Wingate Properties Pty Ltd

332 Ripley Road, Ripley

Stormwater Management Plan for Proposed Service Centre Development Application Phase December 2012

Project Name:	Stormwater Management Plan for Proposed Service Centre, 332 Ripley Road, Ripley
Project Number:	3310045E
Proposal for:	Wingate Properties

PREPARATION, REVIEW AND AUTHORISATION

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1 INTRODUCTION

1.1 General

This Stormwater Management Plan (SMP) has been prepared on behalf of Wingate Properties (Client) in support of a Development Application for a proposed service centre at 332 Ripley Road, Ripley.

1.2 Scope

This report describes the stormwater management proposal to demonstrate compliance with design codes of Ipswich City Council (ICC) which are summarised below:

1. Development of a stormwater treatment train suitable to achieve the pollutant reduction targets of ICC, all ensuring that the quality of stormwater to be discharged into downstream drainage systems does not degrade the environmental values of downstream waterways;
2. Hydraulic calculations of flowrates, pre- and post-development, and on-site detention volume (OSD), demonstrating no increase in peak flow;
3. Demonstration of a legal point of discharge;
4. Maintenance provisions for the treatment devices, to be implemented by the owners of the site;
5. Construction phase requirements.

2 DESCRIPTION OF SITE

2.1 Characteristics Of Site

The site is described as the Lot 1 on SP150064 located at 332 Ripley Road, Ripley, Queensland. The site comprises an area of approximately 15.9ha, with the service station itself covering an area of approximately 1.7ha.

The site is accessed from Ripley Road via the Cunningham Highway westbound off-ramp. From the southern boundary, stormwater runoff flows north-easterly towards an existing stormwater flow path alignment as defined in Ipswich City Council Temporary Local Planning Instrument Flooding Regulation – Overlay Map OV5. An aerial view of the site is shown in Figure 2.1 below.

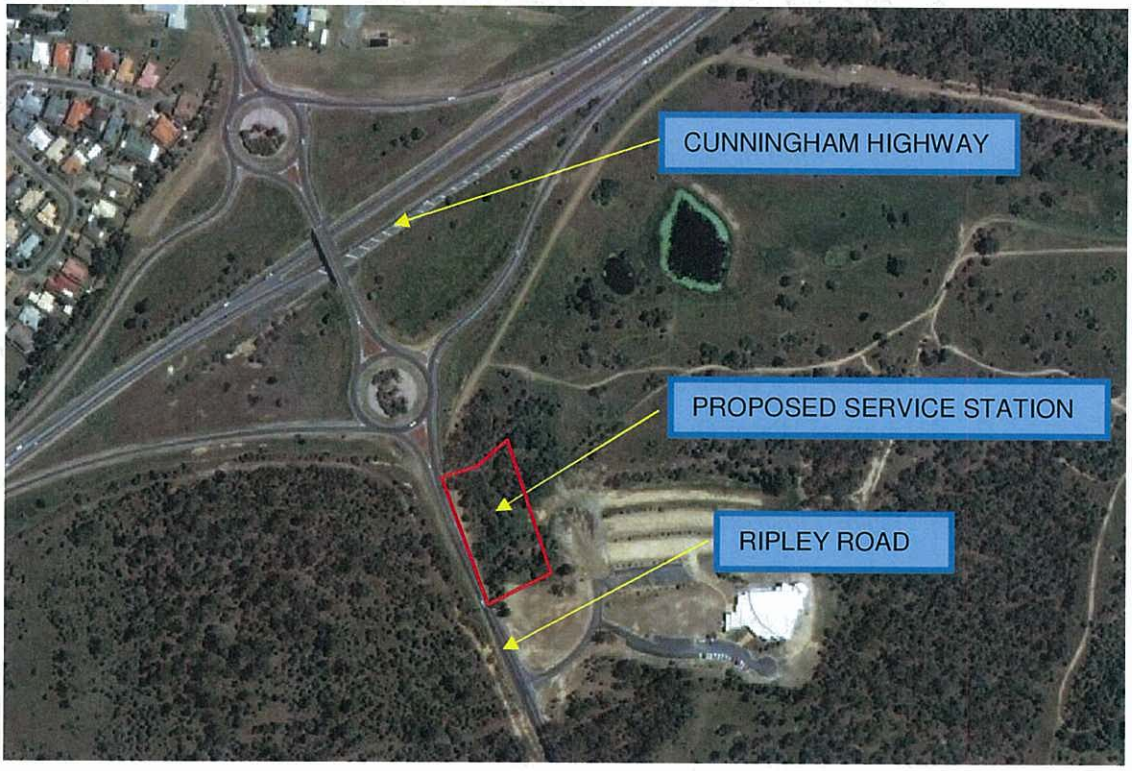


Figure 1: Aerial Photo of the Proposed Service Centre site

2.2 Development Proposal

As described in Section 1.1, it is proposed to construct a service station consisting of a travel centre building, sheltered fuel service area, car park, fast food facility, fuel storage area, playground and truck re-fuelling area.

