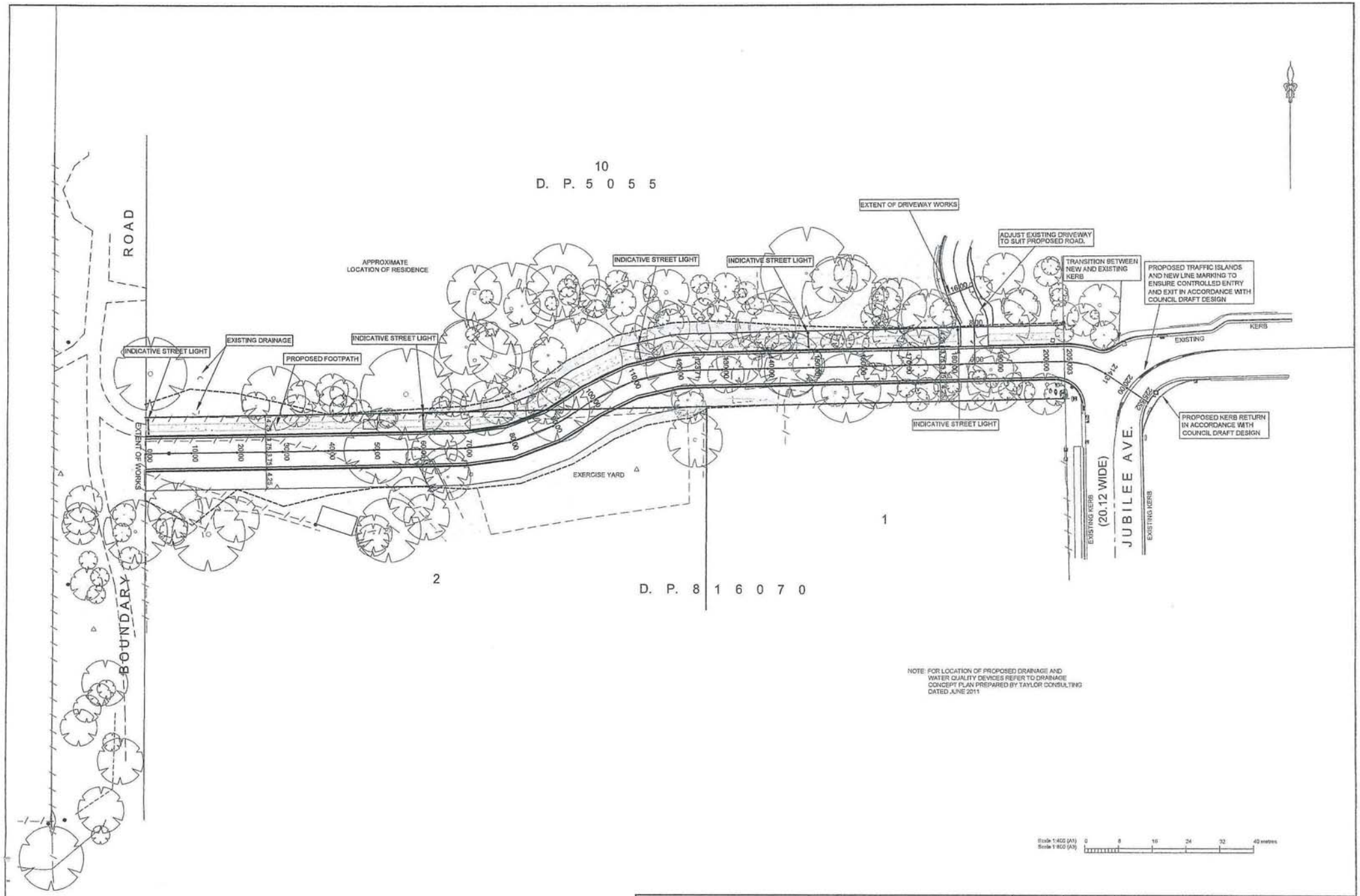
APPENDICES



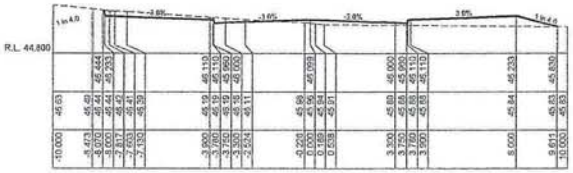
NOTE: FOR LOCATION OF PROPOSED DRAINAGE AND WATER QUALITY DEVICES REFER TO DRAINAGE CONCEPT PLAN PREPARED BY TAYLOR CONSULTING DATED JUNE 2011

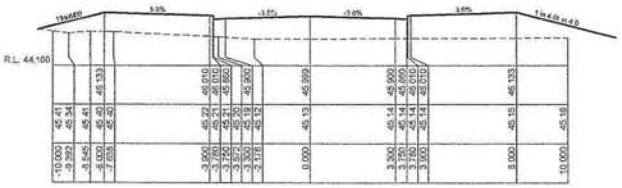
Scale 1:400 (A1) Scale 1:800 (A3) 0 8 16 24 32 40 metres

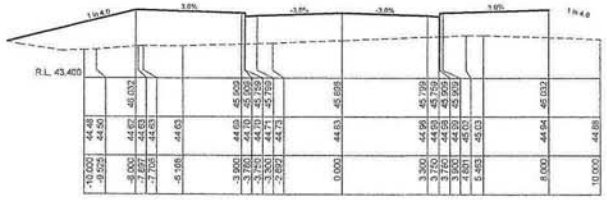
No.	AMENDMENT DESCRIPTION	BY	DATE
B	JUBILEE AVE. INTERSECTION AMENDED	S.W.	29.06.11
A	FIRST ISSUE	A.G.	8.06.11

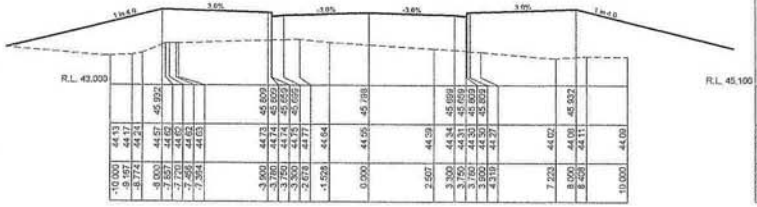
mepstead & ASSOCIATES
REGISTERED SURVEYORS AND DEVELOPMENT CONSULTANTS
Sydney
104 Cor... Thornleigh N.S.W. 2120
Phone ... Fax ...
Postal
PO BOX 226, Pennant Hills N.S.W. 1715
Internet
mepstead@mepstead.com.au
www.mepstead.com.au

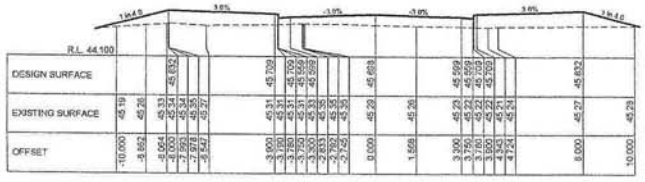
Designed: D.M.	Scale: 1:400	Principal: VOGUE AGENCY	Orig. No. 4034/DP2
Drawn: A.G.	Datum: A.H.D.	Project: PLAN OF PROPOSED PUBLIC ROAD BETWEEN JUBILEE AVENUE AND BOUNDARY ROAD, WARRIEWOOD	Sheet No. 1 of 4 sheets
Checked: D.M.	Date: 08.06.2011		Our Ref: 4034
L.G.A. PITTWATER	A1		

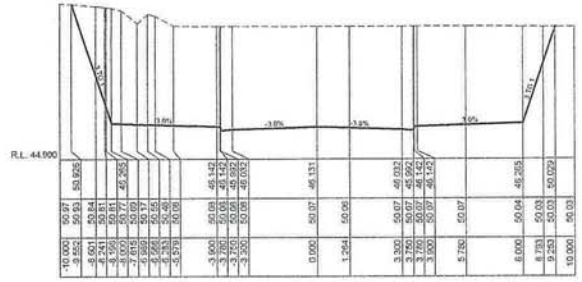


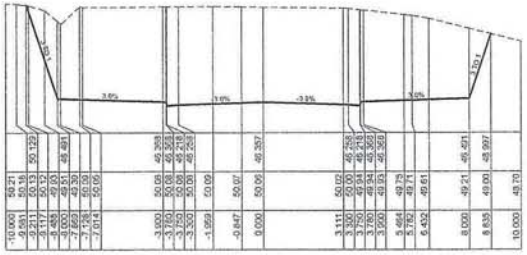


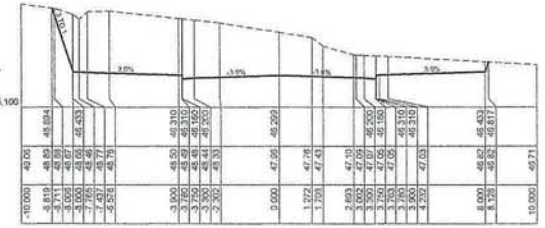


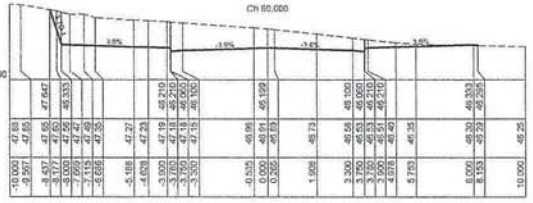


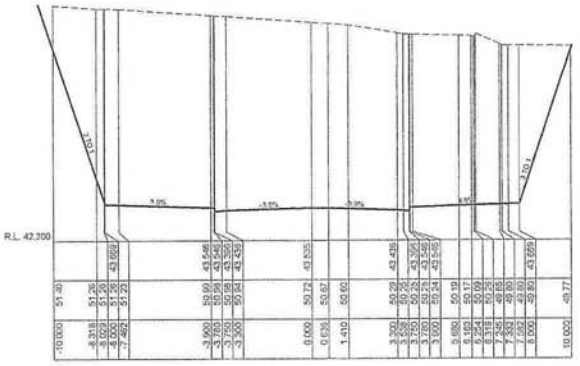


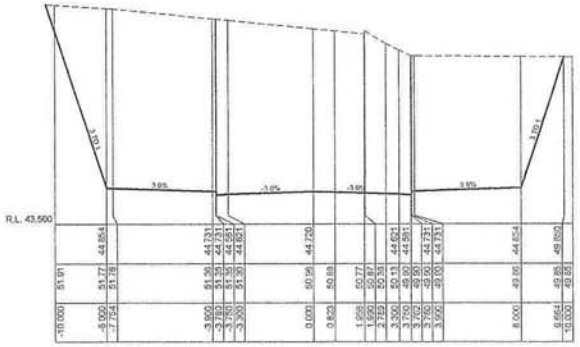


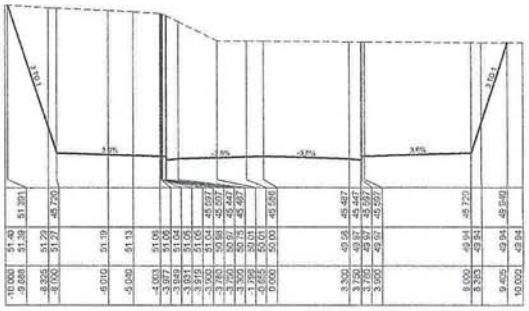












Scale 1:100 (A1) 0 2 4 6 8 10 metres
Scale 1:200 (A3)

No.	AMENDMENT DESCRIPTION	BY	DATE
B	JUBILEE AVE. INTERSECTION AMENDED	S.W.	29.06.11
A	FIRST ISSUE	A.G.	8.05.11

mepstead & ASSOCIATES
REGISTERED SURVEYORS AND DEVELOPMENT CONSULTANTS

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PO BOX 288, Pennant Hills N.S.W. 1715
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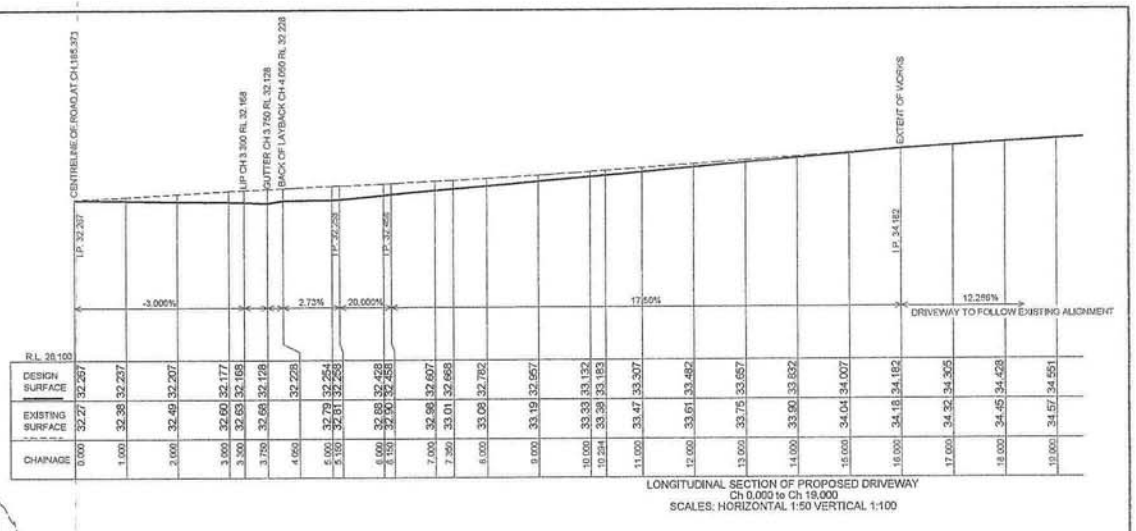
Internet
mepstead@mepstead.com.au
www.mepstead.com.au

