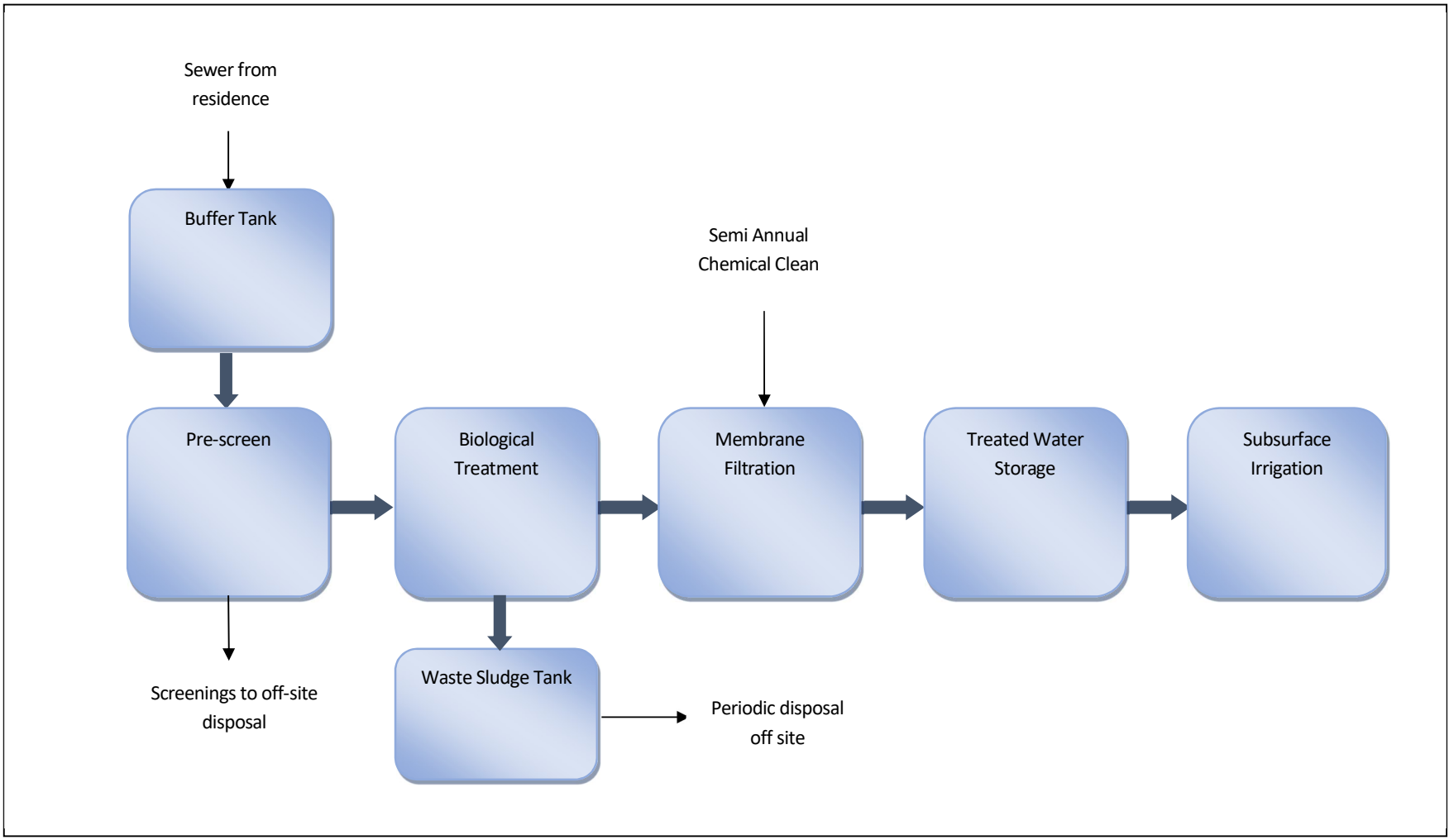
Appendix 4.3.1.1 Flow Diagram Attachment



Appendix 4.3.3.1 Location of Treatment Plant Overview

COURT PROCEEDINGS

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
C	AMENDED TO ADDRESS COUNCIL CONTENTIONS	14/12/2016	RK	SA	GH/DM	DM
B	FOR S34 CONFERENCING	15/08/2016	RK	MD/SA	GH/DM	DM
A	FOR S34 CONFERENCING	04/07/2016	RK			

SCALE
0 5 10 15 20 25 30 35 40 45 50 METRES
A1 (A3) 1:500 (1:1,000)

GRID	DATUM	PROJECT MANAGER
MGA	mAHD	GH

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CLIENT
MMLM TRUST, PRJM P/L

PROJECT NAME/PLANSET TITLE
67 KURRAJONG ROAD
CONCEPT CIVIL WORKS
67 KURRAJONG ROAD
LOT 1 – DP 1185012

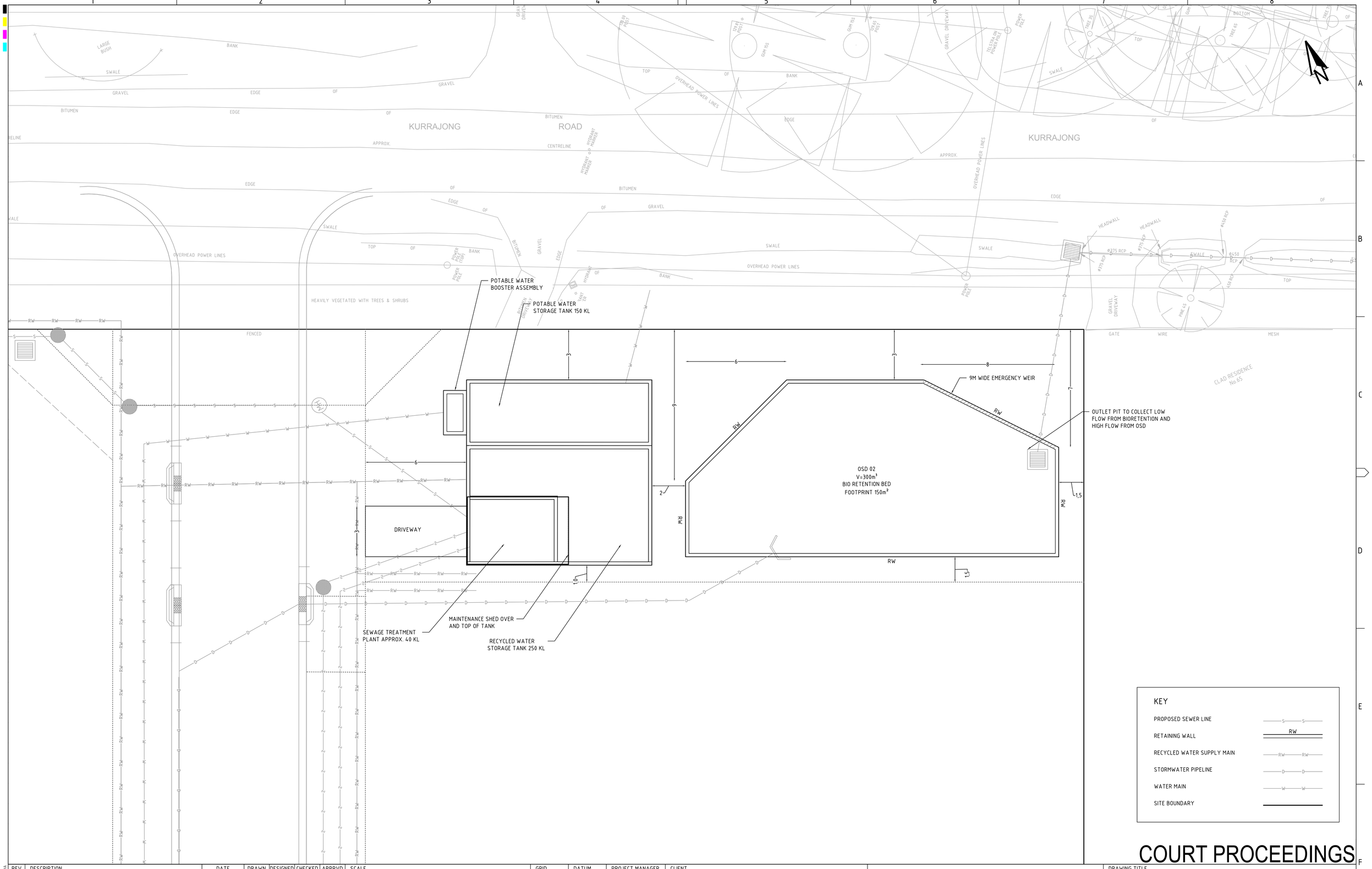
martens & Associates Pty Ltd
Consulting Engineers
Environment
Water
Geotechnical
Civil
Suite 201, 20 George St, Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767
Email: mail@martens.com.au Internet: www.martens.com.au

DRAWING TITLE
RETICULATED WASTEWATER MANAGEMENT SCHEME
(LAYOUT 01)

PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P1504885	PS02	R06	PS02-H200	C

PRINTED: --- USER: RKALANDROPHA
A1 / A3 LANDSCAPE (A1LC_v02.0.01)
DRAWING ID: P1504885-PS02-R06-H200

Appendix 4.3.3.2 Location of Treatment Plant Detail



KEY

- PROPOSED SEWER LINE
- RETAINING WALL
- RECYCLED WATER SUPPLY MAIN
- STORMWATER PIPELINE
- WATER MAIN
- SITE BOUNDARY

COURT PROCEEDINGS

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
D	**AMENDED TO ADDRESS COUNCIL CONTENTIONS**	**14/12/2016**	**RK**	**SA**	**GH/DM**	**DM**
C	AMENDED TO ADDRESS COUNCIL CONTENTIONS	13/12/2016	KT	SA	GH/DM	DM
B	FOR S34 CONFERENCING	15/08/2016	RK	MD/SA	GH/DM	DM
A	FOR S34 CONFERENCING	04/07/2016	RK			

SCALE: A1 (A3) 1:100 (1:200) — METRES

GRID	DATUM	PROJECT MANAGER
MGA	mAHD	GH

CLIENT: MMLM TRUST, PRJM P/L

PROJECT NAME/PLANSET TITLE
67 KURRAJONG ROAD
CONCEPT CIVIL WORKS
67 KURRAJONG ROAD
LOT 1 – DP 1185012

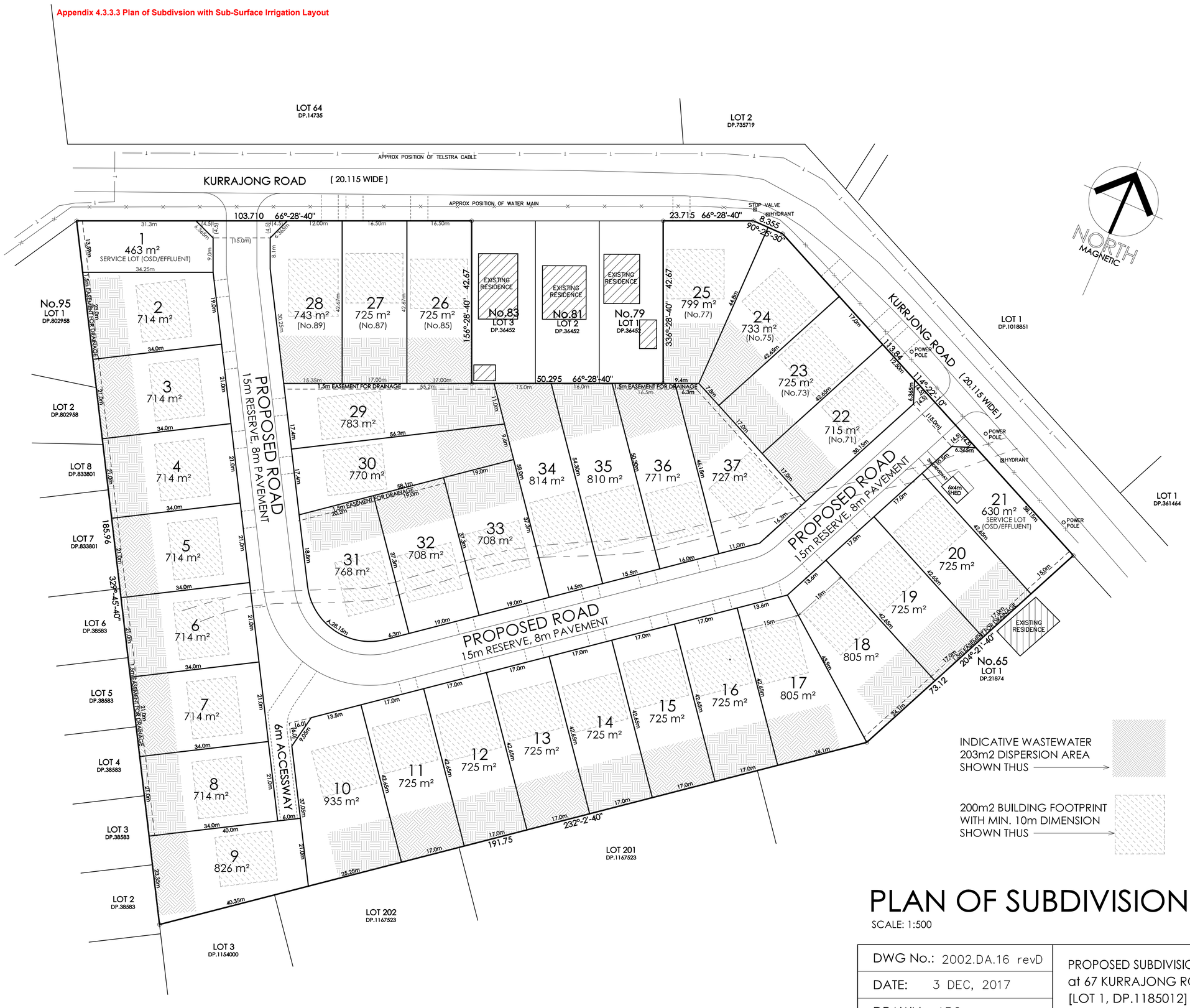
martens & Associates Pty Ltd
Consulting Engineers
Environment
Water
Geotechnical
Civil
Suite 201, 20 George St, Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767
Email: mail@martens.com.au Internet: www.martens.com.au

DRAWING TITLE
SERVICES LOT 'B' LAYOUT PLAN
(VIEWPORT 04)

PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P1504885	PS02	R06	PS02-H102	D

PRINTED: --- USER: RKALANDOUTAH
A1 / A3 LANDSCAPE (A1LC_v02.0.01)
DRAWING ID: P1504885-PS02-R06-H102

Appendix 4.3.3.3 Plan of Subdivsion with Sub-Surface Irrigation Layout



INDICATIVE WASTEWATER
203m2 DISPERSION AREA
SHOWN THUS →

200m2 BUILDING FOOTPRINT
WITH MIN. 10m DIMENSION
SHOWN THUS →

TABLE OF LOTS

LOT	Area (m²)	LOT	Area (m²)
1	463	20	725
2	714	21	630
3	714	22	715
4	714	23	725
5	714	24	733
6	714	25	799
7	714	26	725
8	714	27	725
9	826	28	743
10	935	29	783
11	725	30	770
12	725	31	768
13	725	32	708
14	725	33	708
15	725	34	814
16	725	35	810
17	805	36	771
18	805	37	727
19	725		
Total=	27,286 m²	Average	737 m²

PLAN OF SUBDIVISION - 37 LOTS

SCALE: 1:500

A1 SHEET

DWG No.: 2002.DA.16 revD DATE: 3 DEC, 2017 DRAWN: APG REF: . . ./KURRAJONG/SITE37	PROPOSED SUBDIVISION at 67 KURRAJONG ROAD [LOT 1, DP.1185012] KURRAJONG NSW 2758 for . . .	ANDREW P GRIEVE BACHELOR OF ARCH (HONS) 17 ANNABELLE CRESCENT KELLYVILLE, NSW 2155 MOBILE. 0412 752 579

Appendix 4.3.3.4 Control Shed Enclosure - Detailed

KURRAJONG ROAD

NEW ROAD

38.15m BOUNDARY

1.8m OPEN STYLE METAL FENCING

6.365m BOUNDARY

10.5m BOUNDARY

3m WIDE GATE

3m WIDE SEALED DRIVEWAY

LOT 21
630m2

7.5m SETBACK

6000

800 | 600 | 600 | 600 | 600 | 600 | 600 | 900 | 700

150 | 4400 | 100 | 1200 | 150

VERANDAH
6 x 2m RL.131.30
R/C SLAB TO ENGINEER'S DETAIL

CONTROL SHED
6 x 4m
R/C SLAB TO ENGINEER'S DETAIL
RL.131.30
100mm FRAMED

T

S

WC

WC

200mm GRATED DRAIN

7.5m x 2.4m HIGH ROLLER SHUTTER DOOR

2000 | 600 | 1050 | 700 | 4000 | 1050 | 600 | 6000

6m SETBAVK

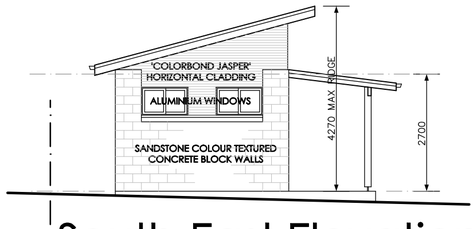
1.5m SETBACK

150mm THICK COLOURED TEXTURE CONCRETE BLOCK WALLS

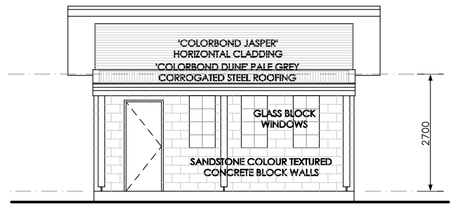
1.8m OPEN STYLE METAL FENCING

42.65m BOUNDARY

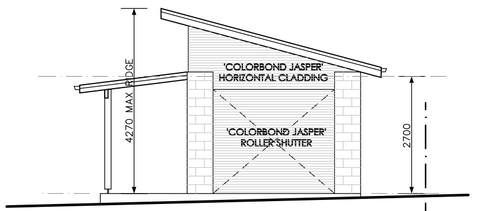
15m BOUNDARY



South-East Elevation
SCALE: 1:100



North-East Elevation
SCALE: 1:100



North-West Elevation
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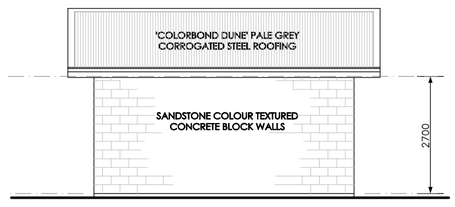
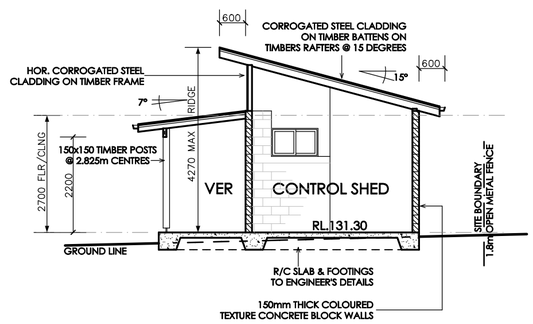


South-West Elevation
SCALE: 1:100

SITE & FLOOR PLAN
SCALE: 1:100



Section 'A-A'
SCALE: 1:100

FINISHES SCHEDULE

'COLORBOND DUNE' PALE GREY CORROGATED STEEL ROOFING

'COLORBOND IRONSTONE' GREY PREFINISHED FASCIA AND GUTTER

'COLORBOND JASPER' HORIZONTAL CLADDING AND GARAGE DOOR

SANDSTONE COLOUR TEXTURED CONCRETE BLOCK WALLS

COLORBOND DUNE COLOUR POWDER COATED ALUMINIUM WINDOWS WITH SECURITY SCREEN

150x150 TIMBER VERANDAH POSTS AND VERANDAH BEAM

'COLORBOND JASPER' FINISH DOWNPIPES

PROPOSED CONTROL SHED

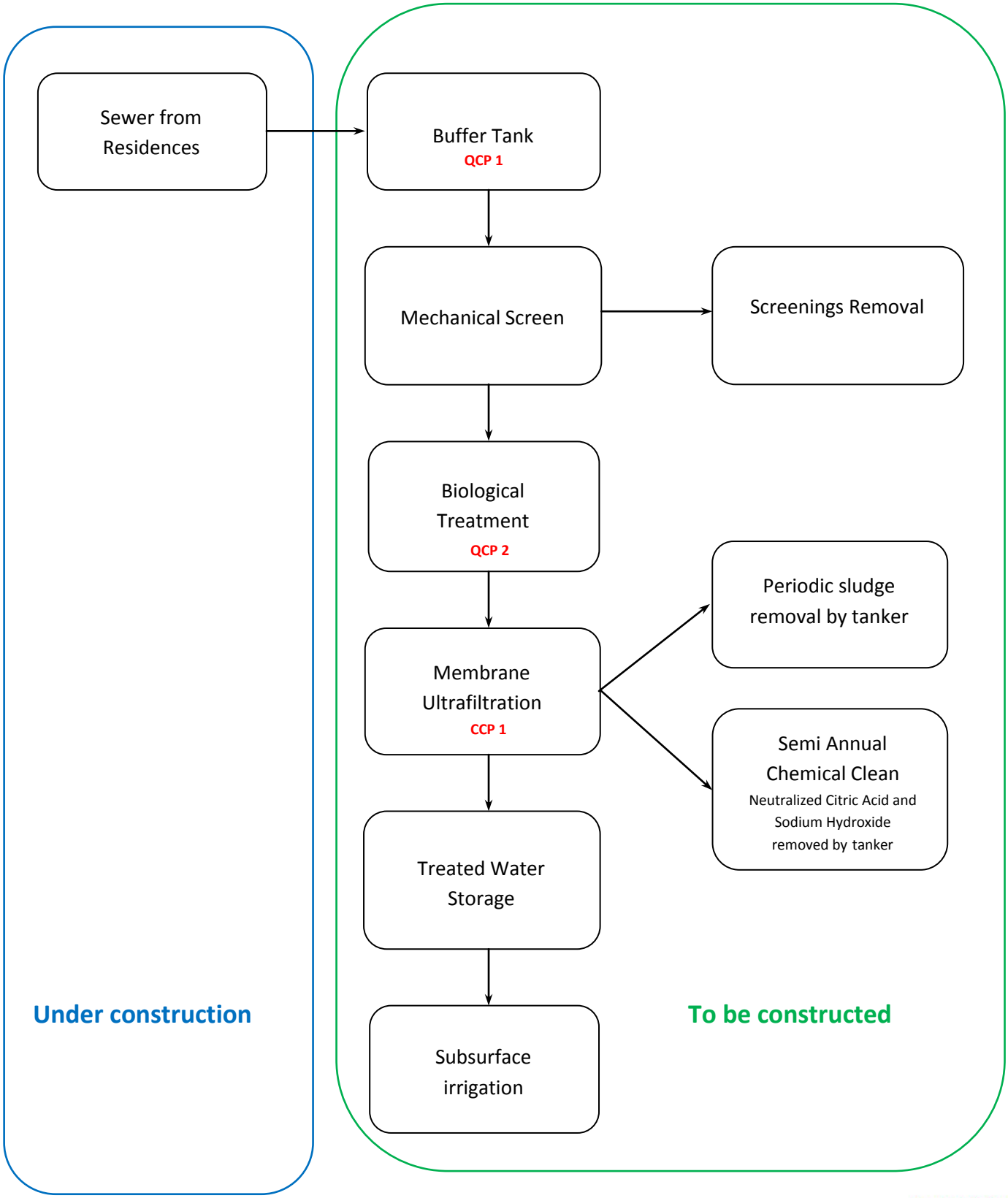
SCALE: 1:100

A1 SHEET

DWG No.: 2003.DA.16 DATE: 7 AUGUST, 2016 DRAWN: APG REF: . . ./KURRAJONG/SITE37	PROPOSED SUBDIVISION at 67 KURRAJONG ROAD [LOT 1, DP.1185012] KURRAJONG NSW 2758 for . . .	ANDREW P GRIEVE BACHELOR OF ARCH (HONS) 17 ANNABELLE CRESCENT KELLYVILLE, NSW 2155 MOBILE. 0412 752 579

aquacell water recycling

Process Flow Diagram of Kurrajong Hamlet Water Treatment Plant



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ABN 79 072 487 015

PRJM Pty Ltd

Kurrajong STP

Odour Impact Assessment

October 2018

Table of contents

Table index

Figure index

Appendices

1. Introduction

1.1 Overview

PRJM Pty Ltd. (PRJM) propose to develop a residential community subdivision at 67 Kurrajong Road, Kurrajong ('the project'). As part of the development, PRJM propose to construct a self-contained sewage treatment plant (STP) at the site.

GHD Pty Ltd (GHD) has been engaged by PRJM to assess odour air quality impacts from the STP at the occupants of the planned subdivision and at existing nearby sensitive receptors.

The assessment has been undertaken in response to a request for information from Independent Pricing and Regulatory Tribunal (IPART) and in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (Approved Methods) (EPA, 2016).

1.2 Limitations

This report: has been prepared by GHD for PRJM Pty Ltd and *may only be used and relied on by PRJM Pty Ltd for the purpose agreed between GHD and the PRJM Pty Ltd as set out in section 1.1 of this report.*

GHD otherwise disclaims responsibility to any person other than PRJM Pty Ltd arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions (including the presence of emissions to air) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by PRJM Pty Ltd and others who provided information to GHD, which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

2. Existing environment

2.1 Site location

The subdivision will be located in Kurrajong Town in the local government area of Hawkesbury City, New South Wales. It is approximately 75 kilometres north-west of Sydney.

The proposed STP is located in the north-west corner of the subdivision. The location of the proposed STP and subdivision is shown in Figure 1.

Kurrajong hills is located approximately 1.9 kilometres to the northwest of the site while Bowen Mountain is located approximately 4.0 kilometres southwest of the project site.

2.2 Sensitive receptors

The sensitive receptors most affected by the potential odour emissions from the STP will be the occupants of the subdivision and existing nearby residences. There are a total of 41 identified sensitive receptors for this odour assessment.

The sensitive receptors are shown in Figure 2 below, with the 35 proposed dwellings inside the subdivision shown as yellow icons, while the 16 existing residences within 150 metres of the proposed STP are shown as green icons.

2.3 Background odour concentration

There are no identified sources of significant odour in the project area. Therefore, cumulative odour impacts are not anticipated at the identified sensitive receptors.

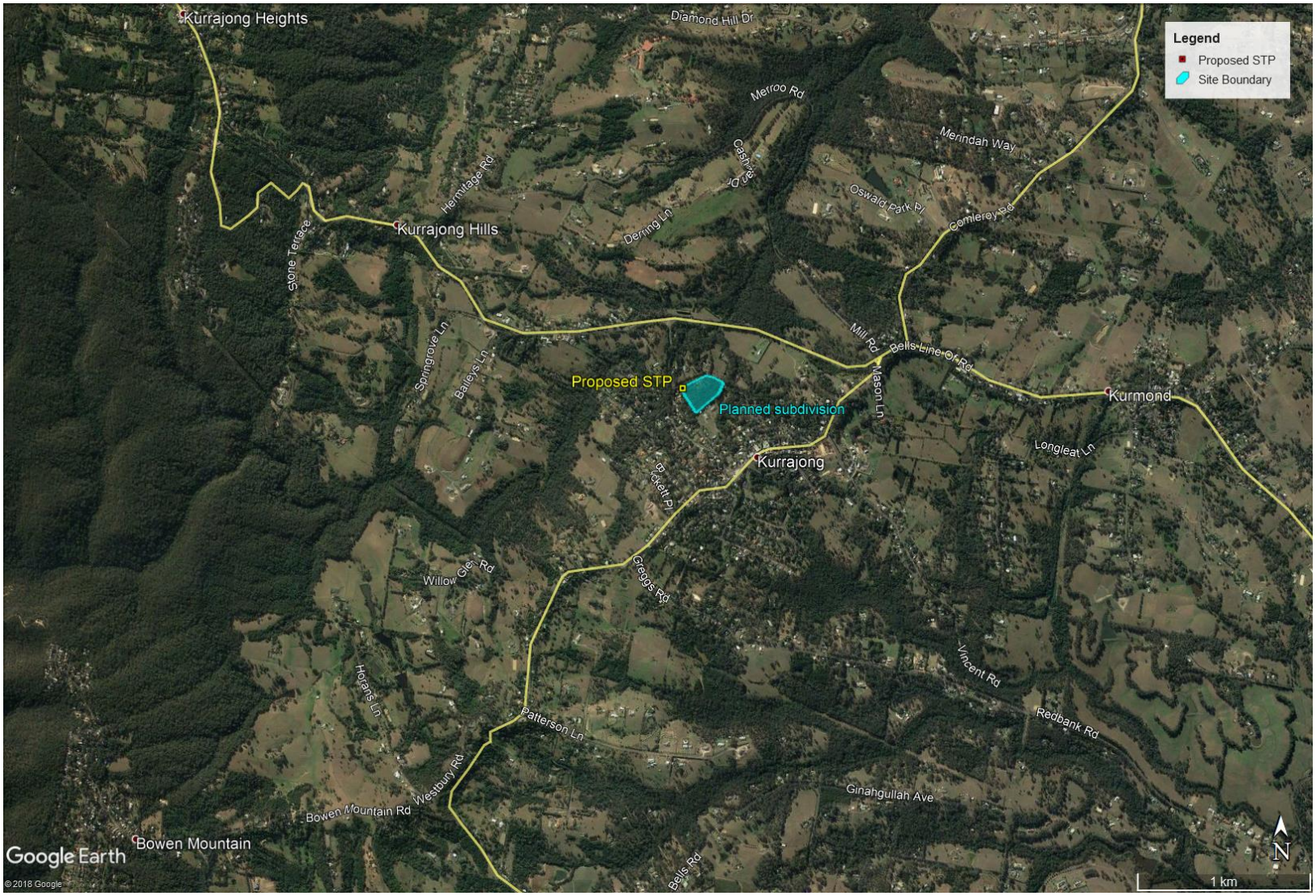

Figure 1 Site location (Source: Google Earth, 2018)

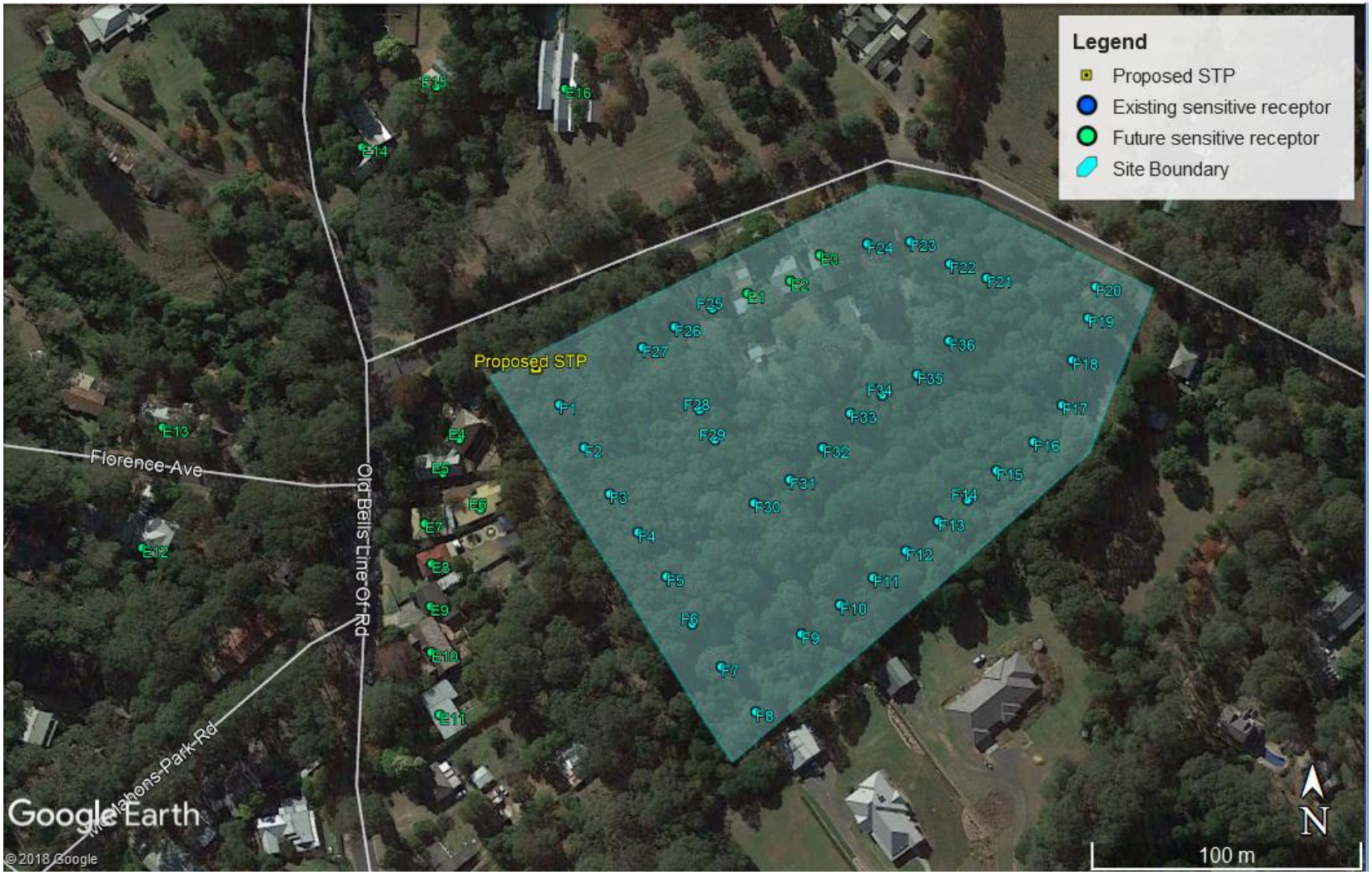

Figure 2 Location of sensitive receptors

3. Odour criteria

3.1 Approved Methods

The Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales ('the Approved Methods') (NSW EPA, 2016) lists the statutory methods for modelling and assessing emissions of air pollutants from stationary sources in NSW. The assessment criteria for odour is applied at the nearest existing or likely future off-site sensitive receptor.

The Approved Methods also defines odour assessment criteria and specifies how they should be applied in dispersion modelling to assess the likelihood of nuisance impact arising from the emission of odour.

3.1.1 Odour assessment criteria

Odour impact is a subjective experience and has been found to depend on many factors, the most important of which are the:

- **F**requency of the exposure
- □ntensity of the odour
- **D**uration of the odour episodes
- □ffensiveness of the odour
- □ocation of the source.

These factors are often referred to as the FIDOL factors.

The odour assessment criteria is defined to take account of two of these factors (**F** is set at 99th percentile; □is set at from 2 to 7 OU). The choice of assessment criteria is also dependent on the population of the affected area as shown in Table 1.

Table 1 Odour criteria for the assessment of odour (EPA, 2016)

Population of affected community	Odour performance criteria (nose response odour certainty units at 99th percentile[1])
Single Residence (≤ ~2)	7
~ 10	6
~ 30	5
~ 125	4
~ 500	3
Urban (≥~2,000)	2

Note 1: This is a prediction of the odour level that may occur 1% of the time, or one hour in one hundred. Odour performance criteria are designed to be precautionary, so that impacts on sensitive receivers can be minimised.

The criteria assumes that 7 OU at the 99th percentile would be acceptable to the average person, but as the number of exposed people increases there is a chance that sensitive individuals would be encountered. The criteria of 2 OU at the 99th percentile is considered to be acceptable for large populations (more than 2,000 people).

The criteria have also been specified at an averaging time of nominally 1 second. The choice of the short averaging time recognises that the human nose has a response time of less than 1 second, so that modelling of odour impact should allow for the short-term concentration fluctuations in an odour plume due to turbulence.

As the dispersion model cannot predict concentrations for a 1 second average, a ratio between the 1 second peak concentration and 60 minute average concentration has been applied in

accordance with Section 6.6 of the Approved Methods. This is known as the peak to mean ratio (PM60). PM60 is a function of source type, stability category and range (that is, near or far-field), and values are tabulated in the Approved Methods

3.2 Proposal odour criteria

GHD has reviewed the number existing and future dwellings in the project area that may be impacted by odour from the proposal. All dwellings that are situated within the 1 OU peak odour contour (refer Section 6) have been assumed to be included in the community potentially affected by odour as per Section 7.5 of the Approved Methods. The number of dwellings is identified as nine dwellings. NSW Government census data for Kurrajong in 2016 shows the average people per household is 2.9 meaning the affected community by the project is approximately 26 individuals.

In order to provide a conservative assessment, a criteria of 4 OU (which assumes a population of 125 people) was applied for the whole assessment area.

4. Sewage Treatment Plant

4.1 Process flow and tank layout

An on-site self-contained STP is to be installed to service all 35 dwellings inside the subdivision. The STP is composed of pre-screening, aerobic biological treatment and membrane bioreactor for tertiary treatment. The STP process flow diagram is shown in Figure 3.

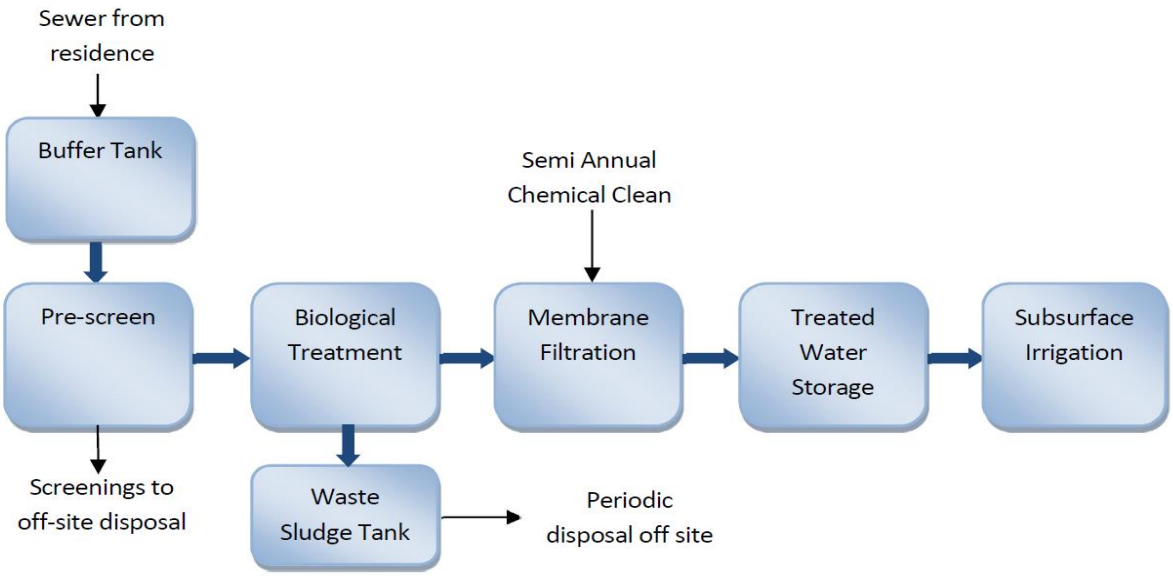

Figure 3 Process flow diagram for sewage treatment

Sewage from the homes on the site flows by gravity through the sewerage network to the buffer tank. The buffer tank is a 100 kilolitre concrete tank. It can provide up to 6 days of storage capacity given an expected wastewater of 15.8 kilolitres per day when the 35 dwellings have been occupied.

Primary treatment involves passing the wastewater through a two-millimetre sieve from the buffer tank into an enclosed pre-screen. Screenings are captured in a sealed bag and discharged off-site while the screened wastewater is transferred to biological treatment.

Biological treatment involves aerobic treatment to break down and digest the organic matter. The aerobic zone uses air blowers and diffusers to distribute air. The sludge is transferred to the waste sludge tank and disposed off-site for further processing. The treated water is further cleaned through membrane filtration.

Advance treatment, such as membrane filtration, involves passing the water through ultrafiltration membrane that removes suspended solids and pathogens. This will be the final water treatment before discharge.

The treated water is stored in a water tank with a maximum volume of 46 kilolitres. This water is discharged to the environment via sub-surface irrigation.

The tank layout of the STP that will service the 35 dwellings of 67 Kurrajong Road subdivision is shown in Figure 4. It can be seen in this layout that the treatment of system is undertaken in enclosed tanks with controlled environment.

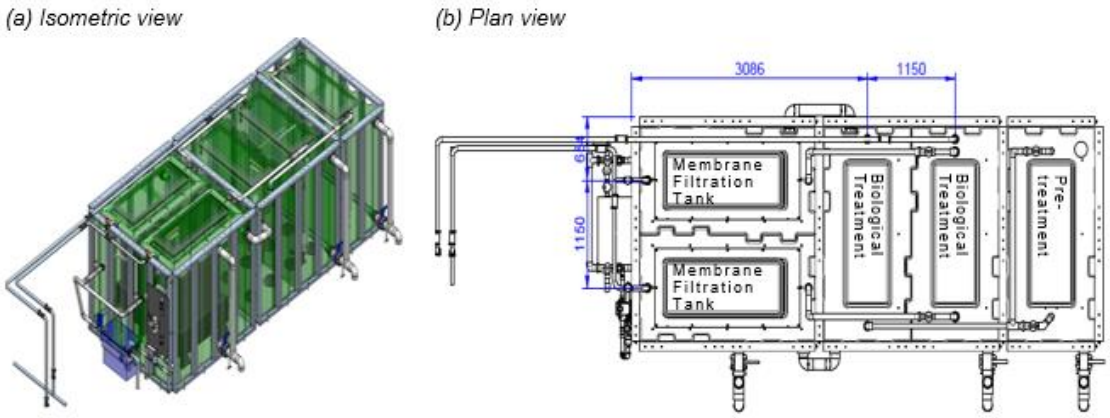

Figure 4 Tank lay-out for the proposed STP

4.2 Odour emission rates

Emission rates used in the dispersion model were based on typical odour concentrations of potential sources, air flow rate and the application of the peak odour concentration factor.

Potential sources of odour emission from this STP were identified as the primary treatment tank and the aerated biological treatment tanks. Odour emission rates used in this assessment were based on conservative assumptions in an assessment of a similar plant at Narara, NSW. The odour assessment (Narara Ecovillage Air Quality (Odour) Impact Assessment, Aubin Environment 2013) states that the odour concentration from primary treatment is typically at 10,000 odour units (OU).

In order to be conservative, this assessment assumes that the primary tank has an odour concentration of 20,000 OU from 5 am to midnight and an odour concentration of 10,000 for the remaining time periods. These peaks would generally correspond with peak flows which occur in the morning and evening time periods only.

Aubin Environment state that emissions from biological treatment through aerobic processes are typically between 270 and 440 OU (2013). A conservative peak level of 500 OU has been used in this assessment.

STP tanks were designed to allow airflow at a rate of 0.005 cubic meter per second through the 50 millimetre vent at a height of 2.1 meters. These design specifications were used as stack parameters in the model.

The 2016 Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (Approved Methods) requires the use of peak concentration factors in the evaluation odour impacts. This factor improves the model from an hourly averaging to a more accurate simulation of the short-term atmospheric dispersion of odours and instantaneous perception of odours by the human nose. A peak concentration factor of 2.3 for wake-affected point source was used in this model.

Summary of emission rate calculations for this dispersion modelling is shown in Table 2. The odour concentrations from primary treatment tank and the three biological tanks were multiplied with the flow rate and peak concentration factor to get the modelled odour emission rates.

Table 2 Emission rate inputs in the model

Source	STP Process	Odour concentration	Flow rate (m^3/seconds)	Peak concentration factor	Odour emission rates (OU*m^3/s)
Tank 1	Primary treatment (12 am to 5 am)	10,000	0.005	2.3	121.4
	Primary treatment (5 am to 12 am)	20,000	0.005	2.3	242.8
Tank 2	Biological treatment	500	0.005	2.3	6.1
Tank 3	Biological treatment	500	0.005	2.3	6.1

5. Dispersion Modelling

5.1 Meteorology

The monitoring station nearest the project site is the Office of Environment and Heritage (OEH) air quality monitoring site located at the University of Western Sydney, in Richmond. A comprehensive analysis from hourly meteorological data in the recent five years from this station was used to determine the representative year and generate a prognostic meteorological model as input into the dispersion modelling.

Year 2016 was identified as the most representative year based on the analysis of the 2013-2017 data from the OEH Richmond site.

A site-representative prognostic meteorological model was established using The Air Pollution Model (TAPM) using the parameters presented in Table 3. Hourly meteorological data was generated.

Table 3 Summary of TAPM configuration

Parameter	Value
Modelled Year	01 December 2015 to 01 January 2017
Domain centre	Latitude: -33 degrees 33 minutes Longitude: 150 degrees 40 minutes
Site location	283042 m E; 6285197 m S Zone 56
Number of vertical levels	25
Number of Easting Grid Points	25
Number of Northing Grid Points	25
Outer Grid Spacing Number of Grids (nests)	30,000 m x 30,000 m 4
Grid Resolution	Level 1 – 30,000 m Level 2 – 10,000 m Level 3 – 3,000 m Level 4 – 1,000 m

The TAPM meteorological data was then processed through the CALMET pre-processor for input into the dispersion model. The resulting wind profile is presented through a wind rose diagram as shown in Figure 5. The diagram shows that winds are generally coming from either the north-east and/or south-west directions with calm winds occurring 3.1% of the time for the entire year.

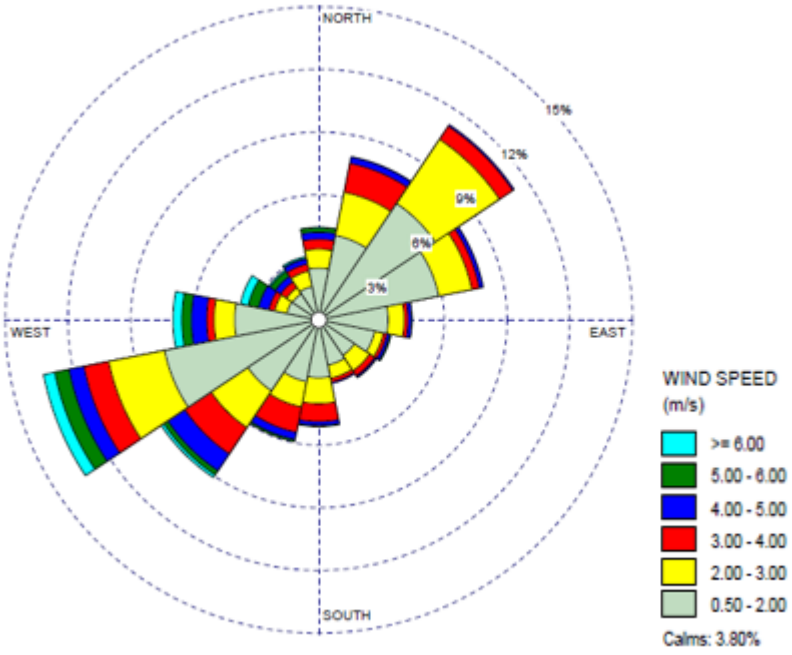

Figure 5 CALMET derived annual wind rose at proposal site - 2016

5.2 Terrain and land use

Terrain elevation was taken from NASA's Shuttle Radar Topography Mission (SRTM) dataset. Figure 6 shows the terrain elevation data within the modelling domain. High elevations at the Kurrajong Hills were observed approximately 5 kilometres northwest of the site at an elevation of 500 to 600 meters above mean sea level. The site was observed at a base elevation of 140 meters above mean sea level.

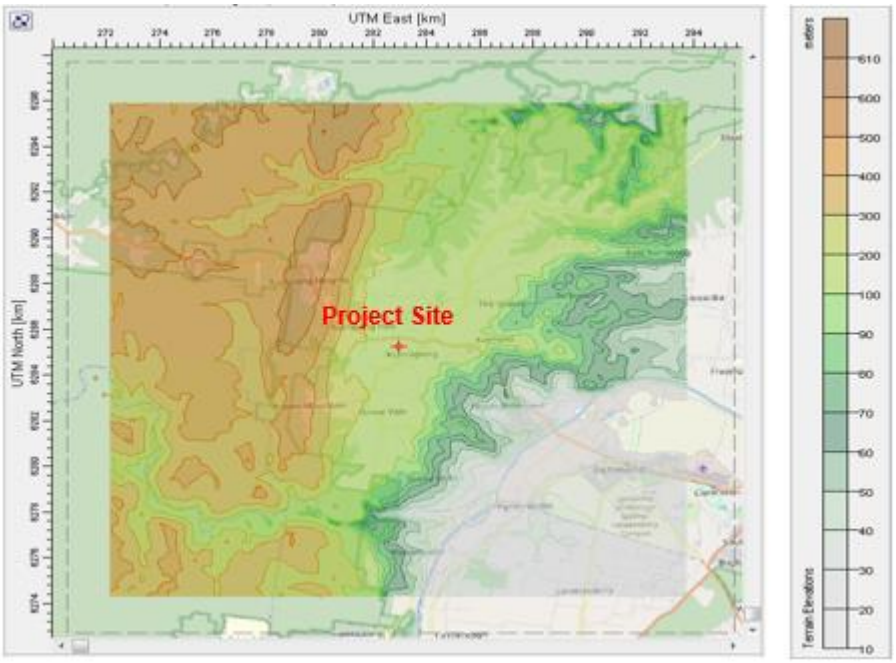

Figure 6 Terrain elevation in the project domain

Land use for the project area was based from USGS Land Use Land Cover (LULC) and refined to be more representative in the vicinity of the project as shown in Figure 7. The land use was observed as mainly Forest Land in the northwest and Rangeland in the southeast.

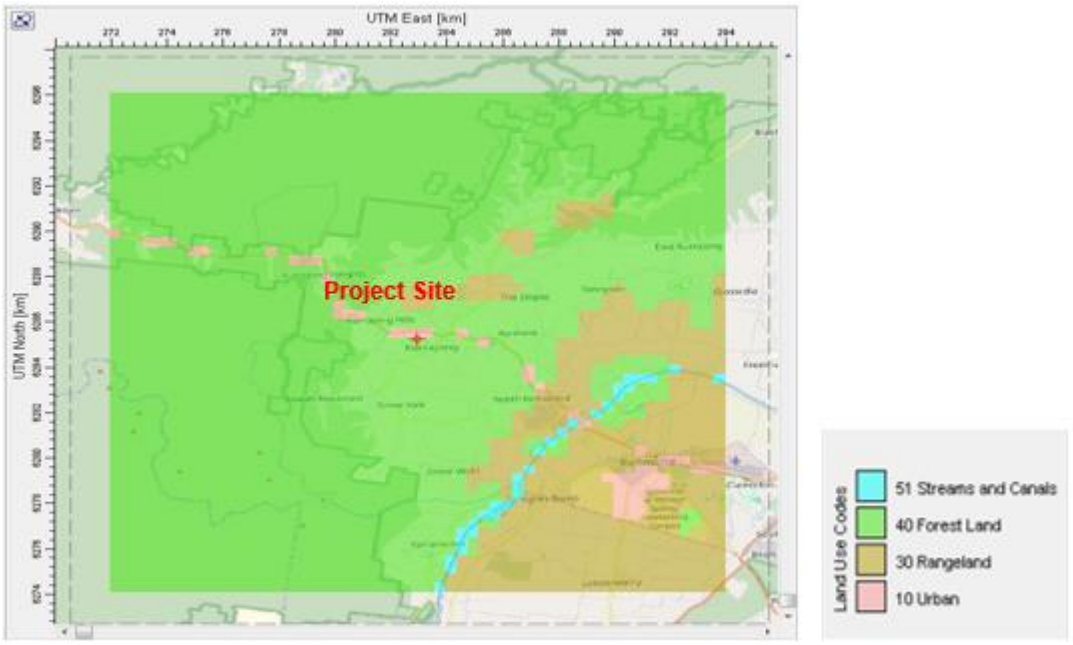

Figure 7 Land use within the project domain

5.3 Dispersion model

An odour impact assessment on the surrounding sensitive receptors has been conducted using the CALPUFF atmospheric dispersion model. CALPUFF is an advanced non-steady-state meteorological conditions and air quality modelling system. The summary of CALPUFF model inputs are shown in Table 4.

Table 4 Summary of CALPUFF configuration

Parameters	Configuration
Model Version	CALPUFF EPA Approved Version 5.8.5 CALPOST EPA Approved Version 6.221
Run Period	01 January 2016 00:00 to 01 January 2017 00:00
Meteorological Data	Prognostic data from TAPM
Grid	24 x 24 km 400 m grid spacing
Building inputs	STP structure
Averaging period	Adjusted one-hour average (adjusted based on peak concentration factor)
Percentile	99th percentile

5.4 Assumptions

The following assumptions were made in the assessment:

- Odour emission data obtained from Narara Ecovillage Air Quality (Odour) Impact Assessment, Aubin Environment 2013 is representative of this proposal
- Conservative modelling assumptions would cover worst-case operating conditions
- The modelling and assessment was based on information provided to GHD
- The location of the STP and future receptors on the lot are indicative only

6. Impact assessment

6.1 Dispersion modelling results

Dispersion modelling was undertaken to predict the maximum ground level odour concentrations resulting from normal operations of the STP. The outputs were compared against the Approved Methods assessment criteria of 4 OU in order to determine the potential impact of the proposed STP.

Predicted 99th percentile odour concentrations at all assessed sensitive receptors are presented in Table 5 from highest to lowest concentration values. All predicted odour concentrations are below the relevant impact assessment criteria of 4 OU.

The maximum predicted concentration at an existing sensitive receptor (E4) was predicted to be 2.2 OU.

The maximum predicted odour concentration at future dwellings is 3.9 OU. This was predicted at Receptor F1 in this study which corresponds with Subdivision Lot 2 on the Subdivision Plan (2002.DA.16 Rev D) as shown in Appendix A. This Lot 2 is located directly adjacent to Lot 1 where the STP is to be located.

Table 5 Predicted 99th percentile odour concentration

Receptor	Type of receptor	Predicted concentration, OU
F1	Future	3.9
F27	Future	2.7
E4	Existing	2.2
F29	Future	1.3
F26	Future	1.3
F28	Future	1.1
F2	Future	1.0
E5	Existing	1.0
F33	Future	1.0
F31	Future	0.9
F13	Future	0.8
F25	Future	0.7
F16	Future	0.7
F32	Future	0.6
F21	Future	0.6
F34	Future	0.6
F22	Future	0.5
F14	Future	0.5
F3	Future	0.5
F20	Future	0.5
F15	Future	0.5
E1	Existing	0.5
E7	Existing	0.4
E6	Existing	0.4
F4	Future	0.4
E2	Existing	0.4
F10	Future	0.3
F12	Future	0.3
F17	Future	0.3

Receptor	Type of receptor	Predicted concentration, OU
E3	Existing	0.3
F9	Future	0.3
F36	Future	0.3
F19	Future	0.3
E8	Existing	0.3
F5	Future	0.2
F24	Future	0.2
F35	Future	0.2
F30	Future	0.2
F23	Future	0.2
E12	Existing	0.2
F6	Future	0.2
E9	Existing	0.2
F7	Future	0.2
E13	Existing	0.1
E10	Existing	0.1
E16	Existing	0.1
F8	Future	0.1
F11	Future	0.1
F18	Future	0.1
E11	Existing	0.1
E14	Existing	0.1
E15	Existing	0.1

The 99th percentile odour concentrations are presented as a contour plot in Figure 8 below. Results show no odour concentrations higher than 4 OU at sensitive receptor locations, which is the odour criteria for this study.

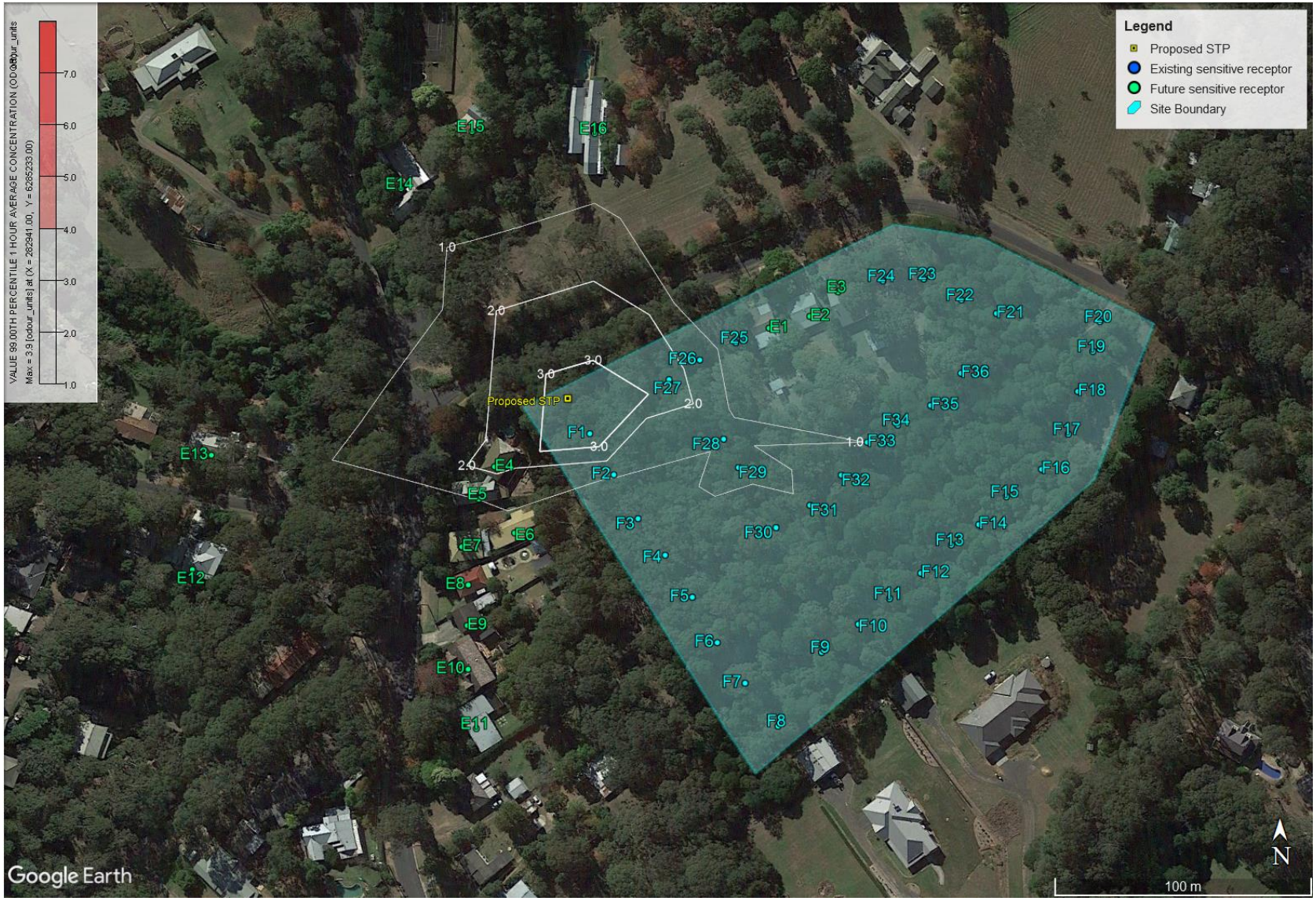

Figure 8 Predicted 99th percentile peak odour concentration contours

7. Conclusion

GHD has undertaken an odour assessment of the STP to be located at the proposed subdivision at 67 Kurrajong Road, Kurrajong. The proposed STP is a modular system consisting of pre-treatment tank, biological tanks and membrane tanks.

