



Legend

- Site Boundary
- 10m Buffer to Adjoining Use
- Caravan Parking - 23 Bays
Caravan parking bays 4m x 8m
- Visitor Car Parking - 66 Bays
Visitor parking bays 2.4m x 6m

House Type	Dimensions	Area (m ²)	No of Lots	% Mix
16m Deep Allotments				
1	12 x 16	192	20	8%
2	12 x 16	192	65	25%
3	12.5 x 16	200	58	23%
4	12.5 x 16	200	60	23%
5	13 x 16	208	36	14%
17m Deep Allotments				
A	12 x 17	204	3	1%
B	12 x 17	204	3	1%
C	12.5 x 17	212.5	6	2%
D	12.5 x 17	212.5	3	1%
E	13 x 17	221	2	1%
Total			256	

DECISION NOTICE
The Approved Plan of Development for Development Approval
MCUI/33/2015
subject to changes in the conditions of approval and these not being a
regulated Decision Notice, other Notice or Court consent order that
changes the development approval

Disclaimer
The contents of this plan are conceptual and for discussion purposes only. All areas and dimensions are approximate and subject to relevant studies, survey, engineering and Council approval. Landscaping detail shown on this plan is for illustrative purposes only.

The information used in this plan is drawn from the following sources:
Aerial, Near Map
Site Boundaries: Registered Survey Plans
Cadastral: DCDB



KOPLICK ROAD

ROAD

FLAT

CHAMBERS

5
RP68700

EXISTING RESIDENTIAL

31
RP848575

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MCU1/33/2015

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LEGEND

- Site Boundary
- Open Space - Waterway Corridor
- Open Space / Landscaping
- 10m Buffer to Adjoining Use
- Carparking - 66 bays
- Caravan Parking - 23 bays

House Type	Dimensions	Area (m ²)	No of Lots	% Mix
16m Deep Allotments				
1.5 Bed	12 x 16	192	20	8%
2 Bed 1.5 Bath	12 x 16	192	65	25%
2 Bed 2 Bath	12.5 x 16	200	58	23%
2.5 Bed	12.5 x 16	200	60	23%
3 Bed	13 x 16	208	36	14%
17m Deep Allotments				
1.5 Bed	12 x 17	204	3	1%
2 Bed 1.5 Bath	12 x 17	204	3	1%
2 Bed 2 Bath	12.5 x 17	212.5	6	2%
2.5 Bed	12.5 x 17	212.5	3	1%
3 Bed	13 x 17	221	2	1%
Total			256	

Note:
All Lot Numbers, Dimensions and Areas
are approximate only, and are subject to
survey and Council approval.
Dimensions have been rounded to the
nearest 0.1 metres.
Areas have been rounded down to the
nearest 5m².
The boundaries shown on this plan
should not be used for final detailed
engineers design.



SCALE 1 : 1000 @ A1

0 20 40 60 80 100

DATE: 10 JULY 2015

DWG NAME : 126720-05-PRO

DWG # 126720-05B

SITE LAYOUT PLAN
Ingenia Communities Holdings Ltd



- Legend**
- Site Boundary
 - 10m Buffer to Adjoining Use
 - Stage Boundary

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Stage	No of Lots
1	23
2	27
3	28
4	39
5	23
6	37
7	41
8	38
Total	256

Disclaimer

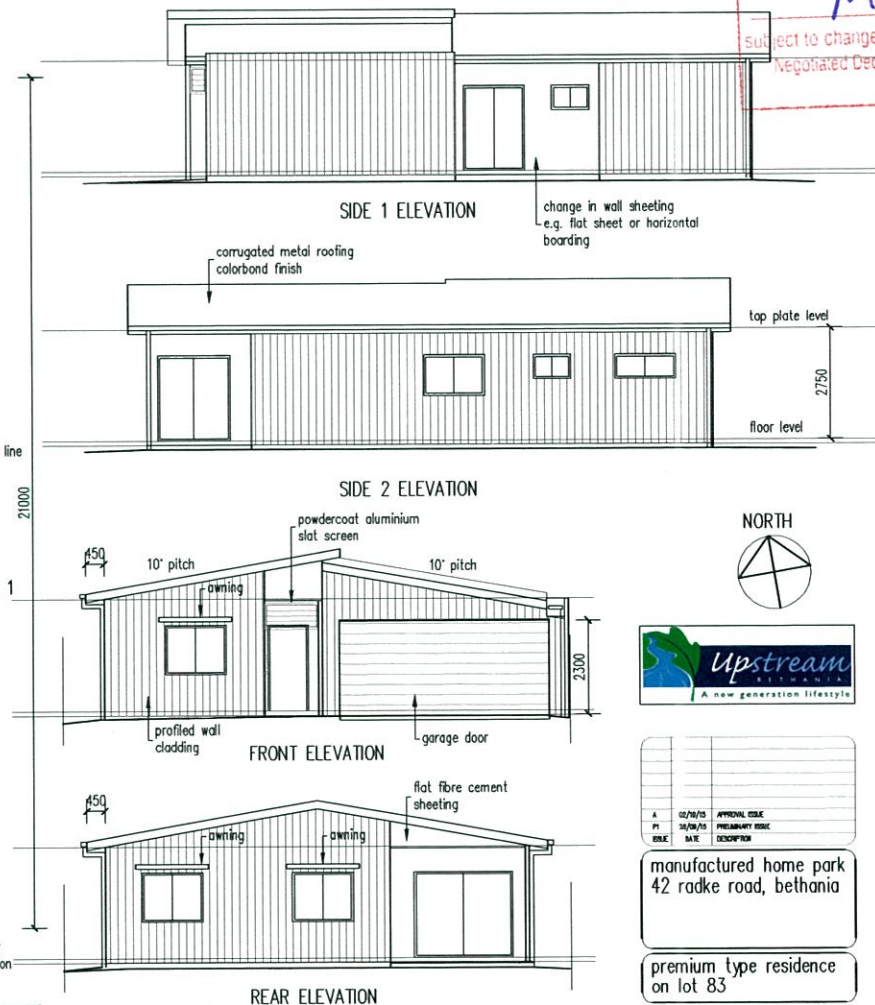
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The information used in this plan is drawn from the following sources:

- Aerial, Near Map
- Site Boundaries: Registered Survey Plans
- Cadastral: DCDB

The Approved Plan of Development for Development Approval

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changes the development approval



change in wall sheeting
e.g. flat sheet or horizontal
boarding

top plate level

50

ONT ELEVATION

flat fibre cement
[sheeting]

AREA SCHEDULE

OUTSIDE OF WALLS EXCLUDING GARAGE = 99.0 SQ.M.

GARAGE = 37.7 SQ.M.

PATIO = 9.6 SQ.M.



A	02/10/15	APPROVAL ISSUE
P1	26/06/15	PRELIMINARY ISSUE
ISSUE	DATE	DESCRIPTION

manufactured home park
42 radke road, bethania

```

premium type residence
on lot 83

```

RAYMOND BARBER ARCHITECT
SUITE 85, 283 GLEN TERRACE, PADDINGTON, 4004.
P.O. BOX 1, PADDINGTON, 4004.
PHONE (07) 381 8177

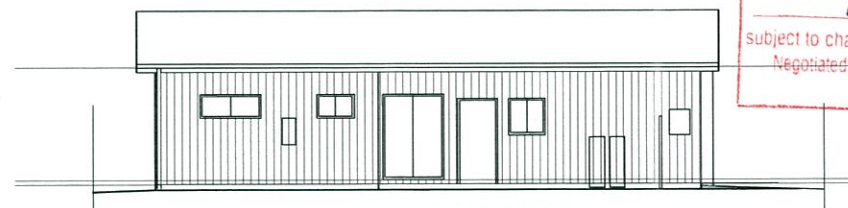
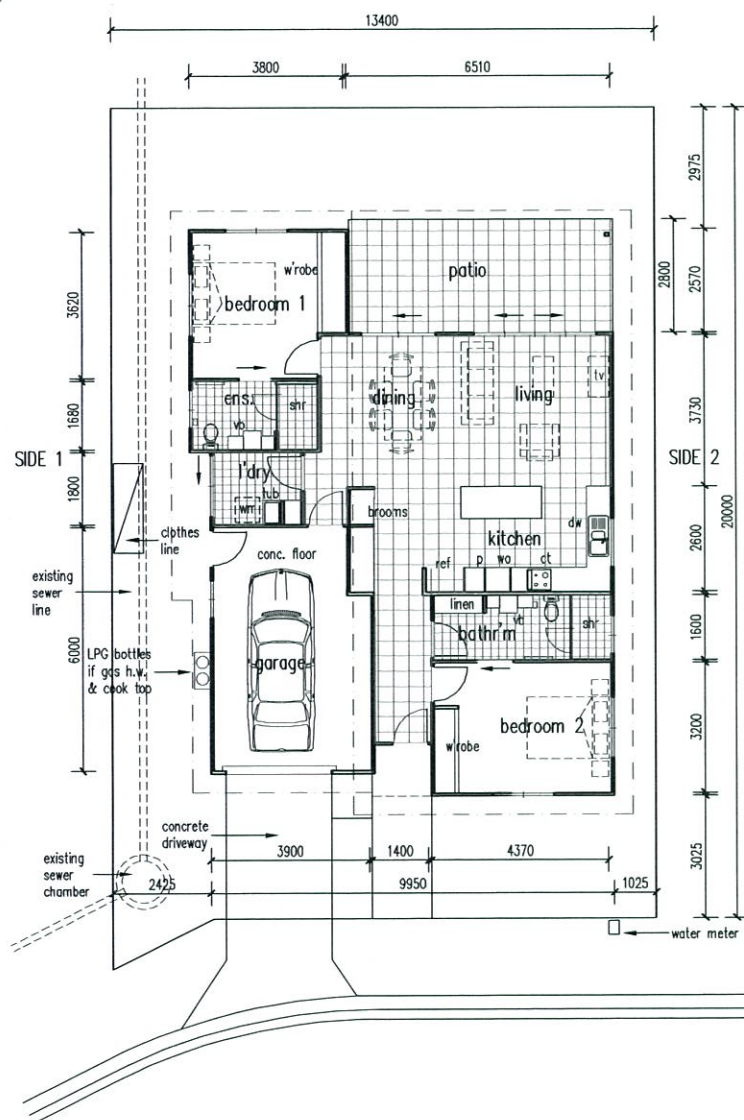
DATE DRAWN CHECKED SCALE
SEP 78 A.B. AS 1:100 1022-0001

DECISION NOTICE

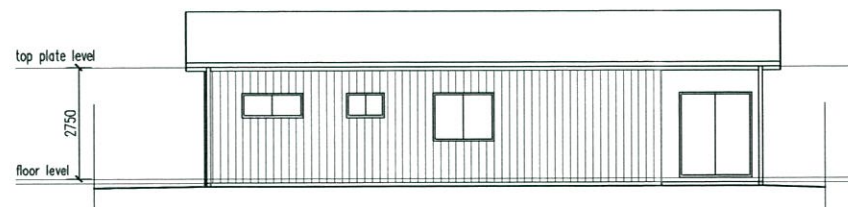
The Approved Plan of Development for Development Approval

MCU1/33/2015

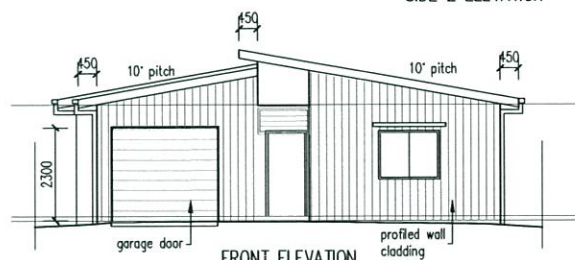
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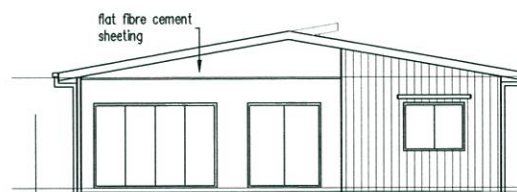
SIDE 1 ELEVATION



SIDE 2 ELEVATION



FRONT ELEVATION



REAR ELEVATION



AREA SCHEDULE

OUTSIDE OF WALLS EXCLUDING GARAGE = 98.0 SQ.M.

GARAGE = 23.0 SQ.M.

PATIO = 18.2 SQ.M.



DATE	DESCRIPTION
02/10/15	APPROVAL ISSUE
16/06/15	PRELIMINARY ISSUE
DATE	DESCRIPTION

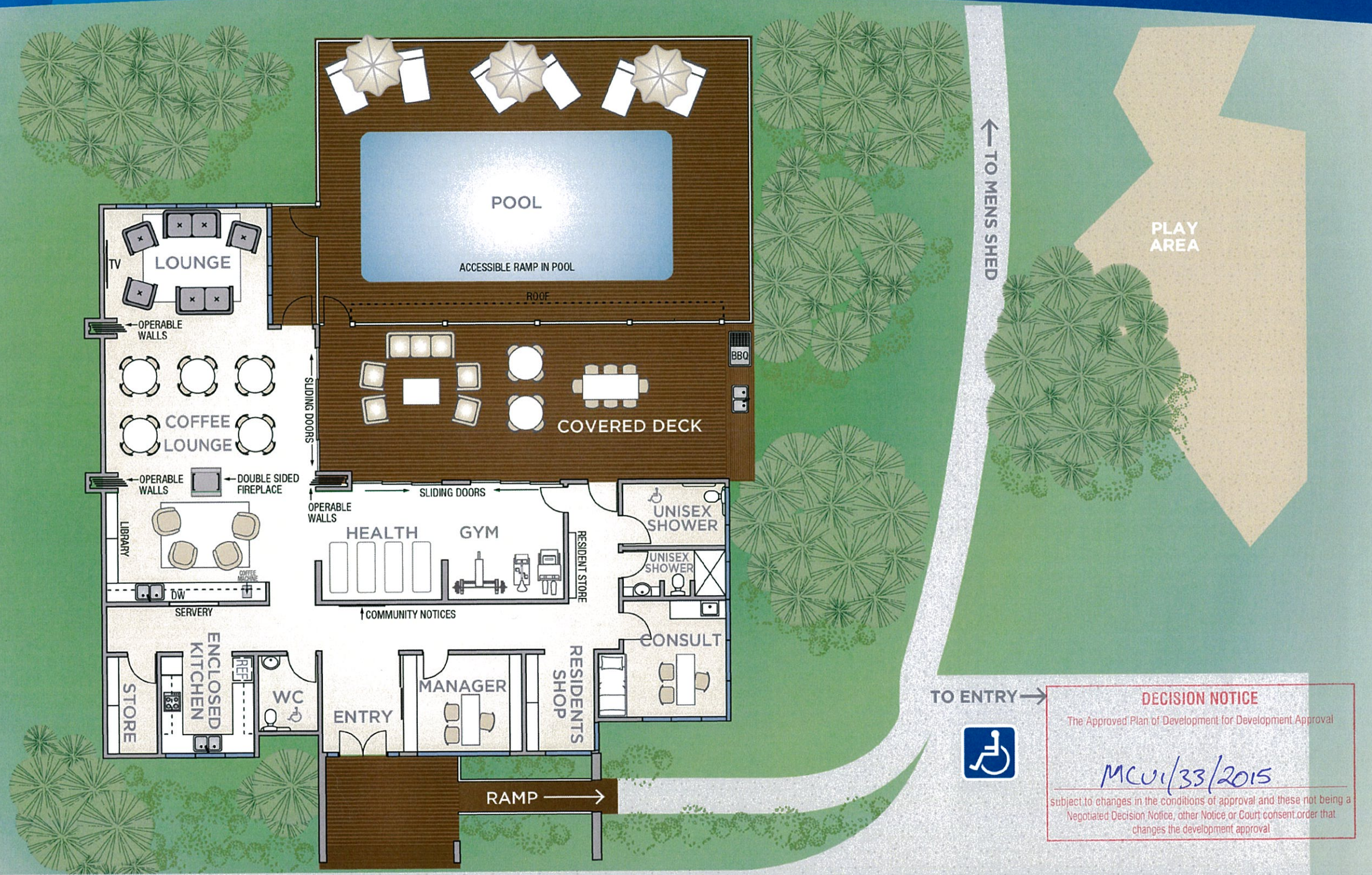
manufactured home park
42 radke road, bethania

standard type residence
on lot 98

RAYMOND BARBER ARCHITECT
SUITE 10, 101 OVEN HERNS, PARRAMATTA, NSW
P.O. BOX 1, PARRAMATTA, N.S.W. 2150
PHONE (02) 361 8177

DATE DRAWN CHECKED SCALE AS SHOWN 1022-0001
SHEET NO. 1 OF 1

COMMUNITY BUILDING FLOOR PLAN CONCEPT



DECISION NOTICE

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MCU/33/2015

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COMMUNITY POOL CONCEPT

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COMMUNITY CLUBHOUSE CONCEPT



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For indicative purposes only.