Designed: D.M.	Scale: 1:100
Drawn: A.G.	Datum: A.H.D.
Checked: D.M.	Date: 08.05.2011
L.G.A: PITTWATER	A1

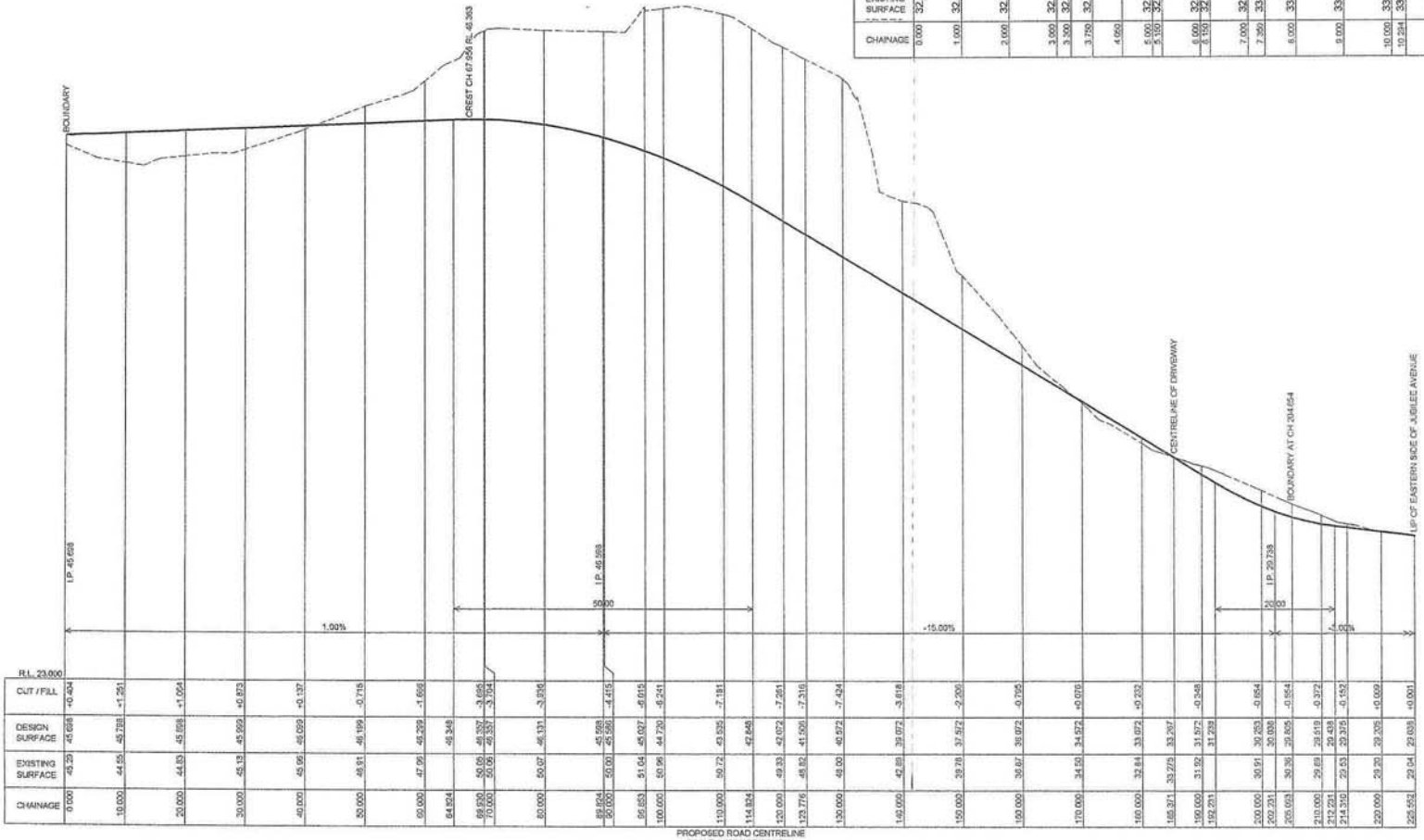
Principal: VOGUE AGENCY

Project: PLAN OF PROPOSED PUBLIC ROAD BETWEEN JUBILEE AVENUE AND BOUNDARY ROAD, WARRIEWOOD

Dwg. No. 4034-DES-2
Sheet No. 3 of 4 sheets
Our Ref. 4034



LONGITUDINAL SECTION OF PROPOSED DRIVEWAY
Ch 0.000 to Ch 19.000
SCALES: HORIZONTAL 1:50 VERTICAL 1:100



PROPOSED ROAD CENTRELINE
SCALE 1:400 HORIZONTAL
1:100 VERTICAL

Scale 1:400 (A1) Scale 1:800 (A3) 0 8 16 24 32 40 metres

Scale 1:100 (A1) Scale 1:200 (A3) 0 2 4 6 8 10 metres

No.	AMENDMENT DESCRIPTION	BY	DATE
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A	FIRST ISSUE	A.G.	8.06.11

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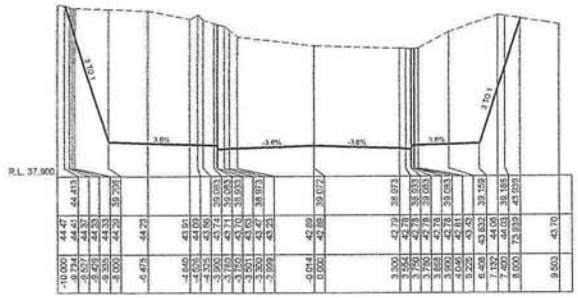
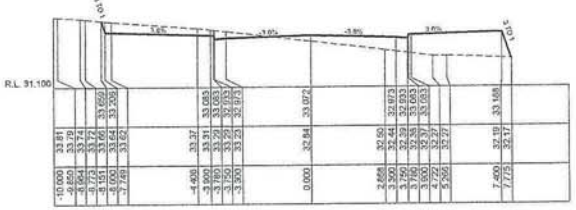
Internet
mepstead@mepstead.com.au
www.mepstead.com.au

Designed: D.M. | Scale: 1:400
Drawn: A.G. | Datum: A.H.D.
Checked: D.M. | Date: 08.06.2011
L.G.A.: PITTWATER | A1

Principal: VOGUE AGENCY
Project: PLAN OF PROPOSED PUBLIC ROAD BETWEEN JUBILEE AVENUE AND BOUNDARY ROAD, WARRIEWOOD
Dwg. No. 4034-DES-2
Sheet No. 2 of 4 sheets
Our Ref 4034



Ch 140.000



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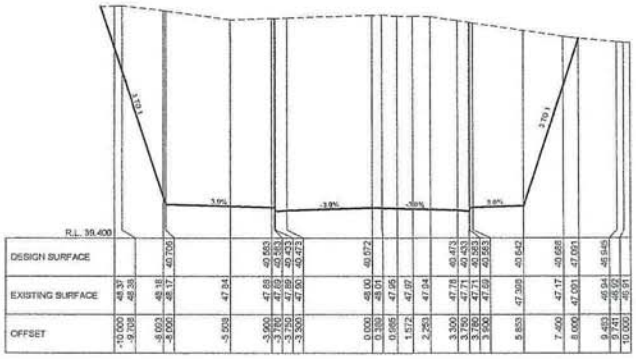

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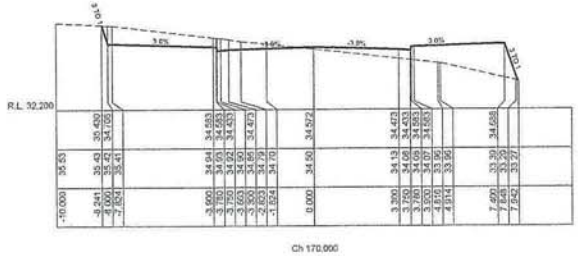

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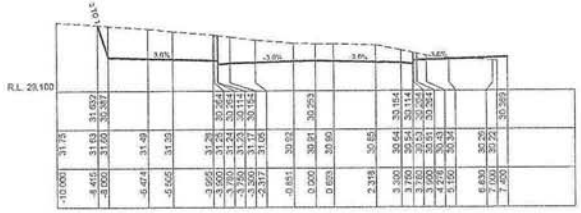

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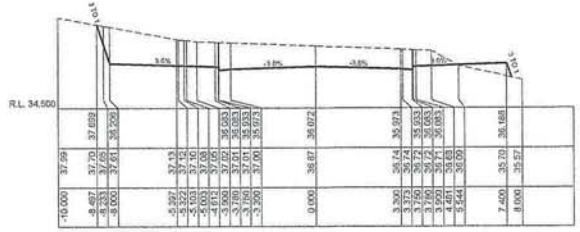
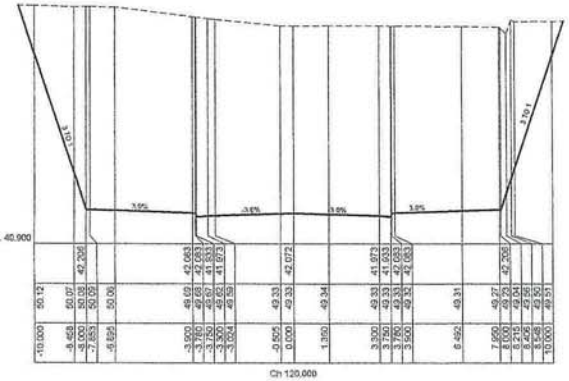
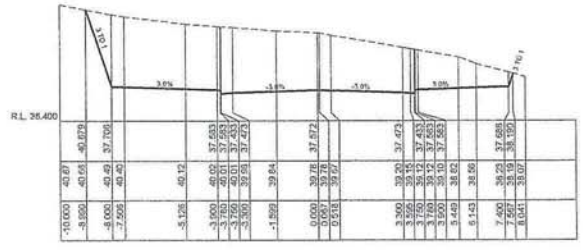


Ch 160.000



Ch 120.000



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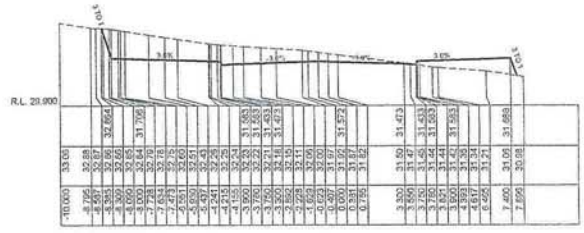


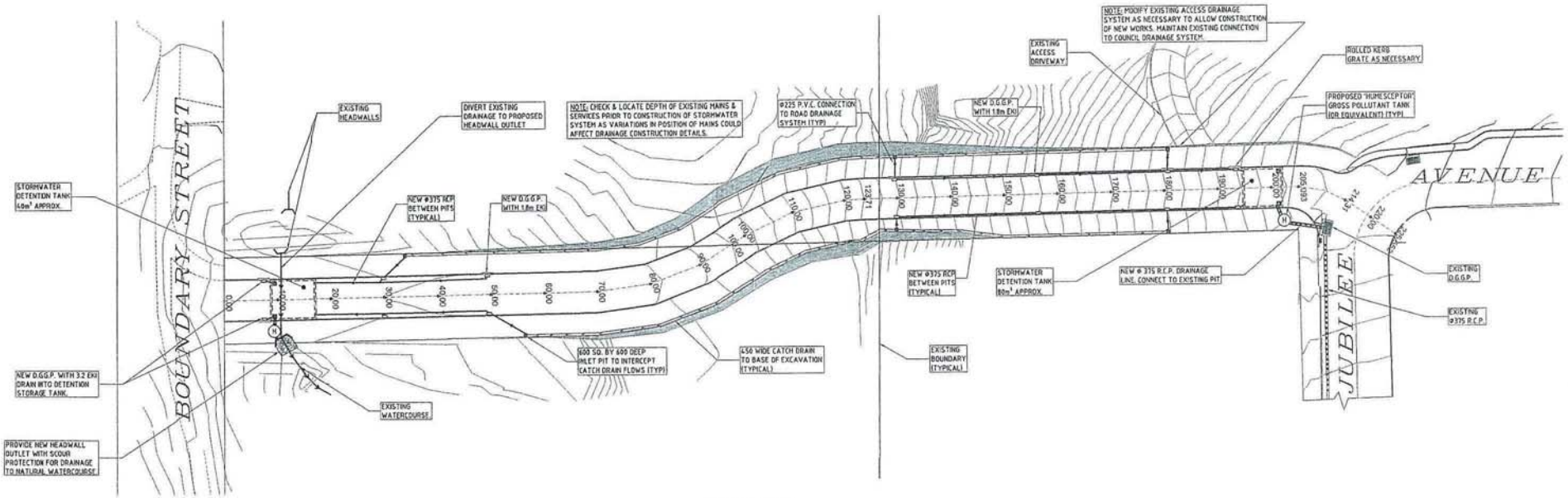
Ch 100.000

No.	AMENDMENT DESCRIPTION	BY	DATE
B	JUBILEE AVE. INTERSECTION AMENDED	S.W.	29.06.11
A	FIRST ISSUE	A.G.	8.06.11

Scale 1:100 (A1)
Scale 1:200 (A3)
0 2 4 6 8 10

mepstead & ASSOCIATES
REGISTERED SURVEYORS AND DEVELOPMENT CONSULTANTS
...y
...d Avenue, Thornleigh 2120
02 9875 4599 Fax ...13
Postal
PO BOX 205, Pennant Hills N.S.W. 1715
Internet
mepstead@mepstead.com.au
www.mepstead.com.au

