RobertBirdGroup

EXALLOS GROUP

SPECIALIST ENGINEERING

Site Based Stormwater Management Plan

for

Cnr Water and Brunswick Street, Fortitude Valley

Lot 1 on RP42507, Lots 1, 5, 6 & 13 on RP81335, Lot 1 on RP10553 & Lots 11 & 12 on RP10552.

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Appendices

Appendix A: **Proposed Phase 1 Podium Plan by Bureau Proberts**

Appendix B: **Concept Stormwater Management Plan by Robert Bird Group**

Appendix C: **Concept Erosion and Sediment Control Plan by Robert Bird Group**

Appendix D: **Brisbane City Council's Erosion Hazard Assessment Form**

Appendix E: **MUSIC Modelling Results Summary**

Appendix F: **BCC's Stormwater Management Code Response and State Planning Policy 4/2010 Healthy Waters - Urban Stormwater Management Code**

1.0 Purpose of Document

This document has been prepared as part of the Development Application submission for a proposed mixed use development located at the corner of Water Street and Brunswick Street, Fortitude Valley.

The purpose of this report is to address the stormwater quantity and quality issues at a conceptual level for the proposed development.

This report was prepared using information obtained from the following sources:

- Part detail survey on corner of Water Street and Brunswick Street, Fortitude Valley prepared by RPS Australia East Pty Ltd, dated 6 October 2011
- Architectural Plans prepared by Bureau Proberts
- Brisbane City Council eBimap information
- Dial-Before-You-Dig (DBYD) services
- Site investigation
- Initial assessment of local flooding issues for Project Waters site prepared by Cardno dated 4 November 2011

2.0 Introduction

2.1 Project Description

The proposed development is on land described as Lot 1 on RP42507, Lots 1, 5, 6 & 13 on RP81335, Lot 1 on RP10553 & Lots 11 & 12 on RP10552.

The site is bound by Brunswick Street to the west, Water Street to the south, residential allotments on the north-eastern boundary and commercial development on the northern boundary. Diggles Close also terminates at the north eastern corner of the site.

The subject site is presently fully developed with commercial buildings and a large on-grade carpark that occupied more than half of the site.

There is a former military drill hall located adjacent to the site's northern boundary which is a heritage listed building and will be retained.

The proposed development is located within the Bowen Hills Urban Development Area (UDA). Under the UDA Land Use Plan, the site is classified as Precinct 4 - Water Street Precinct.

The total area of the existing site is 12,849m².

The proposed redevelopment will comprise a mixture of residential, retail and commercial space.

The proposal will also include a road extension of Diggles Close to Water Street.

Table 2.1 – Pre Development Land Characteristic Summary

	Impervious Area (m^2)	Pervious Area (m^2)	Total Catchment Area (m^2)
Pre-development	10,994	1,855	12,849

Note: The pervious and impervious areas for the existing development are derived from the detail survey plan prepared by RPS dated 6/10/2011. Refer Section 6.3 for more details on the pre development scenario.

Table 2.2 – Post Development Land Characteristic Summary

	Impervious Area (m^2)	Pervious Area (m^2)	Total Catchment Area (m^2)
Post-development	11,564	1,285	12,849

Note: It has been assumed that the overall re-developed site will have approximately 10% pervious area. The assumption has been discussed and confirmed with the landscape architect.

2.2 Erosion Hazard Risk Assessment

According to BCC's Subdivision and Development Guidelines and the completed Erosion Hazard Assessment Form, the proposal is classified as a "high risk" development for erosion potential. Refer Appendix D for a copy of the completed form.

2.3 Study Team

The study team preparing this conceptual SBSMP is the Robert Bird Group, consulting engineers and the plan is being prepared on behalf of the developer, Metro Property Development Pty Ltd.

3.0 Site Characteristics

3.1 Location

The street address for the site is 68 Water Street, Fortitude Valley. The site location is shown in Figure 3.1 below.

Figure 3.1 - Site Location

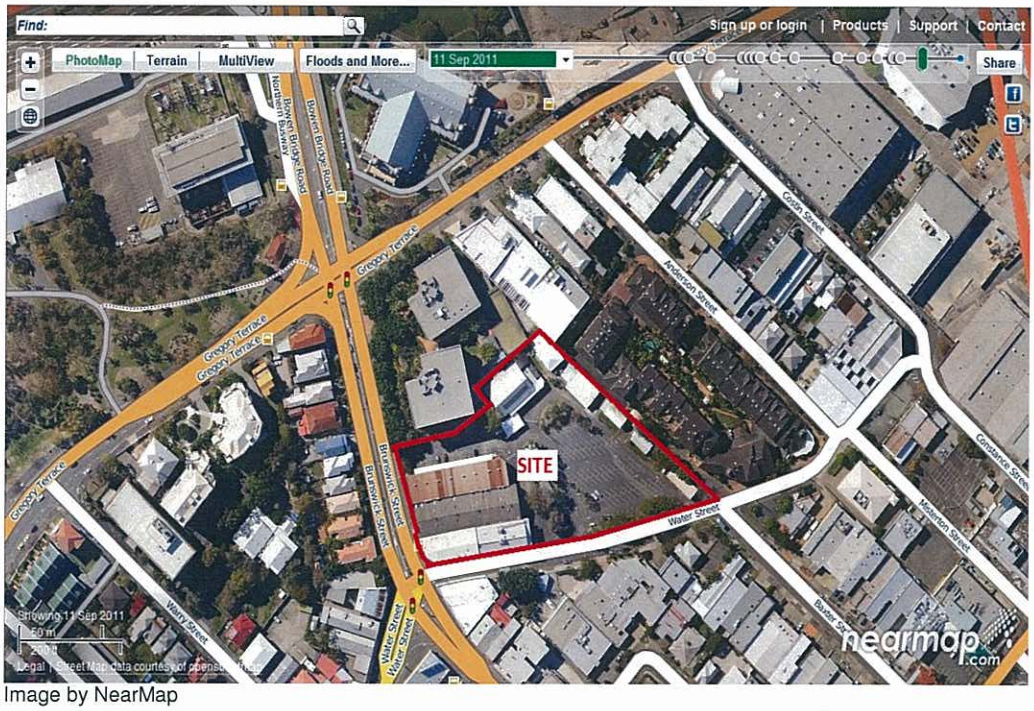


Image by NearMap

3.2 Topography and Site Drainage

Currently half the site is covered by sealed on grade carparking areas and the remaining half of the site is occupied by numerous small buildings scattering the eastern portion of the site and 3 retail/commercial buildings which front Brunswick Street.

Rainfall runoff from the roofs of the existing buildings and the sealed car parking area is believed to discharge to Water Street via a combination of piped and overland flow.

Survey contour information shows the carpark on the site falls from the north to the south-east at grades that vary from 3% to around 10%.

According to aerial imagery and eBimap information, the site appears to have a very small local upstream catchment and therefore is not considered in the context of this report.

There is existing Council stormwater infrastructure located in Water Street.

3.3 Soils

There is no geotechnical report available at the time of preparation of this report.

According to the Brisbane City Council's eBimap information system, the site is not in an acid sulphate soil (ASS) area.

Acid Sulfate Soils (ASS's) are usually found below RL 5.0m AHD. Excavation for the bottom basement will go down to approximately RL 2.5m AHD. This is below RL 5m AHD, therefore ASS's may be encountered.

In the event that future testing for ASS's indicate that ASS's do exist on the site, a suitable Acid Sulphate Soils Management Plan will be developed by an appropriately qualified consultant and implemented to minimise any potential impacts due to the disturbance of ASS's.

3.4 Waterway Corridor

The site is over 700m from the Breakfast Creek and is therefore considered to be outside any Brisbane City Council designated waterway corridor (30m from high-water mark in built up areas). Under the Brisbane City Council eBimap, the site is not affected by any other waterway corridors. Therefore, no further consideration of waterway corridor issues has been documented in this SBSMP.

4.0 Site Data

4.1 Information

Water quantity and quality assessments have been based upon:

- Brisbane City Council (BCC) eBimap information.
- Brisbane City Council FloodWise Property Report.
- Brisbane City Council Water Quality Objectives.
- Brisbane City Council Website.
- Satellite imagery from Google Earth and Nearmap.
- Bureau Proberts Architecture Plans.
- Part detail survey on corner of Water Street and Brunswick Street, Fortitude Valley prepared by RPS Australia East Pty Ltd, dated 6 October 2011.

4.2 Existing Stormwater Infrastructure

According to the Survey Plan produced by RPS and Brisbane City Council's eBimap information the following stormwater infrastructure is located in the vicinity of the site.

