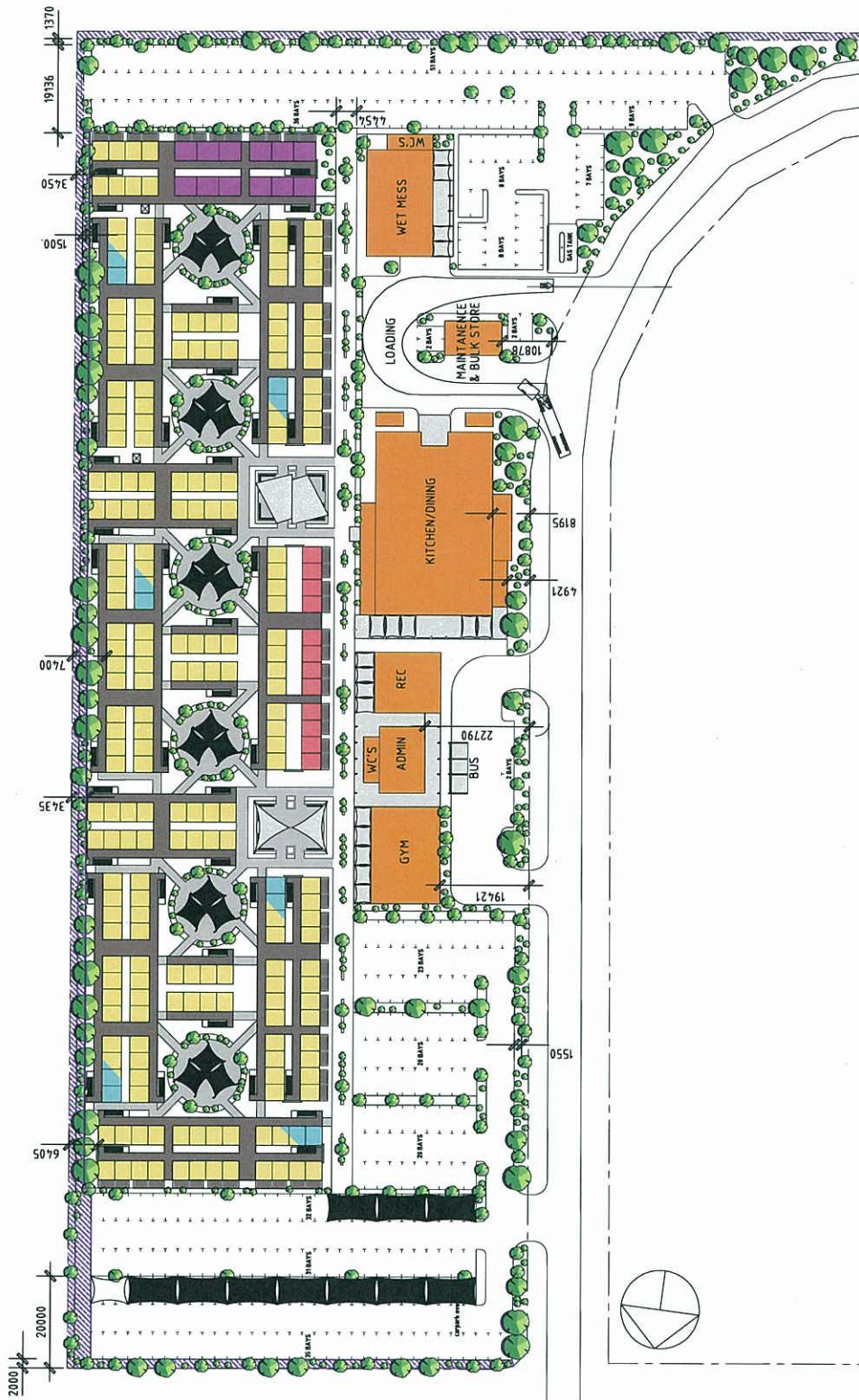
Queensland Government: Queensland Urban Drainage Manual, Volume 1, Second Edition 2007 (QUDM).

ULDA Guideline No 13: Engineering Standards.