Designed: D.M.	Scale: 1:100	Principal: VOGUE AGENCY	Dwg. No. 4034-DES-2
Drawn: A.G.	Datum A.H.D.	Project: PLAN OF PROPOSED PUBLIC ROAD BETWEEN JUBILEE AVENUE AND BOUNDARY ROAD, WARRIEWOOD	Sheet No. 4 of 4 sheets
Checked: D.M.	Date: 08.06.2011		Our Ref: 4034
L.G.A: PITTWATER	A1		



SITE PLAN

SCALE 1:400
SHOWING PROPOSED ROAD ACCESSWAY
& SUBSEQUENT STORMWATER DRAINAGE
LAYOUT TO BE PROVIDED

ISSUE	DATE	REVISION

TITLE
DRAINAGE CONCEPT PLAN – ACCESS ROAD
4 BOUNDARY ST & 10 JUBILEE AVE. WARRIEWOOD

DRAWN	DATE	CHECKED	SCALE
R.D.	JUNE 2011		1:500

TAYLOR CONSULTING
CIVIL & STRUCTURAL ENGINEERS

DRAWING NO
23311–1

Instrument setting out Terms of Easement intended to be created pursuant to Section 88B of the Conveyancing Act 1919.

(Sheet 1 of 2 sheets)

Plan: of right of carriageway within Lot 10 DP5055

Plan of right of carriageway ~~covered by Council Certificate No.~~

Full name and address of the owner of the land:

THE UNITING CHURCH IN AUSTRALIA PROPERTY TRUST (NSW)
59 Darley Road, Mona Vale NSW

DP1045166

Part 1

1. **Identity of easement, to be created and firstly referred to in the plan:** Right of carriageway 8 wide.

Schedule of Lots etc. affected

Lots burdened	**Lots, relevant roads, bodies or prescribed authorities benefited.**
Lot 10 DP5055	Pittwater Council (easement in gross)

Instrument setting out Terms of Easement intended to be created pursuant to Section 88B of the Conveyancing Act 1919.

~~(Sheet 2 of 2 sheets)~~

Plan: of right of carriageway within Lot 10 DP5055

Plan of right of carriageway covered by Council Certificate No.

Part 2

Terms of easement, referred to in the plan:-

Full and free right for the body in whose favour this easement is created and every person authorised by it and falling within the definition hereunder of "authorised person" to go, pass and repass at all times and for all purposes with or without horses or vehicles or both over the land indicated herein as the servient tenement and for the purposes aforesaid "authorised person" shall be limited to:-

For THE UNITING CHURCH IN AUSTRALIA PROPERTY TRUST (N.S.W

Member Member

DP1045166

1. pedestrian members of the public;
2. persons riding horses;
3. motor vehicles (but not trucks exceeding 8.2 tonnes in weight) towing horse trailers and actually being used for the purpose of horse transportation only;
4. cyclists (but excluding motor cyclists); and
5. emergency vehicles;

and the body in whose favour this easement is created shall erect at the eastern and western entrances/exits of the right of carriageway on the eastern and western boundaries of the land burdened by this easement notices in conspicuous positions advising persons of the limitations as to access over the right of carriageway hereby granted to the five categories set out above. Such notices shall be erected and maintained at all times at the cost of the body in whose favour this easement is created.

Name of person empowered to release, vary or modify restriction or positive covenant referred to in the plan:

Pittwater Council

THE COMMON SEAL of **THE UNITING CHURCH OF AUSTRALIA PROPERTY TRUST (NSW)** was hereunto affixed in accordance with its constitution and in the presence of:

THE COMMON SEAL of THE UNITING CHURCH IN AUSTRALIA PROPERTY TRUST (N.S.W.) was hereunto affixed this 2nd day of September 2002 pursuant to a resolution of the Trust at a duly convened meeting in the presence of:

Member

Member

THE UNITING CHURCH IN AUSTRALIA PROPERTY TRUST (N.S.W.) Common Seal

Signature of Secretary

Signature of Director

Name of Secretary – please print

Name of Director - please print

REGISTERED 26-9-2002

Form: 20EV
Release: 1
www.lpi.nsw.gov.au

VARIATION OF EASEMENT

AB605380M

New South Wales
Section 47(5A) Real Property Act 1900

PRIVACY NOTE: this information is legally required and will become part of the public record

(A) **TORRENS TITLE**

Servient Tenement	Dominant Tenement
10/5055	Pittwater Council

(B) **EASEMENT VARIED**

Number	Nature
1045166 RC1	Right of Carriageway

(C) **LODGED BY**

Delivery Box	Name, Address or DX and Telephone	CODE
1W	David Morgan & Associates Level 26, 44 market St SYDNEY NSW 2000 Reference:	R

(D) **APPLICANT (1)**

Registered proprietor of the dominant tenement
Pittwater Council.

(E) **APPLICANT (2)**

Registered proprietor of the servient tenement
The Uniting Church in Australia Property Trust (NSW)

(F) The applicants, having varied the above easement as set out in annexure A hereto, apply to have the variation

(G) recorded on the relevant folio of the Register.

(H) The consent of Pittwater Council is annexed hereto marked B

DATE

THE UNITING CHURCH IN AUSTRALIA PROPERTY TRUST (N.S.W.) Common Seal

Certified correct for the purposes of the Real Property Act 1900 by the corporation named below the common seal of which was affixed pursuant to the authority specified and in the presence of the authorised person(s) whose signature(s) appear(s) below.
Corporation:
Authority:

Signature of authorised person:

Name of authorised person: Alan Charles Robinson
Office held Chairman of Church Council of Pittwater Uniting Church.

I certify that the person(s) signing opposite, with whom I am personally acquainted or as to whose identity I am otherwise satisfied, signed this instrument in my presence.

Signature of witness:

Name of witness: Edward Woodley
Address of witness: 40 PARK CRES RYMBLE

THE COMMON SEAL of THE UNITING CHURCH IN AUSTRALIA PROPERTY TRUST (N.S.W.) was hereunto affixed on the 21st day of June 2005 pursuant to a resolution of the Trust at a duly convened meeting in the presence of:

Member
Ross Manwaring

Member
Gavin Pretorius

Signature of authorised person:

Name of authorised person: Rosemary Ross Johnson
Office held Secretary of Church Council of Pittwater Uniting Church

Certified correct for the purposes of the Real Property Act 1900 by the authorised officer named below.

Signature of authorised officer:

Authorised officer's name:
Authority of officer:
Signing on behalf of:

All handwriting must be in block capitals.

PLAN FORM 2

Plan Drawing only to appear in this space

SIGNATURES AND SEALS ONLY.

THE COMMON SEAL of THE UNITING CHURCH IN AUSTRALIA PROPERTY TRUST (N.S.W.) was hereunto affixed on the 3rd day of September 2002 pursuant to a resolution of the Trust at a duly convened meeting in the presence of:

Member

Member

Common Seal

THE UNITING CHURCH IN AUSTRALIA PROPERTY TRUST (N.S.W.)

Crown Lands Office Approval

PLAN APPROVED. . . . . Authorised Officer

Land District . . . . . .

Paper No. . . . . .

Field Book . . . . . pages. . . . . .

Subdivision Certificate

I hereby certify that the provisions of s 109J of the Environmental Planning and Assessment Act 1979 have been satisfied in relation to:

* the proposed . . . . . set out herein and
(* Insert 'subdivision' or 'new road')

* the subdivision is for lease purposes in accordance with s 22H of the Conveyancing Act 1919

Signature . . . . .
*Authorised Person/ General Manager/ Accredited Certifier

Consent Authority . . . . .

Date of endorsement . . . . .

Accreditation No. . . . . .

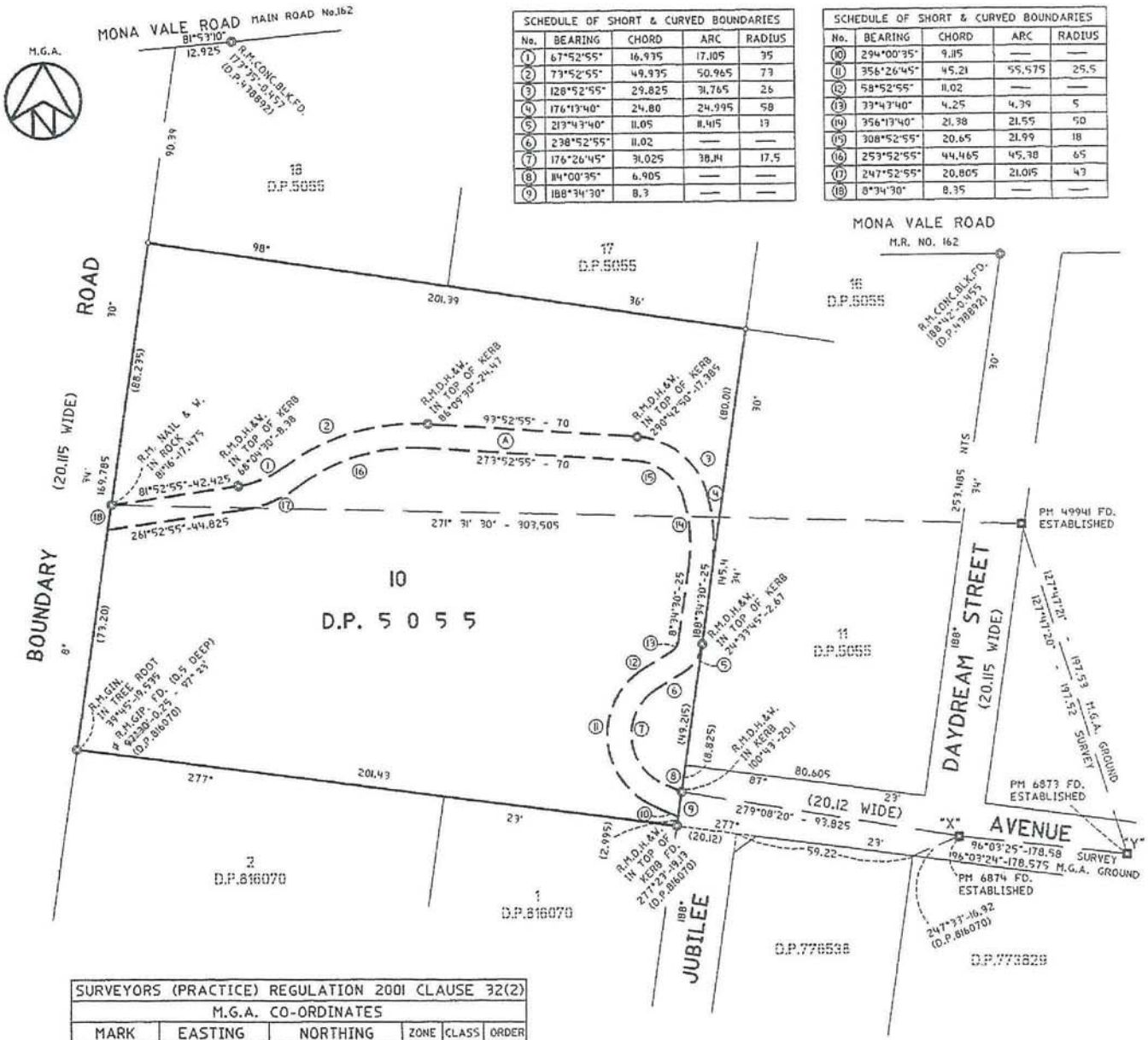
Subdivision Certificate No. . . . . .

File No. . . . . .

Note:
When the plan is to be lodged electronically in the Land Titles Office, it should include a signature in an electronic or digital format approved by the Registrar General.