Bushfire Management Plan

**Chambers Pines Lifestyle Resort
Lot 21 RP804908 - 609-657 Chambers Flat Road,
Chambers Flat, QLD**

Prepared by:

RPS AUSTRALIA EAST PTY LTD

PO Box 428
Hamilton NSW 2303

T: +61 2 4940 4200
F: +61 2 4961 6794
E: stuart.greville@rpsgroup.com.au

Client Manager: Stuart Greville
Report Number: PR123731-1
Version / Date: Final / May 2015

Prepared for:

INGENIA COMMUNITIES

Suite 4, Level 5
241 Adelaide Street
Brisbane QLD 4000

T: 0400 391 784
E: paul.brumpton@possibilitiesqld.com

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Document Status

Version	Orig	Review	Review Date
Draft	LV	SG	12 May 2015
Draft for QA	LV	SG	13 May 2015
Final for Client	SG	SG	15 May 2015

Approval for Issue

Name	Signature	Date
Stuart Greville		15 May 2015

Bushfire Planning and Design Certification


Stuart Greville

Accredited Bushfire Practitioner
BPD-PD-26202



Executive Summary

RPS Australia East Pty Ltd (RPS) has been commissioned by Ingenia Communities to undertake a Bushfire Management Plan (BMP) for the expansion of the existing Chambers Pines Lifestyle Resort on land at Lot 21 RP804908 Chambers Flat Road, Chambers Flat, QLD.

The assessment aims to consider and assess the bushfire hazard and associated potential threats relevant to such a proposal with regard to *Part E* of the *Queensland State Government State Planning Policy* (SPP) (2014), the Draft Logan Planning Scheme (2014) and the Beaudesert Planning Scheme (2007). These policies set out the State's and Council's interest in ensuring that natural bushfire hazards are adequately considered when making decisions regarding development.

The Australian Standard *AS3959-2009 Construction of buildings in bushfire prone areas* applies to Class 1 buildings located within designated bushfire areas. Therefore, this proposal will recommend that all future dwellings meet the performance criteria outlined in the Building Code of Australia (BCA), being compliant with AS3959-2009.

This BMP found the land surrounding the site to support vegetation consistent with *Forest* in accordance with AS3959-2009 and *Vegetation Hazard Class 2: Open Forest/Woodland-shrubby* in accordance with CSIRO (2014) based on the current fuel load assessed during a site visit.

In summary, the following measures are recommended to enable the proposal to address adequate bushfire protection procedures with regard to the abovementioned authorities:

A minimum 11m wide Asset Protection Zone is to be created alongside the entire length of the western boundary of the site;

All vegetation within the setback between the northern and western boundaries and the dwelling sites shall be managed as a low-fuel zone;

All vegetation throughout the entire site shall be managed as a reduced fuel zone;

All dwellings and habitable buildings constructed within the site should have due regard to the specific considerations given in the National Construction Code: Building Code of Australia (BCA) 2014 and Australian Standard *AS3959-2009 Construction of buildings in bushfire prone areas*;

Access roads shall comply with Section 3.3 of this report;

The development is to be connected to the reticulated water supply and that suitable hydrants be clearly marked and provided for the purposes of bushfire protection. Fire hydrant spacing, sizing, and pressure should comply with AS2419.1, 2005; and

An Emergency Management Plan (EMP) shall be prepared to improve the preparedness of the residents and to clearly identify the procedures to be followed in the event of a bushfire.

A review of the site and proposed development layout indicates that compliance with the above recommendations can be achieved or practically implemented without substantial change to the proposed layout or construction methodology.

This assessment has been made based on the bushfire hazards in and around the site at the time of inspection and production (May 2015).

In conclusion, should the recommendations above be duly considered and incorporated, the bushfire hazard present should be reduced to a level considered appropriate to provide an adequate level of protection to life and property of the site, however will not prevent a bushfire from occurring offsite.

Finally, the implementation of the adopted measures and recommendations forwarded within this report will contribute to the amelioration of the potential impact of any bushfire upon the development estate, but they do not and cannot guarantee that the area will not be affected by bushfire at some time.

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Appendices

Appendix 1	Site Layout Plan
Appendix 2	Bushfire Attack Assessor Report

1.0 Introduction

RPS Australia East Pty Ltd (RPS) has been commissioned by Ingenia Communities to undertake a Bushfire Management Plan (BMP) for the expansion of the existing Chambers Pines Lifestyle Resort on land at Lot 21 RP804908, Chambers Flat Road, Chambers Flat, QLD (**Figure 1**).

The assessment aims to consider and assess the bushfire hazard and associated potential threats relevant to such a proposal with regard to *Part E* of the *Queensland State Government Single State Planning Policy* (SPP) (2014), the Draft Logan Planning Scheme (LPS) (2014) and the Beaudesert Planning Scheme (BPS) (2007). These policies set out the State's and Council's interest in ensuring that natural bushfire hazards are adequately considered when making decisions regarding development.

The Australian Standard AS3959-2009 *Construction of buildings in bushfire prone areas* applies to Class 1 buildings located within designated bushfire areas. Therefore, this BTA will recommend that all future dwellings meet the performance criteria outlined in the Building Code of Australia (BCA), being compliant with AS3959-2009.

Additionally, this BMP will make reference to the CSIRO report 'A new methodology for State-wide mapping of bushfire prone areas in Queensland' (2014) with specific focus on their method of vegetation classification.

This BMP has been prepared and reviewed by an Accredited Bushfire Practitioner certified by the Fire Protection Association of Australia.

1.1 Site Particulars

Locality	Chambers Flat Road, Chambers Flat, QLD
LGA	Logan City Council
Titles	Lot 21 RP804908
Area	Approximately 15.9 hectares
Zoning	The site is zoned Mt Lindesay (Countryside (CTYSD)) under the Beaudesert Planning Scheme Zoning Map (ZM 04).
Boundaries	Chambers Flat Road borders the site to the east. Vegetation and a creek line occur directly adjacent to the site's northern boundary, followed by Koplick Road. A large stand of vegetation occurs to the immediate west of the site, with scattered vegetation associated with a rural property occurring to the south.
Current Land Use	The existing Chambers Pines Lifestyle Resort occurs on site, along with a golf course, multiple dams and access ways.
Topography	The site is relatively flat in nature.

1.2 Scope of Works

The scope of works includes the preparation of a Bushfire Management Plan (BMP) in accordance with the SPP and BPS.

The purpose of the BMP in a development assessment context is to:

- (1) Confirm bushfire hazard exposure;
- (2) Direct where on a site development should be located to minimize exposure for people, property and buildings to bushfire hazard;
- (3) Determine measures to be utilized to reduce bushfire hazard;
- (4) Determine measures to be utilized to mitigate any remaining bushfire hazard; and
- (5) Demonstrate all dwelling sites are exposed to Bushfire Attack Level (BAL) 29 or less.

1.3 Proposed Development

The Chambers Pines Lifestyle Resort currently seeks development consent for an additional 256 dwelling sites, 57 car parking spaces and 23 caravan parking bays to be located in the land currently occupied by a golf course.

The reconfiguration and establishment of the new dwelling sites suitable for the installation of relocatable homes is part of the reinvestment program that is being undertaken by Ingenia Communities after their acquisition of the Chambers Pines Lifestyle Resort. The proposed development will assist in modernising the site while providing manufactured home accommodation that is in line with community demands and expectations.

Associated works include clearing, earthworks, roadwork, stormwater and landscaping as well as servicing provisions for sewer, water supply, power and communications.

The Plan of the Proposed Development is contained in **Appendix 1**.

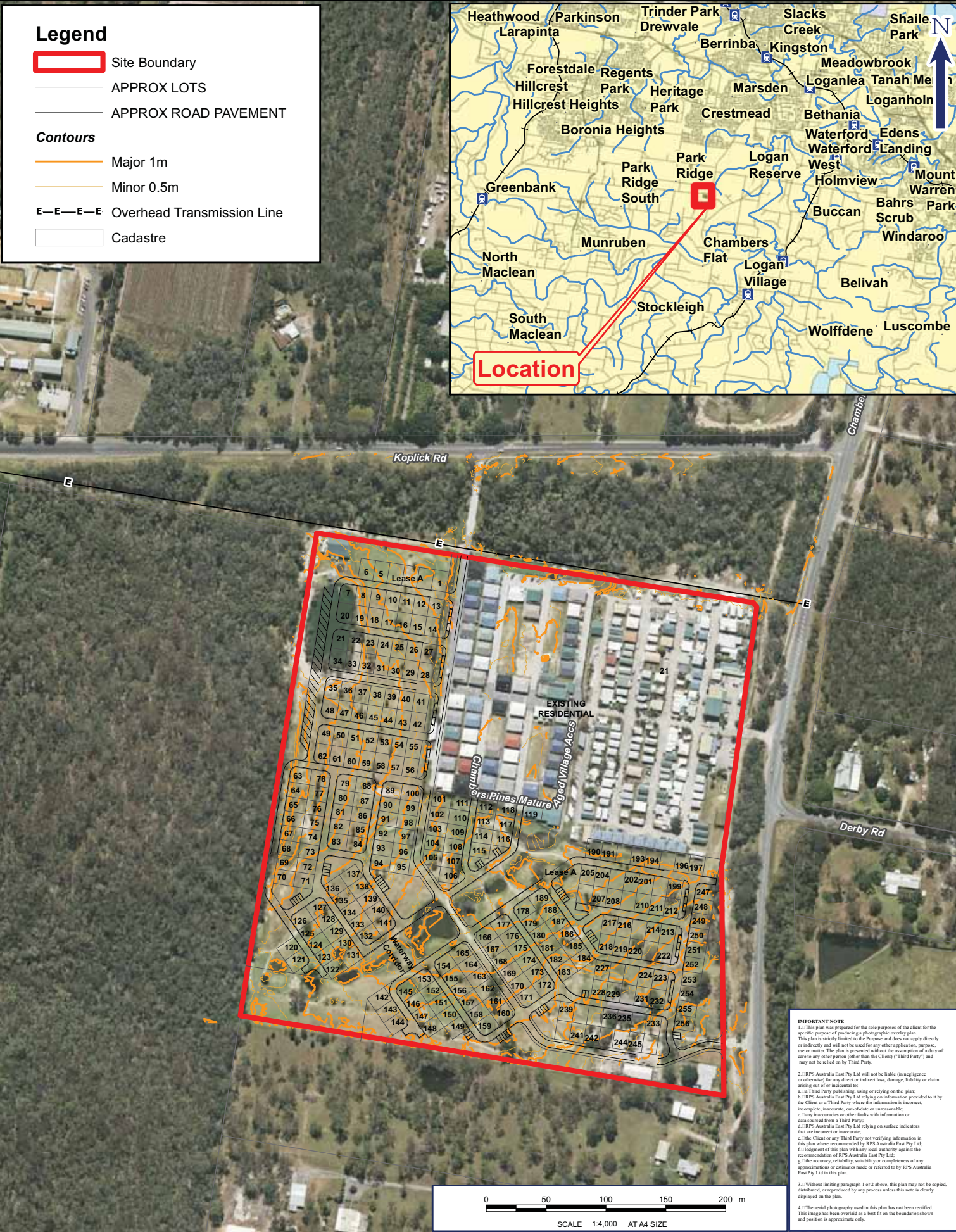


Figure 1: Site Location

LOCATION: Chambers Pine	DATUM: GDA94
	PROJECTION: MGA Zone 56
JOB NO.: PR123731	Data Sources: RPS
PURPOSE: BTA	
Technician: Natalie Wood	Date: 15/05/2015

CLIENT: Ingenia Communities

RPS AUSTRALIA EAST PTY LTD (ABN 44 140 292 762)
241 DENISON STREET BROADMEADOW PO BOX 428 HAMILTON NSW 2303
T: 02 4940 4200 F: 02 4961 6794 www.rpsgroup.com.au

RPS

2.0 Bushfire Hazard Assessment

Bushfire activity is prevalent in landscapes that carry fuel and the two predominant bushfire types are grassland and forest fires. Factors such as topographic characteristics and quantity of fuel loads influence the intensity and spread of fire. The scale of a bushfire hazard is tailored to the characteristics of the hazard, the size and characteristics of the affected population, types of land use exposed to bushfire, predicted development growth pressures and other factors affecting bushfire risk. This section assesses the types and nature of potential hazards surrounding the proposed development.

2.1 Existing Bushfire Prone Land Mapping

The site lies within a geographical area with a Fire Danger Index (FDI) rating of 40 (Queensland). The site is mapped as a Medium Hazard area under the Beaudesert Bushfire Overlay and is only marginally mapped as a Medium Hazard area under the SPP Interactive Mapping (**Figures 2 and 3**). It is noted at the time of lodgement the Beaudesert Shire Planning Scheme is the applicable statutory instrument. Having consideration to the Draft Logan City Council Planning Scheme, the bushfire overlay is consistent with a potential bushfire impact buffer and a marginal area of medium potential bushfire hazard.

Aerial images demonstrate that the adjacent lot to the west of the site (74 Koplick Rd) supports dense vegetation that directly abuts the western boundary of the site. Based on current aerial imagery, both bushfire maps (**Figures 2 and 3**) are therefore inaccurate to some extent. Nevertheless, the site is mapped as a Medium Bushfire Hazard and will be assessed accordingly.



