

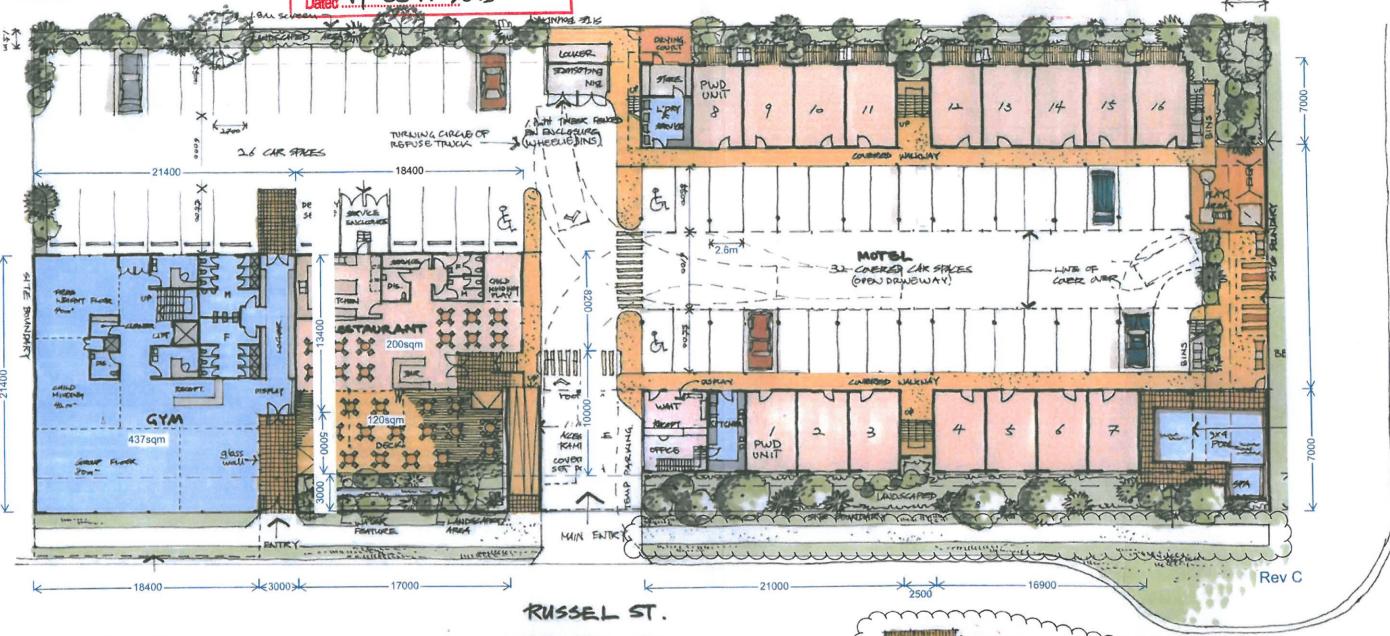


Phopse 13 #523-0383 En 07-8122-0322

ROCKHAMPTON REGIONAL COUNCIL These plans are approved subject to the current

conditions of approval associated with 0183-2013

SEPT. 20B



GROUND + SITE PLAN SCAUS 1:200

PROPOSED : MOTEL+RESTAURANT+ GYM

FOR: DIM O'ROURKE

GRACEMERE

PATE: 27.3.2013 JOBN": BT 130308-503

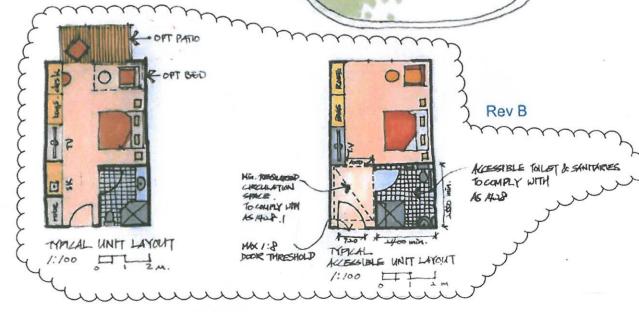
REV: B - PWD UNIT ADDED - 01/05/13 REV: C - PATH ADDED - 13/06/13

DEVELOPMENT DETAILS

- . SITE AREA 4047 Sq. M
- · SITE COVER 2300 sq. in (incl covered carpark)
- 1194 sq.m (intotal) OGFA
- · REPUSE AREA · 20 g. m
- . 32 MOTEL PARKING SPACES
- . 26 COMMERCIAL PARKING SPACES
- · LANDSCAPING 700 99M (17.3%)
- · RESTAURANT 20059M.
- * 44M 831 59.M . Z STOREY
- · MOTEL 32 ROOMS + MANAGER 2. STOREY

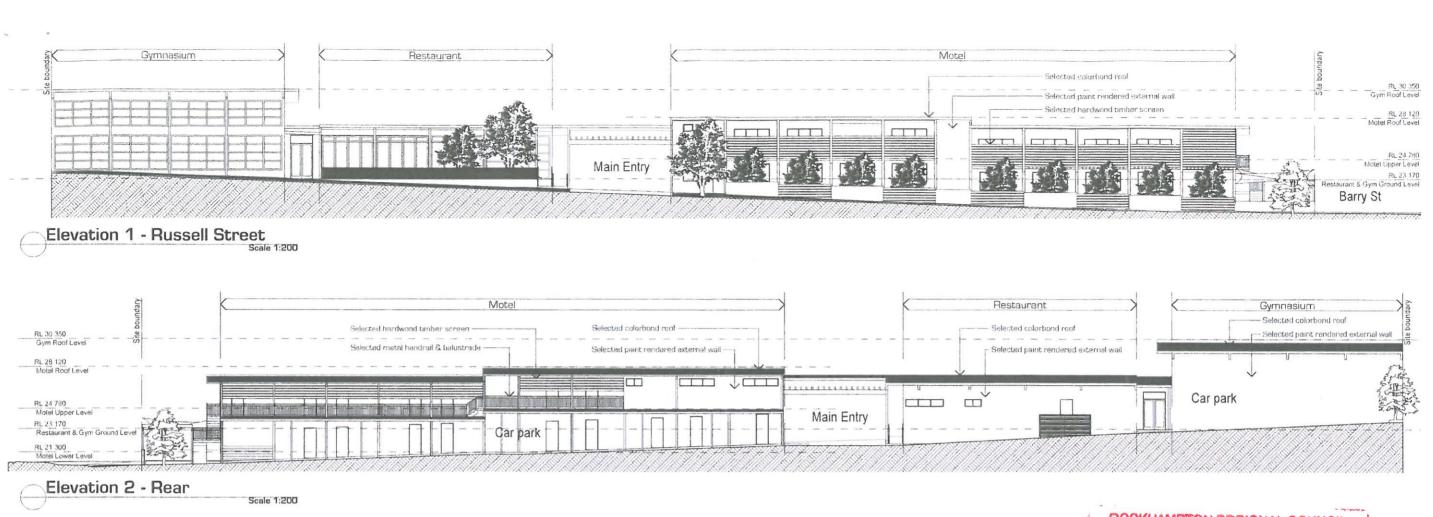
TOTAL GFA (MOTEL) = 2070 sqm TOTAL GFA (MAN. RES) = 130 sqm