GHD has used odour emission rates based on the proposed design and odour concentrations used in an assessment of this same type of plant at another site in NSW.

The predicted peak 99th percentile odour concentration complies with the relevant odour criteria at all existing and future receptors. The assessments finds the proposal would be acceptable from an air quality perspective providing implementation and compliance with the Sewage Management Plan for the proposal.

Appendices

Appendix A – Subdivision Plan

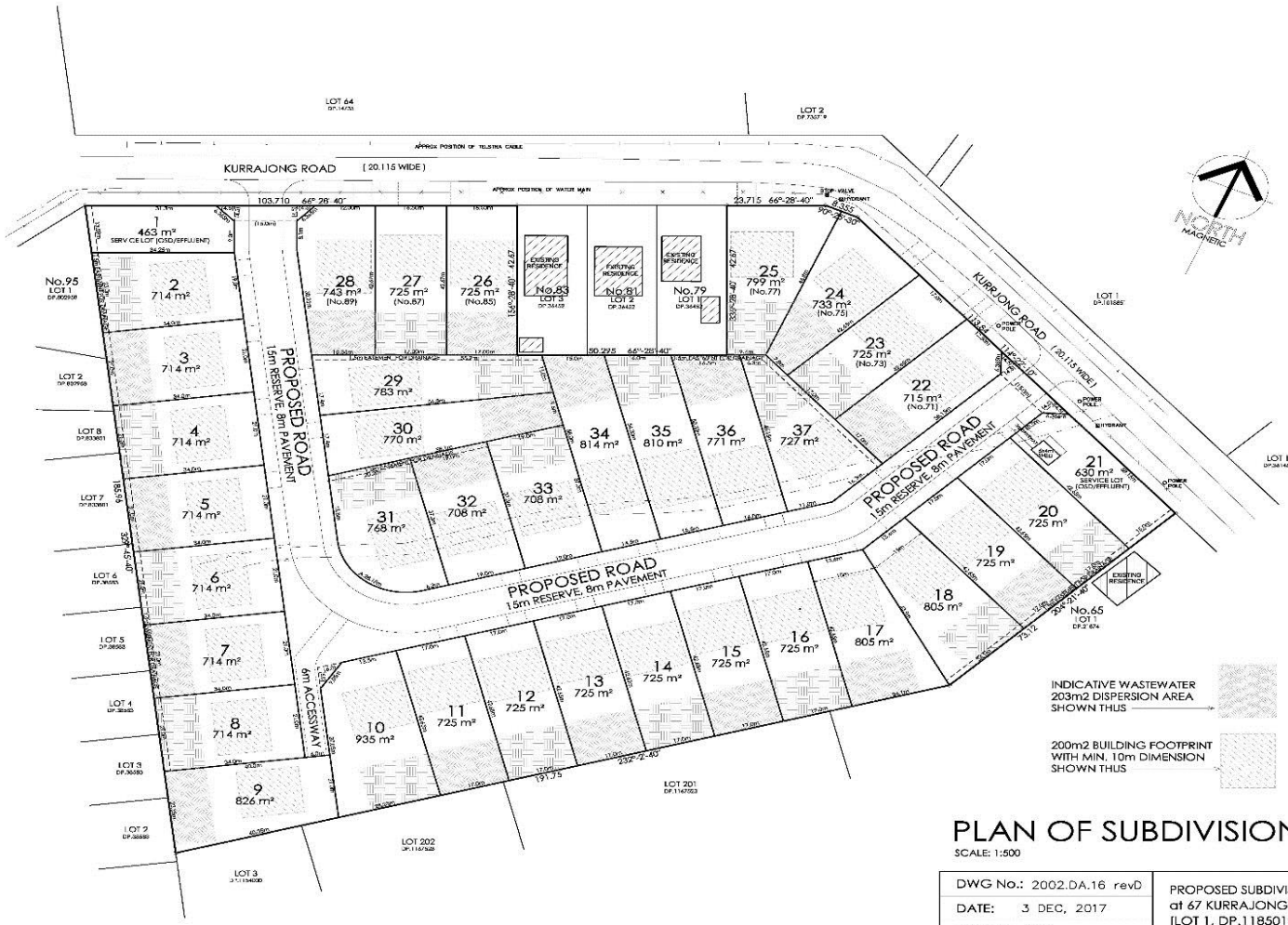

TABLE OF LOTS			
LOT	Area (m²)	LOT	Area (m²)
1	463	20	725
2	714	21	630
3	714	22	715
4	714	23	725
5	714	24	733
6	714	25	799
7	714	26	725
8	714	27	725
9	826	28	743
10	935	29	783
11	725	30	770
12	725	31	768
13	725	32	708
14	725	33	708
15	725	34	814
16	725	35	810
17	805	36	771
18	805	37	727
19	725		
Total=	27,286 m²	Average	737 m²

PLAN OF SUBDIVISION - 37 LOTS

SCALE: 1:500

A1 SHEET

DWG No.: 2002.DA.16 revD DATE: 3 DEC, 2017 DRAWN: APG REF: . . ./KURRAJONG/SITE37	PROPOSED SUBDIVISION at 67 KURRAJONG ROAD [LOT 1, DP.1185012] KURRAJONG NSW 2758 for . . .	ANDREW P GRIEVE BACHELOR OF ARCH (HONS) 17 ANNABELLE CRESCENT KELLYVILLE, NSW 2155 MOBILE. 0412 752 579

GHD

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GHDDocId/https://projects.ghd.com/oc/sydney2/kurrajongstpodourass/Delivery/Documents/REP-2127762 Kurrajong STP Odour Assessment.docx

Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	N Dela Cruz	P Pandey		E Smith		31/10/2018

www.ghd.com

Appendix 4.3.3.7 180561 67 Kurrajong Road, Kurrajong Sewerage Package Plant

REPORT R180561

Revision 0

Noise Assessment,

Proposed Mechanical Noise Assessment

Aquacell S20 Blackwater Treatment Plant

67 Kurrajong Road

Kurrajong

29 October 2018

PO Box 522
Wahroonga NSW 2076
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TABLE OF CONTENTS

1 INTRODUCTION

Rodney Stevens Acoustics has been engaged by PRJM Pty Ltd to undertake an acoustical assessment for the sewerage package plant.

The 67 Kurrajong Road Residential Community Development is a 37-dwelling residential estate. It is located on the southern side of Kurrajong Road to the east of the intersection of Kurrajong Road and Old Bells Line of Road.

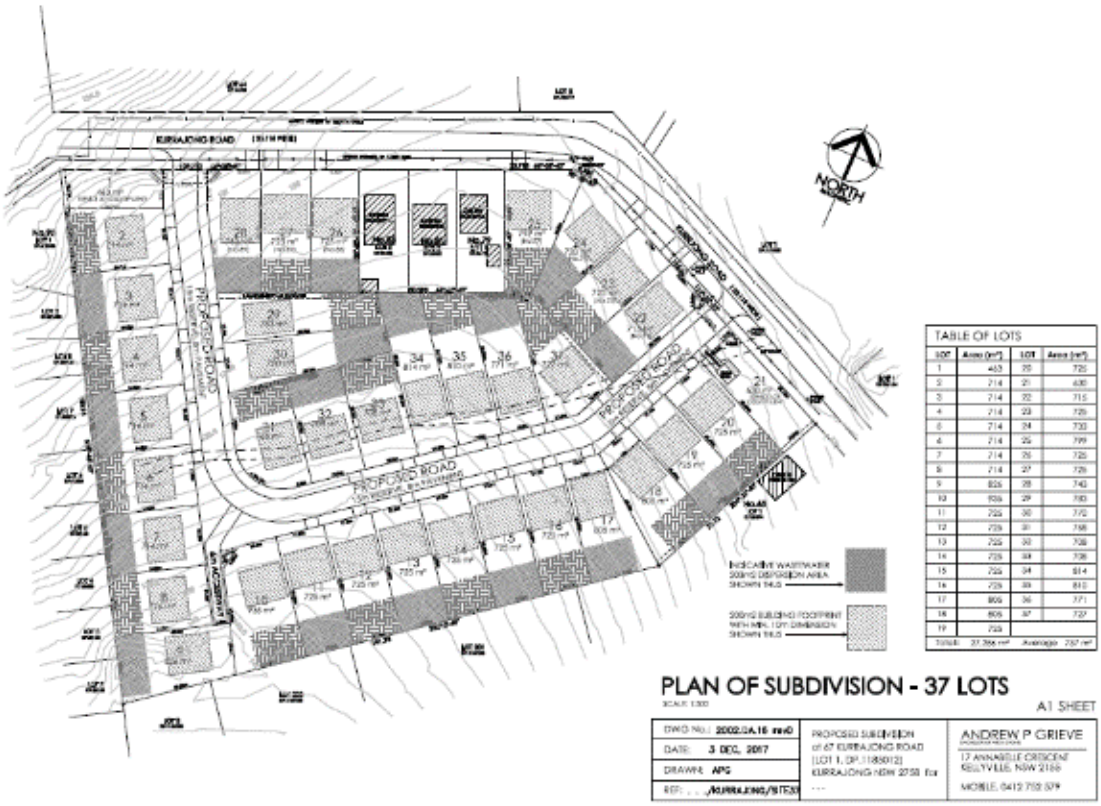
The development was approved subject to granting by IPART of a Network Operator Licence and Retail Supplier Licence and construction of a Blackwater Treatment Plant with designated areas for sub-surface irrigation. Potable water is being supplied by Hawkesbury Council's existing potable water reticulation; however, Council does not intend to provide sewer reticulation for this area.

IPART NOL 4.3.3 states: "No definitive analysis has been presented in the application to clearly demonstrate that there will be no offensive odours and 'noise' emanating from the future operation of the proposed sewerage scheme."

2 SITE LOCATION

The proposed development site is located at 67Kurrajong Road, Kurrajong.

Figure 2-1 Site Location



3 PROPOSED DEVELOPMENT

An Aquacell S20 blackwater treatment plant is to be installed to service all 37 dwellings within the development. There is no effluent reuse/recycling proposed for this site, only waste water disposal. The treated effluent is to be discharged to the environment via sub-surface irrigation, in compliance with WICA and Council s68 approvals.

The proposed Aquacell blackwater system is self-contained. The treated effluent is disposed of via sub-surface irrigation of allotted areas within the boundaries of the development. The proposed blackwater treatment plant will utilise wastewater discharged from the facility and irrigate via sub-surface irrigation at a rate of 21kl/day.

Noise monitoring of an existing Aquacell blackwater system was carried out within the Tallowood 'Over 55' residential development, 19-27 Vincent Road, Kurrajong on Wednesday 24th October 2018.

The Aquacell blackwater system within the Tallowood Development, as shown below, is identical to the proposed system to be with the development within the subdivision, 67 Kurrajong Road, Kurrajong.

Figure 3-1 Aquacall Blackwater System

4 BASELINE NOISE SURVEY

In order to characterize the existing acoustical environment of the area unattended noise monitoring was conducted between 24th and 28th October 2018 in the rear of the Tallowood residential development at a distance from the Aquacell Blackwater system that it was inaudible.

Logger location was selected with consideration to other noise sources that may influence readings, security issues for noise monitoring equipment and gaining permission for access from residents and landowners.

Instrumentation for the survey comprised of a RION NL-42 environmental noise logger (serial number 572559) fitted with microphone windshields. Calibration of the loggers was checked prior to and following measurements. Drift in calibration did not exceed ±0.5 dB(A). All equipment carried appropriate and current NATA (or manufacturer) calibration certificates. Measured data was filtered to remove data measured during adverse weather conditions upon consultation with historical weather reports provided by the Bureau of Meteorology (BOM).

The logger determines L_{A1}, L_{A10}, L_{A90} and L_{Aeq} levels of the ambient noise. L_{A1}, L_{A10}, L_{A90} are the levels exceeded for 1%, 10% and 90% of the sample time respectively (see Glossary for definitions in Appendix A).

5 AMBIENT NOISE LEVEL RESULTS

In order to assess the acoustical implications of the proposed development the measured data was processed according to the NSW Noise Policy for Industry.

Table 5-1 Ambient Noise Results

Noise Level – dBA re 20 µPa					
Day		Evening		Night	
RBL [1]	L_{Aeq} [2]	RBL [1]	L_{Aeq} [2]	RBL [1]	L_{Aeq} [2]
43	49	38	49	30	42

Note 1: The RBL noise level is representative of the average minimum background sound level (in the absence of the source under consideration), or simply the background level.

Note 2: The L_{Aeq} is essentially the average sound level. It is defined as the steady sound level that contains the same amount of acoustical energy as a given time-varying sound.

6 NOISE GUIDELINES AND CRITERIA

6.1 Mechanical Services Noise Criteria – *Noise Policy for Industry*

Responsibility for the control of noise emissions in New South Wales is vested in Local Government and the EPA. The EPA oversees the Noise Policy for Industry (NPfI) October 2017 which provides a framework and process for deriving noise criteria. The NPfI criteria for industrial noise sources have two (2) components:

- Controlling the intrusive noise impacts for residents and other sensitive receivers in the short term; and
- Maintaining noise level amenity for particular land uses for residents and sensitive receivers in other land uses.

6.1.1 Intrusiveness Criterion

For assessing intrusiveness, the background noise generally needs to be measured. The intrusiveness criterion essentially means that the equivalent continuous noise level (LAeq) of the source should not be more than 5 dB(A) above the measured Rated Background Level (RBL), over any 15 minute period.

6.1.2 Amenity Criterion

The amenity criterion is based on land use and associated activities (and their sensitivity to noise emission). The cumulative effect of noise from industrial sources needs to be considered in assessing the impact. The criteria relate only to other industrial-type noise sources and do not include road, rail or community noise. The existing noise level from industry is measured.

If it approaches the criterion value, then noise levels from new industrial-type noise sources, (including air-conditioning mechanical plant) need to be designed so that the cumulative effect does not produce total noise levels that would significantly exceed the criterion.

6.1.3 Area Classification

The NPfI characterises the “Rural” noise environment

Receiver	**Noise amenity area**	**Time of day**	**L_{Aeq}, dB(A)**
(see Table 2.3 to determine which residential receiver category applies)			**Recommended amenity noise level**
Residential	Rural	Day	50
		Evening	45
		Night	40

6.1.4 Project Specific Noise Levels

Having defined the area type, the processed results of the attended noise monitoring have been used to determine project specific noise criteria. The intrusive and amenity criteria for nearby residential premises are presented in Table 6-1. These criteria are nominated for the purpose of assessing potential noise impacts from the proposed Aquacell Blackwater system.

In this case, the ambient noise environment is not controlled by industrial noise sources and therefore the project amenity noise level are assigned as per Table 2.2 of the NPfI (Recommended Amenity Noise Levels).

For each assessment period, the lower (i.e. the more stringent) of the amenity or intrusive criteria are adopted.

Table 6-1 Operational Project Trigger Noise Levels

Receiver	Time of Day	ANL [1] $L_{Aeq(15min)}$	Measured		Project Trigger Noise Levels	
			RBL [2] $L_{A90(15min)}$	L_{Aeq} Noise Level)	Intrusive $L_{Aeq(15min)}$	Amenity $L_{Aeq(15min)}$
Residential	Day	50	43	49	**48**	50
	Evening	45	38	49	**43**	45
	Night	40	30	42	**35**	40

Note 1: ANL = "Amenity Noise Level" for residences in Rural Areas.

Note 2: RBL = "Rating Background Level".

The project trigger noise levels for the sensitive receivers are derived to be $L_{Aeq(15min)}$ 48 dB(A) for the daytime period, $L_{Aeq(15min)}$ 43 dB(A) for the evening period and $L_{Aeq(15min)}$ 35 dB(A) for the night time period.

7 NOISE IMPACT ASSESMENT

Potential for noise emissions from the proposed development will be from the Aquacell Blackwater system. Noise from the Aquacell Blackwater system was measured on the 24th October 2018.

Table 7-1 Predicted Noise Levels at the closest residential receivers within the 67 Kurrajong Road subdivision.

Receiver Location	Predicted $L_{Aeq(15min)}$ Noise Level – dB(A)	Noise Criterion at Receiver Location – dB(A)	Compliance (Yes/No)
Lots A			
Day Time	24	48	Yes
Evening	24	43	Yes
Night Time	24	35	Yes
Lots B			
Day Time	22	48	Yes
Evening	22	43	Yes
Night Time	22	35	Yes
Lots C			
Day Time	20	48	Yes
Evening	20	43	Yes
Night Time	22	35	Yes

The predicted noise levels at the nearest and worst affected residential receivers within the development comply with the established noise criteria.

It is envisaged that the project specific noise goals can be achieved, however, the following measures are to be incorporated with the Aquacell Blackwater system design:

- The compressors will need to be contained within an enclosure having an Rw 30 wall and ceiling. This could be an enclosure from Flexshield
- Air flow into and from the enclosure is to be via an acoustic louvers.
- The enclosure is to have removable side panels for maintenance and to be internal lined with an acoustic insulation.

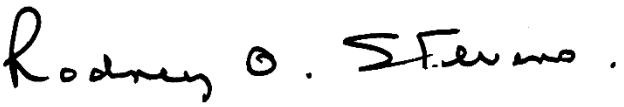
Figure 7-1 Acoustic Treatment

8 CONCLUSION

RSA has conducted a noise impact assessment for PRJM Pty Ltd of the proposed Aquacell Blackwater system to be located at 67 Kurrajong Road, Kurrajong as part of the subdivision of 37 lots. The assessment has comprised the establishment of noise criteria and assess noise impacts with regard to relevant statutory requirements.

Based on the noise impact study conducted, including the enclosure for the compressor, the Aquacell blackwater system will comply with the regulatory requirements

Approved:-



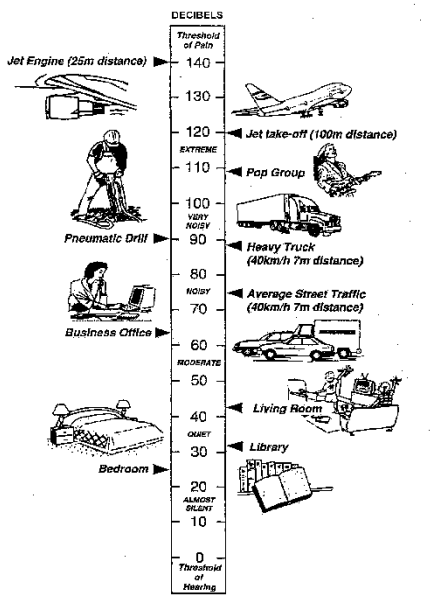
Rodney Stevens

Manager/Principal

Appendix A – Acoustic Terminology

A-weighted sound pressure	The human ear is not equally sensitive to sound at different frequencies. People are more sensitive to sound in the range of 1 to 4 kHz (1000 – 4000 vibrations per second) and less sensitive to lower and higher frequency sound. During noise measurement an electronic '*A-weighting*' frequency filter is applied to the measured sound level *dB(A)* to account for these sensitivities. Other frequency weightings (B, C and D) are less commonly used. Sound measured without a filter is denoted as linear weighted dB(linear).
Ambient noise	The total noise in a given situation, inclusive of all noise source contributions in the near and far field.
Community annoyance	Includes noise annoyance due to: character of the noise (e.g. sound pressure level, tonality, impulsiveness, low-frequency content) character of the environment (e.g. very quiet suburban, suburban, urban, near industry) miscellaneous circumstances (e.g. noise avoidance possibilities, cognitive noise, unpleasant associations) human activity being interrupted (e.g. sleep, communicating, reading, working, listening to radio/TV, recreation).
Compliance	The process of checking that source noise levels meet with the noise limits in a statutory context.
Cumulative noise level	The total level of noise from all sources.
Extraneous noise	Noise resulting from activities that are not typical to the area. Atypical activities may include construction, and traffic generated by holiday periods and by special events such as concerts or sporting events. Normal daily traffic is not considered to be extraneous.
Feasible and reasonable measures	Feasibility relates to engineering considerations and what is practical to build; reasonableness relates to the application of judgement in arriving at a decision, taking into account the following factors: Noise mitigation benefits (amount of noise reduction provided, number of people protected). Cost of mitigation (cost of mitigation versus benefit provided). Community views (aesthetic impacts and community wishes). Noise levels for affected land uses (existing and future levels, and changes in noise levels).

Impulsiveness	Impulsive noise is noise with a high peak of short duration or a sequence of these peaks. Impulsive noise is also considered annoying.
Low frequency	Noise containing major components in the low-frequency range (20 to 250 Hz) of the frequency spectrum.
Noise criteria	The general set of non-mandatory noise levels for protecting against intrusive noise (for example, background noise plus 5 dB) and loss of amenity (e.g. noise levels for various land use).
Noise level (goal)	A noise level that should be adopted for planning purposes as the highest acceptable noise level for the specific area, land use and time of day.
Noise limits	Enforceable noise levels that appear in conditions on consents and licences. The noise limits are based on achievable noise levels, which the proponent has predicted can be met during the environmental assessment. Exceedance of the noise limits can result in the requirement for either the development of noise management plans or legal action.
Performance-based goals	Goals specified in terms of the outcomes/performance to be achieved, but not in terms of the means of achieving them.
Rating Background Level (RBL)	The rating background level is the overall single figure background level representing each day, evening and night time period. The rating background level is the 10th percentile min L_{A90} noise level measured over all day, evening and night time monitoring periods.
Receptor	The noise-sensitive land use at which noise from a development can be heard.
Sleep disturbance	Awakenings and disturbance of sleep stages.
Sound and decibels (dB)	Sound (or noise) is caused by minute changes in atmospheric pressure that are detected by the human ear. The ratio between the quietest noise audible and that which should cause permanent hearing damage is a million times the change in sound pressure. To simplify this range the sound pressures are logarithmically converted to decibels from a reference level of 2 x 10-5 Pa. The picture below indicates typical noise levels from common noise sources.



dB is the abbreviation for decibel – a unit of sound measurement. It is equivalent to 10 times the logarithm (to base 10) of the ratio of a given sound pressure to a reference pressure.

Sound power Level (SWL)

The sound power level of a noise source is the sound energy emitted by the source. Notated as SWL, sound power levels are typically presented in *dB(A)*.

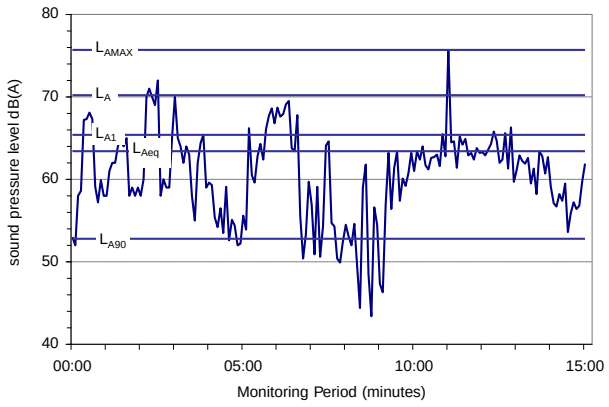
Sound Pressure Level (SPL)

The level of noise, usually expressed as SPL in *dB(A)*, as measured by a standard sound level meter with a pressure microphone. The sound pressure level in *dB(A)* gives a close indication of the subjective loudness of the noise.

Statistic noise levels

Noise levels varying over time (e.g. community noise, traffic noise, construction noise) are described in terms of the statistical exceedance level.

A hypothetical example of A weighted noise levels over a 15 minute measurement period is indicated in the following figure:



Key descriptors:

	L_{Amax} Maximum recorded noise level.
	L_{A1} The noise level exceeded for 1% of the 15 minute interval.
	L_{A10} Noise level present for 10% of the 15 minute interval. Commonly referred to the average maximum noise level.
	L_{Aeq} Equivalent continuous (energy average) A-weighted sound pressure level. It is defined as the steady sound level that contains the same amount of acoustic energy as the corresponding time-varying sound.
	L_{A90} Noise level exceeded for 90% of time (background level). The average minimum background sound level (in the absence of the source under consideration).
Threshold	The lowest sound pressure level that produces a detectable response (in an instrument/person).
Tonality	Tonal noise contains one or more prominent tones (and characterised by a distinct frequency components) and is considered more annoying. A 2 to 5 dB(A) penalty is typically applied to noise sources with tonal characteristics.

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Pages:	4
cc.	-

Appendix 4.3.5.1 Martens STP Specification October 2017

24 October 2017

Att Jock Mathie

Dear Sir,

RE: ON-SITE SEWAGE TREATMENT PLANT SPECIFICATION, COMMUNITY TITLE DEVELOPMENT AT 67 KURRAJONG ROAD, KURRAJONG, NSW

As requested, please find attached the sewage treatment plant (STP) specifications for the above development. Please note that these specifications arise out of the Court approved development for the site.

If you require any further information, please do not hesitate to contact the undersigned.

For and on behalf of

MARTENS & ASSOCIATES PTY LTD

MR MICHAEL DUMAS
BEng (Environmental)
Senior Engineer

SPECIFICATION TYPE: **SEWAGE TREATMENT PLANT SPECIFICATION**

SITE LOCATION: **67 KURRAJONG ROAD, KURRAJONG, NSW**

AUTHOR: **MICHAEL DUMAS**

VERSION: **001**

DATE: **23 OCTOBER 2017**

Overview

Element	Sub-element	Design Specification
Hydraulic Capacity	Average Dry Weather Flow	21 KL/day
	Peak Dry Weather Flow	30 KL/day
	Wet Weather Flow	150 KL/day
	Low Flow	1-2 KL/day during initial operation period
Treatment Process	MBR	Acceptable
	IDEA	Acceptable
	SBR	Acceptable
Treatment Tanks / Layout	Structure	In-ground reinforced concrete tanks
	Minimum treatment tank capacity	1.5 x PDWF
	Tank Configuration (preliminary)	See Attached plan (subject to supplier)
Access points	All tanks	Access required to all tanks
	Lids	Gattic seal

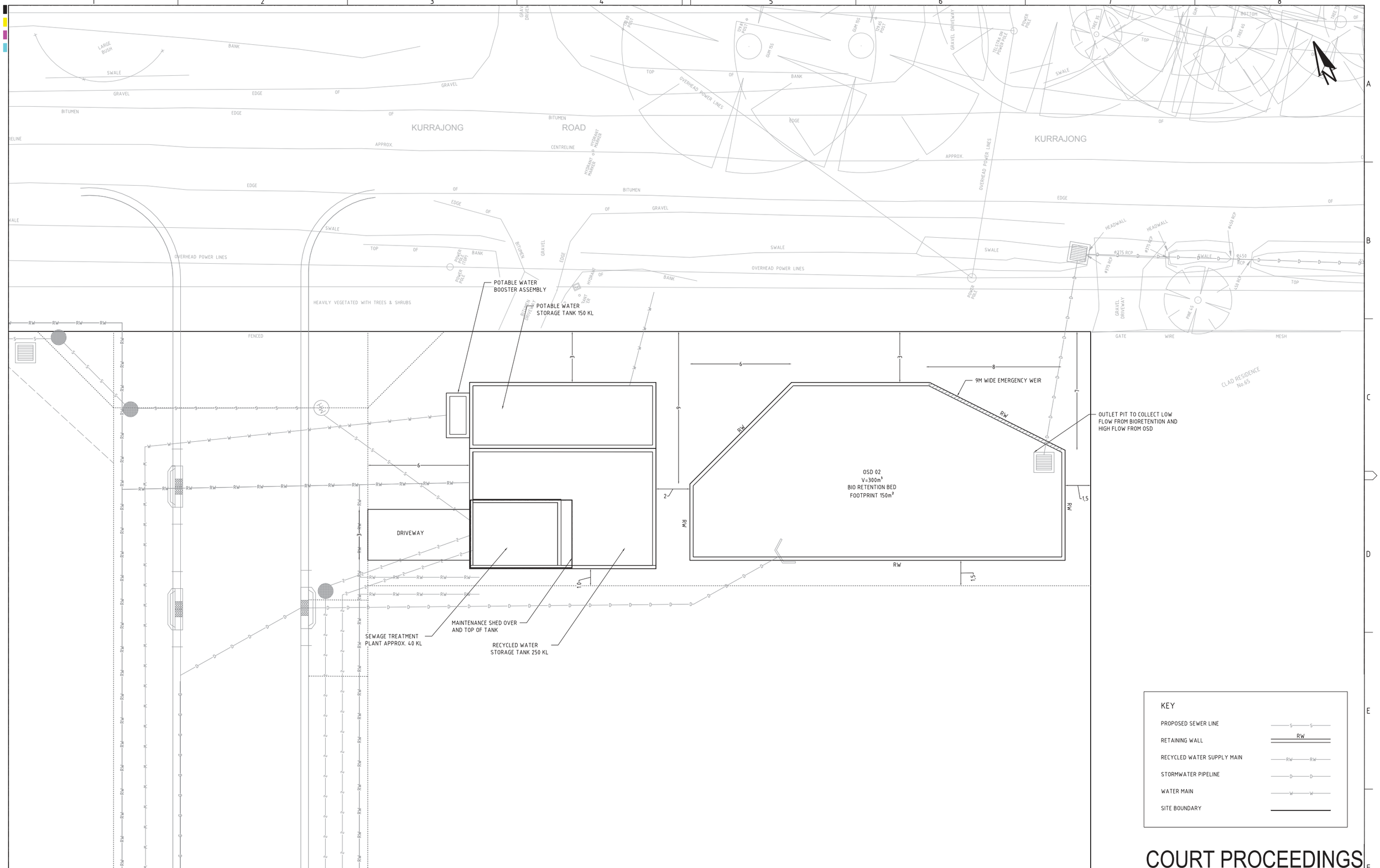
Performance Requirements

Element	Sub-element	Design Specification (100th percentile)
Effluent Quality	E. coli	10 CFU/100 mls
	BOD_5	20 mg/L
	Suspended Solids	30 mg/L
	Total Nitrogen	18 mg/L (90th percentile)
	Total Phosphorus	9 mg/L (90th percentile)
	pH	5.5 – 7.5
Waste Management	Waste sludge storage	Required as per suppliers designs
	Waste sludge disposal	Pump-out connection required
	Overflow management at all tanks	Pump-out connection required
Odour Control	All tanks and odour sources	3 Odour Units at nearest residence

STP Control

Element	Sub-element	Design Specification
Control	Control board	PLC or similar
	Control room	Secure service shed required
	Telemetry	Back to base required
Pumps	All pump sets	Dual duty / standby arrangement
Alarm	High water in all chambers	Required
	Component failure	Required for all components
	Telemetry	Alarms to telemetry required
Disinfection	Double barrier disinfection	Required
Monitoring	Inflow flows	Continuous
	Out flows	Continuous
	pH	Continuous

Attachment A: Preliminary STP configuration



KEY

- PROPOSED SEWER LINE
- RETAINING WALL
- RECYCLED WATER SUPPLY MAIN
- STORMWATER PIPELINE
- WATER MAIN
- SITE BOUNDARY

COURT PROCEEDINGS

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
D	AMENDED TO ADDRESS COUNCIL CONTENTIONS	14/12/2016	RK	SA	GH/DM	DM
C	AMENDED TO ADDRESS COUNCIL CONTENTIONS	13/12/2016	KT	SA	GH/DM	DM
B	FOR S34 CONFERENCING	15/08/2016	RK	MD/SA	GH/DM	DM
A	FOR S34 CONFERENCING	04/07/2016	RK			

SCALE: A1 (A3) 1:100 (1:200) — METRES

GRID	DATUM	PROJECT MANAGER
MGA	mAHD	GH

CLIENT: MMLM TRUST, PRJM P/L

PROJECT NAME/PLANSET TITLE
67 KURRAJONG ROAD
CONCEPT CIVIL WORKS
67 KURRAJONG ROAD
LOT 1 - DP 1185012

martens & Associates Pty Ltd
Consulting Engineers
Environment
Water
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Email: mail@martens.com.au Internet: www.martens.com.au

DRAWING TITLE
SERVICES LOT 'B' LAYOUT PLAN
(VIEWPORT 04)

PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P1504885	PS02	R06	PS02-H102	D

DRAWING ID: P1504885-PS02-R06-H102

PRINTED: ---- USER: RKOLAROOTSIA

A1 / A3 LANDSCAPE (A1LC_v02.0.0)

Appendix 4.3.8.1 Martens Recycled Water Management Scheme - REISSUED

MMLM Unit Trust
C/- PRJM Pty Ltd

Concept Recycled Water Management Scheme, 67 Kurrajong Road, Kurrajong, NSW

P1504885JR03V04
October 2018

ENVIRONMENTAL

WATER

WASTEWATER

GEOTECHNICAL

CIVIL

PROJECT MANAGEMENT

Limitations Statement

The sole purpose of this report and the associated services performed by Martens & Associates Pty Ltd is to provide a concept recycled water management strategy in accordance with the scope of services set out in the contract / quotation between Martens & Associates Pty Ltd and PRJM P/L (hereafter known as the Client). That scope of works and services were defined by the requests of the Client, by the time and budgetary constraints imposed by the Client, and by the availability of access to the site.

Martens & Associates Pty Ltd derived the data in this report primarily from a number of sources which may include for example site inspections, correspondence regarding the proposal, examination of records in the public domain, interviews with individuals with information about the site or the project, and field explorations conducted on the dates indicated. The passage of time, manifestation of latent conditions or impacts of future events may require further examination / exploration of the site and subsequent data analyses, together with a re-evaluation of the findings, observations and conclusions expressed in this report.

In preparing this report, Martens & Associates Pty Ltd may have relied upon and presumed accurate certain information (or absence thereof) relative to the site. Except as otherwise stated in the report, Martens & Associates Pty Ltd has not attempted to verify the accuracy of completeness of any such information (including for example survey data supplied by others).

The findings, observations and conclusions expressed by Martens & Associates Pty Ltd in this report are not, and should not be considered an opinion concerning the completeness and accuracy of information supplied by others. No warranty or guarantee, whether express or implied, is made with respect to the data reported or to the findings, observations and conclusions expressed in this report. Further, such data, findings and conclusions are based solely upon site conditions, information and drawings supplied by the Client *etc*. in existence at the time of the investigation.

This report has been prepared on behalf of and for the exclusive use of the Client, and is subject to and issued in connection with the provisions of the agreement between Martens & Associates Pty Ltd and the Client. Martens & Associates Pty Ltd accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon this report by any third party.

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All enquiries regarding this project are to be directed to the Project Manager.

Contents

Tables

1 Introduction

1.1 Overview

Martens and Associates have prepared this concept recycled water management strategy for a proposed 35 lot residential subdivision located at 67 Kurrajong Road, Kurrajong, NSW (the Site). This documents updates a previous concept recycled water scheme, dated 4 October 2016, with supplementary information and details.

A reticulated sewer, in combination with a Water Recycling Facility (WRF), is proposed to collect and treat all wastewater generated by the residential development, with treated recycled water distributed back to lots to be irrigated, on land dedicated for this purpose.

1.2 Scope of Assessment

The scope of the assessment includes:

- Site description;
- Land and soils constraints assessment;
- Assessment of sewage generation rates for the development;
- Assessment of irrigation requirements for recycled water;
- Preliminary risk assessment;
- Preliminary description of scheme operation and infrastructure; and
- Preliminary recycled water quality requirements for the proposed WRF based on environmental assessment of nutrient loads.

1.3 Relevant Guidelines and Standards

The following guidelines and standards are referred to in this report:

- Department of Water and Energy (2008), *Interim Guidelines for Management of Private Recycled Water Schemes.*
- Water Services Association of Australia (WSA, 2002), *Sewerage Code of Australia.*
- Australian / New Zealand Standard 1547 (2012), *On-site Domestic Wastewater Management.*

- NRMMC, EPHC and AHMC (AGWR, 2006), *Australian Guidelines for Water Recycling (AGWR): Managing Health and Environmental Risks (Phase 1)*.

1.4 Other Regulatory Requirements

1.4.1 WICA Licensing

The WRF, being owned by the community and controlled by residents under a community title management scheme, may require ancillary licensing from the Independent Pricing and Regulatory Tribunal (IPART) under the NSW *Water Industry Competition Act 2006* (WICA), to construct, maintain and operate the proposed sewerage and non-potable water supply scheme. If licensing is required, a network operator's license (NOL) would be required to construct and operate the WRF scheme, and a retail supplier's license (RSL) would be required to supply recycled water to the community.

WICA licensing requirements would be the subject of further discussions with IPART. If licensing is required, then this will need to be obtained prior to issue of construction certificate. The license application procedure is similar to the technical requirements that would need to ordinarily be supplied under a s68 approval for the WRF under the *Local Government Act 1993* (NSW). These are matters that take place after consent is granted in order that certainty offered by the consent can be relied upon for the license application process.

Under the Water Industry Competition (General) Regulation (WICR, 2008), the system operator will be required to provide a Sewage Management Plan (SMP) before commercial operation of the scheme.

The SMP will be in accordance with the AGWR (2006) guidelines, which provide a risk management framework to control hazards arising from recycled water use, comprising the elements of responsible use and management, system analyses, supporting requirements and review.

The licensed operator will also likely need to submit to IPART an infrastructure operating plan (IOP) and a water quality plan (WQP) which are consistent with AGWR (2006) and address the framework for management of recycled water quality and use.

1.4.2 Hawkesbury City Council DCP 2002

Chapter 7 deals with on-site sewage management facilities with the Hawkesbury City Council area. Whilst some of the general principles outlined in the chapter may be of some assistance, the chapter deals with domestic sewage management systems that are contained within and service a single allotment. The chapter does not deal with sub-

divisions that are serviced by a reticulated sewerage system, a centralised water recycling facility and a recycled water supply scheme. The certification requirement under clause 7.4, requires certification of the on-site sewage management scheme in accordance with AS/NZS 1547 (2000) [which should now read 2012]. This standard applies only to domestic single lot sewage management systems.

□ □ite De□cription

2.1 Summary

A summarised site description is provided in Table 1, with a site plan provided in Attachment A.

Table 1: Site description summary.

Element	Description/Detail
Site Address	67 Kurrajong Road, Kurrajong, NSW
Site Area	Approximately 3.232 ha
Lot/DP	Lot 1 DP 1185012
Existing site development	Primarily regrowth vegetation with unsealed road providing informal access to a property on Old Bells Line of Road.
Aspect	Majority of the site is northerly.
Typical slopes	Less than 10%, but typically 5-6 %
Existing vegetation	Trees, shrubs and grasses (regrowth).
Neighbouring environment	The site is bordered by residential allotments and Kurrajong Road to the north, residential allotments to the east, west and south.
Local Government Area (LGA)	Hawkesbury City Council
Easements	None based on review of survey and site investigation.
Drainage	The majority of the property drains towards Kurrajong Road via sheet flow. Site is roughly divided by a north-south running hill crest directing flows to the northwest and northeast site corners.
Geology	The Penrith 1:100,000 Geological Series (1991) identifies the site as being underlain by Wianamatta Group Sandstones, consisting of fine to medium grained quartz-lithic sandstone.

2.2 Soil Profile Description

Bannerman *et al.* (1990) describes site soils as being "Luddenham", consisting of loams over clay loams grading to clays then shale or sandstone bedrock.

Further to this, soil profiles within effluent irrigation areas at the site have been previously investigated and documented in Austin (December 2015) and Hazleton (May 2016). The soil profile is broadly defined as follows:

1. Upper horizon – Loamy sand topsoils to 0.4-0.6m depth.
2. Lower horizon – Clay loams grading to light clays below 0.4-0.6m.

The soil profile within the irrigation fields will be suitable to accept recycled water and does not present a constraint to the operation of a recycled water scheme.

2.3 Geology

NSW Department of Minerals and Energy (1991) Penrith 1:100,000 geological series sheet indicates that the site is underlain by fine to medium grained quartz-lithic sandstones of the Wianamatta Group. Geology does not constrain the development of a WRF at the site.

2.4 Topography

Site elevation ranges from approximately 127 mAHD in the north western corner adjacent to Kurrajong Road to approximately 141 mAHD in the southwestern corner of the site. Site grades are variable between 0 and 10%, but generally of the order of 5-6%.

2.5 Drainage

The site contains no watercourses or formed drainage lines. Any drainage that may occur during and / or after significant wet weather would occur as sheet flows from the southern site boundary to the existing swale drain in Kurrajong Road. Drainage does not constrain the development of a WRF at the site.

Soil profiles are well drained and will not constrain the lateral or downward movement of irrigation water as part of natural soil water percolation processes.

3 De□cription o□□cheme

3.1 Overview

The scheme provides a centralised water recycling system that would comprise a gravity and pressure sewer network delivering wastewater to the WRF, with a recycled water storage, and reticulated recycled water system directing recycled water back to dwellings for non-potable sub-surface irrigation to a dedicated garden area on each lot.

Each dwelling would connect to the sewer network via gravity, with lots on the western side of the development draining to a new sewage pump station (SPS), which would then direct sewage to the WRF located at the site's north east corner. Lots on the eastern side of the development would drain via gravity directly to the WRF.

The WRF will be designed to treat recycled water to an appropriate standard for irrigation.

Figure 1 summarises the operation of the recycled water scheme.

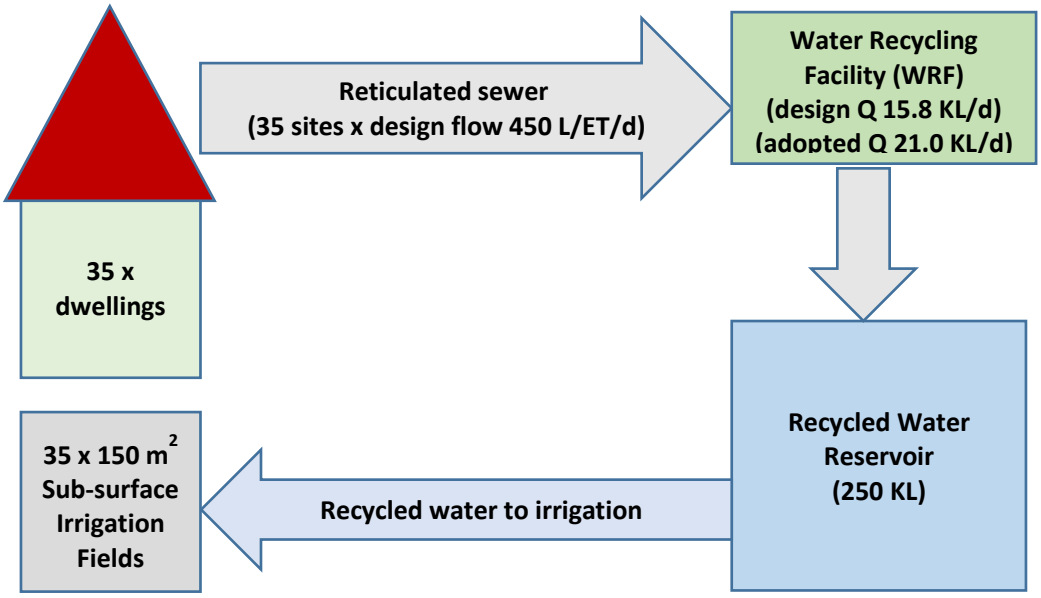

Figure 1: Operation of recycled water scheme.

3.2 Scheme Capacity

Rates are calculated in equivalent tenements (ET) (i.e. households) as follows:

AS/NZS 1547 (2012):

Equivalent Person (EP) design flow rate	= 150 L/day
Mean persons/dwelling (ABS Census, 2011)	= 3
Mean Daily flow rate/dwelling	= 450 L/day
Equivalent Tenements (ET)	= 35
Design Daily flow rate	= 15.8 kL/day
Design with 33% increase as 'buffer'	= 21.0 kL/day

The design rate is therefore equivalent to a mean residential occupation rate of 4 EP/dwelling (or 600 L/ET/day). This is well above the ABS Census rate, and provides for a high level of confidence in the system. Higher mean dwelling occupation rates are inappropriate for community based sewerage schemes where the effects of individual dwelling occupation are averaged across the community.

3.3 Design Recycled Water Quality

The WRF will be designed and managed in accordance with NSW DPI (2015) *Recycled Water Management Systems* and NSW DWE (2008) *Management of Private Recycled Water Schemes*. NSW DPI (2015) and NSW DWE (2008) performance targets are based on end uses with a low level of contact (Table 2). "Low level of contact" is defined as end uses with a low level of human contact including: urban irrigation with enhanced restricted access and application irrigation, in this case subsurface irrigation.

Table 2: Recommended operational compliance and monitoring requirements (NSW DWE, 2008).

Parameter	Compliance Value	Monitoring
E. coli	< 1000 cfu/100 ml	Monthly[1]
BOD_5	< 20 mg/L	n/a[1]
SS	< 30 mg/L	Monthly[1]
pH	6.5-8.5	Continuous on-line
Total Nitrogen [2]	< 18 mg/L	Monthly
Total Phosphorus [2]	< 8 mg/L	Monthly

Notes:
[1] Reviewed after 6 months operation. Twice weekly during validation and verification monitoring.
[2] Based on sustainable irrigation rates.

The WRF shall include tertiary filtration followed by disinfection (chlorine) of recycled water prior to irrigation. We note that the expected *E. coli* levels will be < 10 cfu/100 ml, and that the WRF could readily be designed to achieve this target should this be required by Council.

3.4 Recycled Water Irrigation Rates

Soil profiles and design irrigation rates (DIRs) according to AS/NZS 1547 (2012) are summarised in Table 3. DIRs provide an indication of the hydraulic capacity of the soil to assimilate recycled water.

Table 3: Summary of sub-surface profiles and design irrigation rates based on AS/NZS 1547 (2012).

Soil category	Depth (m) [1]	Texture	Structure	Indicative permeability (K_{sat}) (m/d)	Design irrigation rate[2] (DIR) (mm/day)
TOPSOIL	0.35 – 0.50	Loamy sand	Massive	>3.0	5
SUBSOIL	0.35 – 1.2	Light clay	Moderately structured	0.06 – 0.12	2.5
Design					**5[2]**

Notes: [1] Depth of soil horizons varies across the site. [2] DIR for subsurface and surface irrigation systems adopted based on 350 mm of topsoil.

A DIR of 5 mm/day is adopted for recycled water irrigation field sizing on the site.

3.5 Irrigation Requirements

Irrigation area requirements are summarised in Table 4. As indicated, significant conservatism has been factored into the design by:

- Adoption of the design peak sewage generation rate plus 33%.
- Reduction of the DIR to 4 mm/day.

Table 4: Summary of irrigation requirements.

Scenario	Scheme flow rate (kL/day)	DIR (mm/day)	Scheme irrigation area total (m^2)	Scheme irrigation area per lot (m^2)
Design daily flow	15.8	5	3,150	90
Design daily flow +33%	21.0	5	4,200	120
Adopted Design daily flow +33% and 20% DIR reduction	21.0	4	5,250	150

3.6 Buffers and Set-backs to Recycled Water Re-Use Areas

A nominal 1 m setback to buildings and boundaries is adopted for the irrigation of recycled water within the proposed scheme due to the minimal risk posed due to:

- Single centralised WRF minimising risk of poor maintenance practices and / or failed treatment systems on individual properties.
- Use of sub-surface irrigation systems.
- This providing adequate set-back from fences and fence footing systems.

We note that in the case of community WRF schemes, there is ordinarily no setback requirement for the re-use of reclaimed water. In our experience, it is not uncommon for sub-surface irrigation fields to be setback 1 m from property boundaries even in situations where there is an on-site sewage management system. There are many examples where such setbacks are common, even where sites are constrained by steep slopes, shallow soils or close proximity to water bodies. Residential lots on Scotland Island are an example of such a community. We note that there is sufficient room on the lots to increase the setbacks to buildings to 3 m to alleviate any concerns about footing performance.

3.7 Long Term Sustainability Assessment

3.7.1 Sustainability

Nitrogen and phosphorous balance modelling were conducted using an average daily recycled water generation rates, a recycled water storage (250 kL) being available to balance flows throughout the year, recycled water quality as specified in Table 2 and the proposed 150 m^2 of dedicated garden irrigation area per lot being serviced by the WRF. A summary of results is provided in Table 5. Details of modelling calculations are provided in Attachment B.

Table 5: Modelling summary: minimum area required for sustainable irrigation.

Method	Area required (m^2) for nominal 35 lots
Nitrogen Uptake	149
Phosphorus Saturation	150
Adopted Design Area	**150**

Any nutrients contained within the recycled water will therefore be consumed within the designated irrigation areas. Any residual nutrients would be assimilated within the balance of the site. The development is therefore designed to be ecologically sustainable.

3.7.2 Sydney Regional Environmental Plan 20

Clause 6(3) of SREP 20 requires that future development does not prejudice the achievement of any water quality objectives in the Hawkesbury River or its tributaries. The WRF provides a best practice and ecologically sustainable approach to sewage management. It ensures that water quality in the Hawkesbury River system will not be compromised.

Clause 6(4) of SREP 20 requires that aquatic ecosystems are not adversely affected by development which changes the flow characteristics of surface or groundwater in the Hawkesbury catchment. The WRF will enable on-site re-use of recycled water. There will be no discharges to the river system or the tributaries that will cause an adverse effect on flow regimes.

3.8 Scheme Components and Operation

3.8.1 Concept Overview

Scheme operation would be as follows:

1. Raw sewage generated by the dwellings is directed to WRF via the reticulated sewer system. Due to site topography, at least one sewage pump station (SPS) shall be required.

2. Sewage treated by WRF and recycled water stored in nominal 250 kL reservoir adjacent to WRF.

3. Recycled water delivered to development via pressurized, metered reticulated main to dedicated irrigation garden areas.

4. Each lot to provide 150 m^2 of dedicated garden sub-surface irrigation area. This area will be capable of receiving all recycled water and is oversized by 33% (based on the peak flow rate requirement – Section 3.5).

5. Operation of the recycled water reservoir will be generally as follows:

    a. Water levels in reservoir fluctuate depending on general recycled water generation.

    b. Recycled water is delivered to dedicated garden areas routinely each day, ensuring that recycled water levels are maintained at or less than 7% capacity of the recycled water reservoir.

3.8.2 Plan of Sewerage and Recycled Water Scheme

A concept plan of the reticulated sewerage and recycled water delivery scheme is provided. This is subject to detailed design prior to the construction certificate stage.

3.8.3 Reticulated Sewerage Scheme

The reticulated sewerage scheme would be designed in accordance with industry practice and relevant Australian and National standards. Operation of the scheme would be generally very low maintenance, and nothing more than would be expected in any reticulated sewerage scheme.

3.8.4 Sewage Pumping Station

The sewage pumping station (SPS) would be a packaged 'off-the-shelf' product. This would be operated in accordance with the supplier's recommendations. The SPS would be located on community Lot 21 (see Attachment A).

The SPS would be designed to accommodate a minimum 24 hours storage and include back to base operational and high water alarms. This will ensure that any potential risks to the environment are adequately managed. The SPS would be positioned approximately 130 m from Little Wheeny Creek. Given the low volume operating capacity, reserve storage capacity, alarm system, routine maintenance and significant separation distance from Little Wheeny Creek, the location is acceptable and doe not pose any material risk to the creek. We note that it is not uncommon for sewage pumping stations to be located and operated adjacent to watercourses simply because these are low points in the environment and are therefore by necessity, chosen as suitable sites.

3.8.5 Water Recycling Facility

The WRF would use a traditional activated sludge treatment process, followed by primary and tertiary filtration, and finally disinfection. WRF volume will be in the order of 40 KL, and capable of treating a flow rate of 21 KL/d. A preliminary WRF footprint is provided in Attachment A. The WRF would be fitted with back to base operational and water level alarms to ensure on-going performance and rapid response to any faults.

The WRF is of such a scale that staging would not be necessary. The entire WRF and recycled water reticulation system would be constructed as part of the sub-division and road construction works.

3.8.6 Recycled Water Reservoir

Sewage treated by WRF and recycled water stored in nominal 250 kL reservoir adjacent to WRF. A preliminary footprint of the reservoir is provided in Attachment A. This provides for some 16 days temporary storage at expected flow rates, or approximately 12 days storage at peak design flow rate.

3.8.7 Recycled Water Delivery

Recycled water will be delivered to each developed lot within the development via a pressurised, metered reticulated main to dedicated irrigation garden areas within each lot. The main will likely consist of an 80 mm diameter pressure main. Connection stubs and a recycled water meter would be provided to each residential lot. When the lot is developed and the irrigation field is built, the irrigation field would be connected to the lot connection stub.

3.8.8 Irrigation Fields

The irrigation fields would be constructed at the time of dwelling construction and will be operational prior to occupation. Given the relatively gentle slopes within the development area, no significant earthworks within the irrigation fields is expected. This means that existing native soil profiles can be used for the sub-surface irrigation fields.

If a situation were to arise where earthworks are undertaken within a potential irrigation area, then the soil profile would be reinstated using soil claimed from the lot.

Ultimately, the final location and number of the irrigation field would be a matter to be determined at the individual dwelling development application stage. This would ensure that the irrigation area designs are given sufficient flexibility to be incorporated into the lot landscaping and garden design. It will also ensure that the irrigation areas can be sited such that evapotranspiration will be maximised, whether that be by way of maximising exposure to sunshine and therefore evaporation, or by way of incorporating vegetation to enhance transpiration.

It therefore not appropriate to prepare a plan showing final irrigation field areas within each lot. At the dwelling development application stage, a restrictive / positive covenant would be placed over the final effluent irrigation field area.

3.8.9 Water Balance

The recycled water reservoir will provide some 12-15 days of temporary storage, which will be more than adequate to enable day-to-day flow rate equilibration.

In terms of the irrigation fields, these have been sized in accordance with design irrigation rates based on AS/NZS 1547 (2012). These rates have been developed to enable long-term continuous application, and do not rely on water balance calculations or temporary storage or recycled water. The irrigation rates are of such a low level that normal evaporation, transpiration and percolation processes will remove any recycled water applied to the soil via sub-surface irrigation. Irrigation lines will be placed below the surface to ensure that there is no contact with incident rainfall, which will be otherwise managed through the site's stormwater management system.

In terms of overall site water balance, the net site recycled water application rates will be of the order of 0.5 mm/day. These rates are very low and significantly lower than what the site is capable of assimilating. The irrigation fields will not lead to downslope seepage issues due to

there being adequate soil depths and the irrigation rates being selected in accordance with AS/NZS 1547 (2012).

3.8.10 Sludge Management

Digested sludge produced at the WRF would be typically pumped out by tanker truck once per annum. Waste sludge accumulated will likely be in the order of 40 L/d (2 kg @ 0.05% solids), which is equivalent to approximately 15 KL/year. Ultimately, the sludge accumulation rate may be somewhat lower or higher than this, and the removal rate may therefore either less frequent or perhaps up to 2-4 times per year.

3.8.11 Odour Management

The proposed WRF will be fully aerobic and contained within a sealed vessel fitted with activated carbon odour control units. No detrimental odours will affect the local community. Odour units would be serviced in accordance with the manufacturers requirements.

3.8.12 Operational Costs

The WRF facility and SPS will be automated facilities. Both facilities will be serviced on a routine basis. It is expected that once the scheme is fully operational, costs will be in the order of $600-$1000/year/household. These are reasonable and will not place a burden on the community association. Costs per household may be higher during establishment period when only a small number of houses have been constructed, however, a developer based forward funding arrangement could be provided to ensure a consistent price to all home owners, regardless of the number of houses connected to the WRF scheme.

3.8.13 WRF Upgrades

If ever required, the WRF could be upgraded in the future to provide recycled water to tertiary quality with additional disinfection to allow for external uses (taps such as the existing schemes at Pitt Town and Rouse Hill) and / or for other non-potable uses.

3.9 Construction Certificate Requirements

As part of the construction certificate application for the development, the following matters will need to be provided in respect of the WRF. These are matters appropriate for the construction certificate application because they will vary with the ultimate contractor chosen to construct the WRF scheme, and will depend on the detailed design of the WRF.

1. Detailed design of the sewage collection system, including gravity mains, sewage pumping station and rising mains.

2. Detailed design of the WRF and the recycled water storage tank.

3. Detailed design of the recycled water reticulation network including rising mains and lot connection details.

4. A WRF operation and management plan which would cover operational and failure procedures, routine maintenance requirements, system and water quality monitoring, odour control and sludge handling.

5. An application under Section 68 of the *Local Government Act 1993* (NSW) to install and operate the WRF. At this point, Council will have a final opportunity to request any further design and operational restrictions on the WRF and reuse scheme.

6. Obtain any IPART approval where this is required.

4 □reliminar□ □i□□ A□□e□□ment

4.1 Qualitative Risk Assessment Methodology

Potential hazards are assessed using a qualitative risk assessment methodology in accordance with DWE (2008). Measures for assessing likelihood, consequence and risk provided respectively in Table 6, Table 7 and Table 8.

Table 6: Qualitative measures of likelihood of environmental / public health hazard.

Level	Descriptor	Description
A	Almost Certain	Expected to occur regularly.
B	Likely	Will probably occur regularly.
C	Possible	Could occur under adverse circumstances.
D	Unlikely	May occur under very adverse circumstances.
E	Rare	Conceivably could occur under exceptional circumstances
F	Not Credible	The event is inconceivable or fanciful

Table 7: Qualitative measures of consequence of environmental / public health hazard.

Impact Level	Public Health Descriptor	Environmental Descriptor
Insignificant	None observable	None observable
Minor	1 – 2 persons affected. Short term illness with full recovery.	Short term changes to ecosystem water chemistry but no impact on flora / fauna.
Moderate	1 – 2 persons affected. Illness lasting a few weeks / months with full recovery.	Changes to ecosystem water chemistry lasting weeks / months and causing a response in flora.
Major	More than 1 – 2 persons affected. Long-term illness or loss of life quality. Disability arising.	Long-term ecosystem damage / change. Impacts extending well beyond the local area.
Severe	Death of 1 or more people.	Permanent ecosystem loss. Widespread impact.

Table 8: Risk assessment table.

		Consequence				
		Insignificant	**Minor**	**Moderate**	**Major**	**Severe**
Likelihood	**Almost certain**	Moderate	Moderate	High	High	High
	Likely	Low	Moderate	Moderate	High	High
	Possible	Very Low	Low	Moderate	High	High
	Unlikely	Very Low	Very Low	Low	Moderate	High
	Rare	Very Low	Very Low	Low	Moderate	Moderate
	Barely Credible	Very Low	Very Low	Very Low	Very Low	Very Low

4.2 Hazard Overview

The following environmental and public health risk hazard categories are identified:

- Degraded recycled water quality (Hazard 1).
- System leaks and overflows (Hazard 2).

4.3 Degraded Recycled Water Quality (Hazard 1)

Potential hazards arise when the WRF fails to treat recycled water to appropriate standard prior to irrigation. A number of conceivable mechanisms / pathways exist for this process to occur including:

- Poor maintenance of WRF.
- Failure of WRF treatment processes / short-circuiting of treatment processes.
- Leaks in the reticulated recycled water mains or in storage tank.