*Delete whichever is inapplicable

SURVEYOR'S REFERENCE: RG2319-000



SCHEDULE OF SHORT & CURVED BOUNDARIES				
No.	BEARING	CHORD	ARC	RADIUS
(1)	67°52'55"	16.935	17.105	95
(2)	73°52'55"	49.935	50.965	73
(3)	128°52'55"	29.825	31.765	26
(4)	176°13'40"	24.80	24.995	58
(5)	213°43'40"	11.05	11.415	13
(6)	238°52'55"	11.02	—	—
(7)	176°26'45"	31.025	38.141	17.5
(8)	114°00'35"	6.905	—	—
(9)	188°34'30"	8.3	—	—

SCHEDULE OF SHORT & CURVED BOUNDARIES				
No.	BEARING	CHORD	ARC	RADIUS
(10)	294°00'35"	9.115	—	—
(11)	356°26'45"	45.21	55.575	25.5
(12)	58°52'55"	11.02	—	—
(13)	33°43'40"	4.25	4.39	5
(14)	356°13'40"	21.38	21.55	50
(15)	308°52'55"	20.65	21.99	18
(16)	253°52'55"	44.465	45.38	65
(17)	247°52'55"	20.805	21.015	43
(18)	8°34'30"	8.35	—	—

SURVEYORS (PRACTICE) REGULATION 2001 CLAUSE 32(2)					
M.G.A. CO-ORDINATES					
MARK	EASTING	NORTHING	ZONE	CLASS	ORDER
PM 6873	341 351.865	6 272 178.337	56	B	U
PM 6874	341 174.302	6 272 197.177	56	B	U
PM 49941	341 195.777	6 272 299.364	56	B	U

ADOPTED FROM LAND & PROPERTY INFORMATION (S.C.I.M.S.) AT 25/07/2002
COMBINED SCALE FACTOR ADOPTED : 0.999907

(A) RIGHT OF CARRIAGEWAY 8 WIDE

DP1045166

Registered: 26-9-2002

C.A.

Title System: TORRENS

Purpose: EASEMENT

Ref. Map: UI867-62

Last Plan: D.P. 5055

PLAN OF RIGHT OF CARRIAGEWAY WITHIN LOT 10 IN D.P. 5055

Lengths are in metres. Reduction Ratio 1:1000

LGA: PITTWATER

Locality: MONA VALE

Parish: NARRABEEN

County: CUMBERLAND

This is sheet 1 of my plan in sheets.
(Delete if inapplicable)

SURVEYORS (PRACTICE) REGULATION 2001

I, BRIAN DEWING
of GHD SURVEYS PTY LIMITED
67 Albert Avenue, Chatswood NSW 2067,

a surveyor registered under the Surveyors Act 1929, hereby certify that the survey represented in this plan is accurate, has been made in accordance with the Surveyors (Practice) Regulation 2001 and was completed on 12.8.02

This survey relates to EASEMENT

(Here specify the land actually surveyed or specify any land shown in the plan that is not the subject of the survey)

Datum Line of Azimuth: "X" - "Y"
Zone: Suburban/Country

Signature:
Surveyor registered under Surveyors Act 1929

Plans used in preparation of survey/compilation

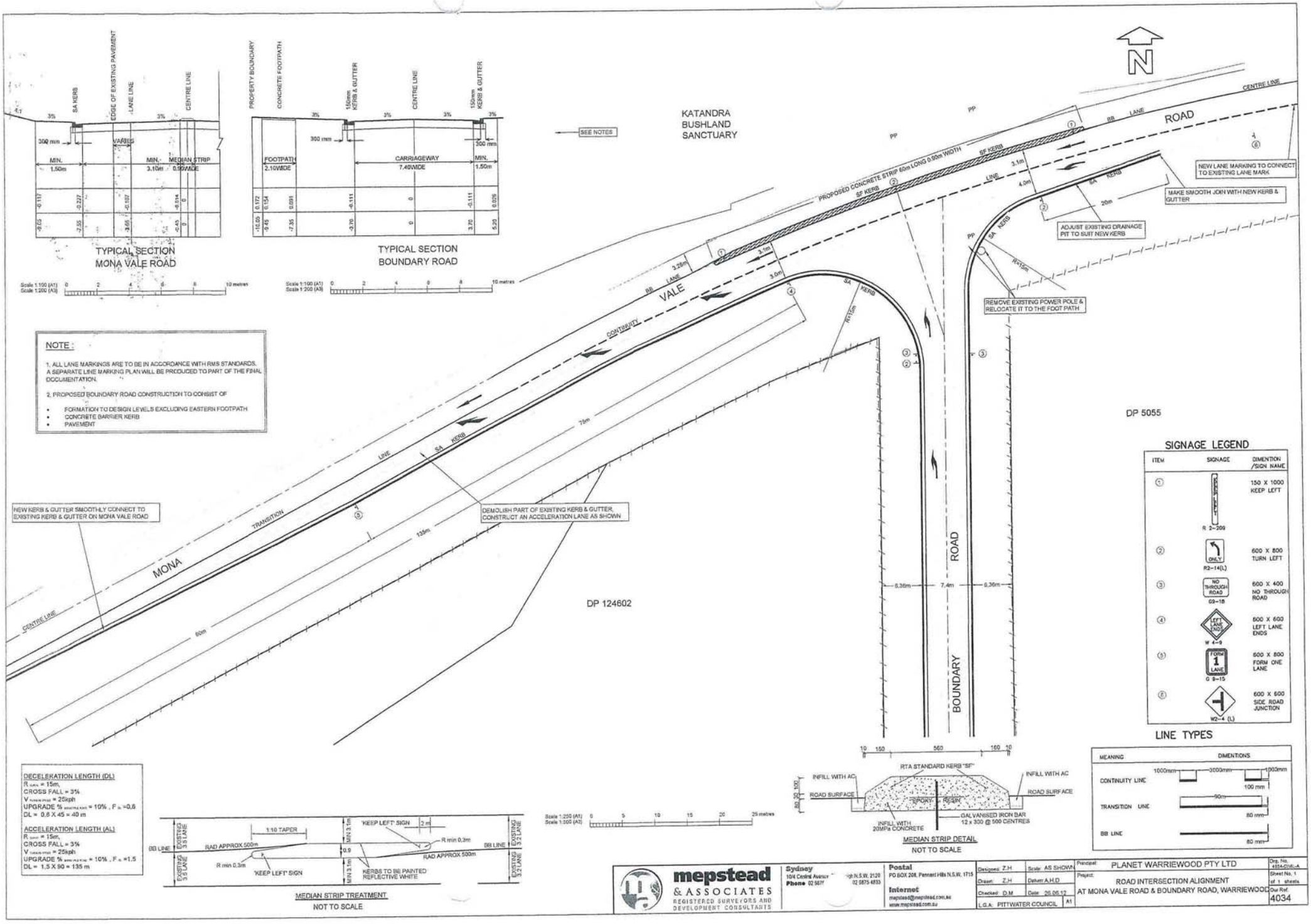
D.P. 5055, D.P. 438892, D.P. 816070

PANEL FOR USE ONLY for statements of intention to dedicate public roads, to create public reserves, drainage reserves, easements, restrictions on the use of land or positive covenants.

PURSUANT TO SECTION 88B OF THE CONVEYANCING ACT, 1919 AS AMENDED, IT IS INTENDED TO CREATE:

1. RIGHT OF CARRIAGEWAY 8 WIDE.

WARNING: CREASING OR FOLDING WILL LEAD TO REJECTION


TYPICAL SECTION
MONA VALE ROAD
TYPICAL SECTION
BOUNDARY ROAD
KATANDRA
BUSHLAND
SANCTUARY
SEE NOTES
PROPOSED CONCRETE STRIP 60m LONG 0.90m WIDTH
NEW LANE MARKING TO CONNECT TO EXISTING LANE MARK
MAKE SMOOTH JOIN WITH NEW KERB & GUTTER
ADJUST EXISTING DRAINAGE PIT TO SUIT NEW KERB
REMOVE EXISTING POWER POLE & RELOCATE IT TO THE FOOT PATH
NEW KERB & GUTTER SMOOTHLY CONNECT TO EXISTING KERB & GUTTER ON MONA VALE ROAD
DEMOLISH PART OF EXISTING KERB & GUTTER, CONSTRUCT AN ACCELERATION LANE AS SHOWN
MONA VALE ROAD
BOUNDARY ROAD
DP 124602
DP 5055
NOTE :
1. ALL LANE MARKINGS ARE TO BE IN ACCORDANCE WITH RMS STANDARDS. A SEPARATE LINE MARKING PLAN WILL BE PRODUCED TO PART OF THE FINAL DOCUMENTATION.
2. PROPOSED BOUNDARY ROAD CONSTRUCTION TO CONSIST OF
FORMATION TO DESIGN LEVELS EXCLUDING EASTERN FOOTPATH
CONCRETE BARRIER KERB
PAVEMENT
SIGNAGE LEGEND
ITEM
SIGNAGE
DIMENTION /SIGN NAME
150 X 1000 KEEP LEFT
600 X 800 TURN LEFT
600 X 400 NO THROUGH ROAD
600 X 600 LEFT LANE ENDS
600 X 800 FORM ONE LANE
600 X 600 SIDE ROAD JUNCTION
LINE TYPES
MEANING
DIMENTIONS
CONTINUITY LINE
TRANSITION LINE
BB LINE
DECELERATION LENGTH (DL)
CROSS FALL = 3%
UPGRADE % = 10% , F = 0.8
DL = 0.8 X 45 = 40 m
ACCELERATION LENGTH (AL)
CROSS FALL = 3%
UPGRADE % = 10% , F = 1.5
DL = 1.5 X 90 = 135 m
MEDIAN STRIP TREATMENT
NOT TO SCALE
MEDIAN STRIP DETAIL
NOT TO SCALE
RTA STANDARD KERB "SF"
INFILL WITH AC
ROAD SURFACE
EPOXY RESIN
GALVANISED IRON BAR 12 x 300 @ 500 CENTRES
INFILL WITH 20MPa CONCRETE
mepstead & ASSOCIATES
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Scale: AS SHOWN
Date: 26.06.12
L.G.A: PITTWATER COUNCIL
A1
Principal: PLANET WARRIEWOOD PTY LTD
Project: ROAD INTERSECTION ALIGNMENT AT MONA VALE ROAD & BOUNDARY ROAD, WARRIEWOOD
Drg. No. 4034-DWG-A
Sheet No. 1 of 1 sheets
Our Ref. 4034

120 MONA VALE ROAD, W ARRIEW OOD

Traffic Report

For:
PLANET WARRIEWOOD P/L
4 VUKO PLACE. WARRIWOOD 2102

January2006

2005136
ReportNo.2005136

Report No. 2005136

This report has been prepared in accordance with the scope of services described in the contract or agreement between TAR Technologies Pty Ltd ACN 099 564 995 (TAR) and the Client. The report relies upon data, surveys, measurements and results taken at or under the particular times and conditions specified herein. Any findings, conclusions or recommendations only apply to the aforementioned circumstances and no greater reliance should be assumed or drawn by the Client. Furthermore, the report has been prepared solely for use by the Client and TAR accepts no responsibility for its use by other parties.

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Chapter1

INTRODUCTION

TAR Technologies Pty Ltd (TAR) has been commissioned by Planet Warriewood P/L to undertake a Traffic Study assessing the impacts of providing approximately 104 lots for single dwellings over approximately 8.33 hectares on vacant Non-Urban 1(a) zoned.

The traffic report has been prepared with reference to generations contained within the Road sand Traffic Authority's (RTA's) *Guide to Traffic Generating Developments.*

Chapter 2

SITE LOCATION

The site is triangular in shape and bounded to the north by Mona Vale Road, to the east by Boundary Street and to the west by Narrabeen Creek bushland. The site area comprises approximately 8.33 hectares and falls steeply to the east to Boundary Street. Boundary Street is currently closed at Mona Vale Road with vehicular access to the property available from Jubilee Avenue and thence via Jubilee Lane, a common access way also shared by a Church.