The existing stormwater system consists of the following:

- A stormwater gully pit (L15092246) located on the northern side of the Water Street adjacent to the site's south-west corner where it intersects with Brunswick Street. Stormwater gully pit L15092246 connects to stormwater gully pit (L15092629) to the south on the eastern side of the Brunswick Street at the same intersection via a 100mm diameter stormwater pipe. The stormwater gully pit L15092629 then connects to stormwater manhole (L15003719) close by. An unknown stormwater pipe connects the stormwater manhole L15003719 to the 1275 x 2150mm stone arch channel which runs along the middle of the intersection.
- From the intersection, the 1275 x 2150mm stone arch channel continues in an easterly direction along the centre of Water Street. A stormwater manhole (L15003723) is located over the stone arch channel at the centre of Water Street adjacent to Lot 11 on RP10552.
- A stormwater gully pit (L15145921) located on the southern side of Water Street adjacent to Lot 1 on RP42507. Stormwater gully pit L15145921 connects via a 750mm diameter stormwater pipe to a stormwater manhole (L15003724) to the north which is located over the 1275 x 2150mm stone arch channel.
- The 1275 x 2150mm stone arch channel discharges into a 1650 x 2075mm stone arch channel through stormwater manhole (L15000116). The 1650 x 2075mm stone arch then runs along centre of Water Street towards north-east direction. This stormwater manhole is located on the centre of the Water Street where Baxter Street intersects.
- 2 stormwater gully pits (L15092259 and L15092260) are located on the each side of Diggles Close adjacent to the site's north-east boundary. Stormwater gully pits L15092259 and L15092260 are connected to a stormwater manhole nearby via a 300mm diameter stormwater pipe and an unknown stormwater pipe respectively.
- From this manhole, a 525mm diameter stormwater pipe runs towards the south-east into Easement B on RP881617 along site's north-east boundary. 2 stormwater field inlets (L15011785 and L15011786) are located along this 525mm diameter pipe in Easement B on RP881617. This 525mm diameter pipe then connects to a stormwater manhole (L15011787) located on the driveway in Lot 2 on RP881617 (Easement No. 700829619). From manhole L15011787, the stormwater pipe continues to run in a south easterly direction via a 750mm stormwater pipe and connects to a stormwater manhole (L15011788) located next to the kerb and channel on the driveway crossover that connecting Water Street. Manhole L15011788 is connected to manhole L15000116 (as mentioned above) on Water Street via a 750mm stormwater pipe.
- A field inlet is located on the south-east corner of the existing carpark adjacent to the site's southern boundary. This field inlet is connected to a gully pit (L15092248) on the northern side of Water Street via a 110mm stormwater pipe. Gully pit L15092248 then connects to another gully pit (L15092249) on the direct opposite (Southern side of the Water Street) via a 300mm diameter stormwater pipe. From gully pit L15092249, a 300mm diameter stormwater pipe then runs to the east and discharges to the stormwater gully pit (L15092273) which located on the western side of the Baxter Street where intersects with Water Street.

It is proposed that the piped (minor) stormwater drainage system from the site will be connected to the existing stormwater infrastructure in Water Street.

Further details will be provided at the operational works stage.

4.3 Water Quantity

The Brisbane City Council's FloodWise Property Report for the site indicates part of the subject site is located within an overland flow path which flows along Water Street. The BCC's flood flag map for Fortitude Valley shows the overland flow path occurs within Water Street .

According to the initial assessment of local flooding issues for Project Waters site prepared by Cardno dated 4 November 2011, the Project Waters site is located within the Water Street catchment which is a highly urbanised catchment with an inadequate stormwater drainage system. The Cardno's assessment indicates that when significant overland occurs will cause flooding to the properties fronting the street.

The finished floor levels and carpark ramp entry levels of the development will be designed to be above the minimum levels in accordance with BCC's SDG's.

Further details will be provided at the operational works stage.

4.4 Water Quality

Based on the Queensland Government EPA's "A city-wide assessment of water quality in Brisbane's creeks" October 1999-April 2000, water quality in Breakfast Creek was noted as being poor.

According to the assessment, concentrations of most nutrient fractions were exceeded, and dissolved oxygen concentrations were below the water quality objectives.

The assessment also indicated that the major source of nutrients in this creek was likely to be water from the Brisbane River via tidal exchange.

Prevention from further water quality degradation is therefore a high priority to ensure protection of Breakfast Creek.

5.0 Stormwater Management – Opportunities and Constraints

5.1 Site Opportunities

The proposed redevelopment enables a number of opportunities to address any impacts that the proposal may have on the quantity and quality of the stormwater discharging from the subject site.

The opportunities identified are as follows:

- **Stormwater Quantity**
  - The collection of roofwater runoff in rainwater tanks which may, for example, be used for toilet flushing, landscape irrigation and topping up of swimming pool purposes. Rainwater harvesting can reduce the quantity of stormwater being discharged into the natural waterways. This can also assist with reducing the site's demand on an external water supply.

- **Stormwater Quality**
  - Implementation of SQID's, for this project; bio-retention planter boxes, gross pollutant traps (GPT's) and rainwater tanks as appropriate to reduce the levels of pollutants in stormwater being discharged from site.
  - It is proposed that runoff from access ramps and cars is to be collected and treated in a silt arrestor, the water will then be pumped to the stormwater system.
  -

- **Groundwater**
  - Groundwater is considered within the context of this report, in terms of the opportunities for stormwater quantity management (i.e. using groundwater recharge techniques) or potential constraints (i.e. high groundwater levels).
  - If a drained basement design is proposed, all groundwater entering the basement and perimeter subsoil drainage system is to be collected. It is recommended that the quality of the water is tested (by a suitable qualified consultant) and if the results are satisfactory, the water may be pumped to the stormwater system. If the water quality results prove unsatisfactory the developer is to either install a suitably designed package treatment plant or enter a trade waste agreement with Council and discharge the water to the sewer (current Council policy permitting).

5.2 Site Constraints

The proposed redevelopment presents specific constraints. Generally sites of this nature would result in the following:

- Limited areas on site to implement Stormwater Quality Improvement Devices (SQID's) due to the nature of the development (i.e. the maximum utilisation of space for residential & commercial areas, and car parking spaces etc).
- The footprint of the development which consists of basement carpark, which normally restricts the use of deep planting zones.

6.0 Stormwater Quantity Assessment

6.1 Flooding Objectives

The proposed finished building floor levels and carpark access will be designed to be in accordance with the latest flood immunity freeboard requirements as documented in Brisbane City Council's Subdivision and Development Guidelines and the initial assessment of local flooding issues for Project Waters site prepared by Cardno dated 4 November 2011.

6.2 Stormwater Quantity Modelling Approach

Stormwater runoff quantity has been considered for both pre-development and post-development scenarios. Modelling of stormwater runoff has been undertaken using the Rational Method of calculation.

6.3 Pre-Development Scenario

The subject site is presently occupied by commercial buildings and a large area of on-grade carpark. The pre-development scenario has therefore been based on the site's current usage of the land.

The existing site consists of approximately 10,994m^2 impervious area and 1,855m^2 pervious area. Summary of the site's pre-development stormwater discharge parameters used are as listed below:

- Steps for obtaining coefficient of discharge for 1 in 10 year ARI storm event (C10) are listed below:
  - Fraction Impervious (fi) = 0.85
  - One hour rainfall intensity for a 1 in 10 year ARI = 70mm/hr
  - C10 = 0.87 (Queensland Urban Drainage Manual (QUDM) 2007 – Table 4.05.3(a))
- Time of concentration (tc) = 5 minutes

Table 6.3 below summarises peak flows from the existing site.

Table 6.3 - Pre-development Site Hydrology

Average Recurrence Interval - ARI (years)	Runoff Coefficient - C	Rainfall Intensity - I (mm/hr)	Peak Flow - Q (m^3/s)
1	0.696	117	0.291
2	0.740	151	0.399
5	0.827	191	0.564
10	0.870	215	0.668
20	0.914	248	0.809
50	1.000	291	1.039
100	1.000	325	1.160

6.4 Post-Development Scenario

At the time of preparing this report, there is no final landscape plan available. However, the landscape architect has discussed that the proposed development may conceptually have 10% of the site as pervious area. The summary of the site's post-developed stormwater discharge parameters are listed below:

- Steps for obtaining coefficient of discharge for 1 in 10 year ARI storm event (C10) are listed below:
  - Fraction Impervious (fi) = 0.9
  - One hour rainfall intensity for a 1 in 10 year ARI = 70mm/hr
  - C10 = 0.88 (Queensland Urban Drainage Manual (QUDM) 2007 – Table 4.05.3(a))

- Time of concentration (tc) = 5 minutes

The following Table 6.4 summarises peak flows from the proposed development.

Table 6.4 - Post-development Site Hydrology

Average Recurrence Interval - ARI (years)	Runoff Coefficient - C	Rainfall Intensity - I (mm/hr)	Peak Flow - Q (m^3/s)
1	0.720	117	0.292
2	0.765	151	0.404
5	0.855	191	0.573
10	0.900	215	0.675
20	0.945	248	0.814
50	1.000	291	1.039
100	1.000	325	1.160

The comparison between pre-development flow and post-development has demonstrated there is a negligible increase in stormwater runoff from the proposed redevelopment. Therefore, detention of stormwater is not considered necessary at this point in time.

6.5 Legal Point of Discharge

The legal points of discharge for the minor and major storm events for the proposed development are as follows:

- Minor Storm (piped drainage) is proposed to discharge into the existing council stormwater drainage infrastructure located in Water Street that eventually discharge into the Breakfast Creek.
- Major Storm events will discharge via overland flow onto Water Street and eventually into the Brisbane River.

7.0 Stormwater Quality Assessment

7.1 Pollutants of Concern

The key pollutants generated by various developments are listed by Brisbane City Council Subdivision and Development Guidelines Part C Water Quality Management Guidelines (2008c). During the operational (post-construction) phase of a mixed use development, Brisbane City Council (Table C4.2, 2008c) identifies the following pollutants as being typically generated:

- Litter
- Sediment
- Nutrients (Nitrogen & Phosphorous)
- Pathogens/Faecal coliforms (bacteria and viruses)
- Hydrocarbons (including oil and grease) - unlikely
- Heavy Metals (often associated with fine sediment)
- Surfactants (e.g. detergents from car washing)
- Thermal pollution (heat)

Brisbane City Council (2008c) recognises that the heterogeneity of mixed use developments requires that site-specific assessment needs to be undertaken in order to determine which of the potential pollutants is likely to occur and require trapping. Considering that the proposed development involves large area of roof and basement carpark, the source points for the above pollutants are fairly limited. Key pollutants which may be of concern in runoff from the proposed development include:

- Litter
- Sediments
- Nutrients
- Surfactants

During the construction phase of a development, the pollutants listed in Table 7.1 have been identified by Brisbane City Council (Table C4.1, 2008c) as being typically generated. Measures should be put in place during the construction phase to manage each of these pollutants.

