





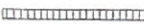




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These plans are approved subject to the current  
conditions of approval associated with  
Development Permit No. D/483-2013  
Dated 03-02-14

#### LEGEND

-  Proposed Driveway
-  Existing Road
-  Existing Stormwater pipe
-  Existing Stormwater Inlet
-  Proposed Stormwater pipe / MH
-  Proposed Stormwater Pit
-  Proposed Tile Material
-  13.90 Preliminary Surface Level
-  Extend Existing Council Stormwater Network

#### STORMWATER PLAN 9 Palmer Street Proposed Stormwater Plan R13178 - SK03

0 0.625 2.5m 1:125 (A1)  
0 1.25 5.0m 1:250 (A3)

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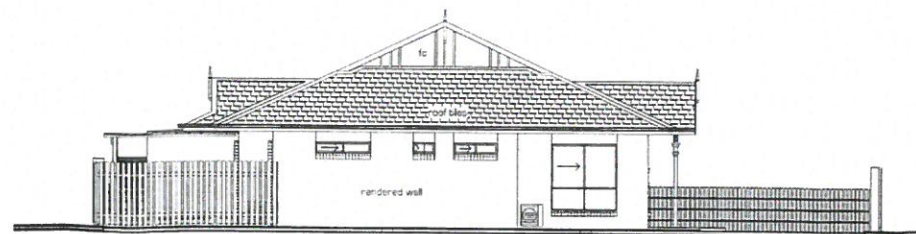
**BROWN**  
*Smart Consulting*