Water Sensitive Urban Design: Technical Design Guidelines for South East Queensland, Version 1, June 2006

## Appendix 1: Site Plan Prepared by Jeff Freeman Architects





## Legend

- typical accommodation  
(2 storey 4.2 x 14.4 4 block  
units)
- typical accommodation  
(single storey 4.2 x 14.4 4 block  
units)
- laundry on ground floor with  
typical accommodation above
- staff accommodation  
(2 storey 3.3 x 14.4 3 block  
units)
- total staff rooms = 24
- total typical rooms = 428
- total = 6 laundries

required carparking bays = 315  
total bays provided = 315

drain

## site coverage + GFA

Gross Floor Area -  
wet mess = 367m<sup>2</sup>  
gym = 315m<sup>2</sup>  
rec = 190m<sup>2</sup>  
kitchen = 1209m<sup>2</sup>  
admin = 177m<sup>2</sup>  
maintenance + store = 240m<sup>2</sup>  
laundries = 358m<sup>2</sup>  
accommodation = 7440m<sup>2</sup>  
  
total site area = 30969m<sup>2</sup>  
total site coverage = 6432m<sup>2</sup>  
total landscaped area = 3925m<sup>2</sup>  
(approx)

site plan  
scale 1:500

## Appendix 2: Drawing 2298-00-000-C-101: Stormwater Catchment Plan



PRELIMINARY  
ISSUE

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|

## Appendix 3: Drawing 2298-00-000-C-102: Conceptual Stormwater Drainage Layout





# LEGEND

- EXISTING SURFACE (CONTOUR @ 25m INTERVAL)
- PROPOSED OPEN CHANNEL
- PROPOSED STORMWATER LINE
- DETENTION & BIO-FILTRATION BASIN