The stormwater quality management strategy proposes a rainwater harvesting tank to enable the ruse of roof water on site as well as a number of bio-retention basins. The bio-retention basins will also incorporate additional detention volume to mitigate the increase in site discharge due to the proposed development.

3 STORMWATER QUALITY MANAGEMENT

3.1 Policies and Codes

The City of Ipswich Planning Scheme Policy 3 – General Works, Part 2 Division 3 – Water Quality Control states that "*The Local Government is committed to minimising erosion and sedimentation , and the degradation of surface and groundwater quality which can result from development, both during and after construction. Effective water quality control involves-*

a. *implementation of Stormwater Quality Best Management Practices;*
b. *integration of water quantity, water quality and waterway corridor issues into the design of both permanent and temporary water quality control measures;*
c. *programming of works to minimise erosion potentials; and*
d. *a commitment to the monitoring and maintenance of water quality control measures.*

Water Quality Control measures can be divided into two categories-

1. *Temporary Water Quality Control (Off Stream)-*
   a. *These measures are required to control and filter the runoff from areas disturbed during construction.*
   b. *These are typically erosion and sediment control measures and should preferably be the first items constructed when work begins.*
2. *Permanent Water Quality Control (On Stream)-*
   a. *These works are to be implemented to control runoff water quality beyond the initial construction and maintenance stages.*

Stormwater Quality Management Strategy:

1. *Development that is likely to have a significant adverse impact on water quality is to compile and submit a Water Quality Management Plan that details the temporary and permanent methods of water quality control that are to be included in the development.*
2. *For developments which are likely to have a significant adverse impact on water quality, relevant water Quality Objectives as outlined in Table 2.3.1 are to be nominated and the temporary and permanent methods for water quality control to ensure that these objectives will be satisfied are to be identified on the Water Quality Management Plan.*
3. *Water Quality Objectives are the "standards" that describe the quality of stormwater that is required to be achieved prior to its discharge from a development site."*

The Acceptable Solutions to this are:

A Stormwater Management Plan which is prepared for the site in accordance with the Stormwater Management and Water Quality Guidelines demonstrates that:

(a) Stormwater is treated prior to discharge into the wetland or waterway;

(b) Stormwater is discharged at appropriate areas of the waterway;

(c) The velocity and quality of stormwater to be discharged into the wetland or waterway does not degrade the environmental values of the wetland or waterway;

(d) The development will not impact on the geo-hydrology affecting the wetland or waterway.

The purpose of the Planning Scheme Policy referred to the *Integrated Planning Act (1997),* which seeks to achieve ecological sustainability by managing the effects of development on the environment. This includes ensuring that decision-making processes take account of short and long-term environmental effects of development at local, regional, State and wider levels and apply the *precautionary principle* as stated in Section 1.2.3 of the Act.

The Policy proposes that there are three stages of stormwater & water quality management planning, comprising:

1. Identification of Water Quality Objectives (WQO), Performance Criteria and Risk Assessment;
2. Stormwater Management Strategy– estimation of pollutants loads and overall conceptual planning; and
3. Stormwater Management Plan (SMP) - a detailed management plan addressing major risks, key pollutants and site specific or development specific issues.

The Policy states that it is critical that planning for stormwater management and treatment is conducted in conjunction with the initial planning phases for a development site. Consideration should be given to:

1. Site constraints and opportunities;
2. Required protection of drainage lines, waterway corridors and wetlands;
3. The level of stormwater treatment required;
4. The area of land required to treat stormwater;
5. Water Sensitive Urban Design and stormwater reuse opportunities;
6. The siting and location of treatment measures; and
7. The cost and timing of works.

3.2 Design Objectives

The proposed strategy is to reduce pollutant loading for the development using the principles of Water Sensitive Urban Design (WSUD). One of the primary roles of WSUD is to reduce the impacts of urban development on receiving water quality.

The following load-reduction best practice targets have been adopted for the post-developed site treatment train (comparison of unmitigated developed case to developed mitigated case):

- 80% reduction in Total Suspended Sediment (TSS);
- 60% reduction in Total Phosphorus (TP);
- 45% reduction in Total Nitrogen (TN); and
- 90% reduction in Gross Pollutant (GP) load.

As pollutant export modelling typically focuses on nutrient and sediment transport during the post-construction phase, these pollutants will be the main focus of modelling assessments.

3.3 Design Strategy

To simulate a treatment train suitable of achieving the aforementioned WQO's, the conceptual modelling package Model for Urban Stormwater Improvement Conceptualisation version 5.1.16 (MUSIC) developed by the Catchment Research Co-operative for Catchment Hydrology (CRCCH) was used. Water quality modelling using the MUSIC program has been conducted in accordance with Water by Design's *MUSIC Modelling Guidelines* [WD, 2010].