Potential consequences of the identified hazards include:

- Nutrient overloading of irrigation areas leading to excessive leaching of nutrients to downslope areas / groundwater with resultant stress being placed on downslope vegetation and environment.
- Clogging of subsurface irrigation systems on lots leading to failure of system / resurfacing of recycled water and subsequent public health issues from human / out of specification recycled water contact.

Table 9 summarises the risk assessment of degraded recycled water quality. The risk assessment assumes the following risk management measures:

- WRF shall be maintained in perpetuity by the Community Association.
- Regular water quality testing (including laboratory testing) shall be carried out to validate the quality of recycled water being delivered to dedicated irrigation areas.
- Regular checks of the reticulated recycled water mains and recycled water storage tank shall be undertaken by the Community Association to ensure that any system leaks are identified and fixed as soon as they are identified.
- Dedicated irrigation areas are designed with a factor of safety included with regards to hydraulic capacity of the soils (Section 3.5).
- Considerable distance exists between the site and downslope receiving environments which decreases the likelihood of impacts on downslope areas.

Table 9: Risk Assessment for Hazard 1.

Risk / Pathway Cause	Likelihood	Consequence		Risk (Worst Case)
		Public Health	Environment	
WRF failure	Possible	Insignificant	Insignificant	Low
Leaks from recycled water main / storage tank	Rare	Minor	Insignificant	Low
Overloading / clogging of irrigation areas	Unlikely	Minor	Insignificant	Low
Nutrient impacts on vegetation	Possible	Insignificant	Insignificant	Low

4.4 System Leaks and Overflows (Hazard 2)

Potential hazards arise when the recycled water system overflows / leaks. A number of conceivable mechanisms / pathways exist for this process to occur including:

- Leaks / blockages in the gravity / rising mains to the WRF.
- Pump failure at SPS or WRF leading to overflows from the SPS or WRF.

- Structural failure of SPS or WRF tanks.

Potential consequences of the identified hazards include:

- Public health issues such as illness or, in extreme cases, death arising from ingestion of pathogens in untreated sewage / recycled water.

- Loss of public amenity arising from sewage being present in public places.

Table 10 summarises the risk assessment of system leaks. The risk assessment assumes the following risk management measures:

- Regular checks and maintenance of the pumps, tanks, alarms and control infrastructure of the WRF, SPS and reticulated recycled water mains and storage tank shall be undertaken by the Community Association to ensure that any system issues are identified and fixed as soon as they are identified.

- WRF treatment tank is designed with a capacity of 40 kL, which is more than double the mean daily wastewater generation rate.

- WRF recycled water tank is designed with a capacity of 250 kL, which equates to 15 days of storage at mean daily design wastewater generation rates.

- SPS is designed with a capacity of 25 kL, which is approximately 3 days storage capacity. This will be sufficient time in which to organise system maintenance in the event of a pump failure at the SPS or issue with the WRF.

- Overloading of the sewerage system, SPS or WRF during periods of extended or extreme wet weather are unlikely as the system shall be designed to prevent groundwater ingress into the system.

- All transfer mains are to be buried at appropriate depths below finished ground surface (areas with vehicular loading) in accordance with WSA02 (2002) to protect them from mechanical damage.

- All WRF components will have backup components onsite and automatic standby operation.

Table 10: Risk Assessment for Hazard 2.

Risk / Pathway Cause	Likelihood	Consequence		Risk (Worst Case)
		Public Health	Environment	
Pump failure	Possible	Minor	Insignificant	Low
Leaks / overflows from sewer, SPS or WRF	Rare	Minor	Insignificant	Very Low
Overloading of sewer / SPS / WRF	Unlikely	Minor	Insignificant	Very Low
Transfer mains damage	Rare	Minor	Insignificant	Very Low

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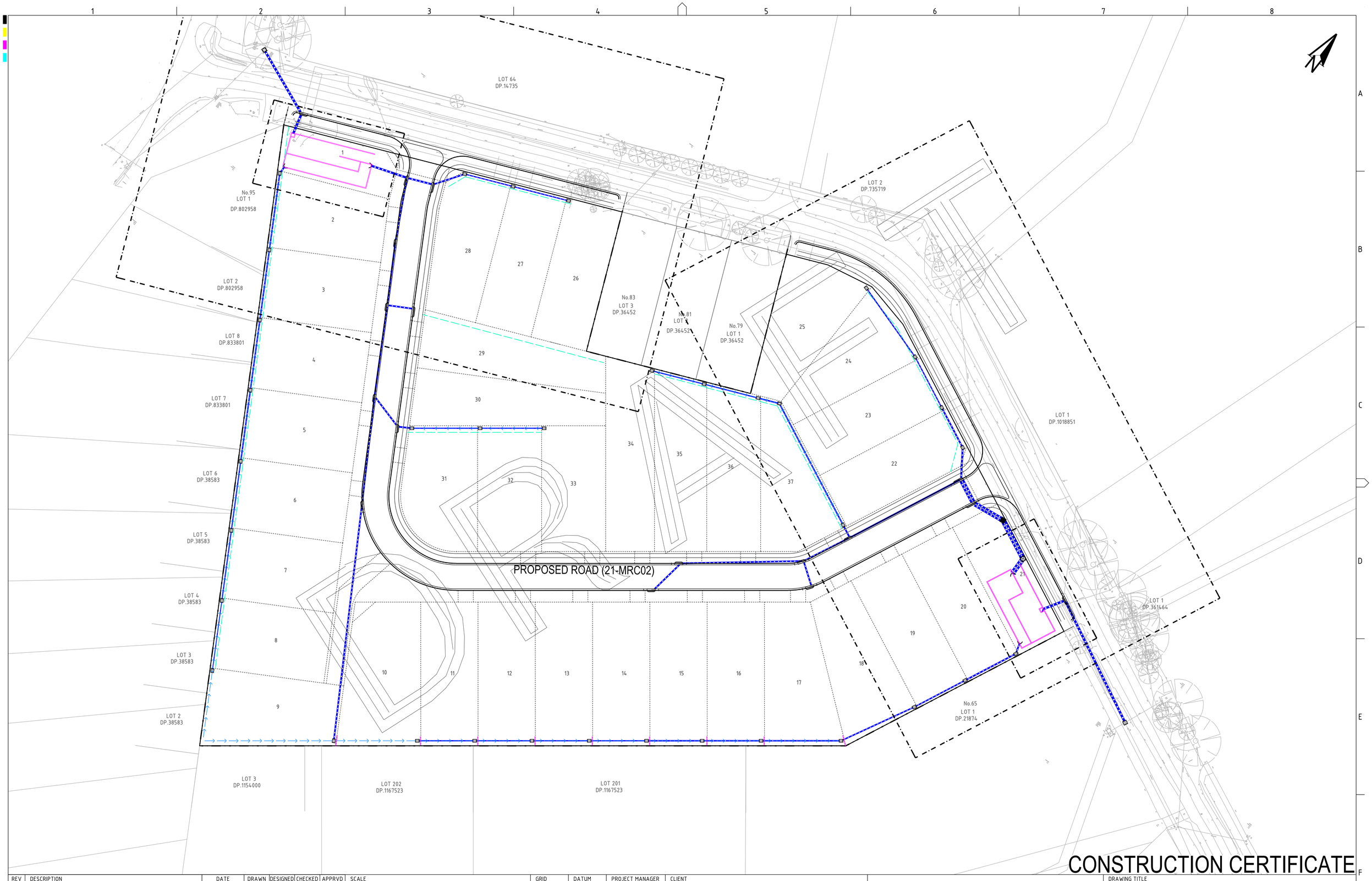
Attachment A – Site Plan



CONSTRUCTION CERTIFICATE

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
A	INITIAL RELEASE	29/03/2018	GM	MD	TH	

SCALE
0 5 10 15 20 25 30 35 40 45 50 METRES
A1 (A3) 1:500 (1:1,000)

GRID	DATUM	PROJECT MANAGER
MGA	mAHD	TH

CLIENT
MMLM TRUST, PRJM P/L

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All measurements in millimetres unless otherwise specified.
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PROJECT NAME/PLANSET TITLE
RES. SUBDIVISION AND DEVELOPMENT
CIVIL AND DRAINAGE WORKS
67 KURRAJONG ROAD
LOT 1 - DP 1185012

martens & Associates Pty Ltd
Consulting Engineers
Environment
Water
Geotechnical
Civil
Suite 201, 20 George St, Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767
Email: mail@martens.com.au Internet: www.martens.com.au

DRAWING TITLE
COMBINED UTILITIES AND SERVICES PLAN

PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P1706231	PS01	R01	PS01-F100	A

PRINTED: ---- - USER: GMOSTOFA
A1 / A3 LANDSCAPE (A1LC_v02.0.01)
DRAWING ID: P1706231-PS01-R01-F100

Attachment – ater and trient alance Modelling

Effluent Disposal Field - Water Balance Assessment

Method ST-XX Revised 11.8.2010

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PROJECT DETAILS

Project	67 Kurrajong Road, Kurrajong, NSW			P1706231
Author	MD	Reviewed	AN	27.07.2018

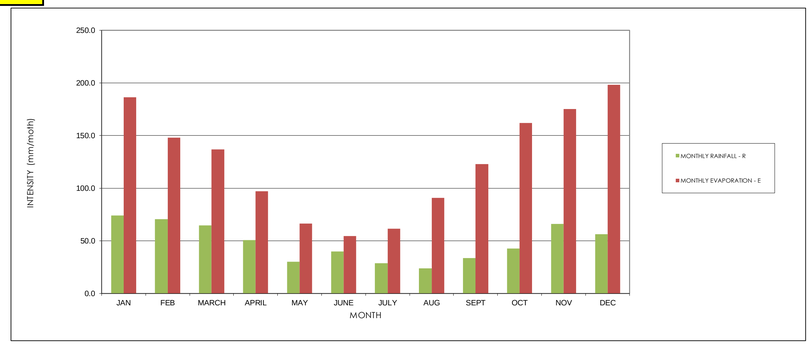
STEP 1 : ENTER SITE AND FIELD CHARACTERISTICS

FACTOR	Enter Data	Unit				
Runoff Factor - RF	0.35	-		Effluent Application Rate	3.0	mm/day
Daily Effluent Load - DEL	21000	L/day		Wet-Weather Storage (KL)	132.6	KL
Effluent Disposal Area - A	7000	m^2	5250			
Design Percolation Rate (DPR)	2.5	mm/day	7000			

STEP 2 : ENTER CLIMATE DATA

Source(s): Rainfall from Richmond UWS (Station No: 067021) and Evaporation data from Richmond RAAF Base (station No: 67033)

MONTH	MONTHLY RAINFALL - R Enter Data	MONTHLY EVAPORATION - E Enter Data
JAN	74.10	186.40
FEB	70.70	148.00
MARCH	64.60	137.00
APRIL	50.70	97.10
MAY	30.00	66.50
JUNE	40.00	54.40
JULY	28.60	61.40
AUG	24.00	91.00
SEPT	33.70	122.80
OCT	42.80	161.80
NOV	66.20	175.10
DEC	56.40	198.10



STEP 3 : ASSESSMENT

MONTH	NUMBER OF DAYS	MONTHLY RAINFALL (mm)	RETAINED RAINFALL	MONTHLY EVAPORATION	CROP FACTOR	EVAPO-TRANSPIRATION RATE	DESIGN PERCOLATION	AVAILABE IRRIGATION CAPACITY	EFFLUENT APPLIED	APPLICATION RATE	INCREASE IN PONDING DEPTH OF EFFLUENT	CUMULATIVE PONDING DEPTH OF EFFLUENT FROM PREVIOUS MONTH	DEPTH OF EFFLUENT	PONDING DEPTH OF EFFLUENT	WET-WEATHER STORAGE REQUIRED
-	(days)	(mm/month)	(mm/month)	(mm/month)	-	(mm/month)	(mm/day)	(mm/month)	(L/month)	(mm/month)	(mm)	(mm)	(mm/month)	(mm)	(KL)
-	DAY	R	RR = R x (1- RF)	E	CF	ETR = E x CF	DP = DPR x DAYS	AIC = ETR - RR +DP	EA = DEL x DAY	AR = EA / A	D = (AIC - AR)	CPD = PD from previous month	DE = D + CPD	PD	WWS
JAN	31	74.10	48.2	186.40	0.80	149.1	77.5	178.5	651000	93.0	-85.5	0.0	-85.5	**0.0**	**0.0**
FEB	28	70.70	46.0	148.00	0.80	118.4	70.0	142.4	588000	84.0	-58.4	0.0	-58.4	**0.0**	**0.0**
MARCH	31	64.60	42.0	137.00	0.70	95.9	77.5	131.4	651000	93.0	-38.4	0.0	-38.4	**0.0**	**0.0**
APRIL	30	50.70	33.0	97.10	0.60	58.3	75.0	100.3	630000	90.0	-10.3	0.0	-10.3	**0.0**	**0.0**
MAY	31	30.00	19.5	66.50	0.50	33.3	77.5	91.3	651000	93.0	1.8	0.0	1.8	**1.8**	**12.3**
JUNE	30	40.00	26.0	54.40	0.50	27.2	75.0	76.2	630000	90.0	13.8	1.8	15.6	**15.6**	**108.9**
JULY	31	28.60	18.6	61.40	0.50	30.7	77.5	89.6	651000	93.0	3.4	15.6	18.9	**18.9**	**132.6**
AUG	31	24.00	15.6	91.00	0.60	54.6	77.5	116.5	651000	93.0	-23.5	18.9	-4.6	**0.0**	**0.0**
SEPT	30	33.70	21.9	122.80	0.70	86.0	75.0	139.1	630000	90.0	-49.1	0.0	-49.1	**0.0**	**0.0**
OCT	31	42.80	27.8	161.80	0.80	129.4	77.5	179.1	651000	93.0	-86.1	0.0	-86.1	**0.0**	**0.0**
NOV	30	66.20	43.0	175.10	0.80	140.1	75.0	172.1	630000	90.0	-82.1	0.0	-82.1	**0.0**	**0.0**
DEC	31	56.40	36.7	198.10	0.80	158.5	77.5	199.3	651000	93.0	-106.3	0.0	-106.3	**0.0**	**0.0**

Effluent Disposal Field - Annual Nutrient Balance Assessment

Method ST-14 Revised 20.3.2007

6/37 Leighton Place, Hornsby, NSW 2077, Ph: (02) 9476 999 Fax: (02) 9476 8767, mail@martens.com.au, www.martens.com.au

PROJECT DETAILS

Project	Subdivision of 67 Kurrajong Road, Kurrajong, NSW			Ref. No.	P1504885
Author	MGD	Reviewed	DMM	Date Created	12/08/2016

STEP 1 : ENTER SITE AND FIELD CHARACTERISTICS

FACTOR	Enter Data	Unit
Treatment System	AWTS	-
Effluent flow rate	450	L/day
Effluent N	18.2	mg/L
Effluent P	8.0	mg/L
Design soil depth	0.50	m
Soil P-sorption	410.0	mg/kg
Plant N uptake	200.0	kg/ha/year
Plant P uptake	20.0	kg/ha/year

STEP 2 : ASSESSMENT

NITROGEN BUDGET FOR RE-USE FIELD

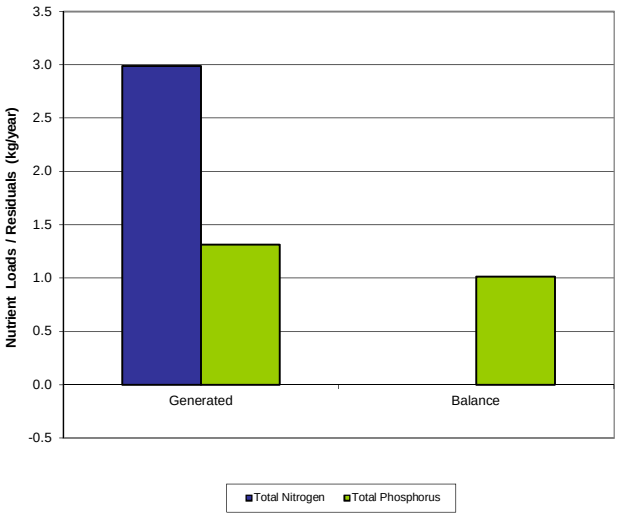
N generated	2.99	kg/year
N consumed	2.99	kg/year
N balance	0.00	kg/year
Min Area	149	m^2

PHOSPHORUS BUDGET FOR RE-USE FIELD

P generated	1.31	kg/year
P consumed	0.30	kg/year
P balance	1.01	kg/year
P sorption	50.7	kg P/design soil depth
Field life (for P)	50.0	Years
Min Area	150	m^2

MINIMUM NUTRIENT ASSIMILATION AREA

Minimum Area	**150**	m^2



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Posted		
Faxed		
Emailed	X	michaelm@clearviewlifestyle.com.au
Courier		
By Hand		

Contact: M. Dumas
Our Ref: P1706231JC05V01
Pages: 3 + attachments
cc.

Appendix 4.3.8.2 Martens Water Balance Calculation and Additional Comments - ADDITIONAL DOCUMENT

27 July 2018

MMLM Unit Trust
C/- Michael McCarthy

(by email)

Dear Michael,

RE: RESPONSE TO IPART RFI – DA 0830/15 FOR 37 LOT SUB-DIVISION AT 67 KURRAJONG ROAD, KURRAJONG, NSW.

Background

This advice has been prepared to address matters raised by IPART in their correspondence of 13 July 2018 (issued by Michael Conciatore). Specifically the following are addressed:

1. Request for a water balance for the re-use scheme
2. Sewage pump station capacity.
3. Noise and odour.

Water Balance

In respect of the scheme more generally, we bring to your attention the following matters which have been incorporated into the design:

1. The scheme's hydraulic load has included a conservative 1.33 factor of safety over the expected peak loads. This means that the scheme has been designed for 4.0 ep/dwelling (21 KL/d), well above design peak of 2.9 ep/dwelling (15.8 KL/d) based on Australian Bureau of Statistics population 2016 data for Kurrajong.
2. The sub-surface irrigation areas include a 1.67 factor of safety over the irrigation loadings acceptable under AS 1547 (2012). The scheme has allowed for 200 m2/dwelling, this being equivalent to 3 mm/day, well below the acceptable rate of 5 mm/day.

Notwithstanding the above, a water balance model for the re-use scheme has been prepared (see Attachment A). The following data and assumptions were used:

1. Richmond UWS rainfall data (BOM station 067021) and Richmond RAAF base evaporation data (BOM station 067033) were used.

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ABN 85 070 240 890 ACN 070 240 890

2. Hydraulic load of 21 kL/day.

3. Total dispersal area of 7,000 m^2.

4. Deep percolation rate of 2.5 mm/day (this below the design 3 mm/day).

The results of the water balance (Attachment A) are summarised as follows:

1. Based on the above data and assumptions, a minimum of 132 KL of wet-weather storage would be required.

2. We note that if a design percolation rate of 3 mm/day is adopted (as approved), then no storage would be required.

3. The court approved scheme included a storage tank of 250 KL. This exceeds the volume required based on the water balance modelling. Sufficient storage is therefore available to prevent waterlogging of irrigation areas or resurfacing of effluent.

Further to the above, we note that the Court imposed Conditions of Consent (the **consent**) require a covenant to be placed over each lot for the effluent dispersal area, preventing lot owners from utilising irrigation areas for other purposes, and requiring owners to maintain the dispersal areas.

Sewage Pump Station Capacity

We note that the sewage pump station (SPS) is only required to collect sewage draining from approximately half of the approved development. The balance of the site drains directly to the STP. The storage capacity of 25 kL will constitute approximately 3.2 days capacity under a site flow of 15.8 KL/day, and 2.4 days under the adopted conservative peak flow of 21 KL/day.

Noise and Odour

The STP will be the commercially available Aquacell system, which is similar to the nearby 'Tallowood' development in Kurrajong. We note:

1. The NSW Land and Environment Court consent did not impose conditions on the operation of the STP regarding noise or odour. These issues were canvassed and considered by the Court and found to be of no material concern for the approved system. We propose that further noise and odour assessments would be unnecessary and onerous.

2. In support of the above, we note the following design elements in respect of noise:

    a. All air blowers, system controls and generators shall be housed in an appropriately designed shed that will preclude noise generation.

    b. All system pumps (within pump station, STP and effluent storage tank) shall be submerged and therefore shall generate no material nuisance noise.

3. In support of the above, we note the following design elements in respect of odour:

    a. Odour management shall include appropriate activated carbon filters (or similar to suit STP). Cleaning and removal of accumulated solids shall generate no material nuisance odours.

Please call our offices if you have any further queries regarding this matter.

For and on behalf of

MARTENS & ASSOCIATES PTY LTD

MICHAEL DUMAS
BEng(Engineering)
Senior Environmental Engineer

ATTACHMENT A – WATER BALANCE CALCULATIONS

Effluent Disposal Field - Water Balance Assessment

Method ST-XX Revised 11.8.2010

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PROJECT DETAILS

Project	67 Kurrajong Road, Kurrajong, NSW			P1706231
Author	MD	Reviewed	AN	27.07.2018

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Design Percolation Rate (DPR)	2.5	mm/day	7000			

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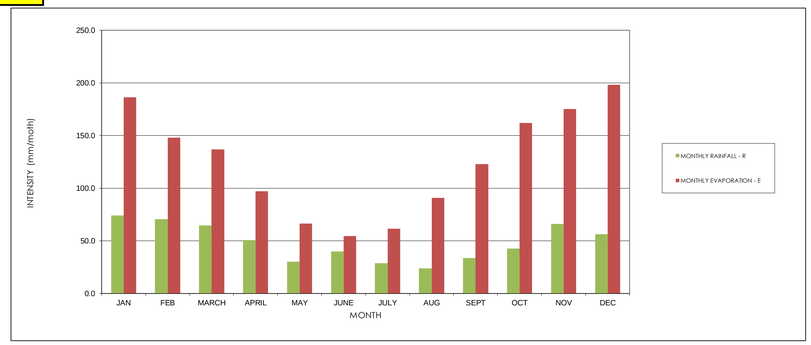

STEP 3 : ASSESSMENT

MONTH	NUMBER OF DAYS	MONTHLY RAINFALL (mm)	RETAINED RAINFALL	MONTHLY EVAPORATION	CROP FACTOR	EVAPO-TRANSPIRATION RATE	DESIGN PERCOLATION	AVAILABE IRRIGATION CAPACITY	EFFLUENT APPLIED	APPLICATION RATE	INCREASE IN PONDING DEPTH OF EFFLUENT	CUMULATIVE PONDING DEPTH OF EFFLUENT FROM PREVIOUS MONTH	DEPTH OF EFFLUENT	PONDING DEPTH OF EFFLUENT	WET-WEATHER STORAGE REQUIRED
-	(days)	(mm/month)	(mm/month)	(mm/month)	-	(mm/month)	(mm/day)	(mm/month)	(L/month)	(mm/month)	(mm)	(mm)	(mm/month)	(mm)	(KL)
-	DAY	R	RR = R x (1- RF)	E	CF	ETR = E x CF	DP = DPR x DAYS	AIC = ETR - RR +DP	EA = DEL x DAY	AR = EA / A	D = (AIC - AR)	CPD = PD from previous month	DE = D + CPD	PD	WWS
JAN	31	74.10	48.2	186.40	0.80	149.1	77.5	178.5	651000	93.0	-85.5	0.0	-85.5	**0.0**	**0.0**
FEB	28	70.70	46.0	148.00	0.80	118.4	70.0	142.4	588000	84.0	-58.4	0.0	-58.4	**0.0**	**0.0**
MARCH	31	64.60	42.0	137.00	0.70	95.9	77.5	131.4	651000	93.0	-38.4	0.0	-38.4	**0.0**	**0.0**
APRIL	30	50.70	33.0	97.10	0.60	58.3	75.0	100.3	630000	90.0	-10.3	0.0	-10.3	**0.0**	**0.0**
MAY	31	30.00	19.5	66.50	0.50	33.3	77.5	91.3	651000	93.0	1.8	0.0	1.8	**1.8**	**12.3**
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JULY	31	28.60	18.6	61.40	0.50	30.7	77.5	89.6	651000	93.0	3.4	15.6	18.9	**18.9**	**132.6**
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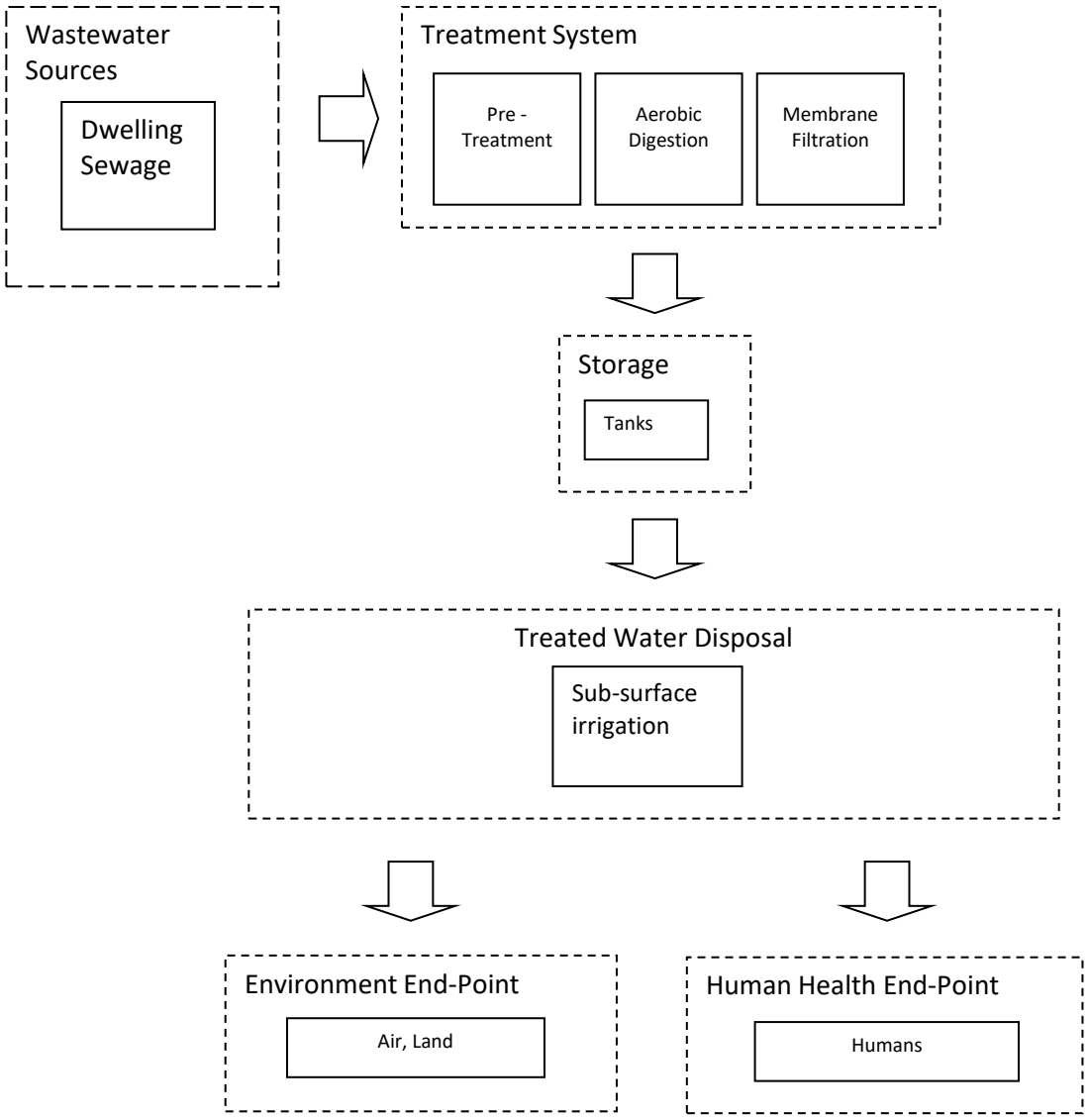
OCT	31	42.80	27.8	161.80	0.80	129.4	77.5	179.1	651000	93.0	-86.1	0.0	-86.1	**0.0**	**0.0**
NOV	30	66.20	43.0	175.10	0.80	140.1	75.0	172.1	630000	90.0	-82.1	0.0	-82.1	**0.0**	**0.0**
DEC	31	56.40	36.7	198.10	0.80	158.5	77.5	199.3	651000	93.0	-106.3	0.0	-106.3	**0.0**	**0.0**


Wastewater Sources
Dwelling Sewage
Treatment System
Pre - Treatment
Aerobic Digestion
Membrane Filtration
Storage
Tanks
Treated Water Disposal
Sub-surface irrigation
Environment End-Point
Air, Land
Human Health End-Point
Humans

HACCP Checklist

Project Name:	67 Kurrajong Rd
Project Engineer:	Technical Manager
Date of Assessment:	23-Aug-18
Revision:	Revision 2
Approved By and Date:	W. Johnson

To be approved by the Technical Manager

HACCP Workshop Attendees	Revision 1 Attendees	Revision 2 Attendees (January, 2016)	Revision 3 (23 August, 2018)	Revisions
	W. Johnson	W. Johnson	W. Johnson	
	J. Taylor	J. Taylor	J. Taylor	
			M. Conciatore	
			H. Fisher	
see RWQMP section 4 for company affiliations				

DESIGN / CONCEPT STAGE HACCP

Step	Potential Hazard	Preventative Measure	Before Mitigation: Likelihood	Consequenc	Resid. Risk	After Mitigation: Likelihood	Consequ	Resid.	Uncertainty	Decision Tree				CCP	Critical Levels		Monitoring	Corrective Action		Records
Process unit	*Physical, chemical, biological, other*		*1 to 5*	*1 to 5*	*D + E*	*1 to 5*	*1 to 5*	*D + E*		*Y or N*					*Target*	*Action*	*How*	*What*	*How*	*Where*
1. Source water (sewage influent, collection lines, pump stations)	Physical contact with wastewater	Covers on tanks, locks where appropriate, trained operators to access site, signage, difficult to access. Training of services personnel.	1	2	3	1	2	3	± 1	N	N			No						
	Biological Hazard. Faecal matter in influent above specification. Additional pathogen load to treatment plant resulting in out of spec treated water	Membrane UF treatment. On-line monitoring. Verification monitoring. Actual pathogen removal likely to be higher than operational target. Ongoing monitoring program includes biological parameters. Turbidity meter indicates membrane breach.	1	2	3	1	2	3	± 1	N	N			No						
	Physical hazard.	Exclude public & residence from plant and raw sewage access points through locked gates and locked plant rooms. Service technicians are trained and experienced in handling influent. Use correct PPE when required. Education of residents as to potential locations of contact. Signage indicating potential hazard.	2	2	4	1	1	2	± 1	Y	N	N		No						
	Chemical Hazard	Buffer tank pH is monitored to detect changes to incoming influent. Buffer tank pumps don't transfer if pH is out of range. Educate residents to ensure only domestic sewage is disposed of via the sewerage sytem.	3	2	5	3	1	4	± 1	Y	N	N		No						
	Blockage or break in sewerage network.	Properly designed sewer installed to Australian standards by qualified installers. Network is comparatively small, with majority gravity flow. Judicious planning of vegetation can minimise risk of root ingress into pipes. Proximity to readily available 24/7 service network to rectify potential blockages and breaks, once identified. Blockages can be quickly identified by residents prior to becoming an issue.	2	1	3	2	1	3	± 1	Y	N	N		No						
2. Screen	Chemical hazard. Non-compliant trade waste discharge up stream.	Buffer tank pH is monitored to detect changes to incoming influent. Buffer tank pumps don't transfer if pH is out of range. Educate residents to ensure only domestic sewage is disposed of via the sewerage sytem. Being a residential system, no sources of trade waste are present at this site.	2	2	4	2	2	4	± 1	N	N			No						
	Resident disposing of chemicals down the drain	Education of resident . pH monitoring of the influent, any out of range feed not accepted. Dilution of feed by other residents	2	2	4	2	1	3	± 1	Y	N	N		No						
	Screen may block or fail.	Routine maintenance inspections. Adequately sized inlet screen to mitigate blockages or failures. High level alarms. Overflow back to buffer tanks. Remote monitoring to identify issues and allow rapid response.	2	1	3	2	1	3	± 1	Y	N	N		No						
	Screenings and grit need to be removed from site and accidental discharge to environment may result with potential public contact to pathogens. Contractor may contact the contaminants via the skin or inhalation	Ensure appropriately experienced and licensed contractors are used for maintenance of systems. Contractors use adequate PPE to mitigate against ingestion, skin contact and inhalation. Remediate spills immediately and exclude public from the spill point until rectified. Size sludge pit to minimize pump out frequency.	2	2	4	1	2	3	± 1	Y	N	N		No						
3. MBR (Aerators, Mixed Liquor, Membranes)	Chemical hazard - pH sensitive Shock loads	High MLSS will reduce effects of shock loads. pH exclusion in pre-treatment prevents delivery of non-compliant water to MBR. MBRs are inherently resistent to shock load due to design. Buffer tank acts as a dilution.	2	2	4	2	1	3	± 1	N	N			No						
	Chemical hazard - pH neutral	DO indicator of biomass health. High MLSS - shock resistance. ????????	3	1	4	3	1	4	± 1					No						
	Chemical hazard - Chemical cleaning process destroys biomass	Appropriate procedures. Operator training. Slow down production to allow biomass to rebuild. Last resort, shutdown and re-seed. Maintain biomass in biology tanks. Membranes are contained in separate tanks, therefore the biomass can be maintained in the biology tanks.	3	1	4	2	1	3	± 1	N	N			No						
	Chemical cleaning damages membranes.	Appropriate procedures. Operator training. Membranes selected for broad compatability range. In the event membranes are damaged, breach would be detected by turbidity probe.	3	3	5	1	3	4	± 1	Y	Y			CCP	Turbidity < 2 NTU	Turbidity > 2 NTU	Online turbidity			
	Biological hazard Over aeration - nitrification reduces pH in tank	Operator training. DO monitoring. pH probe in filtrate pit is indicator of bioreactor pH.	3	2	5	3	2	5	± 1	N	N									
	Biological hazard Under aeration failure. 1) electrical 2) diffuser	Blowers are alarmed for electrical failure. Pressure transducers on aeration system detect diffuser blockages. Separate blowers supply biology and membrane. Routine Maintenance Program with visual inspection. DO probe alarmed for aeration failure. Consider installation of duty standby blowers.	2	2	4	2	1	3	± 1	Y	N	N		No						
	Biological hazard Loss of biomass due to lack of feed.	Residential estate is likely populated at all times. Experience shows biomass can sustain health over several days. Plant throughput can be slowed to allow the biomass to reach equilibrium with lower flow rate.	1	2	3	1	2	3	± 1	Y	N	N		No						

Process unit	*Physical, chemical, biological, other*		*1 to 5*	*1 to 5*	*D + E*	*1 to 5*	*1 to 5*	*D + E*		*Y or N*					*Target*	*Action*	*How*	*What*	*How*	*Where*
1. Source water (sewage influent, collection lines, pump stations)	Physical contact with wastewater	Covers on tanks, locks where appropriate, trained operators to access site, signage, difficult to access. Training of services personnel.	1	2	3	1	2	3	± 1	N	N			No						
	Biological hazard Membrane failure allowing pathogens through, either by gross rupturing or pinholing	Upstream screen to protect membranes from foreign matter. Membrane selection with a broad compatibility range. Level and overflow alarms (prevent membranes drying out). Online turbidity measurement of filtrate. Turbidity shutdown alarm.	2	3	5	2	3	5	± 2	Y	N	Y	N	CCP1	NTU < 2	NTU > 2	Online turbidity			
	Physical hazard Leave drain valve open, emptying membrane tank	Operator training. Remove valve handles. Low level alarm on membrane tank.	1	2	3	1	2	3	± 1	Y	N	N		No						
	Physical hazard Faulty connections to/from membrane filter.	Good pipe work design and flexible connections used. Use stainless steel clamps and screws. Online turbidity to maintain spec.	2	3	5	1	3	4	± 1	Y	N	Y	N	CCP1	Turbidity < 2 NTU	Turbidity > 2 NTU	Online turbidity			
	Physical hazard Loss of air scour due to large bubble size (broken diffuser).	Appropriate design.Inspection. Pressure transducers with low pressure alarm	2	1	3	2	1	3	± 1	Y	N	N		No						
	Physical hazard Faulty membrane installed	Quality checks at manufacturing, construction, commissioning. Manufacturers approval Verification during commissioning . Water Quality Testing. Turbidity monitoring	2	3	5	1	3	4	± 1	Y	N	Y	N	CCP1	Turbidity < 2 NTU	Turbidity > 2 NTU	Online turbidity			
	Sludge needs to be removed from site and accidental discharge to environment may result with potential public contact to pathogens. Operator handling also implies human exposure risk	Ensure contractors are adequately trained and licensed. Exclude public access and immediately rectify spills. Use appropriate PPE to avoid inhalation and skin contact. Supervision by Aquacell staff.	1	3	4	1	3	4	± 1	Y	N	N		No						
	Sludge wasting may fail leading to disruption of plant function	Sludge is manually wasted. Ensure wasted sludge flows to sludge tank and is not contacted by humans.	3	1	4	3	1	4	± 1	Y	N	N		No						
4. Irrigation System and Storage Tanks	Exposure hazard, improper use of treated water.	Education program for occupants. Lilac coloured pipes and fittings. Signage indicating treated water usage. No taps on irrigation network, as it is a properly designed sub-surface irrigation network. Treatment plant operating correctly	1	3	4	1	3	4	± 2	N	N			No						
	Degredation in water quality and delivery due to biofilm growth	Correct sizing of irrigaton field and storage tanks. Flushing point on irrigation system installed. Tank level alarms if irrigation system blocks. Regular flow prevents stagnation of water. Short retention times in storage tanks.	2	3	5	1	3	4	± 2	N	N			No						
	Irrigation pump may fail	Small pump which is readily available. Duty standby can be considered. Adequate storage volume in buffer and irrigation tank to allow time for pump to be replaced. Irrigation tank and buffer tank can be pump out if necessary.	2	3	5	1	3	4	± 1	N	N			No						
	Irrigation pipes or fittings may fail	Seperately operable irrigation zones so problem zones can be isolated. Routine checks to look for pooling or leaking. Adequate storage volume in buffer and irrigation tank to allow time for pump to be replaced. Irrigation tank and buffer tank can be pump out if necesary. Signage on residential lots, and education through community title to inform residents not to disturb irrigation pipes and fittings.	2	3	5	1	3	4	± 1	N	N			No						
11. General	Prolonged power outages	Buffer tank can hold approximately 6 times daily demand. Buffer tank can be pumped out. Plant could be powered by generator.	1	2	3	1	2	3	± 1	N	N			No						
	Extreme weather (flooding/heat)	Critical equipment under cover where practical. Equipment selected appropriate to worst case conditions. Pump out can be used if plant is disabled.	1	4	5	1	4	5	± 1	N	N			No						
	Earth quake	Pump out can be used if plant is disabled.	1	4	5	1	4	5	± 1	N	N			No						
	Fire	Pump out can be used if plant is disabled. Vegetation is maintained around plant.	1	4	5	1	4	5	± 1	N	N			No						
	Human actions (sabotage)	Pump out can be used if plant is disabled. Plant is in gated estate to prevent any access from general public.	1	3	4	1	3	4	± 1	N	N			No						

HAZOP
Checklist

Project Name:	67 Kurrajong Rd
Project Engineer:	Technical Manager
Date of Assessment:	23-Aug-18
Revision:	Revision 3
Approved By and Date:	W. Johnson 23/8/2018

To be approved by the Technical Manager

HAZOP Workshop Attendees			Revision 1 Attendees	Revision 2 Attendees (January, 2016)			
			W. Johnson		W. Johnson		
			J. Taylor		J. Taylor		
	see RWQMP section 4 for company affiliations						

HAZOP

Item	Deviation	Consequence	Causes	Safeguards	Actions	Who	Due Date	Status
Equipment, tank, process unit	*Condition such as no flow, high flow, pH change*	*What happens*	*Why does it happen*	*Valves, alarms, instrument, design*	*To be done to mitigate*			
1. Source water (sewage input, collection lines)	No influent	Low levels, not providing enough flow to biology	Low influent production Blockage or linebreak upstream of buffer tank	Low level switch to protect downstream equipment if no feed is available.				
	Out of spec influent quality	Upsets biological process and possibly membranes	Long storage time turns septic, contaminated waste, other upsets	pH probe which turns influent pump off if pH low. Pump out tank if required				
	Influent feed not used	Septicity develops, buffer tank overflows	Treatement plant offline, treated water tank full	Buffer tank and treated water tank can be pumped out if required				
	High influent flow	Buffer tank fills up	Flooding of sewer pit, stormwater ingress, high demand due to community activities	Additional capcity built into plant, buffer tank volume 6 times daily flow, buffer tank can be pumped out if required				
	Reverse Flow	Back-up in inlet pipe	Blockage in pipework or failed check valve.	Properly designed system. Regular maintenance and inspection. Use of check valves. Monitoring levels in pump station and buffer tanks.				
	Low level	as for 'no influent'						
	High level	Buffer tank fills up. Overflow to sump	Treatement plant offline, treated water tank full	Buffer tank and treated water tank can be pumped out if required				
	High pressure	Not possible in gravity flow section of scheme. Remaining pressurised scheme result of pump or pipe failture.	Potential blockage in pipe. Oversized pump.	Adequately designed system. Majority of scheme is gravity flow.				
	Low pressure	Not possible in gravity flow section of scheme. Remaining pressurised scheme result of pump or pipe failture, or breakage	Breakge downstream. Pump failure.	Adequately designed system. Majority of scheme is gravity flow.				
	Tank rupture	Spill of influent to environment	Earthquake, subsidence, flood, flotation	Good design. Fit for purpose tank. Minimum levels maintained in tank to prevent floatation.				

HAZOP

Item	Deviation	Consequence	Causes	Safeguards	Actions	Who	Due Date	Status
Equipment, tank, process unit	*Condition such as no flow, high flow, pH change*	*What happens*	*Why does it happen*	*Valves, alarms, instrument, design*	*To be done to mitigate*			
	pH outside expected range	Biological process upset	Influent pH	pH meter in buffer tank				
	Start up/ shutdown	No- issue						
	Isolation	No requirement for isolation						
	Cleaning	no requirement for cleaning						
2. Screen	No Flow	No feed into biology tanks	Screen blockage, motor trip	Level switches, motor overload, screen overflow to buffer or sludge tank				
	High flow	Overflow	Screen blockage	High level alarms and control logic, screen overflows to buffer or sludge tank.				
	Reverse flow from sewer overflow	Not possible because it is pumped into screen.						
	Level	As for 'flow'						
	High pressure in pumped line	Damage pipe and pump	Blockage	Trip and alarm on pump				
	Composition	Foaming and possible overflow	Detergents and/or microbiology	Sealing lids. Overflow to buffer or sludge tank.				
	Start up/ shutdown	No Issues						
3.MBR	No Flow into MBR	Biomass dies	No flow from upstream	Low level alarm				
	No flow out of MBR	No effluent produced	Membrane fouling, jammed actuated valve, pipe blockage, turbidity alarms, filtrate pump failure	Turbidity alarm, actuated valve alarm, regular membrane cleaning, flux rate monitoring, air scour of membranes				
	Sludge build up in base of tank	No flux through membranes. Blocked diffusers preventing air scour	Poor influent screening. Blocked diffusers preventing air scouring	Inspections. Monitoring scouring air pressure				
	High flow	High level and overflows	Over-pumping in from previous tank. Blocked recirculation lines.	Level alarms				
	High flux through membrane	More rapid membrane fouling	High trans-membrane pressure. Chemical membrane clean	Turbidity meter. Flux monitoring.				
	High air pressure	Damage pipe and blower. Damage membranes	Diffuser blockage	Thermal overloads on blowers. Scour air pressure monitoring				

HAZOP

Item	Deviation	Consequence	Causes	Safeguards	Actions	Who	Due Date	Status
Equipment, tank, process unit	*Condition such as no flow, high flow, pH change*	*What happens*	*Why does it happen*	*Valves, alarms, instrument, design*	*To be done to mitigate*			
	pH drops	Biomass dies. Corrosion. Out of spec water quality pH	Nitrification in aeration tanks does not have sufficient alkalinity therefore dropping pH	Filtrate pH meter. DO control. Can consider alkalinity dosing.				
	Low air flow	Biomass negatively impacted. Membrane fouling from lack of scouring and BOD removal.	Aeration fails. High MLSS	DO probe, blower alarms Monitoring of MLSS/DO. Monitoring biology air pressure.				
	Low levels	No flux through membrane Membrane dries out and/or fouls Biomass dies	Faulty actuated valve	Low level alarm				
	High level	Overflows	Over-pumping in from previous tank. Recirculation pumps blocked or damaged.	Level alarms. Adjustment of recirculation valves lines from bio to MBR.				
	Low pressure on air lines	Low air supply. Membranes do not scour properly. Anaerobic conditions	Broken diffuser or air pipe	DO monitoring for Bio (not MBR). Pressure monitoring of membrane and biology air				
	High air pressure	Damage pipes and pumps	Blockage in pipes or diffusers	thermal overloads on blowers				
	High permeate pressure	Not possible						
	Composition	Biomass impacted and biological treatment lost. Membranes damaged.	Toxins in waste water	DO probe. Influent pH probe.				
4. Filtrate pit	High level	Overflow	Pump failure, level switch failure, filtrate valve failure	Fault pump detection, overflow pipe				
	Inaccurate turbidity reading	false alarms, instrument failure	Failure of turbidity probe. Biofilm in filtrate pit or lines	Routine servicing and calibration				
	Low level	Dry running pump, turbidity probe function	Failure float switch	Low level alarm				
	No flow or overflow	Same as low and high level						
5 Irrigation system and storage tanks	Low level	Dry running of pumps	Irrigation pump fails to stop	Level switch and low level alarm				
	High level	Overflows to environment	Failure of irrigation controller or solenoid valves.	Level alarms. Treatment plant stops processing				

HAZOP

Item	Deviation	Consequence	Causes	Safeguards	Actions	Who	Due Date	Status
Equipment, tank, process unit	*Condition such as no flow, high flow, pH change*	*What happens*	*Why does it happen*	*Valves, alarms, instrument, design*	*To be done to mitigate*			
	Low pressure	not disposing of water uniformally	irrigation pump stops	Routine inspections of irrigation areas				
	high pressure	irrigation pump stops prematurely	blocked lines	high level alarm in irrigation tank				
	Reverse flow in mains supply	not possible - no cross conneciton potential						
6. Manual Work	Maintenance	Damage to equipment	Poor workmanship	Following Work Instructions				
	Maintenance	Chemical spills	Chemical handling	Following Work Instructions				

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Likelihood	Consequences					
		1	2	3	4	5
	1	Low	Low	Low	Moderate	High
	2	Low	Low	Moderate	High	Very High
	3	Low	Moderate	High	Very High	Very High
	4	Low	Moderate	High	Very High	Very High
	5	Low	Moderate	High	Very High	Very High

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Level	*Descriptor*	*Example of Description*	
1	Rare	May occur only in exceptional circumstances	very rarely > annual
2	Unlikely	Could occur in unusual circumstances	chance of annual occurence
3	Possible	Might occur or should be expected to occur under certain circumstances	chance of monthly occurence
4	Likely	Will probably occur	chance of weekly occurence
5	Almost Certain	Is expected to occur	chance of daily occurrence

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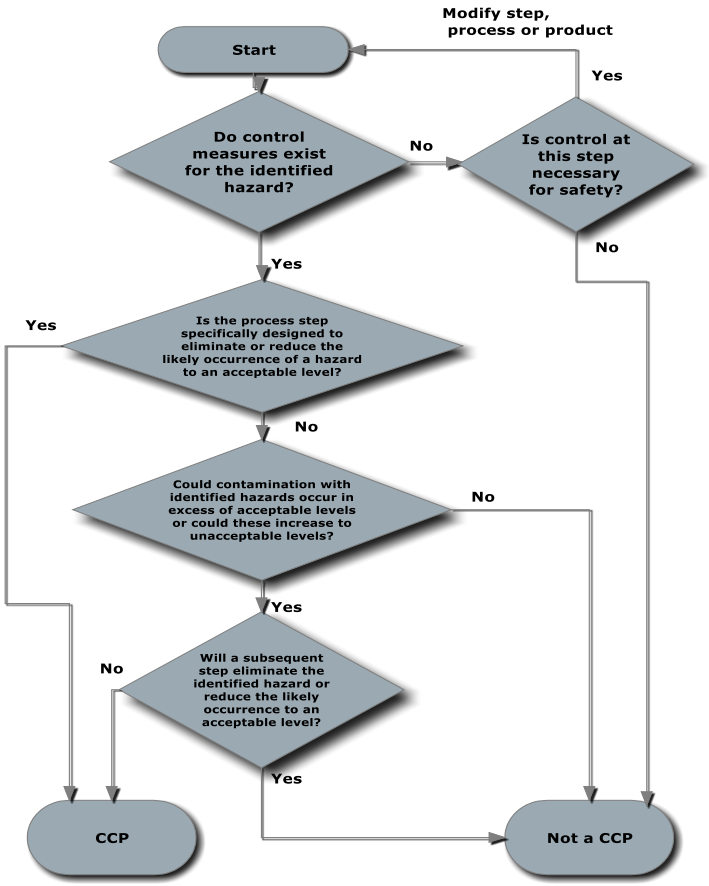
Level	*Descriptor*	*Example of Description*
1	Insignificant	Insignificant impact or not detectable
2	Minor	Health - Minor impact on contact population, first aid treatment
		Environment - Minimal and short term harm to the environment
3	Moderate	Health - Moderate impact on contact population, medical treatment required
		Environment - Significant harm to the local environment for a short period
4	Major	Health - Major impact on contact population, extensive injuries
		Environment - significant harm to the environment
5	Catastrophic	Health - Potentially lethal on on contact population, death
		Environment - significant, widespread harm outside local area

Deci□ion □ree



Appendix 4.3.9.2 Kurrajong Construction and Business Operation Risk Assessment - ADDITIONAL DOCUMENT

Attachment B - Construction and Business Risk Assessment

Risk Matrix

Likelihood	Consequence 1	2	3	4	5
1	Low	Low	Low	Moderate	High
2	Low	Low	Moderate	High	Very High
3	Low	Moderate	High	Very High	Very High
4	Low	Moderate	High	Very High	Very High
5	Low	Moderate	High	Very High	Very High

Qualitative measures of likelihood

Level	*Descriptor*	*Example of Description*	
1	Rare	May occur only in exceptional circumstances	very rarely > annual
2	Unlikely	Could occur in unusual circumstances	chance of annual occurence
3	Possible	Might occur or should be expected to occur under certain circumstances	chance of monthly occurence
4	Likely	Will probably occur	chance of weekly occurence
5	Almost Certain	Is expected to occur	chance of daily occurrence

Qualitative measures of consequence

Level	*Descriptor*	*Example of Description*
1	Insignificant	Insignificant impact or not detectable
2	Minor	Health - Minor impact on contact population, first aid treatment Environment - Minimal and short term harm to the environment
3	Moderate	Health - Moderate impact on contact population, medical treatment required Environment - Significant harm to the local environment for a short period
4	Major	Health - Major impact on contact population, extensive injuries Environment - significant harm to the environment
5	Catastrophic	Health - Potentially lethal on on contact population, death Environment - significant, widespread harm outside local area

Construction and Business Operations Risk Assessment

Project Name:	**67 Kurrajong Rd**
Date of Assessment:	23rd August 2018
Revision:	Revision 1
Created:	Justin Taylor
Approved:	Justin Taylor
Personnel Consulted:	Justin Taylor Michael Conciatore Hugh Fisher

Activity	Risk	Impact	Unmitigated Risk					Control Strategy	Mitigated Risk				
			Likelihood		Consequence		Risk		Likelihood		Consequence		Risk
Construction	Insufficient information available to construct the infrastructure	Infrastructure incomplete or not correctly installed	3	Possible	3	Moderate	High	-Detailed process flow diagram, P&ID, electrical drawings, civil drawings, mechanical fabrication drawings - Detailed GA and installation drawings - Detailed valve, equipment and instrument schedules - Project Manager with waste water treatment experience overseeing the project to ensure design is complete prior to construction commencing - Project Manager relates detailed information to construction team and oversees construction	1	Rare	3	Moderate	Low
	Issued for construction drawings not followed accurately	Infrastructure does not operate correctly. Effluent quality may be outside specification. Plant may not achieve design capacity.	3	Possible	3	Moderate	High	- Installation to be supervised by competent Aquacell staff member - Construction by employees or contractors with prior experience installation Aquacell plants - Detailed commissioning check sheets to ensure plant is systematically checked against design prior to start up	1	Rare	2	Minor	Low
	Wrong equipment delivered by supplier and subsequently installed during construction	Infrastructure does not operate correctly. Effluent quality may be outside specification. Plant may not achieve design capacity.	4	Likely	2	Minor	Medium	- Detailed purchase orders including supplier part number - all goods checked in against goods inwards note, purchase order and supplier delivery docket to ensure ordered part has been correctly supplied - Incoming goods labelled and stored in dedicate project bay	1	Rare	2	Minor	Low
	Correct equipment supplied but mixed up and installed in the wrong position on site	Treatment plant does not produce required effluent quality	2	Unlikely	2	Minor	Low	- Detailed P&ID with tag numbers that match valve, instrument and equipment schedules - detailed commissioning check sheets used by Commissioning Engineer to verify installed equipment against the P&ID	1	Rare	1	Insignificant	Low
	Treated plant cannot be constructed as designed and drawn	Treatment plant cannot be completed with design change	4	Likely	3	Moderate	High	- Treatment plant modelled with 3D software so entire assembly can reviewed prior to 2D fabrication drawings being developed - design review prior to issue for construction drawings being developed which considers constructability of the plant	2	Unlikely	1	Insignificant	Low
	Treatment plant contains design omission or oversight	Non-compliant treated water produced, spill or other adverse environmental condition occurs	2	Unlikely	4	Major	High	- HACCP and HAZOP undertaken prior to issued for construction drawings - HACCP and HAZOP conducted by multidisciplinary team to consider all aspects of the plant design - Peer review of design calculations to check their validity	1	Rare	2	M	Low
	Reticulation pipe work not correctly installed	Non-compliant and possibly non-operational reticulation system	3	Possible	3	Moderate	High	- reticulation system designed by suitably qualified person - licensed plumber used to supervise and install the reticulation system - system installed compliant with relevant Australian Standards	2	Unlikely	1	Insignificant	Low
	Plant, irrigation field or reticulation network installed in incorrect place	Location contrary to approvals which have been granted	3	Possible	4	Major	Very High	- Surveyors used where necessary to mark boundaries and ensure infrastructure installed in DA approved area	1	Rare	1	Insignificant	Low
	Pipe across Vincent Road installed in the incorrect place	Pipe not within designated easement	3	Possible	4	Major	Very High	- Surveyor used to mark location of pipe and ensure it is within designated easement	1	Rare	1	Insignificant	Low
	Working on public road to install pipe across Vincent Road	Injury to installer or public	3	Possible	4	Major	Very High	- Traffic Management Plan implemented to ensure safe work - All approvals sought from local council prior to closing road and undertaking work	1	Rare	2	Minor	Low

	Unsafe work practices during construction	Injury to construction team or equipment damage	4	Likely	4	Major	Very High	- Work undertaken under the jurisdiction of Aquacell's WHS System including, but not limited to procedures for risk assessment, working at heights, confined space, manual handling etc. - Safe Work Method Statements developed to cover the activities undertaken during construction - Licensed persons used to undertake work where necessary - Construction WHS considered at design phase so the plant can be constructed safely, e.g., lifting hooks added to heavy equipment - Correct equipment used to undertake the tasks, e.g., crane for lifting plant in to place	2	Unlikely	2	Minor	Low
	Interruption to residents during construction	Resident complaints	3	Possible	2	Minor	Medium	- Keep noise to a minimum - Work only during normal hours - Workers to keep clear of traffic ways and not park cars or leave materials such that they interrupt the peaceful enjoyment of the residents - Rubbish to be removed from site as soon as practically possible	2	Unlikely	1	Insignificant	Low
	Waste generated on site during construction	Environmental contamination	3	Possible	2	Minor	Medium	- all waste to be removed from site as soon as practical, preferably daily - where waste cannot be immediately removed from site it is stored such that it cannot be blown or washed into the local environment - recyclable material returned to Aquacell for recycling	1	Rare	1	Insignificant	Low
	Chemical spill during construction	Environmental contamination	3	Possible	2	Minor	Medium	- minimise number of chemicals used during construction - bring chemicals onto site only when required - do not store chemicals on site when they are not needed - ensure MSD and appropriate clean up materials are available on site	1	Rare	1	Insignificant	Low
	Plant produces effluent which is out of specification during start up phase	Environmental contamination	4	Likely	4	Major	Very High	- online instrumentation measure critical parameters and causes plant to alarm if effluent is not suitable for discharge - water quality can be verified with hand held instrumentation which the Commissioning Engineer carries - out of specification water can be held in the treated water tank and be tankered off site if required	1	Rare	1	Insignificant	Low
	Construction of infrastructure not completed on time	Residents cannot get occupancy	3	Possible	3	Moderate	High	- install balance tank as first stage of project. Sewage can be collected in the balance tank and tankered out if there are any delays constructing the treatment plant or irrigation field	2	Unlikely	1	Insignificant	Low
	Long lead time items are no longer available in quoted lead time	Residents cannot get occupancy	2	Unlikely	3	Moderate	Medium	- Long lead time items ordered as soon as issued for construction design approved - Long lead time items generally have an alternate which could be used if required	1	Rare	1	Insignificant	Low
Business Operations	Business Interruption, e.g. fire, flood, natural disaster	Aquacell unable to complete construction	1	Rare	5	Catastrophic	High	- Business interruption insurance in place - Procedures in place to minimise disruption, e.g., digital files archived off site - Construction works could be undertaken on site if Aquacell workshop was unavailable	1	Rare	3	Moderate	Low
	Financial Risk - Aquacell Cash Flow	Aquacell unable to complete construction	2	Unlikely	4	Major	High	- Project Manager manages against agreed budget - Project Manager aims to run the project cash flow positive if practical - Project has milestone payments to ensure Aquacell has a revenue stream through the duration of the project - Aquacell has other income streams from servicing and operations to smooth business cash flows - Ongoing management reviews of business wide cash flow to forecast and manage periods of low cash flow	1	Rare	2	Minor	Low

Financial Risk - Supplier Insolvency	Aquacell not able to receive parts which have been ordered. Loss of deposits or payments already made	2	Unlikely	3	Moderate	High	- Aquacell's standard terms are to pay for the goods once received - Aquacell's standard terms are 60 days - Where deposits are required, they are negotiated to minimum amounts to mitigate risk - Where goods are not provided due to supplier insolvency, an equivalent alternate could be sourced	1	Rare	2	Minor	Low
Financial Risk - Customer Insolvency	Aquacell does not get paid for the costs they have incurred	1	Rare	3	Moderate	Low	- Milestone payments negotiated into the contract to minimise financial exposure - Active debtor management to ensure overdue amounts are collected	1	Rare	2	Minor	Low
Technical	Plant doesn't operate as designed due to oversight, omission or error	2	Unlikely	4	Major	High	- Aquacell recruit suitably qualified design personnel who are competent to design to required infrastructure - Where skills are required outside Aquacell's core competency, appropriately qualified persons are contracted to undertake the work - Aquacell maintains Professional Indemnity insurance to mitigate costs associated with technical failures	1	Rare	2	Minor	Low
Contract Labour	Contractor does, or omits to do something that causes harm or damage	3	Possible	3	Moderate	High	- Contractor's management to ensure contractors are reviewed prior to commencing work - Each contractors relevant insurances, licenses and safe work method statements are reviewed prior to engagement - Contractor insurance	2	Unlikely	2	Minor	Low
Personnel - key persons leave the company	Plant cannot be constructed and built with staff available	3	Possible	3	Moderate	High	- disciplined design procedures and storage of documentation to allow others to continue should a staff member become unavailable - Standard design blocks which can be reused on each project rather than requiring bespoke designs for each project - other employees within Aquacell have similar skills and could continue the work to completion	1	Rare	2	Minor	Low
Contractual - Aquacell and client disagree on scope	Delays	3	Possible	3	Moderate	High	- a detailed contract between the customer and Aquacell is put in place prior to commencement of works. This document is the reference document and both parties are bound by it	2	Unlikely	2	Minor	Low
Contractual - Aquacell and supplier/contractor disagree on scope	Delays	3	Possible	3	Moderate	High	- Aquacell only order items with a formal purchase order backed by a set of standard terms and conditions. Scope, price and payment terms are clearly defined prior to purchase	2	Unlikely	2	Minor	Low
Resource - insufficient resources available	Delays	3	Possible	3	Moderate	High	- Aquacell staff have multiple skill sets and can be redeployed within the business to satisfy short term resource deficiencies - Aquacell have established relationships with a number of external contractors who could be called upon if the incumbent was unable to complete the job in a timely manner	2	Unlikely	1	Insignificant	Low
Safety - Employees	Injury, Lost time, costs to business	4	Likely	4	Major	Very High	- WHS system developed and in place - Staff training in WHS procedures - SWMS developed for tasks work which is carried out - Correct methods of work identified and appropriate equipment used to ensure risks associated with work are as low as practically possible - Workers Compensation insurance in place to minimise business costs should an injury occur	1	Rare	2	Minor	Low
Safety - Contractors	Injury, Lost time, costs to business	4	Likely	4	Major	Very High	- WHS system developed and in place - Contractors to supply SWMS prior to commencing work - Contractor selection to ensure appropriate persons selected to undertake work, and licensed where necessary - Contractor management to ensure selected contractors have workers compensation policy and other appropriate insurances in place prior to providing them with a purchase order	1	Rare	2	Minor	Low

	Organisational - restructure, sale of business etc.	Project delivery compromised	1	Rare	3	Moderate	Low	- Aquacell is 100% privately owned with no third parties or holding companies and therefore are unlikely to be sold or restructured at short notice. Any organisational change will be negotiated with the current project and work load in mind	1	Rare	1	Insignificant	Low

Appendix 4.3.10.1 Draft Sewage Management Plan Kurrajong Rd - REISSUED

67 Kurrajong Rd Residential Community Development

Sewage Management Plan

7 January 2018

A0111 Sewage Management Plan

Prepared by: **Warren Johnson - phone 02 4721 0545**

Email: warrenj@aquacell.com.au

Revision	Date	By	Checked	Document Status	Amendments
R1	18/1/18	Gregor R.	Colin F.	Draft	Based on Tallowood SMP

Table of Contents

1. Introduction

The 67 Kurrajong Rd Residential Community Development is a 35-dwelling residential estate, being developed by the PRJM Pty Ltd. It located on the southern side of Kurrajong Road to the east of the intersection of Kurrajong Road with the Old Bells Line of Road. Kurrajong is located 75 kilometres north-west of Sydney, in the local government area of the City of Hawkesbury.