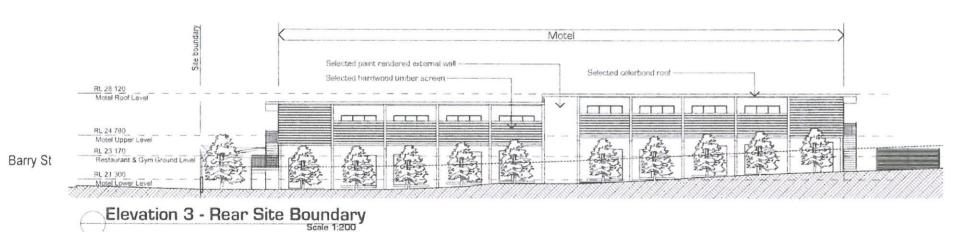
- ALFRESCO DINING 120 sqm



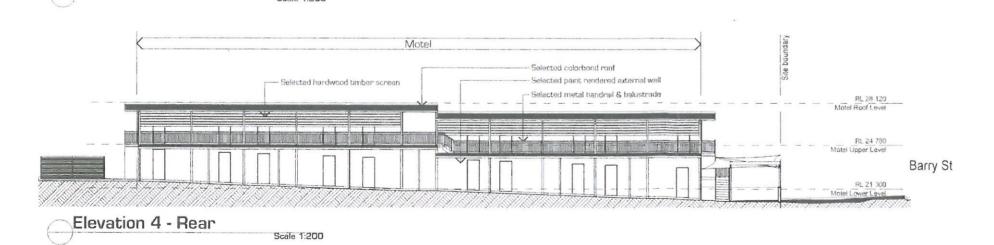
ROCKHAMPTON REGIONAL COUNCIL These plans are approved subject to the current Development Permit No. D[183-2013]

Dated [7] SEPT 2013 2500 -21000-SITE BOUNDARY COVERED WALKWAY 18400 -KOOF LIKE OVER ROOF WERE TOURANT WIDER KOOF WER BUR PARK MOTEL TIMBER PERGREA DER SITTING ANDA CHEDIO WEATER MACHINE PLM 130sqm MYD 3 BEDDEK OPEN 31 UNIT WORKOUT (MANAGEME) AREA. 394sqm SITE BOWN DARY ROOF LINE OVER MAIN ENTRY SHADE STRUCTURE OVER HIGHLIGHT WINDOWS BELOW CANOPY OVER RUSSEL ST PEDESTRIAN ROAD BALCONY FIRST FLOOR PLAN SCAUD 11200 PROPOSED! MOTEL+RESTAURANT+GYM MANAGER'S UNIT LAYOUT D+M O'ROURKE 一 GRACEMERE DATE: 27.3.20B JOBNO: BT 130308-SD4 STYLE - QUALITY - INNOVATION REV: B - MANAGERS UNIT ADDED - 01/05/13 BATH

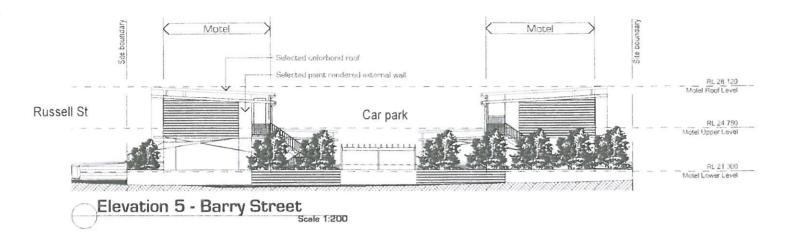


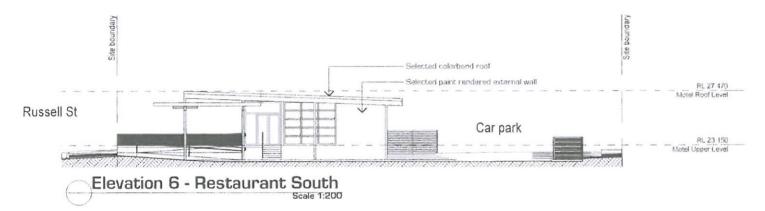


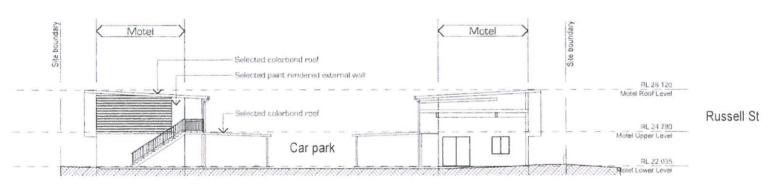




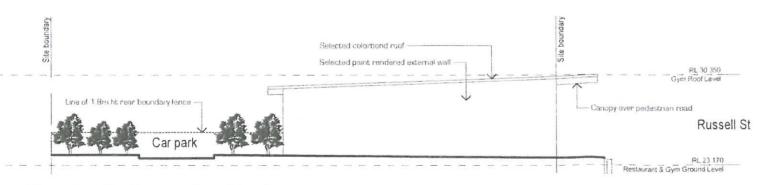








Elevation 7 - Motel North



Elevation 8 - Gymnasium North



These plans are approved subject to the current

conditions of approval associated with Development Permit No. 0/183-20/3
Dated 17 Sept. 2013



SITE BASED STORMWATER MANAGEMENT PLAN

Proposed Motel, Restaurant and Gymnasium Lot 410 on P4031 9 Russell Street, Gracemere

for Damien & Michelle O'Rourke

ROCKHAMPTON REGIONAL COUNCIL

These plans are approved subject to the current

conditions of approval associated with Development Permit No. 0 (183-2013)

Dated 17 SEPT. 2013

28 May 2013

File No: K2464-0003

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Aaron Pianta

Author:

Daley Curran

Client:

Damien & Michelle O'Rourke

Client Contact:

Dale Webb - Rufus Design Group

Client Reference:

Proposed Motel, Restaurant and Gym

Synopsis:

This Site Based Stormwater Management Plan describes the existing site characteristics, proposed development of the site and corresponding stormwater quantity and quality management controls to be implemented during both the construction and operational phases of the development.

rision/Checking His	tory		
Revision No	Date	Checked By	Issued By
Original	28 May 2013	Aaron Pianta	Daley Curran

Distribution			
Recipient	No of Copies	Method	
Dale Webb – Rufus Design Group	1	PDF	

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APPENDICES

Appendix A	-	Capricorn Survey Group, Detail Survey of Lot 410 on P4031 (Ref: 5827-01-DTL)
Appendix B	-	Rufus Design Group, Ground & Site Plan (Ref: BT130308-SD3)
Appendix C	~	Knobel Consulting Pty Ltd, Pre Development Stormwater Catchment Plan (Ref: K2464/P001/A)
Appendix D	-	Knobel Consulting Pty Ltd, Post Development Stormwater Catchment Plan (Ref: K2464/P002/A)
Appendix E	•	Knobel Consulting Pty Ltd, Stormwater Management Plan (Ref: K2464/P003/A) and Bioretention Details (Ref K2464/P004/A)
Appendix F	-	Knobel Consulting Pty Ltd, Sediment and Erosion Control Plan (Ref: K2464/P005/A) and Sediment and Erosion Control Details (Ref: K2464/P006/A)

1.0 INTRODUCTION

1.1 Background

Knobel Consulting Pty Ltd has been commissioned by Damien and Michelle O'Rourke to prepare a *Site Based Stormwater Management Plan* (SBSWMP) to support a development application for a proposed motel, restaurant and gym located at 9 Russell Street, Gracemere.

The purpose of this report is to demonstrate that the proposed development can comply with the current Rockhampton Regional Council (RRC) Policies and Codes in regard to water quantity and quality and discharge runoff to a legal point of discharge.