Table 7.1 - Pollutants Typically Generated During the Construction Phase

Pollutant	Source
Litter	Paper, construction packaging, food packaging, cement bags, off-cuts
Sediment	Unprotected exposed soils and stockpiles during earthworks and building
Hydrocarbons	Fuel and oil spills, leaks from construction equipment
Toxic Materials	Cement slurry, asphalt prime, solvents, cleaning agents, washwaters (e.g. from tile works)
pH Altering Substructures	Acid sulfate soils, cement slurry and washwaters

7.2 Environmental Values and Water Quality Objectives (WQO's)

Based on the nature of the development proposed as described above we have assessed this site to be "high risk". Therefore BCC's WQO's have to be identified and attained for the proposed development.

The Environmental Values (EV's) of the receiving environment and the Water Quality Objective (WQO's) for discharges from the site has been identified for the development using "Guidelines on Identifying and Applying Water Quality Objectives in Brisbane City" (BCC, 2000).

The information contained in Table 1 of Appendix 5 of BCC (2000) may be used to identify the relevant WQO's for freshwater waterway. This information is reproduced in Table 7.3 below. It should be noted that this table of WQO's only accounts for the waterway affected by the development, not the proposed activities associated with the development.

Table 7.3 - WQO's for Combined Wet and Dry Periods involving Land-Disturbing, Vehicle-Related and Acid Sulfate Soil-Related Activities

	SET A Environmental Values (EV's)	**SET B EV's**	**SET C EV's**
Indicator	**Modified ecosystem, wildlife, cultural heritage, secondary and visual recreation, industry, stock and irrigation**	**Human consumer**	**Primary contact**
PH	6.5 to 8.5		
Dissolved oxygen	80 to 105 percent saturation		
Organic matter	NR		
Total phosphorus	70 µg/L		
Total nitrogen	650 µg/L		
Chlorophyll-a	8 µg/L		
Turbidity	20 NTU		
Secchi depth	>0.2m		>1.2m
Suspended	15 mg/L for combined wet		

Solids	and dry periods 90%ile < 100 mg/L for wet weather periods		
Total aluminium	5 µg/L if pH < 6.5 or 100 µg/L if pH > 6.5		
Total Iron	300 to 1,000 µg/L (depending upon Fe(II) concentration)		
Total Arsenic	50 µg/L		
Total cadmium	0.2 to 2 µg/L (depending upon hardness)		
Total chromium	10 µg/L (if it is all chromium (VI))		
Total Copper	2 to 5 µg/L (depending upon hardness)	1.0 µg/L (tainting)	
Total Nickel	15 to 150 µg/L (depending upon hardness)		
Total Lead	1 to 5 µg/L (depending upon hardness)		
Total zinc	5 to 50 µg/L (if iron not present as FE(II)	5.0 µg/L (tainting)	
TPH	NR		
Oils and grease	No visible films or odour		
PAH	<3 µg/L		
Faecal coliforms	1000 organisms/100mL (minimum of 5 samples taken at regular intervals not exceeding one month, with 4 of 5 not exceeding 4000 organisms/100 mL)		150 organisms/100mL (minimum of 5 samples taken at regular intervals not exceeding one month, with 4 of 5 not exceeding 600 organisms/100 mL)
Total Chlorine	0.03 mg/L		
Litter/gross pollutants	No anthropogenic (man-made) material greater than 5mm in any dimension		
Riparian vegetation and habitat	Protect and restore consistent with Council policy and plans (see Council's City Plan)		
Cultural heritage	Protect and restore consistent with Council policy and plans (see Council's City Plan)		

The following minimum key indicators have been evaluated:

- Suspended Soils (sediment)

- Nutrients (nitrogen and phosphorus)
- Litter
- Faecal Coliforms

The final set of WQO's which need to be evaluated for the development is therefore presented in Table 7.4.

Table 7.4 – WQO's for the Minimum Number of Indicators

Indicator	WQO
Suspended Solids	15mg/L for combined wet and dry periods 90%ile < 100mg/L for wet weather periods
Turbidity	20NTU
Total Phosphorus	70µg/L
Total Nitrogen	650µg/L
Litter	No anthropogenic (man-made) material grater than 5mm in any dimension
Faecal Coliforms	1000 organisms/100mL (minimum of 5 samples taken at regular intervals not exceeding one month, with 4 of 5 not exceeding 4000 organisms/100mL)

Other than the BCC's WQO's, the proposed development is also required to comply with the Queensland Government State Planning Policy (SPP) 4/10 for Healthy Waters which has been taken effect on 2 May 2011.

The WQO's addressed in this SPP are identified and shown in Table 7.5 below.

Table 7.5 - Department of Environment and Resource Management (DERM) Water Quality Objectives requirements for South East Queensland Region

Pollutants	Water Quality Objectives
Total Suspended Solids	80%
Total Phosphorous	60%
Total Nitrogen	45%
Gross Pollutants	90%

7.3 Modelling/Assessment Approach

A quantitative assessment of stormwater runoff quality was considered only for the operational phase of the development.

The pollutants of concern during the construction phase are not readily modelled due to the site-specific nature of typical construction pollutant sources that are dependent largely on site management practices and vary throughout the construction phase depending on the particular activities being undertaken.

A Best Management Practice (BMP) approach was adopted in selecting management options for the construction phase.

In order to assess post-development discharge concentration of key pollutants from the site, modelling of stormwater runoff quality for the post-development scenario has been undertaken using the MUSIC software package. The MUSIC modelling has been undertaken with reference to the BCC Guidelines to Pollutant Export Modelling in Brisbane, Version 7 – draft (Supplement to BCC Water Quality Management Guidelines)

The site has been developed into one model, which simulates the entire site discharging into the existing council stormwater drainage system.

7.4 Pre-Development Scenario

The subject site is presently occupied by commercial buildings, smaller timber buildings and on-grade asphalt carpark.

7.5 Post-Development Scenario

The proposed road and existing drill hall has been excluded from the modelling as the road extension will become a Council asset and it is understood that the stormwater connection from the existing drill hall will remain unchanged. All other areas apart from roof areas are modelled with 10% of pervious area.

It is intended to incorporate a number of stormwater quality improvement devices into the stormwater drainage design as part of the development of the site. These devices include:

- Rainwater tank
- Gross Pollutant Trap
- Bio-retention planter box

The MUSIC modelling results for the post-development scenario can be found in Appendix E and is summarised in Table 7.5 and Table 7.6 below.

Table 7.5 - MUSIC Modelling Results (BCC's Water Quality Objectives) – Post Development Scenario (Mixed use Development with Stormwater Treatment)

Pollutant	Median Concentration achieved (mg/L)	Target WQO (median – mg/L)
Total Suspended Solids [90%ile]	1.5 [26.2]	15 [100]
Total Phosphorous	0.048	0.07
Total Nitrogen	0.650	0.65

Table 7.6 - MUSIC Modelling Results (SPP's Water Quality Objectives) – Post Development Scenario (Mixed use Development with Stormwater Treatment)

Pollutant	Objectives Achieved	Min SPP WQO's Required
Total Suspended Solids	92.4%	80%
Total Phosphorous	68.3%	60%
Total Nitrogen	59.7%	45%
Gross Pollutants	100%	90%

The results in Table 7.5 and Table 7.6 have demonstrated the proposed development will attain both BCC's and SPP's Water Quality Objective's.

8.0 Stormwater Quality Management Options

8.1 Construction Phase

Best management practices are proposed to be implemented at various stages of the construction to manage the pollutants generated during the construction phase of the development as discussed in Section 7.1.

It is expected that due to the nature of basement excavations, sump pits will be required to trap sediment in the stormwater runoff, and hence reduce the sediment concentration of the stormwater discharging from the site during the construction period.

In addition to the sump pits mentioned above, it is anticipated that the following erosion and sediment control measures would be implemented either prior to and/or during construction of the development to minimise the impact of stormwater quality discharging from the site.

During the construction phase of the development, an Erosion and Sediment Control Program (ESC Program) will be implemented to minimise water quality impacts.

- **Pre-Construction**

  Before construction activities begin, the following measures need to be implemented to ensure minimal disturbance and adverse water quality impacts. These measures may be adopted in a staged approach, and may be implemented prior to construction beginning in any one section of the project.

  - Sediment fences constructed to the perimeter of the construction area as required.
  - Designation of areas for plant and construction material storage.
  - Diversion of upstream stormwater runoff around disturbed areas of the development as required.
  - Immediate stabilisation of disturbed areas as required.
  - Monitoring of stormwater quality discharging from the development and the implementation of additional measures / modification of existing measures if the quality of stormwater discharging from the site will have a negative impact.
  - Monitoring of groundwater quality infiltrating during any further detailed excavation works and the implementation of additional measures / modification of existing measures if the quality of groundwater discharging from the site will have a negative impact.
  - Designation and marking of transport routes across the site to minimise dust disturbance.
  - Drainage structure protection devices installed to existing stormwater inlet structures within the site, and within the road ways adjacent to the site.
  - Education of site personnel to the sediment and erosion control measures implemented on site.

- **During Construction**

  Runoff is proposed to be directed to the sump pits before discharging into stormwater utilities. Measures to mitigate water quality impacts during construction will include:

  - Provision of pump out facilities to the satisfaction of Brisbane City Council for the sump pits.

- Construction activities to be confined within the necessary construction area(s).
- Regular inspection and maintenance of the erosion control measures. Following rainfall events greater than 20mm, inspection of erosion control measures and removal of collected material shall be undertaken. Replacement of any damaged equipment shall be performed immediately.
- Monitoring of water quality impacts from construction activities as appropriate.

8.2 Operational Phase

It is proposed to implement stormwater quality Best Management Practices (BMP's) on the developed site.

BMP's were selected by giving due consideration to the proposed development layout, and other unique site characteristics.