INCORPORATING GRAHAM SCOTT & ASSOCIATES

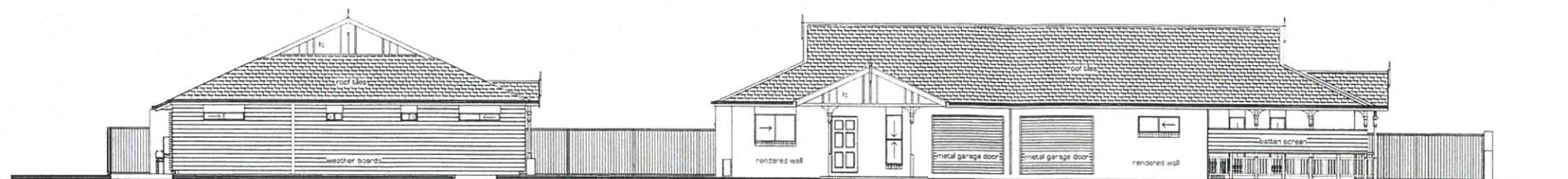




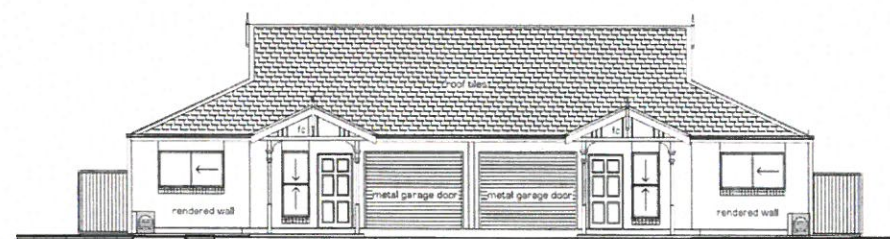
1 Elevation North: Unit 1 1:100



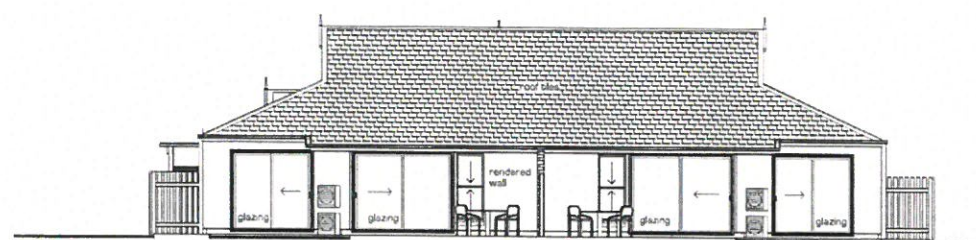
5 Elevation South: Unit 2 1:100



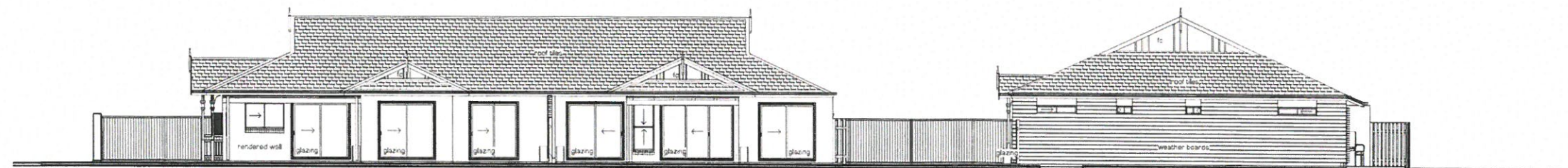
2 Elevation East: Unit 3, 2 & 1 1:100



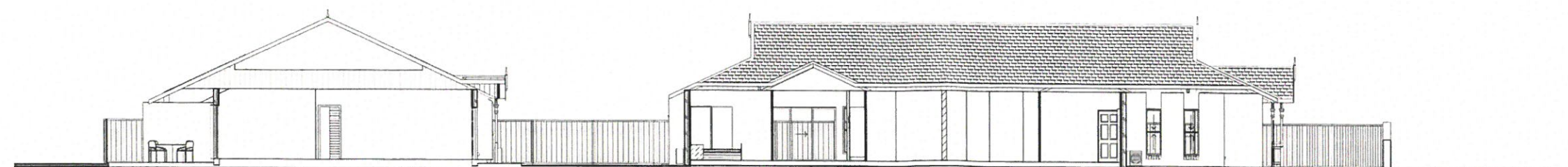
6 Elevation North: Unit 3 & 4 1:100



3 Elevation South: Unit 4 & 3 1:100



4 Elevation West: Unit 1, 2 & 4 1:100



A Section AA 1:100

revision	description	date
P1	01.02.13 Concept Layout	jb
P2	15.03.13 Preliminary Issue	as
P3	22.03.13 Preliminary Issue	as
P4	01.05.13 Preliminary Issue	as
P5	15.05.13 Preliminary Issue	jb

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Dated 03-02-14

#### Project Details

client  
**B. Harth**  
  
project  
**Proposed Units**  
  
address  
**Lot 4 Palmer Street**

type  
**Elevations**



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design	drawn	checked
jb	as	jb
scale	as shown	date 15.03.13
sheet	A1	4 of 5
title		P5



rev	date	description	rev
P1	01.03.13	Concept Layout	16
P2	15.03.13	Preliminary Issue	15
P3	22.03.13	Preliminary Issue	14
P4	01.05.13	Preliminary Issue	13
P5	16.05.13	Preliminary Issue	12