1.2 Objectives

This SBSWMP details the conceptual planning, layout and design of the stormwater management infrastructure for both the construction and operational phases of this development.

This SBSWMP aims to:

- Establish the required performance criteria for the proposed stormwater quantity and quality improvement systems;
- Provide a conceptual design of stormwater infrastructure including stormwater quality improvement devices and stormwater quantity management controls;
- Ensure the quality of stormwater discharging from the proposed development does not adversely
 impact on the water quality and ecological values of downstream watercourses;
- Ensure stormwater runoff is conveyed through the site to a legal point of discharge in accordance with QUDM; and
- Provide reporting and monitoring mechanisms whereby the performance of this system can be measured enabling identification of corrective actions/alterations required to ensure the above mentioned objectives are maintained.

This SBSWMP has been prepared in accordance with the IEAust, (National Committee on Water Engineering), Australian Runoff Quality (Draft), Capricorn Municipal Development Guidelines (2007) and Queensland Urban Drainage Manual (QUDM) (2007).

1.3 Description of the Subject Site

1.3.1 Location

The subject site consists of an area of $4,061 \text{ m}^2$, with details as summarised in Table 1 and as located in Figure 1.

Table 1: Site Description

Developer/Consultant	Property a	nd Location
Owner/Developer	Lot and Property Description	Address
Damien & Michelle O'Rourke	Lot 410 on P4031	9 Russell Street, Gracemere



Figure 1: Site Location Plan (Modified from www.maps.Google.com)

1.3.2 Site Topography

The subject site generally grades from the north eastern boundary to the south western boundary at approximately 4.25%. Ground levels range from 23.95 m AHD in the north eastern boundary to 20.15 m AHD in the south western boundary.

For further details refer to the Capricorn Survey Group, *Detail Survey of Lot 410 on P4031* (Ref: 5827-01-DTL) included as Appendix A.

1.3.3 Vegetation and Land Use

The subject site currently consists of a single residential dwelling with multiple sheds. The site consists of average grass cover with areas of tree cover. An aerial photo of the site is displayed in Figure 2.



Figure 2: Aerial Photograph of the Site (Google Earth)

1.3.4 Rainfall

Rainfall intensity data has been extracted and calculated in accordance with IEAust, Australian Rainfall and Runoff (1987) at location the 23.3667°S, 150.5333°E.

The extracted data is as follows:

Table 2: Rainfall Data

^{2yr}l_{1hr}: 44.3 mm/hr; ^{2yr}|_{12hr}: 8.80 mm/hr; ^{2yr}|_{72hr}: 2.59 mm/hr; 50yr | 1hr: 89.0 mm/hr; 50yr | 12hr: 17.94 mm/hr; 50yr | 72hr; 6.1 mm/hr; F2: 4.22 F50: 17.7 G: 0.22

1.4 Description of Development

With reference to Rufus Design Group, *Ground & Site Plan* (Ref: BT130308-SD3) included as Appendix B the site is proposed to contain a motel, gymnasium and restaurant.

2.0 SITE HYDROLOGY AND HYDRAULICS

2.1 Background

The following sections define the parameters of the sites hydraulics. The Rational Method has been applied to define flow rates at and through the subject site.

2.2 Pre Development

2.2.1 Catchment Definition and Legal Point of Discharge

The subject site consists of a single internal catchment governed by the lot boundaries with a Legal Point of Discharge (LPOD) on the south western boundary. The pre development catchment area and legal points of discharge are shown on Knobel Consulting Pty Ltd, *Pre Development Stormwater Catchment Plan* (Ref: K2464/P001/A) include as Appendix C.

2.2.2 Coefficient of Runoff

The predevelopment coefficient of runoff has been calculated based on the fraction impervious method specified in QUDM. A total of 152 m² of impervious area was determined on the subject site. A fraction impervious of 0.04 was calculated and by applying the one hour rainfall intensity for a 1 in 10 year ($^{1}I_{10}$) of 64 mm/hr the coefficient of runoff was determined from Table 4.05.3(a) in QUDM.

With reference to QUDM Table 4.05.2, applying the frequency factors for the standard storms of 2, 5, 10, 20, 50 and 100 years results in the following pre development coefficients of runoff as shown in Table 3:

Table 3: Pre Development Coefficient of Runoff

C ₂	C _s	C ₁₀	C ₂₀	C ₅₀	C ₁₀₀
0.60	0.67	0.70	0.74	0.81	0.84

2.2.3 Time of Concentration

Friends Equation ($t_c = (107nL^{0.333})/S^{0.2}$) from QUDM has been applied for overland sheet flow from the north eastern boundary to the south western boundary for a length of approximately 100 m. The slope of the site over this length is approximately 4.25 % with a Horton's value of n=0.045 being applied for a average grass surface for the roughness. This equates to a travel time of 17 minutes to the LPOD.

2.2.4 Design Flow Rates

Design storm flow rates have been calculated for standard storms with an ARI of 2, 5, 10, 20, 50 and 100 years for the pre development case using design rainfall intensities from IEAust, Australian Rainfall and Runoff (1987). The Rational Method ($Q = 2.78 \times 10-3$ CIA) has been used to calculate the required design flow rates for the subject site.

The calculated pre development peak flows on the subject site are presented in Table 4:

Table 4: Pre Development Flow Rate

Peak Flow Rate (m³/s)	Q	0.057	0.082	0.098	0.120	0.157	0.185
Average Rainfall Intensity (mm/h)		84	109	124	144	172	195
Area of Catchment (ha)	Α	0.406	0.406	0.406	0.406	0.406	0.406
Coefficient of Runoff	C	0.60	0.67	0.70	0.74	0.81	0.84
Average Recurrence Interval	ARI	2	5	10	20	50	100

2.3 Post Development

2.3.1 Catchment Definition and Legal Point of Discharge

The subject site's post developed catchment has been broken down in to sub catchments however it will be evaluated as a single catchment similar to the predevelopment case. The subject site's LPOD will be to the existing underground stormwater infrastructure on the corner of Russell Street and Barry Street where the flow is currently conveyed after it flows over the south western boundary. The catchment area and legal point of discharge for the proposed development are shown on Knobel Consulting Pty Ltd, Post Development Stormwater Catchment Plan (Ref: K2464/P002/A) included as Appendix D.

2.3.2 Coefficient of Runoff

The post development coefficient of runoff has been calculated based on the fraction impervious method specified in QUDM. The total impervious area in the post developed scenario equates to 3678 m^2 . A fraction impervious of 0.90 was calculated.

With reference to QUDM Table 4.05.3, applying the frequency factors for the standard storms of 2, 5, 10, 20, 50 and 100 years results in the following post development coefficients of runoff as shown in Table 5:

Table 5: Post Development Catchment A Coefficient of Runoff

C ₂	C,	C ₁₀	C _{zo}	C _{so}	C ₁₀₀
0.74	0.83	0.87	0.91	1.0	1.0

2.3.3 Time of Concentration

The time of concentration for the post developed scenario will equate to 5 minutes of roof to ground time plus 2 minutes of pipe/channelized flow. This is a conservative approach as it is expected that some of the pervious areas will not entirely contribute to the peak flow rate in this time.

2.3.4 Design Flow Rates

Design storm flow rates have been calculated for standard storms with an ARI of 2, 5, 10, 20, 50 and 100 years for the post development case using design rainfall intensities from IEAust, *Australian Rainfall and Runoff (1987)*. The Rational Method ($Q = 2.78 \times 10-3 \text{ CIA}$) has been used to calculate the required design flow rates for the subject site.