Due to the nature of the proposed development, the BMP's presented in Table 8.2 is thought to be most suitable for the proposed site.

Table 8.2 - Stormwater Best Management Practices Selection Matrix

Stormwater Quality Best Management Practice	Discussion
Gross Pollutant Trap	Gross Pollutant Trap is effective at capturing coarse sediment, oil and grease, rubbish and vegetation matter found in stormwater runoff.
Bio-retention planter box	Based on the MUSIC modelling, the minimum landscape areas required to be incorporated with bio-retention functions are as shown on Appendix B. Bio-retention basin facilitates the removal of pollutants from local catchment areas through the use of plants and filter media by which the stormwater runoff passes through. These devices are effective in reducing the concentrations of Total Suspended Solids, Total Phosphorous and Total Nitrogen.
Rainwater Storage Tank	Rainwater storage tank enables the reuse of roof runoff, primarily for irrigation and toilet flushing purposes. The main contaminant removal process is the diversion of runoff from roof (impervious) areas to either pervious areas (irrigation) or to the sewer system (toilet flushing)

9.0 Stormwater Quality Monitoring Program

Although stormwater from this development will discharge to the existing stormwater system and eventually to the Breakfast Creek, stormwater quality best management practices are proposed and therefore no stormwater quality monitoring has been proposed.

The proposed measures for stormwater quality are reasonably well understood and their effectiveness has been demonstrated at numerous sites throughout Queensland.

10.0 Maintenance Plans

Maintenance plans are required to be developed for the following stormwater items proposed for the development: consistent with the requirements of this report and the manufacturer's recommendations.

- **Rainwater Storage Tank**

- In accordance with the manufacturer's recommendations / owners manual.
- Inspect the bottom of the tank for sludge at least every 2 - 3 years. If sludge covers the bottom of the tank, remove it by siphoning or completely emptying.

- **Gross Pollutant Trap**
  - In accordance with the manufacturer's recommendations / owners manual.
- **Bio-retention planter box**
  - Routine inspection, cleaning and maintenance.
  - Replacement of filter media as required.

11.0 Asset Hand-Over

It is intended that the stormwater quantity and quality controls detailed in this document will remain under private ownership and will not become a council asset. Therefore, no further assessment of asset handover is relevant to this site.

12.0 Conclusion

This Site Based Stormwater Management Plan demonstrates that under the proposed concept plan, stormwater runoff from the proposed mixed use development will be able to be treated to acceptable levels.

The consideration of the proposed stormwater runoff and drainage demonstrates the viability of the proposed mixed use development, with regards to stormwater quantity and quality.

Further details of the proposed stormwater drainage system will be provided to Council in future applications (i.e. Operational Works submission), however this document demonstrates that sufficient treatment of stormwater runoff from the site is achievable under the current development proposal.

13.0 References

Brisbane City Council (2008) Subdivision and Development Guidelines.

Brisbane City Council (2008) Water Quality Management Guidelines.

DERM's State Planning Policy 4/10 Guideline Healthy Waters.

DERM's Urban Stormwater Quality Planning Guidelines 2010.

Queensland Urban Drainage Manual (2007).

bureau^proberts
PHASE 1
PHASE 2
RL. 19
STUDIO 32m2
1 BED 48m2
CIRCULATION 110m2
2 BED 64m2
STUDIO 36m2
CIRCULATION 108m2
2 BED 62m2
LOBBY 111m2
CIRCULATION 32m2
LOBBY 95m2
STAGE 7 CARPARK 524m2 17 CARS
STAGE 6 CARPARK 335m2 11 CARS
STAGE 5 CARPARK 1290m2 23 CARS
CIRCULATION 117m2
CIRCULATION 154m2
1 BED 52m2
BCC 448m2
BUSLANE DEDICATION 225m2
FOOTPATH WIDENING 168m2
FOOTPATH WIDENING 28m2
FOOTPATH WIDENING & TRUNCATION 34m2
WATER STREET
PHASE 1 PODIUM
21.05.12

Appendix A

Proposed Phase 1 Podium Plan by Bureau Proberts

Appendix B

Concept Stormwater Management Plan by Robert Bird Group

LEGEND – EXISTING

- SURFACE CONTOUR (0.5m INTERVALS)
- STORMWATER LINE
- ADJACENT BOUNDARY
- PROPERTY BOUNDARY

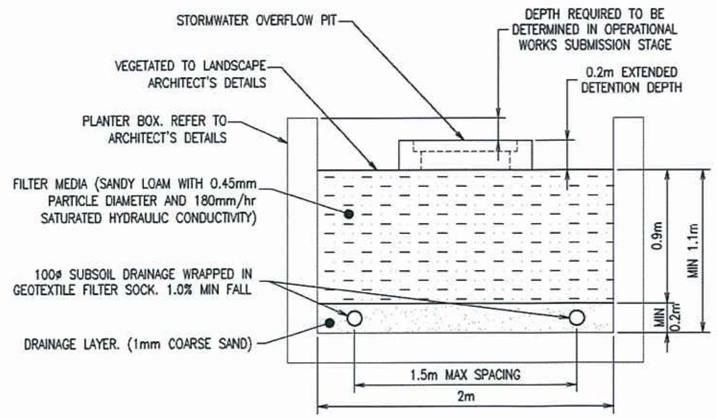
LEGEND – PROPOSED

- BUILDING
- STAGING BOUNDARY
- RESIDENTIAL TOWER OUTLINE
- STORMWATER LINE
- SURCHARGE GULLY
- RAINWATER TANK. LOCATION AND EXTENT OF RAINWATER TANK SHOWN CONCEPTUALLY ONLY.
- BIO-RETENTION PLANTER BOX. REFER TYPICAL DETAIL

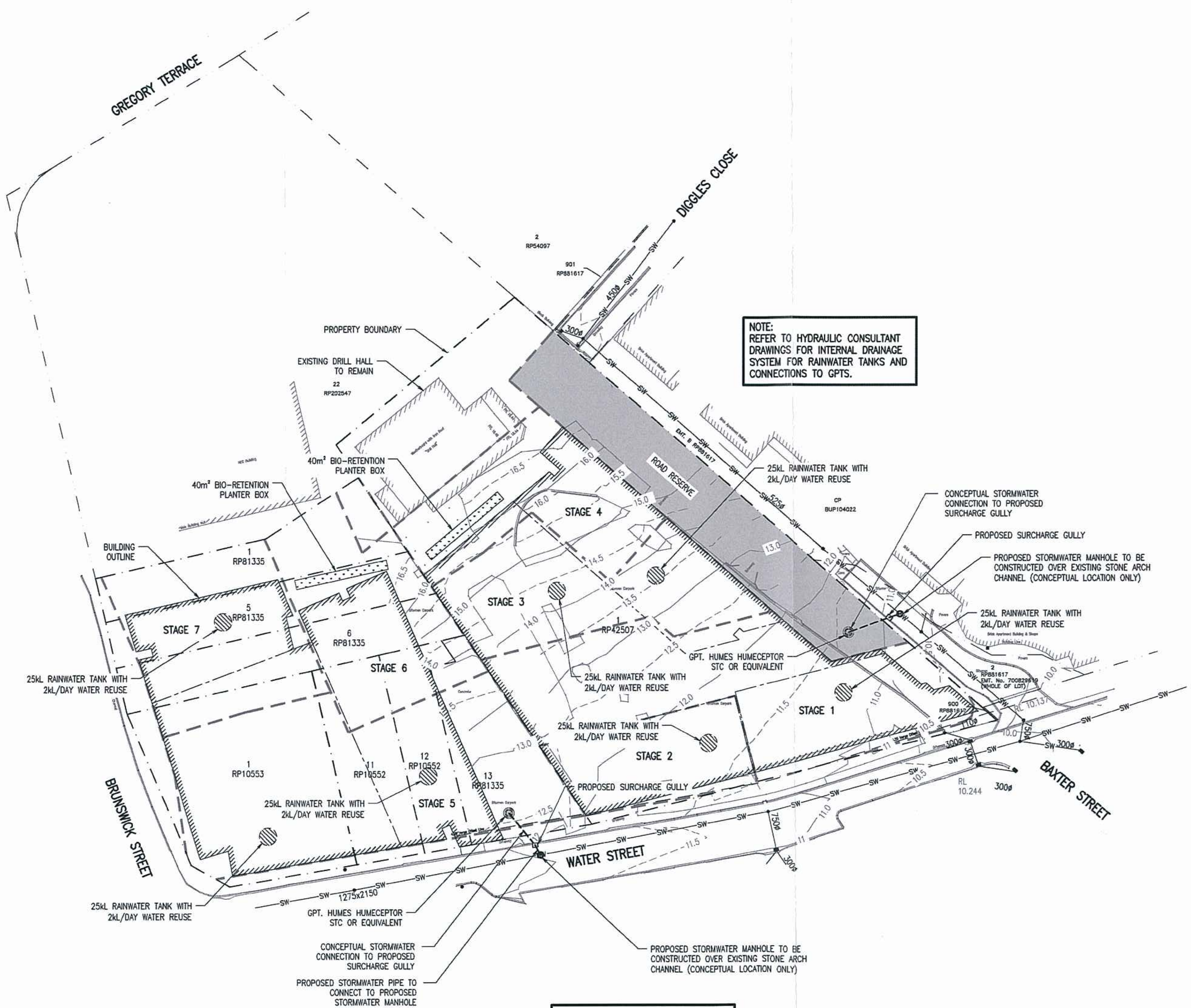
NOTE:
ALL SERVICES SHOWN ARE APPROXIMATE LOCATIONS ONLY AND ARE TO BE CONFIRMED ON SITE PRIOR TO ANY WORKS TAKING PLACE.