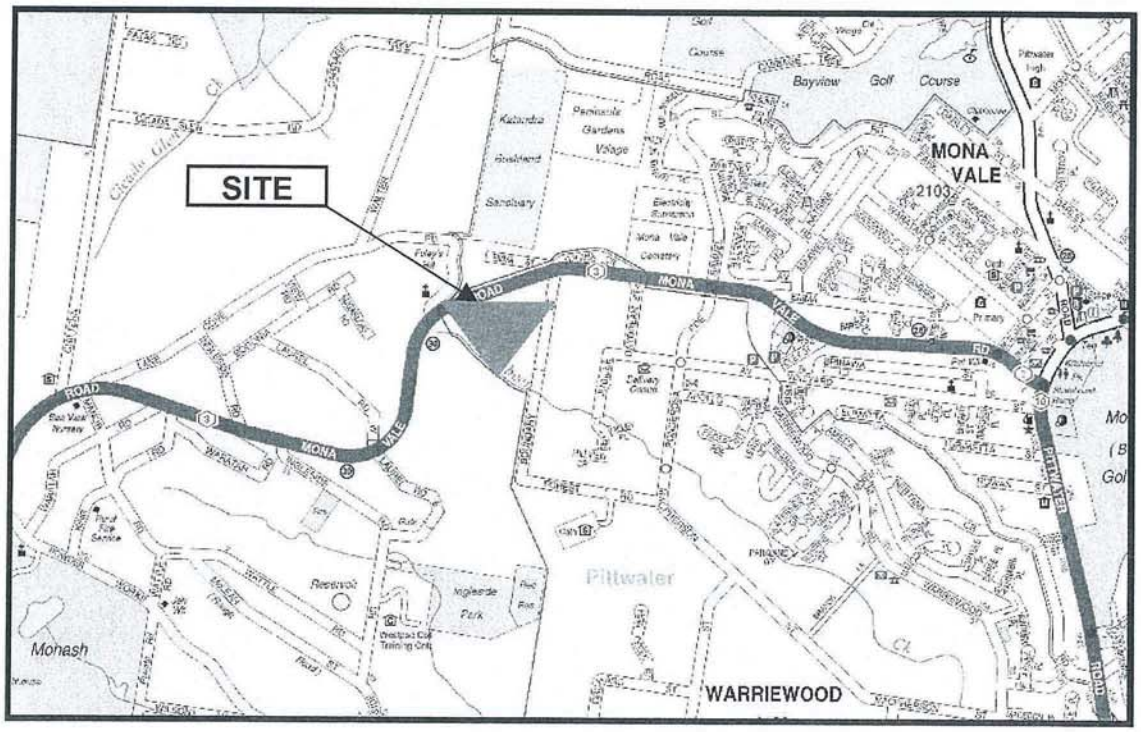


Figure 2.1 Site Location

The site in relation to the surrounding area is shown in *Figure 2.1*. The site has frontage to Mona Vale, which provides a major link to the city and westwards to Parramatta. Jubilee Avenue itself connects to Ponderosa Parade linking Mona Vale Road and Pittwater Road via Vineyard Street and MacPherson Street.

Chapter 3

EXISTING CONDITIONS

3.1 ROAD NETWORK

The local traffic routes that would be used by the site are:

- Mona Vale Road;
- Pittwater Road;
- Ponderosa Parade;
- Jubilee Avenue;
- Vineyard Street;
- Boundary Road;
- MacPherson Street; and
- Jubilee Lane.

These routes are described in detail below:

Mona Vale Road and Pittwater Road are major arterial roads linking, respectively, with the western areas of Sydney and with suburbs to the north and south along the beaches.

Ponderosa Parade, Jubilee Avenue, Vineyard Street and MacPherson Street are local roads that service a light Industrial Area near the site. Road widths vary from 13.2 metres wide in Ponderosa Avenue to 11.5 metres in wide in Jubilee Avenue.

Jubilee Lane is a 6 metre wide road that serves Pittwater Uniting Church and pre-school, and a Sports and Recreation Centre. The lane has 90 degree angle parking and connects to Boundary Road. Jubilee Lane has a 10km/h speed limit which is self-enforcing with a number of speed humps.

Boundary Road runs north-south and currently meets Jubilee Lane at right angles. The road is undulating and narrow with no connection to Mona Vale Road and providing access to a single dwelling to the south.

3.2 EXISTING TRAFFIC NETWORK OPERATION

Intersection turning movement surveys were undertaken at the intersection of Ponderosa Parade and Jubilee Avenue. The surveys were carried out between 8:00 - 9:30 am and 2:30 - 5:30 pm on Thursday, 1st December, 2005. The survey results indicate that the highest peak hour volumes occur in the mornings between 8:15 - 9:15 am, and in the afternoon between 3:00 - 4:00 pm. These time periods have been adopted in the assessment as the AM and PM peak hour periods.

3.3 MID-BLOCK PERFORMANCE

Mid-block flows for the four approach legs of the Ponderosa Parade and Jubilee Avenue intersection have been calculated from the survey data collected for the AM and PM peak hour periods.

The existing mid-block performance of Jubilee Avenue and Jubilee Lane, traffic routes on the direct approach to the development site, has been assessed by comparing existing traffic volumes with the environmental capacity of the road carriageway. Environmental capacity (EC) has been adopted by both the RTA (1993) and DUAP (1992) for density and land use planning on minor roads. It is not related to the physical capacity of the road network, but is a measure of the volume of traffic that a local or collector road can carry before residential amenity and pedestrian safety start to be significantly reduced.

The EC of a street is a function of its road geometry, speed, frontage land use, road surface, and building setbacks. The RTA provides general guidelines for appropriate traffic volumes (Guide to Traffic Generating Developments, 1993), and these are widely used in the analysis of traffic impacts. More specific values of EC can be determined when the individual characteristics of a road are known. The parameters to calculate environmental capacity are listed in the RTA's Guide to Traffic Generating Developments under:

- Traffic characteristics;
- Road characteristics; and
- Locality characteristics.

The work of Song (1993) can be used to assess the environmental capacity of an individual road. Song's method considers variations in road width, pedestrian safety and delay, and traffic noise. It incorporates the factors affecting environmental capacity described in the RTA guidelines.

Once the EC of a street has been calculated, it is possible to assess the level of traffic overload which may exist, expressed as an Environmental Deficiency Index (EDI), by consideration of the actual traffic flow on the street. The EDI is the ratio of actual traffic volume to EC.

Where the EDI value is less than 1.0, it may be considered that no environmental detriment due to traffic volume exists. Where the EDI equals or exceeds 1.0, environmental degradation is occurring.

Roads near the site that provide direct access to local properties include Jubilee Avenue and Jubilee Lane. The peak hour flows recorded in December 2005, the environmental capacities and their ratios are summarised in *Table 3.1*. The results show that the existing volumes are well below the roads' environmental capacities and below the levels where community dissatisfaction should begin to develop.

Table 3.1 ENVIRONMENTAL CAPACITY - EXISTING SITUATION

Street	Peak traffic flow (vehicles per hour)	Environmental capacity (vehicles per hour)	EC ratio
Jubilee Avenue (West of Ponderosa)	283	409	0.69
Jubilee Avenue (East of Ponderosa)	289	367	0.79
Jubilee Lane	103	320[1]	0.32

Notes: 1. Assumes 50/50 distribution and one parking hindrance.

3.4 INTERSECTION PERFORMANCE

In addition to the mid-block performance assessment described in the preceding section, the operation of the Jubilee Avenue and Ponderosa Parade intersection has been assessed based on physical capacity considerations, using the aaSIDRA (or SIDRA) junction modelling program. The program reports on the performance of the junction in terms of the average delay and level of service (LOS), for each individual junction movement.

The LOS reported by SIDRA is related to the average delay, measured in seconds/vehicle (sec/veh) experienced by vehicles waiting to perform a movement. *Table 3.2* sets out the criteria.

Table 3.2 INTERSECTION LEVEL OF SERVICE CRITERIA

LOS	Average delay (secs/veh)	Traffic signals, roundabout	Give way and stop signs
A	Less than 14	Good.	Good.
B	15 to 28	Good, with acceptable delays and spare capacity.	Acceptable delays and spare capacity.
C	29 to 42	Satisfactory.	Satisfactory, but accident study required.
D	43 to 56	Satisfactory, but operating near capacity.	Near capacity and accident study required.
E	57 to 70	At capacity and incidents will cause excessive delays; roundabouts require other control mode.	At capacity and requires other control mode.
F	Greater than 70	Unsatisfactory and requires additional capacity.	Unsatisfactory and requires other control mode.

Adapted from RTA Guide to Traffic Generating Developments, 1993

3.5 JUBILEE AVENUE AND PONDEROSA PARADE

As noted previously, Ponderosa Parade provides a connection to two arterial roads, namely Mona Vale Road and Pittwater Road. The traffic surveys undertaken at this location indicate that the junction currently provides for a mix of light industrial and residential traffic controlled by a single lane roundabout. The results of the SIDRA analysis are contained in *Table 3.3.*

Table 3.3 PONDEROSA PARADE AND JUBILEE AVENUE - EXISTING SITUATION

Approach	AM		PM	
	Average Delay (sec/veh)	LOS	Average Delay (sec/veh)	LOS
Ponderosa Pde (South)	8.1	A	8.0	A
Jubilee Ave (East)	10.8	A	10.0	A
Ponderosa Pde (North)	8.0	A	8.3	A
Jubilee Ave (West)	10.2	A	10.8	A
Intersection	10.8	A	10.8	A

The results for peak hours show that all approaches of the roundabout operate at a "GOOD" level of service with only minor delays currently being experienced.

Chapter 4

DESCRIPTION OF PROPOSAL

4.1 GENERAL

120 Mona Vale Road is triangular in shape covering approximately 8.33 hectares with existing vehicular access to the property from Mona Vale Road. However, the retention of this access is unsuitable due to the available road width and grades along Mona Vale Road adjacent to the subject property. It is proposed to have access only from Boundary Street via Jubilee Lane. The site is currently zoned Non-Urban 1(a) under Pittwater Local Environmental Plan 1993.

This report has been prepared in respect of a proposal, which seeks to rezone the land for residential purposes.

Access is envisaged to be at Boundary Street where it intersects with Jubilee Lane. This access lane would cater exclusively for residential traffic and not include commercial vehicles. Parking would be contained within the site.

4.2 TRIP GENERATION AND DISTRIBUTION

Based on the RTA Guide to Traffic Generating Developments (1993) the potential traffic generation of a development comprising approximately 104 lots generating an estimated 89 trips per weekday peak hour, based on 0.85 trips per dwelling.

Traffic generation associated with the rezoning to allow 104 lots has been based on the assumption that 100% of all trips leaving the site in the morning would travel along Jubilee Lane and then to Jubilee Ave in an easterly direction and 100% of all trips in the afternoon would travel in a westerly direction.

There may be occasions where a small proportion of trips would travel against the peak direction however, for the purposes of the assessment, the worst case scenario has been assumed, i.e. 100%.

Based on existing traffic patterns the forecast 89 trips would be distributed as follows:

- 28% to the north along Ponderosa Parade;
- 22% to Jubilee Avenue (East); and

- 50% to Ponderosa Parade (South).

It is expected that traffic leaving and entering the site would generally occur in the morning peak of 7:00 - 8:00 am to allow commuters sufficient time to arrive at their destination before 9:00 am. Similarly the afternoon arrival time to the site would occur between 6:00 - 7:00pm.

Consequently these times are generally outside the existing activities of the pre-school which operates between 9:00 am - 3:00 pm, Monday - Friday, and the activities of the Sport and Recreation Centre and Church.

4.3 IMPACTS OF THE DEVELOPMENT ON THE EXISTING ROAD NETWORK

To assess the Environmental Capacity of the local street network near the site, the additional traffic generated by the site has been added to the existing traffic volumes. The results of the assessment are contained in *Table 4.1*

Table 4.1 ENVIRONMENTAL CAPACITY - FUTURE SITUATION

Street	Peak traffic flow (vehicles per hour)	Environmental capacity (vehicles per hour)	EC ratio
Jubilee Avenue (West)	372	409	0.91
Jubilee Avenue (East)	309	367	0.84
Jubilee Lane	192	320[1]	0.60

Notes: 1. Assumes 50/50 distribution and one parking hindrance.

The table shows the additional traffic by the proposed redevelopment of the site would not have a detrimental effect on road safety and amenity in Jubilee Avenue and Jubilee Lane. The forecast volumes remain below the roads' environmental capacity.

4.4 INTERSECTION PERFORMANCE

To assess the future operation of the roundabout at Ponderosa Parade and Jubilee Avenue the SIDRA model has been re-run incorporating the additional traffic generated by the development. The results of the analysis are contained in *Table 4.2*

Table 4.2 PONDEROSA PARADE AND JUBILEE AVENUE - FUTURE SITUATION

Approach	AM		PM	
	Average Delay (sec/veh)	LOS	Average Delay (sec/veh)	LOS
Ponderosa Pde (South)	8.1	A	8.4	A
Jubilee Ave (East)	11.2	A	10.1	A
Ponderosa Pde (North)	8.4	A	8.5	A
Jubilee Ave (West)	10.3	A	10.8	A
Intersection	11.2	A	10.8	A

The results of the assessment show that the Level of Service for all movements at the intersection remains unchanged, and that average delays have increased marginally for the morning and are constant for the afternoon.

The intersection of Ponderosa Parade and Jubilee Avenue is the closest intersection to the site and is not expected to experience any significant effect from the development. As this intersection was assessed to experience marginal impacts it can be expected that other sites further away would have even lower impacts.