The MUSIC network is provided as Appendix C, and can be summarised as follows:

1. The new Retail Building roof area is to drain to an underground Rainwater Harvesting Tank (RWT). This is for both internal and external uses, as discussed further in Section 4. Overflows are to be collected in piped drainage and treated as per point 2 below; and

2. Runoff from all areas is proposed to be conveyed via a pipe network and as surface runoff to the proposed bio-retention basins, locations of which are proposed as per the plan provided as Appendix B.

3.4 Modelling Parameters

The MUSIC model has been setup using the procedures outlined in Water by Design's guidelines.

Rainfall inputs consider the continuous simulation of ten years of pluviograph rainfall data from the Greenbank Rainfall Station (station #40659) for the period 1980 to 1989. A six (6) minute time step has been utilised as this allows for the appropriate definition of storm hydrograph movement through small-scale stormwater treatment processes such as the bio-retention systems.

Evapotranspiration data also for station #40659 has been adopted and is presented in Table 1.

Table 1 – Monthly Evapotranspiration

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Evapotranspiration (mm)	190	152	150	105	75	60	65	80	107	150	175	190

A *Commercial* source node has been chosen to model the proposed development with nodes further defined based on the proposed land-uses, being roof, road and general ground areas.

The parameters used for the storm event concentrations for the source nodes are based on the MUSIC Modelling Guidelines for South East Queensland by Healthy Waterway, displayed in Tables 2 and 3 below.

Table 2 – Rainfall-runoff parameters

Parameter	Commercial
Rainfall Threshold (mm)	1
Soil Capacity (mm)	18
Initial Storage (%)	10
Field Capacity	80

Parameter	Commercial
Infiltration Capacity Coefficient a	243
Infiltration Capacity Coefficient b	0.6
Initial Depth (mm)	50
Daily Recharge Rate (%)	0
Daily Baseflow Rate (%)	31
Daily Deep Seepage Rate (%)	0

Table 3 – Stormwater Water Quality Parameters for MUSIC Source Nodes - Commercial

Land Use Category		Log_{10} TSS (mg/L)		Log_{10} TP (mg/L)		Log_{10} TN(mg/L)	
		Storm Flow	Base Flow	Storm Flow	Base Flow	Storm Flow	Base Flow
Road	Mean	2.43	0.78	-0.3	-0.6	0.37	0.32
	Std Dev	0.38	0.39	0.34	0.5	0.34	0.30
Roof	Mean	1.30	0.00	-0.89	0.00	0.37	0.00
	Std Dev	0.38	0.00	0.34	0.00	0.34	0.00

3.5 Treatment Devices

3.5.1 Rainwater Harvesting Tanks

As well as reducing the demand on potable water as further discussed in Section 7.2.6, the collection of roof runoff will reduce catchment stormwater quantities through the utilisation of tank water for residential irrigation and non-potable use.

The use of rainwater tanks will enable separation of "clean" roof runoff from the hardstand runoff. Any overflows from the tanks will be discharged to the local stormwater pipe network and onto the bio-retention basins

3.5.2 Bio-retention Basins

Bio-retention systems are defined as 'modified infiltration basins that treat stormwater through adsorption, filtration, volatilisation, ion exchange and microbial decomposition.' Selection of appropriate filter media is a function of the infiltration rate required and the vegetation for the bio-retention system. The modelling takes into account that the hydraulic conductivity assumed must be considered with regard to ponding of runoff above the filtration medium. Hence a lower infiltration rate – and thus higher detention time – could be utilised where ponding will increase the volume of runoff that can be treated.

Also to be considered in selection of filter media is the intention for landscaping within the bio-retention area. In this case, the basin is assumed to involve shallow depth planting species with roots being able to reach (but not further than) a depth of 500mm. A typical cross-section for a bio-retention basin is included as Figure 2. Basin dimensions/parameters are included as Table 4 below.