SERVICE LOCATIONS ARE FROM:
- PART DETAIL SURVEY "CNR OF WATER STREET & BRUNSWICK STREET FORTITUDE VALLEY" BY RPS GROUP, DRAWING No. 107919-2[-] DATED 06/10/11.
- DBYD INFORMATION
- BCC's eBIMAP INFORMATION

PRELIMINARY STORMWATER FLOW CALCULATION TABLE									
LOCATION		TIME		SUB-CATCHMENT RUNOFF					
		tc	I	fi	C10	A	C x A	Q	Q
DESIGN ARI	CATCHMENT NAME	SUB-CATCHMENT TIME OF CONCENTRATION	RAINFALL INTENSITY	FRACTION IMPERVIOUS	10 YEAR RUNOFF COEFFICIENT	AREA	PRODUCT OF (C x A)	SUB-CATCHMENT DISCHARGE	TOTAL FLOW
years		min	mm/hr			m^2	m^2	l/s	l/s
PRE DEVELOPMENT FLOWS (tc = 5mins, I_{10} = 215mm/hr)									
10	IMPERVIOUS	5	215	1.0	0.90	10,994	9895	591	669
10	PERVIOUS	5	215	0.0	0.70	1,855	1299	78	
					TOTAL	12,849			
POST DEVELOPMENT FLOWS (tc = 5mins, I_{10} = 215mm/hr)									
10	IMPERVIOUS	5	215	1.0	0.90	11,564	10,408	622	676
10	PERVIOUS	5	215	0.0	0.70	1,285	900	54	
					TOTAL	12,849			



TYPICAL SECTION – BIO-RETENTION PLANTER BOX
SCALE 1:25



NOTE:
REFER TO HYDRAULIC CONSULTANT DRAWINGS FOR INTERNAL DRAINAGE SYSTEM FOR RAINWATER TANKS AND CONNECTIONS TO GPTS.

NOTE:
ABOVE CONCEPT SHOWN IS THE MINIMUM REQUIREMENT TO MEET CURRENT WATER QUALITY OBJECTIVES (WQO'S) FOR BCC HIGH RISK SITE.

DO NOT SCALE DRAWINGS, USE FIGURED DIMENSIONS
REFER COVER SHEET FOR NOTES UNLESS NOTED OTHERWISE

SCALE 1:500
10 0 10 20m

Rev.	Revision Description	By.	App.	Date
P1	ISSUED FOR DISCUSSION ONLY	RJM	--	08/11/11
A1	ISSUED FOR DA SUBMISSION	LKT	RJM	25.11.2011
A2	RE-ISSUED FOR DA SUBMISSION	LKT	IJM	23.05.2012

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Ph. (07) 3319 2777
Fax. (07) 3319 2799
ACN 010 580 248
Web Site: www.robertbird.com

Client: METRO PROPERTY DEVELOPMENT PTY LTD

Title: CONCEPT STORMWATER MANAGEMENT PLAN

Project: PROJECT WATERS: 68 WATER STREET, FORTITUDE VALLEY

NOT FOR CONSTRUCTION

Date	Design	Checked
MAY 2012	LKT	IJM
Scale @ A1: 1:500	Drawn: LKT	Approved: ----
Job Number: 11720C	Drawing Number: SKC-03	Revision: A2

Appendix C

Concept Erosion and Sediment Control Plan by Robert Bird Group

LEGEND - EXISTING

- SURFACE CONTOUR (0.5m INTERVALS)
- STORMWATER LINE
- ADJACENT BOUNDARY
- PROPERTY BOUNDARY

LEGEND - PROPOSED

- BUILDING
- EXISTING BUILDING TO BE DEMOLISHED
- STAGING BOUNDARY
- TEMPORARY CONSTRUCTION EXIT
- SUMP PIT
- FALL — INDICATIVE EARTHWORKS FALL.
- SEDIMENT FENCE
- SIP — STORMWATER INLET PROTECTION

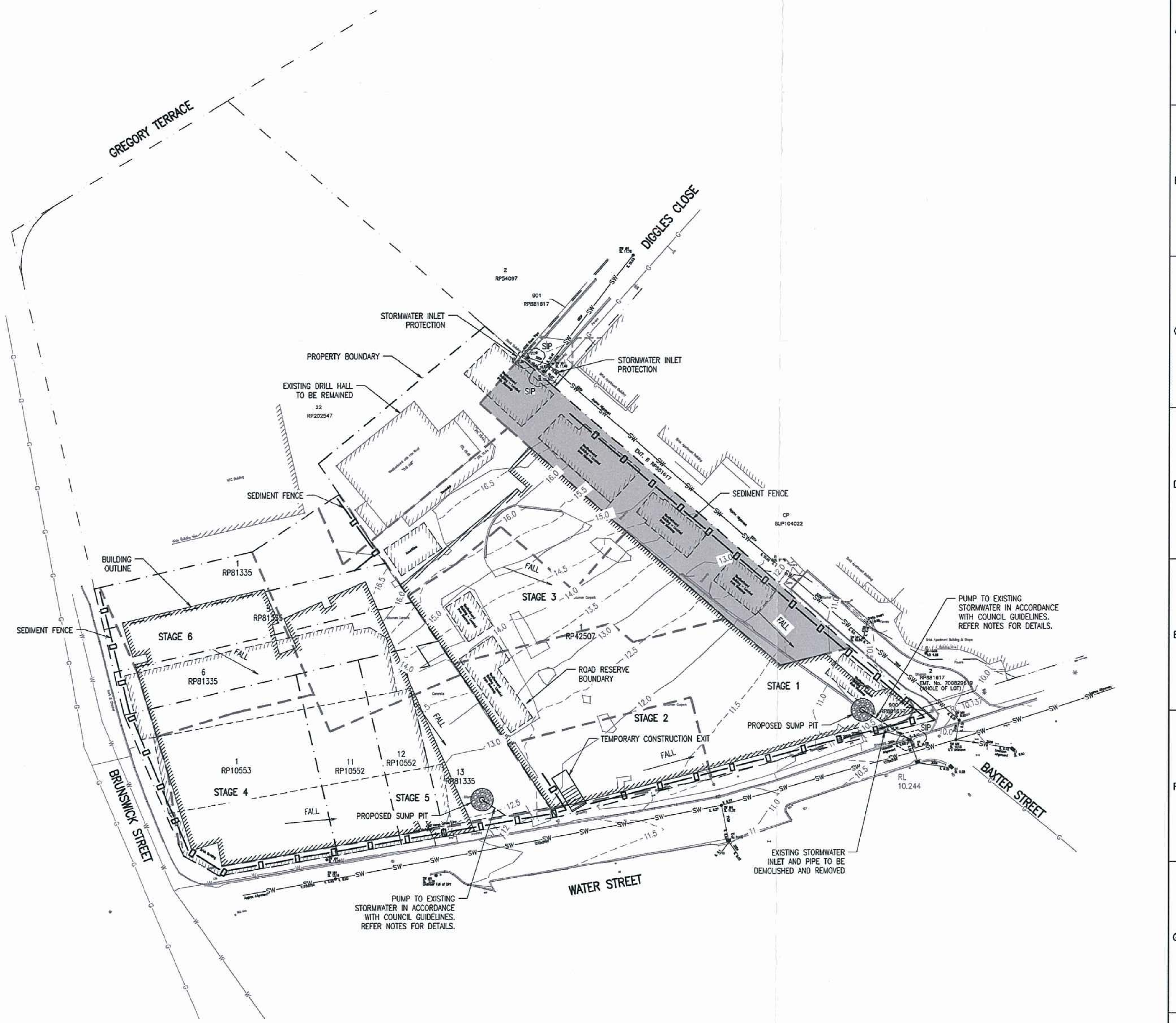
NOTE:
ALL SERVICES SHOWN ARE APPROXIMATE LOCATIONS ONLY AND ARE TO BE CONFIRMED ON SITE PRIOR TO ANY WORKS TAKING PLACE.

SERVICE LOCATIONS ARE FROM:
- PART DETAIL SURVEY "CNR OF WATER STREET & BRUNSWICK STREET FORTITUDE VALLEY" BY RPS GROUP, DRAWING No. 107919-2[-] DATED 06/10/11.
- DBYD INFORMATION
- BCC's eBIMAP INFORMATION

EROSION AND SEDIMENT CONTROL NOTES

1. THESE NOTES SHALL BE READ IN CONJUNCTION WITH:
   A. GENERAL NOTES AND DISCLAIMERS FOR PROJECT
   B. SITE MANAGEMENT PLANS FOR THE SITE
   C. ENVIRONMENTAL NOTES FOR THE PROJECT, AND
   D. BULK EARTHWORKS NOTES FOR THE PROJECT.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING A PLAN TO THE LOCAL AUTHORITY SPECIFYING THE STAGING OF THE VARIOUS EROSION AND SEDIMENT CONTROLS DURING THE DIFFERENT CONSTRUCTION PHASES.
3. EROSION AND SEDIMENT CONTROL MEASURES IDENTIFIED BY THE CONTRACTOR AS BEING REQUIRED FOR THE FIRST CONSTRUCTION PHASE ARE TO BE PLACED PRIOR TO ANY CLEARING AND GRUBBING, AND ANY OTHER EARTHWORKS.
4. ALL EROSION AND SEDIMENT CONTROL MEASURES ARE TO REMAIN OPERATIONAL UNTIL THE SITE IS ACCEPTED "ON MAINTENANCE" BY THE LOCAL AUTHORITY.
5. EROSION AND SEDIMENT CONTROL DEVICES MUST COMPLY WITH:
   A. BRISBANE CITY COUNCIL'S EROSION AND SEDIMENT CONTROL STANDARD (VERSION 9 OR LATER).
   B. SOIL AND EROSION CONTROL ENGINEERING GUIDELINES FOR QUEENSLAND CONSTRUCTION SITES PUBLISHED BY THE INSTITUTE OF ENGINEERS AUSTRALIA – QUEENSLAND DIVISION.
   C. "BEST PRACTICE EROSION & SEDIMENT CONTROL" INTERNATIONAL EROSION CONTROL ASSOCIATION (IECA) 2008.
6. UNDER NO CIRCUMSTANCES IS SILT TO BE ALLOWED TO LEAVE THE SITE.
7. THE CONTRACTOR IS TO PROVIDE WATER TRUCKS AS REQUIRED TO MINIMISE OR ELIMINATE THE DUST PROBLEMS CAUSED BY ON SITE TRAFFIC MOVEMENT.
8. PRIOR TO THE RELEASE OF ANY STORMWATER FROM THE SITE, WATER QUALITY SAMPLES ARE TO BE TAKEN, AND ARE TO BE ANALYSED. THE QUALITY OF ANY STORMWATER RELEASED FROM THE SITE IS TO MEET THE FOLLOWING CRITERIA:
   A. TOTAL SUSPENDED SOLIDS < 20 N.T.U, AND
   B. pH BETWEEN 6.5 AND 8.5