The calculated post development peak flows on the subject site are presented in Table 6:

Table 6: Post Development Flow Rate

Average Recurrence Interval	ARI	2	5	10	20	50	100
Coefficient of Runoff	C	0.74	0.83	0.87	0.91	1.0	1.0
Area of Catchment (ha)	A	0.406	0.406	0.406	0.406	0.406	0.406
Average Rainfall Intensity (mm/h)	THE PARTY	121	157	180	210	251	284
Peak Flow Rate (m³/s)	Q	0.101	0.147	0.177	0.216	0.283	0.320

3.0 STORMWATER DETENTION

The development of land will potentially increase peak flow rates from the subject site due to increased impervious areas and a reduction in the surface roughness of the site. The following section provides preliminary details of an onsite detention system ensuring there will be no adverse impacts associated with the increased runoff rate on downstream properties and infrastructure.

3.1 Objective

The following objective has been set for stormwater discharge from the site and proposed development:

• No net increase in peak flows from the subject site for all events up to and including the Q_{100} storm event during the post developed condition.

This objective shall be achieved by detaining site runoff within the detention tank located within the development.

3.2 Detention Volume Required

The required volume of detention for the catchment has been estimated in accordance with the methods outlined in QUDM Section 5.00. With reference to Table 7, the following detention volumes have been adopted.

Table 7: Catchment A Preliminary Detention Basin Sizing - Peak Discharge Rate

ARI	100	yr
Qo	0.185	m²/s
Qi	0.320	m³/s
tc (post)	7	min
Vi	179.2	m³
Vs	47.03	m³
Vs	75.60	m³
Vs	31.81	m ³
Vs	61.03	m³

(QUDM Eq: 5.01, Culp) (QUDM Eq: 5.02, Boyd) (QUDM Eq: 5.03, Carroll)

(QUDM Eq: 5.04, Basha)

Boyd's equation has been adopted as it produces the most conservative estimate, although it is noted that this equation often over estimates the required volume. A check of the required detention volume has been made for storm durations longer than the critical time of concentration up until the post development discharge rate falls to the peak pre development discharge rate. Often the critical detention volume required is for a storm with a duration longer than the critical time of concentration (and hence peak discharge rate).

Table 8: Catchment A Preliminary Detention Basin Sizing - Q100, Various Durations

Qo (m³/s)	0.185	0.185	0.185	0.185	0.185
Qi (m³/s)	0.320	0.305	0.291	0.279	0.232
tc (post) (min)	7	8	9	10	15
Vi (m³)	179.2	195.2	209.52	223.2	278.4
Vs (m ³)	75.6	76.8	76.32	75.2	56.4

It was found that the post developed site with a storm duration of 8 minutes would require the largest volume. A volume of 76.8 m² (Boyd) has been adopted at this stage. It is anticipated that with efficient design configuration and features a modelled detention volume will be less than this initial estimate.

3.3 Detention Design

It is proposed to provide the required detention in an underground detention tank. The preliminary size and location of the detention tank is shown on the Knobel Consulting Pty Ltd, *Stormwater Management Plan* (Ref: K2464/P003/C) and *Bioretention Details* (Ref: K2464/P004/A) included as Appendix E. Preliminary levels have been investigated to ensure the proposed system is feasible.

The preliminary levels area as follows:

Outlet Pipe Invert:

18.40 m AHD

Receiving Stormwater Infrastructure Invert;

18.20 m AHD (approx)

Detention Tank Roof Level:

20.0 m AHD

Detention Tank Area:

48.0 m²

Detention Tank Volume:

76.8 m³

As finished site levels have not been confirmed at this stage, this initial calculation is an estimate but is accurate enough to progress the design with confidence. The estimated volume above assumes the tank will be 'online' i.e., all Q₁₀₀ runoff is directed into the tank.

4.0 WATER QUALITY ASSESSMENT

4.1 Background

The development of land has the potential to increase the pollutant loads within stormwater runoff and downstream watercourses. During the construction phase of the development disturbance to the vegetation on the site has the potential to significantly increase sediment loads entering downstream watercourses.

The operational phase of the development will increase the density of residential land use potentially increasing the amount of sediments and nutrients washing from the site. The following sections describe the predicted increase in pollutant loads generated by the proposed development and treatment devices to mitigate the potential increases.

4.2 Water Quality Objectives

In accordance with Department of Environment and Resource Management (DERM), State Planning Policy 4/10 and Urban Stormwater Guidelines, 2010, Table 2.2, the following reductions in the average annual pollutant load discharging from the site have been applied:

- 85% for suspended solids;
- 45% for nitrogen;
- · 70% for phosphorus; and
- 100% for gross pollutants.

4.3 Post Development Water Quality

The water quality modelling package Music v5.1 has been used to assess the quantity of pollutants generated from the post developed site. MUSIC Modelling Parameters have been sourced from Water by Design, *Music Modelling Guidelines*, 2010. Rainfall data from the Rockhampton Aero station for years 1989-2010 at 6 minute time step intervals has been used in the analysis.

4.3.1 Water Quality Modelling Results

Table 9 summarises the post development pollutant loads from the subject site without the inclusion of water quality improvement devices.

Table 9: Water Quality Modelling Results

Parameter	Total
Flow (ML/yr)	2.36
TSS (kg/yr)	396
TP (kg/yr)	0.887
TN (kg/yr)	7.55
Gross Pollutants (kg/yr)	53.8

4.4 Operational Phase

The following sections detail proposed Stormwater Quality Improvement Devices (SQID's) to be incorporated into the operational phase of the development.

4.4.1 Stormwater Quality Improvement Devices

The roof area from restaurant and gym (Catchments A & C) will discharge to a bioretention swale along the north western boundary which will also convey and treat the flow generated from the northern motel block courtyard area (Catchment H). The carpark area for the restaurant and gym (Catchment D) will sheet flow in to a bio-retention swale located in the northern half of the south eastern boundary. The entire motel area will be conveyed to a bio-retention basin in the southern corner of the site. A swale will be located in the southern portion of the site on south eastern boundary to convey the minor flow generated from the rear courtyard area of the southern motel rooms (Catchment M). The locations and details of the stormwater quality devices can be seen in Knobel Consulting Pty Ltd, Stormwater Management Plan (Ref: K2464/P003/A) and Bioretention Details (Ref: K2464/P004/A).

A flow chart of the proposed stormwater quality treatment train is show in Figure 3.

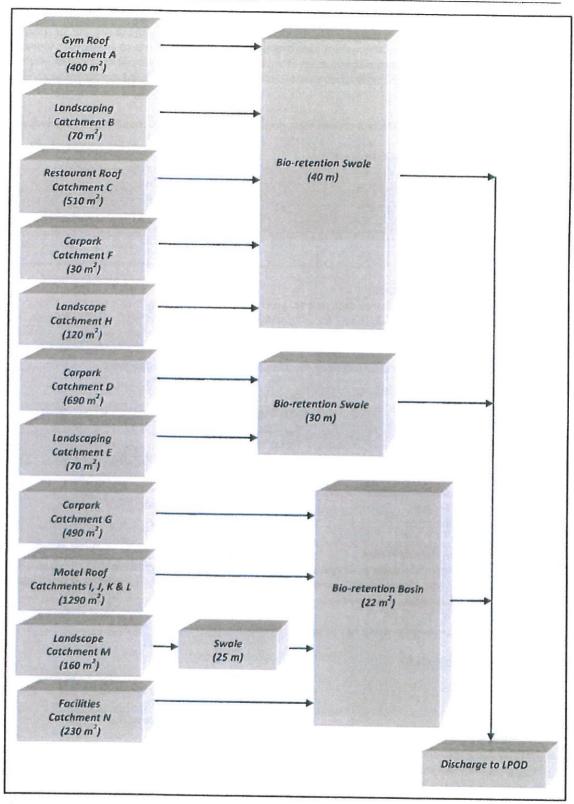


Figure 3: Stormwater Quality Treatment Train Flow Chart

4.4.2 Design Parameters of the Stormwater Quality Improvement System

Detailed design of the stormwater quality treatment train shall be in accordance with the Healthy Waterways, Water Sensitive Urban Design Technical Design Guidelines for South East Queensland (2006).