The development was approved subject to granting by IPART of a Network Operator License and Retail Supplier Licence and construction of a blackwater treatment plant with designated areas for sub-surface irrigation. Potable water is being supplied by Hawkesbury Council's existing potable water reticulation, however Council do not intend to provide sewer reticulation for this area.

An Aquacell S20 blackwater treatment plant is to be installed to service all 35 dwellings. The client will provide gravity sewer reticulation from each dwelling, as well as sub-irrigation reticulation adjacent to the treatment plant. There is no effluent reuse/recycling proposed for this site, only wastewater disposal. The treated effluent is to be discharged to the environment via sub-surface irrigation, in compliance with WICA and Council s68 approvals.

Blackwater treatment system, including the sewer and irrigation reticulation, is to provide an efficient, reliable and complete effluent wastewater disposal system for the entire 35 dwellings of the 67 Kurrajong Rd Residential Community Development, Kurrajong. The proposed Aquacell blackwater system is self-contained and does not place any demand on council's sewerage network. The treated effluent is disposed of via sub-surface irrigation of an allotted areas within the boundaries of the development. The proposed blackwater treatment plant will utilise wastewater discharged from the facility and irrigate via subsurface irrigation at a rate of 21kL/day.

Effective management of domestic sewage and wastewater is an important consideration for human health and the environment. Effective management of this facility requires the active involvement of the residential community representatives, the 67 Kurrajong Rd Community Association, as well as the system maintenance and operator contractor, Aquacell.

This Sewage Management Plan (SMP) is prepared in accordance with the requirements of the Local Government Regulations and WICA Network Operator and Retail Supplier Licence requirements.

The SMP is to regulate and manage the selection, design, installation, operation and maintenance of on-site sewage management systems. The benefits of an on-site sewage management plan are:

- Better catchment management;
- A consistent message to householders and on-site sewage operators;
- A coordinated approach to liaise with industry, including developers, professional consultants, private certifiers, service agents and plumbers.

2. Purpose and Scope of the Sewage Management Plan

The purpose of the on-site Sewage Management Plan is to:

- Guide landholders towards sustainable on-site management of domestic sewage and effluent water.
- Protect and enhance the quality of public health and the environment within the Kurrajong and Hawkesbury Shire Council Local Government Area (LGA).
- Assist landowner to prioritise resources for the efficient regulation and monitoring of On-site Sewage Management Systems.
- Coordinate monitoring, environmental assessment and data collection related to On-site Sewage Management.
- Allow for site assessment on risk management basis and consideration of alternate solutions on environmentally sensitive sites.

3. Objectives

The objectives of the On-Site Sewage Management Plan are to provide for the safe collection, treatment and disposal of wastewater generated by the 67 Kurrajong Rd community.

Sewage contains bacteria, viruses, parasites and other disease-causing organisms. Contact with effluent should be minimised or eliminated, particularly for children. Insects can also act as a vector for disease where they have access to effluent. Residuals, such as composted material, should be handled carefully. Treated sewage should not be used on edible plants that are consumed without cooking.

On-site Sewage Management systems should be selected, sited, designed, constructed, operated and maintained to ensure:

- **Protection of surface water -** surface waters are not contaminated by any flow from treated systems and land application areas (including effluent, rainfall run-off and contaminated groundwater flow).
- **Protection of groundwater -** groundwater will not be contaminated by any flow from either the treatment systems or land application areas.
- **Protection of land and vegetation -** land is not contaminated by any flow from treatment systems, effluent, rainfall run-off or removed tank solids.
- **Protection of community amenity -** quality of life shall not be unreasonably interfered with. Where possible, systems should enhance the local amenity - special consideration should be given to aesthetics, odour, dust, disease vectors and excessive noise.
- **Conservation and reuse of resources -** the resources in domestic wastewater (including nutrients, organic matter and water) should be identified and utilised as much as possible within the bounds posed by the other performance objectives; water conservation should be practiced and wastewater production should be minimised.

4. Goals

The goals of the On-site Sewage Management Plan are to:

- Ensure sustainable on-site sewage management for the 67 Kurrajong Rd Community development.

- Identify roles and responsibilities for the sewage management system.
- To identify communication channels for emergency response and complaints.

5. Roles and Responsibilities

The 67 Kurrajong Rd Residential Development blackwater system will be built by Aquacell and owned/managed by the 67 Kurrajong Rd Community Association (KCA). The system consists of an effluent treatment plant, sewage collection reticulation network and a sub-surface irrigation reticulation network for the disposal of the treated effluent. There is no effluent recycling or reuse on this site.

The following table defines roles and responsibilities of KCA and Aquacell, given the ownership and contract status.

Table 1: Roles and Responsibilities of 67 Kurrajong Residential Development Blackwater Treatment System

Role/Responsibility		Sewage Collection Network		Blackwater Treatment Plant		Irrigation Disposal Scheme	
		KCA	**Aquacell**	KCA	**Aquacell**	KCA	**Aquacell**
Blackwater Treatment System - Owner		X		X		X	
Treated Effluent - Supplier					X		X
SMP	Preparation and Approval		X		X		X
	Statutory reporting		X		X		X
	System audit		X		X		X
Operation and Maintenance	Operation		X		X		X
	Maintenance		X		X		X
	Logs: incident, maint., complaint, calibration, audit, non-compliance		X		X		X
	Water sample collection and forwarding				X		
	Management of water testing contract				X		
Manage Environmental Risk	Initial risk assessment and LCA per SMP		X		X		X
	Resident/neighbour education	X	X	X	X	X	X
Communication Strategy	Development	X	X	X	X	X	X
	Implementation	X	X	X	X	X	X
	Maintenance	X	X	X	X	X	X
	Feedback	X	X	X	X	X	X

Role/Responsibility		Sewage Collection Network		Blackwater Treatment Plant		Irrigation Disposal Scheme	
		KCA	**Aquacell**	KCA	**Aquacell**	KCA	**Aquacell**
	Evaluation	X	X	X	X	X	X
	Review	X	X	X	X	X	X
Incidents and Emergencies	Identification of potential incidents and emergencies	X	X	X	X	X	X
	Development of protocols, response actions, responsibilities and communications		X		X		X
Training of employees and contractors			X		X		X
Documentation and Reporting	Notification of non-compliances and incidents to DHS/EPA		X		X		X
Reviews	SMP		X		X		X

6. Overview of the Sewage Management System

The purpose of the overview is to outline factors that will affect the efficient and appropriate functioning of on-site Sewage Management Systems within the 67 Kurrajong Rd Residential Development.

6.1 Sewage collection

Sewage collected from the homes on the site flows by gravity through the sewerage network to the buffer collection tank.

6.2 Treatment Process

6.2.1 Overview

The treatment process has been selected based on application of the *Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 1)* (2006).

A risk minimisation approach has been adopted which involves the use of sub-surface irrigation and an irrigation area blocked to public access. In addition, as this is a waste disposal project, there is no reuse of treated water allowed. The risk of human contact with pathogens from the plant is therefore limited to workers on the plant and addressed in the use of safe work practises.

The treatment process will be MBR technology which is capable of achieving significant pathogen reduction and very high treated water quality. This, combined with an extremely low risk of human contact during normal operations, ensure that the risk to human health is eliminated.

The process selected to achieve the required water quality as discussed above, and described in further detail in the following sections, is shown below.

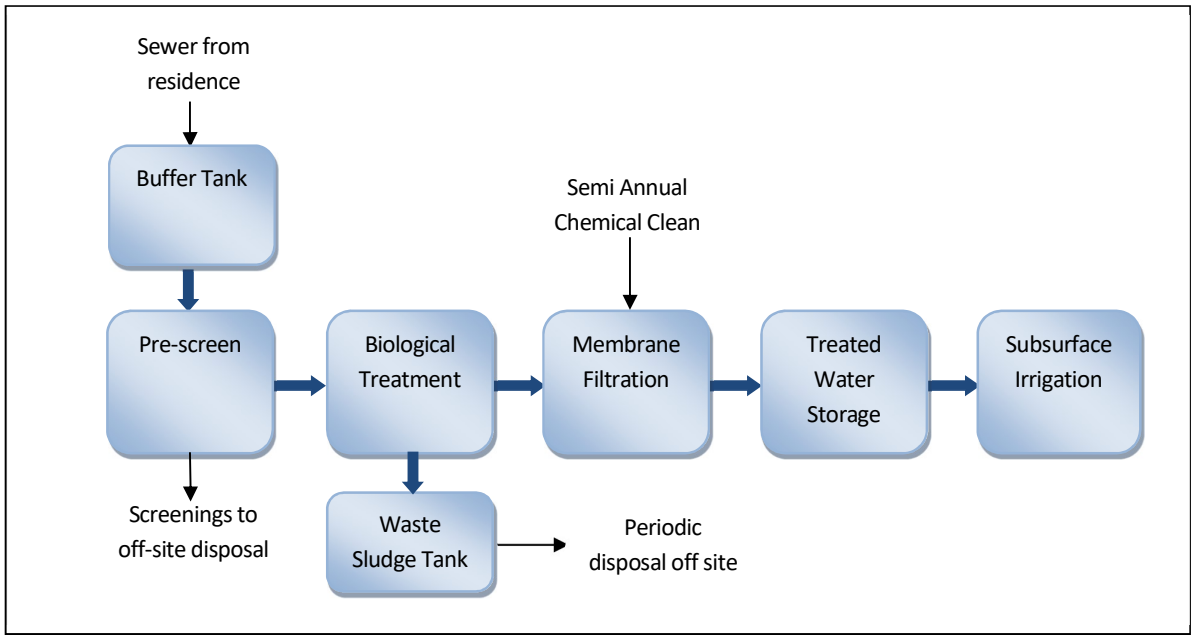


Figure 6.1 – Treatment process to achieve treated effluent fit for subsurface irrigation.

The expected wastewater quality and typical treated water quality is shown in table 6.2.

Table 6.2 Expected raw wastewater quality and typical treated water quality

Parameter	Expected Wastewater	Typical Treated Water
Biochemical Oxygen demand (BOD)	300-600 mg/L	< 20 mg/L
Suspended solids	200-400 mg/L	< 30 mg/L
pH	6.5-8.5	5.5 - 7.5
Oil and grease	< 50 mg/L	< 5 mg/L
Total nitrogen	85mg/L	< 18 mg/L
Total phosphorous	20 mg/L	< 8 mg/L
E. *coli*	10^6-10^8 cfu/100mL	< 10 cfu/100mL
Turbidity		< 2 NTU

6.2.2 Buffer Tank

Wastewater collected from the community residence is directed to a 100 kL concrete buffer tank. When the residential community is fully populated (i.e. 35 lots in total), 15.8 kL/day of wastewater will be produced. This buffer tank will provide up to 6 days storage capacity. Should the tank need to be emptied due to the treatment plant being off line, a tanker will be called in to empty the buffer tank and remove it for disposal off site.

6.2.3 Pre-screen

Wastewater is pumped from the buffer tank to the pre-screen on demand. The pre-screen is a 2mm spiral sieve screen. Screenings are captured, washed and dewatered, then discharged into a wheelie bin via a continuous bagging system. Screenings are sent off site to land fill.

Odours from screenings has been minimised by enclosing the pre-screen and ensuring that screenings are captured in a sealed bag.

The pre-screen is designed to remove fibrous material and large foreign objects, while retaining as little solid organic matter as practical. The screen wastewater is then sent to biological treatment.

6.2.4 Biological Treatment

The biological process uses aerobic treatment to break down and digest the organic matter that contributes to biological oxygen demand (BOD). The aerobic zone uses air blowers and diffusers to distribute air within the reactor to supply the necessary oxygen for biological digestion to take place.

6.2.5 Membrane Filtration

Ultrafiltration membranes (flat sheet 2x BC100 with nominal pore size 0.04 µm) are used to separate the biomass from the treated water. In addition to removing essentially all the suspended solids, a substantial amount of the pathogens present in the wastewater are also removed in this process step.

The membrane is an integral part of the biological process and the combination is usually referred to as a membrane bioreactor (MBR).

Periodic chemical cleaning of the membranes is required to maintain performance. This will be carried out using sodium hypochlorite and citric acid, and occur approximately once every 3-6 months. Spent chemicals will be neutralised and discharged to the sludge tank for periodic disposal.

6.2.6 Treated Water Storage

The final treated water will be sent to treated water storage tank, 46 kL in volume. The treated water is to be discharge to the environment via sub-surface irrigation.

6.3 Irrigation System

Treated water from the storage tank is automatically distributed to subsurface irrigation via an irrigation control system. The irrigation system is controlled independently from the treatment plant, and is based on level in the

treated water storage tank. When water is available, a pump sends water to one of five irrigation zones. Solenoid valves switch the irrigation zones in sequence and timers in the control panel control the duration of irrigation to each zone. This ensures no single area is over irrigated and minimises the risk of surface pooling.

7. Description of End Use

7.1 Overview

The treated water produced by the treatment process is intended for sub-surface irrigation disposal within the lower section of the 67 Kurrajong Rd Community development, and not for distribution beyond the boundaries of the irrigation area.

7.2 Acceptable Uses

The treated water is intended only for disposal by subsurface irrigation in the designated area within the 67 Kurrajong Rd development. The treatment process and associated risk has been assessed on that basis, and although the water quality may exceed the requirements, it is not intended for reuse or disposal by any other means.

8. Managing Human Health Risks

8.1 Overview

The report prepared by Martens Consulting Engineers, Concept Recycled Water Management Scheme – 67 Kurrajong Rd, Kurrajong NSW – October 2016 includes a preliminary risk assessment for managing human health risks. The document is attached as Appendix A.

This SMP focuses on the assessment and management of risks relating to the end uses of sub-surface irrigation.

A summary of the key human health risks and mitigation measures is provided in table 8.1, and detailed further in the following sections.

A HAZOP and HCCP analysis has been previously carried out for the nearby Tallowood project to assist in determining the risks and associated mitigation measures with that development and has been used as a template for this plan. A copy of the risk assessment is provided in Appendix B.

Table 8.1 – Summary of health risk and mitigation measures

Risk	Management Measures	Risk after mitigation
Workers exposed to recycled water	Exposure in minimised by: • No above ground uses. • Irrigation is subsurface, so no exposure to humans. • Signage will be provided to warn people of the use of treated water in allotted irrigation area. • Site inductions of workers and visitors to include reference to the presence of treated effluent and the necessary precautions to take.	Low
Connection to irrigation reticulation	• Plumbing check for connection before delivering treated water to irrigation network. • Site inductions for any plumbing staff to include details on treated effluent water use. • Any plumbing mods to have management approval and qualified certification and inspection. • Signage where treated effluent is being used to warn and advise precautions. • Sub-surface irrigation network does not cross connect with any other water (potable or otherwise) network.	Low
Inappropriate use	• No above ground treated effluent water taps. • All treated effluent reticulation is sub-surface and the reticulation network is isolated and not connected to any other network. The chance for human contact is minimal. • Signage will be displayed, where sub-surface irrigation is being carried out, to warn and advise precautions.	Low
Spray drift and runoff	• All irrigation is sub-surface. • No above ground irrigation, hence no spray drift possible. • No wet weather storage is required hence sub-surface irrigation possible all year round.	Low
Contaminants in water that are detrimental to health	• Chemical contaminant levels in the treated effluent are expected to be very low. No special management practises are required.	Low

8.2 Workers Exposed to Treated Effluent

The water quality of the treated effluent is such that health risks are minimal. However, it is important that on-site workers and people that may come into contact with treated effluent are educated about the presence of treated effluent on site. This includes washing hands before eating, drinking, or smoking.

Signage will be provided to warn people of the potential presence of treated effluent in the allotted irrigation zone.

Site inductions of workers and visitors should also include reference to the presence of treated effluent and the necessary precautions to take.

The above measures make this a low-level risk.

8.3 Cross Connections

There is no dual pipe system or recycled water taps located anywhere in the development. Reuse is not permitted and the disposal network will be largely inaccessible, underground, and sign posted.

The above measures are considered sufficient to eliminate cross connection risk.

8.4 Treated Effluent Outlets

There will be no above ground tap bibs that are fed with treated effluent. These will only be rainwater or potable water.

8.5 Spray Drift and Runoff

Treated effluent will solely be used for sub-surface irrigation of the allotted irrigation zone/area on site

Wet weather storage is not required on site. Refer to Effluent Management Investigations report prepared by Woodlots and Wetlands Pty Ltd. This report states that sub-surface irrigation is possible all year round (even during wet weather) as the soil characteristics and the area allocated enable irrigation all year round. The chance for runoff due to soil saturation is minimal.

These measures are sufficient to consider no spray drift will occur and determine runoff to be a low risk.

8.6 Contaminants

Chemical contaminant levels in the treated effluent are expected to be very low. No special management practises are required.

9. Managing Environmental Risks

9.1 Overview

A risk assessment approach will be undertaken to establish controls for environmental risks associated with the treated effluent treatment and use.

Various control and monitoring measures will be implemented to manage and mitigate environmental risks. Risks to be assessed include soil capability and irrigation risks, noise and odour. A summary of these is provided in table 9.1, and detailed further in the following sections.

Table 9.1 – Summary of environmental risks and mitigation measures

Risk	Management Measures	Risk after mitigation
Nutrients and salinity in irrigation water	• LCA conducted and confirms nutrient load is not an issue.	Low
Spray drift and runoff to the environment	• Spray drift prevented by using subsurface drip irrigation. • Runoff low level risk refer to LCA report	Low
Chemical contaminants in the water	• Chemical concentration in treated effluent is expected to be low. • Chemical usage on site is minimal and spent chemicals are neutralised and discharged to the sludge tank for periodic disposal off site.	Low
Noise	• Treatment plant is situated on site in a cut-away section in the hill side, which helps to reduce operational noise. Equipment that produces noise, such as blowers, are enclosed in noise reduction acoustic enclosures to minimise noise pollution.	Low
Odour	• Covered tanks and enclosed equipment used • Aerobic process, so septic smells are not expected	Low

9.2 Nutrients and Salinity

A land capability assessment has been incorporated into the Martens report for the 67 Kurrajong Rd Residential Community site and is attached as Appendix A. This assessment indicated that the irrigation area within this site do not contain saline soils. This is an important result as it means that salinity will not limit the site's usefulness for treated effluent irrigation.

The report concludes that there is minimal risk of any runoff occurring to the local water ways. The report further concludes that the expected concentration of nitrogen and phosphorus in the effluent do not represent a significant environmental risk.

10. Communication

The 67 Kurrajong Rd Community Association are to liaise with Aquacell to ensure existing and new residents are informed of the wastewater disposal system and how to ensure that it is protected from inappropriate disposal of wastes to the sewer.

This will include addition of community specific information to the Aquacell website, and attendance at community meetings as required.

11. Monitoring and Reporting

11.1 Monitoring

11.1.1 Monitoring of Treatment Plant Operation

Operational monitoring of the treatment plant is carried out by a combination of site visits for routine servicing and remote monitoring.

Routine service visits are carried out monthly for the purpose of checking and calibrating instruments, checking plant operation and performing chemical cleans on the membrane when needed. Periodic inspection of the irrigation field is also carried out to check for signs of water surface pooling or uneven irrigation.

Remote monitoring is used to allow daily checks on plant operation. Operating data are logged every 5-minutes to the Aquacell server to assist with trouble shooting and for reporting purposes.

System failures or operational issues are dealt with as they arise by Aquacell service personnel.

11.1.2 Validation Monitoring

In order to ensure the installed system is performing as intended, a series of 8 samples will be collected over 8 weeks and analysed as per table 11.1. A validation report will be prepared summarising these results.

The target water quality is based on the low risk of subsurface irrigation in an area with controlled and restricted access, as outlined in section 8.

Table 3.8 of the *Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 1)* (NHMRC 2006) is used as a guide to an appropriate water quality. This table provides guidance on the water quality objectives for various uses. As a conservative target the figures for "Landscape irrigation – trees, shrubs, public gardens, etc." can be used. This site has the additional mitigating measure of no public access and

subsurface irrigation. The additional monitoring parameter of membrane turbidity is added to ensure membrane integrity is maintained, as this provides the bulk of the required pathogen reduction.

Table 11.1: Verification Monitoring and target water quality

Parameter	Feed	Treated Water	Target Quality
E. *coli*	Weekly	Weekly	< 1,000 cfu/100mL
BOD	Weekly	Weekly	< 20 mg/L
Suspended Solids	Weekly	Weekly	< 30 mg/L
Turbidity	N/A	continuous	< 5 NTU

11.1.3 Ongoing Monitoring of Treated Water Quality

Treated water quality is monitored by reference to critical control point operating values. The turbidity of the treated water effluent is the critical control point for the plant and will be maintained at or below 5 NTU. An alert level will be maintained at > 2 NTU to give advance warning of a potential problem and trigger an investigation into the cause. If the turbidity exceeds 5 NTU the plant will shutdown and stop delivering water to the storage tank.

The treated water turbidity will logged every 5 minutes and stored on Aquacell's server.

The buffer capacity is sufficient to ensure the plant can be down for periods for service or breakdown, with offsite disposal of waste by pump out a fall-back option for extended periods.

As an added water quality monitor, treated water E. *coli* levels will be tested at least quarterly to ensure the water meets the requirement shown in table 11.1.

11.2 Complaints and Faults Procedure

A record of any complaints received shall be kept by Aquacell, as well as responses and any corrective actions taken. Aquacell will follow the complaints procedure as documented in IMS CS030-3 Complaints Handling and Dispute Resolution Policy. A copy is available on request.

12. Management of incidents and emergencies

Aquacell maintains a community contact and FAQ section of its website with procedures relating to the management of emergencies. This will be updated to include the 67 Kurrajong Rd Community Association.

The specific responses to potential incidents and emergencies have been compiled with reference to IPART Incident Notification by private sector water licensees, WICA 2006, Water – Incident Notification August 2009, Section 2, Incident Notification Process.

Table 12.1: Incidents and emergencies

Hazards and events that may lead to emergencies	Immediate Response		Corrective Action		Authorities	
	What	Who	What	Who	What	Who
Non-conformance of water with critical limits	If detected by online instrument, plant automatically shuts off supply	Aquacell	If fault persists, Aquacell to disable effluent disposal and notify the 67 Kurrajong Rd Community while they continue to troubleshoot and resolve.	Aquacell	Has non-compliant water been discharged? If yes, notify authorities in accordance with WICA licence conditions.	Aquacell
Response to exceedances of water quality targets	If detected by water testing, evaluate severity to determine whether plant should be shutdown. Order immediate reset.	Aquacell	If fault persists, Aquacell to disable effluent disposal and notify the 67 Kurrajong Rd Community while they continue to troubleshoot and resolve.	Aquacell	Has non-compliant water been discharged? If yes, notify authorities in accordance with WICA licence conditions.	Aquacell
Accidents that increase level of contamination in source water	Collection tank continuously monitored for pH. Feed pump disabled when pH outside limits.	Aquacell	Aquacell to review cause and treat if possible. If not possible to treat safely, arrange pump out.	Aquacell		
Equipment breakdown and mechanical failure	Blowers and pumps are alarmed for malfunction. Alarm received by operator. Operator to log in and inspect operation of plant. Disable plant if required.	Aquacell	Repair	Aquacell		
Cross-connections	Not applicable – no reuse in place.					
Gas build-up	As this an outdoors plant, the risk of harmful concentrations of hazardous gases such as methane and ammonia is extremely low.	Aquacell	Investigate any odour complaints or unusual odour occurrences.	Aquacell		
Prolonged power outages	Power failures cause delivery pumps and filtrate solenoid valves to shut. There is sufficient buffer capacity to hold water for at least several days. Power outages beyond this are unlikely.		If buffer tanks fills during a prolonged power outage, arrange pump out.	67 Kurrajong Rd		

Aquacell, as the contracted operator and licence holder will immediately notify the appropriate authorities of any incident that potentially places public health at risk in accordance with the WICA general regulation 2008, Schedule 1, Part 1, cl. 1(2)(a,b) and Schedule 2, Part 1, cl. 1(2)(a,b)

IPART and NSW Health will be notified immediately by Aquacell if any of the following incidents occur:

- An emergency or incident that potentially places public health at risk.
- Any changes to the SMP or operation of the treatment process that may potentially impact achieving the required water quality objectives.

NSW Health information is:

C/- Nepean Hospital
Derby Street
PENRITH NSW 2750
Phone: 02 47342022

EPA NSW

Phone: 131 555

67 Kurrajong Rd Community Association primary contact person is:

TBA…

Aquacell Primary contact for notifications is:

Justin Taylor	General Manager, Aquacell
Address:	64 Alexander St Crows Nest NSW 2065
Phone:	02 4721 0545
Mobile:	0417 652 079
Email:	justint@aquacell.com.au

If an incident occurs, Aquacell are responsible for completing an incident report using a form provided in Appendix C.

13. Operator, contractor and end user awareness and training

All employees, including contractors, that are working on the blackwater treatment system must be appropriately trained, and qualified, and records kept by their employer to document training. It is the responsibility of the Aquacell to ensure that their staff and subcontractors are suitably qualified and trained to carry out work on the recycled water system.

Aquacell operators are made aware of approval conditions and instructed on occupational health and safety requirements as part of their training. An induction program helps ensure new employees understand what is required and operate accordingly.

Training needs for individual Aquacell employees are identified and adequate resources made available during the induction phase. Annual performance reviews help identify additional training requirements and set performance targets. Training records are kept at the Aquacell head office.

The 67 Kurrajong Rd Community Association is provided with a copy of the SMP and additional awareness information is available in the Aquacell website.

14. Community involvement and awareness

All residents and potential residents are made aware of the existence of the on-site wastewater treatment system on disposal areas during the early stages of their move or planned move to the community. The area where the treatment plant is located and the disposal field are clearly marked.

The association is provided with a copy of the SMP which is available to all members of the community. Additional general and site-specific information is provided on the Aquacell website.

15. Research and development

The design and operation of the backwater plant is the responsibility of Aquacell. The technology used is state of the art, and is continually being improved through experience and active research. Any improvements that are identified will be presented to TRC for assessment of potential savings or improvements in efficiency.

Aquacell continuously monitor the regulatory environment. Any changes to regulations that potentially alter the operating requirements of the plant will be assessed. Where appropriate these changes can be made to ensure the required water quality is met in the most efficient and economical way.

16. Auditing, review and improvement programs

This SMP will be reviewed on an annual basis or when a major change or addition to the blackwater treatment system is implemented. The review will take into consideration changes to:

- Customer base
- Water quality
- WICA guidelines

Appendix A – Recycled Water Management Scheme Report (Martens Report)

Appendix B – HAZOP and HCCP

Appendix C – Incident report

Appendix 4.3.10.2 Draft IOP 67 Kurrajong Rd - REVISED

Infrastructure Operating Plan

Blackwater Disposal Scheme

Sites included under this Plan are:

67 Kurrajong Rd Community Development, Kurrajong NSW 2758

Aquacell Pty Ltd

64 Alexander Street, Crows Nest NSW, Australia
PO Box 7, Crows Nest 2065, Australia
P: +61 2 4721 0545
www.aquacell.com.au
ABN 79 072 487 015

Contents

1. DOCUMENTATION CREATION AND REVIEW

Revision	Date	Author	Reviewer	Comments
Draft	17 January 2018	Gregor R.	Colin F.	Draft based on Tallowood IOP

2. EXECUTIVE SUMMARY

This IOP contains important information regarding the following recycled water scheme:

AQUACELL PROJECT NO:	A0111
MODEL NUMBER:	Aquacell S20
YEAR OF CONSTRUCTION:	2018
OWNER:	**67 Kurrajong Rd Community Association**
	c/- [TBA]
APPLICATION:	**Blackwater Water Recycling and sub-surface irrigation**
LOCATION:	**67 Kurrajong Rd,**
	Kurrajong NSW 2758

1. The wastewater disposal system consists of the following main elements
   - Gravity sewer reticulation to each dwelling to a single 100kL collection tank.
   - A blackwater treatment plant located on the lowest point on the east side of the development.
   - Treated effluent sub-surface irrigation, including irrigation reticulation. The designated irrigation area is within the boundaries of the development and has restricted access to the community and public.

2. The wastewater is sourced from each of the 35 dwellings within the proposed development.

3. The design Capacity of blackwater treatment plant is 21kL/day. The wastewater is collected into a 100kL Buffer Tank, providing approximately 6 days storage.

4. The system is managed according to this Infrastructure Operating Plan (IOP) that has been developed specifically for this site, in accordance with Aquacell's obligations under:
   - the Water Industry Competition Act 2006
   - Aquacell Pty Ltd Network Operator's Licence – In progress
   - Aquacell Pty Ltd Retail Supplier's Licence – In progress
   - Section 68 of the Local Government Act

Aquacell, as the licensee, will ensure that the Infrastructure Operating Plan is fully implemented, is kept under regular review and all of its activities are carried out in accordance with this plan. Aquacell will, if the Minister so directs, amend this IOP in accordance with the Minister's direction.

The Minister or IPART will be provided with a report, prepared by an approved auditor, if any significant change is made to this Infrastructure Operating Plan.

3. WICA LICENSES

The water industry infrastructure referred to in this license are covered under the following Water Industry Competition Act (WICA) Licenses:

- Network Operator's Licence – application in progress
- Retail supplier's licence – application in progress

The Network Operator's License has been obtained in accordance with the Water Industry Competition Act (2006) and the associated Regulation.

The Network Operator's License and Retail Operator's License application have been submitted to IPART and are yet to be approved.

4. PERFORMANCE CRITERIA AND LEVEL OF SERVICE

Plant performance and level of service are measured against two key indicators:

- Quality – the delivered water quality set out in the current revision of the Sewage Management Plan.
- Quantity – the volume agreed and documented with the end user. Where the user does not specify a quantity, the plants rated capacity is the upper limiting quantity.

Plant performance is monitored as follows:

- Quality – critical control points ensure that product which does not meet the required treated water quality is not transferred for irrigation. Out of specification water would be removed for offsite disposal
- Quantity – flowmeters record the total treated water and this volume is reported in a monthly report to the customer.

The end user is supplied with a monthly report which summarises the plants performance during the month. It includes:

- Volume of treated water supplied
- Summary of activities which have been undertaken on the plant during the reporting period
- Significant upcoming work which may need to be undertaken

5. ASSET MANAGEMENT

The assets covered by this plan are used for the reticulation, treatment, storage, conveyance and disposal of sewage. This includes pipes, tanks, pumps, aerators, valves, instrumentation and the electrical and

control systems associated with these items. The operation and maintenance manual provides a detailed equipment schedule.

All assets are installed with the area of Operation defined in the Network Operator's License at the 67 Kurrajong Rd residential development in Kurrajong. This area is formally defined as Lot 1 in DP1185012.

Aquacell reproduced the Asset Replacement Risk Assessment for the Tallowood development for the purposes of this report. The risk assessment considers production, financial, health and environment impacts. This risk assessment is included in Appendix A. This risk assessment is used to determine asset replacement and maintenance strategies.

5.1. Asset Replacement Strategy

The asset replacement risk assessment in Appendix A indicates the risk of unforeseen or unpredicted failures which interrupt service are low. The treatment plant has significant upstream and downstream buffering which creates opportunity to undertake work on the plant without interrupting service to the end user. Assets are relatively low cost and preventative or predictive activities will often exceed the cost of the asset. For this reason, the asset replacement strategy is generally reactive. A detailed justification of this approach is included in Section 5.2.Maintenance Strategy

Aquacell has listed plant assets and their life expectancy in the Asset Replacement Schedule shown in the Operations and Maintenance manual and repeated as Appendix B in this document. This schedule allows Aquacell to forecast asset replacements over an extended period, and budget accordingly.

5.2. Maintenance Strategy

The asset replacement risk assessment indicates that equipment failures have low consequence and minimal impact on the end user. This analysis has been used to determine the most appropriate maintenance strategy for the plant.

The treatment plant is subject to routine servicing by an Aquacell Service Technician. The purpose of these visits is to check the plant and undertake preventative activities to ensure the plant operates without interruption. Equipment is serviced and maintained in line with manufacturer's recommendations and Aquacell's experience.

When considering scheduled replacement of assets, the approach has a reactive component. This is a deliberate approach made after consideration of the asset replacement risk assessment contained in Appendix A which highlights the following conclusions:

- The plant will automatically shut down if an asset fails. This ensures there are no uncontrolled discharges of out of specification water to the environment
- There is significant buffer tank capacity at the head of the works to cover short term plant interruptions. The buffer tank has 100kL capacity and the calculated demand at full development is 15.8 kL/day. The buffer tank represents 6 days of storage capacity for incoming sewage.
- Aquacell attend site regularly as part of a service regime. Service Technicians are able to observe equipment in operation and detect changes in equipment performance that require further investigation
- The treatment plant is remotely monitored on a daily basis by Service Technicians who are able to note changes in operation that may be early indicators of asset failure, for example membrane turbidity and blower pressures

- Components are locally sourced and readily available from suppliers. Typically, items are on the shelf, or have very short lead times.
- The plant is located in western Sydney which is close to Aquacell's Werrington office meaning that technicians can be dispatched to site quickly if required
- The plant is located on the edge of the metropolitan area meaning that on the shelf parts can be sourced and delivered to site within a few hours
- The skills and expertise required to undertake asset replacement are readily available through contractors should Aquacell staff be unavailable to complete the task
- Some plant components have a duty-standby arrangement which allows the plant to operate even in the event of the failure of one unit
- Many assets are relatively low cost compared to the cost of undertaking preventative maintenance activities, ie, the cost to replace pump bearings can exceed the cost of the pump
- Asset components are typically low cost relative to the cost of predictive analysis such as oil sampling, vibration analysis or thermal imaging. Predictive maintenance is not considered a cost effect approach.

For the above reasons, Aquacell will service plant and equipment as per manufacturer's recommendations, however a run to fail approach will typically be adopted for replacement of assets. Where a Service Technician observes early symptoms of failure for any asset, the asset will be replaced prior to failure.

Aqaucell's service division hold a limited number of consumables and common spare parts which can be used during routine servicing and breakdown. Typically, spare parts specific to the site will not be held in stock for the following reasons:

- some components of the plant are set up in a duty standby configuration
- spare parts are readily available or substituted by an alternate supplier's product or hire unit as identified in the control measures of the asset replacement risk assessment.

The magnitude of the buffer capacity enables maintenance activities to be carried out at any time. The end user is advised where there are significant works or there is a prolonged interruption to the provision of treatment services.

Aquacell are wholly responsible for the maintenance of the infrastructure and do not subcontract out regular maintenance to any third parties. Where required, some tasks are subcontracted to qualified suppliers to complete works for which Aquacell does not have the requisite expertise in house, eg, electrical work. Aquacell coordinate the activities and retain overall responsibility for the tasks.

6. SEWAGE MANAGEMENT PLAN

The Sewage Management Plan for the 67 Kurrajong Rd Residential Community Development has been prepared in accordance with WIC Act and is the reference document for managing the sewage treatment on site. The current document is Revision 1 and a copy is available on the server at the following location:

S:\Projects\Aquacell Projects\XXXXXXX

7. RETAIL SUPPLY MANAGEMENT PLAN

The retail Supply Management Plan relates to Aquacell's intention, conduct and practices when supplying water under its Retail Supplier's Licence under WICA. In addition, this retail supply management plan

addresses the events and circumstances that could adversely affect Aquacell's ability to supply services to its customers, and the probability of occurrence of any such event. Included are the measures taken to minimise the effect of the occurrence and arrangements made to arrange alternate supplies. This document will be prepared to comply with the WICA legislation Schedule 2 clause 8 and accessible on Aquacell's corporate server.

8. OPERATIONS AND MAINTENANCE MANUAL

This manual sets out to identify the systems, applications, materials and approach which were the basis for the construction of the project. This document will be prepared and be available and accessible on Aquacell's corporate server.

9. OTHER SUPPORTING DOCUMENTATION

9.1. Aquacell's Website

The website is regularly updated and contains information about Aquacell, the Management team, systems, projects and case studies of operations. The site also contains community information, brochures and FAQ's along with information for plumbing contractors.

www.aquacell.com.au

9.2. Audit Reports

The findings contained in any audit reports will be used as the basis for documentation and procedural modifications as part of Aquacell's commitment to continual improvement. Audit reports are available on Aquacell's website.

www.aquacell.com.au

10. INFRASTRUCTURE - DESIGN AND CONSTRUCTION

10.1. History of Development

The 67 Kurrajong Rd Residential Community Development is a 35-dwelling residential estate, being developed by the PRJM Pty Ltd. It located on the southern side of Kurrajong Road to the east of the intersection of Kurrajong Road with the Old Bells Line of Road. Kurrajong is located 75 kilometres north-west of Sydney, in the local government area of the City of Hawkesbury. The development was approved on 30 June 2017 and made subject to granting by IPART of a Network Operator License and Retail Supplier Licence and construction of a blackwater treatment plant with designated areas for sub-surface irrigation.

10.2. New Works covered under existing Network Operator's License

As the holder of the WICA Network Operator's License, Aquacell are responsible for ensuring that all infrastructure is designed and constructed in compliance with all relevant regulations, codes, standards and license conditions. To that end, all new works, inclusive of alterations to any infrastructure must be described to, and approved by Aquacell prior to any works being undertaken.

In reviewing the proposed work, Aquacell will consider the following to determine if the

- The type of waste which will be generated
- The volume of waste which will be generated
- The ability of the treatment plant to process the type and quantity of waste nominated
- If all appropriate approvals are in place
- If the works are compliant with the conditions of the Network Operators License

10.3. Design and Construction of Sewerage Networks

Hawkesbury City Council have clear guidelines pertaining to expected standards governing subdivisions and other development works. The Council publishes the *Hawkesbury Development Control Plan 2002* that outlines their design and construction expectations.

Within the Hawkesbury Development Control Plan, Appendix E, Part 1, Section 9 specifically considers sewerage. The stated purpose of the Section is:

> *The purpose of this document is to provide some guidance to Developers submitting sewer designs for assessment and approval. It covers how to determine whether a project is a major or minor work, procedures regarding application, design criteria that differ from Sydney Water or the Department of Land and Water Conservation and items that are frequently overlooked when preparing a design.*

In submitting a Development Application, applicants are expected to comply with these requirements. An approved Development Application from the Council is a positive indicator to Aquacell that the design of a sewage system is compliant with local authority requirements. While local authority compliance is essential, it does not necessarily imply compliance with all conditions of the Network Operator's License. Aquacell will consider if there are any gaps with the granted approval DA documentation and Network Operator's License requirements.

Hawkesbury City Council generally requires inspections and "as executed" drawings to be submitted to confirm the sewerage network has been constructed as designed. Again, this is a positive indicator that local authority requirements have been satisfied, and once Aquacell receive confirmation of this, it will consider if there are any further requirements to comply with Network Operator's License requirements.

10.4. Design and Construction of Treatment Plant

Aquacell will design the sewage treatment plan to meet the requirements of the Martens report – On-Site Sewage Treatment Plant Specification, Community Title Development at 67 Kurrajong Rd, Kurrajong NSW dated 24 October 2017.

10.5. Design and Construction of Irrigation Disposal Areas

The design and construction of irrigation disposal areas will be the responsibility of the developer and will meet the requirements of the Martens report – Concept Recycled Water Management Scheme – 67 Kurrajong Rd, Kurrajong – October 2016.

11. CONNECTIONS TO SEWERAGE NETWORK

As the holder of the WICA Network Operator's License, Aquacell must approve all new connections made to the sites sewerage network. Aquacell must be made aware of all proposed connections to the network by the proposed connector by completing an Application for Connection to Aquacell Network. The application to connect will be assessed to determine if the type of sewage and the expected volumes can be handled within the capacity of the existing infrastructure.

The following steps must be undertaken by an applicant to establish a new sewer connection in the 67 Kurrajong Rd Residential Community Development:

- The applicant must complete a NSW Fair Trading Notice of Work for Plumbing and Drainage and follow NSW Fair Trading's process including payment of any fees.
- The applicant completes an Application for Connection to Aquacell Network and attaches the completed Notice of Work. Once Aquacell has this information they will consider the application. The connection will be assessed on the basis of:

    - Type of waste which will be discharged
    - Volume of waste which will be discharged
    - The ability of the existing infrastructure to handle the proposed waste stream
    - Whether or not the proposed connection will impact on other users of the system

    Aquacell may seek further information or clarification from the applicant prior to making a determination on the application.
    No connection works shall commence prior to Aquacell approving the application to connect.
- The connection work is undertaken
- The plumbing contractor completes and submits the NSW Fair Trading Certificate of Conformance for Plumbing and Drainage and has the work inspected as appropriate.
- Within 21 days of the connection the applicant supplies Aquacell with copies of the Certificate of Conformance, and Sewer Service Diagram for the works which were completed.

A copy of the Application for Connection to Aquacell Network can be found in the following location:

S:\Projects\Aquacell Projects\xxxxx

12. EMERGENCY PUMP OUT AND REPAIRS

Emergency and incident response actions are outlined in the sites Sewage Management Plan and the Operations and Maintenance Manual. Throughout this documentation, and in the various risk assessments that support them, it has been identified that the buffer tank, and or the irrigation storage tank may need to be pumped out from time to time. Listed below are local contractors who could be contacted to pump out the tanks:

No Fuss Liquid Waste
12/8-10 Smith Street
Emu Plains, NSW, 2750
02 4735 8966
Open 24 hours

Remondis Liquid Waste
32-36 Christie Street
St Marys. NSW 2750
02 9623 4733
13 73 73

JJ Richards
20 Tucks Road
Seven Hills, NSW, 2147
02 9832 4022

Similarly, emergency response to line breaks or blockages will be repaired by local plumbing contractors who are available for response. Local plumbing contractors offering 24/7 service who could be called upon are:

A1 Pronto Plumbing
PO Box 430,
Riverstone, NSW, 2765
1300 184 176

Active Plumbing
Richmond, NSW, 2753,
1300 651 965

Edinburgh Plumbing
6 Christine Street
South Penrith, NSW, 2750
02 4736 4536

The above contacts are indicative only for emergency reference. Other contractors could be called upon as required. The 67 Kurrajong Rd Community Association may have established commercial relationships with local plumbers who could also be called on.

GLOSSARY

WICA	Water Industry Competition Act
IPART	Independent Pricing and Regulatory Tribunal
IOP	Infrastructure Operating Plan

13. APPENDIX A – ASSET REPLACEMENT RISK ASSESSMENT

Project Name:	67 Kurrajong Rd Residents Association
Date of Assessment:	17 January 2018
Revision:	Revision 1
Created	Justin Taylor
Approved	Colin Fisher
Personnel Consulted	Justin Taylor, Warren Johnson Simon Grimwood

Activity	Risk	Impact	Unmitigated Risk					Control Strategy	Mitigated Risk				
			Likelihood		Consequence		Risk		Likelihood		Consequence		Risk
Operation	Production - Asset failure on the treatment plant during operation	Sewage treatment plant may not be able to operate and treat water for disposal	4	Likely	3	Moderate	7	-Service routine in place to visit site at predetermined intervals. - Equipment inspected during routine service visits to detect early signs of failure - a selection of components have duty standby arrangement to allow plant to continue operation - buffer tank capacity is 6 times the daily demand providing a significant window to arrange repair or replacement of asset.	1	Rare	1	Insignificant	3
	Production - Asset failure on the treatment plant goes undetected	Treatment plant may go into alarm and not be detected resulting in delayed response to asset failure	3	Possible	4	Major	7	- remote monitoring used to monitor plant status and report faults - plant automatically protects against any event the leads to out-of-specification water through CCP's - Daily checking of plant status to detect equipment failures - Routine service visits to site to inspect equipment - buffer tank capacity is 6 times the daily demand providing a significant window to arrange repair or replacement of asset.	2	Unlikely	1	Insignificant	3

Production - Replacement asset for the treatment plant has long lead time	Treatment plant may not be able to operate for an extended period until the part becomes available	3	Possible	5	Extreme	8	- All parts locally sourced and held in stock by suppliers (subject to prior sale) - assets are typically off the shelf products that have not been customer designed or are unique to the plant - assets are small scale for the industry and therefore readily available - Some assets could be substituted with an alternate manufacturer's equivalent - Many manufacturers has a facility to hire or loan a piece of equipment if required - Many parts could be substituted with a unit form a general hire company	2	Unlikely	1	Insignificant	3
Production - Service response time to asset failure	Treatment plant may not be able to operate for an extended period because a service technician is unavailable	3	Possible	3	Moderate	6	- Aquacell has Sydney based Service Technician and can have a same day response if required - Aquacell has multiple staff in the Sydney office who could respond to assess the situation if the Service Technician was not immediately available - Buffer tank capacity is 6 times the daily demand providing a significant window to arrange repair or replacement of asset.	2	Unlikely	1	Insignificant	3
Production - Installation of replacement asset takes an extended period of time due to its complexity.	Water treatment plant may not be able to operate for an extended period while the asset is replaced	3	Possible	3	Moderate	6	- All assets on the plant could be replaced within one working day	2	Unlikely	1	Insignificant	3
Production - Ongoing, unforeseen failure of equipment	Excessive maintenance costs and extended down time	3	Possible	3	Moderate	6	- Aquacell designed the plant and ensured that all assets specified are fit for purpose and match industry standards	2	Unlikely	1	Insignificant	3

Production – failure of a component in the irrigation disposal network	Treated water cannot be disposed and plant has to stop treating once the treated water tank is full	4	Likely	3	Possible	7	- the irrigation system is sub-surface and has limited moving parts, generally only solenoid valves and a pump. - the irrigation system is very basic in size and operation. If a failure occurs, solenoid valves and irrigation controllers are readily available off the shelf. A replacement pump could be hired in the unlikely event that the unit was not available of the shelf - treated water could be carted for off-site disposal if a prolonged outage was required - Buffer tank capacity is 6 times the daily demand providing a significant window to arrange repair or replacement of asset.	2	Unlikely	1	Insignificant	3
Production – failure of a component in the sewage collection network	Treated water cannot be transferred to the treatment plant	4	Likely	2	Minor	6	- the network is gravity flow and not dependent on any pump stations or other moving parts - where a line break or blockage occurs, the location is metropolitan so local contractors are readily engaged on an emergency call out arrangement to undertake repairs	4	Likely	1	Insignificant	5
Personnel - appropriate personnel are not available to undertake and asset replacement	Treatment plant may not be able to operate for an extended period while personnel are sourced	2	Unlikely	3	Moderate	5	- Aquacell technical staff could supervise asset replacement by qualified trades man if required - Many asset suppliers are local and offer personnel who could be subcontracted to undertake the work	2	Unlikely	1	Insignificant	3
Financial - asset failure during operation and there are no funds available to repair or replace item	Plant may remain idle until funds are available to make repairs	3	Possible	4	Major	7	- Asset replacement allowance included in service agreement to replace assets as required - Budget for asset replacement based on asset replacement forecast and known costs of components - buffer tank capacity is 6 times the daily demand providing a significant window to arrange repair or replacement of asset.	2	Unlikely	1	Insignificant	3

	Health - asset failure allows out of specification water to be transferred for end use	Customers exposed to pathogens	3	Possible	4	Major	7	- CCP's in place to control transfer of treated water to ensure it is within specifications - Equipment designed to fail safe, eg, instrumentation will go off scale and fall outside CCP's - Plant programed to go to critical alarm when there parameters go outside CCP's - Remote monitoring of plant allows all parameters to be viewed remotely	2	Unlikely	1	Insignificant	3
	Environment - asset failure allows out of specification water to be disposed of to the environment	Uncontrolled discharge to environment	2	Unlikely	2	Minor	4	- CCP's in place to control transfer of treated water to environment to ensure it is within specifications - Equipment designed to fail safe, eg, instrumentation will go off scale and fall outside CCP's - Plant programed to go to critical alarm when their parameters go outside CCP's - Remote monitoring of plant allows all parameters to be viewed remotely	2	Unlikely	1	Insignificant	3
Maintenance	Production - normal servicing of equipment creates plant down time	Treatment plant cannot treat sewage for customer during this period	5	Almost Certain	1	Insignificant	6	- buffer tank capacity is 6 times the daily demand providing a significant window to arrange repair or replacement of asset. - many service activities can be carried out without interrupting operation of the plant - where practical, service work timed to have minimum disruption to production	1	Rare	1	Insignificant	2
	Production - asset replacement activities create plant down time	Treatment plant cannot treat sewage for customer during this period	5	Almost Certain	2	Minor	7	- buffer tank capacity is 6 times the daily demand providing a significant window to arrange repair or replacement of asset. - many service activities can be carried out without interrupting operation of the plant - where practical, service work timed to have minimum disruption to production	2	Unlikely	1	Insignificant	3

Note: Risks assessed using Aquacell's Risk Management Procedure documented in RM030 Revision 5.

14. APPENDIX B – ASSET REPLACEMENT SCHEDULE [UPDATE]

ASSET REPLACEMENT SCHEDULE

Project No & Name:	S0069
Site Location:	Tallowood Residential Development
Customer:	Tallowood Community Association
Done By:	Justin Taylor
Date:	11 Janary 2016
Version:	1

Asset Replacement Schedule

Serial	Description	Year																																																										
		1				2				3				4				5				6				7				8				9				10				11				12				13				14				15			
		3	6	9	12	3	6	9	12	3	6	9	12	3	6	9	12	3	6	9	12	3	6	9	12	3	6	9	12	3	6	9	12	3	6	9	12	3	6	9	12	3	6	9	12	3	6	9	12	3	6	9	12	3	6	9	12	3	6	9	12
1	**Membranes**																				X																				X																				X
2	**Tanks**	**20 years**																																																									
3	**Pumps**																																																										
	Submersible Pumps																				X																				X																				X
	Centrifugal Pumps																				X																				X																				X
4	**Blowers**																																																										
	Biological tank blower																																X																												
	Membrane tank blower																																X																												
5	**Motors**																																																										
	Screen Motor																																								X																				
	Mixer Motor																																								X																				
6	**Monitoring Equipments**																																																										
	DO meter																				X																				X																				X
	DO Probe								X								X								X								X								X								X								X				
	pH meter																				X																				X																				X
	pH Probe		X		X		X		X		X		X		X		X		X		X		X		X		X		X		X		X		X		X		X		X		X		X		X		X		X		X		X		X		X		X
	Turbidity meter																				X																				X																				X
	Turbidity Probe								X								X								X								X								X								X								X				
	Level Transmitters																				X																				X																				X
7	**Valves**																																																										
	Solenoid valve																				X																				X																				X
	Actuated valve																				X																				X																				X
	Butterfly valve	**No Limited Lifetime. Only replace when problem raise**																																																									
	Ball valve (PVC)	**No Limited Lifetime. Only replace when problem raise**																																																									
	Check valve	**No Limited Lifetime. Only replace when problem raise**																																																									
8	**Diffusers**																				X																				X																				X
9	**Others**																																																										
	PLC	**Unlimited life. Only replace when problem raise**																																																									
	Irrigation Controller	**Unlimited life. Only replace when problem raise**																																																									
	Irrigation Pipework	**Unlimited life. Only replace when problem raise**																																																									
	Sewage Pipework	**Unlimited life. Only replace when problem raise**																																																									
	Screen	**Unlimited life. Only replace when problem raise**																																																									
	Float Switches	**Unlimited life. Only replace when problem raise**																																																									
	Brush												X												X												X												X												X

STATEMENT OF ENVIRONMENTAL EFFECTS

Appendix 4.3.12.1 SEE Nexus 2016 - Kurrajong - RESUBMITTED

COMMUNITY TITLE SUBDIVISION OF ONE (1) LOT INTO THIRTY SEVEN (37)

No.67 KURRAJONG ROAD

KURRAJONG

© SIX Maps

NEXUS
Environmental Planning Pty Ltd
ABN 58 061 284 615

STATEMENT OF ENVIRONMENTAL EFFECTS

COMMUNITY TITLE SUBDIVISION OF ONE LOT INTO THIRTY SEVEN

No.67 KURRAJONG ROAD

KURRAJONG

26 July 2016

Prepared by:
Nexus Environmental Planning Pty Ltd
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B3163

Table of Contents

1. INTRODUCTION

Nexus Environmental Planning Pty Ltd has been requested by PRJM Pty Ltd (**the Applicant**) to prepare a Statement of Environmental Effects (**SEE**) to accompany a Development Application to Hawkesbury City Council (**the Council**) for subdivision of the existing lot into thirty seven (37) Community Title lots at No.67 Kurrajong Road, Kurrajong **(the Site**). The location of the Site is shown on **Figure 1**.

Figure 1: Site Location Map. © GOOGLE Maps

2. THE SITE

The Site has an area of 3.25 hectares and is legally defined as:

Lot 1, DP 1185012
No.67 Kurrajong Road
KURRAJONG

The Site is owned by PRJM Pty Ltd. A copy of a NSW Land and Property Information Title Search is at **Attachment 1** with a copy of DP 1185012 at **Attachment 2**.

The Site is located on the southern side of Kurrajong Road to the east of the intersection of Kurrajong Road with the Old Bells Line of Road.

An extract from an aerial photograph of the Site is at **Figure 2**.

Figure 2: Extract from an aerial photograph of the Site. © SIX Maps

A cadastral map is at **Figure 3**.

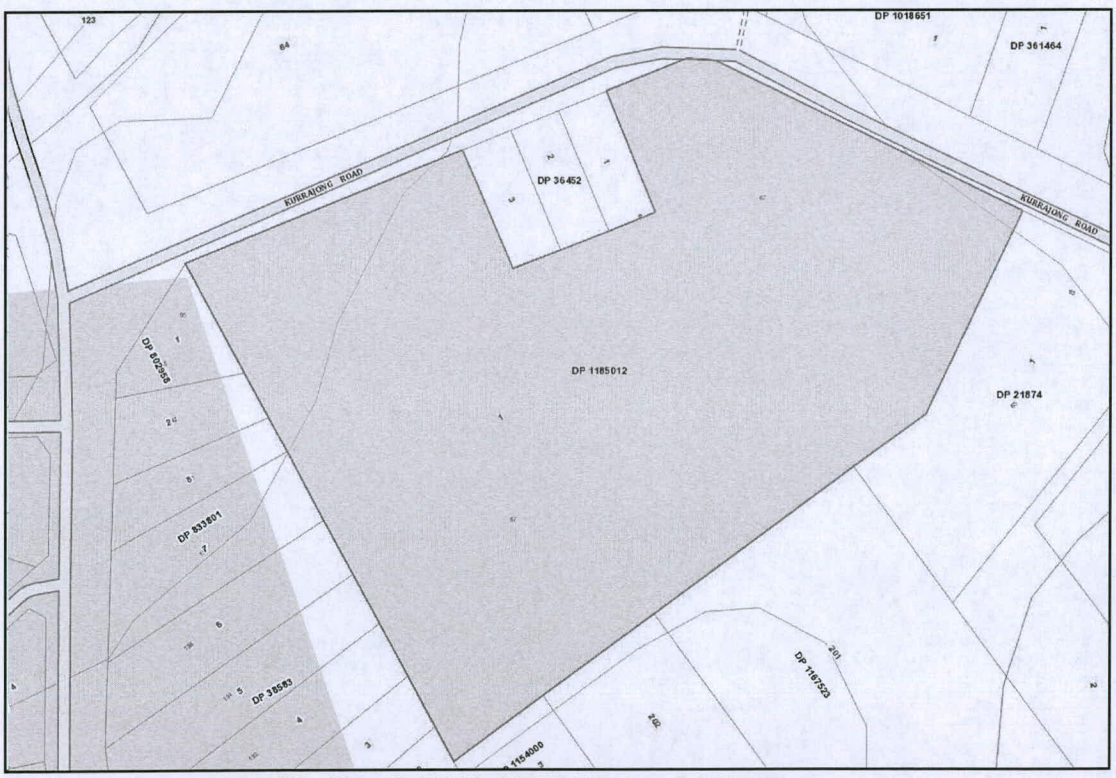


Figure 3: Cadastral Map of the Site with the Site highlighted in yellow. © SIX Maps

The Site is currently vacant land.