   ANALYSIS RESULTS ARE TO BE PROVIDED TO THE SUPERINTENDENT AND THE RELEVANT LOCAL AUTHORITY OFFICER WITHIN 48 HOURS OF SAMPLING.
9. AN ON-SITE REGISTER LOGGING RAINFALL DATES, WATER QUALITY ANALYSIS RESULTS, AND DATES OF RELEASE OF STORMWATER FROM THE SITE IS TO BE MAINTAINED. THIS REGISTER IS TO BE AVAILABLE ON-SITE FOR INSPECTION BY LOCAL AUTHORITY OFFICERS UPON REQUEST.
10. ALL EROSION AND SEDIMENT CONTROL DEVICES ARE TO BE INSPECTED WITH A MINIMUM FREQUENCY OF WEEKLY, AND PRIOR TO ANY EXPECTED RAINFALL, AND AFTER ANY RAINFALL. ANY DAMAGE OR DEVICE FAILURE IS TO BE REPAIRED / MANAGED AS REQUIRED.
11. ANY EROSION AND SEDIMENT CONTROL DEVICES NOT PERFORMING ADEQUATELY ARE TO BE SUPPLEMENTED WITH ADDITIONAL MEASURES, THAT COMPLY WITH THE RELEVANT GUIDELINES. THE SUPERINTENDENT IS TO BE ADVISED OF THE DETAILS OF ANY ADDITIONAL MEASURES PROPOSED.
12. ALL EROSION AND SEDIMENT CONTROL DEVICES ARE TO BE MAINTAINED IN WORKING ORDER AT ALL TIMES. ANY DAMAGE TO ANY DEVICE IS TO BE IMMEDIATELY RECTIFIED.
13. THE CONTRACTOR SHALL MINIMISE THE EXTENT OF AREAS DISTURBED BY EARTHWORKS AT ANY ONE TIME, AND SHALL RETAIN EXISTING VEGETATION COVER WHERE POSSIBLE.
14. ALL VEHICLES EXITING THE SITE SHALL BE CLEANED DOWN AND TREATED SO AS TO PREVENT MATERIAL BEING TRACKED OR DEPOSITED ON PUBLIC ROADS.



SCALE 1:500
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DO NOT SCALE DRAWINGS, USE FIGURED DIMENSIONS
REFER COVER SHEET FOR NOTES UNLESS NOTED OTHERWISE

Rev.	Revision Description	By.	App.	Date
A1	ISSUED FOR DA SUBMISSION	LKT	RJM	25.11.2011
A2	ISSUED FOR DA SUBMISSION	LKT	IJM	23.05.2012

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Client: METRO PROPERTY DEVELOPMENT PTY LTD

Title: CONCEPT EROSION AND SEDIMENT CONTROL PLAN

Project: PROJECT WATERS: 68 WATER STREET, FORTITUDE VALLEY

NOT FOR CONSTRUCTION

Date	Design	Checked
MAY 2012	LKT	IJM
Scale @ A1	Drawn	Approved
1:500	LKT	----
Job Number	Drawing Number	Revision
11720C	SKC-02	A2

Appendix D
Brisbane City Council's Erosion Hazard Assessment Form

BRISBANE CITY COUNCIL ABN 72 002 765 795

Erosion Hazard Assessment - October 2010

11720C
4/11/2011

Brisbane City Council (BCC), *Erosion Hazard Assessment* form must be read in conjunction with the *Erosion Hazard Assessment- Supporting Technical Notes* (June 2006 or later version) for explanatory terms and Certification information.

What is an Erosion Hazard Assessment?

Soil erosion and sediment from urban development, particularly during construction activities, is a significant source of sediment pollution in Brisbane's waterways. The Erosion Hazard Assessment determines whether the risk of soil erosion and sediment pollution to the environment is 'low' or 'high', using a point scoring system to assess the risk based on BCC's requirements for stormwater management and Erosion and Sediment Control (ESC).

When is the EHA required?

An *Erosion Hazard Assessment* form must be completed and lodged with BCC for any Development Application (DA), Operational Works ESC application, or Schedule 12 Compliance Assessment ESC application.

Failure to submit this form during lodgement of an application may result in assessment delays or refusal of the application.

Privacy Statement

The personal information collected on this form will be used by Brisbane City Council for the purposes of fulfilling your request and undertaking associated Council functions and services. Your personal information will not be disclosed to any third party without your consent, unless this is required or permitted by law.

Assessment Details

1 Does this development or operational works/detailed design ESC application trigger the Stormwater Management Code or House Code and involve soil disturbance?

- No ☐ An Erosion Hazard Assessment is not required. ***Go to* 4**
- Yes ☒ ***Complete Assesssment Table on reverse side of this form.***

2 Is the total score equal to or greater than 17?

A 'low' risk score

*Generally, if the Erosion Hazard Assessment produces a Total Score of **less than 17** and no individual score is equal to, or greater than its Trigger Score, the development proposal is considered to be 'low risk' with respect to soil erosion and sediment control.*

A 'high' risk score

*If the Erosion Hazard Assessment produces a Total Score of **17 or greater**, or any individual score is equal to or greater than its Trigger Score, the development proposal is considered to be 'high risk' with respect to soil erosion and sediment control. Applicants must lodge, with their Application, sufficient supporting information to demonstrate that the performance criteria of the Stormwater Management Code or House Code in the City Plan 2000 can be achieved.*

- No ☐
- Yes ☒ Refer to Council's *Erosion Hazard Assessment – Supporting Technical Notes.*

3 Did you answer 'yes' to any Trigger Score questions?

- No ☐
- Yes ☒ Refer to Council's *Erosion Hazard Assessment – Supporting Technical Notes.*

4 Site Information and Certification

Application number (if known)

Site address: Corner of Water and Brunswick Street, Fortitude Valley Postcode 4006

Prepared by *Print name*: Lucas Then

Business name: Robert Bird Group

I certify that:

1. I have made all relevant enquries and am satisfied no matters of significance have been withheld from the assessment manager; and

Where completion of the EHA Assessment Table was required, that:

2. I am a person with suitable qualifications and/or experience in erosion and sediment control; and
3. the Erosion Hazard Assessment was completed in accordance with the Erosion Hazard Assessment Supporting Technical Notes and the BCC Erosion and Sediment Control Standard (version 9 or later); and
4. the Erosion Hazard Assessment Score accurately reflects the site's overall risk of soil erosion and sediment pollution to the environment.

I acknowledge and accept that the BCC, as assessment manager, relies, in good faith, on this certification as part of its development assessment process and the provision of false or misleading information to the BCC constitutes an offence for which BCC may take punitive steps/ action against me/ enforcement action against me.

Certified by *Print name*: RICHARD MORRIS

Certifier's signature

Date: 24 / 11 / 11

Assessment Table

Site Condition	Points	Score	Trigger Score	BCC Use Only
[1] AVERAGE SLOPE OF DISTURBANCE AREA • less than 3% (3% = 33H:1V) ..... 0 • more than 3% but less than 5% (5% = 20H:1V) ..... 1 • more than 5% but less than 10% (10% = 10H:1V) ..... (2) • more than 10% but less than 15% (15% = 6.7H:1V) ..... 4 • more than 15% 6		2	Score equal to or greater than **4**? No [X] Yes [ ]	
[2] SOIL CLASSIFICATION GROUP (AS1726) • GW, GP, GM, GC ..... 0 • SW, SP, SM, SC, Pt ..... 1 • MH, CH, OH ..... 2 • ML, CL, OL, if imported fill will be used, or if soils untested ..... (3)		3		
[3] EMERSON (DISPERSION) CLASS NUMBER • Class 4, 6, 7, or 8 ..... 0 • Class 5 ..... 2 • Class 3 ..... (4) • Class 1 or 2 6		4	Score equal to or greater than **4**? No [ ] Yes [X]	
[4] DURATION OF SOIL DISTURBANCE (including stabilisation period) • less than 1 month ..... 0 • more than 1 month but less than 4 months ..... 2 • more than 4 months but less than 6 months ..... 4 • more than 6 months 6		6	Score equal to or greater than **4**? No [ ] Yes [X]	
[5] AREA OF DISTURBANCE • less than 1000 m² ..... 0 • more than 1000 m² but less than 5000 m² ..... 1 • more than 5000 m² but less than 1 ha ..... 2 • more than 1 ha but less than 4 ha ..... (4) • more than 4 ha 6		4	Score equal to or greater than **4**? No [ ] Yes [X]	
[6] WATERWAY DISTURBANCE • No disturbance to watercourse, open drain or stormwater pipe ..... (0) • Disturbance to watercourse, open drain or stormwater pipe 4		0	Score equal to or greater than **4**? No [X] Yes [ ]	
[7] REHABILITATION METHOD Percentage of area (relative to total disturbance) stabilised by seeding without mulching (i.e. highest risk stabilisation method) • less than 1% ..... 0 • more than 1% but less than 5% ..... (1) • more than 5% but less than 10% ..... 2 • more than 10% 4		1		
[8] RECEIVING WATERS • Open water body (e.g. creek, river, bay) ..... (1) • Enclosed water body (e.g. lake, boat harbour) 2		1		
[9] SUBSOIL EXPOSURE • No subsoil exposure except for service trenches ..... 0 • Subsoils are likely to be exposed ..... (2)		2		
[10] EXTERNAL CATCHMENTS • No external catchment ..... 0 • External catchment diverted around the soil disturbance ..... (1) • External catchment not diverted around the soil disturbance 4		1		
[11] ROAD CONSTRUCTION • No road construction ..... (0) • Involves road construction works 2		0		
[12] pH OF SOILS TO BE REVEGETATED • less than pH 6 ..... 1 • more than pH6 but less than pH 8 ..... 0 • more than pH8, or if pH testing not done at this stage ..... (1)		1		