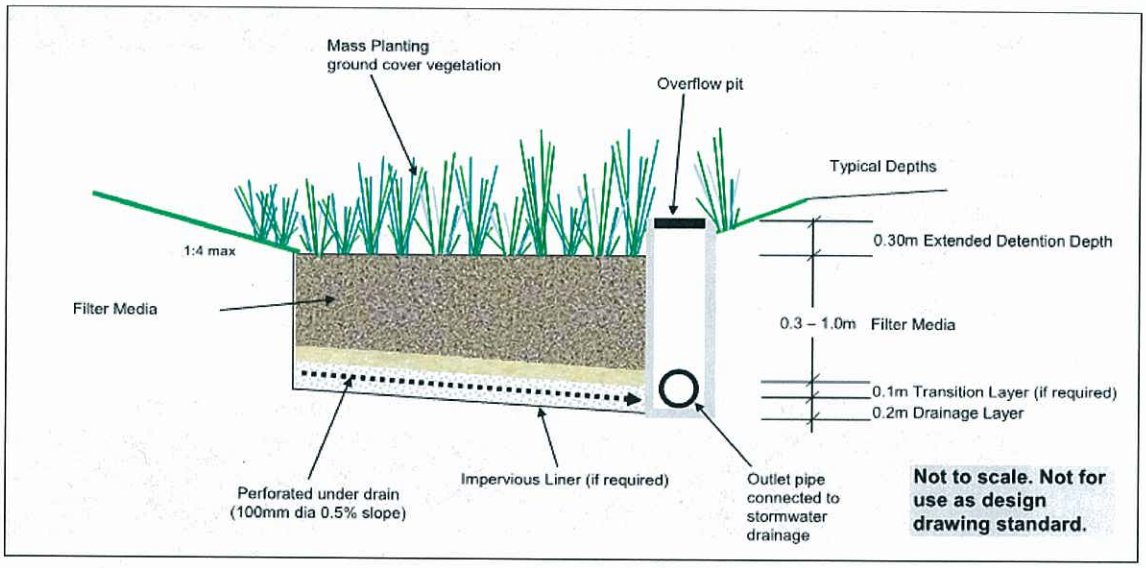


Figure 2: Typical Bio-retention Cross-section (FAWB 2009)

3.6 Developed Treated Case

Based on the modelling of the development's proposed treatment train layout, the proposed bio-retention basin features are as follows:

Table 4 – Bio-retention Basin Details

Basin Parameter	Basin A	Basin B	Basin C
Filter Surface Area (m^2)	95	50	60
Storage Surface Area (m^2)	95	50	60
Extended Detention Depth (m)	0.2	0.2	0.2
Saturated Hydraulic Conductivity (mm/hr)	200	200	200
Filter Media Depth (m)	0.5	0.5	0.5
TN Content of filter Media (mg/kg)	800	800	800
Othophosphate Content of filter Media (mg/kg)	50	50	50

Table 5 demonstrates the pollutant reduction achieved with the proposed treatment train.

Table 5 – MUSIC Model Pollutants Results

Pollutants	Sources	Residual	Reduction (%)
Total Suspended Solids (kg/yr)	3.83E3	747	80.5
Total Phosphorus (kg/yr)	6.80	2.26	66.8
Total Nitrogen (kg/yr)	34.0	17.4	48.7
Gross Pollutants (kg/yr)	271	13.3	95.1

The above table demonstrates that the proposed stormwater quality improvement devices will meet or exceed the target reductions in pollutants.

4 MAINTENANCE OF TREATMENT DEVICES

4.1 Rainwater Harvesting Tanks

Rainwater tanks are recommended to have a regular preventative maintenance process. A typical recommended maintenance program may include:

1. 6-monthly inspections of roof areas and gutters to ensure they are relatively free of leaves and debris;
2. Vegetation and trees that overhang the roof may need to be pruned;
3. First flush devices should be checked and cleaned out once every 3-6 months;
4. Bypass screens at inlet and overflow points should be inspected each 6 months to check for fouling and cleaned as required;
5. Every 2-3 years, tanks should be checked for accumulation of sludge. Sludge may become a problem if it is deep enough to reach the level of the out take pipe and so produce discoloured or sediment-laden water, or when it affects storage capacity. When necessary, sludge can be removed by vacuum, by siphon, by suspending the sludge and washing it through, or by completely emptying the tank.
6. If a pump system is used, the pump manufacturer should be consulted for advice on necessary maintenance.

4.2 Bio-retention Basins

The vegetation within a bio-retention device plays a vital role in maintaining the porosity of the filter media and a strong healthy growth of vegetation is critical to its performance. The asset custodian will need to undertake on-going maintenance of the bio-retention device, and this comprises the tasks described below.

The typical maintenance requirements of the bio-retention devices are as follows:

1. Regular watering/irrigation of vegetation until plants are established and actively growing;
2. For the first two years from completion of the works, as this is the typical plant establishment period, weed removal and replanting may be required;
3. Inflow systems and overflow pits require careful monitoring, as these can be prone to scour and litter build up. Debris can block inlets or outlets and can be unsightly, particularly in high visibility areas. Inspection and removal of debris should be done regularly, and debris should be removed whenever it is observed on a site.
4. Routine inspection of the bio-retention device profile to identify any areas of obvious increased sediment deposition, scouring from storm flows, rill erosion of the batters from lateral inflows, damage to the profile from vehicles and clogging of the bio-retention basin (evident by a 'boggy' filter media surface);
5. Removal of sediment where it is smothering the bio-retention basin vegetation;
6. Where a sediment forebay is adopted, removal of accumulated sediment;
7. Repairing any damage to the profile resulting from scour, rill erosion or vehicle damage by replacement of appropriate fill (to match onsite soils) and revegetating;
8. Tilling of the bio-retention basin surface, or removal of the surface layer, if there is evidence of clogging;

9. Removal and management of invasive weeds (herbicides should not be used);
10. Removal of plants that have died and replacement with plants of equivalent size and species as detailed in the plant schedule included in the Landscape Assessment Report;
11. Pruning to remove dead or diseased vegetation material and to stimulate growth; and
12. Vegetation pest monitoring and control.