VEGETATED SWALES

Vegetated swales are used to convey stormwater in lieu of pipes and to provide for removal of coarse and medium sediment. The system uses overland flow and mild slopes to slowly convey water downstream. Swales also provide a disconnection of impervious areas from hydraulically efficient pipe drainage systems resulting in slower travel times thus reducing the impact of increased catchment imperviousness on peak flow rates.

The following swales dimensions were determined for the MUSIC modelling as summarised in Table 10:

Table 10: Swale Parameters

		Vegetatio			Swale D	imensions		Req.	Actual
Swale Id	Slope (%)	n Height (mm)	Mannings 'n'	Base Width (m)	Side Slope (1in)	Depth (m)	Top Width (m)	Flow Rate (m³/s)	Flow Rate (m³/s)
5wale	1.0 (Min.)	75	0.030	0	2.0	0.15	0.6	0.014	0.025

BIO-RETENTION BASIN

A bio-retention basin is designed to pond stormwater allowing it to percolate through a layer of filter media, typically sandy loam. Runoff passing through the filter media is collected within a perforated pipe discharging to downstream drainage infrastructure.

The bio-retention basin has been modelled with the following properties:

Filter media

Sandy Loam;
>3% Organic Content;

K_{sat} = 180 mm/hr;
TN Content = 400 mg/kg
Orthophosphate Content = 20 mg/kg

Filter media depth
Extended detention depth
Filter Area
Exfiltration

Sandy Loam;

300 mm/hr

BIO-RETENTION SWALE

A bio-retention swale is designed to convey stormwater while allowing it to percolate through a layer of filter media, typically sandy loam. Runoff passing through the filter media is collected within a perforated pipe discharging to downstream drainage infrastructure.

The bio-retention swale has been modelled with the following properties:

Filter media	Sandy Loam;
	>3% Organic Content;
	$K_{sat} = 180 \text{ mm/hr};$
	TN Content = 400 mg/kg
	Orthophosphate Content = 20 mg/kg
Filter media depth	400 mm;
Extended detention depth	0 mm;
Filter Area	24.0 m ² - 24.0 m ²
Exfiltration	0 mm/hr
Swale Grade	4.0% (Max.)
Vegetation Height	100 mm
Base Width	0.8 m - 1.0 m
Side Slope	1 in 2
Depth	0.20 m
Length	30.0 m - 40.0 m

4.4.3 Post Development Modelling Results - Mitigated

The MUSIC modelling results are shown in Table 11 below and demonstrate that by treating stormwater runoff from the subject site the required pollutant removal rates are achieved in all pollutants apart from the TSS which misses the removal target by 0.2%. This can be overlooked in this case as the model does not take in to account the grass buffers in the landscape areas which predominantly remove TSS from stormwater runoff.

Table 11: Mitigated Pollutant Loads

Parameter	Post	Post Mitigated	Removal %
Flow (ML/yr)	2.36	2.22	0
TSS (kg/yr)	396	59.3	85.0
TP (kg/yr)	0.887	0.266	70.1
TN (kg/yr)	7.55	3.72	50.8
Gross Pollutants (kg/yr)	53.8	0.00	100

4.5 Construction Phase

4.5.1 Key Pollutants

During the construction phase a number of key pollutants have been identified for this development.

Table 12 illustrates the key pollutants that have been identified.

Table 12: Key Pollutants, Construction Phase

Poliutant	Sources
Litter	Paper, construction packaging, food packaging, cement bags, material off cuts.
Sediment	Exposed soils and stockpiles during earthworks and building works.
Hydrocarbons	Fuel and oil spills, leaks from construction equipment and temporary car park areas.
Toxic Materials	Cement slurry, asphalt primer, solvents, cleaning agents, and wash waters (e.g., from tile works).
Acids or Alkaline substances	Acid sulphate soil, cement slurry and wash waters.

4.5.2 Performance Criteria

The following site discharge pollutant criteria have been identified during the construction phase of the development.

Table 13: Construction Phase, Water Quality Performance Criteria

Pollutant	Criteria
Total Suspended Solids	90 th percentile <50mg/L
pH	6.5 - 8.5
Dissolved Oxygen	90 th percentile >80% saturation or 6mg/L
Hydrocarbons	No visible sheen on receiving waters
Litter	No visible litter washed from site.

4.5.3 Sediment and Erosion Controls

Sediment and erosion control devices (S&EC) employed on the site shall be designed and constructed in accordance with the Institution of Engineers, *Soil Erosion and Sediment Control Guidelines*. Details of the proposed controls are shown on the Knobel Consulting Pty Ltd, *Sediment and Erosion Control Plan* (Ref: K2464/P005/A) and Knobel Consulting Pty Ltd, *Sediment and Erosion Control Details* (Ref: K2464/P006/A) included as Appendix F.

PRE CONSTRUCTION

- Stabilised site access/exits on Russell Street;
- Sediment fences to be located along the contour lines downstream of disturbed areas;
- Diversion drain to divert clean runoff around the construction site; and

Educate site personnel to the requirements of the Sediment and Erosion Control Plan.

CONSTRUCTION

- Maintain construction access/exit, sediment fencing, sediment basin, catch drains and all other existing controls as required;
- Drainage structure protection around field inlets and gully pits; and
- Confine construction activities to stages to minimise areas of disturbance at any given time.

During construction, all areas of exposed soils allowing dust generation are to be suitably treated. Treatments will include mulching the soil and watering. Road accesses are to be regularly cleaned to prevent the transmission of soil on vehicle wheels and eliminate any build up of typical road dirt and tyre dusts from delivery vehicles.

Adequate waste disposal facilities are to be provided and maintained on the site to cater for all waste materials such as litter hydrocarbons, toxic materials, acids or alkaline substances.

4.5.4 Bio-retention Systems Construction Controls

Protection of the filtration media and vegetation within bio-retention systems is important during the construction phase of the development; uncontrolled runoff can cause sedimentation and clogging of the filter media.

For the proposed bio-retention basin the contractor shall adopt a staged implementation. During the later stages of the construction phase of the development the filter media shall be covered with a layer of geotextile, 50 mm of soil and turf strips laid perpendicular to the direction of flow.

Bio-retention basins shall be fenced during the construction phase of the development to prevent both the compaction of the filter media by vehicles and the wash down of waste materials within the basins.

5.0 CONCLUSIONS

This Site Based Stormwater Management Plan (SBSWMP) details the planning, layout and design of the stormwater management infrastructure for both the construction and operational phases of this development.

The proposed development will result in an increase in runoff compared to the pre developed site. The report outlines a successful mitigation strategy for the post development flow rates.