A ridge runs through the centre of the Site and slopes away from that ridge towards Kurrajong Road. An extract from the Council contour plan of the Site is at **Figure 4**.

Development in the vicinity of the Site comprises low density residential development.

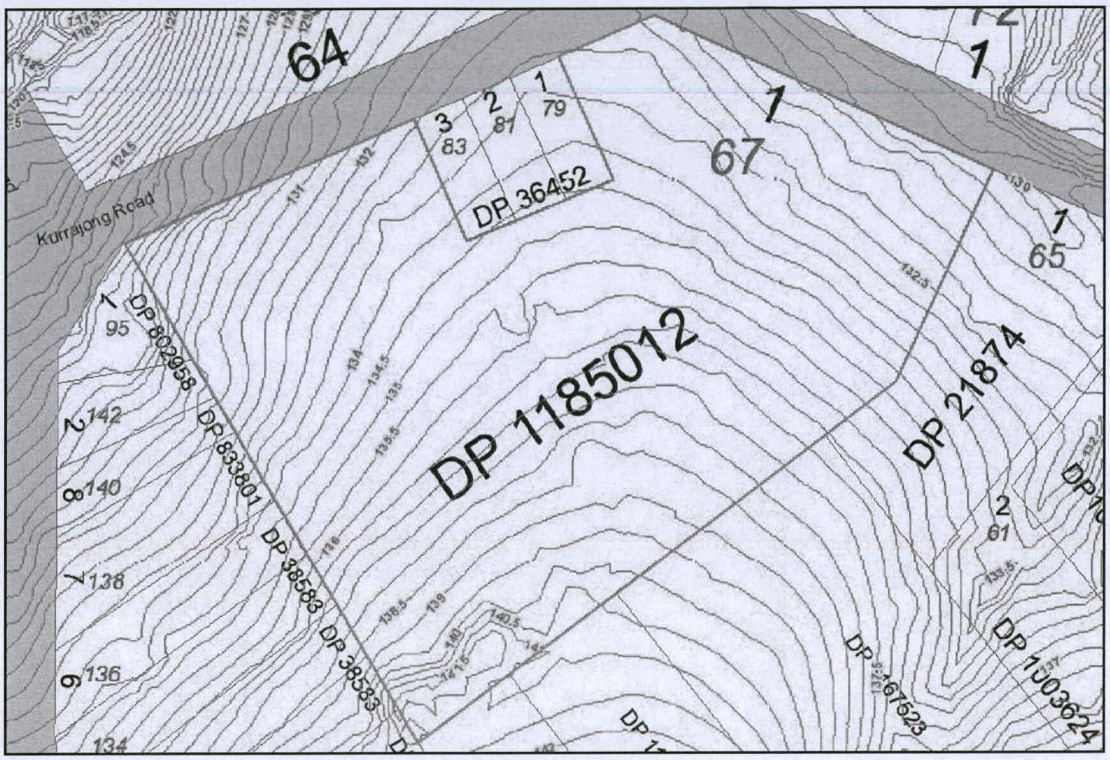


Figure 4: Extract from the Council contour map over the Site.

3. PROPOSED DEVELOPMENT

It is proposed to subdivide the Site into thirty seven (37) Community Title lots.

A Plan of Proposed Subdivision is submitted with the development application, a reduced copy of which is at **Attachment 3**. An extract from the Plan of Proposed Subdivision is at **Figure 5**.

Access to the proposed Lots 22 - 28 is to be directly from Kurrajong Road, with access to proposed Lots 2 - 20 and 29 - 37 being from a proposed road running through the centre of the proposed subdivision.

The remaining two (2) lots, being Lots 1 and 21 adjacent to proposed lots 2 and 20, are to be utilised for the provision of services to the proposed subdivision as discussed in later sections of the SEE and in more detail in documents prepared by Martens & Associates which are submitted with the revised application.

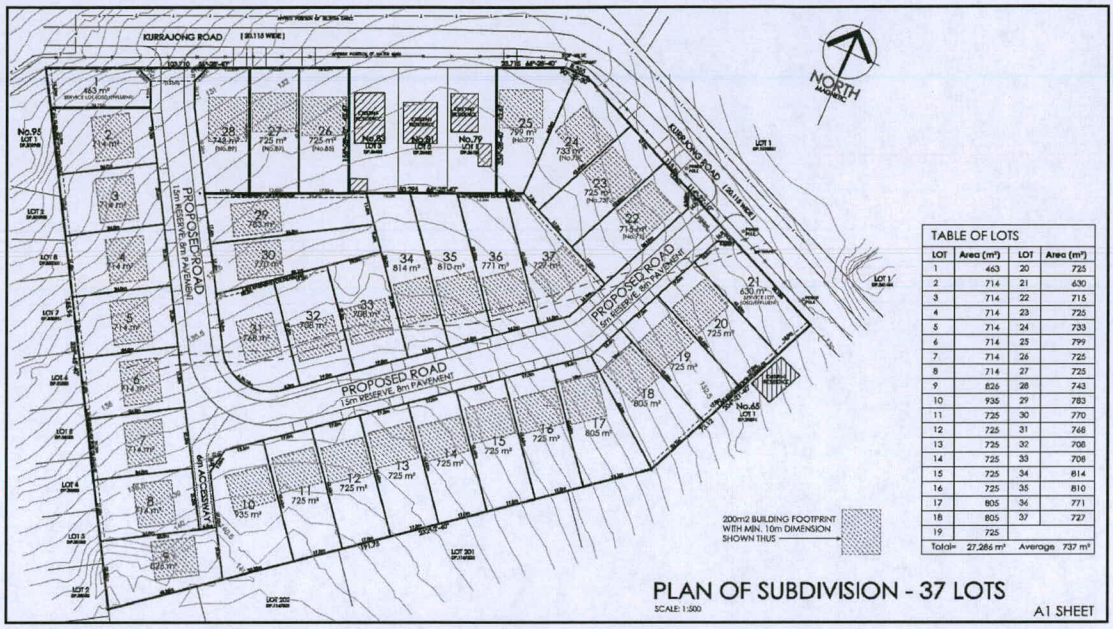


Figure 5: Extract from the Plan of Proposed Subdivision.

4. ENVIRONMENTAL IMPACT OF THE PROPOSED DEVELOPMENT

This section provides an analysis of the proposed development in terms of its impact on the environment. Specific reference is made to the relevant heads of consideration contained in Section 79C of the Environmental Planning and Assessment Act 1979. The relevant Section 79C head is shown in italics and bold with comments as appropriate.

Section 79C(1)(a)(i) ***(a) the provisions of:-***

(i) any environmental planning instrument.

4.1 State Environmental Planning Policy No.55 - Remediation of Land

State Environmental Planning Policy No.55 - Remediation of Land (**SEPP 55**) aims:

> *.... to promote the remediation of contaminated land for the purpose of reducing the risk of harm to human health or any other aspect of the environment.*

Clause 7 of SEPP 55 states:

> *7. (1) A consent authority must not consent to the carrying out of any development on land unless:*
>
> *(a) it has considered whether the land is contaminated, and*
>
> *(b) if the land is contaminated, it is satisfied that the land is suitable in its contaminated state (or will be suitable, after remediation) for the purpose for which the development is proposed to be*

carried out, and

(c) if the land requires remediation to be made suitable for the purpose for which the development is proposed to be carried out, it is satisfied that the land will be remediated before the land is used for that purpose.

(2) Before determining an application for consent to carry out development that would involve a change of use on any of the land specified in subclause (4), the consent authority must consider a report specifying the findings of a preliminary investigation of the land concerned carried out in accordance with the contaminated land planning guidelines.

(3) The applicant for development consent must carry out the investigation required by subclause (2) and must provide a report on it to the consent authority. The consent authority may require the applicant to carry out, and provide a report on, a detailed investigation (as referred to in the contaminated land planning guidelines) if it considers that the findings of the preliminary investigation warrant such an investigation.

(4) The land concerned is:

(a) land that is within an investigation area,

(b) land on which development for a purpose referred to in Table 1 to the contaminated land planning guidelines is being, or is known to have been, carried out,

(c) to the extent to which it is proposed to carry out development on it for residential, educational, recreational or child care purposes, or for the purposes of a hospital land:

(i) in relation to which there is no knowledge (or incomplete knowledge) as to whether development for a purpose referred to in Table 1 to the contaminated land planning guidelines has been carried out, and

(ii) on which it would have been lawful to carry out such development during any period in respect of which there is no knowledge (or incomplete knowledge).

To assess whether the Site contains any contamination, a Phase 1 Environmental Site Assessment (**ESA**) was prepared by C M Jewell & Associates, copies of which have been submitted with the development application. The objectives of the ESA were to:

- *Review the history and current status of the site;*
- *Identify potential sources of contamination and determine potential contaminants of concern;*
- *Identify areas of potential contamination;*
- *Identify potential human and ecological receptors;*
- *Identify potentially affected media (soil, sediment, groundwater, surface water, indoor and ambient air).*
- *Assess the risks posed by potential contamination under the land uses permitted by its zoning.*

The ESA concludes:

- *Review of historical aerial photography indicates that the Site was previously, and is currently, undeveloped vacant land and, prior to its purchase in 2015, was Crown Land.*
- *A review of NSW LPI mapping indicates that a fence line, a lean-to, a chicken coop, a compost bin and a clothes line relating to 79, 81 and 83 Kurrajong Road encroach onto the Site.*
- *Most of the Site is covered in medium to dense vegetation, although areas of cleared (mowed) land were observed in the northern and eastern portions of the Site and surrounding the adjoining residential properties.*
- *There were no obvious signs of vegetation die-back at the Site.*
- *The Site was free of statutory notices issued by the NSW EPA under the Contaminated Land Management Act 1997 and the Protection of the Environment Operations Act 1997.*
- *There was no evidence to suggest that any underground storage tank, aboveground storage tank, or similar has been present on the Site.*
- *There was no evidence that extensive filling activities have taken place at the Site.*
- *There was some evidence of minor cutting activity along the Kurrajong Road boundary and at the rear of 136 Old Bells Line of Road.*
- *The following issues were noted during the site visit:*
  - *an area of dumped material consisting of metal and plastic piping, tyres, bricks and tin cans;*
  - *an area of dumped rubble consisting of bricks, tiles and ACM;*
  - *a small pile of dumped soil containing bricks, pavers and concrete; and*
  - *general rubbish throughout the Site at various locations.*

Pursuant to **sub-clause 7(1)**, the Council can be satisfied that the proposed development is suitable for the Site.

4.2 State Environmental Planning Policy No.44 - Koala Habitat Protection

State Environmental Planning Policy No.44 - Koala Habitat Protection (**SEPP 44**) applies in the Hawkesbury local government area.

SEPP 44 aims to encourage the proper conservation and management of areas of natural vegetation which provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline.

An assessment pursuant to SEPP 44 was undertaken as part of the Flora and Fauna Assessment which accompanies the development application. The assessment states:

SEPP 44 Koala Habitat Protection applies to land within Local Government Areas (LGAs) listed under Schedule 1 of the Policy. In addition, Part 2 of the Policy outlines a three (3) step process to assess the likelihood of the land in question being potential or core koala habitat. Part 2 applies to land which has an area of greater than 1 hectare or has, together with any adjoining land in the same ownership, an area of more than 1 hectare.

The subject site is required to be considered under SEPP 44 as it falls within the Hawkesbury LGA, which is listed on Schedule 1 of this Policy. In addition, the total area of the subject site is greater than 1 hectare, hence Part 2 - Development Control of Koala Habitats, of the Policy applies.

Potential Koala Habitat (PKH) is defined as land where at least 15% of the total number of trees in the upper or lower strata constitutes any of the tree species listed in Schedule 2 of the policy.

Core Koala Habitat (CKH) is defined as an area of land with a resident population of koalas, evidenced by attributes such as breeding females (i.e. females with young) and recent sightings of and historical records of a population.

A Koala Plan of Management is required to be prepared where council is satisfied that the land is CKH.

Step 1 – Is the land PKH?

One (1) Koala food tree species – Forest Red Gum (Eucalyptus tereticornis), as listed on Schedule 2 of SEPP 44 – was recorded within the study area. These trees comprised less than 15% of the total number of trees present within the vegetation community Cabbage Gum Forest (Disturbed), and therefore this community area is not classified under SEPP 44 as 'potential Koala habitat' and no further consideration to this policy need apply.

4.3 Sydney Regional Environmental Plan No.20 Hawkesbury Nepean River (No.2 - 1997)

The site is located within the catchment of the Hawkesbury River.

Clause 4(1)(a) of SREP No.20 states:

> *(1) The general planning considerations set out in clause 5, and the specific planning policies and related recommended strategies set out in clause 6 which are applicable to the proposed development, must be taken into consideration:*
>
> *(a) by a **consent authority** determining an application for consent to the carrying out of development on land to which this plan applies,*

The general planning considerations detailed in clause 5 which are applicable to the subject development application are:

> *(a) the aim of this plan, and*
>
> *(c) whether there are any feasible alternatives to the development or other proposal concerned, and*
>
> *(d) the relationship between the different impacts of the development or other proposal and the environment, and how those impacts will be addressed and monitored.*

The aim of the plan is:

> *... to protect the environment of the Hawkesbury-Nepean River system by ensuring that the impacts of future land uses are considered in a regional context.*

As detailed elsewhere in this SEE, it is considered that the impact of the proposed development will not have any significant impact on the environment.

The specific planning policies and recommended strategies listed in clause 6 are:

(1) Total catchment management

Comment: The proposed development, suitably conditioned, should not have any adverse impact on the total catchment management of the Hawkesbury Nepean River system.

(2) Environmentally sensitive areas

Comment: The impact to environmentally significant areas has been addressed in the Flora and Fauna Assessments submitted with the development application. No adverse impact is proposed to warrant refusal of the development application.

(3) Water quality

Comment: Water treatment facilities are to be provided on-site as part of the proposed development. The proposed stormwater management strategy has been formulated to satisfy the Net or Beneficial Effect (**NoRBE**) test for both water quality and Onsite Stormwater Detention (**OSD**). Key components of the system are as follows:

1. Dwelling roof areas collected by slimline rainwater reuse tanks with an OSD component (or separate slimline OSD tank) within each proposed residential allotment.

2. Overflow from tanks and lot surface drainage is to be collected by inter-allotment drainage systems across the rear of lots and/or the proposed subdivision road kerb and gutter drainage system.

3. Inter-allotment and roadside drainage systems are to drain to the site's two existing low points, the proposed service allotments, Lots 1 and 21.

4. Further, the OSD provided within each service allotment within a landscaped OSD basin underlain by a bio-filtration filter.

5. Stormwater from each basin/filter is to discharge in a controlled manner to the existing Kurrajong Road system via upgraded pipe drainage to the existing downstream watercourse.

The proposed wastewater management strategy has been formulated to provide a reticulated sewer scheme, together with a recycled water supply scheme. It does not rely on connection to a municipal sewage network or routine pump out via tanker truck to municipal treatment system. Key components of the system are as follows:

1. Household sewerage would be connected to the proposed reticulated sewerage network and delivered to the site's two existing low points, the proposed service allotments, Lots 1 and 21.

2. The household sewage draining via reticulation to Lot 21 and will be collected within a small pump station and pumped back along the new subdivision's road reserve to the proposed site water recycling facility.

3. The household sewage draining via reticulation to Lot 1 and will be collected directly into site's water recycling facility.

4. Treated effluent from the site water recycling facility would be collected in a recycled water storage tank with approximately 2 weeks of surplus storage to manage flows during routine maintenance and in unforeseen circumstances such as power outages an pump breakdown.

5. The recycled water storage tank will also be accessible by pump-out truck in emergency circumstances.

6. Recycled water would be delivered back to sustainably designed dedicated lawns and garden bed areas on each lot, with recycled water being applied within a sub-surface drip irrigation system.

Full details of the proposed water treatment facilities are provided in the documents prepared by Martens & Associates as submitted with the development application.

Suitable erosion and sediment control measures would be employed during the construction of the proposed subdivision as design by Martens & Associates, details of which have been submitted with the development application to ensure that sediment laden waters do not leave the Site.

(4) Water quantity

Comment: The proposed development would not have an impact on the quantity of water available in the catchment.

(5) Cultural heritage

Comment: No heritage items are located on the Site, however, there is a Heritage Item located in the vicinity of the Site. The Site is not located within a heritage conservation area.

A heritage impact assessment has been provided as **Attachment 5**. The Heritage Impact assessment states, among other things:

> *In order to assuage the concerns of the Council .... to potential impacts the proposal would have on the nearby heritage item I357 Goldfinders (Former Inn), 164 Old Bells Line of Road, I make the following comments ....*
>
> ***The Site***

The site is a large allotment bounded to the north by Kurrajong Road, south east of its intersection with Old Bells Line of Road where the heritage item identified as Goldfinders Inn Group is located.

The heritage buildings on the listed site are visually screened along the south eastern boundary by a dense line of trees that follow the creek line that forms the border of its lot. Further to the south open land and more trees further separate the heritage lot from Kurrajong Road and create a substantial visual and physical separation to the subject site.

The Heritage Item

Lot 123 in DP1063011 located at 164 Old Bells Line of Road is identified as a heritage item in Schedule 5 of the Hawkesbury Local Environmental Plan 2012. It comprises three buildings located at the southern end of the site, near the junction of Bells Line of Road with Little Wheeny Creek. The buildings are a single storey timber cottage, a two-storey, sandstone building constructed as an inn and a timber barn structure. They are set in a garden of mature trees

> *"The Goldfinders Inn site is of state significance as a continually inhabited place of residence in the Hawkesbury area from the time of the land grant in 1809 to the present day. The cottage, inn and barn together provide physical evidence of successive occupancies and uses of the site initially for farming, through to commercial use as an inn and licensed premises, later a post office and general store and as private residence."*

The Proposal

The proposal .... is for a subdivision of Lot 1 in DP1185012 into 35 housing lots by the creation of a new loop road through the site entering and exiting onto Kurrajong Road. This application is shown on a Plan prepared by Andrew P. Grieve dated 21st May 2016.

Potential Heritage Impacts

The subject site is separated from the listed heritage site by a substantial distance that ensures that there is no direct visible connection between the two. Modern housing already occupies the area to the west of the proposed subdivision and this currently has no detrimental impact on the setting or appreciation of the heritage item.

The proposed subdivision will create 35 new lots on the subject land with provisions that require appropriate setbacks to the street frontages. The character of resulting development will mirror existing development on adjacent land.

In relation to the heritage item, the Goldfinders Inn Group on Bells Old Line of Road, the only impact would be an increase in traffic passing the site to gain access to Bells Line of Road, though other access through the area is also provided by Kurrajong Road which does not pass the heritage site.

I am of the professional opinion that this revised development application for 35 allotments would have no significant adverse impact on any heritage values associated with the heritage item or its critical setting and that there is no reason why heritage concerns should form part of any contention raised by the Council in regard to this application.

(6) Flora and fauna

Comment: Details assessment report of the potential impact to flora and fauna are submitted with the development application. The proposed development is unlikely to have any adverse impact on the flora and fauna of the catchment to warrant refusal of the development application.

(7) Riverine scenic quality

Comment: The Site is not located within the riverine corridor and no scenic quality impact will occur as a result of the proposed development.

(8) Agriculture / Aquaculture and Fishing

Comment: No impact will result from the proposed development.

(9) Rural residential development

Comment: The proposed development is not for rural residential development.

(10) Urban development

Comment: Not applicable.

(11) Recreation and tourism

Comment: The proposed development will not impact on the recreation and tourism activities in the catchment.

(12) Metropolitan Strategy

Comment: The proposed development will not be adverse to the Metropolitan Strategy.

The proposed development is consistent with the requirements of SREP No.20.

4.4 Hawkesbury Local Environmental Plan 2012 (LEP 2012)

The Site is zoned R2 Low Density Residential pursuant to LEP 2012.

An extract from the LEP 2012 Map is at **Figure 6**.

The proposed development is for subdivision which is permissible, with the consent of the Council, in the zone.

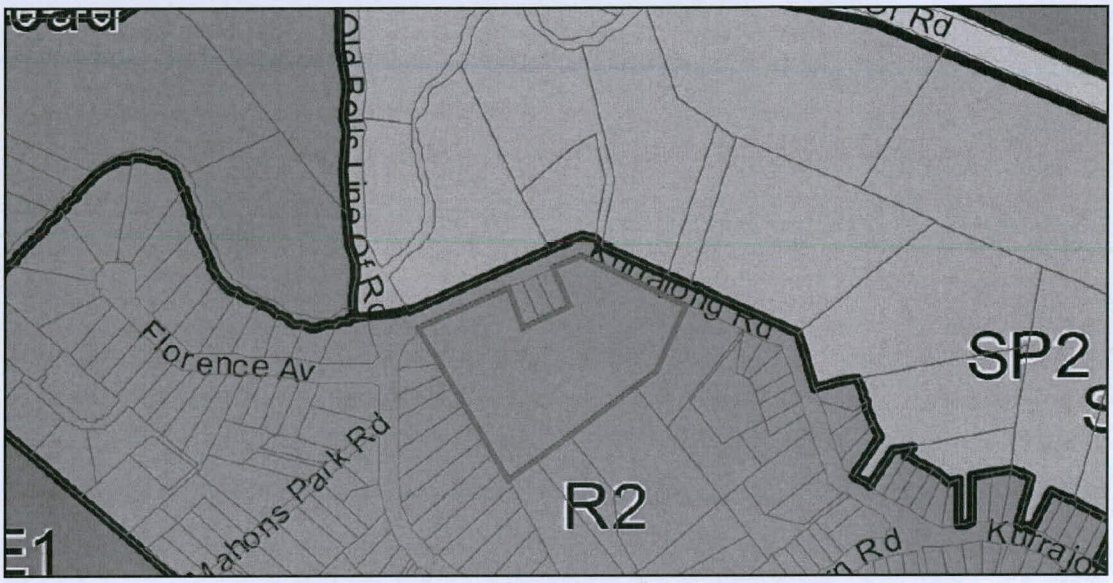


Figure 6: Extract from the LEP 2012 Zone Map with the Site outlined in red.

Sub-clause 2.3(2) of LEP 2012 states:

> *(2) The consent authority must have regard to the objectives for development in a zone when determining a development application in respect of land within the zone.*

The objectives of the R2 Low Density Residential zone are:

- *To provide for the housing needs of the community within a low density residential environment.*
- *To enable other land uses that provide facilities or services to meet the day to day needs of residents.*
- *To protect the character of traditional residential development and streetscapes.*
- *To ensure that new development retains and enhances that character.*
- *To ensure that development is sympathetic to the natural environment and ecological processes of the area.*
- *To enable development for purposes other than residential only if it is compatible with the character of the living area and has a domestic scale.*
- *To ensure that water supply and sewage disposal on each resultant lot of a subdivision is provided to the satisfaction of the Council.*
- *To ensure that development does not create unreasonable demands for the provision or extension of public amenities or services.*

The proposed development:

- would provide for the housing needs of the community.
- is sympathetic to the natural environment and ecological processes of the area.

- ensures that water supply and sewage disposal is provided.
- does not create unreasonable demands for the provision or extension of public amenities or services.

The proposal is consistent with the objectives of the R2 Low Density Residential zone.

Clause 4.1AA relates to minimum lot size for subdivision of a community title scheme. The objective is:

> *(a) to ensure that land to which this clause applies is not fragmented by inappropriate subdivisions that would create additional dwelling entitlements.*

Sub-clauses 4.1AA(3) & (3A) state:

> *(3) The size of any lot resulting from a subdivision of land to which this clause applies (other than any lot comprising association property within the meaning of the Community Land Development Act 1989) is not to be less than the minimum size shown on the Lot Size Map in relation to that land.*
>
> *(3A) If a lot in a following zone is a battle-axe lot or other lot with an access handle, the area of the access handle is not to be included in calculating the lot size:*
>
> *(a) Zone R1 General Residential,*
>
> *(b) Zone R2 Low Density Residential,*
>
> *(c) Zone R3 Medium Density Residential.*

An extract from the Lot Size Map is at **Figure 7**.

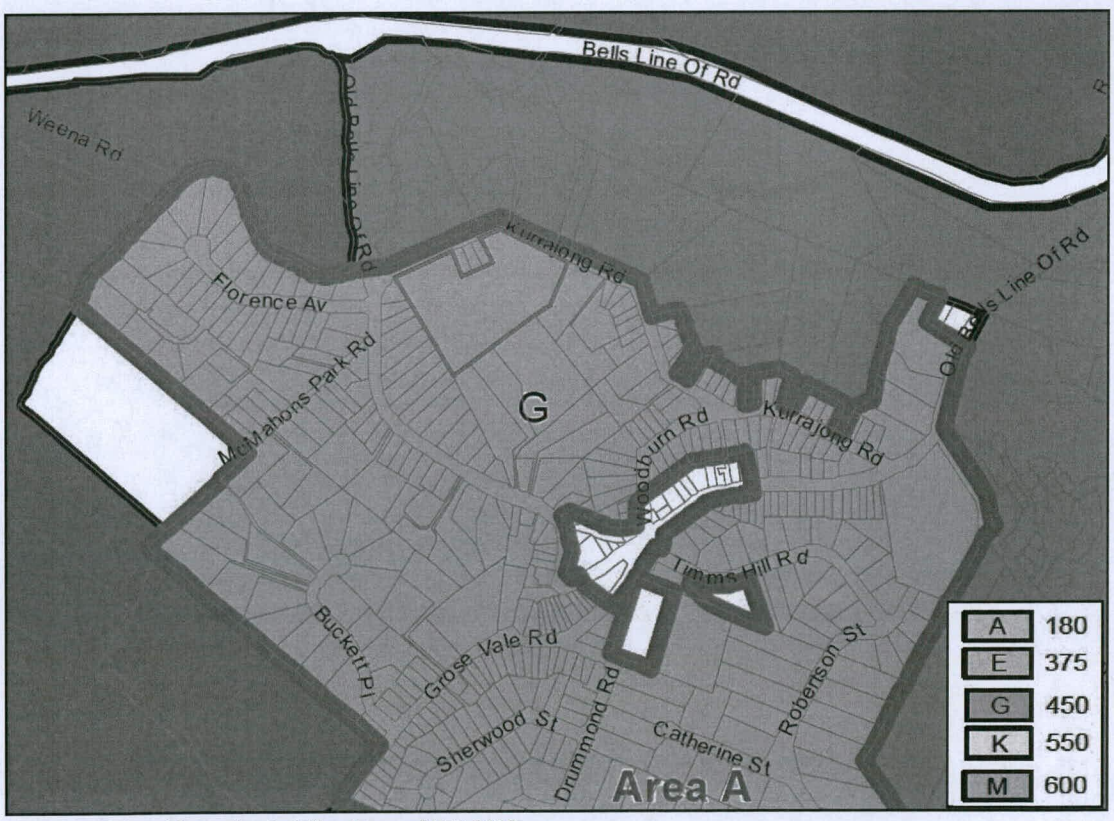


Figure 7: Extract from the Lot Size Map of LEP 2012.

The minimum lot size for subdivision is 450m^2. As seen in **Figure 7**, however, the Site is located in Area A. **Clause 4.1(D)(1)** of LEP 2012 states:

> *(1) Despite clauses 4.1, 4.1AA and 4.1A, development consent must not be granted for the subdivision of land that is identified as "Area A" and edged heavy blue on the Lot Size Map if:*
>
> *(a) arrangements satisfactory to the consent authority have not been made before the application is determined to ensure that each lot created by the subdivision will be serviced by a reticulated sewerage system from the date it is created, and*
>
> *(b) the area of any lot created by the subdivision that contains or is to contain a dwelling house is less than 4,000 square metres.*

As seen in **Attachment 3** and **Figure 5**, each of the proposed residential lots contains and area of minimum 714m^2 to maximum 935m^2. As such, pursuant to **sub-clause 4.1(D)(1)(a)**, arrangements satisfactory to the consent authority must be made before the application is determined to ensure that each lot created by the subdivision will be serviced by a reticulated sewerage system from the date it is created.

LEP 2012 defines a "*sewage reticulation system*" as:

> ***sewage reticulation system*** *means a building or place used for the collection and transfer of sewage to a sewage treatment plant or water recycling facility for treatment, or transfer of the treated waste for use or disposal, including associated:*
>
> *(a) pipelines and tunnels, and*
>
> *(b) pumping stations, and*
>
> *(c) dosing facilities, and*
>
> *(d) odour control works, and*
>
> *(e) sewage overflow structures, and*
>
> *(f) vent stacks.*

A detailed design of a proposed sewage disposal system has been prepared by Martens & Associates, copies of which have been submitted with the amended application.

Water treatment facilities are to be provided on-site as part of the proposed development. The proposed stormwater management strategy has been formulated to satisfy the Net or Beneficial Effect (**NoRBE**) test for both water quality and Onsite Stormwater Detention (**OSD**). Key components of the system are as follows:

1. Dwelling roof areas collected by slimline rainwater reuse tanks with an OSD component (or separate slimline OSD tank) within each proposed residential allotment.

2. Overflow from tanks and lot surface drainage is to be collected by inter-allotment drainage systems across the rear of lots and/or the proposed subdivision road kerb and gutter drainage system.

3. Inter-allotment and roadside drainage systems are to drain to the site's two existing low points, the proposed service allotments, Lots 1 and 21.

4. Further, the OSD provided within each service allotment within a landscaped OSD basin underlain by a bio-filtration filter.

5. Stormwater from each basin/filter is to discharge in a controlled manner to the existing Kurrajong Road system via upgraded pipe drainage to the existing downstream watercourse.

6. The proposed wastewater management strategy has been formulated to provide a reticulated sewer scheme, together with a recycled water supply scheme. It does not rely on connection to a municipal sewage network or routine pump out via tanker truck to municipal treatment system. Key components of the system are as follows:

(a) Household sewerage would be connected to the proposed reticulated sewerage network and delivered to the site's two existing low points, the proposed service allotments, Lots 1 and 21.

(b) The household sewage draining via reticulation to Lot 21 and will be collected within a small pump station and pumped back along the new subdivision's road reserve to the proposed site water recycling facility.

(c) The household sewage draining via reticulation to Lot 1 and will be collected directly into site's water recycling facility.

(d) Treated effluent from the site water recycling facility would be collected in a recycled water storage tank with approximately 2 weeks of surplus storage to manage flows during routine maintenance and in unforeseen circumstances such as power outages an pump breakdown.

(e) The recycled water storage tank will also be accessible by pump-out truck in emergency circumstances.

(f) Recycled water would be delivered back to sustainably designed dedicated lawns and garden bed areas on each lot, with recycled water being applied within a sub-surface drip irrigation system

In light of the above, it is considered that the proposed development meets the minimum lot size development standard of LEP 2012.

Clause 9 relates to the preservation of trees or vegetation, the objective of which is:

> *... is to preserve the amenity of the area, including biodiversity values, through the preservation of trees and other vegetation.*

Sub-clause 9(2) states:

> *(2) This clause applies to species or kinds of trees or other vegetation that are prescribed for the purposes of this clause by a development control plan made by the Council.*

As seen on **Figure 2**, the Site contains a number of trees. To ascertain the impact the proposed subdivision would have on the flora on the Site, a detailed Flora and Fauna Assessments have been prepared, copies of which have been submitted with the development application.

The Flora and Fauna Assessment of Travers Bushfire & Ecology states:

Ecological survey and assessment has been undertaken in accordance with relevant legislation including the Environmental Planning and Assessment Act 1979, the Threatened Species Conservation Act 1995, the Environment Protection and Biodiversity Conservation Act 1999 and the Fisheries Management Act 1994.

In respect of matters required to be considered under the Environmental Planning and Assessment Act 1979 and relating to the species / provisions of the Threatened Species Conservation Act 1995, no threatened fauna species, no threatened flora species, and no endangered ecological communities (EECs) were recorded within the study area.

In accordance with Section 5A of the Environmental Planning and Assessment Act 1979, the 7 part test of significance concluded that the proposed subdivision development will not have a significant impact upon threatened species, EECs or endangered populations. A Species Impact Statement is not required for the proposal.

In respect of matters required to be considered under the Environment Protection and Biodiversity Conservation Act 1999, no threatened fauna species, no protected migratory bird species, no threatened flora species, and no EECs listed under this Act were recorded within the study area.

The proposed subdivision development was not considered to have a significant impact on matters of national environmental significance. As such a referral to Department of Environment is not required.

In respect of matters relative to the Fisheries Management Act 1994, no suitable habitat for threatened marine or aquatic species was observed within the subject site and there are no matters requiring further consideration under this Act.

Clause 5.10 relates to heritage conservation. In particular, **sub-clause 5.10(5)** states:

(5) Heritage assessment

The consent authority may, before granting consent to any development:

(a) on land on which a heritage item is located, or

(b) on land that is within a heritage conservation area, or

(c) on land that is within the vicinity of land referred to in paragraph (a) or (b),

require a heritage management document to be prepared that assesses the extent to which the carrying out of the proposed development would affect the heritage significance of the heritage item or heritage conservation area concerned.

As detailed in **Section 4.3** of this SEE, no heritage items are located on the Site, however, there is a Heritage Item located in the vicinity of the Site. The Site is not located within a heritage conservation area.

A heritage impact assessment has been provided as **Attachment 5**. The Heritage Impact assessment states, among other things:

In order to assuage the concerns of the Council .... to potential impacts the proposal would have on the nearby heritage item I357 Goldfinders (Former Inn), 164 Old Bells Line of Road, I make the following comments ....

The Site

The site is a large allotment bounded to the north by Kurrajong Road, south east of its

intersection with Old Bells Line of Road where the heritage item identified as Goldfinders Inn Group is located.

The heritage buildings on the listed site are visually screened along the south eastern boundary by a dense line of trees that follow the creek line that forms the border of its lot. Further to the south open land and more trees further separate the heritage lot from Kurrajong Road and create a substantial visual and physical separation to the subject site.

The Heritage Item

Lot 123 in DP1063011 located at 164 Old Bells Line of Road is identified as a heritage item in Schedule 5 of the Hawkesbury Local Environmental Plan 2012. It comprises three buildings located at the southern end of the site, near the junction of Bells Line of Road with Little Wheeny Creek. The buildings are a single storey timber cottage, a two-storey, sandstone building constructed as an inn and a timber barn structure. They are set in a garden of mature trees

"The Goldfinders Inn site is of state significance as a continually inhabited place of residence in the Hawkesbury area from the time of the land grant in 1809 to the present day. The cottage, inn and barn together provide physical evidence of successive occupancies and uses of the site initially for farming, through to commercial use as an inn and licensed premises, later a post office and general store and as private residence."

The Proposal

The proposal .... is for a subdivision of Lot 1 in DP1185012 into 35 housing lots by the creation of a new loop road through the site entering and exiting onto Kurrajong Road. This application is shown on a Plan prepared by Andrew P. Grieve dated 21st May 2016.

Potential Heritage Impacts

The subject site is separated from the listed heritage site by a substantial distance that ensures that there is no direct visible connection between the two. Modern housing already occupies the area to the west of the proposed subdivision and this currently has no detrimental impact on the setting or appreciation of the heritage item.

The proposed subdivision will create 35 new lots on the subject land with provisions that require appropriate setbacks to the street frontages. The character of resulting development will mirror existing development on adjacent land.

In relation to the heritage item, the Goldfinders Inn Group on Bells Old Line of Road, the only impact would be an increase in traffic passing the site to gain access to Bells Line of Road, though other access through the area is also provided by Kurrajong Road which does not pass the heritage site.

I am of the professional opinion that this revised development application for 35 allotments would have no significant adverse impact on any heritage values associated with the heritage item or its critical setting and that there is no reason why heritage concerns should form part of any contention raised by the Council in regard to this application.

Clause 6.1 relates to Acid Sulfate Soils. **Sub-clause 6.1(1)** states:

> *(1) The objective of this clause is to ensure that development does not disturb, expose or drain acid sulfate soils and cause environmental damage.*

Figure 8 is an extract from the LEP 2012 Acid Sulfate Soils map which shows that the Site is classified as Class 5.

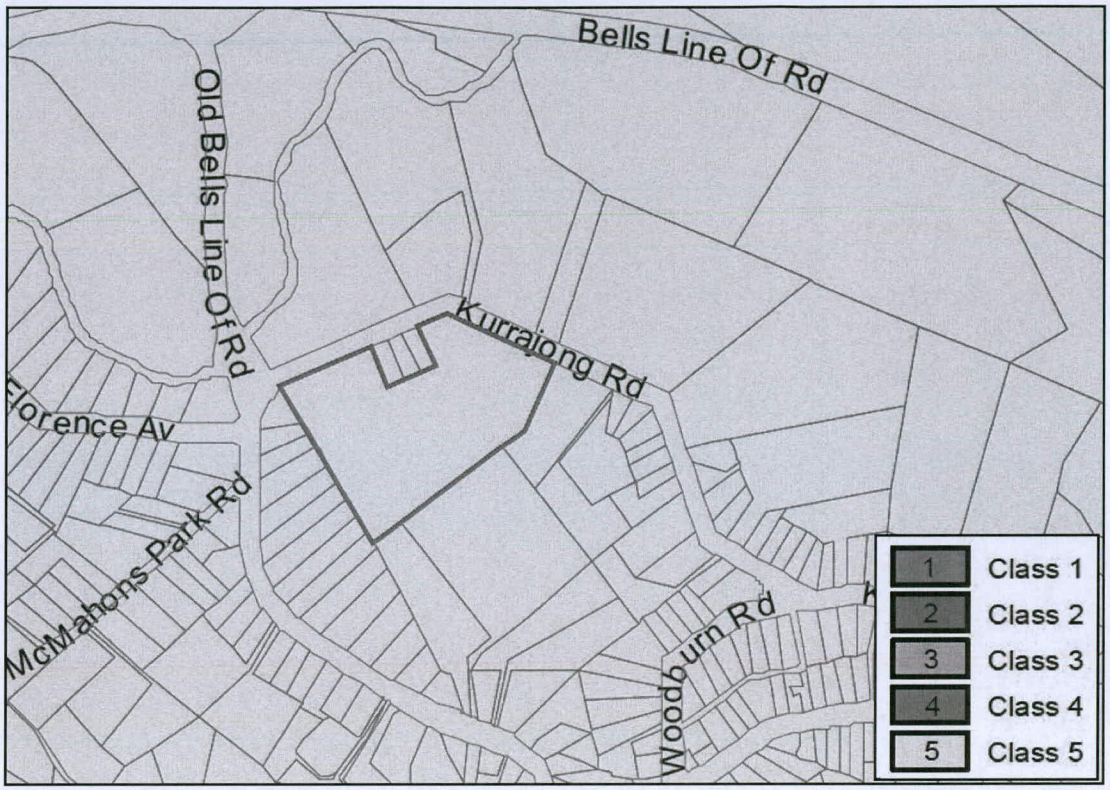


Figure 8: Extract from the LEP 2012 Acid Sulfate Soils map.

The table to **Clause 6.1** states that development consent is required for:

> *Works within 500 metres of adjacent Class 1, 2, 3 or 4 land that is below 5 metres Australian Height Datum and by which the watertable is likely to be lowered below 1 metre Australian Height Datum on adjacent Class 1, 2, 3 or 4 land.*

The Site is located such that the provisions of **Clause 6.1** are not applicable.

Clause 6.4 relates to Terrestrial Biodiversity. The objective is:

> *.... to maintain terrestrial biodiversity by:*
>
> *(a) protecting native fauna and flora, and*
>
> *(b) protecting the ecological processes necessary for their continued existence, and*
>
> *(c) encouraging the conservation and recovery of native fauna and flora and their habitats.*

Clause 6.4 continues:

> *(2) This clause applies to land identified as "Significant vegetation" and "Connectivity between significant vegetation" on the Terrestrial Biodiversity Map.*
>
> *(3) Before determining a development application for development on land to which this clause applies, the consent authority must consider:*
>
> *(a) whether the development:*
>
> *(i) is likely to have any adverse impact on the condition,*

ecological value and significance of the fauna and flora on the land, and

(ii) is likely to have any adverse impact on the importance of the vegetation on the land to the habitat and survival of native fauna, and

(iii) has any potential to fragment, disturb or diminish the biodiversity structure, function and composition of the land, and

(iv) is likely to have any adverse impact on the habitat elements providing connectivity on the land.

(b) any appropriate measures proposed to avoid, minimise or mitigate the impacts of the development.

(4) Development consent must not be granted to development on land to which this clause applies unless the consent authority is satisfied that:

(a) the development is designed, sited and will be managed to avoid any significant adverse environmental impact, or

(b) if that impact cannot be reasonably avoided by adopting feasible alternatives—the development is designed, sited and will be managed to minimise that impact, or

(c) if that impact cannot be minimised—the development will be managed to mitigate that impact.

The Site is identified as "*Significant Vegetation*" on the Terrestrial Biodiversity map, an extract from which is at **Figure 9**.

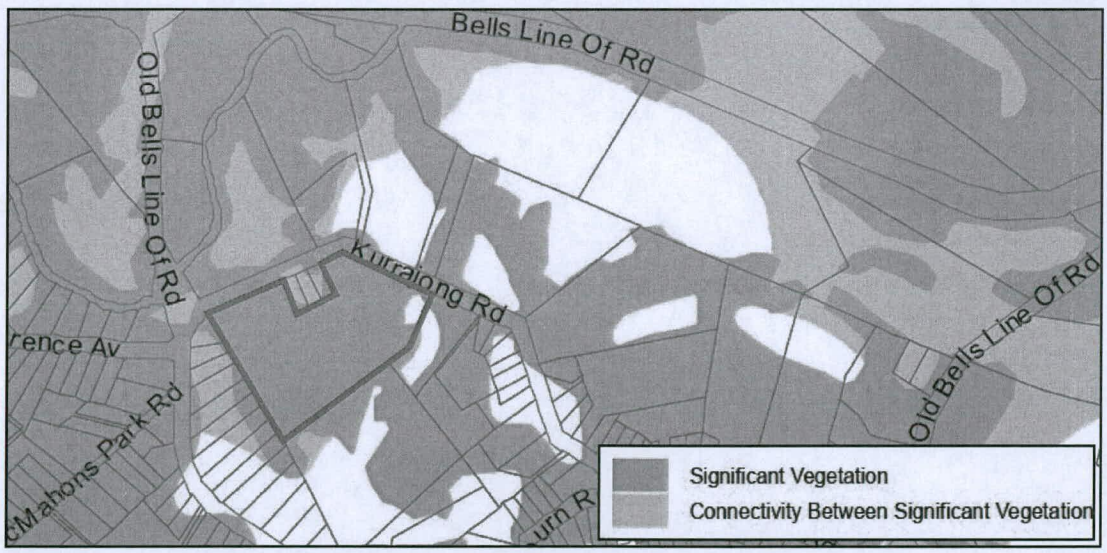


Figure 9: Extract from the LEP 2012 Terrestrial Biodiversity Map.

As noted in the Travers Bushfire & Ecology Flora and Fauna Assessment submitted with the development application:

> *Ecological survey and assessment has been undertaken in accordance with relevant legislation including the Environmental Planning and Assessment Act 1979, the Threatened Species Conservation Act 1995, the Environment Protection and Biodiversity Conservation Act 1999 and the Fisheries Management Act 1994.*

In respect of matters required to be considered under the Environmental Planning and Assessment Act 1979 and relating to the species / provisions of the Threatened Species Conservation Act 1995, no threatened fauna species, no threatened flora species, and no endangered ecological communities (EECs) were recorded within the study area.

In accordance with Section 5A of the Environmental Planning and Assessment Act 1979, the 7 part test of significance concluded that the proposed subdivision development will not have a significant impact upon threatened species, EECs or endangered populations. A Species Impact Statement is not required for the proposal.

In respect of matters required to be considered under the Environment Protection and Biodiversity Conservation Act 1999, no threatened fauna species, no protected migratory bird species, no threatened flora species, and no EECs listed under this Act were recorded within the study area.

The proposed subdivision development was not considered to have a significant impact on matters of national environmental significance. As such a referral to Department of Environment is not required.

In respect of matters relative to the Fisheries Management Act 1994, no suitable habitat for threatened marine or aquatic species was observed within the subject site and there are no matters requiring further consideration under this Act.

Clause 6.7 relates to the provision of essential services and states:

Development consent must not be granted to development unless the consent authority is satisfied that any of the following services that are essential for the proposed development are available or that adequate arrangements have been made to make them available when required:

(a) the supply of water,

(b) the supply of electricity,

(c) the disposal and management of sewage,

(d) stormwater drainage or on-site conservation,

(e) suitable road access.

Reticulated water, electricity supply and suitable road access are available to the Site. It is noted, however, that there may not be sufficient pressure in the existing water supply to the Site to maintain quality reticulated water supply to each of the proposed lots. To remedy this situation, is it proposed to establish a water storage system within the proposed subdivision suitable to reticulate suitable water pressure to each lot. Provision of a suitable for bush fire fighting purposes is also proposed. Full details are provided in the documentation submitted from Martens & Associates.

The proposed means for disposal of sewage, stormwater drainage and internal road construction have been developed by Martens & Associates. Details have been provided with the modified application. The documentation prepared by Martens & Associates clearly shows that the requirements of **Clause 6.7** of LEP 2012 have been addressed.

There are no other provisions of the Hawkesbury LEP 2012 which are considered relevant to the proposed development.

Section 79C(1)(a)(ii) ***(a) the provisions of:***

(ii) any proposed instrument.

There are no proposed instruments affecting the proposed development of which the writer is aware.

Section 79C(1)(a)(iii) ***(a) the provisions of:***

(iii) any development control plan.

4.5 Hawkesbury Development Control Plan 2002

The Hawkesbury Development Control Plan 2002 (**DCP 2002**) is used by Council to assess development applications submitted under the Hawkesbury LEP 2012.

In assessing a development application, Council is to have regard to **Sub-clause 79C(3A)** of the Environmental Planning and Assessment Act 1979 which states:

> *(3A)* ***Development control plans***
>
> *If a development control plan contains provisions that relate to the development that is the subject of a development application, the consent authority:*
>
> *(a) if those provisions set standards with respect to an aspect of the development and the development application complies with those standards-is not to require more onerous standards with respect to that aspect of the development, and*
>
> *(b) if those provisions set standards with respect to an aspect of the development and the development application does not comply with those standards-is to be flexible in applying those provisions and allow reasonable alternative solutions that achieve the objects of those standards for dealing with that aspect of the development, and*
>
> *(c) may consider those provisions only in connection with the assessment of that development application.*
>
> *In this subsection, standards include performance criteria.*

Chapter 5.1 of **Part C** of DCP 2002 relates to bush fire prone land.

The Site is bush fire prone land as shown on the extract from the Bush Fire Prone Land Map at **Figure 10**.

To assess the risks associated with bush fire, a Bush Fire Risk Assessment has been submitted with the development application.

Figure 10: Extract from the Bush Fire Prone Land Map with the Site outlined in red.

The Bush Fire Risk Assessment concludes:

Building envelopes compliant with the requirements of table A2.4 of Planning for Bushfire Protection have been identified within each proposed new allotment. In addition, the proposal meets the requirements for setbacks to achieve less than BAL 29 in accordance with table 2.4.2 of AS 3959-2009 (amendment 3).

The proposal is for the subdivision of the current 3.25 ha (approximately) lot; lot 1, DP 1185012 into 52 smaller residential allotments lots. 10 of the proposed new allotments will have direct road frontage onto Kurrajong Road with the remainder being accessed by a proposed internal road and access rights of way.

The subject lot itself contains the unmanaged hazard within the study area for this proposal, the vast majority of this vegetation will be removed as part of the development process leaving no major hazard within 100m of any of the proposed new buildings.

The land surrounding the proposal on all aspects contains either established residential development, managed rural residential development or land that is otherwise considered to be of minimal hazard to this proposal. All the vegetation within the study area is within the boundaries of privately owned allotments.

This proposal could achieve the AS3959 construction level of BAL- LOW given that there is no significant hazard within the study area. However, given the proposal's location and the fire history of the area, it is considered best practice that some form of bushfire protection is built into this development. To this end, it is considered appropriate that the proposal includes complying with the requirements of AS3959 BAL-12.5 to all buildings.

All other aspects of this proposal can comply with the acceptable solutions for subdivision as outlined in Planning for Bushfire Protection.

Based on the assumptions and measurements contained within this assessment, the development is considered to be able to meet the requirements of clause 44 of the Rural Fires Regulation 2008 and the RFS requirements as outlined in Planning for Bushfire

Protection.

Chapter 3 of **Part D** of DCP 2002 relates to subdivision.

The table at **Attachment 4** contains an assessment of the proposed development against the relevant provisions of **Chapter 3** of **Part D** of DCP 2002.

The proposed development is generally consistent with the provisions of DCP 2002.

Section 79C(1)(a)(iiia) ***(a) the provisions of:***

(iiia) any planning agreement or draft planning agreement.

There are no planning agreements or draft planning agreements relating to the proposed development.

Section 79C(1)(a)(iv) ***(a) the provisions of:***

(iv) the regulations.

There are no specific requirements of the Environmental Planning and Assessment Regulation 2000 which relate to this development application.

Section 79C(1)(a)(v) ***(a) the provisions of:***

(v) any coastal management plan.

Not applicable.

Section 79C(1)(b) ***(b) the likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality.***

Impacts to the natural and built environment

The proposed development would have no adverse impact to the natural or built environment.

There may, however, be a need for demolition activities to be undertaken as part of the proposed development. Those activities would be carried out in accordance with the provisions of *Australian Standard AS 2601 - 1991: The Demolition of Structures.*

Traffic Impacts

The creation of fifty (50) new residential lots has the potential to impact the existing road network and the operation of the network.

A Traffic and Access Assessment report was been prepared for the original 52 lots

proposal, copies of which were submitted with the original development application. The Traffic and Access Assessment stated, among other things:

Existing Road Network

Kurrajong Road - is a local street linking Old Bells Line of Road in the east with Old Bells Line of Road in the west. The road includes a 6-7m wide pavement with unformed shoulders. The street provides access to adjacent residential properties. The street has a posted speed limit of 50km/hr. The intersections at either end of the road with Bells Line of Road are priority controlled intersections.

Old Bells Line of Road – forms a loop around the proposed development site area and is a collector road linking in two locations with Bells Line of Road. It generally consists of a 6.0m – 7.0m wide pavement with unformed shoulders providing direct access to local rural residential properties. The intersection in the west with Bells Line of Road is a priority controlled intersection whereas in the east is controlled by traffic signals.

Bells Line of Road – is the main east – west arterial road through the area and generally consists of a single travel lane in each direction. The road in the vicinity of Old Bells Line of Road has a posted speed limit of 60km/hr.

Existing Traffic Conditions

Intersection counts were undertaken at the traffic signal controlled intersection of Bells Line of Road / Old Bells Line of Road between the hours 6:00am – 9:00am and 3:00pm – 6:00pm on a weekday. This location was chosen as it provided traffic flows in Old Bells Line of Road in the vicinity of its intersection with Kurrajong Road (east).

Existing Conditions Intersection Analysis

All intersections surveyed have been analysed using the Sidra Intersection analysis program.

Sidra Intersection determines the average delay that vehicles encounter, the degree of saturation of the intersection, and the level of service. The degree of saturation is the ratio of the arrival rate of vehicles to the capacity of the approach.

The existing weekday and weekend day intersection operating conditions are presented in Table 3. Average delay is expressed in seconds per vehicle.

Table 3 – Existing Weekday Intersection Operating Conditions

		Morning Peak		Evening Peak	
Intersection	Control	Av Delay	LOS	Av Delay	LOS
Bells Line of Rd / Old Bells Line of Rd	Signals	27.0	B	24.5	B

Avg Delay (sec/veh) is over all movements at signals, and for worst movement at priority and roundabouts

From Table 3, it can be seen that the intersection of Bells Line of Road / Old Bells Line of Road currently operates with a satisfactory level of service.

Existing Public Transport Services

Busways operates two bus routes in the vicinity of the development site along Old Bells Line of Road and Kurrajong Road (east of the site). Route 680 provides a service between Richmond and Kurrajong via Bowen Mountain. Route 682 provides a Kurrajong loop service.

Proposed Development

.... The proposed sub division would deliver a total of 52 residential lots and internal road network. As stated above, 50 lots would provide housing whereas two (2) lots would provide common servicing facilities for the development as a whole. Twelve (12) lots would have frontages to Kurrajong Road with the remainder serviced by the internal road network.

All internal roads would be constructed with a clear 15.0m road reservation width with 8.0m wide carriageways.

Potential Traffic Generation

The RTA Guide to Traffic Generating Developments suggests a peak hour traffic generation rate of 0.85 trips per dwelling. Further, 80% of this traffic would travel outbound in the AM peak and 20% would travel inbound. The reverse would occur during the PM peak.

Thus the proposed sub division ... would have the potential to generate a total of forty three (43) peak hour trips two way in Kurrajong Road.

Potential Traffic Impacts

As stated above, traffic counts were undertaken at Bells Line of Road / Old Bells Line of Road to provide an indication of traffic flows in the vicinity of Kurrajong Road (east). The expected draw of traffic would be to / from the east of the site via the existing set of traffic signals at Bells Line of Road / Old Bells of Road.

.....

To conservatively gauge the existing traffic generation of Kurrajong Road at Old Bells Line of Road east of the site, it has been assumed all traffic generated by residential properties in Kurrajong Road would travel to / from the east. This would equate to an approximate total of 45 properties (including Woodburn Road east of Kurrajong Road). That is a peak hour traffic generation of 36 vehicles two way.

The northbound / southbound traffic flows in Old Bells Line of Road at Bells Line of Road have been conservatively assumed to pass through the intersection of Old Bells of Road / Kurrajong Road.

... future flows on Kurrajong Road would be well below the expected environmental capacity of the street. Thus the traffic impacts of the proposal are considered satisfactory.

Future Intersection Operation

The traffic generated by the proposal has been added to the surrounding road network as per the adopted trip distribution detailed above. It has been assumed that all traffic generated by the development would travel to / from the east at Bells Line of Road / Old Bells Line of Road intersection. The resulting future traffic flows are presented below.

The future traffic flows on the surrounding road network have been assessed in SIDRA. The resulting future intersection operation for the PM peak is presented below.

Table 5 – Future AM & PM Peak Intersection Operating Conditions

		Morning Peak		Evening Peak	
Intersection	Control	Av Delay	LOS	Av Delay	LOS
Bells Line of Road / Old Bells Line of Road	Signals	28.5	C	25.0	B
Old Bells Line of Road / Kurrajong Road	Give Way	6.5	A	6.6	A

Avg Delay (sec/veh) is over all movements at signals, and for worst movement at priority and roundabouts

From Table 5 it can be seen that all intersections in the vicinity of the development site would continue to operate at a satisfactory level of service in the future.

Development Design

The Hawkesbury Development Control Plan (DCP) provides design guidelines for a range of development types.

....

The internal roads within the development are consider local / minor roads serving some 40 residential lots. As stated above the development includes 8.0 wide two way carriageways and road reservations of 15.0m.

Thus the proposed internal roads exceed the minimum requirements of the DCP and thus are considered satisfactory.

The Traffic and Access Assessment concluded:

This report has assessed the potential traffic impacts of the proposed 52 lot sub division (delivering 50 houses) at the site known as 67 Kurrajong Road, Kurrajong. The findings of this assessment are presented below:

1. *The traffic impacts of the development would be minimal with future traffic flows on surrounding roads within acceptable limits.*

2. *Intersections surrounding the development would continue to operate at levels of service to that which currently occurs.*

3. *The proposed design of the internal roads exceed the minimum requirements of the DCP and are considered satisfactory.*

Overall the traffic impacts of the proposal are considered acceptable.

The amended proposal has been assessed by the Traffic Engineer with the conclusion:

.... the revised proposal includes a central spine road which exceeds the minimum requirements of the DCP (as was the case with the 52 lot proposal).

....

The proposed design can fully accommodate a 9.8m long garbage truck without issue.

The original traffic report included an assessment of potential traffic generation of the 52 lot sub division applying the standard RMS rate of 0.85 trips per dwelling. The 35 lot proposal would result in a potential for 30 peak hour trips two-way, a 33% reduction in potential traffic generation compared to the 52 lot proposal.

Overall the potential traffic impacts of the less intensive 35 lot proposal are considered satisfactory and would not impact to the point of detriment on the surrounding road

network.

Social Impacts

There would be no social impact resulting from the proposed development other than the provision of a quality subdivision which would provide the opportunity for future landowners to provide quality residential development in the form of dwelling houses.

The subdivision layout is such that the proposed lots fronting Kurrajong Road are similar in size and shape to the adjoining three(3) lots being Nos.79, 81 and 83 Kurrajong Road. It is proposed to maintain the existing built form frontage to Kurrajong Road which would not provide for a formed kerb and gutter such that the existing character of the locality would be maintained.

Economic Impact

The economic impact associated with the proposed development would be that employment opportunities would be available during both the demolition of any existing development on the Site (if required) and the construction of the proposed subdivision works.

There would be A positive economic impact to the local economy associated with the increase in the population of the locality.

Section 79C(1)(c) ***(c) the suitability of the site for the development.***

The Site is within the R2 Low Density Residential zone.

The proposed development is permitted in the zone and the Site is suitable for the proposed development.

Section 79C(1)(d) ***(d) any submissions made.***

Not applicable.

Section 79C(1)(e) ***(e) the public interest.***

It is in the public interest to have land developed according to its capabilities and, indeed, within the environmental constraints of a particular site.

The proposed development would have negligible impact on the environment and would be in accordance with the objectives of the Hawkesbury Local Environmental Plan 2012.

The proposed subdivision has been designed to accommodate dwelling houses without impact to adjoining development and would provide for additional housing stock of the locality.

It is in the public interest that such a development be approved.

5. CONCLUSION

It is proposed to subdivide the existing to into thirty seven (37) lots, comprising 35 residential lots and two (2) service lots. The residential lots each have an area between 714m^2 and 935m^2.

It has been demonstrated that the proposal would have no adverse impact on the environment or any significant impact to existing views from the adjoining property.

The Site is located within the R2 Low Density Residential zone and the proposed development is permitted with the consent of the Council.

The development has planning merit and should be approved by the Council.