A complete reconstruction of the bio-retention devices is required if the system fails to drain adequately after tilling of the surface has occurred. Maintenance should only occur after an extended rain free period when the soil in the bio-retention system is dry. Inspections are also recommended following large storm events to check for scour and other damage.

A Bio-retention Basin Maintenance Checklist is provided in Appendix D of this report.

5 WATER TANK SIZING REQUIREMENT

Pursuant to the Queensland Development Code (QDC) *Part MP4.3 - Alternative Water Sources – Commercial Buildings* [DHPW, 2008], the installation of rainwater tanks is required as part of all new *class 3-9* developments.

As per acceptable solution A3 of Part MP4.3, a water harvesting volume of 1.5kL (minimum) per pedestal is required for the purposes of re-use within the area of the development.

At the time of writing, the building designers have proposed 11 WC's and 2 wall hung urinals. Therefore 20kL of water harvesting volume is proposed for re-use on the site.

As per Acceptable Solution A8, the water storage tanks are to be connected to:

(a) Each required pedestal;

(b) an external use;

(c) washing machine cold water taps; and

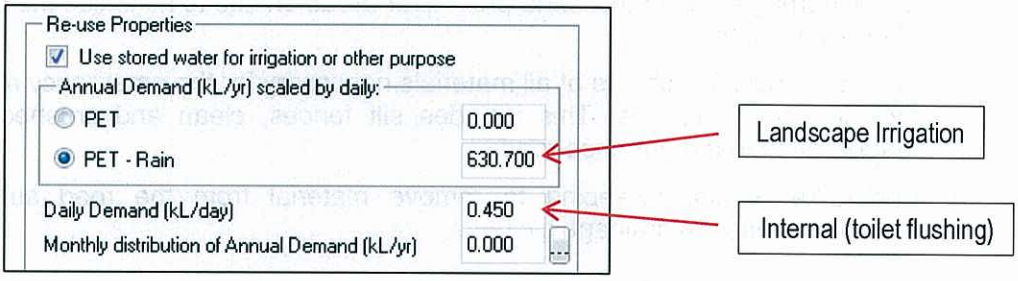
(d) other fixtures as specified by the local government in a local planning instrument.

It is proposed as a minimum to use harvested water for irrigation and toilet flushing within the development site. Calculations for irrigation rates as simulated in the MUSIC modelling are based on Water by Design's *MUSIC Modelling Guidelines,* and considers that 50% of the landscaped areas receives an annual irrigation application of 0.548m.

Internal re-use was calculated considering the following:

- minimum 100 people per day using toilet facilities (it is believed this is a conservative underestimation and is significant enough to warrant its inclusion in the model so as to reduce the need for other treatment devices); and
- Average flush being 4.5L (considers both half and full flushes of 3L and 6L respectively).

On this basis the following re-use was applied to the rainwater tank node in the MUSIC model:



6 CONSTRUCTION PHASE REQUIREMENTS

Table 6 illustrates the typical types of pollutants generated during the construction phase of developments. It is important that these are managed appropriately to ensure that downstream environments are not degraded due to the development of this site.

Table 6 – Typical Pollutants Generated During the Construction Phase

Pollutant	Sources	Priority
Litter	Paper, construction packaging, food packaging, cement bags, off-cuts	High
Sediment	Unprotected exposed soils and stockpiles during earthworks and building works	High
Hydrocarbons	Fuel and oil spills, leaks from construction equipment and temporary carpark areas	High
Toxic materials	Cement slurry, asphalt primer, solvents, cleaning agents, washwaters (e.g. from tile works)	Medium
Acid or Alkaline substances or producing substances	Acid sulfate soils, cement slurry and washwaters	High

It shall be the responsibility of the developer, through their principal contractor, to ensure that temporary sediment and erosion controls are installed and maintained correctly.

For this development, the following Erosion and Sediment Control plan is proposed:

1. Establish a single stabilised entry/exit point for the site works, preferably not in the location of the proposed permanent driveway;
2. Construct a shake-down grid at the entrance to facilitate the removal of sediment from vehicles leaving the site. The access road extending from the kerb to the grid should be comprised of 150-200mm deep pad of 40mm crushed rock;
3. Install sediment fences along site boundary.
4. Install garbage bins and/or wind-proof litter areas on-site to minimise the dispersion of gross pollutants;
5. Maintain stockpiles on site of all materials necessary for the emergency repair of all erosion control devices. This includes silt fences, clean and crushed rock for reapplication to the entrance road;
6. Undertake regular sweeping to remove material from the road surface and minimise impact on drainage system.

In addition, the following should be addressed while constructing the proposed bio-retention basin.

1. Do not construct or place filter media into trenches until all construction works that will add to sediment runoff have ceased onsite, or
2. Place filter media within device and place a suitable geofabric over the media along with 50 mm of shallow top soil and instant turf laid perpendicular to the flow path. This can then easily be removed prior to the final device planting. Sedimentation fences are to be located around the device to exclude silt and restrict access.