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#### Project Details

client

**B. Harth**

project

**Proposed Units**

address

**Lot 4 Palmer Street**

title

**Floor Plan**



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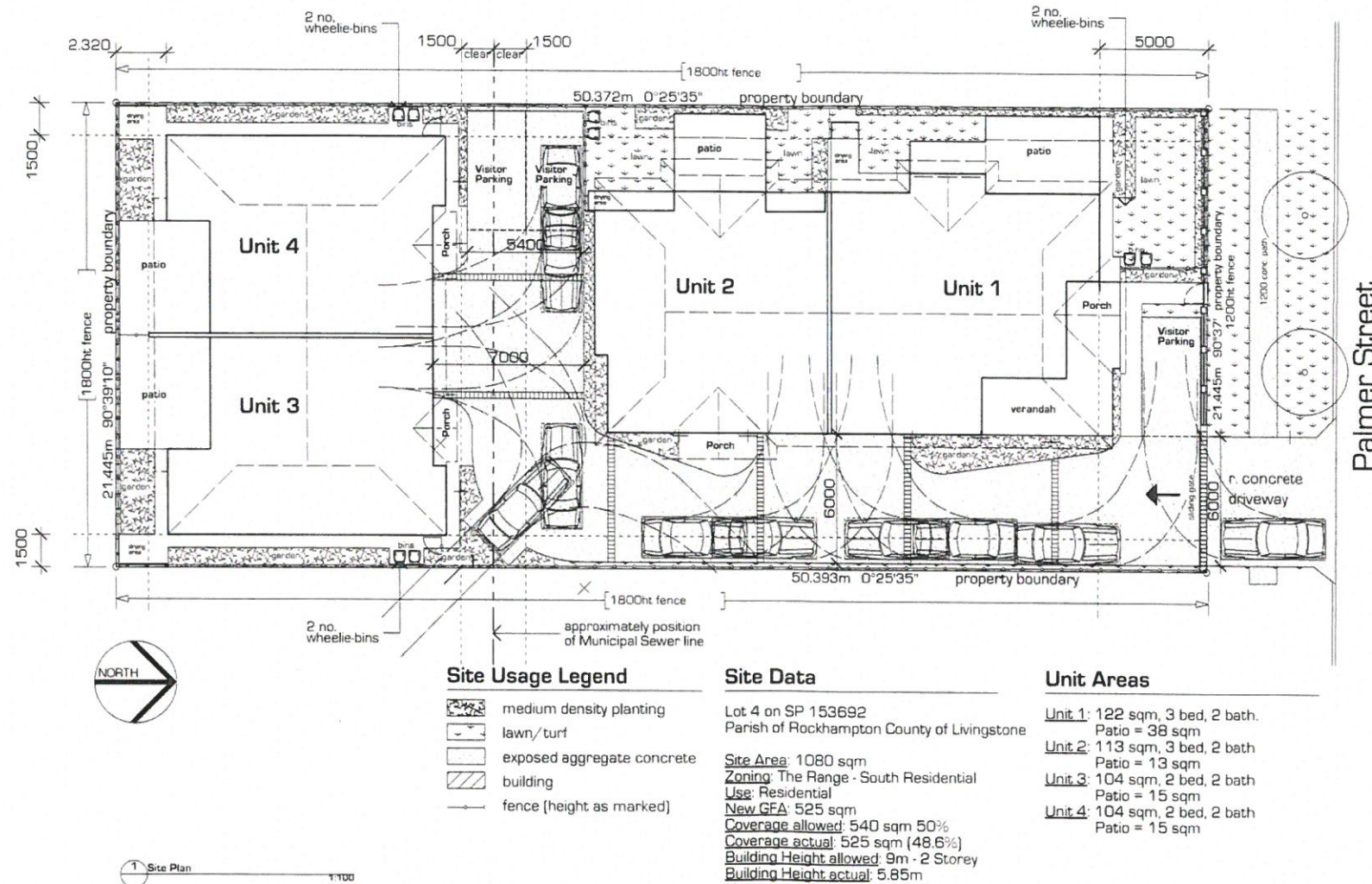
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design	drawn	rev	date
as shown	BT120252		15.03.13
scale	SD.02		
sheet	A1	2 of 5	P5

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Dated **03-02-14**





Revisions	By	Date
1	10/01/11	10/01/11
2	10/01/11	10/01/11
3	10/01/11	10/01/11
4	10/01/11	10/01/11
5	10/01/11	10/01/11