Figure 2 Excerpt from the SPP Interactive Mapping System showing the locations and extents of bushfire hazard area.

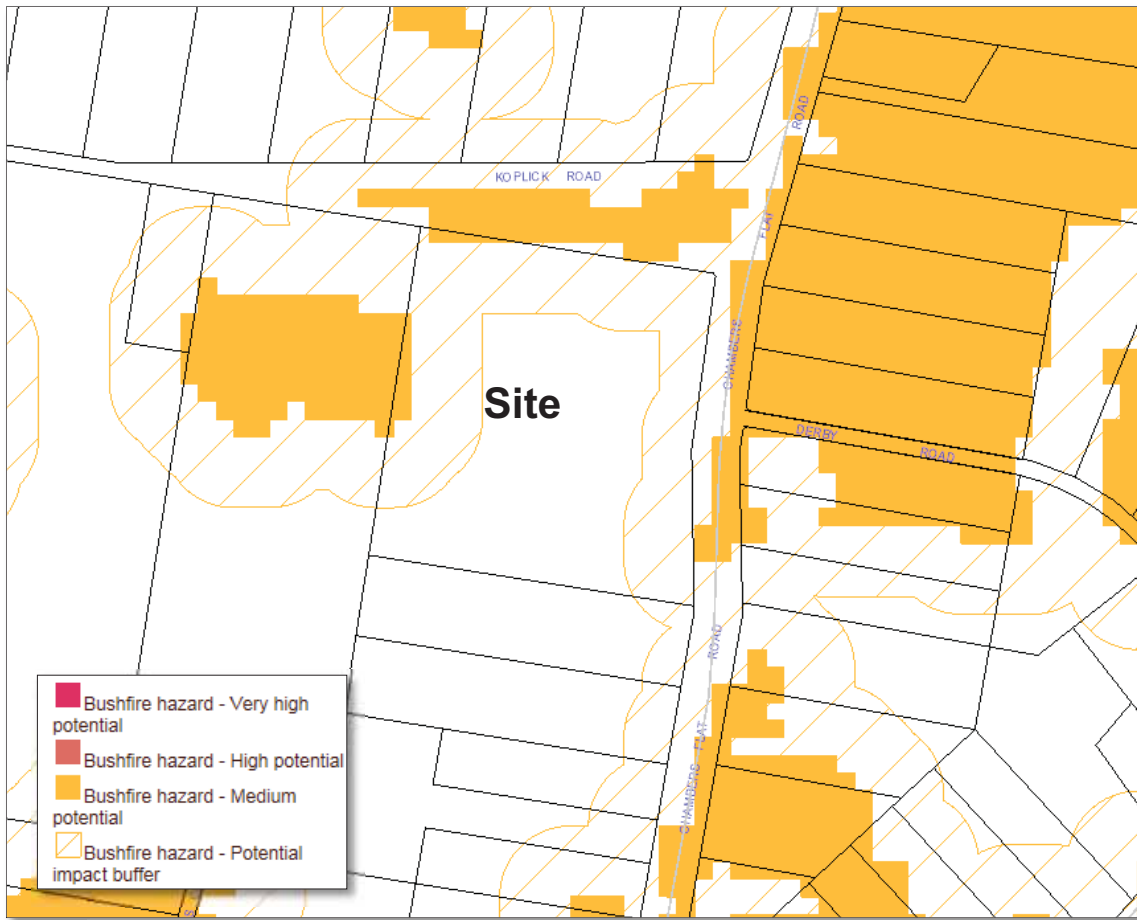


Figure 3 Excerpt of the Draft Logan Planning Scheme Bushfire Overlay



Figure 4 Excerpt of the Beaudesert Planning Scheme Bushfire Overlay

2.2 Vegetation Assessment

2.2.1 Methodology

The site is located within Bushfire Prone Land. Vegetation classification over the site has been carried out as follows:

- Aerial Photograph Interpretation to map the vegetation classification and extent;
- Queensland Department of Natural Resources and Mines Vegetation Mapping;
- CSIRO, A new methodology for State-wide mapping of bushfire prone areas in Queensland; and
- On site vegetation assessment (29th April 2015).

In accordance with AS3959-2009, an assessment of the vegetation over a distance of 140m in all directions from the site was undertaken. The predominant vegetation was identified in all directions from the site. The vegetation was classified in accordance with Table 2.3 in AS3959-2009, Appendix A of CSIRO (2014) and the QLD Globe Vegetation Mapping.

2.2.2 Predominant Vegetation Formation

An RPS Ecologist ground truthed all vegetation hazards surrounding the proposed development with reference to the QLD Department of Natural Resources and Mines (DNRM) Regulated Vegetation and Regional Ecosystem (RE) Mapping. In some instances Regional Ecosystems (RE) mapped by DNRM were marginally inconsistent with the true vegetation. Consequently, as a result of varying vegetation ecotones the available fuel load varied. Existing vegetation mapping along with the site inspection results were cross referenced with the CSIRO Report (2014) to determine the overall fuel load to provide the most accurate fuel load for each hazard. In cases where REs overlap, the predominant vegetation with the higher fuel load has been taken into account.

The determined vegetation classifications are displayed in **Table 1** and **Figures 4** and **5**. **Plates 1 – 6** depict the site and surrounding vegetation.

Table 1 Vegetation Classifications

Direction of Bushfire Attack	Vegetation or other infrastructure	Classification of Vegetation Formations AS3959-2009	DNRM Vegetation Mapping	Classification of Vegetation Formations CSIRO (2014)	Overall Fuel Load
North	Vegetation, Koplick Road and existing resort – separated by an overhead electricity line (12m wide)	Forest (Hazard) / No Hazard	RE 12.3.11	Class 2: Open Forest/Woodland-shrubby	30 Tonnes/ha
North east	Vegetation (not considered a threat to the development)	Forest	RE 12.3.6	Class 1: Melaleuca Communities	33 Tonnes/ha
East	Existing Resort and Chambers Flat Road	No Hazard	No Hazard	No Hazard	N/A
South	Scattered vegetation and rural residential property	Low Threat Vegetation	N/A	Class 16: Mixture of Urban Classes	5 Tonnes/ha
West	Vegetation	Forest (Hazard)	RE 12.9-10.4	Class 2: Open Forest/Woodland-shrubby	30 Tonnes/ha
North-west	Vegetation and Koplick Road	Forest (Hazard)	RE 12.3.11	Class 2: Open Forest/Woodland-shrubby	30 Tonnes/ha



Figure 5 DNR Vegetation Mapping



Plate 1 Vegetation along the southwest boundary of the site



Plate 2 A more open area of vegetation to the west of the site



Plate 3 Shrubby woodland community to the west of the site



Plate 4 Melaleuca dominated community adjacent to the northern access road



Plate 5 Melaleuca dominated community adjacent to the northern access road



Plate 6 Managed land underneath overhead transmission line – north of the site

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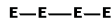
f. judgment of this plan with any local authority against the recommendation of RPS Australia East Pty Ltd;

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Legend

-  Site Boundary
-  APPROX LOTS
-  APPROX ROAD PAVEMENT
-  Cadastre
-  100m Slope Buffer
-  140m Vegetation Buffer
-  Overhead Transmission Line (12 wide and variable)
-  1m Contours

Vegetation Classification

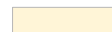
-  Forest - Class 1
-  Forest - Class 2
-  Low Threat Vegetation - Class 16
-  No Hazard



Figure 5: Vegetation Classification

LOCATION: Chambers Pine	DATUM: GDA94
	PROJECTION: MGA Zone 56
JOB NO.: PR123731	Data Sources:
PURPOSE: BTA	RPS
Technician: Natalie Wood	Date: 15/05/2015

CLIENT: Ingenia Communities

RPS AUSTRALIA EAST PTY LTD (ABN 44 140 292 762)
241 DENISON STREET BROADMEADOW PO BOX 428 HAMILTON NSW 2303
T: 02 4940 4200 F: 02 4961 6794 www.rpsgroup.com.au

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2.3 Effective Slope Assessment

2.3.1 Methodology

Slope assessment has been undertaken as follows:

- Aerial photography;
- UAV detail survey; and
- Site inspection (29th April 2015).

As outlined in AS3959-2009, an assessment of the slope over a distance of 100m of the hazard direction from the site boundary was undertaken. The effective slope was then calculated under the classified vegetation. The topography of the site has been evaluated to identify both the average slope and by identifying the maximum slope present. These values help determine the level of gradient which will most significantly influence the fire behaviour of the site.

2.3.2 Effective Slope

The slope of the bushfire hazard is documented in **Table 2** below.

Table 2 Site Slope Assessment

Direction of Hazard	Classification of Vegetation Formations AS3959-2009	Classification of Vegetation Formations CSIRO (2014)	DNRM Vegetation Mapping	Slope
North	Forest	Class 2: Open Forest/Woodland-shrubby	RE 12.3.11	Flat
South	Low Threat Vegetation	Class 16: Mixture of Urban Classes	N/A	Flat
West	Forest	Class 2: Open Forest/Woodland-shrubby	RE 12.9-10.4	Upslope
North-west	Forest	Class 2: Open Forest/Woodland-shrubby	RE 12.3.11	Flat

2.4 Significant Environmental Features

Current operations on site largely prohibit the potential presence of any significant environmental features. The Chambers Pines Lifestyle Resort and Golf Course currently occupies the site, with few areas remaining that contain natural environs. The site inspection also revealed that no significant environmental features were present on site.

3.0 Bushfire Mitigation Measures

The Queensland State Government *State Planning Policy* and the *Draft Logan Planning Scheme* (2014) have been used to determine the appropriate measures for protection from bushfire hazards across the site and immediate vicinity.

Requirements outlined by the SPP and LPS include the following:

- Development avoids natural hazard areas or mitigates the risk of the natural hazard;
- Development supports, and does not unduly burden, disaster management response, or recovery capacity and capabilities;
- Development directly, indirectly and cumulatively avoids an increase in the severity of the natural hazard and the potential for damage on the site or to other properties;
- Development avoids the risk to public safety and the environment from the location of hazardous materials and the release of these materials as a result of a natural hazard; and
- Development maintains or enhances natural processes and the protective function of landforms and vegetation that can mitigate risks associated with the natural hazard.

3.1 Asset Protection Zones and Fire Breaks

Acceptable Outcomes

Areas of defensible space are created by firebreaks that separate lots from areas of bushfire hazard. The Bushfire Overlay Code in the Draft LPS provides several acceptable solutions to provide setbacks, access and defensible space for emergency vehicles. These firebreaks will be referred to as Asset Protection Zones (APZs).

An APZ is an area surrounding a development that is managed to reduce the bushfire hazard to an acceptable level to mitigate the risk to life and property.

An APZ can include the following:

- lawns;
- discontinuous gardens;
- swimming pools;
- roads, driveways and managed verges;
- unattached non-combustible garages with suitable separation from the dwelling;
- open space / parkland; and
- car parking.

The presence of a few shrubs or trees in the firebreak is acceptable provided that they:

- do not touch or overhang any buildings;
- are well spread out and do not form a continuous canopy;
- are not species that retain dead material or deposit excessive quantities of ground fuel in a short period or in a danger period; and
- are located far enough away from any dwelling so that they will not ignite the dwelling by direct flame contact or radiant heat emission.

Woodpiles, wooden sheds, combustible material storage areas, large areas / quantities of garden mulch, stacked flammable building materials etc. are not be recommended in the APZ.

Proposed Measures

AS3959-2009 applies a Fire Danger Index (FDI) of 40 to the entire state of Queensland. APZs are not mandatory under the SPP, however adequate defendable space is required for each dwelling affected by a medium or high bushfire hazard. Additionally, APZ distances have not been prescribed under the LPS however APZs are still a requirement under the Bushfire Hazard Overlay Code (Part 8 section 8.2.3) for medium or high bushfire hazard areas. LPS requires that APZs should be situated on land <18 degrees and within the boundaries of the private property of the development site.

The methodology to establish the appropriate setbacks outlined in the bushfire planning guidelines have been considered to support requirements of the LPS Bushfire Hazard Overlay Code. Refer to **Table 3** and **Figure 6** for required APZs and fire trails.

Table 3 Required APZ

Direction of Hazard	Classification of Vegetation Formations AS3959-2009	DNRM Vegetation Mapping	Classification of Vegetation Formations CSIRO (2014)	Slope	Required APZ (BAL-29)	APZ Provided
North	Forest	RE 12.3.11	Class 2: Open Forest/Woodland-shrubby	Flat	11m	27m
South	Low Threat Vegetation	N/A	Class 16: Mixture of Urban Classes	Flat	N/A	N/A
West	Forest	RE 12.9-10.4	Class 2: Open Forest/Woodland-shrubby	Upslope	11m	11.5m – 29m
North-west	Forest	RE 12.3.11	Class 2: Open Forest/Woodland-shrubby	Flat	11m	>27m

There is sufficient space between the vegetation hazards and the edge of the development footprint to provide an 11m APZ. At a distance of 11m from the bushfire hazard, the exposure to radiant heat is modeled to not exceed 29kW/m² (BAL-29).

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Legend

Site Boundary

APPROX LOTS

APPROX ROAD PAVEMENT

Cadastre

1m Contours

Asset Protection Zone 11m

Overhead Transmission Line (12 wide and variable)

E—E—E—E

N

Figure 6: Required Asset Protection Zone

CLIENT: Ingenia Communities

LOCATION: Chambers Pine

DATUM: GDA94

PROJECTION: MGA Zone 56

JOB NO.: PR123731

Data Sources:

PURPOSE: BTA

RPS

Technician: Natalie Wood Date: 15/05/2015

RPS AUSTRALIA EAST PTY LTD (ABN 44 140 292 762)
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T: 02 4940 4200 F: 02 4961 6794 www.rpsgroup.com.au

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3.2 Building Design and Construction

Acceptable Outcomes

All buildings, including pre-fabricated relocatable homes (Class 1), must satisfy the Performance Requirements of the National Construction Code: Building Code of Australia (BCA). Part 2.3 of Volume 2 of the BCA applies to dwellings located within designated bushfire areas, which are defined as:

Land which has been designated under a power in legislation as being subject, or likely to be subject to, bushfires.

Accordingly, due consideration of the requirements of the BCA should be made. The *Deemed-to-Satisfy* provision of the BCA can only be achieved if dwellings in bushfire prone areas are constructed in accordance with Australia Standard AS3959-2009 *Construction of buildings in bushfire prone areas*.

Building design and the materials used for construction of future dwellings should be chosen based on the information contained within AS3959-2009, and accordingly the designer/architect should be made aware of this recommendation. The dwelling plans should be checked by the architect to confirm they meet the relevant Bushfire Attack Level (BAL) as detailed in AS3959-2009.

The determinations of the appropriate BAL are based upon parameters such as weather modelling, fire-line intensity, flame length calculations, as well as vegetation and fuel load analysis. The determination of the construction level is derived by assessing the:

- Relevant FDI = 40;
- Flame temperature;
- Slope;
- Vegetation classification; and
- Building location.