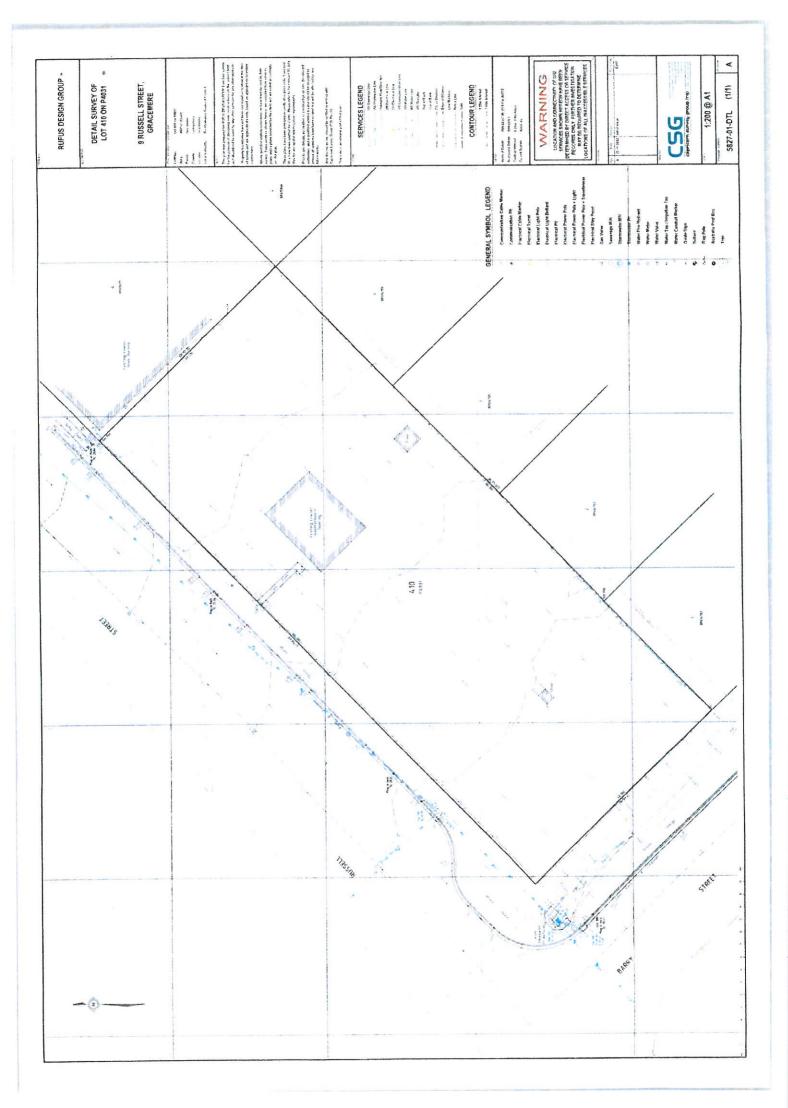
Knobel Consulting Pty Ltd has adopted a water sensitive urban design (WSUD) approach to managing the stormwater runoff from the proposed development by treating stormwater runoff within the SQID's. Through the use of these SQID's it can be seen to satisfy the performance outcomes and water quality objectives outlined in Department of Environment and Resource Management, State Planning Policy 4/10 Healthy Waterways and Urban Stormwater Guidelines.

A

Capricorn Survey Group

Detail Survey of Lot 410 on P4031

(Ref: 5827-01-DTL)

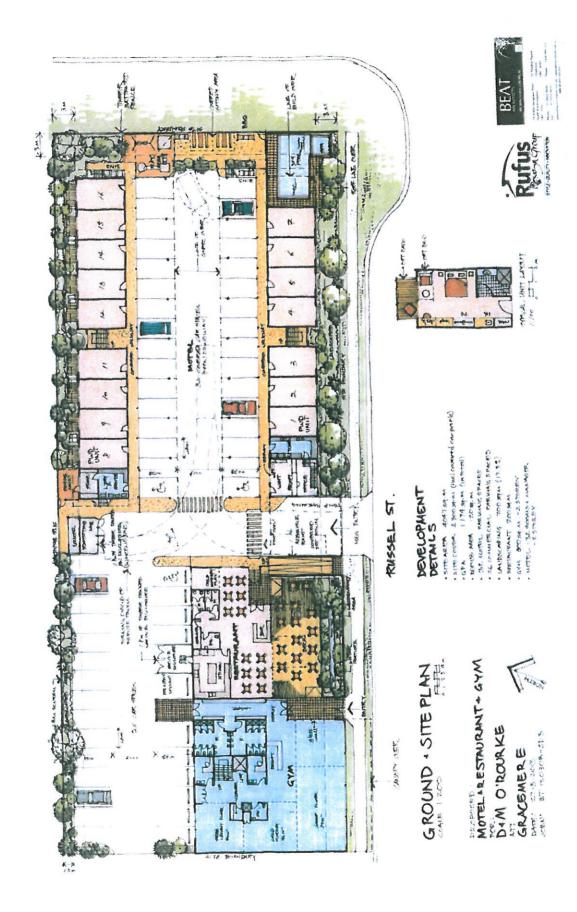


B

Rufus Design Group

Ground & Site Plan

(Ref: BT130308-SD3)

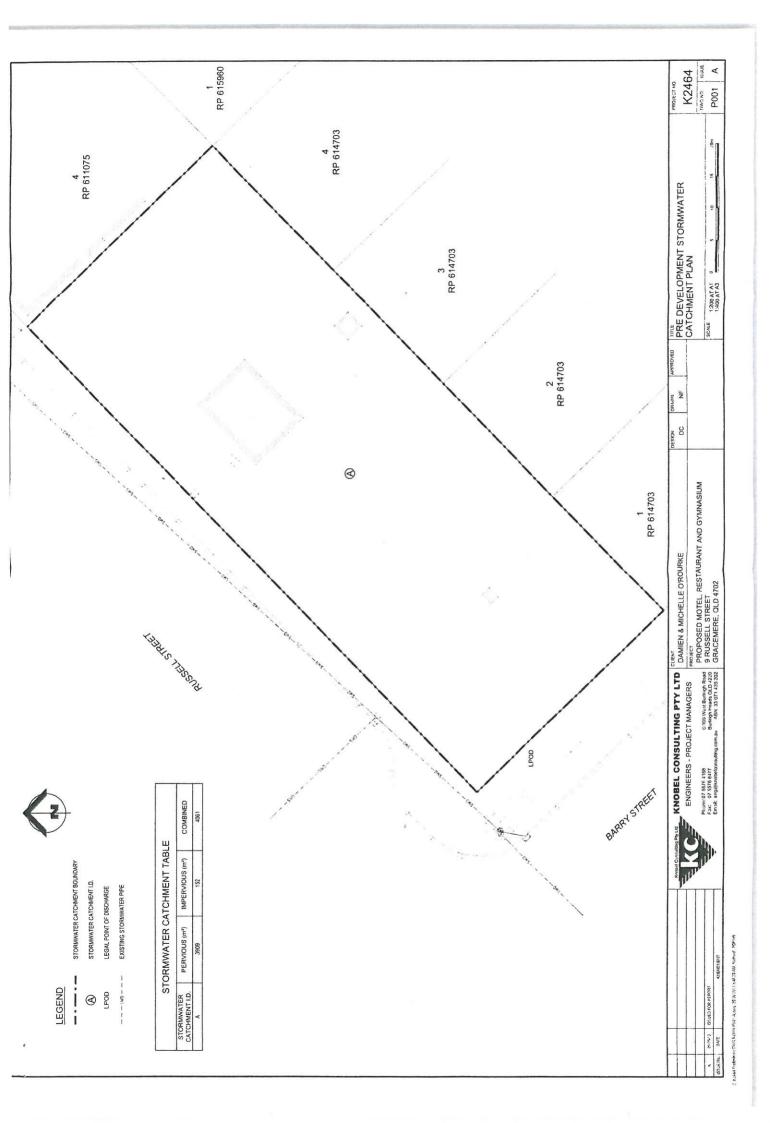


C

Knobel Consulting Pty Ltd

Pre Development Stormwater Catchment Plan

(Ref: K2464/P001/A)