Chapter 5

CONCLUSIONS

This traffic study has examined the impacts of rezoning 120 Mona Vale Road from Non-Urban (1A) to Residential. The assessment has been carried out in accordance with generations contained within the RTA's Guide to Traffic Generating Developments. The findings of the study are summarised below:

- The proposal includes the development of up to 104 single dwelling residential allotments, with access at Boundary Road and Jubilee Lane.
- The expected additional traffic generated by the proposal is 89 trips per hour during the morning and afternoon commuter peak periods.
- The impact of traffic generated by the development on the surrounding road network has been assessed for the AM and PM peak hour periods. The results indicate the additional traffic will have a negligible impact on the existing operation of Ponderosa Parade and Jubilee Avenue.
- The site is to use a shared access way, Jubilee Lane, which currently serves Pittwater Uniting Church and associated activities that would operate outside of the main travel time from a residential estate.
- The environmental capacity, which is a measure of road safety and amenity, has been considered in the study for Jubilee Lane and Jubilee Avenue. The results show that future traffic volumes are within the roads' environmental capacity, which is acceptable.

In summary, there are no significant traffic issues that could preclude the change of the site to residential.

mepstead
& ASSOCIATES

Ref: 4034

6th September, 2012

IMPACT OF WARRIEWOOD VALLEY STRATEGIC REVIEW HYDROLOGY STUDY ON PROPOSED DEVELOPMENT OF 120-122 MONA VALE ROAD, WARRIEWOOD

Cardno prepared a Hydrology Study in November 2011 which was intended to determine the suitability of undeveloped land for future development in terms of flooding and water management within the Warriewood Valley.

Some of the sites investigated in the report are directly affected by the 100 year flood event and Probable Maximum Flood (PMF) events. The subject land is not affected by either of these apart from the local flood generated by the local catchment.

Within the report the site is defined as Category A under a classification system devised by the Department of Planning and Infrastructure and Council.

Category A land is that land

- which is located above the PMF plus Climate change allowance level.
- which may be subject to overland flow
- which allows for flood evacuations with minimum risk to life and no possibility of flood entrapment or flood isolation

Table 11-1 "OSD and WQ Requirements for Sectors Outside of the Floodplain" shows the following figure in relation to the subject land:

120 Mona Vale Road

Developable Area:	8.3 hectares
OSD Basin Size:	3,060m^3
Water Quality Basin Area:	4,150m^2

The OSD basin size has been calculated using a rate of 368m^3 per hectare of developable area and the Water Quality Basin using a rate of 5% of the developable area. The formula used to determine these parameters was set out in an earlier report prepared by Lawson and Treloar in

2001 (Warriewood Valley Water Management Specification). These parameters are very conservative and assume medium density development with 50% impervious area.

However, as much of the subject site will not be developed and will remain unchanged the calculations based on the entire site area are in our opinion not valid and instead should be based on the proposed lot design.

There are distinct catchments within the property as shown on the plan titled "Catchment Areas for the Proposed Subdivision of 120-122 Mona Vale Road, Warriewood". Some of the future developed area and much of the undeveloped area will drain directly to Narrabeen Creek which forms part of the south western boundary of the subject land. A developable area of 3.13 hectare, being a combination of residential lots and roads west of Boundary Street and proposed lots east of Boundary Street will drain to the head of a small watercourse which eventually drains to Narrabeen Creek (Catchment A). A further 2.54 hectare of developable area comprising lots and roads can be directed to an existing pipeline under Boundary Street approximately 120 metres south of Mona Vale Road (Catchment B).

Based on these areas the required OSD storage volume and Water Quality area would be as follows:

Catchment A	OSD Volume:	1152 m^3	Water Quality Basin Area:	1,565m^2
Catchment B	OSD Volume:	935 m^3	Water Quality Basin Area:	1,270m^2

Therefore it is proposed to have two separate areas for on-site detention.

Area A will achieve the required OSD storage in the following way:

1. The 39 residential lots will each have a 5 cubic metre OSD tank within their property. This gives a total volume of 195 cubic metres.
2. Two tanks will be constructed underground within No.4 Boundary Street having a combined volume of 957 cubic metres. Indicative locations for these tanks are shown on the plan titled "Plan showing proposed OSD and Water Quality Basins for Proposed Subdivision of 120-122 Mona Vale Road, Warriewood"

Area B will achieve the required OSD storage in the following way:

1. The 30 residential lots will each have a 5 cubic metre OSD tank within their property. This will give a combined volume of 150 cubic metres.
2. There is an area above the proposed subdivision road running north-south within the proposed open space that can be utilised for an OSD basin. It is estimated that storage of approximately 190 cubic metres could be achieved here.
3. There is an existing dam on the property located within the gully adjacent to Boundary Street. There is additional area north west of the dam adjacent to the pipe located under Boundary Street which could be utilised as an OSD basin. The existing dam would form the primary storage area with a spillway leading to the lower area. The area proposed for this purpose does not contain any trees. The combined total volume which could be achieved is 595 cubic metres.

The ten lots which drain directly to Narrabeen Creek would have individual OSD tanks or basins based on the proposed impervious area for each lot in accordance with Council's DCP.

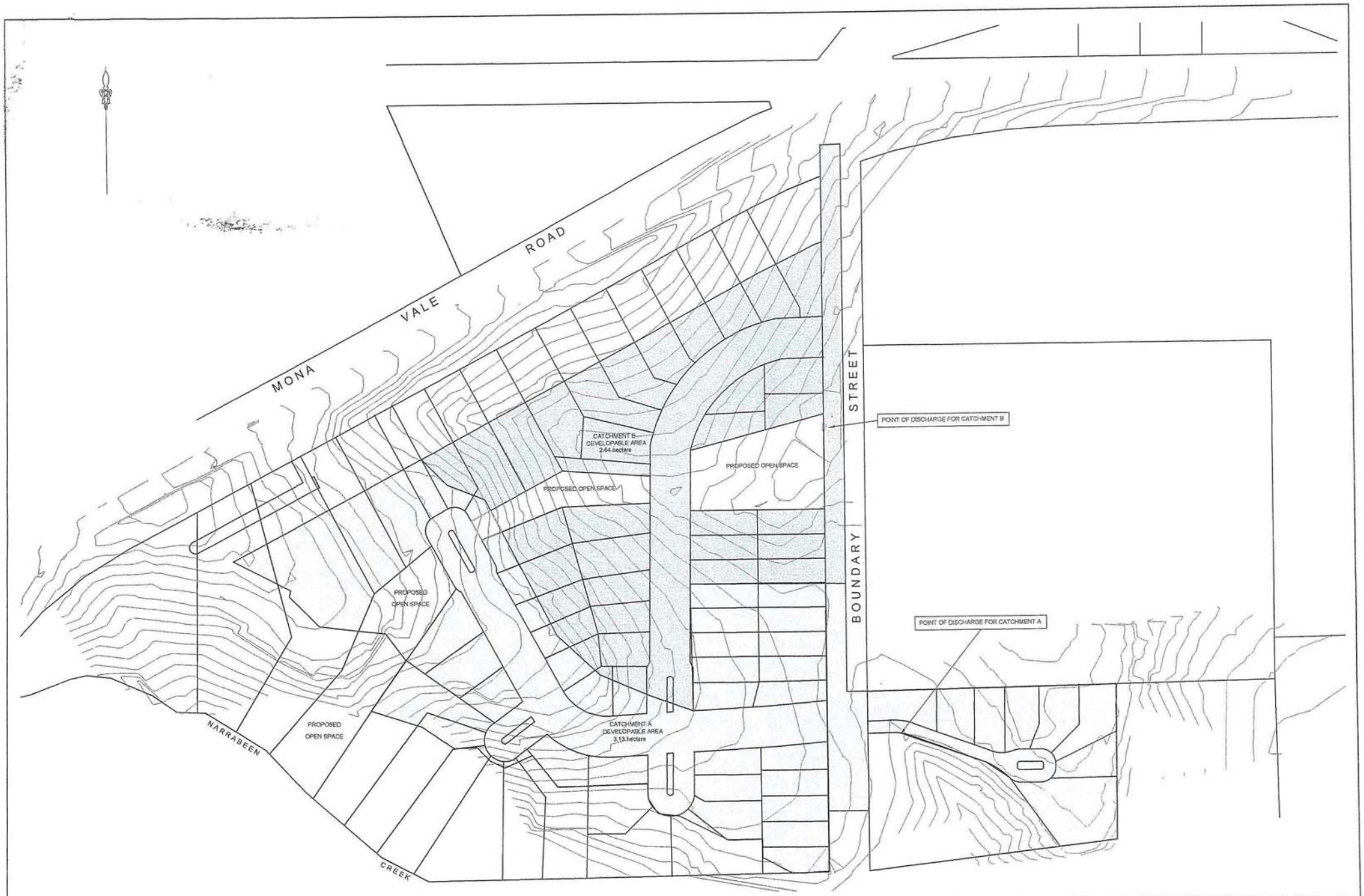
With regard to areas set aside for Water Quality these are shown on the plan titled "Plan showing proposed OSD and Water Quality Basins". It is proposed to utilise bio-swales as the primary method for achieving the acceptable quality of water leaving the site. A typical section showing how the bio-swales can be incorporated into the proposed road reserves is also shown on this plan. In accordance with the areas required for Water Quality there is a combined total area of 2,631 m^2 contained within the proposed bio-swales. In addition there is a further 204m^2 proposed in individual water quality basins on twelve of the larger lots. This will control the quality of the water which will flow directly into Narrabeen Creek.

The volume and area proposed to be set aside for OSD and Water Quality respectively is more than what would be required under the Pittwater 21 DCP. The DCP sets the OSD requirements for sites where there is an increase of over 1000 square metres of impervious area at 60 litres per square metre of additional impervious area. The impervious area currently on the site as a result of structures is 2,170 m^2. This does not include any driveways or tracks in use. As we are proposing 79 lots and if we assume an average impervious area of 280 m^2 per lot then the increase in total impervious area would be 1.995 ha plus approximately another 3500m^2 in roads requiring OSD of 1407 cubic metres. This proposal allows for a possible 2087 cubic metres which is 26.4 cubic metres per lot.

Naturally when a DA is approved and the civil design is prepared a full model and calculations will be undertaken for OSD requirements.

Stella Walter

Stella Walter
Registered Surveyor
Mepstead & Associates Pty Ltd



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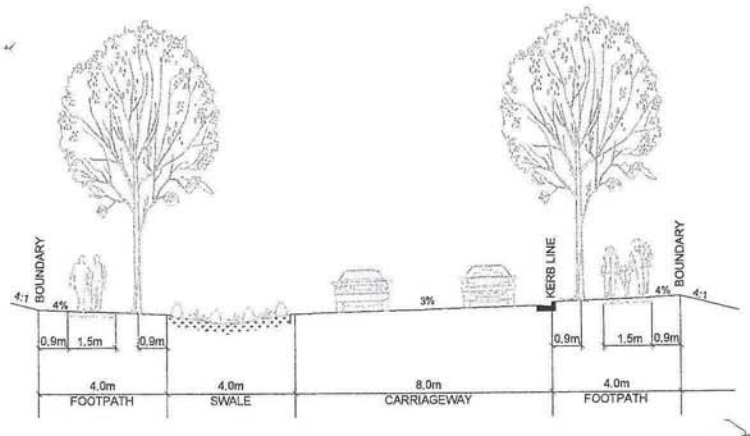
Designed: D.M.	Scale: 1:500	Principal: SAM MUSTACA	Org. No. 4034CATCHM'T
Drawn: S.W.	Datum: A.H.D.	Project: CATCHMENT AREAS FOR PROPOSED SUBDIVISION OF 120-122 MONA VALE ROAD WARRIEWOOD	Sheet No. 1 of 1 sheets
Checked: S.W.	Date: 6.03.12		Our Ref: 4034
L.G.A: PITTWATER	A1		



WATER QUALITY BASIN AREA REQUIRED: 2635m²

BIO SWALES ALONG INTERNAL ROADS AND MEDIANS: 1826m²
BIO SWALES IN BOUNDARY ROAD: 603m²
12 REAR LOTS EACH WITH 17m² : 204m²

ON SITE DETENTION VOLUME REQUIRED: 2087m³

79 LOTS EACH WITH A 5000 LITRE TANK: 395m³
EXISTING DAM: 218m³
NEW BASIN ABOVE PROPOSED ROAD: 190m³
NEW CONCRETE TANKS IN No. 8A BOUNDARY ROAD: 957m³
EXTENSION TO EXISTING DAM: 377m³

Scale 1:600 (A1) 0 16 32 48 64 80 metres
Scale 1:1600 (A3)