3.2.1 Bushfire Attack Level for the Proposed Development

The Detailed Assessment (Method 2) outlined in Australian Standard AS3959-2009 *Construction of buildings in bushfire prone areas* was used to calculate the Bushfire Attack Level for the development. The NBC Bushfire Attack Assessor V2.1 was used to model the bushfire radiant heat exposure which determined the applicable bushfire attack level.

Refer to **Table 4** and **Figure 7** for the distance between the bushfire hazard and the proposed development.

Table 4 Required BAL (AS 3959-2009)

Direction of Hazard	Vegetation Classification			Slope	APZ	Separation Distance from Lot	AS3959-2009 BAL – 29 (Detailed Method)	Construction Section
	AS3959-2009	CSIRO (2014)	DNRM (2015)					
North	Forest	RE 12.3.11	Class 2: Open Forest/Wood land-shrubby	Flat	12m	0m – 10m	BAL – FZ	Sect 5, 6, 7, 8 & 9 of AS3959-2009 and Sect A3.7 of PBP Addendum Appendix 3.
						10m – 11m	BAL – 40	
						11m - 16m	BAL – 29	
						16m - 23m	BAL – 19	

Direction of Hazard	Vegetation Classification			Slope	APZ	Separation Distance from Lot	AS3959-2009 BAL – 29 (Detailed Method)	Construction Section
	AS3959-2009	CSIRO (2014)	DNRM (2015)					
						23m - 100m	BAL – 12.5	
South	Low Threat Vegetation	N/A	Class 16: Mixture of Urban Classes	Flat	N/A	0m - 100m	BAL - LOW	
West	Forest	RE 12.9-10.4	Class 2: Open Forest/Wood land-shrubby	Flat	10m	0m – 10m	BAL – FZ	
						10m – 11m	BAL – 40	
						11m - 16m	BAL – 29	
						16m - 23m	BAL – 19	
						23m - 100m	BAL – 12.5	
North-west	Forest	RE 12.3.11	Class 2: Open Forest/Wood land-shrubby	Flat	11m	0m – 10m	BAL – FZ	
						10m – 11m	BAL – 40	
						11m - 16m	BAL – 29	
						16m - 23m	BAL – 19	
						23m - 100m	BAL – 12.5	

To Note: The construction requirements for the next lower BAL than that determined for the site may be applied to an elevation of the building where the elevation is not exposed to the source of bushfire attack. An elevation is deemed to be not exposed to the source of bushfire attack if all straight lines between that elevation and the source of bushfire attack are obstructed by another part of the building.

3.3 Access – Evacuation Routes

Acceptable Outcomes

In the unlikely event of a serious bushfire, it will be essential to ensure that adequate ingress / egress and the provision of defensible space are afforded in the subdivision layout. The following recommends design specifications for internal public roads as designated under the Draft LPS (2014):

- A minimum cleared width of six metres located between the premises and adjoining vegetation;
- To have a minimum formed width of four metres;
- To have a maximum gradient of 12.5 percent;
- To have vehicular access to a road at each end and at least every 200 metres;
- Does not include a dead end; and
- To have a turning or passing area at least every 400 metres.

Proposed Measures

Access to the proposed development will be provided from 3 resort entry points from Koplick Road to the north the primary entrance on Chambers Flat Road to the east and a redesigned entrance to Chambers Flat Road near the existing golf club.

The internal road layout provides a regular grid network of access roads including perimeter roads along the western boundary that provides defensible space and multiple evacuation routes. All internal roads are a minimum of 6.5 wide and connect to central spine road that is 10m wide. Given the extensive internal road layout and the 3 points of access to the site, evacuating residents are unlikely to obstruct emergency personnel from accessing all areas of the site.

With the exception of sites 63-70, all sites are separated from the nearest bushfire hazard by at least 22m. In the case of sites 63-70, a perimeter road combined with a 5m bushfire buffer combines to create an 11.5m setback, which also results in the dwelling sites being exposed to a radiant heat of $<29\text{kW/m}^2$ – equivalent to BAL-29. The reduced setback does not expose emergency personnel to an unacceptable risk as defensive fire fighting operations can be safely carried out.

Reversing bays are provided for the 2 short cul-de-sacs to ensure residents and emergency personnel can safely access all areas of the site.

Refer to **Appendix 1** for proposed development showing access.

3.3.1 Fire Trails

Acceptable Outcomes

Fire trails are used as access for firefighters as fire control lines if they are connected to the public road system at regular intervals. In urban areas fire trails may also function as a strategic control line around the hazard side of the APZ.

The following design specifications are required under the Draft LPS (2014):

- Access for fire management and evacuation is provided by vehicular access in the form of a perimeter road:
 - » Within a minimum reserve width of 20 metres;

- » Located between the premises and adjoining vegetation;
- » With a maximum gradient of 12.5 percent;
- » Constructed to otherwise comply with section 3.4-Movement infrastructure standards of planning scheme policy 5-infrastructure; and
- » That has a layout that does not include a cul-de-sac.

Proposed Measures

In addition to the perimeter road being situated between the hazard and the proposed development, a 6m fire trail may be incorporated within the 11m APZ to provide direct access to the threat for emergency personnel permanently. Accordingly, the proposed development generally meets the Acceptable Outcomes.

3.4 Water

Acceptable Outcomes

Provision of access to the reticulated water supply must be provided for fire-crews in the form of readily accessible and easily located fire hydrants. Fire hydrant spacing, sizing and pressure should comply with AS 2419.1 – 2005. Hydrants are not to be located within any road carriageway. All above ground water and gas service pipes external to the building are metal, including and up to any taps. The reticulated water supply must provide a minimum pressure and flow of 10 litres per second at 200KPa.

Alternatively, an on-site water storage with a dedicated water supply for fire fighting purposes of 20,000 litres is acceptable.

Proposed Measures

To facilitate quick and efficient action by the Fire & Rescue / Rural Fire Service upon arrival, all necessary connections / pumps etc be clearly marked and visible, and in good working order.

3.5 Gas

Acceptable Outcomes

Any reticulated or bottled gas should be installed and maintained according to the requirements of the relevant authorities and AS 1596 – 2002.

Proposed Measures

It is expected that the location of gas services will not lead to ignition of surrounding bushland or the fabric of buildings.

3.6 Landscaping

Acceptable Outcomes

In areas that are prone to bushfire, the design and management of the landscape in the immediate vicinity of buildings have great potential to improve the chances of survival of people and buildings. Generally landscaping in and around a bushfire hazard should consider the following:

- Priority given to retaining species that have a low flammability;
- Priority given to retaining species which do not drop much litter in the bushfire season and which do not drop litter that persists as ground fuel in the bush fire season;

- Priority given to retaining smooth barked species over stringy bark; and
- Create discontinuous or gaps in the vegetation to slow down or break the progress of fire towards the dwellings.

The principles of landscaping for bush fire protection aim to:

- Prevent flame impingement on the dwelling;
- Provide for a defendable space for the property protection;
- Reduce fire spread;
- Deflect and filter embers;
- Provide shelter from radiant heat; and
- Reduce wind speed.

Avoiding understorey planting and regular trimming of the lower limbs of trees also assists in reducing fire penetration into the canopy. Rainforests species such as *Syzygium* and figs are preferred to species with high fine fuel and/or oil content.

Trees with loose, fibrous or stringy bark should be avoided. These trees can easily ignite and encourage ground fire to spread up to, and then through the crown of trees.

Proposed Measures

The following sets out the specific requirements for vegetation management within the expanded Chambers Pines Lifestyle Resort:

- Grass must be no more than 10 centimetres in height and leaf and other debris must be mowed, slashed or mulched;
- Shrubs, and/or trees must not form a continuous canopy with unmanaged fuels;
- Tree branches below 2 metres from ground level must be removed;
- Trees may touch each other with an overall canopy cover of no more than 30% at maturity; and
- Shrubs must be in clumps of no greater than 10m², which are separated from each other by at least 10m.

3.7 Community Infrastructure

Acceptable Outcomes

The proposed development includes the construction of a new community building for the use of residents. The location of the community building is greater than 60m from the bushfire and will provide a temporary refuge for residents during a bushfire event; therefore able to function effectively during and immediately after a bushfire event.

Proposed Measures

The community building has three road frontages and direct access to all three evacuation routes.

4.0 Ongoing Management Actions

4.1 Property Maintenance and Inspection Regime

In considering property maintenance the following items should be implemented in advance of the bushfire season; prior to October each year:

- Removal of material such as litter from the roof and gutters of buildings;
- Ensure painted surfaces are in good condition with decaying timbers being given particular attention to prevent the lodging of embers within gaps;
- Check pumps and water supplies (fire hydrants) are available and in good working order;
- Driveways are in good condition with trees not being too close and forming an obstacles during smoky conditions;
- Check tiles and roof lines for broken tiles or dislodging roofing materials;
- Screens on windows and doors are in good condition without breaks or holes in flyscreen material and frames are well fitting into sills and window frames;
- Hose and hose reels are not perished and fittings are tight and in good order;
- Doors are fitted with draught seals and well maintained;
- Mats are of non combustible material or in areas of low potential exposure (sheltered from direction of bushfire hazard and under cover); and
- Woodpiles, sheds and other combustible materials are located well away from buildings.

4.2 Vegetation Fuel Management

Consideration should be given to vegetation fuel loads present on site with particular attention to APZs.

Careful thought must be given to the type and physical location of any proposed site landscaping. Inappropriately selected and positioned vegetation has the potential to 'replace' any previously removed fuel load.

Bearing in mind the desired aesthetic and environment sought by site landscaping, some basic principles have been recommended to help minimise the chance of such works contributing to the potential hazard on site.

Whilst it is recognised that fire-retardant plant species are not always the most aesthetically pleasing choice for site landscaping, the need for adequate protection of life and property requires that a suitable balance between visual and safety concerns be considered.

It is reiterated again that it is essential that any landscaped areas and surrounds are subject to ongoing fuel management and reduction to ensure that fine fuels do not build up.

The following sets out the specific requirements for vegetation management within the entire site:

- Shrubs, and/or trees must not form a continuous canopy with unmanaged fuels;
- Tree branches below 2 metres from ground level must be removed;
- Trees may touch each other with an overall canopy cover of no more than 30% at maturity; and
- Shrubs must be in clumps of no greater than 10m², which are separated from each other by at least 10m.

4.2.1 Fine Fuel loads

Ground fuels such as fallen leaves, twigs and barks should be removed on a regular basis from within the APZ. The most flammable fuel is dry vegetation, sticks and other debris less than 6mm in diameter.

4.2.2 Grass

Grass within the site and APZ shall be kept short (<100mm) and mowed regularly. No stockpiling of mown grass should be left within the APZ.

5.0 Recommendations

In summary, the following recommendations have been prepared based on the Specific Outcomes assessment criteria outlined in the *QLD Government Single State Planning Policy* and Draft Logan Planning Scheme;

- A minimum 11m wide Asset Protection Zone is to be created alongside the entire length of the western boundary of the site;
- All vegetation within the setback between the northern and western boundaries and the dwelling sites shall be managed as a low-fuel zone;
- All vegetation throughout the entire site shall be managed as a reduced fuel zone;
- All dwellings and habitable buildings constructed within the site should have due regard to the specific considerations given in the National Construction Code: Building Code of Australia (BCA) 2014 and Australian Standard AS3959-2009 *Construction of buildings in bushfire prone areas*;
- Access roads shall comply with Section 3.3 of this report;
- The development is to be connected to the reticulated water supply and that suitable hydrants be clearly marked and provided for the purposes of bushfire protection. Fire hydrant spacing, sizing, and pressure should comply with AS2419.1, 2005; and
- An Emergency Management Plan (EMP) shall be prepared to improve the preparedness of the residents and to clearly identify the procedures to be followed in the event of a bushfire.

This assessment has been made based on the bushfire hazards in and around the site at the time of inspection, production, and a review of the development vision documentation (May 2015).

A review of the site and proposed development layout indicates that compliance with the above recommendations can be achieved or practically implemented without substantial change to the proposed layout or construction methodology.

6.0 Conclusion

It is clear from this investigation and assessment that the site constitutes Bushfire Prone Land.

The Bushfire Management Plan provided an assessment of the potential bushfire hazards specific to the proposed development on land at 609-657 Chambers Flat Road, Chambers Flat, Qld; known as the Chambers Pines Lifestyle Resort. This Bushfire Management Plan considered the performance criteria of the Queensland Government Single State Planning Policy and Draft Logan Planning Scheme and concluded that subject to the implementation of the recommended bushfire protection measures the risk of harm or injury to life or damage to property is minimised.

Finally, the implementation of the adopted measures and recommendations forwarded within this report will contribute to the amelioration of the potential impact of any bushfire upon the development estate, but they do not and cannot guarantee that the area will not be affected by bushfire at some time.

7.0 References

Beaudesert Planning Scheme (2007) *Development Constraints Overlay – Bushfire Hazard*. Accessed online:
http://www.logan.qld.gov.au/_data/assets/pdf_file/0019/8038/ov3-1a.pdf

CSIRO (2014) *A New Methodology for State-wide Mapping of Bushfire Prone Areas in Queensland*.
Queensland Government, Queensland.

Logan City Council (2014) *Revised Logan Planning Scheme 2014*: Draft (currently in review).

Standards Australia (2009) AS 3959 – 2009: *Construction of Buildings in Bushfire-prone Areas*.

Appendix I

Site Layout Plan

DRAFT



KOPLICK ROAD

ROAD

FLAT

CHAMBERS

EXISTING RESIDENTIAL

5
RP68700

31
RP848575

LEGEND	
	Site Boundary
	Open Space - Waterway Corridor
	Open Space / Landscaping
	10m Buffer to Adjoining Use
	Carparking - 62 bays
	Caravan Parking - 23 bays

House Type	Dimensions	Area (m ²)	No of Lots	% Mix
16m Deep Allotments				
1.5 Bed	12 x 16	192	20	8%
2 Bed 1.5 Bath	12 x 16	192	64	25%
2 Bed 2 Bath	12.5 x 16	200	59	23%
2.5 Bed	12.5 x 16	200	59	23%
3 Bed	13 x 16	208	35	14%
17m Deep Allotments				
1.5 Bed	12 x 17	204	2	1%
2 Bed 1.5 Bath	12 x 17	204	4	2%
2 Bed 2 Bath	12.5 x 17	212.5	5	2%
2.5 Bed	12.5 x 17	212.5	5	2%
3 Bed	13 x 17	221	3	1%
Total			256	

Note:
All Lot Numbers, Dimensions and Areas are approximate only, and are subject to survey and Council approval.
Dimensions have been rounded to the nearest 0.1 metres.
Areas have been rounded down to the nearest 5m².
The boundaries shown on this plan should not be used for final detailed engineers design.