7 LOCAL DRAINAGE IMPACT

7.1 Peak Flow Policy

There are a number of sections within the ICC Planning Scheme which requires that flow from the post-developed site be limited to that prior to development.

Note 2.1.1A of Planning Scheme Policy 3 – General Works, Part 2 – *Stormwater Drainage states that "(1) The design of the proposed drainage system is to ensure that the upstream drainage is not adversely affected and that the downstream drainage system is capable of adequately catering for the discharge of the additional flow produced as a result of the development; and (2) I f the downstream system is not capable of carrying the increased discharge, measures are to be proposed to ensure the downstream system is capable of carrying the increased discharge, measures are to be proposed to ensure the downstream system is capable of carrying the increased discharge or the stormwater is to be detained on the site."*

Note 51 of Planning Scheme Policy 2 – Information Local Government May Request indicates that *".....(4) If the downstream system is not capable of carrying the increased discharge, measures are to be proposed to – (a) ensure that the downstream system is capable of carrying the intended discharge (which may included upgrading the existing downstream system); or (b) indicated the method of detention of stormwater on the site."*

7.2 Calculations Of Flow Rate And Required OSD Volume

As required by the scope, the outflows from the proposed development will need to be attenuated such that post-development peak flow rates at the legal point of discharge are no greater than those occurring under existing conditions.

Pre-development and post-development stormwater peak flow rates (Rational Method) have been calculated based on the standard procedures in the Queensland Urban Drainage Manual (QUDM) [QUDM, 2008]. Parameters required for runoff calculation were derived considering the following:

- Impervious and pervious areas of the catchments – based upon site inspection and assessment of aerial photography;
- Slopes of the catchment - based upon detailed site survey and proposed grading; and
- Roughness of the catchment - based upon site inspection and aerial photography QUDM has been used for calculating the existing and proposed peak flow rates by the Rational Method.
- Rainfall Intensity Frequency Duration (IFD) Parameters - derived from the Bureau of Meteorology (BoM) [BoM, 2012], as shown in Appendix A.

Table 7 – Rational Method for Discharge Calculation based on QUDM

Scenario	Rational Method Parameter					Q100 Flowrate (m^3/s)
	Area (ha)	Fraction Impervious	C_{10}	Time of Concentration, tc (min)	Rainfall Intensity (mm/hr)	
Pre-dev.	1.708	0.00	0.7	13.5	221	0.88
Post-dev.	1.708	0.83	0.86	7.9	273	1.29

The results show that the peak flow will increase from 0.88m^3/s in the pre-development case, to 1.29m^3/s in the post-developed (unattenuated) case, with an increase of 47%.

Flood storage is proposed to sufficiently retain runoff such that the total peak runoff rate and volume released during a rainfall event is not greater than would have been the case prior to development. The post-development peak flow needs to be reduced by 0.41m^3/s using On-Site Detention (OSD). Initial sizing of the detention basin has been calculated using the following equation 5.04 of QUDM:

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

V_i = the inflow volume = $4.t_c.Q_i / 3$ and

r = the reduction ratio = $(Q_i - Q_o) / Q_i$

The results show that an attenuation volume of 201m^3 is required. The OSD can be accommodated by providing an additional depth of ponding above the extended detention depth in the bio-retention basins of 300mm as well as 100mm of ponding within the recreation and caravan/boat parking area.

7.3 Legal point of discharge

Runoff from the site is proposed to be piped into the existing flow path located to the north-east of the site.

8 CONCLUSION

This report demonstrates that the relevant stormwater management requirements as prescribed by the state and local government have been satisfactorily complied with.

The water quality treatment train considers stormwater harvesting and re-use as well as bio-retention basins. The basins have been positioned to best capture runoff from the various sub-catchments within the site while allowing for optimal use of the site for its intended purpose.

Through the use of OSD the development can manage the increase in runoff from the site such that post-development rates mimic pre-development conditions.

9 REFERENCES

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- [DHPW, 2008], Department of Housing and Public Works, *Queensland Development Code, Part MP4.3 - Alternative Water Sources – Commercial Buildings*, October 2008.
- [QUDM, 2008] Natural Resources and Water, Queensland Urban Drainage Manual – Second Edition, 2008.
- [WD, 2010], Water by Design, MUSIC Modelling Guidelines for South East Queensland, 2010.
- [WD, 2006], Water by Design, Water Sensitive Urban Design (WSUD) Technical Design Guidelines for Southeast Queensland, 2006.