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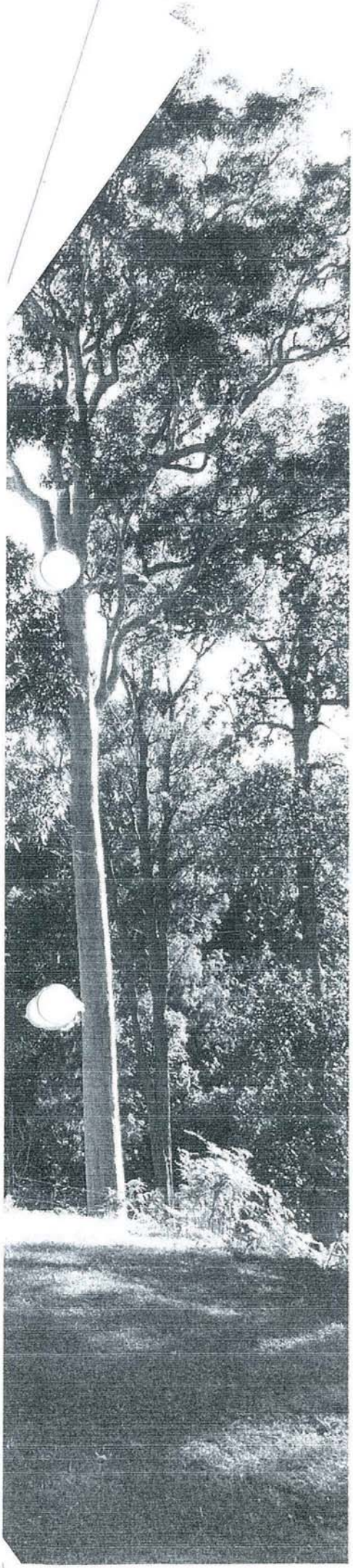
Designed: D.M.	Scale: 1:600	Principal: SAM MUSTACA	Drg. No. 4034-05B_E
Drawn: S.W.	Datum: A.H.D.	Project: PLAN SHOWING PROPOSED OSD AND WATER QUALITY BASINS FOR PROPOSED SUBDIVISION OF 120-122 MONA VALE ROAD, WARRIEWOOD	Sheet No. 1 of 1 sheets
Checked: S.W.	Date: 06.09.2012		Our Ref: 4034
L.G.A: PITTWATER	A1		



Ecological Site Analysis

120 & 122 Mona Vale Road, Warriewood

13th July 2011

prepared by

Mark Couston CPESC. - Ass. Dip. Env. Ctrl. (CSU), Grad. Dip. Env. Mgmt. (CSU),
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1. introduction

1.1 background

This report has been prepared to present the findings of detailed flora and fauna surveys and habitat assessments carried out over the site known as 120 & 122 Mona Vale Road, Warriewood. This report also incorporates species and ecological communities known to occur within the local area which have been identified through database and literature searches.

Specific assessment has been undertaken to identify potential habitats of threatened species, populations and ecological communities known to occur in the local area and listed in the schedules of the *Threatened Species Conservation Act (NSW) 1995.*

Subsequent site inspections and field work were conducted between the 3rd May & 10th June 2011. For the purposes of this report the allotments known as 120 & 122 Mona Vale Road, Warriewood will be referred to as the site.

1.2 existing site

The site is located on the southern side of Mona Vale Road and the topography ranges from moderately- steeply sloping to undulating slopes.

The site is currently used for rural activities and contains a number of greenhouses, detached sheds, open paddocks with remnant trees and indigenous vegetation along the steeper riparian areas of Narrabeen Creek.

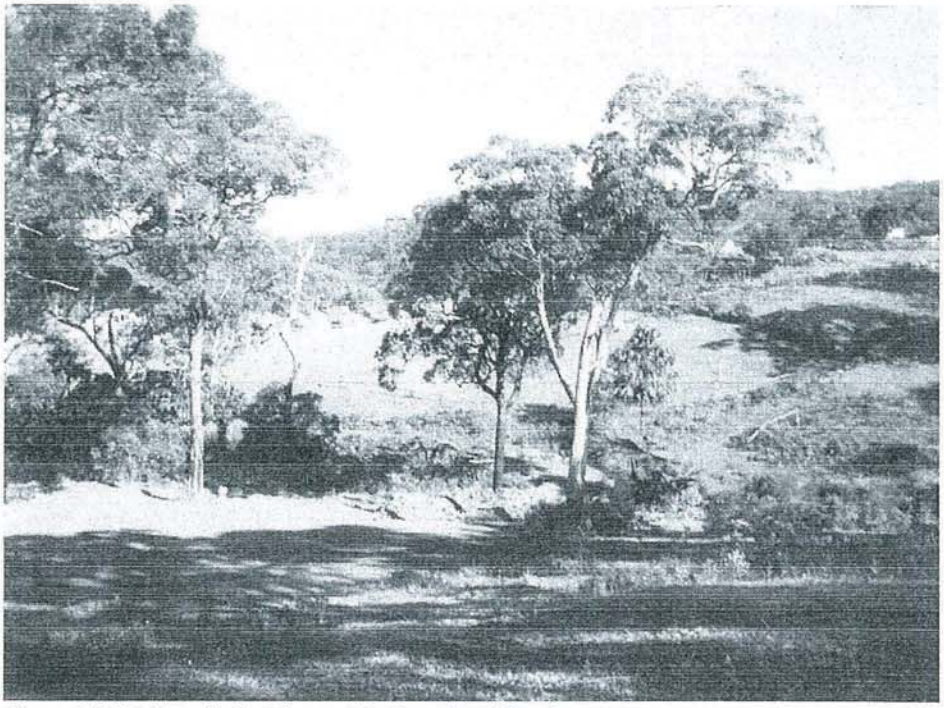

Figure 1.1 Existing site looking east to Boundary Street.

1.3 NSW Environmental planning & assessment

Whilst there are a several State Acts and planning instruments that relate to flora and fauna issues, those covered in this report include:

- relevant species, populations and communities listed in the schedules of the *Threatened Species Conservation Act 1995 (NSW);*
- S. 5A(2) (7-part test) Environmental Planning and Assessment Act 1979 (NSW);

Should this report conclude that the proposed development will have a significant impact on species, communities or populations listed in the schedules of *Threatened Species Conservation Act 1995 (NSW)* a more detailed Species Impact Statement will need to be prepared in accordance with the requirements of the *Threatened Species Conservation Act 1995 (NSW).*

1.4 Commonwealth context

This report identifies flora and fauna species or communities, relevant to the site, that are listed under Part 13 Division 1 of the *Environment Protection & Biodiversity Act 1999 (Cwlth)* (EPBC) as being of "matters of national environmental significance". Consideration must be given as to whether the proposed development will, or is likely to have a "significant impact" on "matters of national environmental significance".

A bilateral agreement was made in January 2007 between the Commonwealth & NSW Governments whereby the Commonwealth Government recognised the NSW assessment process in the *Environmental Planning and Assessment Act 1979 (NSW).*

In accordance with this agreement "controlled actions" as defined in the *Environment Protection & Biodiversity Act 1999 (Cwlth)* relating to threatened species, do not require assessment under Part 8 of the *Environment Protection & Biodiversity Act 1999 (Cwlth)* where they are assessed or approved under Part 3A, 4 or 5 of the *Environmental Planning and Assessment Act 1979 (NSW).*

2. the site

2.1 general information

The subject site consists of Lot 1 in DP 308009 and Lots 3, 4 & 5 in DP 12460 and is known as 120 & 122 Mona Vale Road, Warriewood and has a combined area of approximately 8.33 hectares. The site has the reference co-ordinates of AMG (56) 340700E and 6272300N and is currently zoned Non Urban 1(a).

Local aerial photo showing the site at 120 Mona Vale Road Warriewood
not to scale

2.2 geology

2.2.1 Site geology

Although no exploratory excavation was conducted, based upon site and local observations, rock outcrops and soil types, the geology associated with the site appears to be consistent with that described as Hawkesbury Sandstone (Herbert, 1983) with some influences of the underlying Narrabeen Geological Group.

2.2.2 Hawkesbury Sandstone

Hawkesbury Sandstone consists of sediments laid down during the mid Triassic Period, some 230 million years ago.

During the mid Triassic period a major shift in the watershed pattern occurred and the Sydney basin experienced the deposition of quartz sediments from the south west (Herbert, 1983). These quartz sediments were deposited by vigorous braided streams and they deposited a thick blanket of Hawkesbury Sandstone over the earlier Newport Formation sediments.

2.2.3 Narrabeen Geological Group

The Narrabeen Geological Group consists of sediments laid down during the early part of the Triassic Period, some 245 million years ago. It is made up of interbedded laminate and shale with quartz to lithic quartz sandstone. Clay pellet sandstone also occur south of the Hawkesbury River (Herbert, 1983)

2.3 soil landscape

2.3.1 Subject site

The landform consists of a central crest and simple slopes that give way to 2 open depressions, one being Narrabeen Creek on the south western boundary and another smaller drainage line towards the north eastern portion of the site.

The site has a predominately easterly aspect with slope / gradients generally ranging from between moderately inclined 10^0 (18%) to steep 28^0 (53%). Sandstone rock outcrops are also evident particularly in the steeper slopes on the southern side of the central crest.

The soils over the steeper south western portion of the site retain the natural soil profiles and although other parts of the site have been disturbed some characteristics of the natural soils remain. Where the natural soil profiles are evident, the soils appear to be influenced by Narrabeen Geological Group and range from brown to yellow podsolic soils and in other areas varying depths of siliceous sand.

Based upon this information and the geology it is considered that the site is consistent with that described as the Watagan Soil Landscape (Chapman & Murphy 1989).

2.3.2 Watagan Soil Landscape

The Watagan Soil Landscape is described as being rolling to very steep hills of fine grained sediments, having a local relief of 60m – 120m, slopes >25%, occasional sandstone boulder and benches. The soils are described as shallow to deep lithosols / siliceous sands and yellow podsolic soils on sandstone and brown, red and gleyed podsolic soils on shales (Chapman & Murphy 1989).

2.4 catchment

The site is divided into 2 catchments by a central ridge.

The southern portion of the site drains to Narrabeen Creek which forms part of the allotment boundary. Narrabeen Creek is an open channel meandering through residential and commercial land uses to join Mullet Creek and in turn Narrabeen Lakes and the Tasman Sea.

The northern portion of the site drains to an open channel and immediately down stream of the site overland flows in the channel are to be collected and piped as part of a recent development approval. This piped drainage system is likely to be connected to inter-allotment drainage lines which appear to discharge into Cahill Creek which inturn discharges into the Pittwater inlet.

2.5 vegetation & habitats

2.5.1 Vegetation & habitat units

The site has been considered in 3 main habitat units based upon similarities in the vegetation's physical structure, floristic composition, level of disturbance and the current land use.

- Area A - Open Forest,
- Area B – Disturbed Woodland & Scrubland areas
- Area C – Open Paddocks & Infrastructure areas.

Footprint Green Pty Ltd

Arboricultural, Environmental & Horticultural Consultants

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project: preliminary site planning - 120 mona vale road, warriewood

drawing title: site habitat units

3. flora & fauna survey

3.1 flora species survey methods

3.1.1 Flora literature search

Records of threatened flora species were obtained from the Office of Environment & Heritage's (OEH, 2010) Wildlife Atlas database searching a 10km grid square centred on the site (AMG(56) 340700 E and 6272300 N).

3.1.2 Flora field surveys

The flora survey covered an area of approximately 8 ha over the site using the Random Meander Method described by Cropper (1993) and focussed on the undisturbed and less modified parts of the site. The main flora field survey was conducted on the 20/05/10 and the 10/06/11. Where there was some taxonomic species uncertainty, samples were taken for verification using recognised floristic keys.

Specific effort was undertaken to identify optimal and sub-optimal habitats of threatened species and communities and in these areas detailed searches were undertaken.

Species identifications are consistent with the nomenclature in Harden (1992, 1993, 2000 & 2002) with recent name changes as amended in the Royal Botanic Gardens Sydney publication *Cunninghamia*.

3.2 fauna species survey methods

3.2.1 Fauna literature search

Records of threatened fauna species and populations were obtained from Office of Environment & Heritage's (OEH, 2010) Wildlife Atlas database searching a 10km grid square centred on the site (AMG(56) 340700 E and 6272300 N).

3.2.2 Fauna field surveys

3.2.2.1 Habitat assessment

Because of the cryptic nature of many fauna species and seasonal limitations of short term surveys, a habitat assessment was conducted to identify potential habitats where threatened and other fauna species could reside or forage as well as noting key habitat features.

3.2.2.2 Herpetofauna diurnal observations

A 60 minute herpetofauna survey was conducted during daylight hours in conjunction with the flora survey on the 20/05/11. This was an active survey involving identifying differing microhabitats such as leaf litter, logs, dense ground cover vegetation and rubble and each microhabitat was searched by hand. This survey focussed on the rear portion of the site and the sandstone rock outcrops.

3.2.2.3 Nocturnal fauna sightings

Spotlighting was conducted to identify frogs, bats, mammals and nocturnal birds and reptiles and specifically targeted small ground mammals, possums, gliders, and owls. Two (2) 60-minute surveys were undertaken on the site using a 100-watt hand held spotlights. This survey was conducted on dusk extending for 60 minutes into the early evening on the 27/05/11 & 02/06/11.