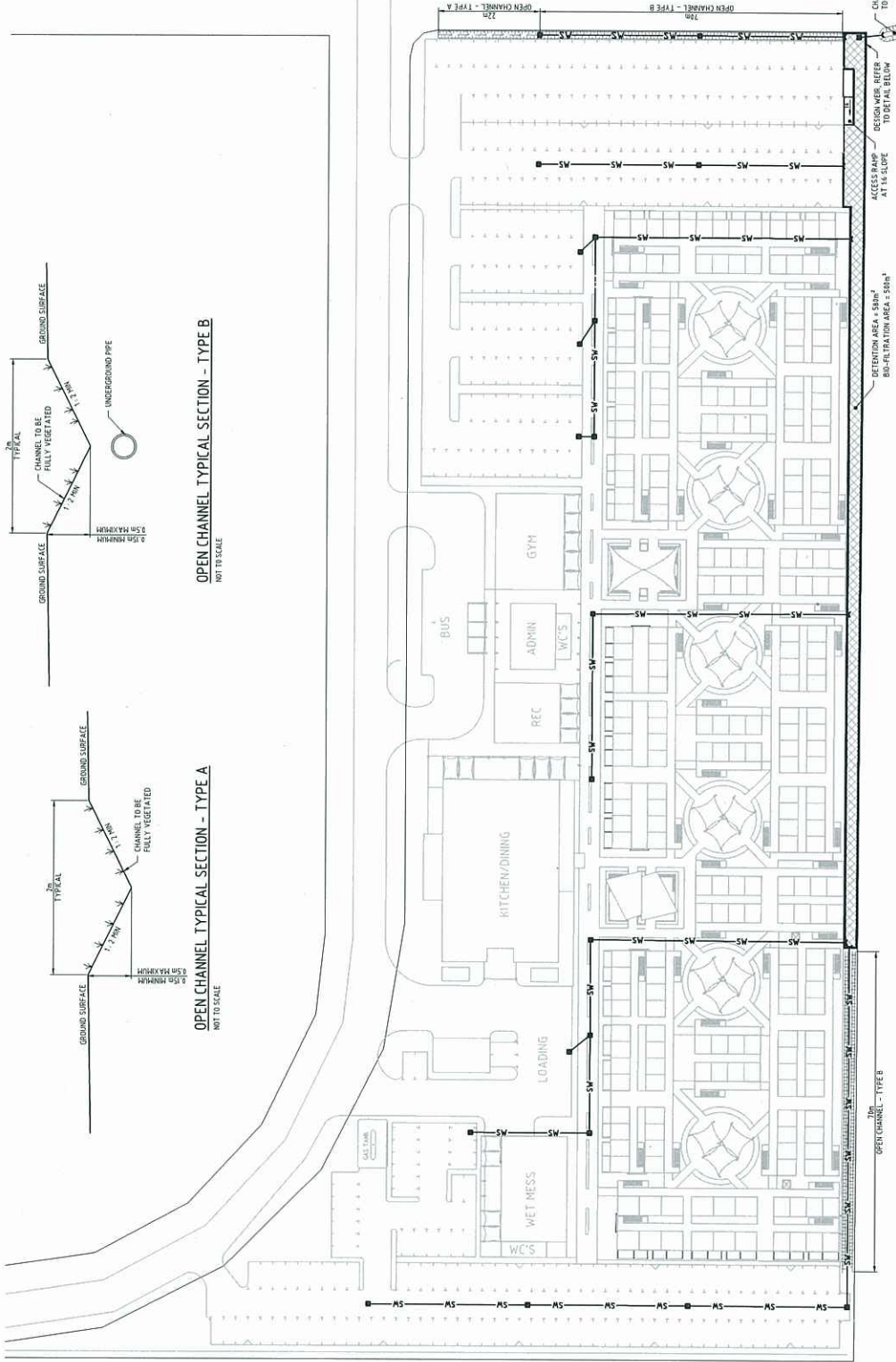
OPEN CHANNEL TYPICAL SECTION - TYPE A

NOT TO SCALE



OPEN CHANNEL TYPICAL SECTION - TYPE B

NOT TO SCALE



PRELIMINARY  
ISSUE



Email: [sales@wave-solutions.co.uk](mailto:sales@wave-solutions.co.uk)  
Website: [www.wave-solutions.co.uk](http://www.wave-solutions.co.uk)

Copyright ©  
This document is the property of Wave Solutions Ltd. It is not to be used for any other purpose without the written consent of Wave Solutions Ltd. All rights reserved.

| DATE       | BY | FOR                              |
|------------|----|----------------------------------|
| 22.03.2012 | SW | CLIENT COMPASS GROUP             |
| 22.03.2012 | SW | BLACKWATER ACCOMMODATION VILLAGE |
| 22.03.2012 | SW | CONCEPTUAL                       |
| 22.03.2012 | SW | STORMWATER DRAINAGE LAYOUT       |
| 22.03.2012 | SW | 2298-00-000-C-102                |

| DATE       | BY | FOR                              |
|------------|----|----------------------------------|
| 09.05.2012 | SW | CLIENT COMPASS GROUP             |
| 14.03.2012 | SW | BLACKWATER ACCOMMODATION VILLAGE |
| 22.03.2012 | SW | CONCEPTUAL                       |
| 22.03.2012 | SW | STORMWATER DRAINAGE LAYOUT       |
| 22.03.2012 | SW | 2298-00-000-C-102                |