APPENDIX A: IFD TABLE FOR RIPLEY

Intensity-Frequency-Duration Table

Location: 27.650S 152.775E NEAR.. Ripley, Queensland Issued: 20/9/2011

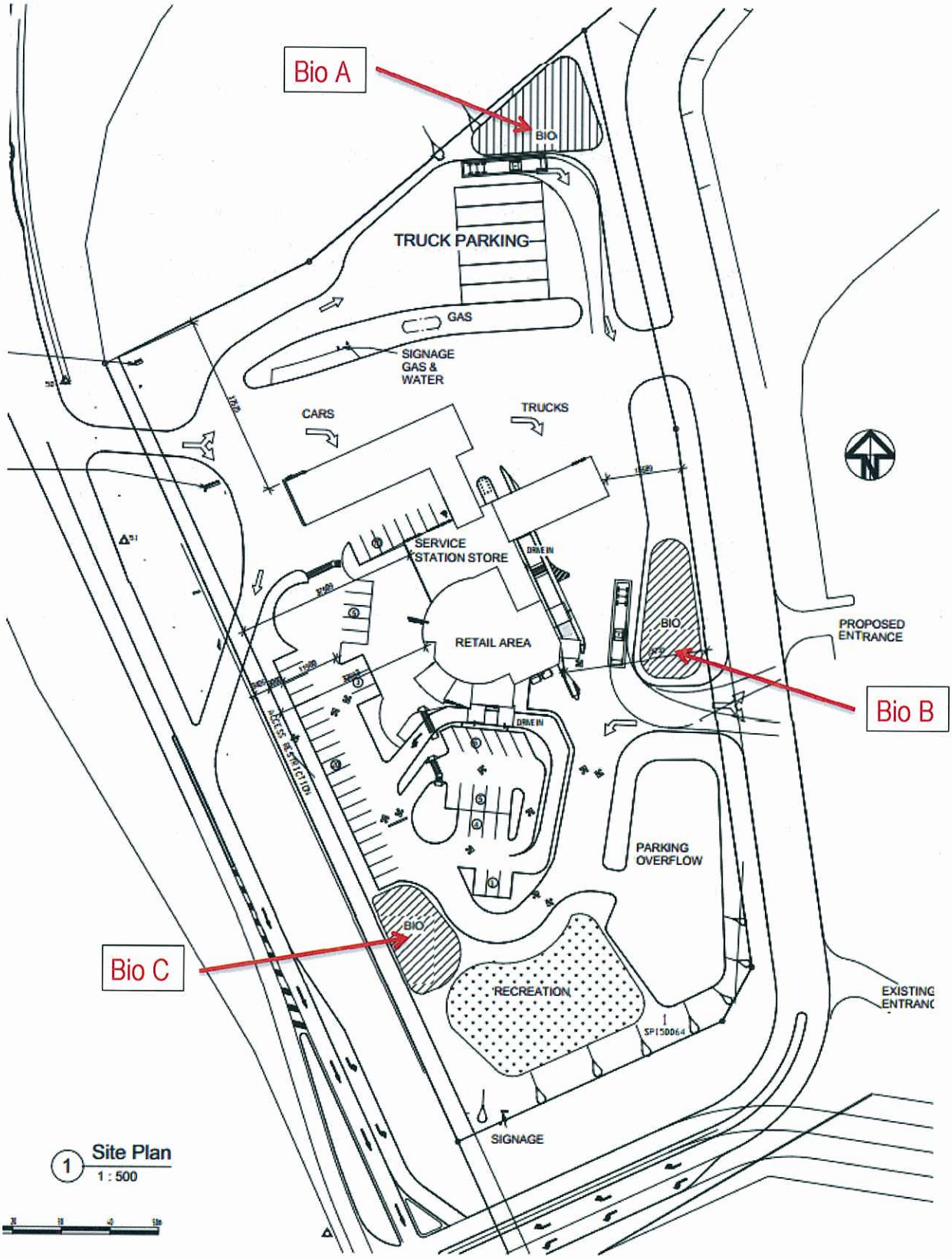
Rainfall intensity in mm/h for various durations and Average Recurrence Interval