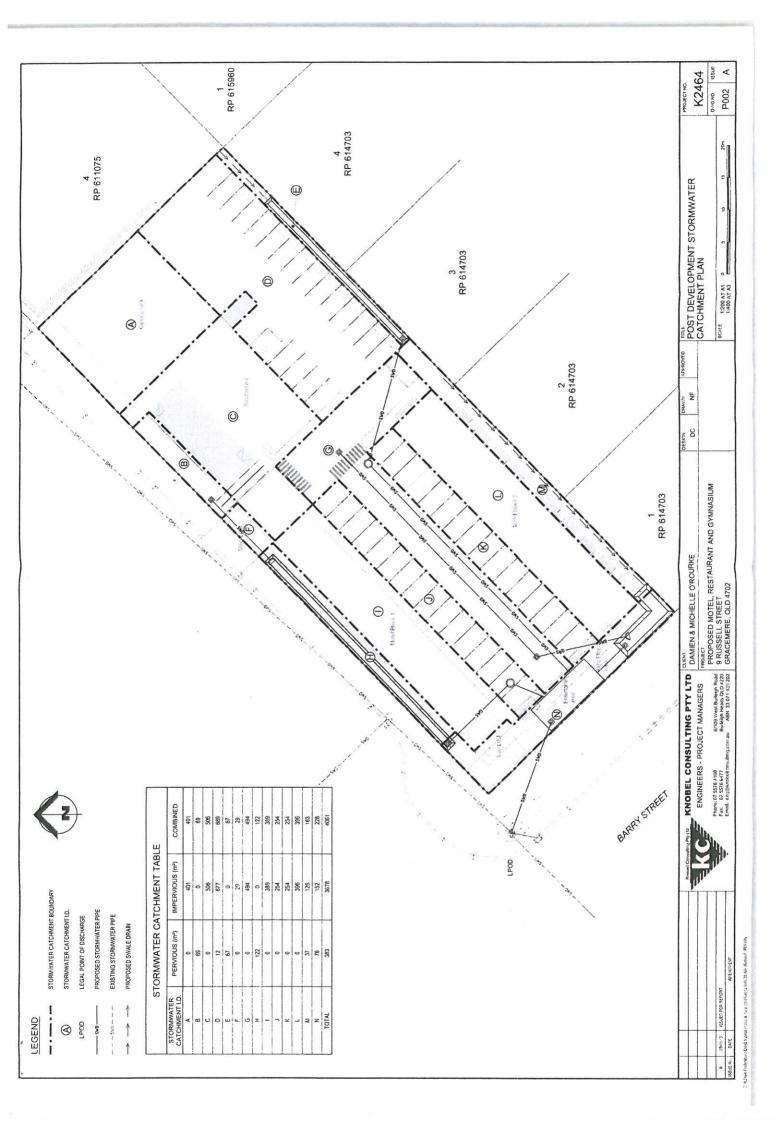


D

Knobel Consulting Pty Ltd

Post Development Stormwater Catchment Plan

(Ref: K2464/P002/A)