SCALE 1 : 1000 @ A1

0 20 40 60 80 100
DATE : 14 MAY 2015 DWG NAME : 126720-05-PRO DWG # 126720-05A

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SITE LAYOUT PLAN
Ingénia Communities Holdings Ltd

Appendix 2

Bushfire Attack Assessor Report

NBC Bushfire Attack Assessment Report V2.1

AS3959 (2009) Appendix B - Detailed Method 2

Printed: 15/05/2015 Assessment Date: 14/04/2015



Site Street Address: Chambers Pines, Chambers Flat
Assessor: Stuart Greville; RPS Australia East Pty Ltd
Local Government Area: QLD **Alpine Area:** No

Equations Used

Transmissivity: Fuss and Hammins, 2002
Flame Length: RFS PBP, 2001
Rate of Fire Spread: Noble et al., 1980
Radiant Heat: Drysdale, 1985; Sullivan et al., 2003; Tan et al., 2005
Peak Elevation of Receiver: Tan et al., 2005
Peak Flame Angle: Tan et al., 2005

Run Description: West

Vegetation Information

Vegetation Type:	Forest	Vegetation Group:	Forest and Woodland
Vegetation Slope:	2 Degrees	Vegetation Slope Type:	Upslope
Surface Fuel Load(t/ha):	22	Overall Fuel Load(t/ha):	30

Site Information

Site Slope	0 Degrees	Site Slope Type:	Downslope
Elevation of Receiver(m)	Default	APZ/Separation(m):	11

Fire Inputs

Veg./Flame Width(m):	100	Flame Temp(K)	1090
-----------------------------	-----	----------------------	------

Calculation Parameters

Flame Emissivity:	95	Relative Humidity(%):	25
Heat of Combustion(kJ/kg)	18600	Ambient Temp(K):	308
Moisture Factor:	5	FDI:	40

Program Outputs

Category of Attack:	HIGH	Peak Elevation of Receiver(m):	4.3
Level of Construction:	BAL 29	Fire Intensity(kW/m):	14258
Radiant Heat(kW/m2):	28.66	Flame Angle (degrees):	64
Flame Length(m):	9.58	Maximum View Factor:	0.434
Rate Of Spread (km/h):	0.92	Inner Protection Area(m):	11
Transmissivity:	0.868	Outer Protection Area(m):	0

Stormwater Management Plan – Chambers Pines Lifestyle Resort

Lot 21 on RP804908, Chambers Flat



CLIENT:

Ingenia Communities

STATUS:

FINAL REPORT

REPORT NUMBER:

R003321a

ISSUE DATE:

May 2015



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O2 Environmental Pty Ltd t/as O2 ABN 79 136 340 924
 Originating Office – Sunshine Coast
 Unit 7, 8 Grebe St, Peregrine Beach QLD 4573
 PO Box 199 Peregrine Beach QLD 4573
 T 61 7 5448 3288 | F 61 7 5302 6680 | info@o-2.com.au

Version Register

Version	Status	Author	Reviewer	Change from Previous Version	Authorised for Release	
					Signature	Date
-	FINAL	S Chamberlain (RPEQ 15545)	T Bailey	n/a		18/05/2015
a	FINAL	S Chamberlain (RPEQ 15545)	T Bailey	Modified property description		25/05/2015

Transmission Register

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Name	Email Address
Paul Brumpton	paul.brumpton@possibilitiesqld.com

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1. Introduction

O2 Environment + Engineering (O2) has been commissioned by Ingenia Communities to develop a Stormwater Management Plan (SMP) for the proposed expansion of an existing Relocatable Home Park located on Lot 21 on RP804908, Chambers Flat, Qld.

Stormwater management is an important element of residential development. Long term impacts of stormwater runoff from residential development have the ability to degrade natural environments. These impacts on receiving environments can be reduced through the effective management of stormwater runoff during and after development.

The regional location of the Project area is presented in **Figure 1**.

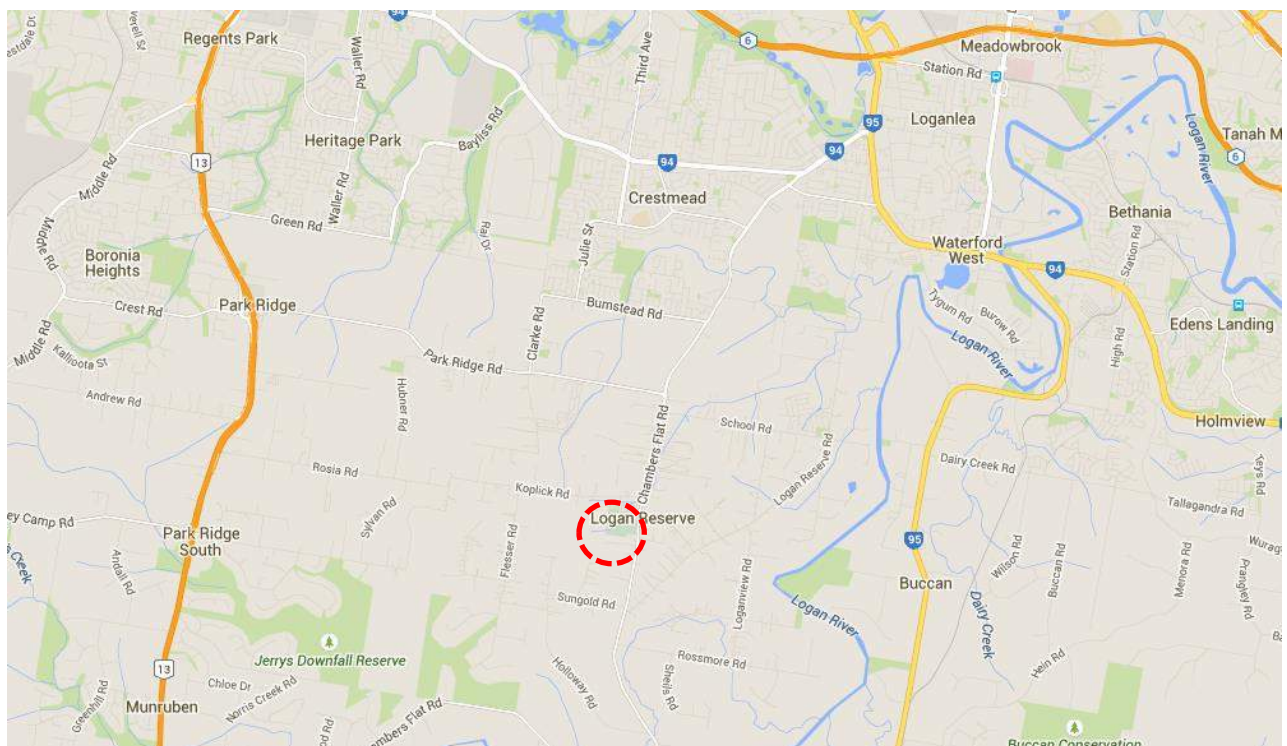


Figure 1 - Site Location (Source: NearMap)

1.1. Objectives

This report has been developed to assist Ingenia Communities in meeting specific stormwater management objectives for the proposed development. These objectives are based on the requirements of the Logan City Council, the Queensland Urban Drainage Manual (QUDM) and State Planning Policy 4/10 Guideline Healthy Waters. This objective will be achieved by:

- Ensuring the pre-development flow rates at the Legal Point of Discharge (LPD) from the site are maintained for all standard AEP events, and
- Demonstrating that the water quality objectives for the site are met by providing treatment measures to ensure the 80%, 60%, 45% load based reduction targets for Total Suspended Solids (TSS), Total Nitrogen (TN) and Total Phosphorous (TP) are achieved.

2. Site Description

2.1. Land use

The site and its surroundings are dominated by a rural residential land use, with large parcels of heavily vegetated land remaining in all directions around the site. The site of the proposed development is currently a golf course, and forms part of an existing caravan/relocatable home park. Chambers Flat Road forms the eastern site boundary.

2.2. Topography and Drainage

The site generally falls to the north, with the majority of runoff being conveyed through an existing concrete lined drain through the existing caravan/relocatable home park. On exiting the drain at the northern boundary of the existing caravan/relocatable home park, runoff is conveyed a short distance before passing through culverts under Chambers Flat Road.

On leaving the site, runoff is conveyed through a number of downstream properties, eventually making its way to the Logan River. Refer to **Figure 2** for the indicative flow regime through the site.

2.2.1. Legal Point of Discharge

For the purposes of this assessment, the existing caravan/relocatable home park has been taken into consideration. Therefore, the Legal Point of Discharge (LPD) for has been identified as the northern boundary of the existing caravan/relocatable home park where runoff enters the drainage reserve. The LPD is illustrated in **Figure 2**.



Figure 2 – Existing Flow Characteristics & LPD

2.3. Climate and Hydrology

Greenbank has been chosen for this assessment as it is the station recommended in the Water by Design *MUSIC Modelling Guidelines Version 1.0* (2010) for use in MUSIC modelling.

Figure 3 shows the monthly rainfall and temperature averages in Greenbank. Greenbank experiences a sub-tropical climate with warm wet summers and mild dry winters. The mean maximum temperatures range from 21.4°C in July to 29.7°C in January, with the mean minimum temperatures ranging from 8.7°C in July to 20.6°C in January. The mean annual rainfall is 939.7mm with December, the wettest month, averaging 133.5mm of rainfall and August, the driest month, averaging 33mm of rainfall. (BOM, 2012).

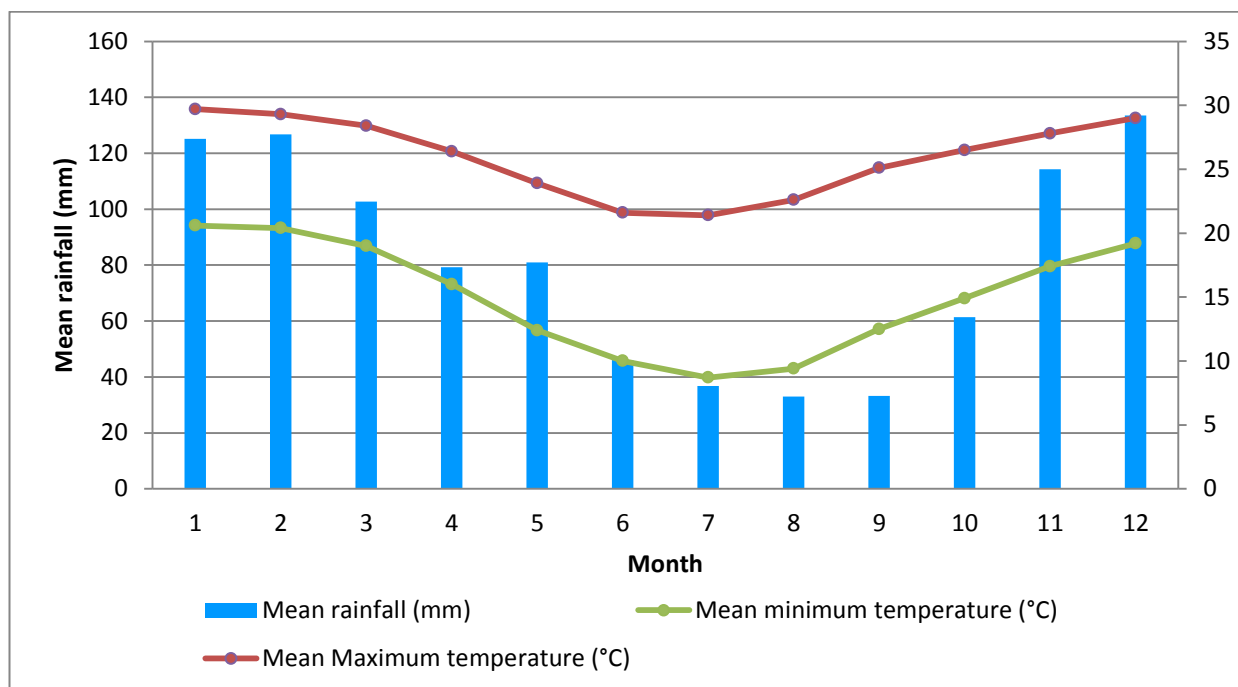


Figure 3 – Greenbank Thompson Rd Monthly Rainfall and Temperature Averages

3. Construction Phase Stormwater Quality Management

Management of stormwater during the construction phase is to be undertaken in accordance with the site specific Erosion and Sediment Control Plan and other management plans provided by the supervising engineers or civil contractors.

Construction and establishment of proposed bioretention basins should be undertaken in accordance with Council guidelines and conditions as well as the approved engineering and landscape plans. The Water by Design 'Construction and Establishment Guidelines – Swales, Bioretention Systems and Wetlands, 2009' is a useful guide to utilise during the construction and establishment phase of the bioretention systems.

A major risk for establishing effectively functioning bioretention systems is the inflow of sediment-laden runoff during the construction and building phases. Captured sediment has the potential to clog the filter media, thus minimizing the overall effectiveness of the constructed system. Managing sediment during the construction and building phases is critical for the establishment of the bioretention system and in reducing the risk and costs associated with reconstructing the system. The typical phases associated in the creation of a development site are detailed below in **Figure 4**.

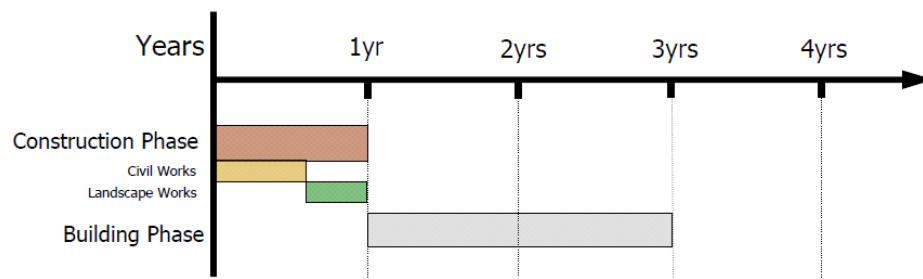


Figure 4 - Typical phases in the creation of a development site (Source: Water by Design, 2009)

To overcome challenges associated with delivering bioretention systems, one of the following four options for construction and establishment are recommended:

- Option 1: Surface Protection,
- Option 2: Bypass flows and early establishment of vegetation,
- Option 3: Sediment basin and bioretention function, and
- Option 4: Leave as sediment basin.

Further information on each option is provided in the Water by design 'Construction and Establishment Guidelines – Swales, Bioretention Systems and Wetlands, 2009'.

For this development Option 1 is recommended. The filter media can be installed upon completion of civil works, including under-drainage and media, for the bioretention systems. Install protective layers on the surface of the filter media, allowing it to operate as a shallow sediment basin during the building phase. Surface protection options are:

- Filter cloth, topsoil and turf, and
- Coarse sand, topsoil and turf.

When 80-90% of building in the catchment is complete, remove the protective layers and establish vegetation in the bioretention system.

4. Operational Phase Stormwater Quality Management

It is proposed to construct bioretention systems to capture and treat runoff from the development site to achieve the water quality objectives for runoff exiting the site. .

4.1. Bioretention Systems

A bioretention system's primary function is to remove pollutants from stormwater prior to the stormwater being discharged from the site and ultimately into a local waterway.