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Dated 03-02-14

#### Project Details

1. Harth

Proposed Units

Lot 4 Palmer Street

Site Plan

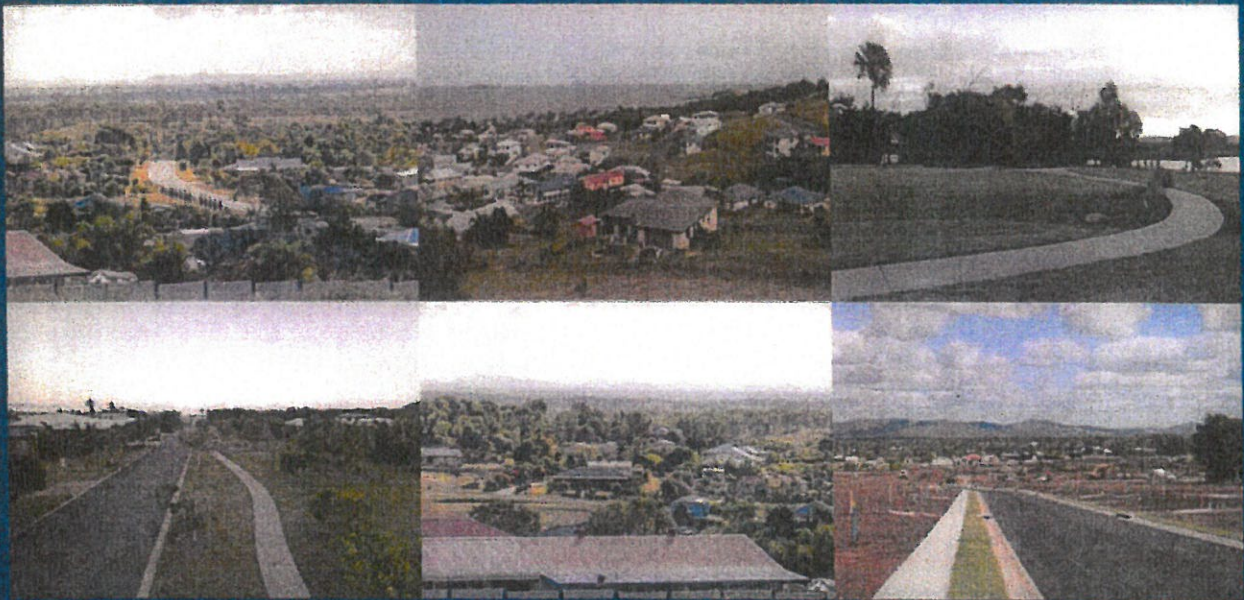


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## Stormwater Management Report

ROCKHAMPTON REGIONAL COUNCIL

These plans are approved subject to the current  
conditions of approval associated with  
Development Permit No. D/483-2013  
Dated 03-02-14

Proposed 4 Unit Development  
9 Palmer Street, Rockhampton

October 2013

R13178

Prepared by: Jarey and Jane North

Urban Development - Rockhampton





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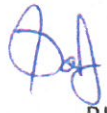

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2013

### DOCUMENT CONTROL

Stormwater Management Report – October 2013

Issue	Date	Issue Details	Author	Checked	Approved
A	10/13	Stormwater Management Report	 PJ	JD	 Jeff Davey RPEQ 8386

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### APPENDICES

Appendix A	Existing Site Conditions
Appendix B	Proposed Plan of Development Plan (BEAT Architects)
Appendix C	Preliminary Surface and Floor Levels
Appendix D	Proposed Stormwater Plan
Appendix E	Stormwater Calculations Spreadsheets



## 1. Introduction/Background

Brown Smart Consulting has been engaged to prepare the following Stormwater Management Report which will address stormwater quantity issues, associated with the proposed development of four (4) units on Lot 4 on SP 153692 known as 9 Palmer Street, Rockhampton.

The existing site plan is illustrated on Brown Consulting Sketch R13178 – SK01 and is included as Appendix A.

The objective of this report is to provide confirmation that the development will not create adverse stormwater impacts on external properties.