Attachment 1

NSW Land and Property Information Notice

Land and Property Information Division
ABN: 84 104 377 806
GPO BOX 15
Sydney NSW 2001
DX 17 SYDNEY Telephone: 1300 052 637

NSW GOVERNMENT Land & Property Information
A division of the Department of Finance & Services

TITLE SEARCH

Title Reference: 1/11 012

LAND AND PROPERTY INFORMATION NEW SOUTH WALES - TITLE SEARCH

FOLIO: 1/1185012

SEARCH DATE	TIME	EDITION NO	DATE
14/8/2015	11:35 AM	1	25/7/2015

LAND

LOT 1 IN DEPOSITED PLAN 1185012
AT KURRAJONG
LOCAL GOVERNMENT AREA HAWKESBURY
PARISH OF KURRAJONG COUNTY OF COOK
TITLE DIAGRAM DP1185012

FIRST SCHEDULE

PRJM PTY LTD (T AJ684006)

SECOND SCHEDULE (2 NOTIFICATIONS)

1 LAND EXCLUDES MINERALS (S.171 CROWN LANDS ACT 1989)
2 AJ684007 MORTGAGE TO WESTPAC BANKING CORPORATION

NOTATIONS

UNREGISTERED DEALINGS: NIL

*** END OF SEARCH ***

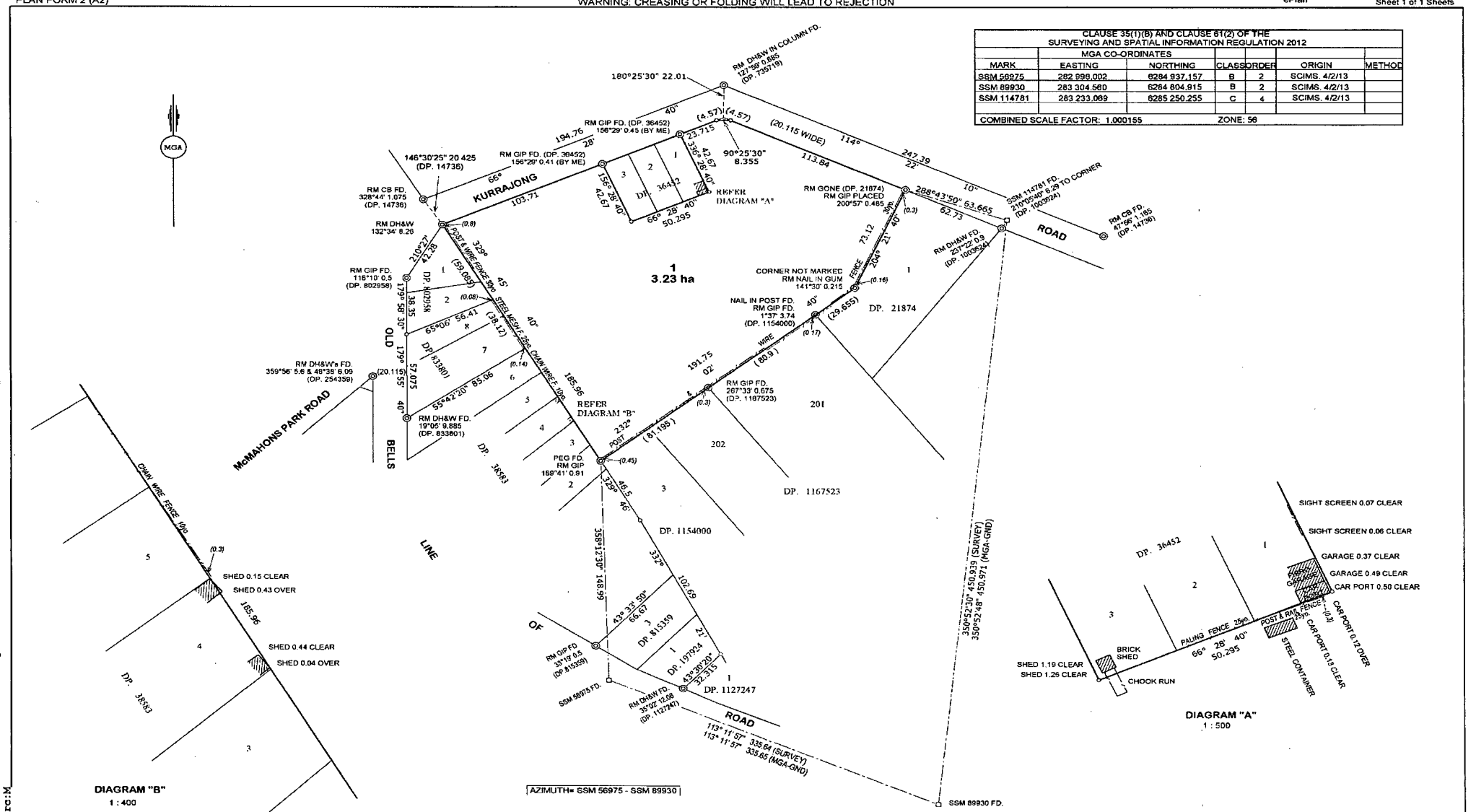
PRINTED ON 14/8/2015

** ANY ENTRIES PRECEDED BY AN ASTERISK DO NOT APPEAR ON THE CURRENT EDITION OF THE CERTIFICATE OF TITLE.*
WARNING: THE INFORMATION APPEARING UNDER NOTATIONS HAS NOT BEEN FORMALLY RECORDED IN THE REGISTER.

Attachment 2

DP 1185012

PLAN FORM 2 (A2) DP1185012 WARNING: CREASING OR FOLDING WILL LEAD TO REJECTION ePlan Sheet 1 of 1 Sheets



Surveyor: STEWART MCNEILL BLAND Date of Survey: 19/2/13 Surveyor's Ref: 20/13	PLAN OF DELIMITATION OF LOT 7304 DP. 1141427	LGA: HAWKESBURY Locality: KURRAJONG Subdivision No: —— Lengths are in metres. Reduction Ratio 1: 1500	Registered 15.5.2013	DP1185012

10 20 30 40 50 60 Table of mm 90 100 110 120 130 140

Req:R516384 /Doc:DP 1185012 P /Rev:15-May-2013 /Sts:SC.OK /Prt:14-Oct-2015 17:07 /Pgs:ALL /Seq:1 of 3
Ref:Andrew's /Src:M

PLAN FORM 6 (2012) WARNING: Creasing or folding will lead to rejection ePlan

DEPOSITED PLAN ADMINISTRATION SHEET

Sheet 1 of 12 sheet(s)

Registered: 15.5.2013 Office Use Only Title System: TORRENS Purpose: DELIMITATION	Office Use Only DP1185012
PLAN OF Delimitation of Lot 7304 DP. 1141427	LGA: Hawkesbury Locality: Kurrajong Parish: Kurrajong County: Cook

Crown Lands NSW/Western Lands Office Approval

I, BRUCE WADDINGTON (Authorised Officer) in approving this plan certify that all necessary approvals in regard to the allocation of the land shown herein have been given.

Signature: .....

Date: 9/4/2013

File Number: 11/12227

Office: PARRAMATTA

~~Subdivision Certificate~~

I, ...

~~*Authorised Person/*General Manager/*Accredited Certifier, certify that the provisions of s.109J of the Environmental Planning and Assessment Act 1979 have been satisfied in relation to the proposed subdivision, new road or reserve set out herein.~~

Signature: .....

Accreditation number: .....

Consent Authority: .....

Date of endorsement: .....

Subdivision Certificate number: .....

File number: .....

*Strike through if inapplicable.

Survey Certificate

I, Stewart McNeill Bland

of 8 Berrilee Lane Turramurra

a surveyor registered under the *Surveying and Spatial Information Act 2002*, certify that:

*(a) The land shown in the plan was surveyed in accordance with the *Surveying and Spatial Information Regulation 2012*, is accurate and the survey was completed on 19/2/13

~~*(b) The part of the land shown in the plan (*being/*excluding ^ .....) was surveyed in accordance with the *Surveying and Spatial Information Regulation 2012*, is accurate and the survey was completed on, the part not surveyed was compiled in accordance with that Regulation.~~

~~*(c) The land shown in this plan was compiled in accordance with the *Surveying and Spatial Information Regulation 2012*.~~

Signature: ..... Dated: 16/4/13

Surveyor ID: 504

Datum Line: SSM 56975 - SSM 89930

Type: ~~*Urban~~/*Rural

The terrain is *Level-Undulating / ~~*Steep-Mountainous~~.

*Strike through if inapplicable.

^Specify the land actually surveyed or specify any land shown in the plan that is not the subject of the survey.

Statements of intention to dedicate public roads, public reserves and drainage reserves.

SUBDIVISION CERTIFICATE

PLAN PREPARED FOR ISSUE OF FIRST TITLE OVER CROWN LAND. EXEMPTION CLAIMED UNDER SEC.23G (B) OF THE CONVEYANCING ACT 1919.

9/4/2013

CROWN LANDS AUTHORISED OFFICER

Plans used in the preparation of survey/compilation.

DP 254359
DP. 735719
DP. 1127247
DP. 1141427
DP. 1167523
DP. 1154000
DP. 833801
DP. 802958
DP. 36452
DP. 21874
DP. 1003624
DP. 14736

If space is insufficient continue on PLAN FORM 6A

Signatures, Seals and Section 88B Statements should appear on PLAN FORM 6A

Surveyor's Reference: ~~13/13~~ 20/13

PLAN Form 6A (2012) WARNING: Creasing or folding will lead to rejection

DEPOSITED PLAN ADMINISTRATION SHEET

Sheet 2 of 2 Sheets

Office Use Only

Registered: 15.5.2013

Office Use Only

DP1185012

PLAN OF

Delimitation of Lot 7304 D.P.1141427

This sheet is for the provision of the following information as required:

- A schedule of lots and addresses - See 60(c) *SSI Regulation 2012*
- Statements of intention to create and release affecting interests in accordance with section 88B *Conveyancing Act 1919*
- Signatures and seals- see 195D *Conveyancing Act 1919*
- Any information which cannot fit in the appropriate panel of sheet 1 of the administration sheets.

Subdivision Certificate number: .....

Date of Endorsement: .....

Lot 1 – No. 67 Kurrajong Road, Kurrajong

If space is insufficient use additional annexure sheet

Surveyor's Reference: 20/13

Attachment 3

Plan of Proposed Subdivision

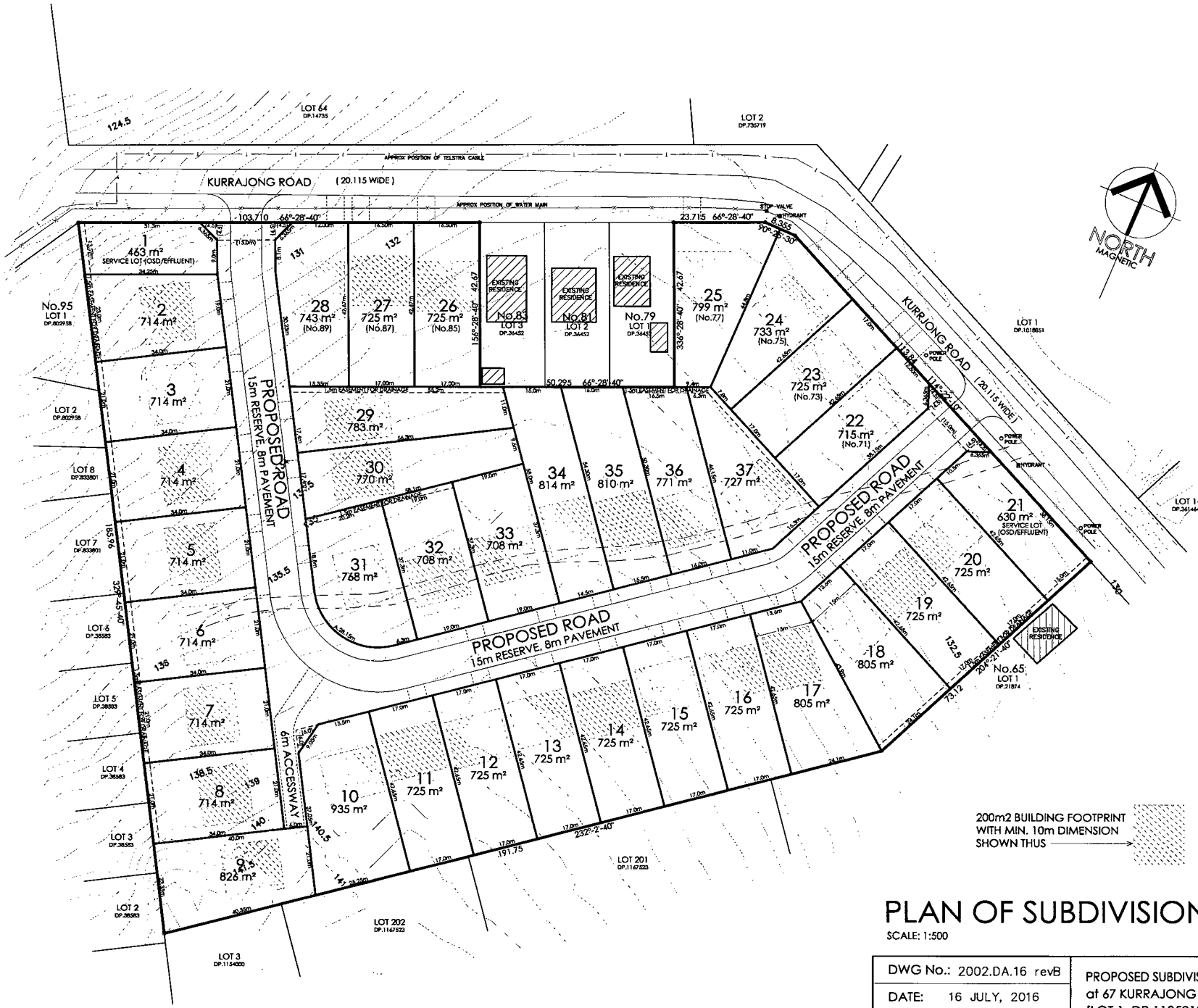


TABLE OF LOTS			
LOT	Area (m²)	LOT	Area (m²)
1	463	20	725
2	714	21	630
3	714	22	715
4	714	23	725
5	714	24	733
6	714	25	799
7	714	26	725
8	714	27	725
9	826	28	743
10	935	29	783
11	725	30	770
12	725	31	768
13	725	32	708
14	725	33	708
15	725	34	814
16	725	35	810
17	805	36	771
18	805	37	727
19	725		
Total=	27,286 m²	Average	737 m²

PLAN OF SUBDIVISION - 37 LOTS

SCALE: 1:500

A1 SHEET

DWG No.: 2002.DA.16 revB	PROPOSED SUBDIVISION at 67 KURRAJONG ROAD [LOT 1, DP.1185012] KURRAJONG NSW 2758 for ...	ANDREW P GRIEVE BACHELOR OF ARCH (HONS)
DATE: 16 JULY, 2016		17 ANNABELLE CRESCENT KELLYVILLE, NSW 2155
DRAWN: APG		MOBILE. 0412 752 579
REF: . . ./KURRAJONG/SITE37		

Attachment 4

DCP Compliance Table

Control	Proposed	Complies
3.2: *Flora and Fauna Protection*		
Aims		
(i) To protect bushland, significant flora and fauna habitats and wildlife corridors from the impacts of subdivision and subsequent development.	A detailed Flora and Fauna Assessment has been submitted with the development application.	Yes
Objectives		
The movement of fauna species on sites should be maximised so as to maintain biological diversity within the subdivision and road network.		
Opportunities for revegetation should be pursued as part of the subdivision process as a trade off for site development and as a means of value adding to the environment through the development process.		
Rules		
(a) Any subdivision proposal which is likely to result in any clearing of native vegetation or impact on any environmentally sensitive area is to be accompanied by a flora and fauna assessment report prepared by a suitably qualified person. This report is to primarily address the Eight Part Test pursuant to the Act (Section 5A) and State Environmental Planning Policy 44 - Koala Habitat Protection.		
(b) Vegetation cover should be retained where ever practicable as it acts to stabilise soils, minimise runoff, acts as a pollutant trap along watercourses and is important as a habitat for native fauna.		
(c) Degraded areas are to be rehabilitated as part of the subdivision.		
(d) Vegetation should be retained where it forms a link between other bush land areas.		

Control	Proposed	Complies
(e) *Vegetation which is scenically and environmentally significant should be retained.* (f) *Vegetation which adds to the soil stability of the land should be retained.* (g) *All subdivision proposals should be designed so as to minimise fragmentation of bushland.*		
3.3: Visual Amenity ***Aims*** (h) *To ensure that subdivision proposals do not facilitate development which would detrimentally impact upon important views and vistas.* (i) *To ensure that subdivision proposals are designed so as to preserve and enhance any visual landscapes.* ***Objectives*** *A subdivision proposal should be:* - *designed to have minimal impact on significant views and vistas; and* - *compatible with the cultural and landscape characteristics of the locality or region.* ***Rules*** (a) *Building envelopes, accessways and roads shall avoid ridge tops and steep slopes.* (b) *Subdivision of escarpments, ridges, and other visually interesting places should:* - *be managed in such a way that the visual impact rising from development on newly created allotments is minimal; and*	The proposed subdivision, being a subdivision of one (1) lot into thirty seven (37) with minimum area of 714m^2 per new allotment, would not have any impact on significant views or vistas. SREP 20 has been addressed in **Part 4.3** of the SEE.	Yes

Control	Proposed	Complies
- *retain visually significant vegetation such as that found on ridge tops and other visually prominent locations.* (c) *Development Applications for subdivision shall take into consideration the provisions of SREP20 in relation to scenic quality.*		
3.4 Heritage ***Aims*** (d) *To protect heritage items, their settings and conservation areas.* (e) *To ensure that the design of new subdivisions take into consideration and respect the heritage significance of heritage items and other places and features of the City's historical character.* ***Objectives*** *Subdivision should be sympathetically designed to minimise the impact on heritage items of the subject land or adjoining lands.* *The subdivision should maintain a reasonable curtilage around heritage items on the subject land or surrounding lands.* *Subdivisions should be sympathetically designed to ensure that the existing heritage value of the streetscape and character of the area is maintained.* ***Rules*** (a) *A subdivision proposal on land which contains or is adjacent to an item of environmental heritage as defined in Schedule 1 of the Hawkesbury LEP should illustrate the means proposed to preserve and protect such items. With such*	The Site does not contain any heritage items, is located in the vicinity of a heritage item, and is not located within a Heritage Conservation Area. A heritage impact assessment has been provided as part of the SEE.	Yes

Control	Proposed	Complies
subdivisions a Heritage Impact Statement may be required to determine the heritage curtilage. Council staff and Council's Heritage Advisor should be consulted in this regard.		
3.5 UTILITY SERVICES ***Aims*** *(f) To provide public utilities in a safe, efficient and cost effective manner.* *(g) To provide public utilities in such a way as to maximise retention of vegetation.* ***Objectives*** *All lots created for residential purposes should have an adequate provision of utility services and not result in a detrimental impact on the environment.* *The design and provision of public utilities should conform to the cost effective criteria of the relevant servicing authority.* *Compatible public utility services should be located in common trenches so as to minimise the land required, soil erosion and the cost of providing the services.* *Adequate buffers should be maintained between utilities and houses to protect residential amenity and health.* *The provision of utility services should not detrimentally impact on the landscape character of an area.* *Adequate water supplies for both domestic and fire fighting purposes should be available.* ***Rules*** *(a) Underground power provided to all residential and industrial*	The proposed subdivision is serviced by electricity and water. A reticulated sewerage system, stormwater drainage, and internal road construction details have been prepared by Martens & Associates. Full design details are provided with the development application.	Yes

Control	Proposed	Complies
subdivisions. Where infill subdivision is proposed, the existing system, whether above or underground shall be maintained. *(b) All lots created are to have the provision of power.* *(c) Where reticulated water is not available, a minimum storage of 100,000 litres must be provided. A minimum of 10,000 litres must be available at all times on Bushfire Prone Land.*		
3.6 FLOODING, LANDSLIP & CONTAMINATED LAND ***Aims*** *(d) Subdivision proposals should be designed to minimise the risk to life and/or property from flooding, landslip and contaminated land.* ***Objectives*** *Subdivision of flood prone land should not result in increased risk to life or property both on the subject land and adjoining lands.* *Subdivision of land that has been identified as being prone to landslip should not increase the risk to life or property on the subject land or adjoining lands.* ***Rules*** *(a) Compliance with clause 25 of Hawkesbury Local Environmental Plan 1989.* *(b) Access to the subdivision shall be located above the 1% AEP flood level.* *(c) Where a subdivision proposal is on land identified as being potentially subject to landslip, the applicant shall engage a geotechnical consultant to*	The Site is not flood prone land. The Phase 1 Environmental Assessment submitted with the development application has concluded that the Site is not contaminated to preclude the proposed subdivision and the subsequent development of a dwelling house on each of the proposed lots.	Yes

Control	Proposed	Complies
prepare a report on the viability of subdividing the land and provide recommendations as to the siting and the type of buildings which could be permitted on the subject land. *(d) In the event that Council deems that there is the potential that land subject to a subdivision application is contaminated then the applicant shall engage a suitably qualified person to undertake a soil and ground water assessment.* *(e) Contaminated Land shall be remediated prior to the issue of the Subdivision Certificate.*		
3.7.1 Residential Local Street Design ***Aims*** *(f) To create street networks in which the function of each street is clearly defined.* *(g) To ensure that vehicular and pedestrian access is simple, safe and direct.* *(h) To minimise the impact of traffic on the residential amenity of the locality.* ***Objectives*** *Street widths should reflect the role and function of the street in the road hierarchy.* *Streets should be designed to allow on street car parking.* *Streets should be designed to cater for service vehicles.* *Streets should be designed to provide interest and variety in the streetscape through kerbs (where appropriate), landscaping and paving treatments. The street design should be compatible with the existing road pattern in the locality.*	An internal street and associated accessway would be created as part of the proposed subdivision. Full details have been provided in the document prepare by Marten & Associates which have been submitted with the development application.	Yes

Control	Proposed	Complies
Junctions along residential streets should be spaced to create safe and convenient vehicle movements. *The street network should create a convenient route for residents between their home and higher order roads.* *The street network should facilitate walking and cycling within the neighbourhood and to local activity centres.* *The street network should take into account existing topography and existing open space systems.* *Streets should not operate as through traffic routes for externally generated traffic while at the same time limiting the length of time local drivers need to spend in a low speed environment.* *Streets and lots should be located so that residential dwellings are not subjected to unacceptable traffic noise.* ***Rules*** *(a) The design specifications in Figure D3.3 are met.* *(b) A minimum spacing of staggered junctions in a local street network should be 20 metres.* *(c) The street network should be orientated where practical, to promote efficient solar access for dwellings as shown in Part C Chapter 6 Energy Efficiency.* *(d) Cul-de-sacs for residential roads should have minimum seal radii of 8.5 metres and boundary radii of 12.0 metres.* *(e) Cul-de-sacs should not exceed 200 metres in length unless topographic constraints render other options impracticable.* *(f) Off street parking shall be provided in cul-de-sacs at the*		

Control	Proposed	Complies
rate of 1 space per lot. *(g) Streets should be designed to allow for the provision of suitable and safe conditions for street trees.*		
3.7.2 Residential Accessway Design *An accessway is a driveway or private road which services between one and five allotments.* ***Aims*** *(h) To ensure that vehicular access to all lots within the subdivision is simple, safe and direct.* *(i) To ensure that accessways do not detract from the amenity of localities.* ***Objectives*** *Accessways design should provide safe and efficient entrance/exit to individual lots.* *Accessways should be landscaped and treated so as to reduce the visual and environmental impact of hard paved areas.* *Accessway designs should minimise the impact on the amenity of the existing and future dwellings. They should be sited away from noise and visually sensitive components of existing and future dwellings.* *Accessways should provide interest and variety and avoid lengthy straight sections.* ***Rules*** *(a) Accessways should have a minimum width of 4 metres and sealed pavement of 2.5 metres.* *(b) Accessways should not serve more than 5 lots.* *(c) Accessways should have a*	Details of access to each of the proposed lots has been prepared by Martens & Associates. Full details have been submitted with the development application.	Yes

	Control	Proposed	Complies
	maximum grade of 25% (1:4) at any point.		
(d)	*Where the accessways is steep or fronts a local collector or higher order road (greater than 3,000 vehicles per day) or a high pedestrian area, accessways should be designed so that vehicles can be driven both onto and off the property in a forward direction.*		
(e)	*Where vehicles would otherwise have to reverse more than 50 metres, a turning area should be provided to enable the vehicles to enter and leave the site in a forward direction and reduce the need to reverse over long distances.*		
(f)	*Refer to Part D Chapter 1 Residential Development for further requirements regarding accessways should a subdivision be part of a residential development.*		
3.7.4	***Stormwater Management***		
Aims			
(d)	*To control the flow of water into the natural and man made drainage systems in such a way to minimise impacts from storm water runoff.*	Each of the proposed lots would subsequently be developed with a dwelling house, that process being the subject of future development applications. Stormwater drainage and management has been design by Martens & Associates. Full details of the stormwater design and treatment process have been submitted with the development application.	Yes
(e)	*To contribute positively to the environmental enhancement of catchment areas.*		
(f)	*To provide water quality management systems which:*		
	- *ensure that disturbance to natural stream systems is minimal; and*		
	- *storm water discharge to surface and underground receiving waters, both during*		

Control	Proposed	Complies
construction and during residential use of the subject land, does not degrade the quality of the water at the receiving end. **Objectives** Drainage from subdivision sites should be consistent in both water quality and quantity terms with the predevelopment storm water patterns. Drainage systems should be designed so as to ensure safety and minimise the likelihood of storm water inundation of existing and future dwellings. Adequate provision should be made for measures during construction to ensure that the landform is stabilised and erosion controlled. **Rules** (a) Where site topography prevents discharge of storm water directly to the street gutter or a Council controlled pipe system, inter allotment drainage provided to accept run off from all existing or future impervious areas on the subject land. The design and construction of the inter allotment drainage system should be in accordance with the requirements of the Australian Rainfall and Runoff (1987). (b) Where proposals require the creation of easements over downstream properties for drainage purposes, a letter of consent from the owner(s) of the downstream properties should be submitted with DAs. (c) Stormwater piped in roads and through allotments in all residential subdivisions. (d) For subdivision proposals comprising 5 lots or more or where Council deems it		

Control	Proposed	Complies
necessary, a soil and water management plan should be prepared by a properly qualified practitioner with the aim of minimising erosion and maximising the quality of any water leaving the site.		
3.7.5 Lot Size and Shape ***Aims*** *(e) To ensure that newly created allotments have dimensions which allow flexibility and choice of housing design whilst minimising development costs.* *(f) To promote allotments of varying sizes which provide pleasant streetscapes, satisfy user requirements and minimise environmental impacts.* ***Objectives*** *Lot sizes and dimensions should enable dwellings to be sited to:* - *protect natural and cultural features;* - *acknowledge site constraints including soil erosion and bush fire risk;* - *retain special features such as trees and views;* - *dispose of effluent on site where sewer not available; and* - *Provide for wildlife habitats and the growth of trees.* - *Lot sizes and configurations should be varied to provide a mix of allotment types which create pleasant streetscapes and encourage a variety of housing types.* ***Rules*** *(a) In calculating the area of a*	Each of the proposed lots contains a minimum area of 450m^2 as required by LEP 2012. A minimum 15 metre building line is achieved for each of the proposed lots. The Plan of Proposed Subdivision shows a building envelope of minimum 200m^2 and width of 15 metres for each of the proposed lots. All of the proposed lots has a depth of minimum 20 metres. As much as possible of the existing vegetation on the Site would be retained. Vegetation would need to be removed as part of the development of each of the proposed lots for a dwelling house. The nature of the Site and the configuration of the proposed lots are such that future dwelling houses should be able to be constructed with a minimum amount of cut and/or fill of 1 metre.	Yes

Control		Proposed	Complies
	battle-axe or hatchet shaped allotment the accessway is to be excluded. The area of an allotment effected by a "right of carriage way" or private road should also be excluded.		
(b)	*Allotments should have a minimum width of 15 metres at the building line. Council may consider a lesser dimension but only as part of an integrated housing development.*		
(c)	*Lots should be able to accommodate a building envelope of 200m^2 with a minimum dimension of 10 metres.*		
(d)	*An allotment should not be less than 20 metres in depth to ensure there is some flexibility in the choice of housing design and siting as well as the availability of suitable space for other activities normally associated with a dwelling.*		
(e)	*Vegetation which adds significantly to the visual amenity of a locality and/or which is environmentally significant should be conserved in the design of the subdivision proposal.*		
(f)	*Lots should be designed to allow the construction of a dwelling with a maximum cut or fill of 1 metre from the natural ground level.*		
3.7.6	***Solar Access and Lot Orientation***		
Aims			
(g)	*To encourage the design of subdivisions which maximise solar access.*	All proposed lots are oriented such that dwelling houses would be able to be constructed on each lot with maximum solar access.	Yes
(h)	*To ensure flexibility in the siting of buildings to take advantage of a northern orientation.*	The design of the subdivision is such that no lot would be configured to allow a future dwelling to overshadow existing adjoining development.	
(i)	*To maximise the number of*		

Control	Proposed	Complies
allotments which have good solar access and therefore which optimise the design performance of energy smart homes. ***Objectives*** *Lots should be designed to maximise solar access.* *Lots should be orientated to take advantage of micro climatic benefits and have dimensions to allow adequate on site solar access, taking into account likely future dwelling size and a relationship of each lot to the streets.* *Lots are of a suitable shape to permit the location of a dwelling with suitable solar access and private open space.* ***Rules*** *(a) Lots orientated to provide long access in a northerly direction (plus or minus 200).* *(b) Eighty per cent of lots in a new subdivision having 5 star solar access, and the remainder either 4 or 3 star.* *(c) On a street running north-south, lots to be increased in width to enable private open space on the northern side of the building envelope.* *(d) Lots designed so that future buildings will not overshadow neighbouring houses to the south, and have a sufficiently long northern facade to receive winter sun*		

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Appendix 4.3.12.2 Envionmental report - Jewel Phase 1 Sept 2015 - ADDITIONAL DOCUMENT

Phase 1 Environmental Site Assessment

67 Kurrajong Road, Kurrajong NSW

for PRJM Pty Ltd

September 2015

J1696.2R-rev0

CMJA

C. M. Jewell & Associates Pty Ltd

Phase 1 Environmental Site Assessment – 67 Kurrajong Road, Kurrajong NSW
September 2015

J1696.2R-rev0

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CHRIS JEWELL
Principal

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

Measures

cm	centimetre
L/s	litre per second
m	metre
m^2	square metre
mg/L	milligram per litre
mm	millimetre

General

ACM	asbestos containing material
AHD	Australian Height Datum
ASC NEPM	National Environment Protection (Assessment of Site Contamination) Measure 1999
CMJA	C. M. Jewell & Associates Pty Ltd
Council	Hawkesbury City Council
DP	deposited plan
DPI Water	Department of Primary Industries Water
EPA	Environment Protection Authority
ESA	Environmental Site Assessment
Hawkesbury LEP	*Hawkesbury Local Environmental Plan 2012*
LPI	Land and Property Information
MGA	Map Grid of Australia

1.0 INTRODUCTION

1.1 Background

This Phase 1 Environmental Site Assessment (ESA) report relates to land located at 67 Kurrajong Road, Kurrajong, New South Wales (the Site). Specifically, the Site is identified as Lot 1 in DP1185012.

At the time of this report, the Site is owned by PRJM Pty Ltd.

It is understood that this Phase 1 ESA is required to support a development application to be lodged with Hawkesbury Council for a proposed 49-lot residential development at the site. Accordingly, PRJM Pty Ltd commissioned C. M. Jewell & Associates Pty Ltd (CMJA) on 11 August 2015 to undertake a Phase 1 ESA in line with CMJA's proposal dated 10 August 2015 (ref. P1696.1L).

1.2 Project Objectives

The objectives of this project were to:

- Review the history and current status of the site;
- Identify potential sources of contamination and determine potential contaminants of concern;
- Identify areas of potential contamination;
- Identify potential human and ecological receptors;
- Identify potentially affected media (soil, sediment, groundwater, surface water, indoor and ambient air).
- Assess the risks posed by potential contamination under the land uses permitted by its zoning.

1.3 Scope of Work

The scope of work carried out for this Phase 1 ESA, consistent with the *National Environment Protection (Assessment of Site Contamination) Measure 1999* (ASC NEPM), included the following:

- Land title search.
- Historical aerial photography review.
- Identification of zoning.
- Site ownership and occupation train.
- Chronological list of previous, present and proposed site uses.
- Hawkesbury City Council (Council) development application search and provision of a Planning Certificate (under Section 149 of the *Environmental Planning and Assessment Act* 1979).
- Search for any underground services within the site (Dial Before You Dig).
- Identification of adjacent land uses.
- Desktop assessment of the local groundwater conditions.
- Assessment of environmental conditions at the site, including topography, geology, hydrogeology, soil type, surface water drainage, and flood potential.
- Identification of local sensitive environments.
- A site walkover inspection – identification of any evidence of contamination, potential contaminants of concern, and likely contamination pathways.

- Visual assessment of any capped surfaces.
- Obtaining current site photographs.
- Discussions with Council with regards to site history.
- Production of this report.

1.4 Report Format

Section 1 of this report provides background information for the assessment, the project objectives and the scope of work conducted to achieve those objectives.

Section 2 sets out basic identification and description details for the Site. It also provides a summary of the environmental conditions at the site, including the Site's topography and drainage, geology, and hydrogeological setting.

Section 3 discusses the Site's history, and also provides a brief discussion on historical aerial photographs of the Site.

Section 4 describes the condition of the Site and surrounding land as observed during a site walkover, together with the results of laboratory analysis from samples taken during the site visit.

Section 5 presents the conclusions of the assessment and recommendations.

1.5 Limitations and Intellectual Property Matters

This report has been prepared by C. M. Jewell & Associates Pty Limited for the use of the client identified in Section 1.1, for the specific purpose described in that section. The project objectives and scope of work outlined in Sections 1.2 and 1.3 were developed for that purpose, taking into consideration any client requirements and budgetary constraints set out in the proposal referenced in Section 1.1.

The work has been carried out, and this report prepared, utilising the standards of skill and care normally expected of professional scientists practising in the fields of hydrogeology and contaminated land management in Australia. The level of confidence of the conclusions reached is governed, as in all such work, by the scope of the investigation carried out and by the availability and quality of existing data. Where limitations or uncertainties in conclusions are known, they are identified in this report. However, no liability can be accepted for failure to identify conditions or issues which arise in the future and which could not reasonably have been assessed or predicted using the adopted scope of investigation and the data derived from that investigation. An information sheet – 'Important Information about your Environmental Site Assessment' – is provided with this report. The report should be read in conjunction with that information sheet.

Where data collected by others have been used to support the conclusions of this report, those data have been subjected to reasonable scrutiny but have essentially, and necessarily, been used in good faith. Liability cannot be accepted for errors in data collected by others.

This report, the original data contained in the report, and its findings and conclusions remain the intellectual property of C. M. Jewell & Associates Pty Ltd. A licence to use the report for the specific purpose identified in Section 1.1 is granted to the persons identified in that section on the condition of receipt of full payment for the services involved in the preparation of the report.

This report should not be used by other persons or for other purposes than those identified in Section 1.1, and should not be reproduced except in full and with the permission of C. M. Jewell & Associates Pty Ltd.

2.0 SITE CONDITIONS

2.1 Site Identification

This assessment relates to land identified as 67 Kurrajong Road, Kurrajong, NSW, and further identified as Lot 1 in DP1185012, in the Parish of Kurrajong, County of Cook (the Site).

The Site is located approximately 75 kilometres north-west of Sydney. It lies within Hawkesbury City Council's Local Government Area and is currently zoned R2 Low Density Residential under the *Hawkesbury Local Environmental Plan 2012* (Hawkesbury LEP).

The location and setting of the Site is shown on Figure 1.

2.2 Site Description

The Site covers an area of approximately 32,500 m^2 and is irregular in shape.

Map Grid of Australia (MGA) Zone 56H co-ordinates of the centre of the site are 283036 mE and 6285210 mN.

2.3 Current Site Use and Layout

The Site is vacant with no current land use. However, according to the NSW Land and Property Information (LPI) online map (maps.six.nsw.gov.au), the fence line and structures (chicken coop, compost bin, shed lean-to, clothes line) located at the rear of residential properties located at 79, 81 and 83 Kurrajong Road encroach onto the Site. See Section 4 for further discussion.

The Site is covered in dense bushland with the exception of several cleared areas in its eastern and northern portions and surrounding adjacent residential properties, and a dirt (vehicle) track that runs from the Site's eastern boundary (entrance on Kurrajong Road) to the rear of a residential property (136 Old Bells Line of Road) located on its western boundary.

The Site's layout is illustrated on Figure 2.

2.4 Surrounding Area

The Site is located in a rural residential area, bounded as outlined below.

To the north	Kurrajong Road and three residential properties, beyond which lies rural residential properties
To the east	Kurrajong Road beyond which lies rural residential properties and Kurrajong Baptist Church
To the south	Residential properties (under construction at the date of this report)
To the west	The rear of residential properties and Bellbird Kindergarten & Preschool, that front Old Bells Line of Road

2.5 Topography and Drainage

The Site lies at an elevation ranging from 135 metres above Australian Height Datum (AHD) at its lowest to 144 metres AHD at its highest; sloping from the south of the Site to the north-west and east.

Regionally, the landscape consists of undulating to rolling low hills on Wianamatta Group shales without crops of Minchinbury Sandstone. Hawkesbury Sandstone is exposed in the deeper valleys. Local relief is to 50 to 80 metres, and slopes are usually 5 to 20%. Narrow ridges, hillcrests and valleys are typical of the landscape. Tree cover has been extensively cleared; it was formerly tall open-forest (wet sclerophyll forest).

Drainage of the Site is via infiltration and runoff; runoff is likely to follow the flow of topography towards the north-west and towards the east.

A review of Council's Planning Certificate indicates that the land is not subject to riverine flood-related development controls.

2.6 Geology and Soils

Inspection of the Penrith 1:100,000 Geological Map (Geological Series Sheet 9030, Geological Survey of NSW 1991) indicates that the site is underlain by a thin cap of Triassic-age Ashfield Shale overlying Triassic-age Hawkesbury Sandstone, which outcrops along Little Wheeny Creek.

Ashfield Shale is part of the Wianamatta Group of shales that outcrop widely in the central part of the Sydney basin. The Ashfield Shale typically comprises dark grey shale and laminite.

The Hawkesbury Sandstone is a quartz sandstone averaging 68 per cent quartz, 2 per cent rock fragments, 1 per cent feldspar and 1 per cent mica. The sandstone usually has a clay matrix, which comprises up to 20 per cent of rock volume. The sandstone is predominantly medium to coarse grained, and varies locally from fine to very coarse-grained. Scattered pebbles of white vein quartz, usually less than 6 millimetres, are common throughout and also occur in bands.

Inspection of the Penrith Soil Landscape Series Sheet 9030 indicates that the Site is located on the Luddenham Landscape, comprised of shallow (<100 cm) dark podzolic soils or massive earthy clays on crests, moderately deep (70 to 150 cm) red podzolic soils on upper slopes, moderately deep (<150 cm) yellow podzolic soils and prairie soils on lower slopes and drainage lines. Limitations include high soil erosion hazard and moderately reactive localised impermeable highly plastic subsoil.

The Department of Infrastructure, Planning and Natural Resources' *Salinity Potential in Western Sydney 2002* map (1:100,000 scale) indicates that there is moderate potential for salinity in the region.

2.7 Acid Sulphate Soils

Because the Site lies at an elevation of at least 135 metres AHD, acid sulphate soils would not be expected to be an issue in the area around the Site.

A review of the Acid Sulphate Soil Risk Map (NSW Natural Resource Atlas) showed that the Site is not within an acid sulphate soil risk area. Therefore, acid sulphate soils are not known or expected to occur in this environment.

However, CMJA notes that Section 7.5 of the Planning Certificate indicates that Council or another public authority has adopted a policy that restricts the development of the land because of the likelihood of acid sulphate soils.

PRJM Pty Ltd may wish to query this statement as it appears anomalous.

2.8 Hydrogeology

2.8.1 Groundwater Regime

Locally, groundwater is likely to be encountered at a depth of 60 to 130 metres below ground level, within the Hawkesbury Sandstone. The potentiometric surface (the level to which water will rise in a completed bore) is likely to be 30 to 50 metres below ground level. The potential also exists for one or more perched groundwater tables to be present between the ground surface and the underlying aquifer.

Groundwater movement within the sandstone is likely to be via two processes. Groundwater would move predominantly through secondary features such as fracturing associated with the network of joints (which are generally high angle) and features such as subhorizontal bedding-plane fractures. Although these fractures do generally not conduct large volumes of water in themselves, the secondary porosity is important in providing potential contaminant transport conduits. In addition, some intergranular flow may occur in horizons of weathered sandstone, cross-stratified sandstone, and coarse poorly cemented sandstone horizons deeper within the unit. These groundwater movements would be consistent with the local structural orientation of the aquifer. Porous layers with primary permeability may be present in some of the coarser sandstone units.

Yields obtained from the Hawkesbury Sandstone are generally low, usually less than 1.5 litres per second; the groundwater would be expected to have a low salinity, typically less than 500 milligrams per litre (mg/L). The pH of the water is also generally low, usually of the order of 5.8 to 6.8.

2.8.2 Local Registered Groundwater Wells

Groundwater beneath the site is regulated by the Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources, which commenced in July 2011. This groundwater is part of the Hawkesbury Nepean water management area. Groundwater from this source may only be taken subject to the grant of an aquifer access licence and works approval for the bore or other abstraction works.

A search of the NSW Department of Primary Industries Water (DPI Water) groundwater database identified no registered groundwater wells on the site and seven registered groundwater wells located within a 1-kilometre radius of the site.

Details of the groundwater wells are described in Table 1. Figure 3 shows the locations of the groundwater wells whilst Appendix A presents the groundwater works summary for each well.

TABLE 1
Details of Local Registered Groundwater Wells

ID / Location from Site	Use	SWL (m)	Well Depth (m)	Yield (L/s)	Geology (m)
GW100708 (775 metres east)	Domestic, Stock, Irrigation, Industrial	38.0	134.0	1.50	0.00 – 3.00 Clay 3.00 – 58.00 Shale 58.00 – 134.00 Sandstone
GW104396 (840 metres east)	Stock, Domestic	-	165.0	4.00	No information
GW105804 (980 m north-west)	Stock, Domestic	41.0	134.0	2.30	0.00 – 14.00 Soil 14.00 – 39.00 Shale 39.00 – 103.00 Sandstone 103.00 – 104.00 Shale 104.00 – 134.00 Sandstone
GW107452 (875 m south-east)	Stock, Domestic	2.0	108.0	9.85	0.00 – 6.00 Clay, brown shale 6.00 – 21.00 Shale 21.00 – 39.00 Sandstone / Shale 39.00 – 53.00 Sandstone 53.00 – 84.00 Sandstone / Shale 84.00 – 86.00 Shale 86.00 – 93.00 Sandstone / Shale 93.00 – 108.00 Sandstone, quartzite

TABLE 1
Details of Local Registered Groundwater Wells

ID / Location from Site	Use	SWL (m)	Well Depth (m)	Yield (L/s)	Geology (m)
GW107611 (910 m south-east)	Domestic	35.0	78.0	21.60	0.00 – 1.00 Soil (fill) 1.00 – 3.00 Clay 3.00 – 30.00 Sandstone, yellow 30.00 – 32.00 Sandstone / Shale 32.00 – 34.00 Sandstone 34.00 – 35.00 Shale 35.00 – 56.00 Sandstone / Shale 56.00 – 57.00 Shale 57.00 – 78.00 Sandstone
GW111033	Domestic	43.0	138.0	1.20	0.00 – 12.00 Clay 12.00 – 36.00 Shale 36.00 – 45.00 Sandstone / Shale 45.00 – 115.00 Sandstone 115.00 – 122.00 Shale 122.00 – 138.00 Sandstone / Quartz
GW111034 (660 m south-east)	Domestic	30.0	84.0	2.00	0.00 – 5.00 Clay 5.00 – 10.00 Sandstone 10.00 – 15.00 Sandstone / Shale 15.00 – 84.00 Sandstone

2.9 Environmental Setting

2.9.1 Ecological Receptors

CMJA carried out a 500-metre radius search around the Site to identify potential ecological receptors such as surface water bodies, wetlands and areas of ecological significance. The search indicated that Little Wheeny Creek is located approximately 50 metres north and west of the Site, tributaries of which also flow approximately 15 metres to the east, 100 metres to the south-east and 150 metres to the south-west of the Site.

The location of Little Wheeny Creek is shown on Figure 3.

2.9.2 Endangered Ecological Communities

A review of Council's Planning Certificate indicated that the Site:

- does not include or comprise a critical habitat declared under Part 3 of the *Threatened Species Conservation Act* 1995 and Part 7A of the *Fisheries Management Act* 1994;
- is not within a conservation area;
- is not biodiversity certified land within the meaning of the *Threatened Species Conservation Act* 1995;
- has not been notified as land to which a biobanking agreement under the *Threatened Species Conservation Act* 1995 relates; and
- is not subject to a property vegetation plan under the provisions of the *Native Vegetation Act* 2003.

The Hawkesbury LEP and the *Hawkesbury Development Control Plan* 2002 contain provisions which relate to the preservation of trees and vegetation throughout the local government area.

A copy of the Planning Certificate is provided as Appendix B.

2.10 Contaminated Land Search

A search of NSW Environment Protection Authority's (EPA) contaminated land register indicated that the Site is not the subject of a declaration, order, agreement, proposal or notice under the *Contaminated Land Management Act* 1997.

A search of NSW EPA's public register indicated that the Site is not the subject of a licence, application, notice, audit or pollution studies and reduction programs under the *Protection of the Environment Operations Act* 1997.

2.11 Meteorology

Records collected by the Bureau of Meteorology indicate that annual average rainfall at the Site is 1248 millimetres (mm). This has been determined from data received from the Kurrajong Heights (Bells Line of Road) weather station (located approximately 2.5 kilometres north-west of the Site), over a period of 149 years.

2.12 Underground Services Search

An online search for utilities located within the Site was conducted and is summarised in Table 2. Asset owners Endeavour Energy and Sydney Water provided information on their utilities.

Copies of underground services reports supplied by the asset owners are provided as Appendix C.

TABLE 2
Summary of Underground Services Search

Asset Owner	Utility Type	Utility Location
Sydney Water	Sewer Main	Sydney Water's map shows no sewer mains crossing the Site.
	Water Main	Sydney Water's map shows no water mains crossing the Site. A 150 cast iron cement lined pipe is located adjacent to the Site's Kurrajong Road boundary.
Endeavour Energy	Electrical Cable	Endeavour Energy's map shows that no underground assets are present within the Site.

3.0 SITE HISTORY

3.1 NSW Land Titles Search

On 14 August 2015, CMJA conducted an historical land title search for the Site through the NSW LPI website. The results of the land title search are summarised below in Table 3.

TABLE 3
Summary of Land Title Search

Date	Activity
Prior to 25 Jul 2015, the Site was Crown Land owned and managed by NSW Government.	
8 Jul 2009	Folio Lot 7304 in DP1141427 was created for the Site.
15 May 2013	Folio Lot 1 in DP1185012 was created for the Site and previous folio was cancelled.
25 Jul 2015	The title for Lot 1 in DP1185012 was transferred to PRJM Pty Ltd.

Copies of the land title documents are provided as Appendix D.

3.2 Council Records

A review of Council's Planning Certificate indicated:

- The Site does not contain an item of environmental heritage under the protection of Hawkesbury LEP.
- The Site is not affected by the operation of Sections 38 or 39 of the *Coastal Protection Act* 1979.
- The Site has not been proclaimed to be a mine subsidence district within the meaning of Section 15 of the *Mine Subsidence Compensation Act* 1961.
- The Site is not affected by any road widening / road realignment under Division 2 of Part 3 of the *Roads Act* 1993 and/or an environmental planning instrument.
- The Site **is** bush fire prone land.

3.3 Review of Historical Aerial Photographs

Historical aerial photographs of the Site were sourced from Google Earth and NSW LPI.

The information provided in Table 4 is based on a review of aerial photographs that were taken between 1958 and 2015.

Copies of the historical aerial photographs are provided as Appendix E.

TABLE 4
Review of Aerial Photographs

Date	Summary
1958	The Site appears predominantly cleared / grassed with a few trees in the western portion. No buildings are visible on the Site. The surrounding area comprises small farming properties, orchards, open land and wooded areas. Three residential properties (79, 81 and 83 Kurrajong Road) are visible adjacent to the Site's northern boundary.
1970	The Site appears mostly cleared / grassed however what appear to be tractor marks suggest the majority of the Site has recently been tilled, maybe for agricultural use. Trees / shrubs are visible in the middle and western corner of the Site. The surrounding area comprises small farming properties, orchards, open land and wooded areas. An orchard is visible adjacent to the Site's southern boundary. A few more small residential properties are visible in the area than in 1958.
1975	The Site appears mostly cleared / grassed, however, trees are now visible in the western and southern portions of the Site. The tilled areas noted in the 1970 photograph are no longer visible. The surrounding area comprises small farming properties, orchards (fewer than 1970), open land and wooded areas. Several more residential properties are visible in the area and the orchard noted to the south of the Site in the 1970 photograph is now partially cleared.
1982	The Site consists of equal grassed and wooded areas. Trees / shrubs cover the western and southern portions of the Site and are visible (sporadically) over the remainder of the Lot. A vehicle track is visible running through the centre of the Site from Kurrajong Road (in the east) to the rear of a residential property on the Site's western boundary (136 Bells Line of Road). Similar to 1975, the surrounding area comprises small farming properties, open land and wooded areas. However, more small residential properties are now visible to the west of the Site. A building is now visible where the Kurrajong Baptist Church is now situated. The orchard that appeared in the 1970 photograph to the south of the Site is no longer visible, and the area is now grassed.
1994	Most of the Site is now covered with trees and shrubs, grassed areas are still visible in the eastern portion of the Site. The vehicle track is still visible running east-west across the Site. The surrounding area comprises small farming properties, open land and wooded areas, however, several more residential allotments are visible to the south and west of the Site.
2002	Except for patches in the northern and eastern portions, the Site is covered with trees and shrubs. The vehicle track is barely visible due to tree canopies. Similar to 1994, the surrounding area comprises small farming properties, open land, wooded areas and residential allotments.
2010	Except for patches in the northern and eastern portions, the Site is covered with trees and shrubs. The vehicle track is once again visible. The surrounding area still comprises small farming properties, open land and wooded areas. However, there is an increase in the number of residential allotments to the south and east of the Site.
2015	Except for patches in the northern and eastern portions, the Site is covered with trees and shrubs. The vehicle track is barely visible due to tree canopies. Similar to 2010, the surrounding area comprises small farming properties, open land, residential allotments. Two large residential properties are now visible adjacent to the Site's southern boundary.

3.4 Historical Research of the Area

A review of Council's website and Kurrajong.org.au indicated that prior to the European settlement circa 1790, up to 3000 Dharug people lived in the Hawkesbury Valley, drawn to the banks of the Hawkesbury River (which they called the Deerubbin). The name Kurrajong came from the Aboriginal word for beautiful tree and was used as a general name for the area from the Hawkesbury River to the mountains.

The oldest settlement in Kurrajong was along Comleroy Road, which from about 1819 had been the main road north from Sydney to the Hunter Valley and was primarily used to drove cattle. By 1841, the convict built road through Kurrajong, Bells Line of Road, was opened. Several inns, catering for locals and travellers, were situated along the Bells Line of Road, one of which, the Goldfinder's Rest, established in 1851, later (in 1870) became a Post Office and Store. The original building still exists beside Little Wheeney Creek and is a private residence. The present Bells Line of Road, with easier grades, was opened in 1901.

In the late 19th century, as more settlers moved into the area, the area was found to be suitable for growing of fruit trees and became renowned for its orchards. During the 1920s and 1930s, may guest houses were established in the district, especially along Comleroy Road; the beautiful scenery of rolling hills and orchards with the mountain backdrop attracting many city people for a stay in the country. However, the 1950s and 60s saw a decline in local tourism and Kurrajong's orchards also declined with many properties being subdivided into smaller acreages and horses and cattle grazed on the paddocks once covered by fruit trees.

More recently, the scenery and rural tranquility has made Kurrajong a popular location for both tourism and people wanting an escape from the bustle of life in the city with many purchasing small acreages as hobby farms or rural retreats.

4.0 SITE VISIT

On 27 August 2015, CMJA conducted a limited surface walkover inspection of the Site and surrounding area. Photographs taken during the Site walkover are included as Appendix F.

The following observations were made:

- The Site is a partially-fenced vacant block of land located in a semi-rural area.
- A dirt vehicle track runs through the Site from the eastern boundary (entrance on Kurrajong Road) to the rear of a residential property on the western boundary (located at 136 Old Bells Line of Road) (see Photographs 1 and 2).
- There were no obvious signs of **off-site** activities which could impact the Site.
- The Site was generally flat, i.e. with little undulation, with slight slopes to the north-west and to the east.
- There was no evidence of rock outcropping within the Site.
- Most of the Site is covered in medium to dense vegetation consisting of native and foreign species of trees and shrubs, and groundcover consisting of vines, grasses, weeds, leaf / bark litter, fallen branches, etc., making some areas of the Site inaccessible during the walkover. Photographs 3 to 7 show examples of vegetation observed during the walkover.
- Areas of cleared (mowed) land were noted in the northern and south-eastern portions of the Site and surrounding the adjoining residential properties (see Photographs 8, 9 and 10).
- There were no obvious signs of vegetation die-back on the Site.
- A cleared area adjacent to 79 Kurrajong Road contained a pile of woodchips, tree logs and evidence of a bonfire (see Photograph 10). It appears that this area has also been used to park cars.
- A small (likely man-made) gully filled with tree cuttings, was observed at the rear of 83 Kurrajong Road (see Photograph 11).
- A Satin Bowerbird (*Ptilonorhynchus violaceus*) nest (conservation status: not listed) was observed in the eastern portion of the Site, adjacent to 65 Kurrajong Road, as indicated on Figure 2 (see Photograph 12).
- No surface water was observed on the Site (seepage or drainage), even though heavy rainfall had recently occurred in the area.
- General rubbish was scattered (sparsely) across the property and included glass and plastic bottles, paint cans, tarpaulin, metal pipes, lumps of concrete, wire, and a for-sale sign. Several piles of cuttings (branches) were also observed on areas of the Site that surrounded the adjoining properties.
- Although there were no obvious signs of extensive illegal dumping or contamination on the Site, several areas of concern (as indicated on Figure 2) were observed during the walkover:
    - an area of dumped material consisting of metal and plastic piping, tyres, bricks and tin cans (Area A) (see Photographs 13 and 14);
    - an area of dumped rubble consisting of bricks, tiles and potential asbestos-containing material (ACM) (Area B) (see Photograph 15). Two pieces of potential

ACM were collected from this area and analysed for asbestos content (see Section 4.1 for details); and

- a small pile of dumped soil containing bricks, pavers and concrete (Area C) (see Photograph 16).

- There was no visible surface staining within the Site.
- There was some evidence of cutting activity along the Kurrajong Road boundary (see Photograph 7) and where the vehicle track that runs through the centre of the Site met the rear of the adjoining residential property on the western boundary (see Photograph 2).
- Slight filling (gravel) was observed in the area where the vehicle track met the rear of the adjoining residential property on the western boundary (see Photograph 2); and fill (mulch) was observed on the northern boundary of the Site adjacent to 144 Old Bells Line of Road (see Photograph 17).
- No areas of pavement or hardstand were observed on the Site.
- As noted in Section 2.3, the following structures appeared to encroach onto the Site:
  - part of the chicken coop and a compost bin at the rear of 83 Kurrajong Road;
  - the fence line at the rear of 81 Kurrajong Road; and
  - a lean-to and clothes line at the rear of 79 Kurrajong Road.

  As shown in Photographs 10 and 18.

4.1 Analysis of Potential Asbestos-Containing Material

During the site walkover, CMJA observed an area of dumped material consisting of bricks, tiles and pieces of potential ACM in the south-western portion of the Site (as illustrated on Figure 2). Two pieces of the potential ACM were collected by CMJA, placed in zip-lock bags and submitted to Australian Laboratory Services (ALS) for asbestos identification.

The results of the laboratory analysis indicated that one of the pieces was bonded asbestos cement sheeting. Copies of the chain of custody, sample receipt notification, certificate of analysis and quality assurance / quality control documentation are provided as Appendix G of this report.

Section 5.2 of this report sets out CMJA's recommendations regarding the disposal of material from the area in which the ACM was observed.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Based on the findings of this Phase 1 ESA, CMJA concludes that:

- Review of historical aerial photography indicates that the Site was previously, and is currently, undeveloped vacant land and, prior to its purchase in 2015, was Crown Land.
- A review of NSW LPI mapping (http://maps.six.nsw.gov.au/) indicates that a fence line, a lean-to, a chicken coop, a compost bin and a clothes line relating to 79, 81 and 83 Kurrajong Road encroach onto the Site (see Photographs 10 and 18).
- Most of the Site is covered in medium to dense vegetation, although areas of cleared (mowed) land were observed in the northern and eastern portions of the Site and surrounding the adjoining residential properties.
- There were no obvious signs of vegetation die-back at the Site.
- The Site was free of statutory notices issued by the NSW EPA under the *Contaminated Land Management Act* 1997 and the *Protection of the Environment Operations Act* 1997.
- There was no evidence to suggest that any underground storage tank, aboveground storage tank, or similar has been present on the Site.
- There was no evidence that extensive filling activities have taken place at the Site.
- There was some evidence of minor cutting activity along the Kurrajong Road boundary and at the rear of 136 Old Bells Line of Road.
- The following issues were noted during the site visit:
  - an area of dumped material consisting of metal and plastic piping, tyres, bricks and tin cans (Area A);
  - an area of dumped rubble consisting of bricks, tiles and ACM (Area B);
  - a small pile of dumped soil containing bricks, pavers and concrete (Area C); and
  - general rubbish throughout the Site at various locations.

5.1.1 Qualitative Risk Assessment

A qualitative risk assessment is subjective and based on professional judgement, taking into account all the information about the site that has been assembled in this report.

Risk has two components, consequence, and probability or likelihood of that consequence occurring. Consequences relevant to this assessment are defined in Table 5, and likelihood is defined in Table 6.

TABLE 5
Classification of Consequence

Classification	Definition	Examples
Severe	Long-term damage to human health (including unacceptable cancer risk) or acute hazard in the absence of remediation or management. Land declared to be significantly contaminated pursuant to Sections 11 and 12 of the *Contaminated Land Management Act* 1997. Major delays to development or construction. Major remediation costs (> $1M or >site value).	Severe groundwater contamination extending off-site. High or very high ground gas risk. Extensive and/or deep soil contamination requiring remediation.
Medium	Long-term damage to human health (including unacceptable cancer risk) or acute hazard in the absence of remediation or management. Land declared to be significantly contaminated pursuant to Sections 11 and 12 of the *Contaminated Land Management Act* 1997. Major delays to development or construction. Significant remediation costs (>$100,000 or 10-100% of site value).	Significant groundwater contamination restricted to site, or site impacted by groundwater contamination originating off-site. Ground gas risk requiring management measures. Extensive and/or deep soil contamination requiring remediation or long-term management.
Mild	Minor delays to construction (<1 month). Remediation costs up to 10% of site value.	Chemical or ACM contamination of soils extending to depth and requiring remediation or long-term management.
Minor	Short delays to development or construction (< c 1 week). Minor unplanned remediation costs (< c $10,000).	Minor chemical or asbestos-containing material (ACM) contamination of shallow soil restricted to a small proportion of site.