Bioretention systems operate by filtering stormwater through a prescribed soil media prior to collection at the base of the system via perforated pipes located within a gravel drainage layer. During percolation through the soil media, pollutants are retained through fine filtration, adsorption and some biological uptake.

The vegetation on the surface of the soil media is vital to the overall performance of the system. In conjunction with facilitating pollutant removal, the species also need to be relatively hardy and tolerant of freely draining sandy soils and regular inundation.

A typical section of a bio-retention system is shown below in **Figure 5**.

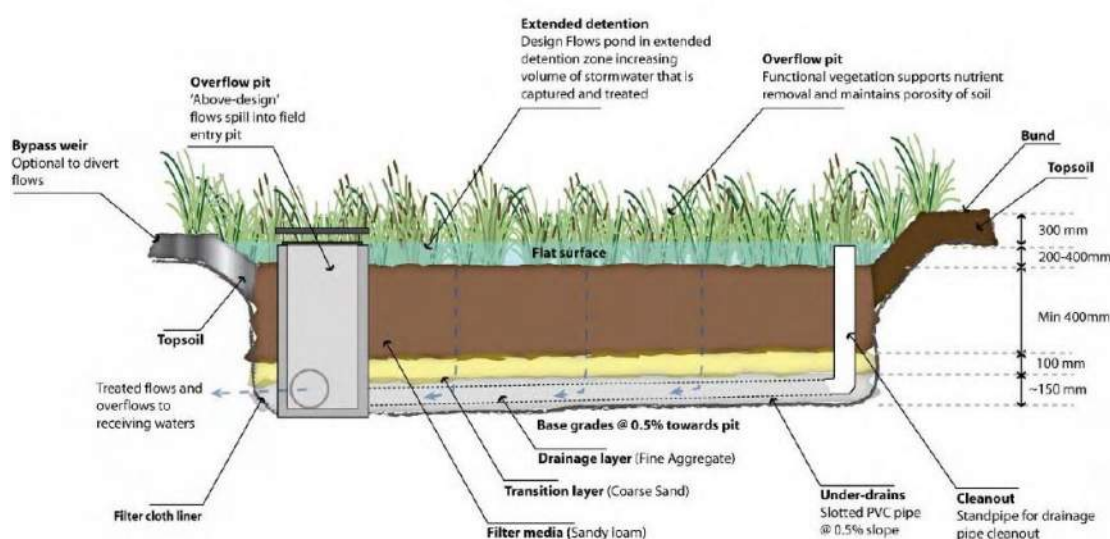


Figure 5 - Typical cross-section through a bio-retention system (Source: Water by Design, 2009)

Details of the proposed system are shown below in **Table 1** and detailed in **Section 5.7**. MUSIC modelling has been undertaken to size the systems, as detailed in **Section 5**. For the purposes of this assessment, it is assumed that runoff will flow to one of three bioretention systems. However, the final location of the bioretention systems and the exact configuration will be detailed during the Operational Works Phase of the development.

Table 1 - Bioretention Filter Details

Name	Catchment Area (ha)	Filter Media Area (m²)	Filter Media Depth (m)	Saturated Zone Present
Bioretention 1	1.70	116	0.5	No
Bioretention 2	3.83	249	0.5	No
Bioretention 3	5.14	334	0.5	No

5. MUSIC Modelling

The Model for Urban Stormwater Improvement Conceptualisation (MUSIC) Version 6 was used in combination with MUSIC Modelling Guidelines Version 1.0 – 2010 to evaluate expected stormwater quality outcomes for the proposed development.

Stormwater runoff is simulated using historical rainfall data. Data from Greenbank Thompson Road, station number 40659, has been used from 1980 - 1989 to represent the climatic period upon which the MUSIC model is based. Mean potential evapotranspiration from the Climate Atlas of Australia was used to account for rainfall loss. These designations are in line with requirements specified in the MUSIC Modelling Guidelines.

Catchment delineation and model arrangement was based on the proposed development layout, included as **Figure 6**.

5.1. Model Objectives

The objective of the MUSIC model is to accurately represent the site and facilitate stormwater quality management. Stormwater quality management aims to protect the quality of receiving waters by limiting the quantity of stormwater pollutants discharged to the receiving environment as a result of urban development.

5.1.1. Water Quality Objectives

The following water quality objectives have been adopted from the DERM 'Urban Stormwater Planning Guidelines – 2010'.

Table 2 - Water Quality Objectives

Minimum reductions in Mean Annual Loads from unmitigated catchment			
Total Suspended Solids (TSS)	Total Phosphorus (TP)	Total Nitrogen (TN)	Gross Pollutants > 5mm
80%	60%	45%	90%



Figure 6 - Development Layout

Stormwater Management Plan – Chambers Pines Lifestyle Resort

5.2. Rainfall Data

A summary of the meteorological parameters used to simulate climate behaviour are presented in **Table 3**.

Table 3 - Meteorological and Rainfall Runoff Data

Input	Data Used in Modelling
Rainfall station	40659 – Greenbank Thompson Road
Time step	6 minute
Modelling period	1/1/1980 - 31/12/1989
Mean annual rainfall (mm)	784
Annual evapotranspiration (mm)	1,426
Rainfall runoff parameters	Residential
Pollutant export parameters	Residential

Rainfall runoff and pollutant export parameters included as model inputs are in line with the *MUSIC Modelling Guidelines Version 1.0* (2010).

5.3. Evapotranspiration Data

Greenbank Thompson Road evapotranspiration data was extracted from Table 3.1 of the *MUSIC Modelling Guidelines Version 1.0* (2010), as detailed in **Table 4**.

Table 4 - MUSIC Monthly Evapotranspiration Data (mm)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
181	139	137	102	72	62	63	81	108	138	159	184

5.4. Catchment Description

For the purposes of MUSIC modelling, the subject site has been broken into a series of catchments, based on the existing topography and likely directions of fall in the post-development scenario. A summary of the catchment areas, modelled land use and fraction impervious is included as **Table 5**. The catchment plan is included as **Figure 6**.

MUSIC modelling has been undertaken using “lumped” catchments. A fraction impervious of 85% has been applied to the portions of the catchment where a residential land use will be provided, with 0% impervious applies to the bushfire buffer and open space areas. A weighted average has been calculated to determine the fraction impervious.

Table 5 - Summary of MUSIC Catchments

Catchment ID	Area (ha)	Land use	Fraction Impervious (%)
WQ1	1.70	Urban	65
WQ2	0.92	Urban	73
WQ3	2.21	Urban	57
WQ4	0.70	Urban	70
WQ5	2.39	Urban	45
WQ6	2.75	Urban	70
TOTAL	10.67	-	-



Figure 7 – MUSIC Modelling Catchment Layout

5.5. Rainfall Runoff Parameters

The rainfall runoff export parameters have been adopted from Table 3.7 of the *MUSIC Modelling Guidelines Version 1.0*, as summarised in Table 6.

Table 6 - Rainfall-runoff parameters for residential urban source nodes

Parameter	Urban Residential
Rainfall threshold (mm)	1
Soil storage capacity (mm)	500
Initial storage (% capacity)	10
Field capacity (mm)	200
Infiltration capacity coefficient a	211
Infiltration capacity exponent b	5.0
Initial depth (mm)	50
Daily recharge rate (%)	28
Daily baseflow rate (%)	27
Daily deep seepage rate (%)	0

(extracted from Table 3.7, *Water by Design*, 2010)

5.6. Pollutant Export Parameters

The pollutant export parameters have been adopted from Table 3.8 of the *MUSIC Modelling Guidelines Version 1.0* for a “lumped” catchment, as summarised in **Table 7**.

Table 7 - Pollutant export parameters for residential urban source nodes (extracted from Table 3.8, *Water by Design*, 2010)

Flow Type	TSS log ¹⁰ values		TP log ¹⁰ values		TN log ¹⁰ values	
	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.
Baseflow	1.00	0.34	-0.97	0.31	0.20	0.20
Stormflow	2.18	0.39	-0.47	0.32	0.26	0.23

5.7. Bioretention Systems

The parameters utilised to analyse the bioretention systems are presented in **Table 8**.

Table 8 – Bioretention System MUSIC Modelling Parameters

Bioretention Design Parameter	Bio. 1	Bio. 2	Bio. 3
Surface Area (m ²)	148	296	388
Extended detention depth (m)	0.3	0.3	0.3
Filter area (m ²)	116	249	334
Unlined filter media perimeter (m)	50	73	84
Saturated hydraulic conductivity (mm/hr.)	200	200	200
Filter depth (m)	0.5	0.5	0.5
TN content of filter media (%)	800 ⁽¹⁾	800 ⁽¹⁾	800 ⁽¹⁾
Orthophosphate content of filter media (mg/kg)	55 ⁽¹⁾	55 ⁽¹⁾	55 ⁽¹⁾
Is the base lined?	No	No	No
Vegetated with effective nutrient removal plants	Yes	Yes	Yes
Overflow weir width (m)	15	30	39
Exfiltration rate (mm/hr.)	0	0	0
If an exfiltration rate has been used, have node water balance losses been used in calculation of treatment train effectiveness	N/A	N/A	N/A
If exfiltration rate has been used is the exfiltration rate justified?	N/A	N/A	N/A
Underdrain present?	Yes	Yes	Yes
Submerged zone with carbon present?	No	No	No
Confirmation that K an C* remain default	Yes	Yes	Yes

NOTE: (1) Recommended values from the MUSIC Modelling Guidelines Version 1 (2010) if values are unknown.

6. MUSIC Model

The MUSIC model produced to analyse the proposed development is shown in **Figure 8**.

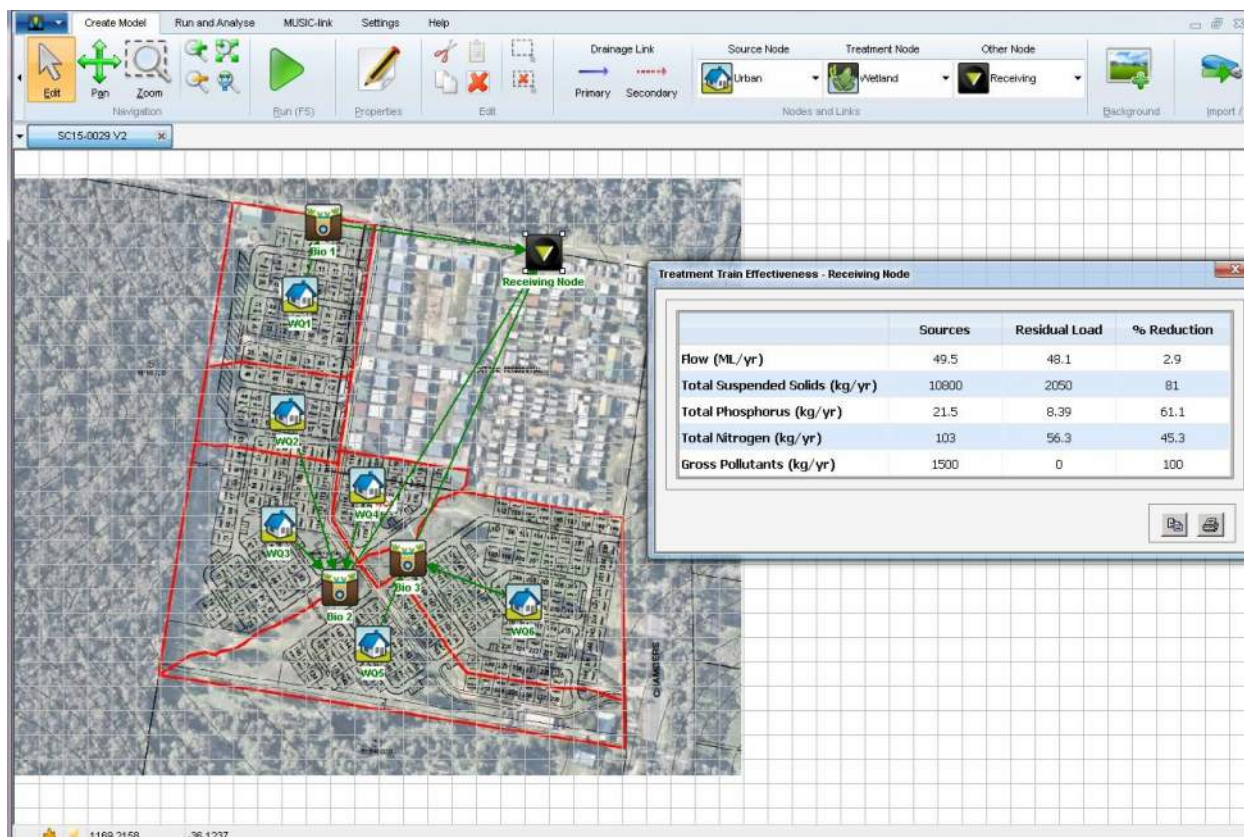


Figure 8 - MUSIC Model Layout

6.1. Modelling Results

The results of the MUSIC analysis are reported in **Table 9**. As per the Water by Design (2010) *MUSIC Modelling Guidelines Version 1.0* saturated hydraulic conductivity rates at both 50mm/hr and 200mm/hr. were modelled.

Table 9 - MUSIC Modelling Results

Pollutant	Reduction (%)	Objective (%)	Objective Achieved
TSS	81	80	Yes
TP	61.1	60	Yes
TN	45.3	45	Yes
Gross Pollutants	100	90	Yes

As can be seen in **Table 9**, the proposed treatment train for the development site is adequate in achieving the required pollutant load based reduction targets.

7. Water Quantity Management

7.1. Introduction

Hydrologic and hydraulic modelling has been undertaken to establish the flow regime and peak discharges at the outlet of the site to the north. The modelling has been undertaken in XP-SWMM for both the pre and post development scenarios.

7.2. Catchments

Site runoff is conveyed to the Legal Point of Discharge (LPD) located in the northern portion of the site. The site has a total area of approximately 15.7ha, while the external catchments cover an area of approximately 33.5ha. The pre- and post-development catchment plans are included within **Appendix B**.

7.3. Rainfall Intensities

Intensity Frequency Duration (IFD) data for the site has been derived in accordance with Australian Rainfall and Runoff (ARR) through the use of the AUS-IFD software. The rainfall intensities generated are shown below in **Table 10**.

Table 10 - IFD Data Applied to Hydrologic Assessment

Duration (mins)	63% AEP (mm/hr)	39% AEP (mm/hr)	18% AEP (mm/hr)	10% AEP (mm/hr)	5% AEP (mm/hr)	2% AEP (mm/hr)	1% AEP (mm/hr)
10	90	114	142	158	180	209	232
15	75	96	119	133	152	176	195
20	65	83	104	116	133	155	171
25	58	75	93	104	119	139	154
30	53	68	85	95	109	127	141
45	42.7	55	69	77	88	103	114
60	36.3	46.5	58	66	75	88	98
90	27.6	35.4	44.7	50	58	68	75
120	22.6	29.1	36.8	41.4	47.7	56	62

7.4. Hydrologic Modelling

The XP-SWMM runoff-routing model has been used to estimate design flood discharges within the site. The model represents the sub-catchments as a network of nodes linked to a 1D drainage network. Each node is defined by its pervious (undeveloped) and impervious (developed) area, fraction impervious and average catchment slope. A fraction impervious of 0% has been applied to the undeveloped portion and 100% to the developed portion. The net rainfall is routed through the network after appropriate losses (initial and continuing) and roughness factors are applied, resulting in a surface runoff hydrograph for each sub-catchment. Hydrologic modelling has been undertaken using the Laurenson Runoff Routing Method.