## 2. Site Characteristics

The total area of the site is approximately 0.108 hectares and currently exists as a developed single residential dwelling, with a sizeable shed in the backyard. The property is also serviced by a large internal concrete driveway.

The site currently grades from approximately RL 15m AHD in the north-west of the property to approximately RL 13.0m AHD in the south-east corner.

## 3. Proposed Development and Preliminary Surface Levels

The proposed development is to demolish the existing multi bedroom residential dwelling and establish four (4) high quality residential units.

These units will a mixture of two (2) x two (2) bedroom units and two (2) x three (3) bedroom units.

The proposed Plan of Development (POD) has been illustrated in BEAT Architects drawings and these drawings are included as Appendix B.

In considering this POD, preliminary surface levels throughout the site have been determined to blend in as much as possible with the natural surface level. Preliminary surface levels have been illustrated on Brown Consulting Sketch R13178 – SK08 and has been included as Appendix C.

Based upon these preliminary surface levels, preliminary floor levels have established at RL 13.90m AHD, using a freeboard of 400mm.



## 4. Stormwater Management

### 4.1 Existing Hydrological Characteristics

The existing site, Lot 4 on SP 153692, forms part of a catchment that encompasses proportions of several upstream properties, namely:

- » Lot 1 RP 606183,
- » Lot 2 RP 603232,
- » Lot 2 RP 605257, and
- » Lot 1 RP 605257.

In assessing the hydrological conditions, this report will consider and assume that:

1. The existing upstream catchment will remain in its current developed condition, and
2. The subject site's hardstand area will increase, post development.

Therefore, as part of the development, Brown Consulting will need to cater for both the existing upstream catchment and retain stormwater on-site, to prevent actionable damage from occurring on external properties.

### 4.2 Existing Upstream Catchment Characteristics

The catchment area, which currently drains into and across Lot 4 on SP 153692, is approximately 0.25 hectares.

The Minor Design Storm Event has been designed to cater for the 5year ARI storm event, whilst the Major Design Storm Event is the 100 year ARI.

An average Horton's factor ( $n$ )\* of 0.033 was used, which is representative of earthen surfaces (ie. Backyard Lawns etc.). Please note that Horton's value for " $n$ " in this instance, is very similar to Manning's value for " $n$ ".

Friend's Equation was used to determine the maximum overland sheet flow travel time across the 75metre, catchment "spine"; which graded approximately 6.67% (ie. 5 metres over a 75 metre length). The Time of Concentration was calculated to be 11 minutes.

Rainfall Intensities, for the Rockhampton region, were then determined to be the following:

- » Minor Storm Event (5 year ARI) 131mm/hr, and
- » Major Storm Event (100 year ARI) 237mm/hr.

In accordance with Tables 4.05.1 to 4.05.3(b) of QUDM, the existing runoff coefficient ( $C_{10}$ ) of 0.7. Based upon the above calculations, the following flow rates generated by the upstream catchment were as follows:

- » Minor Storm Event (5 year ARI) 0.060 m<sup>3</sup>/sec, and
- » Major Storm Event (100 year ARI) 0.138 m<sup>3</sup>/sec.

To cater for the above flows, a 300mm pipe with XX pits, is to be constructed on the western (ie. upstream side) of the development to cater for the upstream flows and to prevent any ponding, that may create actionable damage, occurring.



## 4.3 Proposed Development of Site

### 4.3.1 Pre-Development Conditions

The proposed development site involves the demolition of the existing single dwelling and the construction of four (4) units on the 0.103 hectares.

The Minor Design Storm Event has been designed to cater for the 5year ARI storm event, whilst the Major Design Storm Event is the 100 year ARI.

An average Horton's factor ( $n$ )\* of 0.033 was used, which is representative of earthen surfaces (ie. Backyard Lawns etc.). Please note that Horton's value for " $n$ " in this instance, is very similar to Manning's value for " $n$ ".