TABLE 6
Classification of Likelihood

Classification	Definition
High likelihood	A credible linkage exists between the site and a current or historical source of contamination, and a hazardous event is very likely to exist or occur in the short term, and almost inevitable over the full timeframe of concern (typically the planning and construction process and the effective life of a building or development). The likelihood of the stated consequence is high.
Likely	A credible linkage exists and all necessary elements required for a hazardous event to exist or occur are present. Occurrence is not inevitable, but it is possible in the short-term and probable over the full timeframe of concern. The stated consequence is likely.
Low likelihood	A credible linkage exists and circumstances under which a hazardous event could exist or occur are possible. However, it is by no means certain that the event exists or will occur within the timeframe of concern, and it is less likely in the short term. Thus there is a low likelihood that that the stated consequence exists or will occur.
Unlikely	It is improbable that a hazardous event would occur within the timeframe of concern, and therefore unlikely that the stated consequence exists or will occur.

Risk is calculated as the product of these two qualities, using the matrix.

Probability	Consequence: Severe	Consequence: Medium	Consequence: Mild	Consequence: Minor
Highly likely	Very high risk	High risk	Moderate risk	Moderate/low risk
Likely	High risk	Moderate risk	Moderate/low risk	Low risk
Low likelihood	Moderate risk	Moderate/low risk	Low risk	Very low risk
Unlikely	Moderate/low risk	Low risk	Very low risk	Very low risk

Based on the scope of work undertaken, CMJA considers that the proposed development of the Site as a 49-lot residential subdivision (R2 Low Density Residential) is subject to the following levels of risk arising from potential contamination.

1) The risk of the Site being impacted by chemical contamination originating from adjacent sites is considered to be very low.

2) The risk of the Site being impacted by hazardous ground gases is considered to be very low.

3a) The risk of the Site being impacted by soil contamination arising from previous uses is very low.

3b) Except for the dumping of asbestos waste materials, the risk of the Site being impacted by asbestos (e.g. resulting from burial of demolition waste from on-site structures) is considered to be very low.

3c) There is a very low risk of chemical contamination of site soils and groundwater arising from previous land uses.

5.2 Recommendations

CMJA recommends that **prior to clearing the site** for the proposed development:

- The dumped material consisting of metal and plastic piping, tyres, bricks and tin cans (Area A), together with the metal pipes, wire, tin cans, etc. indicated on Figure 2 be removed from the Site and disposed of appropriately (i.e. to premises that may lawfully receive it).

- The area of dumped material consisting of bricks, tiles and ACM (Area B) together with the small pile of dumped soil containing bricks, pavers and concrete (Area C) be removed from the Site and disposed of appropriately (i.e. to premises that may lawfully receive it) by a suitably-qualified asbestos removal contractor. Following the removal of the material, Areas B and C should be inspected for ACM and a clearance certificate provided.

  Note: Removal of more than 10 m^2 of ACM requires a Class B asbestos removal licence. Pieces of ACM smaller than 7 mm x 7 mm in size should be treated as friable asbestos. Removal of friable asbestos requires a Class A asbestos removal licence, with an

exemption for removal of minor asbestos fines or asbestos-containing debris contamination.

- A walkover of the Site be carried out and any general rubbish (tarpaulin, bottles, etc.) be removed and disposed of appropriately.

As some areas of the Site were inaccessible during the walkover, CMJA recommends that if any unexpected finds are observed during the clearing of the Site (e.g. dumped soil, building materials, general waste, etc.) work should cease and the area be inspected for potential ACM. If potential ACM is observed it should be removed from the Site and disposed of appropriately prior to clearing recommencing to prevent spreading the material to other sections of the Site.

Following a survey of the Site by a registered surveyor, if the fence line, lean-to, chicken coop, compost bin and clothes line relating to 79, 81 and 83 Kurrajong Road are found to be encroaching onto the Site and require removal, CMJA recommends that materials associated with the demolition of the structures (if not retrieved by the occupiers of the adjacent properties) be disposed off-site appropriately.

The findings of this report and any subsequent investigation should be noted on the workplace asbestos register for the Site.

Any materials to be removed from the Site during development work are to be appropriately waste classified, and transported to a waste facility that may lawfully receive them.

Also, CMJA suggests that caution be taken when clearing the area in which the Bowerbird nest is located so as not to harm the bird or any eggs / chicks that may be present.

REFERENCES

ASC NEPM 1999, *National Environment Protection (Assessment of Site Contamination) Measure*, revised 2013, National Environment Protection Council

Websites Referenced

Dial Before You Dig, www.1100.com.au
NSW Land and Property Information, http://www.lpi.nsw.gov.au/
NSW DPI, Office of Water, http://allwaterdata.water.nsw.gov.au/water.stm
Six NSW Spatial Information Exchange, http://maps.six.nsw.gov.au/
Hawkesbury City Council, http://www.hawkesbury.nsw.gov.au
Kurrajong, http://www.kurrajong.org.au/kjhist.html

CMJA
C. M. Jewell & Associates Pty Ltd
Water and Environmental Management
ABN 54 056 283 295

Important Information About Your Environmental Site Assessment

These notes will help you to interpret your hydrogeological and Environmental Site Assessment (ESA) reports.

Why are ESAs conducted?

An ESA is conducted to assess the environmental condition of a site. It is usually, but not always, carried out in one of the following circumstances.

- As a pre-purchase assessment, on behalf of either purchaser or vendor, when a property is to be sold.
- As a pre-development assessment, if a property or area of land is to be redeveloped, or if its use is to change (for example, from a factory to a residential subdivision) – to meet a requirement for development approval.
- As a pre-development assessment of a 'greenfield' (undeveloped) site - to establish baseline conditions and to assess environmental, geological and hydrological constraints to the proposed development.
- As an audit of the environmental effects of an ongoing operation.

Each type of assessment requires its own specific approach. In all cases, however, the aim is to identify and if possible quantify the risks posed by unrecognised contamination. Such risks may be financial (for example, clean-up costs or limitations on site use), or physical (for example, health risks to site users or the public).

What are the limitations of an ESA?

Although the information provided by an ESA can reduce exposure to these risks, no ESA, however diligently carried out, can eliminate risks altogether. Even a rigorous professional assessment may not detect all contamination on a site. The following paragraphs explain why.

ESA 'findings' are professional estimates

The ground surface conceals a complex 3-dimensional subsurface environment. Subsurface materials, whether placed by geological processes or human activities, are always heterogeneous. Large variations in lithology and hydraulic properties can occur over short distances. Surface observation, and data obtained from boreholes and test pits, can never give us a complete picture of the subsurface.

All data from sampling and laboratory testing must be interpreted by a qualified professional – a geologist, engineer or scientist. They then render an opinion - about overall subsurface conditions, the nature and extent of contamination, its likely impact on the proposed development, and appropriate remediation measures.

Interpretation and professional judgement are thus essential to the assessment process.

Accuracy depends on the scope of work

Site assessment identifies actual subsurface conditions only at those specific points where samples are taken and when they are taken. The accuracy of the entire process depends on sampling frequency and sampling methods - yet the extent of sampling and soil analysis must necessarily be limited.

Sampling generally targets those areas where contamination is considered to be most likely, on the basis of visual observation and the site's history. This approach does maximise the probability of identifying contaminants, but it may not identify contamination in unexpected locations or from unexpected sources.

No professional, no matter how qualified, and no subsurface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock and time. For example, there may be contaminants in areas not surveyed or sampled; furthermore, they may migrate to areas that showed no signs of contamination at the time of sampling.

Conditions between sample locations can only be inferred – from estimates of geological and hydrogeological conditions, and from the nature and extent of identified contamination. Soil, rock and aquifer conditions are often variable, and so the distribution of contaminants across a site can be difficult to assess. Actual conditions in areas not sampled may differ from predictions.

The accuracy of an assessment is therefore limited by the scope of work undertaken.

Statistical tools can be helpful, but the validity of conclusions still depends entirely on the degree to which the original data reflect site conditions.

Uncertainty is also inevitable when it comes to assessing chemical fate and transport in groundwater and surface water systems, and calculating human health and environmental exposure risks. It is inevitable, too, when estimating remediation performance and time frames.

Your CMJA report includes a statement of the uncertainty associated with this particular project; you should read it carefully.

We can offer solutions

We cannot prevent the unanticipated, but we can minimise its impact. For this reason we recommend that you retain CMJA's services through the remediation and development stages. We can identify differences from predicted conditions, conduct additional tests as required, and recommend solutions for problems encountered on site.

Don't rely on out-of-date information

Subsurface conditions are changed by natural processes and the activity of people. Your ESA report is based on conditions that existed at the time of subsurface exploration. Don't make decisions on the basis of an ESA report whose adequacy may have been affected by time. Speak with CMJA to learn if additional tests are advisable.

If things change, contact us

Every report is based on a unique set of project-specific factors. If any one of these factors changes after the report is produced, its conclusions and recommendations may no longer be appropriate for the site.

Your environmental report should not be used:

- if the nature of the proposed development is changed - for example, if a residential development is proposed instead of a commercial one;
- if the size or configuration of the proposed development is altered;
- if the location or orientation of the proposed structure is modified;
- if there is a change of ownership; or
- for application to an adjacent site.

To help avoid expensive problems, talk to CMJA. We will help you to determine how any factors that have changed since the date of the report may affect its recommendations.

Your ESA report is prepared specifically for you

Every hydrogeological study and ESA report is prepared to meet the specific needs of specific individuals. A report prepared for a consulting civil engineer may not be adequate for a construction contractor, or even for another consulting civil engineer. A report should not be used by anyone other than the client, and it should not be used for any purpose other than that originally intended. Any such proposed use must first be discussed with CMJA.

Beware of misinterpretation

Costly problems can occur if plans are based on misinterpretations of an ESA. These problems can be avoided if CMJA is retained to work with appropriate design professionals. We will explain the relevant findings and review the adequacy of plans and specifications.

Logs and laboratory data should not be separated from the report

Final borehole or test pit logs are developed by CMJA's environmental scientists, engineers or geologists, using field logs (assembled by site personnel) and laboratory evaluation of field samples. Our reports usually include only the final logs, which must not under any circumstances be redrawn for inclusion in other documents.

Similarly, our reports often include field and laboratory data, and laboratory reports. These data should not be reproduced separately from the main report, which provides guidance on their interpretation and limitations.

To reduce the likelihood of misinterpretation, only the complete report should be made available for the use of persons or organisations involved in the project, such as contractors. Consult CMJA before distributing reports, and we will assist with any additional interpretation that is required.

Always read responsibility clauses closely

To avoid misunderstandings, our report includes qualifying statements that explain the level of certainty associated with our findings and recommendations, and responsibility clauses that indicate where our responsibilities to clients and other parties begin and end.

These qualifying statements and responsibility clauses are an important part of your report. Please read them carefully. They are not there to transfer our responsibilities to others but to help all parties understand where individual responsibilities lie.

These notes were prepared by C. M. Jewell & Associates Pty Ltd (CMJA) using guidelines prepared by the National Ground Water Association (NGWA) and other sources.

Source: NSW LPI

200 metres

C. M. Jewell & Associates Pty Ltd

Report Ref: J1696.2R
Rev: 0
Rev Date: 1-Sep-15
Author: naa

Figure 1

Site Location and Setting

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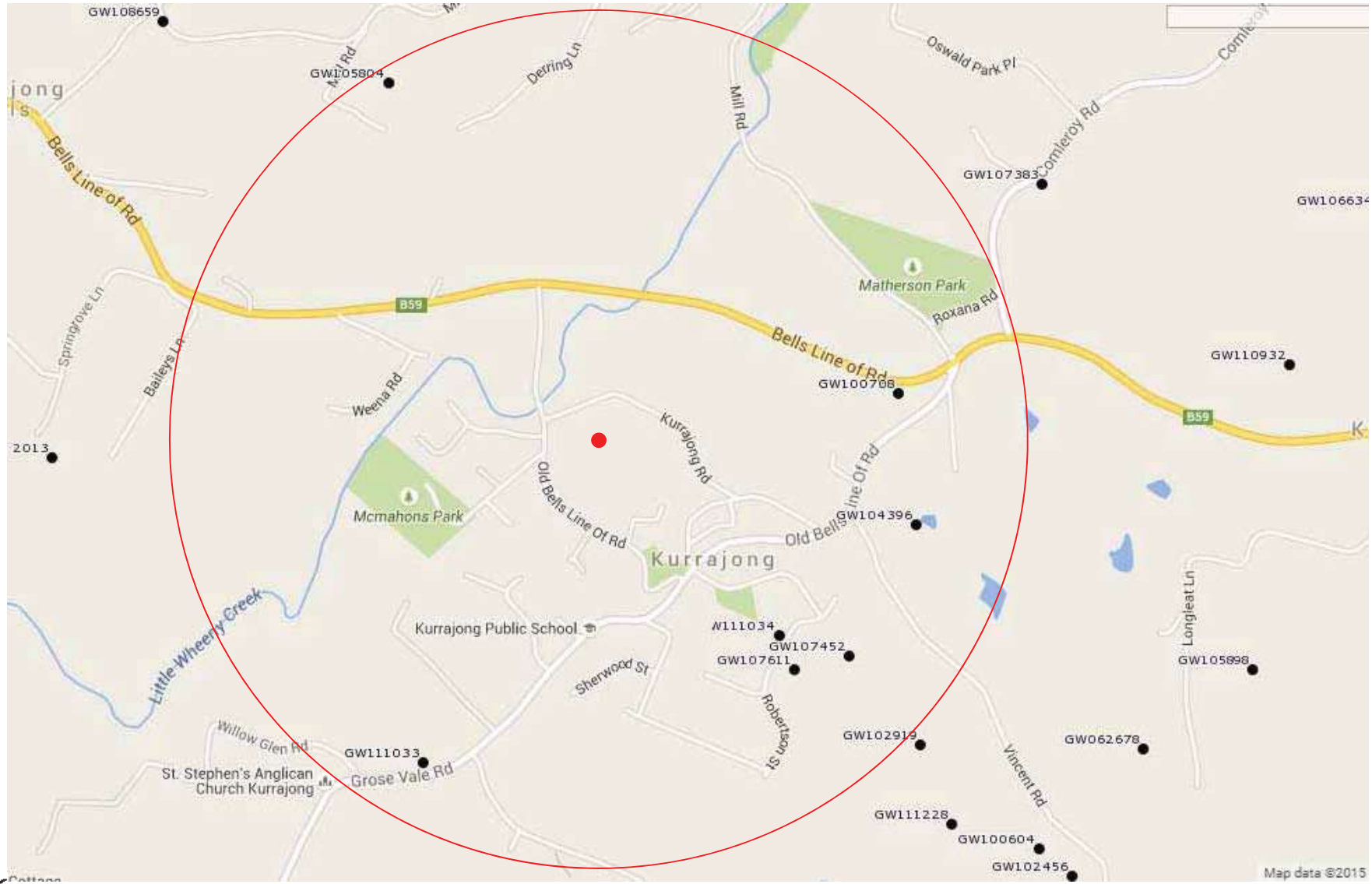
Report Ref: J1696.2R
Rev: 0
Rev Date: 1-Sep-15
Author: naa

Site Boundary
Rubbish observed (tin cans, bricks, etc.)
Trees / Foliage
Areas of Cutting

Figure 2
Site Layout



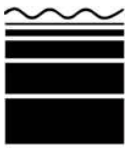
C. M. Jewell & Associates Pty Ltd

Report Ref: J1696.2R
Rev: 0
Rev Date: 1-Sep-15
Author: naa

Registered Boreholes
Centre of Site
1-Kilometre Radius

Figure 3

Local Ecological Receptors and Registered Groundwater Wells



APPENDIX A

Local Registered Groundwater Works Summaries

NSW Office of Water
Work Summary

GW100708

Licence: 10BL157597
Licence Status: CONVERTED

Authorised Purpose(s): DOMESTIC,STOCK,IRRIGATION,INDUSTRIAL
Intended Purpose(s): STOCK, INDUSTRIAL, DOMESTIC, IRRIGATION

Work Type: Bore
Work Status: Supply Obtained
Construct.Method: Other
Owner Type: Private

Commenced Date:
Completion Date: 20/08/1996
Final Depth: 134.00 m
Drilled Depth: 134.00 m

Contractor Name: Ultra Drilling
Driller: Bradley Alan Dodd
Assistant Driller:

Property: MINIMBAH 10 OLD BELLS LINE OF RD KURRAJONG 2758
GWMA: -
GW Zone: -
Standing Water Level: 38.000
Salinity:
Yield: 1.500

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	COOK	COOK.25	271//661435
Licensed:	COOK	KURRAJONG	Whole Lot 271//661435

Region: 10 - Sydney South Coast
River Basin: - Unknown
Area/District:
CMA Map:
Grid Zone:
Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source: Unknown
Northing: 6285346.0
Easting: 283898.0
Latitude: 33°32'58.9"S
Longitude: 150°40'20.5"E

GS Map: -
MGA Zone: 0
Coordinate Source: Unknown

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	6.00	171			Other
1		Hole	Hole	6.00	134.00	145			Other
1	1	Casing	Pvc Class 9	-0.20	6.00	150			Driven into Hole
1	1	Casing	Steel	-0.20	3.00	168	158		Driven into Hole

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
125.00	128.00	3.00	Unknown	38.00	128.00	1.50	134.00	03:00:00	38.00

Geologists Log
Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	3.00	3.00	CLAY/SHALE	Clay	
3.00	58.00	55.00	SHALE	Shale	
58.00	134.00	76.00	SANDSTONE	Sandstone	

Remarks

25/01/2013: Nat Carling, 25-Jan-2013; Added rock type codes to driller's log & added missing information (based on existing data).

***** End of GW100708 *****

NSW Office of Water
Work Summary

GW104396

Licence: 10BL160809 **Licence Status:** CONVERTED

Authorised Purpose(s): STOCK,DOMESTIC
Intended Purpose(s): STOCK, DOMESTIC

Work Type: Bore
Work Status: Supply Obtained
Construct.Method: Rotary
Owner Type:

Commenced Date:
Completion Date: 30/08/1982
Final Depth: 165.00 m
Drilled Depth:

Contractor Name: Ultra Drilling
Driller: Alan Marcus Dodd
Assistant Driller:

Property: N/A
GWMA: -
GW Zone: -
Standing Water Level:
Salinity:
Yield: 4.000

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	COOK	COOK.025	LT 19 DP 874188
Licensed:	COOK	KURRAJONG	Whole Lot 19//874188

Region: 10 - Sydney South Coast
River Basin: - Unknown
Area/District:
CMA Map:
Grid Zone:
Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source: Unknown
Northing: 6284968.0
Easting: 283958.0
Latitude: 33°33'11.2"S
Longitude: 150°40'22.5"E

GS Map: -
MGA Zone: 0
Coordinate Source: Map Interpretation

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	52.00	203			Down Hole Hammer
1		Hole	Hole	52.00	165.00	140			Down Hole Hammer
1	1	Casing	Steel	0.30	52.00	140	130		Driven into Hole, Welded

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
121.00	122.00	1.00	Unknown		124.00	0.80	124.00		100.00
152.00	153.00	1.00	Unknown		154.00	1.70	154.00		100.00
156.00	160.00	4.00	Unknown			4.00	165.00	02:00:00	100.00

Geologists Log
Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments

Remarks

30/08/1982: Form A Remarks:
No strata details on file.

***** End of GW104396 *****

NSW Office of Water
Work Summary

GW105804

Licence: 10BL160836 **Licence Status:** CONVERTED

Authorised Purpose(s): STOCK,DOMESTIC
Intended Purpose(s): STOCK, DOMESTIC

Work Type: Bore
Work Status: Supply Obtained
Construct.Method: Down Hole Hammer
Owner Type: Private

Commenced Date:
Completion Date: 13/09/2002
Final Depth: 134.00 m
Drilled Depth: 134.00 m

Contractor Name: Ultra Drilling
Driller: Bradley Alan Dodd
Assistant Driller:

Property: N/A
GWMA: -
GW Zone: -
Standing Water Level: 41.000
Salinity: Good
Yield: 2.300

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	COOK	COOK.25	1//803195
Licensed:	COOK	KURRAJONG	Whole Lot 1//803195

Region: 10 - Sydney South Coast
River Basin: 212 - HAWKESBURY RIVER
Area/District:
CMA Map: 9030-4N
Grid Zone:
Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source: (Unknown)
Northing: 6286216.0
Easting: 282388.0
Latitude: 33°32'29.5"S
Longitude: 150°39'22.8"E

GS Map: -
MGA Zone: 0
Coordinate Source: GIS - Geographic Information System

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	43.00	165			Down Hole Hammer
1		Hole	Hole	43.00	134.00	140			Down Hole Hammer
1	1	Casing	Pvc Class 9	-0.30	43.00	140			Driven into Hole, Riveted and Glued

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
60.00	61.00	1.00	Unknown			0.40		01:00:00	
91.00	92.00	1.00	Unknown			0.70		01:00:00	
127.00	128.00	1.00	Unknown	41.00		1.20		01:00:00	

Geologists Log
Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	14.00	14.00	soil, clay	Soil	
14.00	39.00	25.00	shale	Shale	
39.00	103.00	64.00	sandstone,	Sandstone	
103.00	104.00	1.00	shale	Shale	
104.00	134.00	30.00	sandstone	Sandstone	

Remarks

16/11/2009: updated from original form A

***** End of GW105804 *****

NSW Office of Water
Work Summary

GW107452

Licence: 10BL163415
Licence Status: CONVERTED

Authorised Purpose(s): STOCK,DOMESTIC
Intended Purpose(s): STOCK, DOMESTIC

Work Type: Bore
Work Status: Supply Obtained
Construct.Method: Down Hole Hammer
Owner Type: Private

Commenced Date:
Completion Date: 02/04/2005
Final Depth: 108.00 m
Drilled Depth: 108.00 m

Contractor Name: Ultra Drilling
Driller: Peter Edward Davidson
Assistant Driller:

Property: DALKEITH HOLDINGS 2 VINCENT RD KURRAJONG 2758
Standing Water Level: 2.000
GWMA: -
GW Zone: -
Salinity: Good
Yield: 9.850

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	COOK	COOK.25	13//1036297
Licensed:	COOK	KURRAJONG	Whole Lot 13//1036297

Region: 10 - Sydney South Coast
CMA Map: 9030-4N
River Basin: 212 - HAWKESBURY RIVER
Area/District:
Grid Zone:
Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source: Unknown
Northing: 6284580.0
Easting: 283769.0
Latitude: 33°33'23.6"S
Longitude: 150°40'14.9"E

GS Map: -
MGA Zone: 0
Coordinate Source: GIS - Geographic Information System

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	24.00	171			Down Hole Hammer
1		Hole	Hole	24.00	108.00	145			Down Hole Hammer
1		Annulus	Concrete	6.00	24.00	171			
1	1	Casing	Steel	-0.30	24.00	168	158		Driven into Hole, Welded

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
60.00	61.00	1.00	Unknown	18.00	62.00	0.35		00:05:00	

72.00	73.00	1.00	Unknown			0.50		00:05:00	
96.00	97.00	1.00	Unknown			1.00		01:00:00	
100.00	102.00	2.00	Unknown	2.00		8.00		02:00:00	

Geologists Log
Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	6.00	6.00	clay, brown shale	Clay	
6.00	21.00	15.00	shale	Shale	
21.00	39.00	18.00	sandstone/shale	Sandstone	
39.00	53.00	14.00	sandstone,	Sandstone	
53.00	84.00	31.00	sandstone/shale	Sandstone	
84.00	86.00	2.00	shale	Shale	
86.00	93.00	7.00	sandstone/shale	Sandstone	
93.00	108.00	15.00	sandstone, quartzite	Sandstone	

Remarks

01/04/2010: updated from original form A

***** End of GW107452 *****

NSW Office of Water
Work Summary

GW107611

Licence: 10BL165451
Licence Status: CONVERTED

Authorised Purpose(s): DOMESTIC
Intended Purpose(s): DOMESTIC

Work Type: Bore
Work Status: Supply Obtained
Construct.Method: Rotary Air
Owner Type: Private

Commenced Date:
Completion Date: 16/11/2005
Final Depth: 78.00 m
Drilled Depth: 78.00 m

Contractor Name: Ultra Drilling
Driller: Peter Edward Davidson
Assistant Driller:

Property: MISON 42 ROBERTSON ST KURRAJONG 2758 NSW
GWMA: -
GW Zone: -
Standing Water Level: 35.000
Salinity:
Yield: 21.600

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	COOK	COOK.25	46//248295
Licensed:	COOK	KURRAJONG	Whole Lot 46//248295

Region: 10 - Sydney South Coast
River Basin: 212 - HAWKESBURY RIVER
Area/District:
CMA Map: 9030-4N
Grid Zone:
Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source: Unknown
Northing: 6284537.0
Easting: 283610.0
Latitude: 33°33'24.9"S
Longitude: 150°40'08.7"E

GS Map: -
MGA Zone: 0
Coordinate Source: GIS - Geographic Information System

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	5.00	241			Rotary Air
1		Hole	Hole	5.00	36.00	171			Down Hole Hammer
1		Hole	Hole	36.00	78.00	145			Down Hole Hammer
1		Annulus	Concrete	35.00	42.00	145			
1	1	Casing	Pvc Class 9	-0.30	42.00	140			Driven into Hole, Riveted and Glued
1	1	Casing	Steel	-0.30	2.00	168			Driven into Hole

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth	Duration (hr)	Salinity (mg/L)

							(m)		
28.00	30.00	2.00	Unknown	35.00		1.00		01:00:00	1100.00
42.00	48.00	6.00	Unknown	35.00		1.60		01:00:00	460.00
68.00	70.00	2.00	Unknown	35.00		4.50		01:05:00	380.00

Geologists Log
Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	1.00	1.00	soil (fill)	Soil	
1.00	3.00	2.00	clay	Clay	
3.00	30.00	27.00	sandstone, yellow	Sandstone	
30.00	32.00	2.00	sandstone/shale	Sandstone	
32.00	34.00	2.00	sandstone	Sandstone	
34.00	35.00	1.00	shale	Shale	
35.00	56.00	21.00	sandstone/shale	Sandstone	
56.00	57.00	1.00	shale	Shale	
57.00	78.00	21.00	sandstone	Sandstone	

Remarks

16/11/2005: Form A Remarks:
residval pumping yield up to 3.5L/S pump depth 50-55m
08/04/2010: updated from original form A

***** End of GW107611 *****

NSW Office of Water
Work Summary

GW111033

Licence: 10BL604135
Licence Status: CONVERTED

Authorised Purpose(s): DOMESTIC
Intended Purpose(s): DOMESTIC

Work Type: Bore
Work Status: Supply Obtained
Construct.Method: Rotary Air
Owner Type: Private

Commenced Date:
Completion Date: 25/08/2010
Final Depth: 138.00 m
Drilled Depth: 138.00 m

Contractor Name: Ultra Drilling
Driller: Bradley Alan Dodd
Assistant Driller:

Property: PAULL 1033 GROSE VALE ROAD KURRAJONG 2758 NSW
GWMA:
GW Zone:
Standing Water Level: 43.000
Salinity:
Yield: 1.200

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	COOK	COOK.25	1//1153901
Licensed:			

Region: 10 - Sydney South Coast
River Basin: - Unknown
Area/District:
CMA Map:
Grid Zone:
Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source: Unknown
Northing: 6284246.0
Easting: 282533.0
Latitude: 33°33'33.5"S
Longitude: 150°39'26.7"E

GS Map: -
MGA Zone: 0
Coordinate Source: Unknown

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	24.00	170			Rotary Air
1		Hole	Hole	24.00	138.00	145			Rotary Air
1	1	Casing	Pvc Class 9	-0.50	40.00	145			Driven into Hole, Glued

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
90.00	93.00	3.00	Unknown			0.40			1600.00
126.00	132.00	6.00	Unknown	43.00		1.20		01:00:00	600.00

Geologists Log
Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	12.00	12.00	CLAY	Clay	
12.00	36.00	24.00	SHALE	Shale	
36.00	45.00	9.00	SANDSTONE/ SHALE	Sandstone	
45.00	115.00	70.00	SANDSTONE	Sandstone	
115.00	122.00	7.00	SHALE	Shale	
122.00	138.00	16.00	SANDSTONE / QUARTZ	Sandstone	

Remarks

***** End of GW111033 *****

NSW Office of Water
Work Summary

GW111034

Licence: 10BL603973 **Licence Status:** CONVERTED

Authorised Purpose(s): DOMESTIC
Intended Purpose(s): DOMESTIC

Work Type: Bore
Work Status: Supply Obtained
Construct.Method:
Owner Type: Private

Commenced Date:
Completion Date: 27/07/2010
Final Depth: 84.00 m
Drilled Depth: 84.00 m

Contractor Name: Ultra Drilling
Driller: Bradley Alan Dodd
Assistant Driller:

Property: SALLUSTIO 45 ROBERTSTON STREET KURRAJONG 2758 NSW
Standing Water Level: 30.000
GWMA:
GW Zone:
Salinity:
Yield: 2.000

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	COOK	COOK.25	49//248295
Licensed:			

Region: 10 - Sydney South Coast
CMA Map:
River Basin: - Unknown
Area/District:
Grid Zone:
Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source: Unknown
Northing: 6284636.0
Easting: 283565.0
Latitude: 33°33'21.6"S
Longitude: 150°40'07.0"E

GS Map: -
MGA Zone: 0
Coordinate Source: Unknown

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	5.00	200			Rotary Air
1		Hole	Hole	5.00	84.00	150			Rotary Air
1	1	Casing	Steel	-0.50	5.00	168			Driven into Hole

Water Bearing Zones

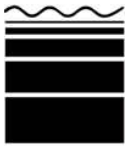
From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)
66.00	80.00	14.00	Unknown	30.00		2.00	84.00	01:00:00	650.00

Geologists Log
Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	5.00	5.00	CLAY	Clay	
5.00	10.00	5.00	SANDSTONE	Sandstone	
10.00	15.00	5.00	SANDSTONE / SHALE	Sandstone	
15.00	84.00	69.00	SANDSTONE	Sandstone	

Remarks

***** End of GW111034 *****



APPENDIX B

S149 Planning Certificate

149 I/h

Hawkesbury City Council
366 George Street (PO Box 146) Windsor NSW 2756 Phone: (02) 4560 4444 Facsimile: (02) 4587 7740 DX: 8601 Windsor

Certificate No. PC0441/16

C M Jewell & Associates Pty Ltd
PO Box 10
WENTWORTH FALLS NSW 2782

HAWKESBURY CITY COUNCIL

PLANNING CERTIFICATE

ISSUED UNDER SECTION 149

ENVIRONMENTAL PLANNING AND ASSESSMENT ACT, 1979, AS AMENDED

Your Ref: **J1696**

LAND DESCRIPTION: **Lot 1 DP 1185012,**
67 Kurrajong Road
KURRAJONG NSW 2758

The following information is only applicable as of the date of this certificate and is provided pursuant to Section 149 of the Environmental Planning and Assessment Act 1979, as prescribed by Schedule 4 of the Environmental Planning and Assessment Regulation 2000.

INFORMATION PURSUANT TO SECTION 149 (2) OF THE ACT

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1. **Names of relevant planning instruments and Development Control Plans.**

1.1 The land is affected by the following environmental planning instruments:

Hawkesbury Local Environmental Plan 2012

Sydney Regional Environmental Plan No 9 - Extractive Industry (No 2 - 1995)

Identifies regionally significant extractive resources within the Sydney Region to facilitate their utilisation. The plan ensures extraction is carried out in an environmentally acceptable manner and prohibits extraction from certain environmentally sensitive areas. It ensures that decisions on future urban expansion take into account the ability to realise the full potential of important deposits.

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Sydney Regional Environmental Plan No 20 - Hawkesbury Nepean River (No 2 - 1997)

SREP No 20 (No 2 - 1997) was gazetted on 6 November 1997, and is accompanied by the 'Hawkesbury-Nepean Action Plan 1997' and 'Codes of Practice for Consultation'.

The aim of SREP No 20 (No 2 - 1997) is to protect the environment of the Hawkesbury-Nepean River system by ensuring that the impacts of future land uses are considered in a regional context.

SREP No 20 (No 2 - 1997) requires development consent for the purpose of caravan parks or camping grounds; composting facilities or works; buildings works or land uses within conservation area sub-catchments; remediation of contaminated land; filling; certain activities in relation to items of non-aboriginal heritage; intensive horticulture industries; some intensive animal industries; manufactured home estates; marinas; recreational facilities; land uses in or near the river; land uses in riverine scenic areas; sewerage systems or works.

Development for extractive industries is prohibited in some areas. Consent of Council and the concurrence of the Director-General is required for maintenance dredging and extractive operations carried out downstream of the Wallacia Bridge as a consequence of, and ancillary to, works for flood mitigation, bank stabilisation, the construction of bridges or other instream structures (such as marinas) or the licensed or unlicensed withdrawal of water where extraction is necessary to carry out the works. Some intensive animal industries and potentially hazardous or offensive industries are prohibited if carried out on a floodway. Development in mapped wetlands requires the consent of Council and the concurrence of the Director-General of Urban Affairs and Planning.

State Environmental Planning Policy No 19 - Bushland in Urban Areas

Protects and preserves bushland within certain urban areas, as part of the natural heritage or for recreation, educational and scientific purposes. The policy is designed to protect bushland in public open space zones and reservations, and to ensure that bush preservation is given a high priority when local environmental plans for urban development are prepared.

State Environmental Planning Policy No 21 - Caravan Parks

Ensures that where caravan parks or camping grounds are permitted under an environmental planning instrument, movable dwellings, as defined in the Local Government Act 1993, are also permitted. The specific kinds of movable dwellings allowed under the Local Government Act in caravan parks and camping grounds are subject to the provisions of the Caravan Parks Regulation. The policy ensures that development consent is required for new caravan parks and camping grounds and for additional long-term sites in existing caravan parks. It also enables, with the

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council's consent, long-term sites in caravan parks to be subdivided by leases of up to 20 years.

State Environmental Planning Policy No 30 - Intensive Agriculture

Requires development consent for cattle feedlots having a capacity of 50 or more cattle or piggeries having a capacity of 200 or more pigs. The policy sets out information and public notification requirements to ensure there are effective planning control over this export-driven rural industry. The policy does not alter if, and where, such development is permitted, or the functions of the consent authority.

State Environmental Planning Policy No 32 - Urban Consolidation (Redevelopment of Urban land)

States the Government's intention to ensure that urban consolidation objectives are met in all urban areas throughout the State. The policy focuses on the redevelopment of urban land that is no longer required for the purpose it is currently zoned or used, and encourages local councils to pursue their own urban consolidation strategies to help implement the aims and objectives of the policy. Councils will continue to be responsible for the majority of rezonings. The policy sets out guidelines for the Minister to follow when considering whether to initiate a regional environmental plan (REP) to make particular sites available for consolidated urban redevelopment. Where a site is rezoned by an REP, the Minister will be the consent authority.

State Environmental Planning Policy No 33 - Hazardous and Offensive Development

Provides definitions for 'hazardous industry', 'hazardous storage establishment', 'offensive industry' and 'offensive storage establishment'. The definitions apply to all planning instruments, existing and future. The definitions enable decisions to approve or refuse a development to be based on the merit of proposal. The consent authority must carefully consider the specifics of the case, the location and the way in which the proposed activity is to be carried out. The policy also requires specified matters to be considered for proposals that are 'potentially hazardous' or 'potentially offensive' as defined in the policy. For example, any application to carry out a potentially hazardous or potentially offensive development is to be advertised for public comment, and applications to carry out potentially hazardous development must be supported by a preliminary hazard analysis (PHA). The policy does not change the role of councils as consent authorities, land zoning, or the designated development provisions of the Environmental Planning and Assessment Act 1979.

State Environmental Planning Policy No 44 - Koala Habitat Protection

Encourages the conservation and management of natural vegetation areas that provide habitat for koalas to ensure permanent free-living populations will be maintained over their present range. Local councils cannot approve development in an area affected by the policy without an investigation of core koala habitat. The

Hawkesbury City Council
366 George Street (PO Box 146) Windsor NSW 2756 Phone: (02) 4560 4444 Facsimile: (02) 4587 7740 DX: 8601 Windsor

policy provides the state-wide approach needed to enable appropriate development to continue, while ensuring there is ongoing protection of koalas and their habitat.

State Environmental Planning Policy No 50 - Canal Estate Development

Bans new canal estates from the date of gazettal, to ensure coastal and aquatic environments are not affected by these developments.

State Environmental Planning Policy No 55 - Remediation of Land

Introduces state-wide planning controls for the remediation of contaminated land. The policy states that land must not be developed if it is unsuitable for a proposed use because it is contaminated. If the land is unsuitable, remediation must take place before the land is developed. The policy makes remediation permissible across the State, defines when consent is required, requires all remediation to comply with standards, ensures land is investigated if contamination is suspected, and requires councils to be notified of all remediation proposals.

State Environmental Planning Policy No 62 - Sustainable Aquaculture

Encourages the sustainable expansion of the industry in NSW. The policy implements the regional strategies already developed by creating a simple approach to identify and categorise aquaculture development on the basis of its potential environmental impact. The SEPP also identifies aquaculture development as a designated development only where there are potential environmental risks.

State Environmental Planning Policy No 64 - Advertising and Signage

Aims to ensure that outdoor advertising is compatible with the desired amenity and visual character of an area, provides effective communication in suitable locations and is of high quality design and finish.

State Environmental Planning Policy No 65 - Design Quality of Residential Flat Development

Raises the design quality of residential flat development across the state through the application of a series of design principles. Provides for the establishment of Design Review Panels to provide independent expert advice to councils on the merit of residential flat development.

State Environmental Planning Policy No 70 - Affordable Housing (Revised Schemes)

Extends the life of affordable housing provisions relating to: Sydney Regional Environmental Plan No. 26 - City West, Willoughby Local Environmental Plan 1995, South Sydney Local Environmental Plan 1998. Schemes such as these are helping to provide affordable housing in areas undergoing significant redevelopment.

Hawkesbury City Council
366 George Street (PO Box 146) Windsor NSW 2756 Phone: (02) 4560 4444 Facsimile: (02) 4587 7740 DX: 8601 Windsor

State Environmental Planning Policy (Building Sustainability Index: BASIX) 2004

This SEPP operates in conjunction with Environmental Planning and Assessment Amendment (Building Sustainability Index: BASIX) Regulation 2004 to ensure the effective introduction of BASIX in NSW. The SEPP ensures consistency in the implementation of BASIX throughout the State by overriding competing provisions in other environmental planning instruments and development control plans, and specifying that SEPP 1 does not apply in relation to any development standard arising under BASIX.

State Environmental Planning Policy (Major Development) 2005

Defines certain developments that are major projects under Part 3A of the *Environmental Planning & Assessment Act 1979* and determined by the Minister for Planning. The SEPP also lists State significant sites.

State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007

The Policy aims to provide for the proper management and development of mining, petroleum and extractive material resources for the social and economic welfare of the State. The Policy establishes appropriate planning controls to encourage ecologically sustainable development.

State Environmental Planning Policy (Miscellaneous Consent Provisions) 2007

Provides for the erection of temporary structures. The SEPP supports the transfer temporary structures (such as tents, marquees and booths) from the *Local Government Act 1993* to the *Environmental Planning and Assessment Act 1979.*

State Environmental Planning Policy (Repeal of Concurrence and Referral Provisions) 2004

Amends various environmental planning instruments so as to omit provisions requiring consent authorities to obtain certain concurrences or refer matter to various persons or bodies.

State Environmental Planning Policy (Housing for Seniors or People with a Disability) 2004

Encourage the development of high quality accommodation for our ageing population and for people who have disabilities - housing that is in keeping with the local neighbourhood.

State Environmental Planning Policy (State and Regional Development) 2011

The aims of this Policy are to identify development that is State significant development, to identify development that is State significant infrastructure and

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critical State significant infrastructure, to confer functions on joint regional planning panels to determine development applications.

State Environmental Planning Policy (Repeal of Concurrence and Referral Provisions) 2008

Removes duplicative or unnecessary requirements in environmental planning instruments which require concurrence from or referral to government agencies.

State Environmental Planning Policy (Exempt and Complying Development Codes) 2008

Aims to provide streamlined assessment processes for development that complies with specified development standards.

State Environmental Planning Policy (Affordable Rental Housing) 2009

Aims to provide a consistent planning regime for the retention and provision of affordable rental housing.

State Environmental Planning Policy (Infrastructure) 2007

Provides a consistent planning regime for infrastructure and the provision of services across NSW, along with providing for consultation with relevant public authorities during the assessment process. The SEPP supports greater flexibility in the location of infrastructure and service facilities along with improved regulatory certainty and efficiency.

1.2 The land is affected by the following proposed environmental planning instruments that is or has been the subject of community consultation or on public exhibition under the Act (excludes instruments where the Director-General has notified the council that the making of the proposed instrument has been deferred indefinitely or has not been approved):

Draft State Environmental Planning Policy - Integrating Land Use and Transport

Draft State Environmental Planning Policy (Application of Development Standards) 2004

Draft State Environmental Planning Policy (Competition) 2010

Draft State Environmental Planning Policy (Infrastructure) Amendment (Shooting Ranges) 2013

1.3 The land is affected by the following development control plans.

Hawkesbury Development Control Plan 2002

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1.4 In this clause, proposed environmental planning instrument includes a planning proposal for a LEP or a draft environmental planning instrument.

2. Zoning and land use under relevant LEPs

2.1 The land is zoned: **R2 Low Density Residential under Hawkesbury Local Environmental Plan 2012**

2.2 Under the provisions of Hawkesbury Local Environmental Plan 2012 the purposes for which development may be carried out within the zone without development consent are referred to in the Land Use Table Annexure.

2.3 Under the provisions of Hawkesbury Local Environmental Plan 2012 the purposes for which development may not be carried out within the zone except with development consent are referred to in the Land Use Table Annexure.

2.4 Under the provisions of Hawkesbury Local Environmental Plan 2012 the purposes for which the carrying out of development is prohibited within the zone are referred to in the Land Use Table Annexure.

The following special provisions of Hawkesbury Local Environmental Plan 2012 may apply to the subject land.

Clause 2.5 Additional permitted uses for particular land
Clause 2.6 Subdivision – consent requirements
Clause 2.7 Demolition requires development consent
Clause 2.8 Temporary use of land
Part 3 Exempt and complying development
Clause 4.2 Rural subdivision
Clause 4.2A Residential development and subdivision prohibited on certain land
Clause 5.1 Relevant acquisition authority
Clause 5.1A Development on land intended to be acquired for public purposes
Clause 5.3 Development near zone boundaries
Clause 5.7 Development below mean high water mark
Clause 5.8 Conversion of fire alarms
Clause 5.9 Preservation of trees or vegetation
Clause 5.9AA Trees or vegetation not prescribed by development control plan
Clause 5.10 Heritage conservation
Clause 5.11 Bush fire hazard reduction
Clause 5.12 Infrastructure development and use of existing buildings of the Crown
Clause 6.1 Acid sulfate soils
Clause 6.2 Earthworks

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Clause 6.11 Residential accommodation at Johnston and New Streets, Windsor

These special provisions may alter the development shown in the Land Use Table which may be carried out with or without development consent and prohibited land uses. Please refer to the above mentioned provisions of Hawkesbury Local Environmental Plan 2012 to determine applicability.

2.5	Has Hawkesbury City Council adopted a development standard relating to a minimum dimension of land to permit the erection of a dwelling house on the land?	**No**
2.6	Does the subject property include or comprise critical habitat?	**No**
2.7	Is the subject property in a local conservation area, however described?	**No**
2.8	Is an item of environmental heritage situated on the subject property?	**No**

The land may also be subject to a proposed environmental planning instrument (see 1.2) which may change the information given in this section of the certificate.

3. Complying Development under each of the codes for complying development because of the provisions of clauses 1.17A (1) (c) to (e), (2), (3) and (4), 1.18 (1) (c3), and 1.19 of State Environmental Planning Policy (Exempt and Complying Development Codes) 2008

3.1 **General Housing Code**

Can complying development under the General Housing Code be carried out on the subject land?

Yes

3.2 **Housing Alterations Code**

Can complying development under the Housing Alterations Code be carried out on the subject land?

Yes

3.3 **Commercial and Industrial Alterations Code**

Can complying development under the Commercial and Industrial Alterations Code be carried out on the subject land?

Yes

Hawkesbury City Council
366 George Street (PO Box 146) Windsor NSW 2756 Phone: (02) 4560 4444 Facsimile: (02) 4587 7740 DX: 8601 Windsor

3.4 **Subdivisions Code**

Can complying development under the Subdivisions Code be carried out on the subject land?

Yes

3.5 **Rural Housing Code**

Can complying development under the Rural Housing Code be carried out on the subject land?

Yes

3.6 **General Development Code**

Can complying development under the General Development Code be carried out on the subject land?

Yes

3.7 **Demolition Code**

Can complying development under the Demolition Code be carried out on the subject land?

Yes

3.8 **Commercial and Industrial (New Buildings and Additions) Code**

Can complying development under the Commercial and Industrial (New Buildings and Additions) Code be carried out on the subject land?

Yes

4. Coastal Protection

Has Council been notified by the Department of Services, Technology and Administration that the land is affected by the operation of section 38 or 39 of the *Coastal Protection Act 1979*? **No**

4A Certain information relating to beaches and coasts

(1) Has an order been made under Part 4D of the *Coastal Protection Act 1979* in relation to temporary coastal protection works (within the meaning of that Act) on the land (or on public land adjacent to that land)? **No**

Hawkesbury City Council
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2(a)	Has Council been notified under section 55X of the *Coastal Protection Act 1979* that temporary coastal protection works (within the meaning of that Act) have been placed on the land (or on public land adjacent to that land)?	**No**
2(b)	Is Council satisfied that the works have been removed and the land restored in accordance with that Act?	**Not Applicable**

4B Annual charges under Local Government Act 1993 for coastal protection services that relate to existing coastal protection works

Has the owner (or any previous owner) of the land consented in writing to the land being subject to annual charges under section 496B of the *Local Government Act 1993* for coastal protection services that relate to existing coastal protection works (within the meaning of section 553B of that Act)?	**No**

Note. "Existing coastal protection works" are works to reduce the impact of coastal hazards on land (such as seawalls, revetments, groynes and beach nourishment) that existed before the commencement of section 553B of the *Local Government Act 1993*.

5. Mine Subsidence

Is the subject land within a mine subsidence district within the meaning of Section 15 of the *Mine Subsidence Compensation Act 1961*?	**No**

6. Road widening and road realignment

Is the subject land affected by road widening or road re-alignment under Division 2 of Part 3 of the *Roads Act 1993* or any environmental planning instruments, or any resolution of Hawkesbury City Council?	**No**

7. Council and other public authority policies on hazard risk restrictions

Has Hawkesbury City Council or any other public authority adopted a policy that restricts the development of the land because of the likelihood of :

7.1	Landslip?	**No**
7.2	Bushfire Risk?	**No**
7.3	Tidal inundation?	**No**
7.4	Subsidence?	**No**

Hawkesbury City Council
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7.5	Acid Sulfate Soils?	**Yes**
7.6	Any other risk?	**No**

7A Flood Related Development Controls Information

(1) Whether or not development on that land or part of the land for the purposes of dwelling houses, dual occupancies, multi dwelling housing or residential flat buildings (not including development for the purposes of group homes or seniors housing) is subject to flood related development controls.

The land is not subject to riverine flood related development controls.

(2) Whether or not development on that land or part of the land for any other purpose is subject to flood related development controls.

The land is not subject to riverine flood related development controls.

(3) Words and expressions in this clause have the same meanings as in the standard instrument set out in the *Standard Instrument (Local Environmental Plans) Order 2006.*

The above responses are provided in relation to the flood related development controls of Hawkesbury Local Environmental Plan 2012. Some State or Regional planning instruments may contain flood related development controls which affect the land. These include, but are not necessarily restricted to, State Environmental Planning Policy (Exempt and Complying Development Code) 2008, State Environmental Planning Policy No 30 – Intensive Agriculture, State Environmental Planning Policy (Infrastructure) 2007, State Environmental Planning Policy No 62 – Sustainable Aquaculture, SEPP (Sydney Regional Growth Centre) 2006, Sydney Regional Environmental No 9 – Extractive Industry (No 2 – 1995), and Sydney Regional Environmental Plan No 20 – Hawkesbury – Nepean River (No 2 – 1997).

8. Land Reserved for Acquisition

Is the land affected by any environmental planning instrument, or proposed environmental planning instrument referred to in clause 1, which makes provision for the acquisition of the land by a public authority, as referred to in Section 27 of the Act?	**No**

9. Contributions Plans

The "Hawkesbury Section 94 Contributions Plan 2015" applies to the subject land.

The Hawkesbury City Council "Section 94A Development Contributions Plan 2006" applies to the subject land.

Hawkesbury City Council
366 George Street (PO Box 146) Windsor NSW 2756 Phone: (02) 4560 4444 Facsimile: (02) 4587 7740 DX: 8601 Windsor

9A. *Biodiversity certified land*

Is the land biodiversity certified land (within the meaning of the Part 7AA of the *Threatened Species Conservation Act 1995*)? **No**

10. *Biobanking Agreements*

Has Council been notified that the land is subject to a biobanking agreement under Part 7A of the *Threatened Species Conservation Act 1995?* **No**

11. *Bush fire prone land*

Is the land bush fire prone? **All of the land is bush fire prone**

12. *Property Vegetation Plan*

Has Council been notified that the land is land to which a property vegetation plan under the *Native Vegetation Act 2003* applies? **No**

13. *Orders under Trees (Disputes Between Neighbours) Act 2006*

Has Council been notified whether an order has been made under the *Trees (Disputes Between Neighbours) Act 2006* to carry out work in relation to a tree on the land? **No**

14. *Directions under Part 3A*

Is the land subject to a direction by the Minister in force under section 75P (2) (c1) of the *Environmental Planning and Assessment Act 1979*? **No**

15. *Site compatibility certificate and conditions for seniors housing*

15.1 Is the land subject to a current site compatibility certificate (seniors housing), of which the council is aware, issued under *State Environmental Planning Policy (Housing for Seniors or People with a Disability) 2004?* **No**

15.2 Has Council granted a development consent after 11 October 2007 in respect of the land, setting out any terms of a kind referred to in clause 18 (2) of the *State Environmental Planning Policy (Housing for Seniors or People with a Disability) 2004*? **No**

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16. Site compatibility certificate for infrastructure

	Is the land subject to a valid site compatibility certificate (infrastructure), of which the council is aware?	**No**

17. Site compatibility certificates and conditions for affordable rental

17.1	Is the land subject to a current site compatibility certificate (affordable rental housing), of which the council is aware?	**No**
17.2	Is the land subject to a statement setting out any terms of a kind referred to in clause 17(1) or 37(1) of *State Environmental Planning Policy (Affordable Rental Housing) 2009* that have been imposed as a condition of consent to a development application?	**No**

18. Paper subdivision information

18.1	Is the land subject to a development plan adopted by a relevant authority that applies to the land or that is proposed to be subject to a consent ballot?	**No**
18.2	Is the land subject to a subdivision order?	**No**
18.3	Words and expressions used in this clause have the same meaning as they have in Part 16C of the *Environmental Planning and Assessment Regulation 2000*.	

Additional Matters

Certain prescribed matters under Section 59(2) of the *Contaminated Land Management Act 1997* (CLMA1997).

a)	Is the land significantly contaminated land within the meaning of the CLMA 1997?	**No**
b)	Is the land subject to a management order within the meaning of the CLMA 1997?	**No**
c)	Is the land subject to an approved voluntary management proposal within the meaning of the CLMA 1997?	**No**
d)	Is the land subject to an ongoing maintenance order within the meaning of the CLMA 1997?	**No**
e)	Is the land subject to a site audit statement within the meaning of the CLMA 1997?	**No**

149 I/h

Hawkesbury City Council
366 George Street (PO Box 146) Windsor NSW 2756 Phone: (02) 4560 4444 Facsimile: (02) 4587 7740 DX: 8601 Windsor

INFORMATION PURSUANT TO SECTION 149 (5) OF THE ACT

Applicants are advised that Council does not accept any liability in respect of any advice provided under the heading "Development Consent".

1. Preservation of trees and vegetation

The Hawkesbury Local Environmental Plan 2012 and the Hawkesbury Development Control Plan 2002 contain provisions which relate to the preservation of trees and vegetation throughout the local government area.

2. Development Consent

Has a development consent which applies to the subject land been issued within the past five 5 years? If a development consent has been issued within the past 5 years, reference should be made to Section 95 of the Act to determine whether or not the consent has lapsed.

No

Peter Jackson
General Manager.

Per: ..... Date: 21 August 2015

Hawkesbury City Council

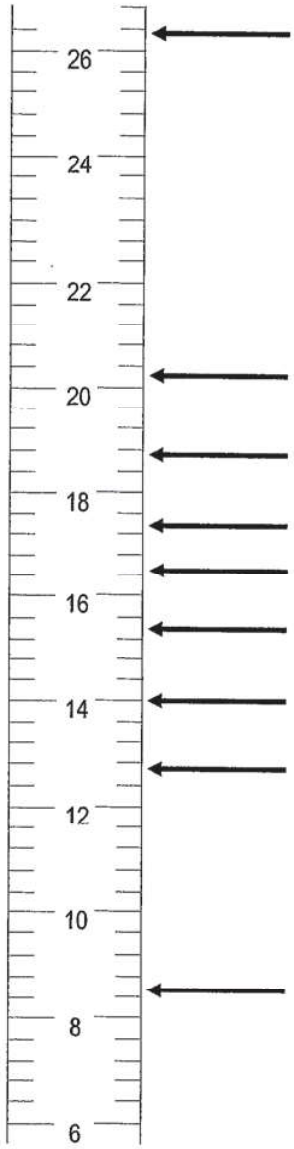
366 George Street (PO Box 146) Windsor NSW 2756 DX 8601 WINDSOR
Phone: (02) 4560 4444 **Facsimile:** (02) 4587 7740 **Email:** council@hawkesbury.nsw.gov.au

Flood Awareness - City of Hawkesbury

North Richmond

Please note that there is a risk of flooding above Council's residential floor height control. The table below indicates levels to Australian Height Datum (above sea level) for estimated flooding probabilities and historical flood peaks.

Flood chance of occurrence per year and historical floods



26.5m	1 in 100,000 chance per year (Probable Maximum Flood)
20.4m	1 in 500 chance per year
18.9m	1 in 200 chance per year
17.5m	1 in 100 chance per year - Residential Floor Standard
16.4m	1 in 50 chance per year
15.3m	1 in 20 chance per year
14.0m	1 in 10 chance per year
12.5m	1 in 5 chance per year

Please Note: Figures are average estimated occurances

8.4m Level of North Richmond Bridge

Flood heights obtained from:

Webb, McKeown & Associates Pty Ltd and Sydney Water 1996 Warragamba Dam Auxiliary Spillway Environmental Impact Study Flood Study / prepared by Webb, McKeown & Associates Pty for Sydney Water

New South Wales Department of Urban Affairs and Planning 1998 Warragamba Dam Auxiliary Spillway: Director-General's Report Section 115C of the Environmental Planning and Assessment Act / Department of Urban Affairs and Planning

April 2014

Hawkesbury City Council

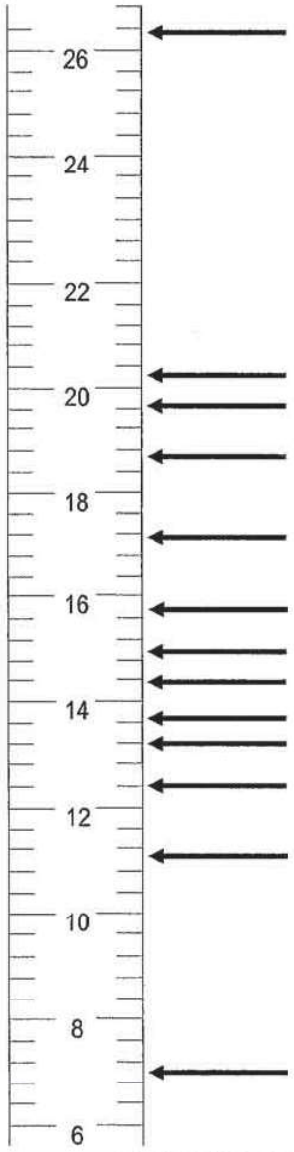
366 George Street (PO Box 146) Windsor NSW 2756 DX 8601 WINDSOR
Phone: (02) 4560 4444 **Facsimile:** (02) 4587 7740 **Email:** council@hawkesbury.nsw.gov.au

Flood Awareness - City of Hawkesbury

Windsor

Please note that there is a risk of flooding above Council's residential floor height control. The table below indicates levels to Australian Height Datum (above sea level) for estimated flooding probabilities and historical flood peaks.

Flood chance of occurrence per year and historical floods



26.4m	1 in 100,000 chance per year (Probable Maximum Flood)
20.2m	1 in 500 chance per year
19.7m	June 1867 flood peak
18.7m	1 in 200 chance per year
17.3m	1 in 100 chance per year - Residential Floor Standard
15.7m	1 in 50 chance per year
14.95m	November 1961 flood peak
14.46m	March 1978 flood peak
13.7m	1 in 20 chance per year
13.5m	August 1990 flood peak
12.3m	1 in 10 chance per year
11.1m	1 in 5 chance per year
7.0m	Level of Windsor Bridge

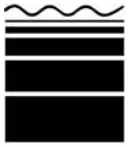
Please Note: Figures are average estimated occurances

Flood heights obtained from:

Webb, McKeown & Associates Pty Ltd and Sydney Water 1996 Warragamba Dam Auxiliary Spillway Environmental Impact Study Flood Study / prepared by Webb, McKeown & Associates Pty for Sydney Water

New South Wales Department of Urban Affairs and Planning 1998 Warragamba Dam Auxiliary Spillway: Director-General's Report Section 115C of the Environmental Planning and Assessment Act / Department of Urban Affairs and Planning

April 2014



APPENDIX C

Underground Services Reports

Job No 9539121

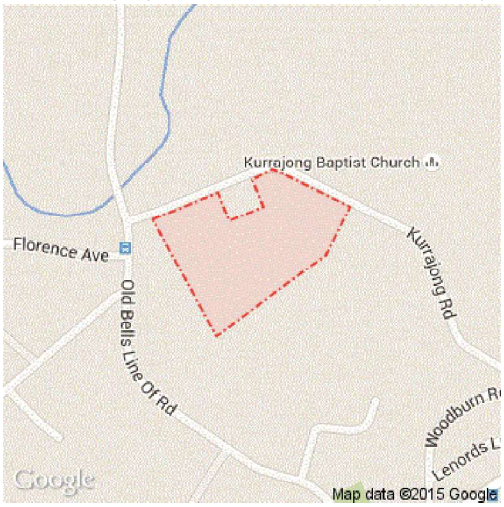
Phone: 1100
www.1100.com.au

Caller Details

Contact:	Ms Natalie Addison	**Caller Id:**	1205271	**Phone:**	0247593251
Company:	CM Jewell & Associates Pty Ltd	**Mobile:**	Not Supplied	**Fax:**	0247593257
Address:	PO Box 10 Wentworth Falls NSW 2782	**Email:**	natalie@cm-jewell.com.au		

Dig Site and Enquiry Details

WARNING: The map below only displays the location of the proposed dig site and does not display any asset owners' pipe or cables.
The area highlighted has been used only to identify the participating asset owners, who will send information to you directly.