7.4.1. Rational Method Comparison

The peak discharges provided by the hydrologic model for the 100 year ARI event have been compared against those obtained from the Rational Method calculations to ensure the model is providing reasonable results. The results of this comparison are provided in **Table 11** and demonstrate the hydrologic model is providing results within a reasonable range of the Rational Method calculations and is therefore considered appropriate for use in this analysis.

Table 11 – Rational Method Comparison – 1% AEP Event

Pre-Development Scenario			Post-Development Scenario		
Catchment ID	1% AEP - Peak Discharges (m ³ /s)		Catchment ID	1% AEP - Peak Discharges (m ³ /s)	
	Rational Method	XP-SWMM		Rational Method	XP-SWMM
Ext1	0.29	0.36	Ext1	0.29	0.36
Ext2	0.55	0.62	Ext2	0.55	0.62
Ext3	0.28	0.34	Ext3	0.28	0.34
Ext4	3.74	3.52	Ext4	3.74	3.52
Ext5	2.49	2.34	Ext5	2.49	2.34
Ext6	0.65	0.68	Ext6	0.65	0.68
C01	0.90	1.01	C01	0.90	1.01
C02	0.94	1.02	C02	0.94	1.02
C03	0.71	0.82	C03	0.71	0.82
C04	0.77	0.86	C04	0.77	0.86
C05	0.18	0.18	P05	1.00	1.11
C06	0.62	0.64	P06	0.56	0.62
C07	0.45	0.48	P07	1.26	1.37
C08	0.56	0.58	P08	0.43	0.48
C09	0.71	0.72	P09	1.31	1.41
C10	0.72	0.65	P10	1.63	1.79
C11	0.57	0.60			
C12	0.97	0.90			

7.5. Hydraulic Modelling

The unsteady state, 1D hydrodynamic model XP-SWMM was used to analyse the flood behaviour of the site with the proposed mitigation measures. Flood levels, discharge and velocity can be extracted from the model as functions of time at required locations.

The key objective of the hydraulic modelling was to demonstrate that the post development peak discharge from the site for the 63% to 1 % AEP events is less than or equal to the pre development peak discharge. It has been assumed that any development of the external catchments will require them to provide on site detention measures. Therefore, the fraction impervious for the external catchments remains consistent in the pre-development and post- development scenario.

7.6. Peak Flow Rate

The peak flow rate has been assessed at the LPD to determine the increase in peak flow rate as a result of the development. For the purposes of this assessment, the external catchments have been removed from the model. Therefore, **Table 11** summarises the peak flow rate from the site in the pre- and post-development (un-mitigated) scenarios, and quantifies the increase in flow rate as a result of the increase in impervious surfaces.

Table 12 – Assessment of Increase I Peak Flow Rate as a Result of the Development

Event	Peak-Discharge (m ³ /s)		Increase in Peak Flow
	Pre-development	Post-development (Unmitigated)	
1% AEP	7.13	9.66	35%

7.7. Drainage Reserve

As illustrated in the site layout, a 30m drainage reserve is proposed to convey internal and external catchment runoff through the site. For this purposes of this assessment, the drainage reserve has been assume to be a trapezoidal channel, as illustrated in **Figure 9**.

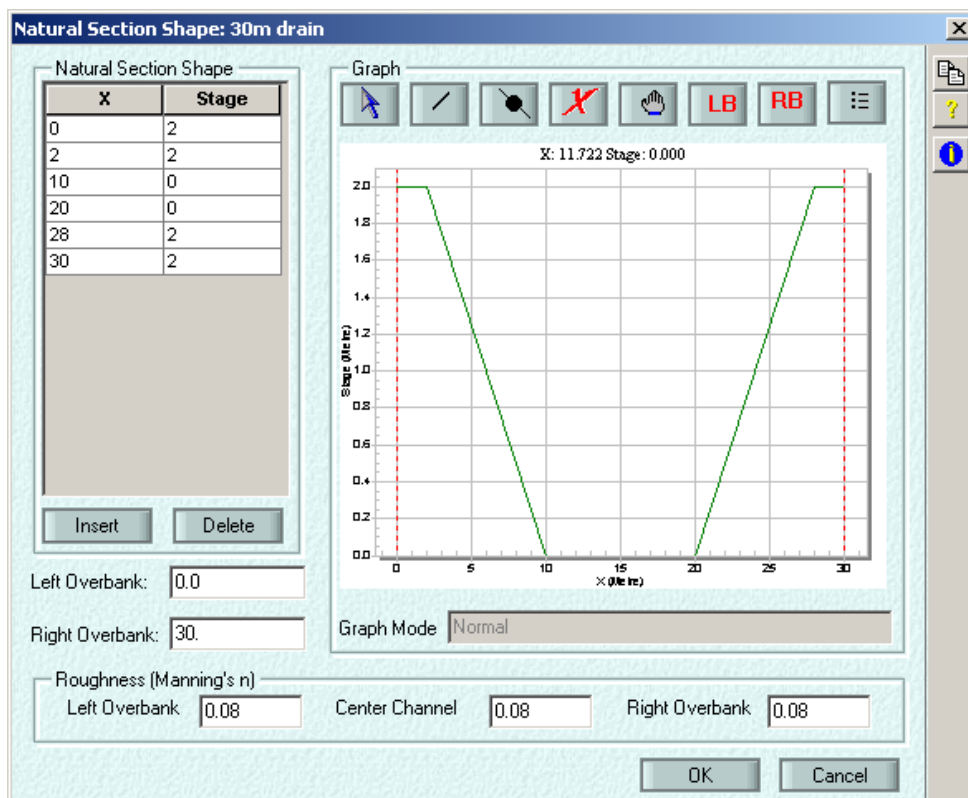


Figure 9 - Drainage Reserve Profile - Post-Development Scenario

7.8. Mitigation Measures

Modelling was undertaken to determine if the proposed drainage reserve can detain the increase in peak flow rate as a result of the development, and ensure the pre-development peak flow rates are being maintained at the LPD. To ensure the pre-development peak discharges are not exceeded for all ARI events, a staged outlet structure has been designed for the retention basins. To achieve this objective, two control structures have proposed within the drainage reserve. These are located:

1. At the internal road crossing of the drainage reserve, and
2. At the upstream end of the existing concrete lined drain in the existing relocatable home/caravan park.

The location of these control structures is illustrated in **Figure 10**.

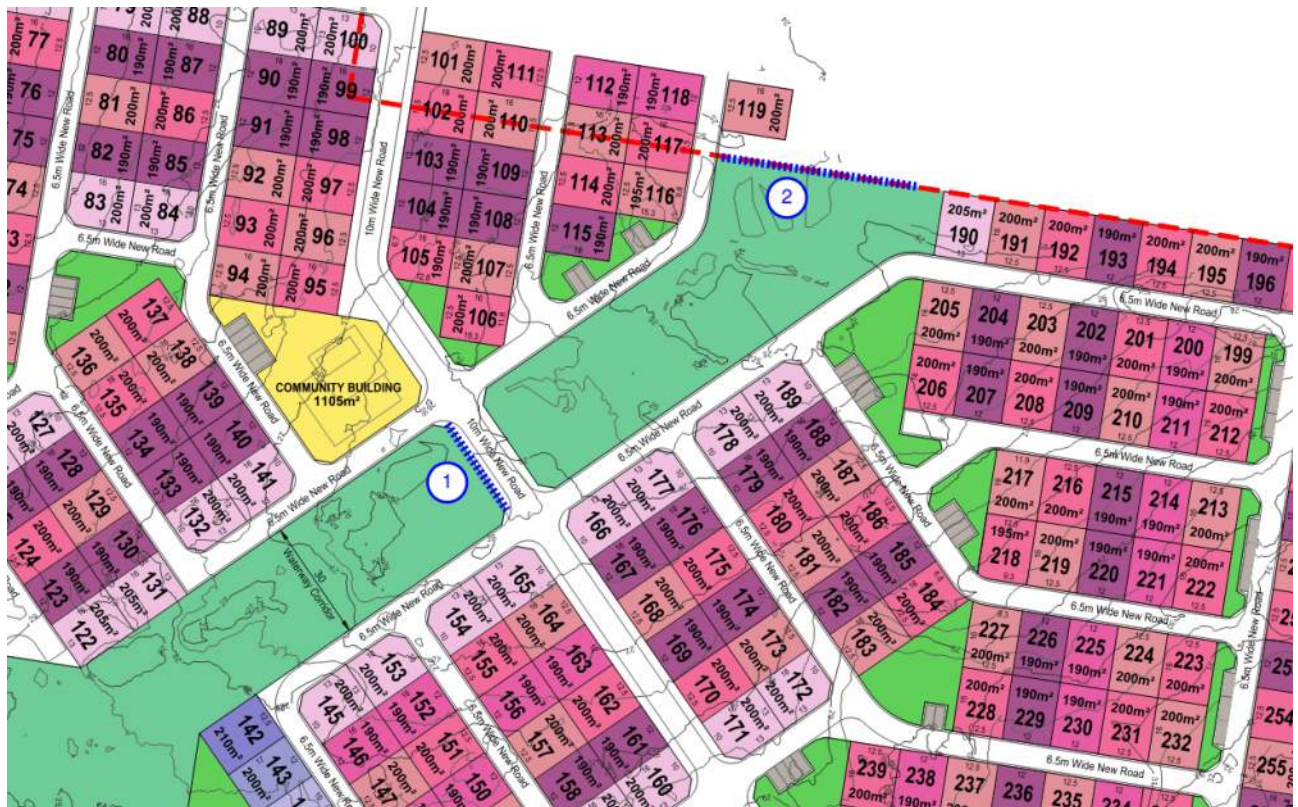


Figure 10 - Location of Flow Control Structures

7.8.1. Control Structures

Location 1

Control of runoff at Location 1 will be provided by the road formation, combined with the following culvert arrangement:

- 2 x 600mm RCPs at 25.8m AHD (assumed channel invert level),
- 2 x 600mm RCPs at 26.25m AHD (assumed channel invert level plus 0.45m), and
- Road level set at 27.3m AHD (assumed channel invert level plus 1.50m).

Location 2

Control of runoff at Location 2 will be provided by forming a bund across the drainage reserve, between the proposed development and the existing relocatable home/caravan park. In addition to the bund, the following culvert and weir arrangement will be required:

- 2 x 600mm RCPs at 24.4m AHD (assumed channel invert level),
- 2 x 600mm RCPs at 24.9m AHD (assumed channel invert level plus 0.50m), and
- Weir level set at 25.9m AHD (assumed channel invert level plus 1.50m).

7.9. Performance of Mitigation and Detention Volumes

The performance of the control structures has been assessed by comparing the mitigated post-development peak flow rate with the pre-development peak flow rate. A summary of this assessment is shown below in **Table 13**.

Table 13 – Performance of Control Structures

AEP Event	Pre-Development (m ³ /s)	Post-Development – mitigated (m ³ /s)
1%	12.96	12.48
2%	11.18	10.89
5%	9.26	9.21
10%	7.63	7.10
18%	6.25	5.53
39%	4.37	3.88
63%	2.85	2.85

As can be seen in **Table 13**, the post-development peak discharges have been mitigated to below the pre-development peak discharges for the 63% to 1% AEP events.

The maximum depth observed at the control structures is summarised below:

- Location 1 – maximum depth = 1.67m
- Location 2 – maximum depth = 1.61m

Therefore, at both locations, the proposed channel section provides in excess of the 300mm of freeboard required by QUDM. More defiles in relation to the top of bank levels and minimum flor levels for the proposed dwellings will be provided as part of the operational works stage of the development.

The peak water level through the channel was used to determine the detention volume provided by the proposed drainage reserve and the control structures. In doing so, it has been determined that **3,681m³** of detention storage is provided within the drainage reserve, and is therefore sufficient to maintain pre-development peak flow rates.

7.10. Road Crossings

In accordance with the *Queensland Urban Drainage Manual* (QUDM), 2008 Section 10.02 all flow over roadways must satisfy the following conditions:

- A maximum Depth x Velocity product of $0.4\text{m}^2/\text{s}$, and
- A maximum flow depth of 200mm.

Table 14 provides an assessment of the flow conditions at internal road crossing for the 1% AEP storm events

Table 14 - Assessment of Flow Conditions at Road Crossings

	100 yr
Road Level (m AHD)	27.3
Peak Water Level (m AHD)	27.50
Flow Depth over Road (m)	0.20
Flow Velocity over Road (m/s)	1.1
Velocity x Depth Product (m^2/s)	0.22

The results in **Table 14** demonstrate compliance with these above conditions for the internal road crossings for the major storm event.

8. Summary

This SMP has been developed for the proposed residential development located on Chambers Flat Road. A treatment train has been devised to ensure the relevant water quality objectives can be achieved for runoff exiting the site, and that pre development peak flow rates can be maintained.

Based on this assessment, the following conclusions have been made:

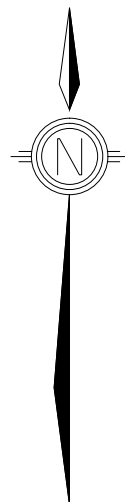
- The relevant water quality objective for the site are load based reduction targets of:
 - TSS 80%,
 - TP 60%,
 - TN 45%, and
 - GP 90%.
- These water quality objectives can be achieved by implementing a treatment train consisting of bioretention systems providing a total of 699m² of filter area (at 0.5m depth).
- Detention of runoff will be required to ensure pre development peak flow rates from the site are maintained. A storage volume of approximately **3,681m³** is required within the drainage reserve to achieve this objective.

9. Reference List

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Appendix A Development Layout

DRAFT



KOPLICK ROAD

ROAD

FLAT

CHAMBERS

EXISTING RESIDENTIAL

5
RP68700

31
RP848575

- LEGEND
- Site Boundary
 - Open Space - Waterway Corridor
 - Open Space / Landscaping
 - 10m Buffer to Adjoining Use
 - Carparking - 62 bays
 - Caravan Parking - 23 bays

House Type	Dimensions	Plot Area	No of Lots	% Mix
16m Deep Allotments				
1.5 Bed	12 x 16	192	20	8%
2 Bed 1.5 Bath	12 x 16	192	64	25%
2 Bed 2 Bath	12.5 x 16	200	59	23%
2.5 Bed	12.5 x 16	200	59	23%
3 Bed	13 x 16	208	35	14%
17m Deep Allotments				
1.5 Bed	12 x 17	204	2	1%
2 Bed 1.5 Bath	12 x 17	204	4	2%
2 Bed 2 Bath	12.5 x 17	212.5	5	2%
2.5 Bed	12.5 x 17	212.5	5	2%
3 Bed	13 x 17	221	3	1%
Total			256	

Note:
All Lot Numbers, Dimensions and Areas are approximate only, and are subject to survey and Council approval.
Dimensions have been rounded to the nearest 0.1 metres.
Areas have been rounded down to the nearest 5m².
The boundaries shown on this plan should not be used for final detailed engineers design.