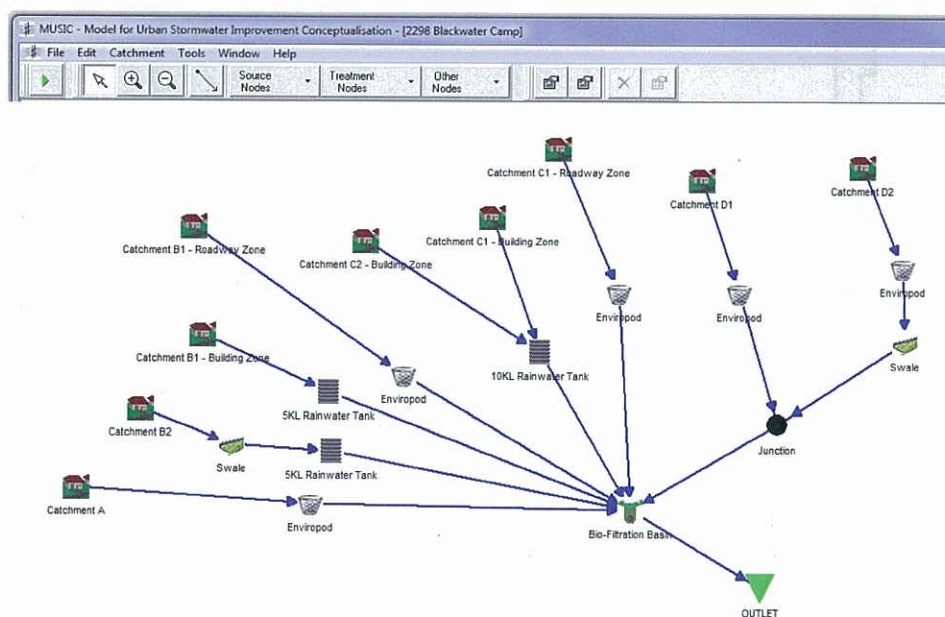
| NO | DESCRIPTION        |
|----|--------------------|
| 1  | REFERENCE DRAINAGE |

## Appendix 4: Drawing 2298-00-000-C-103: Detention and Bio-filtration Layout and Details





## Appendix 5: Music Layout Diagram and Results



### OUTLET

#### Treatment Train Effectiveness

|               | Flow (ML/yr) | TSS (kg/yr) | TP (kg/yr) | TN (kg/yr) | Gross Pollutants (kg/yr) |
|---------------|--------------|-------------|------------|------------|--------------------------|
| Sources       | 34.2         | 7.67E3      | 14.8       | 71.4       | 737                      |
| Residual Load | 33.8         | 567         | 3.29       | 39.3       | 0.00                     |
| % Reduction   | 1.2          | 92.6        | 77.8       | 45.0       | 100.0                    |

### OUTLET

#### Flow-Based Sub-Sample Statistics

|                                     | Inflow  |         |          |         |         |         |          |
|-------------------------------------|---------|---------|----------|---------|---------|---------|----------|
|                                     | mean    | stddev  | median   | maximum | minimum | 10 %ile | 90 %ile  |
| Flow (cubic metres/sec)             | 1.07E-3 | 8.43E-3 | 920E-9   | 0.523   | 0.00    | 0.00    | 340E-6   |
| TSS Concentration (mg/L)            | 1.26    | 2.59    | 0.729    | 87.6    | 0.00    | 0.00    | 2.68     |
| Log [TSS] (mg/L)                    | 67.0E-3 | 0.331   | 6.57E-3  | 1.94    | -8.00   | -0.252  | 0.588    |
| TP Concentration (mg/L)             | 29.2E-3 | 23.0E-3 | 34.7E-3  | 0.350   | 0.00    | 0.00    | 50.3E-3  |
| Log [TP] (mg/L)                     | -1.43   | 0.171   | -1.41    | -0.456  | -8.00   | -1.62   | -1.23    |
| TN Concentration (mg/L)             | 0.573   | 0.377   | 0.748    | 2.08    | 0.00    | 0.00    | 0.905    |
| Log [TN] (mg/L)                     | -0.118  | 0.154   | -87.9E-3 | 0.318   | -8.00   | -0.208  | -33.6E-3 |
| TSS Load (kg/6 Minutes)             | 6.47E-3 | 0.172   | 226E-9   | 13.6    | 0.00    | 0.00    | 335E-6   |
| TP Load (kg/6 Minutes)              | 37.5E-6 | 636E-6  | 10.4E-9  | 48.1E-3 | 0.00    | 0.00    | 6.00E-6  |
| TN Load (kg/6 Minutes)              | 449E-6  | 4.85E-3 | 250E-9   | 0.343   | 0.00    | 0.00    | 104E-6   |
| Gross Pollutant Load (kg/6 Minutes) | 0.00    | 0.00    | 0.00     | 0.00    | 0.00    | 0.00    | 0.00     |