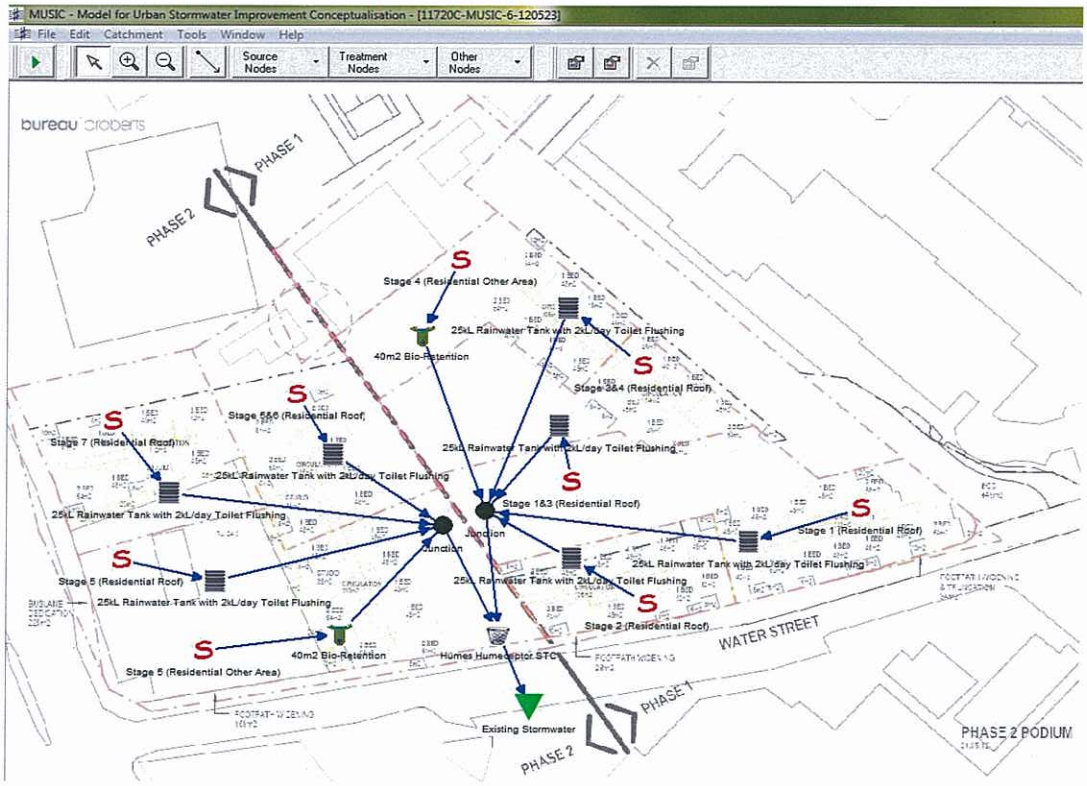
[13] Total Score = 25 *Go to 2 (front page)*

Appendix E
MUSIC Modelling Results Summary

Date: 23/05/2012
Job Number: 11720C

RobertBirdGroup

MUSIC Results (Post Development with Treatment) for Project Waters



Inflow	Mean	Standard Deviation	Median	Maximum	Minimum	10 Percentile	90 Percentile
Flow (cubic metres/sec)	0.00328	0.01140	0.00059	0.60900	0.00010	0.00014	0.00779
TSS Concentration (mg/L)	7.8	10.7	1.5	76.3	0.0	0.0	26.2
Log [TSS] (mg/L)	-0.05	1.99	0.60	1.88	-8.00	-2.30	1.44
TP Concentration (mg/L)	0.0826	0.0852	0.0479	0.7360	0.0000	0.0000	0.2150
Log [TP] (mg/L)	-1.7500	1.6800	-1.1100	-0.1330	-8.0000	-4.4200	-0.6570
TN Concentration (mg/L)	0.646	0.504	0.65	2.79	0	0.00000184	1.3
Log [TN] (mg/L)	-1.0300	1.9300	-0.1630	0.4450	-8.0000	-4.2100	0.1160
TSS Load (kg/6 Minutes)	0.0290	0.1430	0.0002	9.1300	0.0000	0.0000	0.0659
TP Load (kg/6 Minutes)	2.34E-04	1.05E-03	6.38E-06	6.63E-02	0.00E+00	0.00E+00	5.61E-04
TN Load (kg/6 Minutes)	1.42E-03	5.77E-03	8.75E-05	0.314	0.00E+00	1.75E-10	3.49E-03
Gross Pollutant Load (kg/6 Minutes)	0	0	0	0	0	0	0

	Sources	Residual Load	Pollutant Reduction Achieved (%)	SPP WQO's (%)
Total Suspended Solids (kg/yr)	2520	191	92.4	80
Total Phosphorus (kg/yr)	4.86	1.54	68.3	60
Total Nitrogen (kg/yr)	23.2	9.33	59.7	45
Gross Pollutants (kg/yr)	256	0	100	90

Appendix F

BCC's Stormwater Management Code Response and DERM's State Planning Policy 4/10 Healthy Waters Code Response - Urban Stormwater Management

Stormwater Management Code

Performance Criteria and Acceptable Solutions

GENERAL

Performance Criteria		Acceptable Solutions		Proposal Compliance Response
P1	The planning of the stormwater management system must provide for the integrated management of stormwater in order to: • minimise flooding • protect and enhance environmental values of receiving waters • maximise the use of water sensitive urban design principles • maximise the use of natural waterway corridors and natural channel design principles • maximise community benefit • minimise public safety risk	**A1.1**	The proposal complies with the **Subdivision and Development Guidelines.**	**R1.1**: The development will be carried out to comply with the guidelines.
		A1.2	A Site Based Stormwater Management Plan (SBSMP) is prepared for all major and minor stormwater management measures. The SBSMP must provide for the following where applicable: • an underground and/or open drain/overland flow path network maximising the use of natural channel design and water sensitive urban design principles • make provision for detention/retention storage basins • an Erosion and Sediment Control (ESC) Program where required by Council's **Erosion and Sediment Control Standard** • retention of natural waterway corridors • public safety factors and risk management measures • an acceptable level of flood immunity	**R1.2**: A conceptual SBSMP has been prepared by Robert Bird Group (RBG) to support the development application. The SBSMP describes how the design of the stormwater will comply with Brisbane City Council's (BCC's) Subdivision and Development Guidelines. All stormwater will be discharged into the existing stormwater drainage system. The proposed stormwater system consists of rainwater harvesting from the roofs for reuse and runoff from the ground level being collected and treated before being discharged into the council system. Detention is not considered as being a requirement for the proposed development. An ESC program will be prepared as per the SBSMP and RBG's concept sketch. Retention of a waterway corridor is not applicable to this development. There is no risk to public safety factors from drainage from the development. All habitable and non habitable levels will have flood immunity in accordance with BCC's standards. *Compliance achieved - further details to be included in the future Operational Works Application.*

Performance Criteria		Acceptable Solutions		Proposal Compliance Response
		A1.3	The proposal complies with any Stormwater Management Plan (SMP), Local Stormwater Management Plan (LSMP), or Waterways Management Plan (WMP) prepared by Council. *Note: The **Subdivision and Development Guidelines** provide guidelines on the level of information required for different development types.*	**R1.3**: The proposal will comply with the BCC plans identified.

FLOODING

Performance Criteria		Acceptable Solutions		Proposal Compliance Response
P1	The proposed stormwater management system or site works must not adversely impact on flooding or drainage of properties that are upstream, downstream or adjacent to the subject site.	**A1**	The proposal meets the requirements of Council's **Subdivision and Development Guidelines** and does not result in an increase in flood level or flood duration on upstream, downstream or adjacent properties *Note:* *Compliance with this acceptable solution can be demonstrated by the submission of a hydraulic and hydrology report (as part of a SBSMP) identifying potential flooding impacts on upstream, downstream or adjacent properties.*	**R1**: The proposal is the redevelopment of an existing site. Stormwater will be discharged to BCC's existing stormwater drainage system. The development will not alter existing flood levels. *Acceptable solution provided.*
P2	The drainage network must provide capacity to safely convey stormwater run-off resulting from relevant design storm events taking into account increased run-off from roof drainage.	**A2.1**	The design demonstrates that a drainage network will be provided that will comply with Council's **Subdivision and Development Guidelines.** *Note:* *Compliance with this acceptable solution can be demonstrated by identifying the conceptual drainage requirements for the proposal in a SBSMP.*	**R2.1**: Runoff from roofs and developed surfaces will be collected internally and piped to the existing stormwater drainage system. Refer the SBSMP prepared for the site. Full details will be submitted with the Operational Works application. The design will be in accordance with BCC's Subdivision and Development Guidelines. *Acceptable solution provided.*
		A2.2	The design allows sufficient area to provide for a drainage network that will comply with Council's **Subdivision and Development Guidelines.** *Note:* *Compliance with this acceptable solution can be*	**R2.2**: As above.