Friend's Equation was used to determine the maximum overland sheet flow travel time across the 20metre, catchment "spine"; which graded approximately 7.5% (ie. 1.5 metres over a 20 metre length). The Time of Concentration was calculated to be 5 minutes.

Rainfall Intensities, for the Rockhampton region, were then determined to be the following:

- » Minor Storm Event (5 year ARI) 177mm/hr, and
- » Major Storm Event (100 year ARI) 321mm/hr.

Using an existing runoff coefficient ( $C_{10}$ ) of 0.7, the following flow rates were calculated for the site:

- » Minor Storm Event (5 year ARI) 0.034 m<sup>3</sup>/sec, and
- » Major Storm Event (100 year ARI) 0.077 m<sup>3</sup>/sec.

### 4.3.2 Post-Development Conditions

With the development of the Units, the average Horton's factor ( $n$ )\* was changed to 0.015, which is representative of paved surfaces (ie. predominately hardstand etc.). Again please note that Horton's value for " $n$ " in this instance, is very similar to Manning's value for " $n$ ".

A roof and internal drainage time of 5 minutes was used, in the post development scenario, which complies with QUDM section 4.06.5. Therefore, the Rainfall Intensities, for the Rockhampton region, were then determined to be the following:

- » Minor Storm Event (5 year ARI) 177mm/hr, and
- » Major Storm Event (100 year ARI) 321mm/hr.

Using a post development runoff coefficient ( $C_{10}$ ) of 0.0.95, the following flow rates were calculated for the site:

- » Minor Storm Event (5 year ARI) 0.046 m<sup>3</sup>/sec, and
- » Major Storm Event (100 year ARI) 0.092 m<sup>3</sup>/sec.

Based upon the above calculations, a slight increase of 0.012 m<sup>3</sup>/sec for the Minor Storm event is attributable to the development and a similar minor increase of 0.015 m<sup>3</sup>/sec for the Major Storm event has resulted.



Therefore implementation of an on-site detention tank(s), with a capacity of 7,120 litres would need to be constructed, to prevent an increase in stormwater flows affecting the adjoining downstream properties. Stormwater calculation spreadsheets have been included in Appendix E.

The upgrading of the existing stormwater network development site, will discharge into Council's system, which exists in the Palmer Street verge. Further detailed calculations will be undertaken at the Operational Works phase of the application.

## 5. Conclusion

The proposed development of the site would generate a minor increase the flow rate of stormwater being released into the legal point of discharge. To mitigate this increase in stormwater runoff from the sites catchments, the development proposes to detain stormwater by rainwater tank(s).

These rainwater tank(s) will form part of the detention storage for roof water runoff from the buildings and the stormwater can be collected by an eaves gutter drainage system.

To limit the stormwater runoff from the site to pre development conditions, it is recommended that a total of 7,120 litres of detention is provided onsite. Proposed rainwater tank(s), with a capacity of 8KL can adequately handle this situation.

Detention volume has been calculated using a method in QUDM and further advice from a research paper (C.J Scraggs & C.J Lemckert – Griffith University, QLD 2004) on which method is most appropriate considering the reduction ratio. In this case the Boyd method was used. A minimum time of concentration of 5 minutes has been applied in accordance with QUDM table 4.06.1.

These rainwater tanks can also assist with the provision of water for irrigation purposes.

To ensure that the upstream properties are not adversely affected by the proposed development, a "pit and pipe" network is proposed to be constructed at the western boundary of the site, to cater for the existing stormwater flows.

This internal stormwater network will grade from the rear of the property towards Palmer Street and discharge into a newly constructed stormwater pit, located in the Palmer Street verge. To accommodate this, the existing Council stormwater infrastructure will need to be extended to the north-east corner of the development site.

By incorporating the recommendations of this report into the proposed design, Brown Consulting believe that both the existing upstream catchment and the downstream properties, will not be adversely affected by this proposed development.

If you should have any questions regarding this report, please do not hesitate to contact our office and speak with either Jeff Davey or Paul Jenkins.