User Reference: J1696
Working on Behalf of:
Private

Enquiry Date:	Start Date:	End Date:
14/08/2015	18/08/2015	19/08/2015

Address:
67 Kurrajong Road
Kurrajong NSW 2758

Job Purpose: Design
Onsite Activity: Subdivision
Location of Workplace: Private Property
Location in Road: Not Supplied

- Check that the location of the dig site is correct. If not you must submit a new enquiry.
- Should the scope of works change, or plan validity dates expire, you must submit a new enquiry.
- Do NOT dig without plans. Safe excavation is your responsibility. If you do not understand the plans or how to proceed safely, please contact the relevant asset owners.

Notes/Description of Works:
Not Supplied

Your Responsibilities and Duty of Care

- If plans are not received within 2 working days, contact the asset owners directly & quote their Sequence No.
- ALWAYS perform an onsite inspection for the presence of assets. Should you require an onsite location, contact the asset owners directly. Please remember, plans do not detail the exact location of assets.
- Pothole to establish the exact location of all underground assets using a hand shovel, before using heavy machinery.
- Ensure you adhere to any State legislative requirements regarding Duty of Care and safe digging requirements.
- If you damage an underground asset you MUST advise the asset owner immediately.
- By using this service, you agree to Privacy Policy and the terms and disclaimers set out at **www.1100.com.au**
- **For more information on safe excavation practices, visit www.1100.com.au**

Asset Owner Details

The assets owners listed below have been requested to contact you with information about their asset locations within 2 working days. Additional time should be allowed for information issued by post. It is **your responsibility** to identify the presence of any underground assets in and around your proposed dig site. Please be aware, that not all asset owners are registered with the Dial Before You Dig service, so it is **your responsibility** to identify and contact any asset owners not listed here directly.
** Asset owners highlighted by asterisks ** require that you visit their offices to collect plans.
# Asset owners highlighted with a hash require that you call them to discuss your enquiry or to obtain plans.

Seq. No.	Authority Name	Phone	Status
47275334	Endeavour Energy	0298534161	NOTIFIED
47275336	Sydney Water	132092	NOTIFIED
47275335	Telstra NSW, Central	1800653935	NOTIFIED

END OF UTILITIES LIST

Lodge Your Free Enquiry Online – 24 Hours a Day, Seven Days a Week

If further clarification is required, please contact:
Endeavour Energy
Phone: (02) 9853 4161 (8:00am-4:30pm Mon-Fri)
Emergency Phone Number: 131 003

Endeavour Energy

DBYD Underground Search Report

Date: 14/08/2015

DBYD Sequence No: 47275334 **DBYD Job No:** 9539121

ENDEAVOUR ENERGY ASSETS NOT AFFECTED

To:	Ms Natalie Addison		Company:	CM Jewell & Associates Pty Ltd	
Address:	PO Box 10, Wentworth Falls, NSW 2782				
Cust. ID:	1205271	Email:	natalie@cm-jewell.com.au		
Phone:	0247593251	Mobile:	Not Supplied	Fax:	0247593257
Enquiry Location:	67 Kurrajong Road, Kurrajong, NSW 2758				

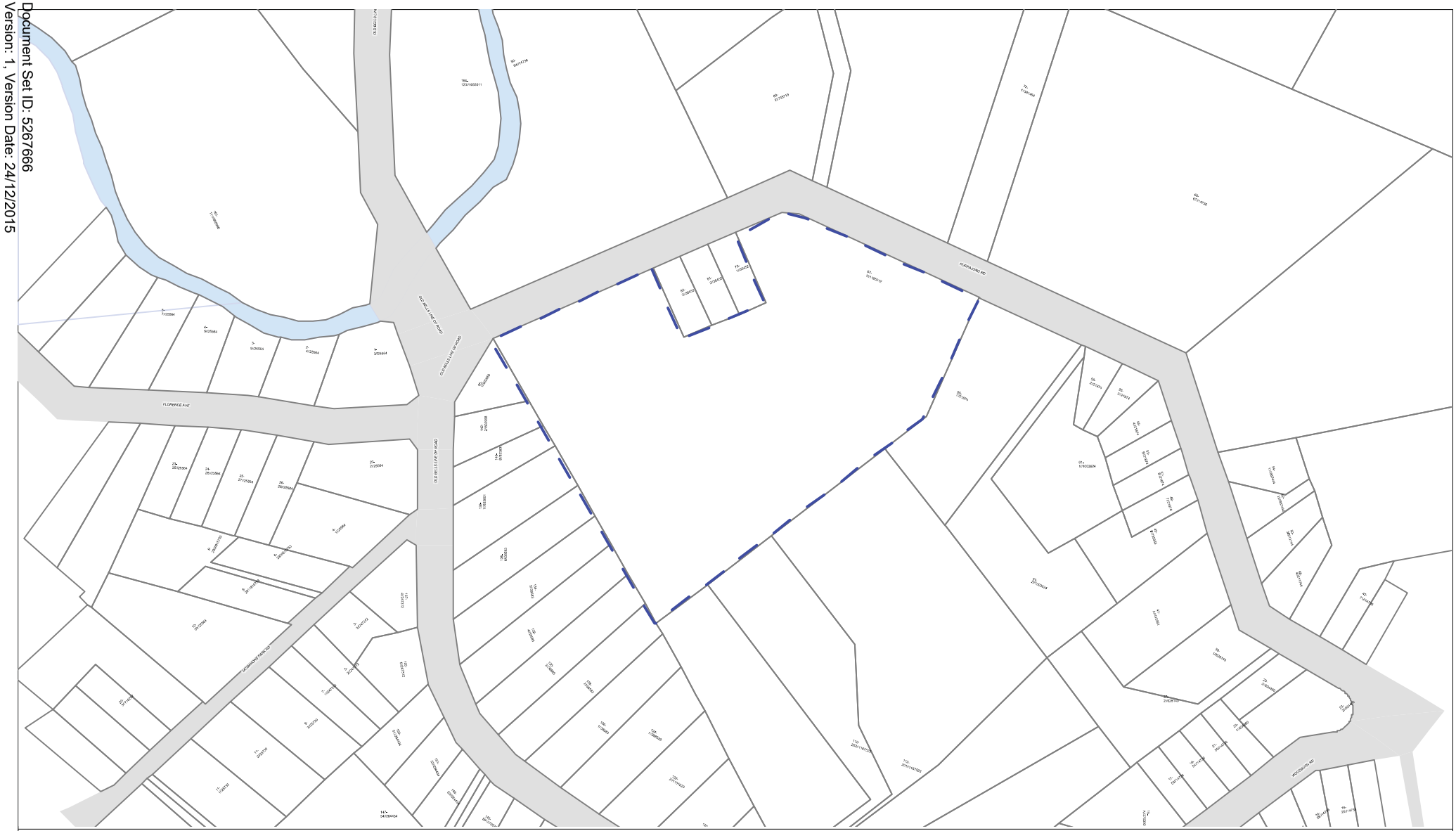
Our Search has shown that **NO UNDERGROUND ASSETS ARE PRESENT** on our plans within the nominated enquiry location. However all persons planning excavation shall read and understand the warnings below. This search is based on the graphical position of the excavation site as denoted in the DBYD customer confirmation sheet.

WARNING

- **All electrical apparatus shall be regarded as live until proved de-energised.** Contact with live electrical apparatus will cause severe injury or death.
- In accordance with the *Electricity Supply Act 1995*, you are obliged to report any damage to Endeavour Energy Assets immediately by calling **131 003**.
- The customer must obtain a new set of plans from Endeavour Energy if work has not been started or completed within twenty **(20)** working days of the original plan issue date.
- The customer must contact Endeavour Energy if any of the plans provided have blank pages, as some underground asset information may be incomplete.
- Endeavour Energy underground earth grids may exist and their location **may not** be shown on plans. Persons excavating are expected to exercise all due care, especially in the vicinity of padmount substations, pole mounted substations, pole mounted switches, transmission poles and towers.
- Endeavour Energy plans **do not** show any underground customer service mains or information relating to service mains within private property.
- Asbestos or asbestos-containing material may be present on or near Endeavour Energy's underground assets.
- Organo-Chloride Pesticides (OCP) may be present in some sub-transmission trenches.
- All plans must be printed and made available at the worksite where excavation is to be undertaken. Plans must be reviewed and understood by the crew on site prior to commencing excavation.

SUPPLEMENTARY MATERIAL

Material	Purpose	Location
DBYD Cover Letter	Endeavour Energy DBYD response Cover Letter	Attached
DBYD Important Information & Disclaimer	Endeavour Energy disclaimer, responsibilities and information on understanding plans	Attached
DBYD Response Plans	Endeavour Energy DBYD plans	Attached
Work Cover NSW *"Work near underground assets: Guide"*	Guideline for anyone involved in construction work near underground assets	Contact Work Cover NSW for a copy
Work Cover NSW *"Excavation work: Code of practice"*	Practical guidance on managing health and safety risks associated with excavation	URL [Click Here]
Safe Work Australia *"Working in the vicinity of overhead and underground electric lines guidance material"*	Provides information on how to manage risks when working in the vicinity of overhead and underground electric lines at a workplace	URL [Click Here]
Endeavour Energy Safety Brochures & Guides	To raise awareness of dangers of working on or near Endeavour Energy's assets	URL [Click Here]



Endeavour Energy

ENDEAVOUR ENERGY WARNING

This plan shows the approximate location of underground cables relative to fixtures existing when the cables were laid, and has been prepared solely for Endeavour Energy's own use. Endeavour Energy has taken all reasonable steps to ensure that the information is accurate as possible but will accept no liability for inaccuracies in the information shown on such plans from any cause whatsoever arising. Persons excavating are expected to exercise all due care in the vicinity where cables are indicated and will be held responsible for any damage caused to Endeavour Energy's property.

ALL ELECTRICAL APPARATUS SHALL BE CONSIDERED LIVE UNTIL PROVED DE-ENERGISED.
Contact with live electrical apparatus will cause severe injury or death.

Those excavating near Endeavour Energy's cables should be aware that **ASBESTOS OR ASBESTOS - CONTAINING MATERIAL MAY BE PRESENT** in Endeavour Energy's underground assets and that Organo-Chloride Pesticides(OCP) may be present in some sub-transmission trenches.

N

DO NOT SCALE

DBYD Sequence Number:	47275334
Issued Date:	14/08/2015

If further clarification is required, please contact:
Endeavour Energy
Phone: (02) 9853 4161 (8:00am-4:30pm Mon-Fri)
Emergency Phone Number: 131 003

BEFORE COMMENCING EXCAVATION YOU MUST READ AND UNDERSTAND ALL INFORMATION PROVIDED IN THE DBYD RESPONSE AND LISTED BELOW

BACKGROUND

Endeavour Energy is able to make available plans of its underground assets to persons who intend to undertake excavation works in Endeavour Energy's distribution area. Any plans provided to you are made available subject to the provisions set out below, in the provided plans, and in the Endeavour Energy DBYD response Cover Letter.

We have set out below important information regarding the recommended procedures that should be followed when using this service and also the extent of our responsibility in respect of any plans provided. It is very important that you read and understand all the information and disclaimers provided below before excavating.

Information Provided by Endeavour Energy:

- Any plans provided pursuant to this service are intended to show the approximate location of underground assets relative to road boundaries, property fences and other structures at the time of installation.
- Depth of underground assets may vary significantly from information provided on plans as a result of changes to road, footpath or surface levels subsequent to installation.
- Such plans have been prepared solely for use by Endeavour Energy staff for design, construction and maintenance purposes.
- All enquiry details and results are kept in a register.

DISCLAIMER

Whilst Endeavour Energy has taken all reasonable steps to ensure that the information contained in the plans is as accurate as possible it will accept no liability for inaccuracies in the information shown on such plans.

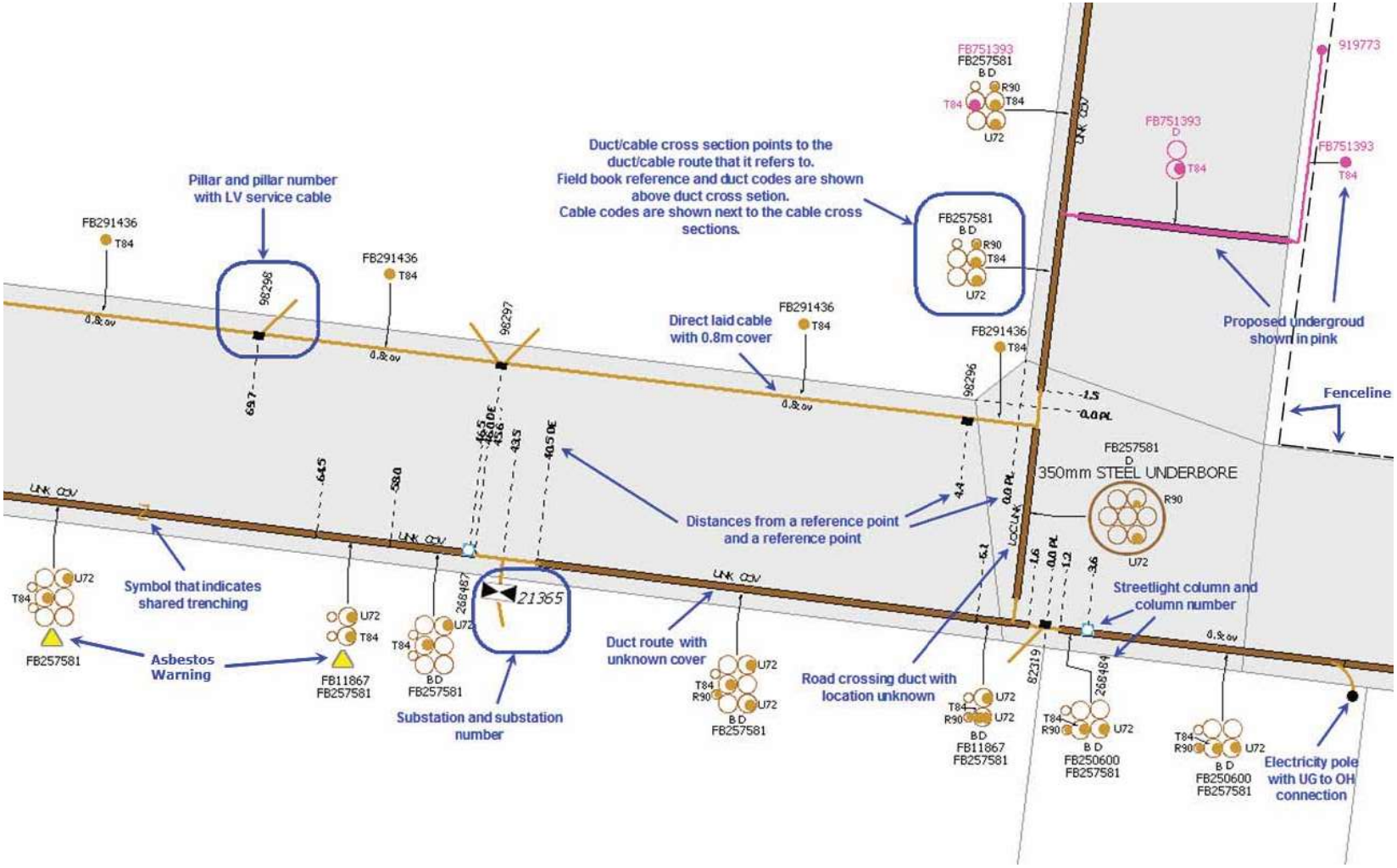
CUSTOMER REQUESTS AND RESPONSIBILITIES

- Endeavour Energy expects to be able to provide relevant plans within 48 hours after a request is made.
- If the enquiry falls within the Transmission Mains area, additional notification requirements shall be complied with as per the instructions in the response Cover Letter.
- Endeavour Energy retains copyright over all plans and details provided in response to a customer's request.
- Persons excavating are expected to exercise all due care in the vicinity where underground assets are indicated and will be held responsible for any damage to any underground assets (including any Endeavour Energy property) or any other loss caused (including consequential losses) as a result of such excavations.
- All underground assets should be visually located by soft digging (pot holing) or hand digging.
- A person who undertakes excavation work is subject to duties and responsibilities under the *Work Health and Safety Act 2011* and *Work Health and Safety Regulation 2011*. Please refer to the Work Cover NSW "*Work near underground assets: Guide*" and "*Excavation work: Code of practice*" which contain practical advice for working near underground utility services.
- Any damage to Endeavour Energy's assets must be immediately reported on **131 003**.
- In all cases of electric shock or suspected electric shock the victim shall immediately be transported to hospital or medical centre for treatment.
- If conduit material cannot be identified, it should be assumed to contain asbestos material.
- Endeavour Energy plans are frequently updated to record changes to underground assets. All plans are valid for **20** working days from the date of issue.

If further clarification is required, please contact:
Endeavour Energy
Phone: (02) 9853 4161 (8:00am-4:30pm Mon-Fri)
Emergency Phone Number: 131 003

Endeavour Energy

EXAMPLE OF HOW TO READ ENDEAVOUR ENERGY PLANS

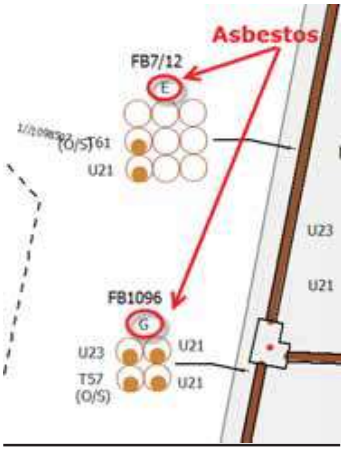


If further clarification is required, please contact:
Endeavour Energy
Phone: (02) 9853 4161 (8:00am-4:30pm Mon-Fri)
Emergency Phone Number: 131 003

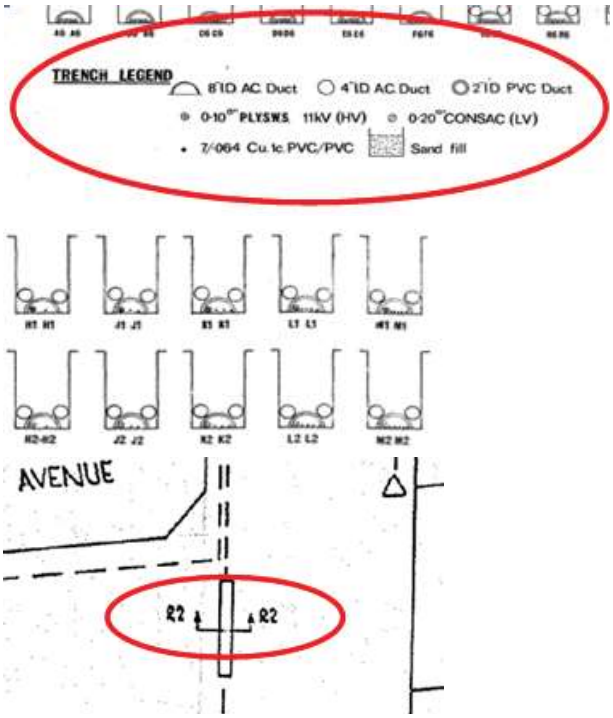
Endeavour Energy

IDENTIFYING ASBESTOS DUCTS

1. Duct codes **E, F** and **G** identify Fibro Conduits

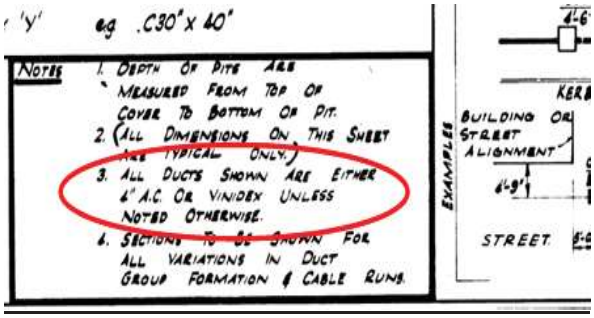


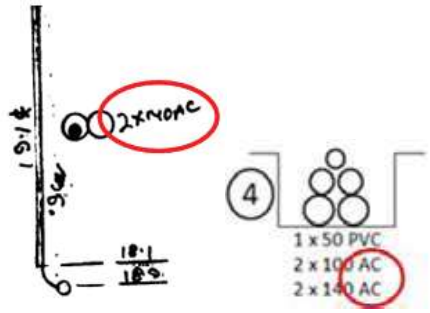
2. The duct codes **G,H,J,K,L,M Q,R,S,T,U,V,W & X** under each configuration are used on old Blue Mountains drawings to identify Asbestos



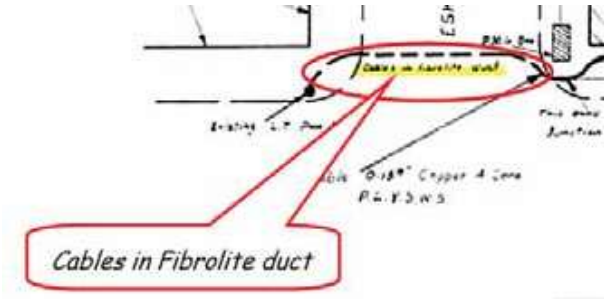
If underground details have not been captured and drawings are used, the method for identifying asbestos ducts and standards are different for the different utilities that amalgamated with Endeavour Energy. Using Reticulation Drawings, there are numerous ways to determine if a duct route has asbestos ducts, refer to following examples:

3. **AC** (Asbestos Cement) acronym

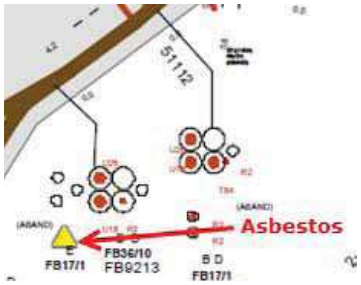




4. **Fibrolite** (asbestos) ducts



5. Yellow **triangle** identifies Fibro Conduits



If further clarification is required, please contact:
Endeavour Energy
Phone: (02) 9853 4161 (8:00am-4:30pm Mon-Fri)
Emergency Phone Number: 131 003

STANDARD UNDERGROUND SYMBOLS / LABELS

NOTE: *If symbology has not been provided on the plan use symbols as shown below.*

SYMBOLS & ACRONYMS

- or — Street light column
- Padmount substation
- or — Overground pillar (O.G.Box)
- Underground pit
- Duct run
- Cable run
- Typical duct section
- Typical underbore section
- Blocked duct
- Cable section
- Asbestos warning
- STJ, PBJ, TTJ
- **STJ** Straight through joint
- **PBJ** Parallel branch joint
- **TTJ** Transition through joint
- Underground to overhead pole
- **SL** Streetlight conductor
- **SC** Service cable
- **SE** Cable sealed end
- **SF** Service Feeder
- **OS** Out of Service
- **O.A.M.** Over awning main
- **U.A.M.** Under awning main
- **N.I.S.** Not in service
- Fence/dimensioning
- Shared trenching
- Service point of attachment

DUCT CODE LABLES

B = 50 mm PVC

D = 125mm PVC

E = 100mm Fibro Conduit (Asbestos)

F = 140mm Fibro Conduit (Asbestos)

G = 150mm Fibro Conduit (Asbestos)

DEPTH & LOCATION LABELS

0.5- 0.7 COV = 0.5m – 0.7m

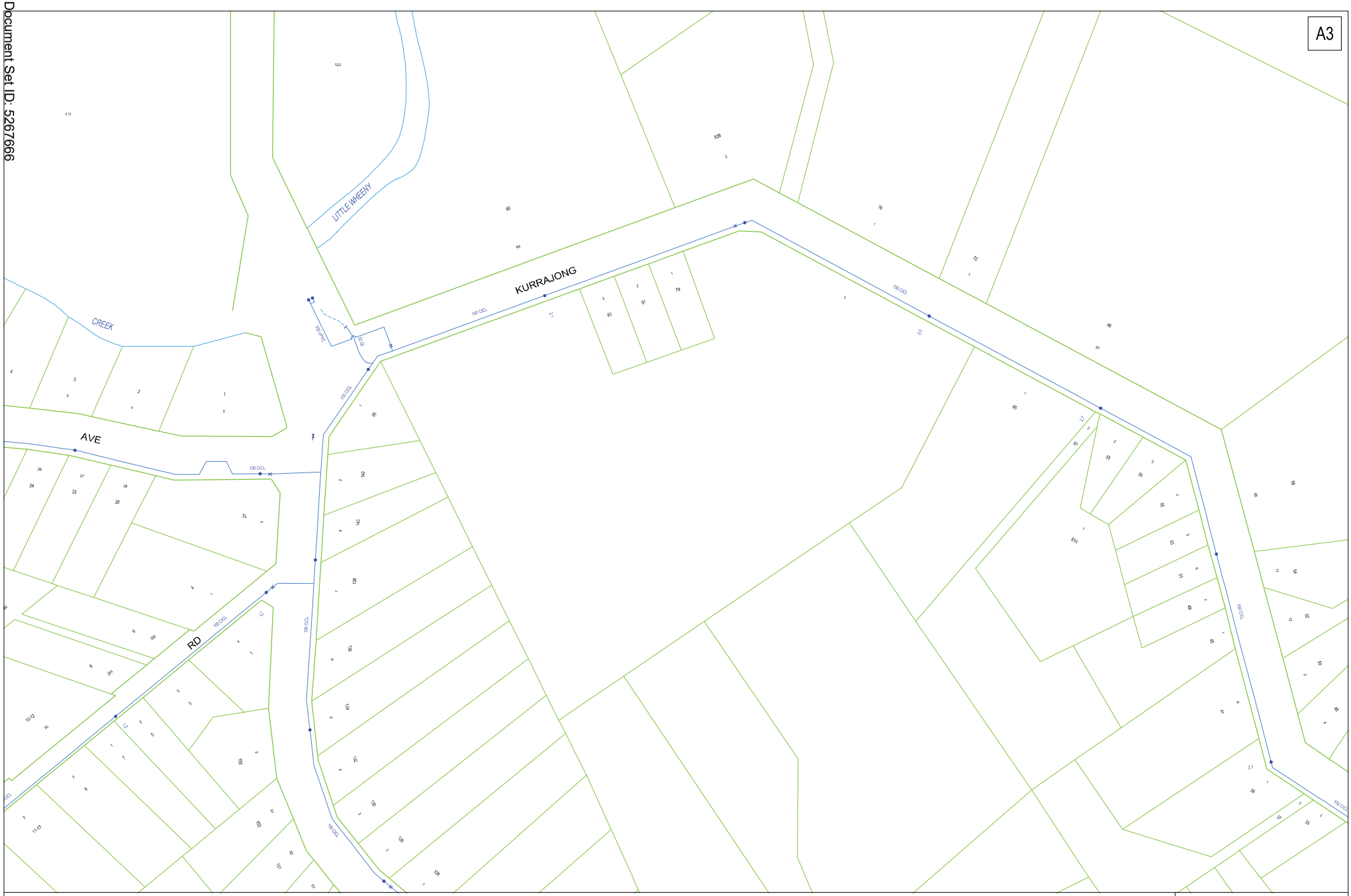
0.9 COV = 0.9m Depth

UNK COV = Depth Unknown

LOC UNK = Location Unknown

0.9 PL = Located 0.9m from Property Line

A3



DBYD Address:
67 Kurrajong Road
Kurrajong NSW 2758

DBYD Job No: 9539121

DBYD Sequence No: 47275336

Scale: 1:1500

Date of Production: 14/08/2015

Plan 1 of 1

N

0m 9m 18m 27m 36m

Guide to reading Sydney Water DBYD Plans

February 2015

Asset Information

Legend

Sewer

- Sewer Main (with flow arrow & size type text) — 225 PVC
- Disused Main
- Rising Main
- Maintenance Hole (with upstream depth to invert) — 1.7
- Sub-surface chamber
- Maintenance Hole with Overflow chamber — MSE
- Ventshaft EDUCT
- Ventshaft INDUCT — MSI
- Property Connection Point (with chainage to downstream MH) — 10.6
- Concrete Encased Section — Concrete Encased
- Terminal Maintenance Shaft — TMS
- Maintenance Shaft — MS
- Rodding Point — RP
- Lamphole
- Vertical — VERT
- Pumping Station — SP0882
- Sewer Rehabilitation

Pressure Sewer

- Pressure Sewer Main
- Pump Unit (Alarm, Electrical Cable, Pump Unit) — A
- Property Valve Boundary Assembly
- Stop Valve
- Reducer / Taper
- Flushing Point — FP

Vacuum Sewer

- Pressure Sewer Main
- Division Valve
- Vacuum Chamber
- Clean Out Point

Stormwater

- Stormwater Pipe
- Stormwater Channel
- Stormwater Gully
- Stormwater Maintenance Hole

Property Details

- Boundary Line
- Easement Line
- House Number
- Lot Number — 25, 6, 26, 8, 27, 10, 28, 12
- Proposed Land
- Sydney Water Heritage Site (please call **132 092** and ask for the **Heritage Unit**)

Water

- WaterMain - Potable (with size type text) — 200 PVC
- Disconnected Main - Potable
- Proposed Main - Potable
- Water Main - Recycled
- Special Supply Conditions - Potable
- Special Supply Conditions - Recycled
- Restrained Joints - Potable
- Restrained Joints - Recycled
- Hydrant
- Maintenance Hole
- Stop Valve
- Stop Vale with By-pass
- Stop Valve with Tapers
- Closed Stop Valve
- Air Valve
- Valve
- Scour
- Reducer / Taper
- Vertical Bends
- Reservoir
- Recycled Water is shown as per Potable above. Colour as indicated

Private Mains

- Potable Water Main
- Recycled Water Main
- Sewer Main
- Symbols for Private Mains shown grey

Asset Information

Pipe Types

ABS	Acrylonitrile Butadiene Styrene	**AC**	Asbestos Cement
BRICK	Brick	**CI**	Cast Iron
CICL	Cast Iron Cement Lined	**CONC**	Concrete
COPPER	Copper	**DI**	Ductile Iron
DICL	Ductile Iron Cement (mortar) Lined	**DIPL**	Ductile Iron Polymeric Lined
EW	Earthenware	**FIBG**	Fibreglass
FL BAR	Forged Locking Bar	**GI**	Galvanised Iron
GRP	Glass Reinforced Plastics	**HDPE**	High Density Polyethylene
MS	Mild Steel	**MSCL**	Mild Steel Cement Lined
PE	Polyethylene	**PC**	Polymer Concrete
PP	Polypropylene	**PVC**	Polyvinylchloride
PVC - M	Polyvinylchloride, Modified	**PVC - O**	Polyvinylchloride, Oriented
PVC - U	Polyvinylchloride, Unplasticised	**RC**	Reinforced Concrete
RC-PL	Reinforced Concrete Plastics Lined	**S**	Steel
SCL	Steel Cement (mortar) Lined	**SCL IBL**	Steel Cement Lined Internal Bitumen Lined
SGW	Salt Glazed Ware	**SPL**	Steel Polymeric Lined
SS	Stainless Steel	**STONE**	Stone
VC	Vitrified Clay	**WI**	Wrought Iron
WS	Woodstave		

Further Information

Please consult the Dial Before You Dig enquiries page on the Sydney Water website

For general enquiries please call the Customer Contact Centre on **132 092**

In an emergency, or to notify Sydney Water of damage or threats to its structures, call 13 20 90 (24 hours, 7 days)

IMPORTANT INFORMATION - DIAL BEFORE YOU DIG

Attention: You must read the information below

The material provided or made available to you by Sydney Water (including on the Sydney Water website) in relation to your Dial Before You Dig enquiry (**Information**) is provided on each of the following conditions, which you are taken to have accepted by using the Information:

1 The Information has been generated by an automated system based on the area highlighted in the "Locality Indication Only" window on your Caller Confirmation. It is your responsibility to ensure that the dig site is properly defined when submitting your Dial Before You Dig enquiry and, if the Information does not match the dig site, to resubmit your enquiry for the correct dig site.

2 Neither Sydney Water nor Dial Before You Dig make any representation or give any guarantee, warranty or undertaking (express or implied) as to the currency, accuracy, completeness, effectiveness or reliability of the Information. The Information, including Sydney Water plans and work-as-executed diagrams, amongst other things:

(a) may not show all existing structures, including Sydney Water's pipelines, particularly in relation to newer developments and in relation to structures owned by parties who do not participate in the Dial Before You Dig service;

(b) may be out of date and not show changes to surface levels, road alignments, fences, buildings and the like;

(c) is approximate only and is therefore not suitable for scaling purposes; and

(d) does not show locations of property services (often called house service lines) belonging to or servicing individual customers, which are usually connected to Sydney Water's structures.

3 You are responsible for, amongst other things:

(a) exposing underground structures, including Sydney Water's pipelines, by pot-holing using hand-held tools or vacuum techniques so as to determine the precise location and extent of structures before any mechanical means of excavation are used;

(b) the safe and proper excavation of and for underground works and structures, including having regard to the fact that asbestos cement pipelines, which can pose a risk to health, may form part of Sydney Water's water and sewerage reticulation systems;

(c) protecting underground structures, including Sydney Water's pipelines, from damage and interference;

(d) maintaining minimum clearances between Sydney Water's structures and structures belonging to others;

(e) ensuring that backfilling of excavation work in the vicinity of Sydney Water's structures complies with Sydney Water's standards contained on its website or otherwise communicated to you;

(f) notifying Sydney Water immediately of any damage caused or threat of damage to Sydney Water's structures;

(g) ensuring that plans are approved by Sydney Water (usually signified by stamping) prior to landscaping or building over or in the vicinity of any Sydney Water structure; and

(h) ensuring that the Information is used only for the purposes for which Sydney Water and Dial Before You Dig intended.

4 You acknowledge that you use the Information at your own risk. In consideration for the provision of the Dial Before You Dig service and the Information by Sydney Water and Dial Before You Dig, to the fullest extent permitted by law:

(a) all conditions and guarantees concerning the Information (whether as to quality, outcome, fitness, care, skill or otherwise) expressed or implied by statute, common law, equity, trade, custom or usage or otherwise are expressly excluded and to the extent that those statutory guarantees cannot be excluded, the liability of Sydney Water and Dial Before You Dig to you is limited to either of the following as nominated by Sydney Water in its discretion, which you agree is your only remedy:

(i) the supplying of the Information again; or

(ii) payment of the cost of having the Information supplied again;

(b) in no event will Sydney Water or Dial Before You Dig be liable for, and you release Sydney Water and Dial Before You Dig from, any Loss arising from or in connection with the Information, including the use of or inability to use the Information and delay in the provision of the Information:

(i) whether arising under statute or in contract, tort or any other legal doctrine, including any negligent act, omission or default (including wilful default) by Sydney Water or Dial Before You Dig; and

(ii) regardless of whether Sydney Water or Dial Before You Dig are or ought to have been aware of, or advised of, the possibility of such loss, costs or damages;

(c) you will indemnify Sydney Water and Dial Before You Dig against any Loss arising from or in connection with Sydney Water providing incorrect or incomplete information to you in connection with the Dial Before You Dig service; and

(d) you assume all risks associated with the use of the Dial Before You Dig and Sydney Water websites, including risk to your computer, software or data being damaged by any virus, and you release and discharge Sydney Water and Dial Before You Dig from all Loss which might arise in respect of your use of the websites.

5 "**Sydney Water**" means Sydney Water Corporation and its employees, agents, representatives and contractors. "**Dial Before You Dig**" means Dial Before You Dig Incorporated and its employees, agents, representatives and contractors. References to "**you**" include references to your employees, agents, representatives, contractors and anyone else using the Information. References to "**Loss**" include any loss, cost, expense, claim, liability or damage (including arising in connection with personal injury, death or any damage to or loss of property and economic or consequential loss, lost profits, loss of revenue, loss of management time, opportunity costs or special damages). To the extent of any inconsistency, the conditions in this document will prevail over any other information provided to you by Sydney Water and Dial Before You Dig.

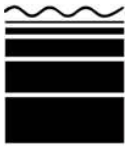
In an emergency, or to notify Sydney Water of damage or threats to its structures, call 13 20 90 (24 hours, 7 days)

Further information and guidance is available in the Building Development and Plumbing section of Sydney Water's website at www.sydneywater.com.au, where you will find the following documents under 'Dial Before You Dig':

- Avoid Damaging Water and Sewer Pipelines
- Water Main Symbols
- Depths of Mains
- Guidelines for Building Over/Adjacent to Sydney Water Assets
- Clearances Between Underground Services

Or call **13 20 92** for Customer Enquires.

Note: The lodging of enquiries via **www.1100.com.au** will enable you to receive colour plans in PDF format 24 hours a day, 7 days a week via email.



APPENDIX D
Land Title Documents

Land and Property Information Division

ABN: 84 104 377 806
GPO BOX 15
Sydney NSW 2001
DX 17 SYDNEY Telephone: 1300 052 637

NSW GOVERNMENT Land & Property Information
A division of the Department of Finance & Services

HISTORY OF TITLE TRANSACTION

Title Reference: 7304/1141427

LAND AND PROPERTY INFORMATION NEW SOUTH WALES - HISTORICAL SEARCH

SEARCH DATE
14/8/2015 11:22AM

FOLIO: 7304/1141427

First Title(s): THIS FOLIO
Prior Title(s): CROWN LAND

Recorded	Number	Type of Instrument	C.T. Issue
8/7/2009	DP1141427	DEPOSITED PLAN	FOLIO CREATED CT NOT ISSUED
8/7/2009	CA146628	CONVERSION ACTION	
15/5/2013	DP1185012	DEPOSITED PLAN	FOLIO CANCELLED

*** END OF SEARCH ***

PRINTED ON 14/8/2015

Land and Property Information Division

ABN: 84 104 377 806
GPO BOX 15
Sydney NSW 2001
DX 17 SYDNEY Telephone: 1300 052 637

NSW GOVERNMENT Land & Property Information
A division of the Department of Finance & Services

TITLE SEARCH

Title Reference: 1/11 012

LAND AND PROPERTY INFORMATION NEW SOUTH WALES - TITLE SEARCH

FOLIO: 1/1185012

SEARCH DATE	TIME	EDITION NO	DATE
14/8/2015	11:35 AM	1	25/7/2015

LAND

LOT 1 IN DEPOSITED PLAN 1185012
AT KURRAJONG
LOCAL GOVERNMENT AREA HAWKESBURY
PARISH OF KURRAJONG COUNTY OF COOK
TITLE DIAGRAM DP1185012

FIRST SCHEDULE

PRJM PTY LTD (T AJ684006)

SECOND SCHEDULE (2 NOTIFICATIONS)

1 LAND EXCLUDES MINERALS (S.171 CROWN LANDS ACT 1989)
2 AJ684007 MORTGAGE TO WESTPAC BANKING CORPORATION

NOTATIONS

UNREGISTERED DEALINGS: NIL

*** END OF SEARCH ***

PRINTED ON 14/8/2015

** ANY ENTRIES PRECEDED BY AN ASTERISK DO NOT APPEAR ON THE CURRENT EDITION OF THE CERTIFICATE OF TITLE.*
WARNING: THE INFORMATION APPEARING UNDER NOTATIONS HAS NOT BEEN FORMALLY RECORDED IN THE REGISTER.

APPENDIX E

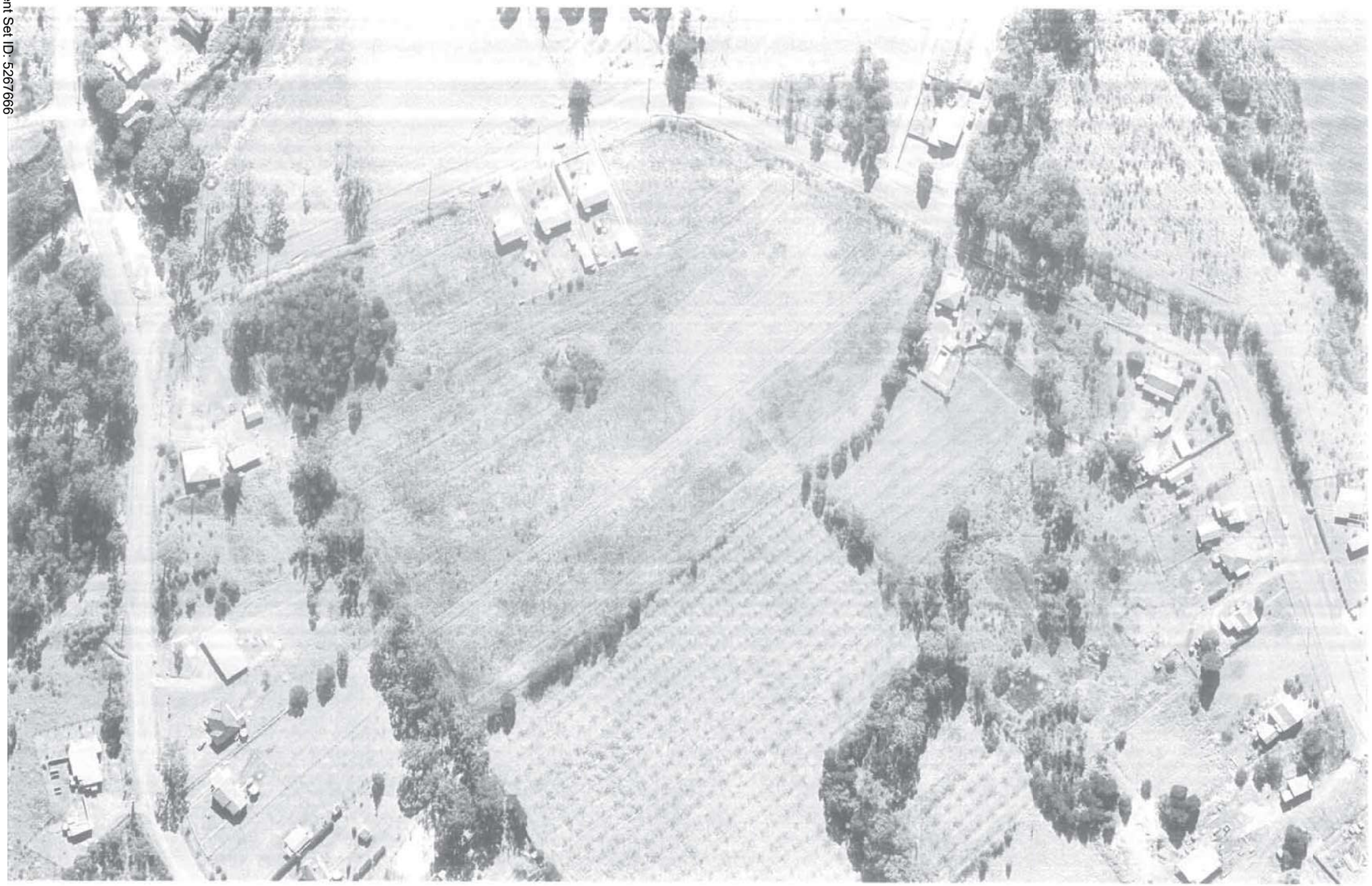
Historical Aerial Photography

1958

1958

1970

1970



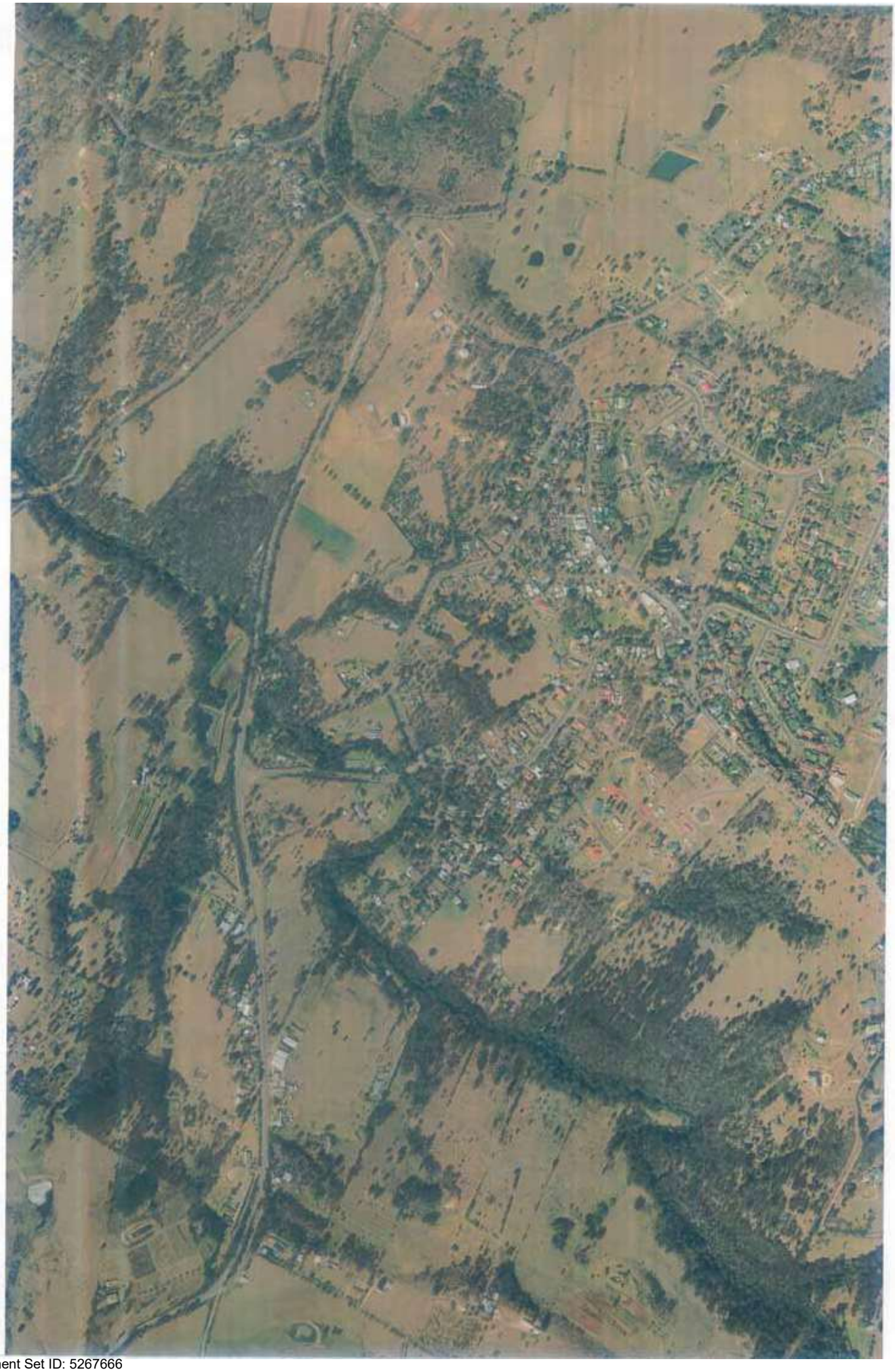
1975

1975

1982

1982

1994



1994

2002

2002

2010

2010

2015

2015

APPENDIX F
Site Photographs

Photograph 1: Entrance of dirt track on Kurrajong Road.

Photograph 2: End of dirt track at the rear of 136 Old Bells Line of Road. Note gravel fill and also area of cutting on the left of the photograph

Photograph 3: Looking from the west to the east along southern fenced boundary. Note the dense vegetation on the Site (inaccessible area).

Photograph 4: An example of vegetation on the Site - Groundcover consisting of vines.

Photograph 5: An example of vegetation on the Site – bushes / trees and groundcover consisting of fallen branches, leaf / bark litter.

Photograph 6: An example of vegetation on the Site – small clear area and groundcover consisting of leaf / bark litter.

Photograph 7: Looking north along Kurrajong Road boundary. Note the dense (inaccessible) vegetation and the area of cutting (natural drainage) along the boundary.

Photograph 8: Looking east towards the south-eastern corner of the Site. Note area of maintained cleared (mowed) land.

Photograph 9: Looking north along the western boundary of the Site. Note the cleared areas at the rear of adjoining residential properties.

Photograph 10: Looking north from the middle of the Site – 79 Kurrajong Road is on the left. Note the cleared area used for car parking, evidence of bonfire and tree logs. Also note the lean-to attached to the shed appears to encroach onto the Site.

Photograph 11: Small (possibly man-made) gully filled with cuttings (branches) at the rear of 83 Kurrajong Road.

Photograph 12: Bowerbird ground nest observed in the eastern portion of the Site.

Photograph 13: Area A (see Figure 2) containing metal, plastic and metal piping, tyres, bricks, tin cans, etc.

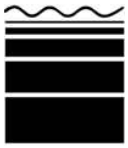
Photograph 14: Area A (see Figure 2) containing metal, plastic and metal piping, tyres, bricks, tin cans, etc.

Photograph 15: Area B (see Figure 2) where pieces of ACM, bricks and tiles were observed.

Photograph 16: Area C (see Figure 2) where an area of dumped soil containing bricks, pavers and concrete was observed.

Photograph 17: On Kurrajong Road looking south along the western boundary – 144 Old Bells Line of Road is on the right. Note pile of mulch fill.

Photograph 18: Looking east along the rear boundaries of 79-83 Kurrajong Road. Noting that the rear of chicken coop, compost bin, clothesline appear to encroach onto the Site.



APPENDIX G
Analytical Documentation

Document Set ID: 5267666
Version: 1, Version Date: 24/12/2015

CHAIN OF CUSTODY DOCUMENTATION

Australian Laboratory Services Pty Ltd

CLIENT: CM Jewell & Associates Pty Ltd
POSTAL ADDRESS: PO Box 10, Wentworth Falls NSW 2782
SEND REPORT TO: Chris Jewell — SEND INVOICE TO: Chris Jewell
DATA NEEDED BY: — REPORT NEEDED BY:
PROJECT ID: J1696 — QUOTE NO.:
P.O. NO.: J1696 — COMMENTS/SPECIAL HANDLING/STORAGE OR DIPOSAL:

LABORATORY BATCH NO.:
SAMPLERS:
PHONE: FAX: E-MAIL:
REPORT FORMAT: HARD: ☐ FAX: ☐ DISK: ☐ BULLETIN BOARD: ☐ E-MAIL: ☑
QC LEVEL: QCS1: ☐ QCS2: ☐ QCS3: ☐ QCS4: ☐

FOR LAB USE ONLY
COOLER SEAL
Yes ..... No .....
Broken ..... Intact ...
COOLER TEMP: deg.C

ANALYSIS REQUIRED

SAMPLE DATA				CONTAINER DATA			Asbestos Presence/Absence	NOTES
SAMPLE ID	MATRIX	DATE	TIME	TYPE & PRESERVATIVE	NO.	Ph		
Asb1 1	Bulk Solid	27/08/2015	10:30				X	
Asb2 2	Bulk Solid	27/08/2015	10:30				X	

Environmental Division
Sydney
Work Order Reference
ES1529700

Telephone : +61-2-8784 8555

RELINQUISHED BY:
NAME: Natalie Addison — DATE: 31/8/15
OF: CMJA — TIME:
NAME: ED Kerr — DATE: 31-5-15
OF: COURIER PLEASE — TIME: 10-15

RECEIVED BY
NAME: Front — DATE: 31/8
OF: ALS — TIME: 1345
NAME: — DATE:
OF: — TIME:

METHOD OF SHIPMENT
CONSIGNMENT NOTE NO.
TRANSPORT CO. NAME.

*Container Type and Preservative Codes: P = Neutral Plastic; N = Nitric Acid Preserved; C = Sodium Hydroxide Preserved; J = Solvent Washed Acid Rinced Jar; S = Solvent Washed Acid Rinced Glass Bottle; VC = Hydrochloric Acid Preserved Vial; VS = Sulfuric Acid Preserved Vial; BS = Sulfuric Acid Preserved Glass Bottle; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; O = Other.

AUSTRALIAN LABORATORY SERVICES P/L

ALS Environmental

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **ES1529700**

Client	: **C M JEWELL & ASSOC PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MR CHRIS JEWELL	Contact	:
Address	: P O BOX 10 WENTWORTH FALLS NSW, AUSTRALIA 2782	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: chris@cm-jewell.com.au	E-mail	:
Telephone	: +61 02 4759 3251	Telephone	: +61-2-8784 8555
Facsimile	: +61 02 4759 3257	Facsimile	: +61-2-8784 8500
Project	: J1696	Page	: 1 of 2
Order number	: J1696	Quote number	: ES2014CMJEWE0287 (SY/489/14)
C-O-C number	: ----	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
Sampler	:		

Dates

Date Samples Received	: 31-Aug-2015 1:45 PM	Issue Date	: 01-Sep-2015
Client Requested Due Date	: 07-Sep-2015	Scheduled Reporting Date	: **07-Sep-2015**

Delivery Details

Mode of Delivery	: Undefined	Security Seal	: Intact.
No. of coolers/boxes	: 1	Temperature	: 22.2'C
Receipt Detail	:	No. of samples received / analysed	: 2 / 2

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- **Asbestos analysis will be conducted by ALS Newcastle.**
- Please direct any queries you have regarding this work order to the above ALS laboratory contact.
- Analytical work for this work order will be conducted at ALS Sydney.
- Sample Disposal - Aqueous (14 days), Solid (60 days) from date of completion of work order.

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exist.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.

Matrix: **SOLID**

Laboratory sample ID	Client sampling date / time	Client sample ID	SOLID - EA200B Asbestos Identification in Bulk Solids (Excluding
ES1529700-001	27-Aug-2015 10:30	ASB 1	✓
ES1529700-002	27-Aug-2015 10:30	ASB 2	✓

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

Requested Deliverables

CHRIS JEWELL

- *AU Certificate of Analysis - NATA (COA)	Email	chris@cm-jewell.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	chris@cm-jewell.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	chris@cm-jewell.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	chris@cm-jewell.com.au
- A4 - AU Tax Invoice (INV)	Email	chris@cm-jewell.com.au
- Chain of Custody (CoC) (COC)	Email	chris@cm-jewell.com.au
- EDI Format - ENMRG (ENMRG)	Email	chris@cm-jewell.com.au
- EDI Format - ESDAT (ESDAT)	Email	chris@cm-jewell.com.au

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1529700**	Page	: 1 of 2
Client	: **C M JEWELL & ASSOC PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MR CHRIS JEWELL	Contact	:
Address	: P O BOX 10 WENTWORTH FALLS NSW, AUSTRALIA 2782	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: chris@cm-jewell.com.au	E-mail	:
Telephone	: +61 02 4759 3251	Telephone	: +61-2-8784 8555
Facsimile	: +61 02 4759 3257	Facsimile	: +61-2-8784 8500
Project	: J1696	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: J1696	Date Samples Received	: 31-Aug-2015 13:45
C-O-C number	: ----	Date Analysis Commenced	: 02-Sep-2015
Sampler	: ----	Issue Date	: 02-Sep-2015 16:07
Site	: ----		
		No. of samples received	: 2
Quote number	: ----	No. of samples analysed	: 2

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Descriptive Results

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Gerrad Morgan	Asbestos Identifier	Newcastle - Asbestos

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.

- EA200: Asbestos Identification Samples were analysed by Polarised Light Microscopy including dispersion staining.
- EA200: Negative results for vinyl tiles should be confirmed by an independent analytical technique.
- EA200 Legend
- EA200 'Am' Amosite (brown asbestos)
- EA200 'Ch' Chrysotile (white asbestos)
- EA200 'Cr' Crocidolite (blue asbestos)
- EA200: 'UMF' Unknown Mineral Fibres. "-" indicates fibres detected may or may not be asbestos fibres. Confirmation by alternative techniques is recommended.

Analytical Results

Sub-Matrix: **SOLID** (Matrix: **SOLID**)			Client sample ID	**ASB 1**	**ASB 2**	**----**	**----**	**----**
			Client sampling date / time	27-Aug-2015 10:30	27-Aug-2015 10:30	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES1529700-001**	**ES1529700-002**	**--------**	**--------**	**--------**
				Result	Result	Result	Result	Result
EA200: AS 4964 - 2004 Identification of Asbestos in bulk samples								
Asbestos Detected	1332-21-4	0.1	g/kg	**Yes**	**No**	**----**	**----**	**----**
Asbestos Type	1332-21-4	-	--	**Ch + Am + Cr**	**-**	**----**	**----**	**----**
Sample weight (dry)	----	0.01	g	**113**	**97.8**	**----**	**----**	**----**
APPROVED IDENTIFIER:	----	-	--	**G.MORGAN**	**G.MORGAN**	**----**	**----**	**----**

Analytical Results

Descriptive Results

Sub-Matrix: **SOLID**

Method: Compound	*Client sample ID - Client sampling date / time*	*Analytical Results*
EA200: AS 4964 - 2004 Identification of Asbestos in bulk samples		
EA200: Description	ASB 1 - 27-Aug-2015 10:30:00	One piece of bonded asbestos cement sheeting approximately 125 x 95 x 5mm.
EA200: Description	ASB 2 - 27-Aug-2015 10:30:00	One piece of organic fibre board approximately 120 x 85 x 7mm.

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **ES1529700**	Page	: 1 of 4
Client	: **C M JEWELL & ASSOC PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MR CHRIS JEWELL	Contact	:
Address	: P O BOX 10 WENTWORTH FALLS NSW, AUSTRALIA 2782	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: chris@cm-jewell.com.au	E-mail	:
Telephone	: +61 02 4759 3251	Telephone	: +61-2-8784 8555
Facsimile	: +61 02 4759 3257	Facsimile	: +61-2-8784 8500
Project	: J1696	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: J1696	Date Samples Received	: 31-Aug-2015
C-O-C number	: ----	Date Analysis Commenced	: 02-Sep-2015
Sampler	: ----	Issue Date	: 02-Sep-2015
Site	: ----	No. of samples received	: 2
Quote number	: ----	No. of samples analysed	: 2

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

NATA WORLD RECOGNISED ACCREDITATION

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out ir compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Gerrad Morgan	Asbestos Identifier	Newcastle - Asbestos

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR:- 0% - 50%; Result > 20 times LOR:0% - 20%.

- **No Laboratory Duplicate (DUP) Results are required to be reported.**

Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

- **No Method Blank (MB) or Laboratory Control Spike (LCS) Results are required to be reported.**

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

- **No Matrix Spike (MS) or Matrix Spike Duplicate (MSD) Results are required to be reported.**

ALS Environmental

QA/QC Compliance Assessment for DQO Reporting

Work Order	: **ES1529700**	Page	: 1 of 4
Client	: **C M JEWELL & ASSOC PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MR CHRIS JEWELL	Telephone	: +61-2-8784 8555
Project	: J1696	Date Samples Received	: 31-Aug-2015
Site	: ----	Issue Date	: 02-Sep-2015
Sampler	: ----	No. of samples received	: 2
Order number	: J1696	No. of samples analysed	: 2

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOLID** Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA200: AS 4964 - 2004 Identification of Asbestos in bulk samples							
Snap Lock Bag - ACM/Asbestos Grab Sample bag (EA200)							
ASB 1, ASB 2	**27-Aug-2015**	**----**	----	----	**02-Sep-2015**	23-Feb-2016	✓

Quality Control Parameter Frequency Compliance

- **No Quality Control data available for this section.**

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Asbestos Identification in Bulk Solids	EA200	SOLID	AS 4964 - 2004 Method for the qualitative identification of asbestos in bulk samples Analysis by Polarised Light Microscopy including dispersion staining