Performance Criteria		Acceptable Solutions		Proposal Compliance Response
			demonstrated by the submission of a hydraulic and hydrology report (as part of a SBSMP) identifying the area required to accommodate the drainage network.	
P3	Development design must reduce property damage and, where applicable, ensure public safety by ensuring that the development levels are set above the relevant design flood level or storm surge level.	**A3.1**	All development is located above minimum flood immunity levels in accordance with Council's **Subdivision and Development Guidelines.** *Note:* *Compliance with this acceptable solution can be demonstrated by the submission of a hydraulic and hydrology report identifying flood levels and development design levels (as part of a SBSMP).*	**R3.1**: Levels for the proposed development will comply with BCC's current Subdivision and Development Guidelines and *Temporary Local Planning Instrument - 01/11 Brisbane Interim Flood Response.* *Compliance Achieved.*
		A3.2	Road access is provided in accordance with the flood immunity levels identified in Council's **Subdivision and Development Guidelines.** *Note:* *Compliance with this acceptable solution can be demonstrated by the submission of a hydraulic and hydrology report identifying flood levels and development design levels.*	**R3.2** .Refer R3.1 above. *Compliance Achieved.*
P4	Any channel works that are part of the development, major drainage works or flood mitigation works must maintain and/or enhance the environmental values of the waterway corridor or drainage corridor.	**A4**	Design and construction of channel works incorporate water sensitive urban design and natural channel design features which will comply with: • Council's **Subdivision and Development Guidelines**, and • where applicable any SMP, LSMP or WMP prepared by Council. *Note:* *Compliance with this acceptable solution can be demonstrated by the provision of conceptual details of any channel works (as part of a SBSMP).*	**R4**: Not applicable to this development.
P5	Erosion treatment works along waterway banks and associated drainage structures must maintain or enhance the environmental values of waterways.	**A5**	Design and construction of erosion treatment features incorporate natural channel design features which will comply with: • Council's **Subdivision and Development Guidelines**, and • Council's **Urban Creek Erosion – Guidelines for Selecting Remedial Works**	**R5**: Not applicable to this development.

Performance Criteria		Acceptable Solutions		Proposal Compliance Response
			Note: *Compliance with this acceptable solution can be demonstrated by the provision of conceptual details of any erosion treatment works (as part of an SBSMP).*	
P6	Bridges and culverts provided for flood immunity to minimise traffic disruption must improve public safety and allow for fauna movement and recreation corridors where these needs are identified.	**A6**	The design complies with Council's **Subdivision and Development Guidelines.** *Note:* *Compliance with this acceptable solution can be demonstrated by the provision of conceptual details of any bridge or culvert works (as part of a SBSMP).*	**R6**: Not applicable to this development.
P7	The design and construction of detention and retention storage features must: • achieve acceptable impacts on environmental values • provide for recreational use where possible • achieve acceptable risk to public safety and property	**A7**	The design complies with Council's **Subdivision and Development Guidelines** and where applicable any SMP, LSMP or WMP prepared by Council. *Note:* *Compliance with this acceptable solution can be demonstrated by the provision of conceptual details of any detention and retention storage features (as part of a SBSMP).*	**R7:** Refer the prepared SBSMP for the site.. *Acceptable solution provided.*

WATER QUALITY AND DRAINAGE

Performance Criteria		Acceptable Solutions		Proposal
High Risk Development				
P3	Environmental values and water quality objectives of receiving waters within or downstream of the proposal are protected or enhanced.	**A3.1**	Relevant water quality objectives for receiving waters are identified and site specific discharge standards met. ***Note:*** *Compliance with this acceptable solution may be demonstrated by following the process outlined in the* ***Management of Urban Stormwater Quality Planning Scheme Policy****. This can be documented in a SBSMP.*	**R3**: *Compliance achieved.* The SBSMP prepared for the project identifies relevant Water Quality Objectives (WQO's) and presents the results from MUSIC modelling for stormwater discharge.
		A3.2	The design provides for stormwater quality best management practices that are sufficient to treat the target pollutants and will comply with the Council's **Subdivision and Development Guidelines.**	*Compliance achieved* Refer to the SBSMP for proposed design and implementation of best management practices. Section 8.
		A3.3	Stormwater quality best management practices are designed, constructed and maintained in accordance with Council's **Subdivision and Development Guidelines** ***Note:*** *Compliance with this acceptable solution can be demonstrated by providing conceptual detail of how stormwater quality will be managed (as part of a SBSMP).*	*Compliance achieved.* Refer A3.2
P4	Release of sediment laden stormwater is minimised.	**A4**	All development complies with Council's **Erosion and Sediment Control Standard.** *Note:* *Compliance with this acceptable solution can be demonstrated by providing conceptual details of how the requirements of Council's* ***Erosion and Sediment Control Standard*** *will be met (conceptual SBSMP). This will generally be conditioned and may require the submission of a subsequent detailed SBSMP for operational works.*	**R4**: *Compliance achieved.* A SBSMP has been prepared in accordance with Council's Subdivision and Development Guidelines. • An ESC Program will be prepared and will be submitted to council under an Operational Works Application. A copy of Council's Erosion and Sediment Control Standard (BCC, 2000a) will be given to the contractor for his reference during the project.

State Planning Policy 4/2010 - Healthy Waters
Urban Stormwater Management Code

Performance Outcomes and Acceptable Solutions

Protecting Water Quality

Performance Outcomes		Acceptable Outcomes		Proposal Compliance Response
PO1	The development is compatible with the land use constraints of the site for achieving stormwater design objectives.	**AO1.1**	The nature, design, and stormwater management of the development is in accordance with design objectives stated in Chapter 4 (section 4.9) of the State Planning Policy Guideline for Healthy Waters (the guideline) **and** Prepare a site stormwater quality management plan (SQMP) that: *a)* is consistent with any local area stormwater management planning; and *b)* provides for achievable stormwater quality treatment measures reflecting land use constraints, such as soil type, landscape features (including landform), nutrient hazardous areas, acid sulfate soil, rainfall erosivity.	**RO1.1**: The development will be carried out to comply with the design objectives stated in Chapter 4 (section 4.9) of the State Planning Policy Guideline for Healthy Waters (the guideline). A SQMP has been prepared by RBG as part of the SBSMP prepared in accordance with BCC guidelines to support the development application. The proposal is a redevelopment of an existing site. All stormwater will be discharged to the existing Council stormwater drainage system in accordance with current BCC SDG's. Best management practices (BMP's) are incorporated into the stormwater quality treatment train. *Compliance achieved*
PO2	The entry of contaminants into, and transport of contaminants, in stormwater is avoided or minimised.	**AO2.1**	Any development application incorporates: • stormwater management measures to achieve relevant design objectives outlined in Chapter 4 of the guideline • management of nutrients of concern and acid sulfate soils. **and** Prepare a site stormwater quality management plan	**RO2.1** The development will incorporate stormwater management measures to achieve relevant design objectives outlined in Chapter 4 (section 4.9) of guideline. Acid sulfate soils (ASS's) are likely to be encountered. If ASS's do exist on the site, a suitable Acid Sulfate Soils Management Plan will be developed by an appropriately qualified consultant and implemented.

Performance Outcomes		Acceptable Outcomes	Proposal Compliance Response
		(SQMP) that: a) accounts for development type, construction phase, local landscape, climatic conditions and design objectives in accordance with the guideline; and b) is consistent with the Queensland Acid Sulfate Soil technical manual.	A SQMP has been prepared by RBG as part of the SBSMP prepared in accordance with BCC guidelines to support the development application and takes into account the proposed development type, construction phase and relevant design objectives. Refer SBSMP for further details. *Compliance achieved*
PO3	Construction activities for the development avoid or minimise adverse impacts on stormwater quality.	**AO3.1** Any development application for the development is accompanied by and erosion and sediment control plan (ESCP) prepared in accordance with the guideline that demonstrates release of sediment laden stormwater is avoided for the nominated design storm, and minimised when the design storm is exceeded by addressing design objectives in the guideline, Chapter 4, for; • drainage control; • erosion control; • sediment control; and • water quality outcomes. Addressing the design objectives may include enhancing the achievement of some objectives if achievement of other objectives is impractical. **and** **AO3.2** Erosion and sediment control practices including any proprietary erosion and sediment control products are designed, installed, constructed, operated, monitored and maintained, and any other erosion and sediment control practices are carried out, in accordance with	**RO3.1 & RO3.2** An ESC program has been prepared as per RBG's concept sketch SKC-02 and addresses the design objectives. *Compliance achieved - further details to be included in the future Operational Works Application.*

Performance Outcomes	Acceptable Outcomes	Proposal Compliance Response
	local conditions and appropriate recommendations from a suitably qualified person. **Or** The ESCP demonstrates how stormwater quality will be managed in accordance with an acceptable **regional or local guideline** so that target contaminants are treated to a design objective at least equivalent to Acceptable Outcome AO3.1.	

PROTECTION OF NATURAL FLOWS

Performance Outcome		Acceptable Outcome		Proposal Compliance Response
PO4	Construction and operation activities for the development avoid or minimise changes to waterway hydrology from adverse impacts of altered stormwater quality and flow.	**AO4.1**	Development incorporates stormwater flow control measures to achieve at least the design objectives set out in Chapter 4 of the guideline. Both the construction and operational phases for the development comply with advice and the design objectives in Chapter 4 of the guideline including management of frequent flows, peak flows, and construction phase hydrological impacts.	**RO4.1**: The proposal is the redevelopment of an existing site. Stormwater flows will not be altered and are proposed to be discharged to Council's existing stormwater drainage system. *Acceptable solution provided.*