E

Knobel Consulting Pty Ltd

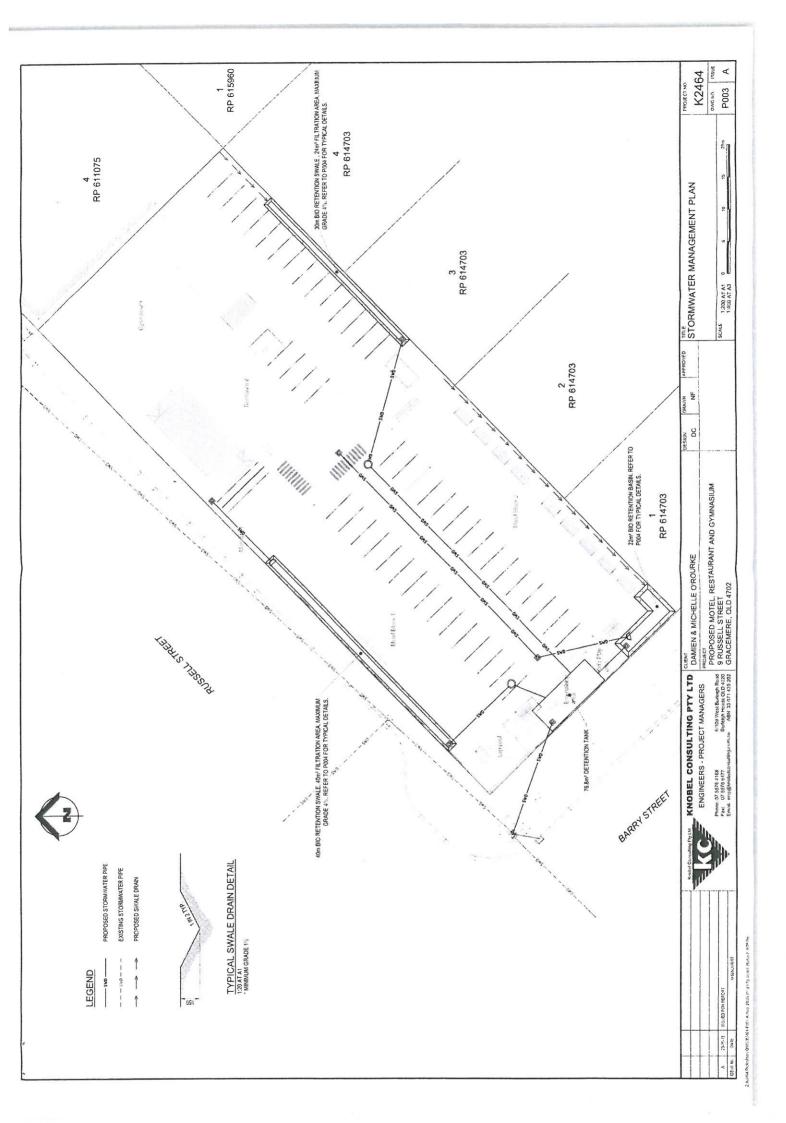
Stormwater Management Plan

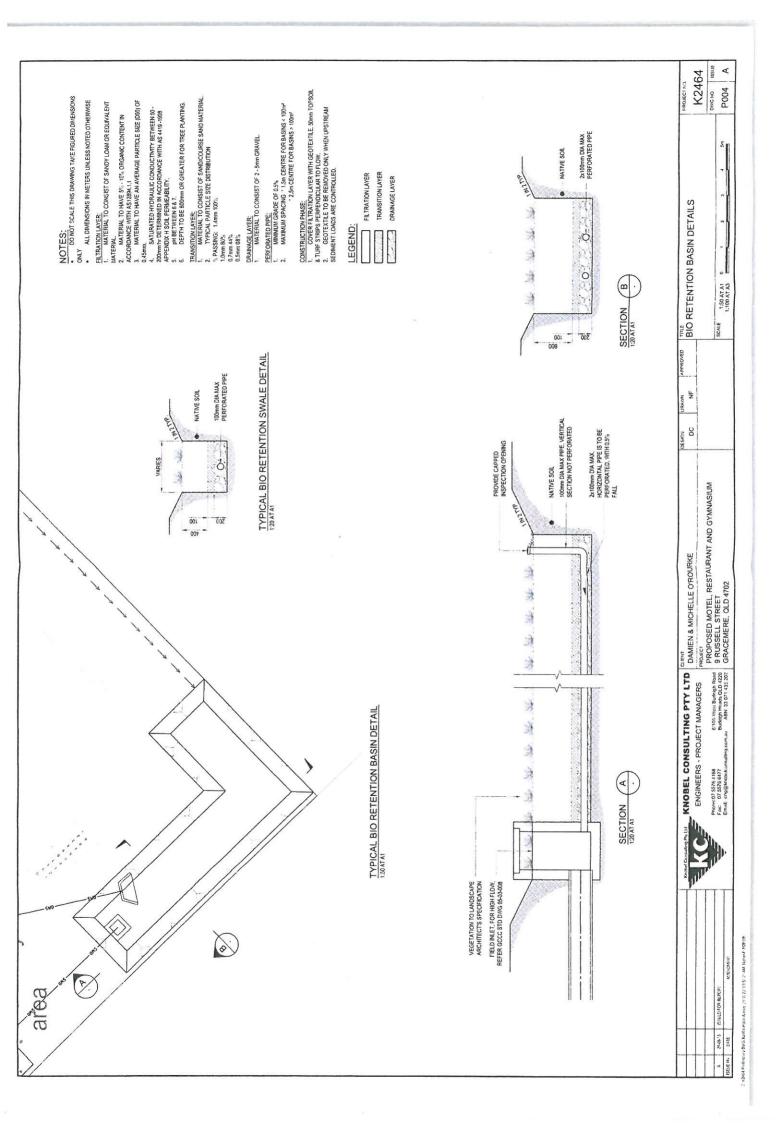
(Ref: K2464/P003/A)

and

Bioretention Details

(Ref: K2464/P004/A)





F

Knobel Consulting Pty Ltd

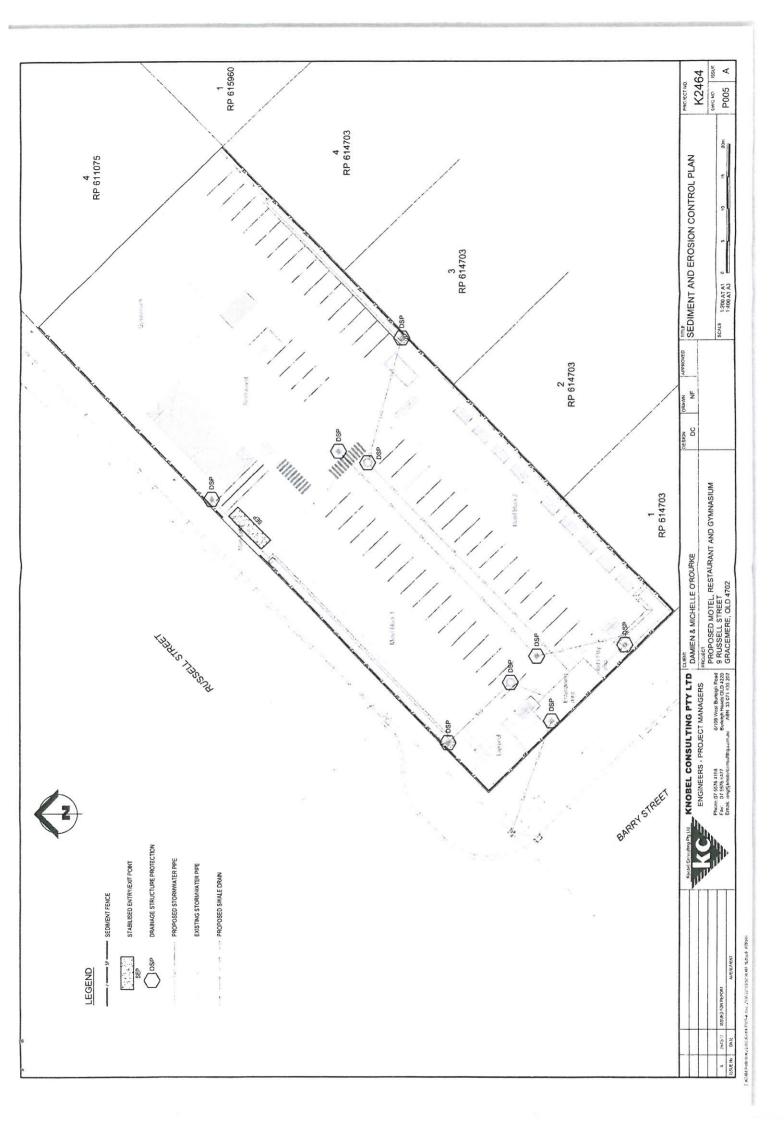
Sediment and Erosion Control Plan

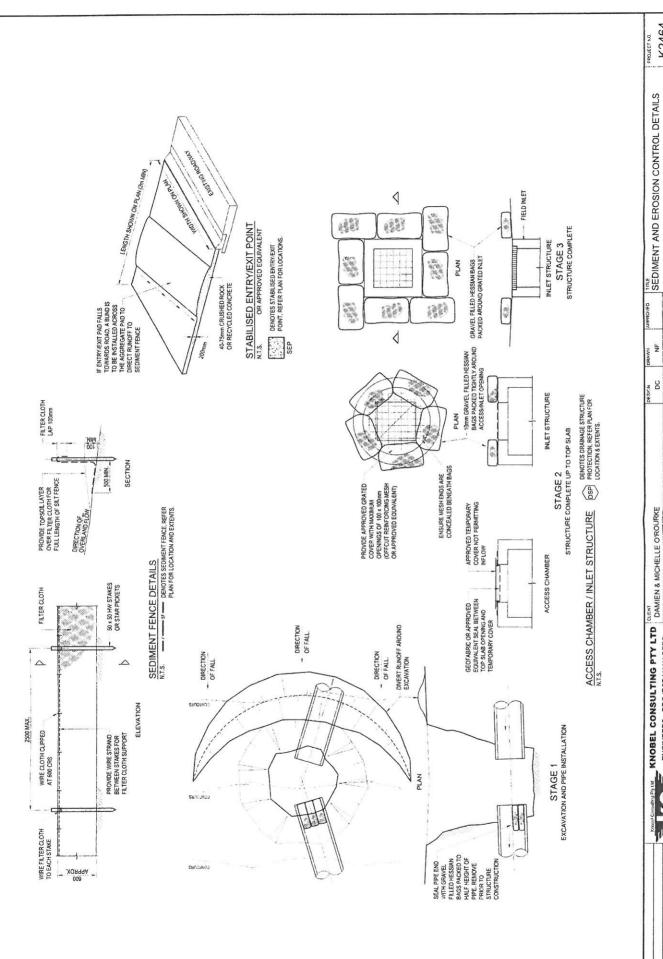
(Ref: K2464/P005/A)

and

Sediment and Erosion Control Details

(Ref: K2464/P006/A)





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2	DAMIEN & MICHELLE O'ROURKE	20	¥
	PROJECT		
	PROPOSED MOTEL, RESTAURANT AND GYMNASIUM		
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THIS DRAWING IS NOT TO SCALE