Average Recurrence Interval

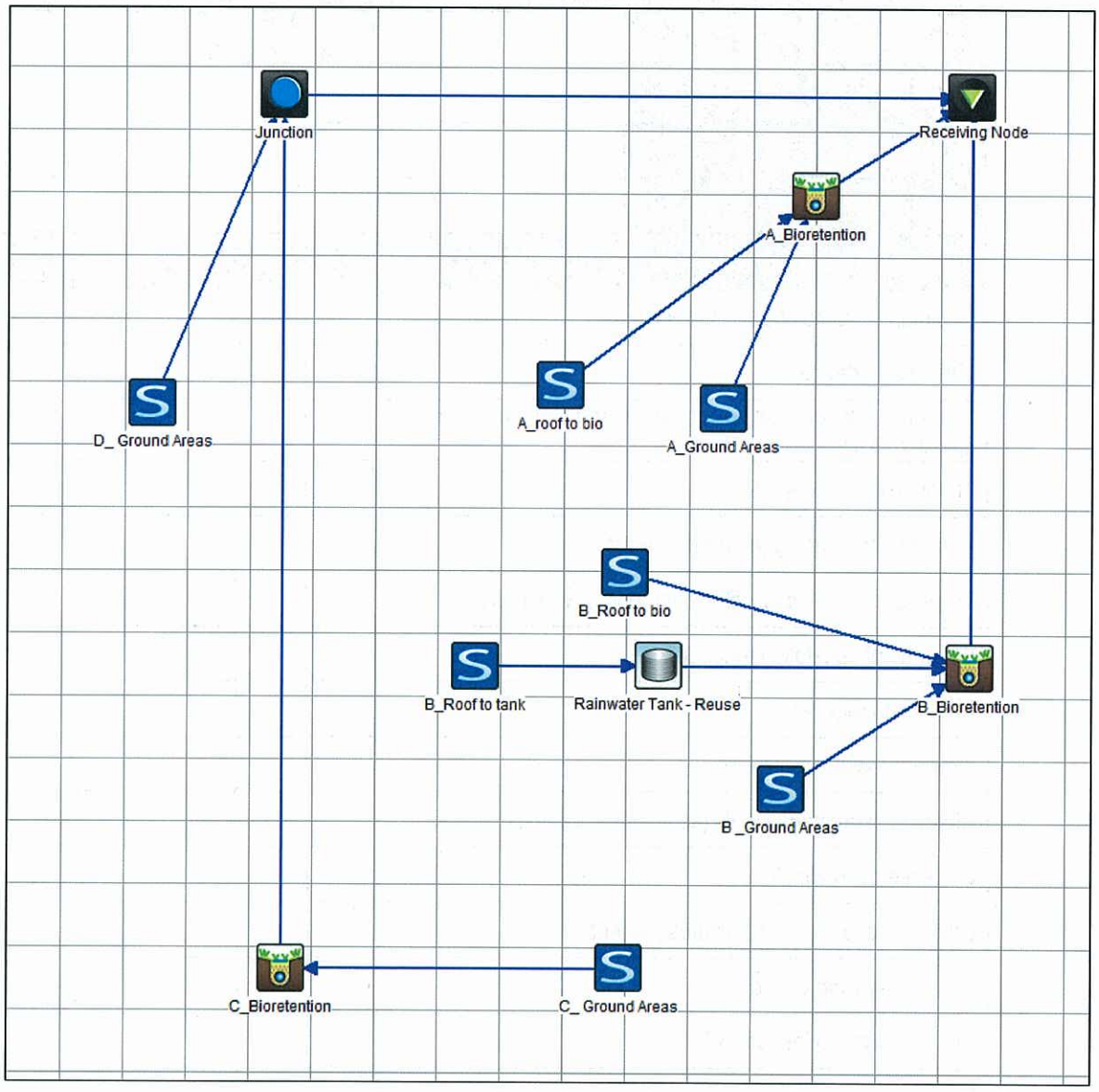
Duration	1 YEAR	2 YEARS	5 YEARS	10 YEARS	20 YEARS	50 YEARS	100 YEARS
5Mins	112	144	183	208	240	284	319
6Mins	104	134	171	194	224	265	298
10Mins	84.9	110	141	160	185	220	247
20Mins	62.8	81.5	105	120	140	167	188
30Mins	51.1	66.4	86.3	98.6	115	138	155
1Hr	33.8	44.0	57.6	66.2	77.5	93.0	105
2Hrs	20.8	27.1	35.8	41.2	48.4	58.3	66.2
3Hrs	15.2	20.0	26.4	30.5	35.9	43.3	49.3
6Hrs	8.89	11.7	15.5	18.0	21.2	25.7	29.3
12Hrs	5.28	6.94	9.28	10.8	12.8	15.5	17.7
24Hrs	3.26	4.28	5.74	6.68	7.91	9.62	11.0
48Hrs	2.00	2.63	3.54	4.12	4.88	5.94	6.79
72Hrs	1.44	1.88	2.53	2.95	3.51	4.27	4.88

(Raw data: 45.6, 7.02, 1.92, 91.4, 14.81, 4.09, skew=0.20, F2=4.39, F50=17.13)

APPENDIX B: BIO-RETENTION BASIN LOCATION PLAN



APPENDIX C: MUSIC SCHEMATIC



APPENDIX D: BIO-RETENTION MAINTENANCE CHECKLIST

Bio-retention Basin Maintenance Checklist			
Inspection frequency:		Date of visit:	
Location:			
Description:			
Site visit by:			

Inspection items	Y	N	Action required (details)
Sediment accumulation at inflow points?			
Litter within device?			
Erosion at inlet or other key structures (eg crossovers, near splash rocks)?			
Traffic damage present?			
Evidence of dumping (eg building waste)?			
Vegetation condition satisfactory (density, weeds etc)?			
Watering of vegetation required?			
Replanting required?			
Mowing/slashing required?			
Clogging of drainage points (sediment or debris)?			
Evidence of ponding?			
Damage/vandalism to structures present?			
Surface clogging visible?			
Drainage system inspected?			
Resetting of system required?			
Comments:			