SCALE 1 : 1000 @ A1

0 20 40 60 80 100

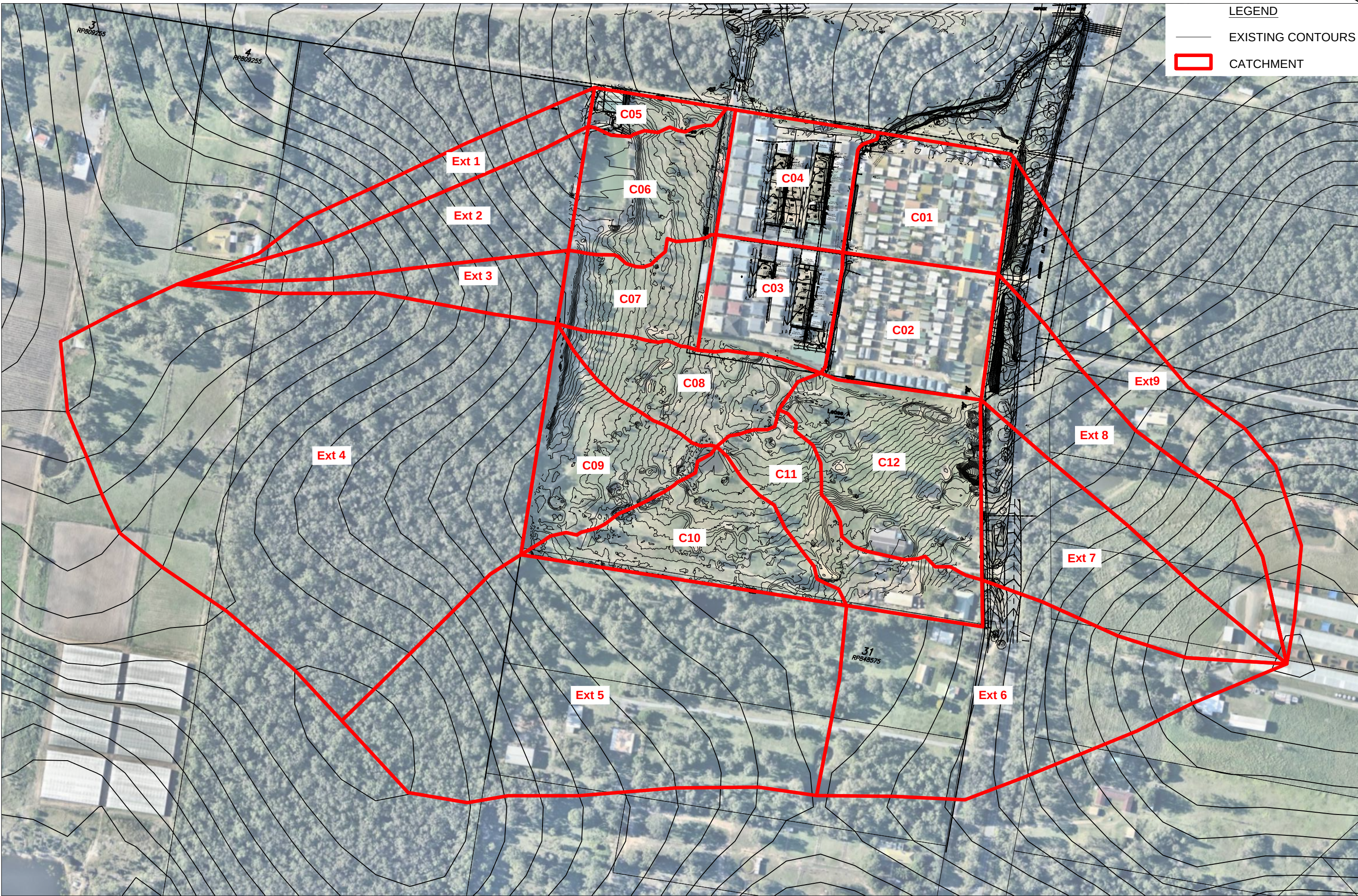
RPS

DATE : 14 MAY 2015 DWG NAME : 126720-05-PRO DWG # 126720-05A

SITE LAYOUT PLAN
Ingenia Communities Holdings Ltd



Appendix B Pre- and Post-Development Catchment Plans



LEGEND

EXISTING CONTOURS

CATCHMENT

02

ENVIRONMENT+
ENGINEERING

www.o-2.com.au

ACN: 136 340 924 | ABN: 79 136 340 924
SUNSHINE COAST
8 Grebe Street
Peregian Beach, QLD, 4566
t (07) 5448 3288

BRISBANE
Ground Floor, 48 Wharf St
Kangaroo Point, QLD, 4169
t (07) 3339 7900

REV	DATE	REVISION DETAILS	APPROVED



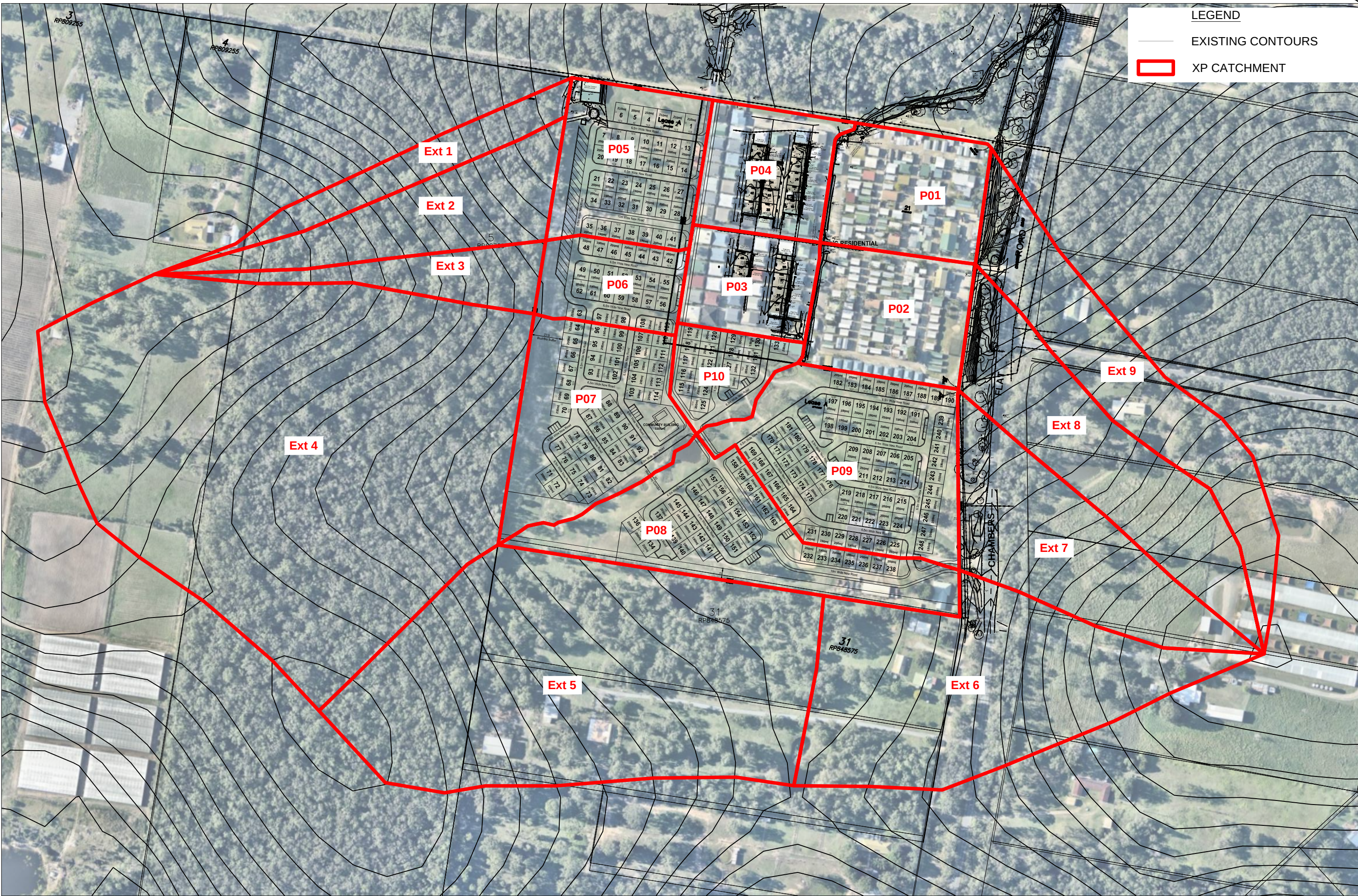
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SCALE 1:3000

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DRAWN	BN	CLIENT
DESIGNED	BN	EST2
APPROVED	SC	PROJECT
DATE	16/04/15	SWMP RELOCATABLE HOMEPARK
RPEQ NO.	N/A	CHAMBER FLAT
GRID REF.	MGA-Z56	

TITLE	PRE-DEVELOPMENT CATCHMENT PLAN	REV.
DRAWING NO.	SC15-0029-001	-



02

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ACN: 136 340 924 | ABN: 79 136 340 924

SUNSHINE COAST
8 Grebe Street
Peregian Beach, QLD, 4566
t (07) 5448 3288

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Ground Floor, 48 Wharf St
Kangaroo Point, QLD, 4169
t (07) 3339 7900

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REV	DATE	REVISION DETAILS	APPROVED



0 30 60 90 120 150m

SCALE 1:3000

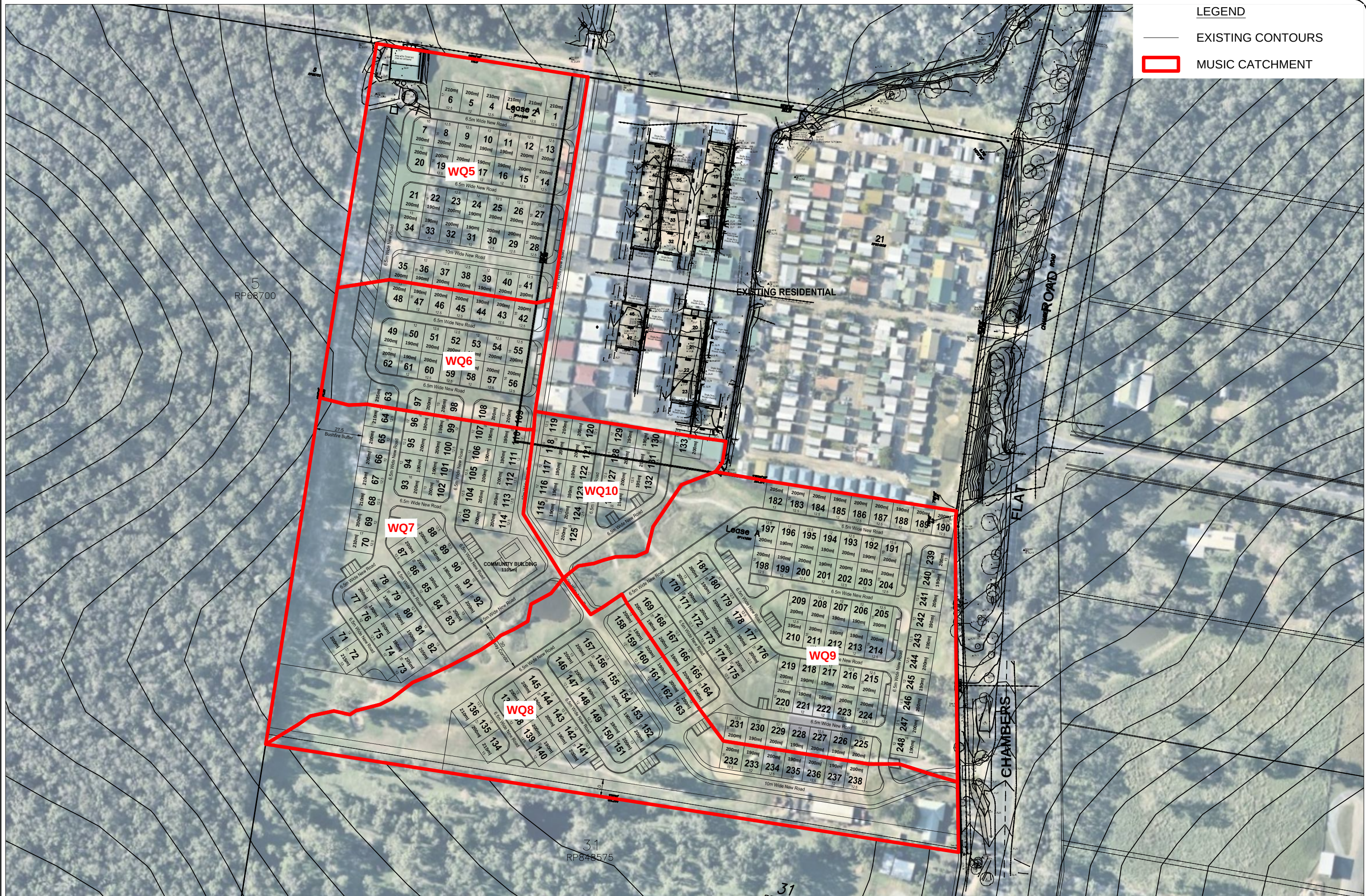
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DRAWN	BN	CLIENT
DESIGNED	BN	EST2
APPROVED	SC	PROJECT
DATE	21/04/15	SWMP RELOCATABLE HOMEPARK
RPEQ NO.	N/A	CHAMBER FLAT
GRID REF.	MGA-Z56	

TITLE	POST - DEVELOPMENT CATCHMENT PLAN	REV.
DRAWING NO.	SC15-0029-002	-



LEGEND

EXISTING CONTOURS

MUSIC CATCHMENT

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ACN: 136 340 924 | ABN: 79 136 340 924

SUNSHINE COAST
8 Grebe Street
Peregian Beach, QLD, 4566
t (07) 5448 3288

BRISBANE
Ground Floor, 48 Wharf St
Kangaroo Point, QLD, 4169
t (07) 3339 7900

REV	DATE	REVISION DETAILS	APPROVED

0 20 40 60 80 100m

SCALE 1:2000

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NORTH

DRAWN	BN	CLIENT
DESIGNED	BN	EST2
APPROVED	SC	PROJECT
DATE	04/05/13	SWMP RELOCATABLE HOMEPARK
RPEQ NO.	N/A	CHAMBER FLAT
GRID REF.	MGA-Z56	

TITLE	MUSIC CATCHMENT PLAN
DRAWING NO.	SC15-0029-003
REV.	-

Wednesday, 13 May 2015 12:55:59 AM