3.2.2.4 Diurnal bird observations and call recognition

Four (4), 60 minute surveys were undertaken, of which 2 were conducted in the afternoon of 27/05/11 and 02/06/11 and 2 was conducted in the mornings on 28/05/11 and 03/06/11.

3.2.2.5 Ultrasonic bat detection

Ultrasonic bat detection was undertaken over 2 nights commencing on the evening of the 27/05/11 and again on the 02/06/11. Recording equipment was activated before dusk, running throughout the night until the following morning. Bat ultrasonic recordings were taken using an Anabat II detector with a digital ZCAIM storage unit and recordings were identified by Ray Williams from Ecotone Environmental Consultants.

3.2.2.6 Call playback

No nocturnal call play back of Owls was conducted as it disrupts the activities of nocturnal mammals.

Call playback for Red-crowned Toadlet (*Pseudophryne australis*) and Giant Burrowing Frog (*Heleioporus australiacus*) was conducted on the evening of the 27/05/11 & 02/06/11 as part of the spotlight survey focussing on the drainage line and peripheral areas and again during the day on the 20/05/11. Call play back involved broadcasting separate calls for a 5 minute period and listening for 3 minutes for a response.

3.2.2.7 Hair tube traps

Ten (10) hair tube traps were deployed to identify mammals such as rodents, gliders, bandicoots and possums. Of the 15 hair tubes, 10 were larger tubes with 90mm diameter and 5 were smaller tubes with a 50mm diameter. Ten (10) hair tubes were placed on the ground, (9 large & 1 small) and 5 (1 large & 4 small) hair tubes were located in trees/shrubs at 1.5m -2m above ground level. Hair tubes were baited with a mixture consisting of peanut butter, rolled oats, honey, canola oil, almond essence, aniseed essence and left for 6 nights between the 03/06/11 and 10/06/11. Hair samples collected were identified by Barbara Triggs of dead Finish using the method outlined by Brunner & Coleman (1974).

3.2.2.8 Opportunistic sighting, calls, scats and scratchings

During the course of individual surveys opportunistic observations, calls, scats, tracks and scratchings were also recorded both within the study area and locally off site.

3.3 survey findings

3.3.1 Flora species data

The following table identifies flora species:

- listed in the schedules of the *Environment Protection & Biodiversity Conservation Act 1999 (Cwth)* and recorded within a 10km grid square centred on the site in the Wildlife Atlas (OEH, 2010);
- listed in the schedules of the *Threatened Species Conservation Act 1995 (NSW)* and recorded within a 10km grid square centred on the site in the Wildlife Atlas (OEH 2010);
- listed in Schedule 13 of the *National Parks & Wildlife Act 1974 (NSW)* and recorded on site; and
- recorded on the site as part of field surveys.

OEH Wildlife Atlas	Recorded On Site – Area A	Recorded On Site – Area B	Recorded On Site – Area C	Genus species	Common Name	Autochthony	Conservation Status
✔ - Recorded, 🌲 - Planted Native Species. **Unprotected / Protected** - Schedule 13 National Parks & Wildlife Act 1974 (NSW), Vulnerable **NSW / Endangered NSW / Critically Endangered NSW** - NSW Threatened Species Conservation Act 1995 (NSW), **Noxious** - Noxious Weeds Act 1993 (NSW), **Critically Endangered Cwth / Endangered Cwth** / Vulnerable **Cwth** - Environment Protection & Biodiversity Conservation Act 1999 (Cwth).							
	✔			*Acacia decurrens*	Black Wattle	Indigenous	Unprotected
		✔		*Acacia longifolia*	Sydney Golden Wattle	Indigenous	Unprotected
	✔	✔		*Acacia longissima*	Narrow-leaved Wattle	Indigenous	Unprotected
	✔			*Acacia terminalis subsp. augustifolia*	Sunshine Wattle	Indigenous	Unprotected
	✔			*Acacia ulicifolia*	Prickly Moses Wattle	Indigenous	Unprotected
		✔	✔	*Acetosa sagittata*	Potato Vine/	Exotic	Noxious
		✔		*Acmena smithii*	Lilly Pilly	Indigenous	Unprotected
	✔	✔		*Adiantum aethiopicum*	Common Maidenhair Fern	Indigenous	Protected
	✔			*Adiantum formosum*	Giant Maidenhair Fern	Indigenous	Protected
	✔	✔	✔	*Ageratina adenophora*	Crofton Weed	Exotic	Unprotected
	✔			*Ageratina riparia*	Mist Flower	Exotic	Unprotected
	✔	✔		*Allocasuarina torulosa*	Forest Oak	Indigenous	Unprotected
	✔	✔	✔	*Andropogon virginicus*	Whisky Grass	Exotic	Unprotected
	✔	✔		*Angophora costata*	Sydney Red/Rusty Gum	Indigenous	Unprotected
	✔			*Araujia sericiflora*	Moth Vine	Exotic	Noxious
		✔		*Arbutus unedo*	Irish Strawberry Tree	Exotic	Unprotected

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		✔		*Asparagus aethiopicus*	Asparagus Fern	Exotic	Noxious
	✔			*Astrotricha floccosa*	Star-hairs	Indigenous	Unprotected
	✔			*Backhousia myrtifolia*	Ironwood/Grey Myrtle Tree	Indigenous	Unprotected
		✔		*Banksia integrifolia*	Coastal Banksia	Indigenous	Unprotected
	✔			*Banksia serrata*	Old Man Banksia	Indigenous	Unprotected
		✔		*Banksia spinulosa*	Hairpin Banksia	Indigenous	Unprotected
	✔		✔	*Bidens pilosa*	Cobbler's Peg	Exotic	Unprotected
		✔		*Billardiera scandens*	Appleberry	Indigenous	Unprotected
		✔		*Blechnum cartilagineum*	Gristle Fern	Indigenous	Unprotected
	✔			*Boronia ledifolia*	Ledum/Sydney Boronia	Indigenous	Protected
	✔			*Boronia pinnata*	Pinnate Boronia	Indigenous	Protected
	✔	✔		*Breynia oblongifolia*	Coffee Bush Shrub	Indigenous	Unprotected
	✔			*Bursaria spinosa*	Native Blackthorn	Indigenous	Unprotected
	✔			*Callicoma serratifolia*	Black Wattle	Indigenous	Unprotected
✔				*Callistemon linearifolius*	Netted Bottle Brush	Indigenous	Vulnerable NSW
	✔			*Callistemon rigidus*	Stiff Bottlebrush	Indigenous	Unprotected
	✔	✔	✔	*Calochlaena dubia*	Common Ground Fern	Indigenous	Protected
	✔			*Cassytha sp.*	Devil's Twine	Indigenous	Unprotected
	✔			*Cayratia clematidea*	Slender Grape	Indigenous	Unprotected
		✔	✔	*Centella asiatica*	Swamp Pennywort	Indigenous	Unprotected
	✔			*Ceratopetalum apetalum*	Coachwood Tree	Indigenous	Unprotected
	✔			*Cestrum parqui*	Green Cestrum	Exotic	Noxious
			✔	*Chlorophytum comosum*	Ribbon / Spider Plant	Exotic	Unprotected
		✔		*Cinnamomum camphora*	Camphor Laurel	Exotic	Noxious
	✔	✔		*Cissus hypoglauca*	Giant Water Vine	Indigenous	Unprotected
		✔		*Clerodendrum tomentosum*	Hairy Clerodendrum	Indigenous	Unprotected
		✔		*Commelina cyanea*	Scurvy Weed	Indigenous	Unprotected

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	✔		✔	*Conyza bonariensis*	Flaxleaf Fleabane	Exotic	Unprotected
	✔			*Correa reflexa*	Native Fuchsia	Indigenous	Unprotected
	✔	✔		*Crowea exalata*	-	Indigenous	Protected
	✔	✔		*Cyathea australis*	Rough Treefern	Indigenous	Protected
	✔	✔		*Cyathea cooperi*	Straw Treefern	Native	Protected
			✔	*Cynodon dactylon*	Common Couch Grass	Exotic	Unprotected
	✔			*Dampiera purpurea*	-	Indigenous	Unprotected
✔				*Darwinia biflora*	-	Indigenous	Vulnerable NSW
	✔	✔		*Dianella caerulea*	Blue Flax Lily	Indigenous	Unprotected
			✔	*Dietes bicolor*	Dietes	Exotic	Unprotected
	✔	✔		*Dodonaea triquetra*	Hop Bush	Indigenous	Unprotected
			✔	*Ehrharta erecta*	Panic Veldtgrass	Exotic	Unprotected
	✔	✔		*Elaeocarpus reticulatus*	Blueberry Ash	Indigenous	Unprotected
		✔	✔	*Entolasia marginata*	Bordered Panic	Indigenous	Unprotected
	✔	✔	✔	*Entolasia stricta*	Wiry Panic	Indigenous	Unprotected
✔				*Epacris purpurascens var. purpurascens*	-	Indigenous	Vulnerable NSW
		✔	✔	*Eragrostis curvula*	African Love Grass	Exotic	Unprotected
	✔	✔		*Eucalyptus botryoides*	Bangalay	Indigenous	Unprotected
✔				*Eucalyptus camfieldii*	Heart-Leaved Stringybark	Indigenous	Vulnerable NSW, Cwth
✔🌲				*Eucalyptus nicholii*	Narrow-Leaf Peppermint	Native	Vulnerable NSW
		✔		*Eucalyptus paniculata*	Grey Ironbark	Indigenous	Unprotected
	✔			*Eucalyptus piperita*	Sydney Peppermint	Indigenous	Unprotected
	✔			*Eucalyptus punctata*	Grey Gum	Indigenous	Unprotected
✔🌲				*Eucalyptus scoparia*	Wallangarra White Gum	Native	Endangered NSW, Vulnerable Cwth
	✔	✔		*Eucalyptus umbra*	Broad-leaved White Mahogany	Indigenous	Unprotected
	✔	✔		*Eustrephus latifolius*	Wombat Berry	Indigenous	Unprotected
	✔			*Exocarpos cupressiformis*	Cherry Ballart / Native Cherry	Indigenous	Unprotected

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	✔	✔		*Gahnia sieberiana*	Sawsedge	Indigenous	Protected
	✔	✔		*Geitonoplesium cymosum*	Scrambling Lilly	Indigenous	Unprotected
		✔		*Genista monspessulana*	Montpellier Broom	Exotic	Noxious
		✔		*Gleichenia dicarpa*	Coral Fern	Indigenous	Unprotected
		✔		*Glochidion ferdinandi*	Cheese Tree	Indigenous	Unprotected
		✔		*Glycine clandestina*	Twining Glycine	Indigenous	Unprotected
	✔		✔	*Gonocarpus teucrioides*	Raspwort	Indigenous	Unprotected
✔				*Grammitis stenophylla*	Narrow-leaf Finger Fern	Indigenous	Endangered NSW
✔				*Grevillea caleyi*	Caley's Grevillea	Indigenous	Endangered NSW, Cwlth
	✔			*Grevillea sericea*	Pink Spider Flower	Indigenous	Unprotected
	✔			*Gymnostachys anceps*	Settler's Flax	Indigenous	Unprotected
	✔			*Hakea dactyloides*	Broad-leaved Hakea	Indigenous	Unprotected
	✔			*Hedychium gardnerianum*	Ginger Lily	Exotic	Unprotected
	✔	✔		*Hibbertia dentata*	Twining Guinea Flower	Indigenous	Unprotected
		✔		*Histiopteris incisa*	Bat's-wing Fern	Indigenous	Unprotected
	✔	✔		*Homalanthus populifolius*	Bleeding Heart / Native Poplar	Indigenous	Unprotected
		✔	✔	*Hydrocotyle bonariensis*	Pennywort	Exotic	Unprotected
		✔		*Hypolepis muelleri*	Harsh Ground Fern	Indigenous	Unprotected
		✔	✔	*Imperata cylindrica*	Blady Grass	Indigenous	Unprotected
		✔		*Ipomoea cairica*	Coastal Morning Glory	Exotic	Unprotected
		✔		*Ipomoea indica*	Blue Morning Glory	Exotic	Noxious
	✔			*Kennedia rubicunda*	Red Kennedy Pea	Indigenous	Unprotected
	✔	✔	✔	*Kunzea ambigua*	Tick Bush	Indigenous	Unprotected
		✔		*Lambertia formosa*	Mountain Devil	Indigenous	Unprotected
	✔	✔	✔	*Lantana camara*	Lantana	Exotic	Noxious
	✔	✔		*Lepidosperma filiforme*	-	Indigenous	Unprotected
	✔			*Lepidosperma laterale*	Variable Sword-sedge	Indigenous	Unprotected

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✔				*Leptospermum deanei*	-	Indigenous	Vulnerable NSW, Cwth
	✔			*Leptospermum trinervium*	Paperbark Tea-tree	Indigenous	Unprotected
	✔	✔	✔	*Livistona australis*	Cabbage Palm / Fan Palm	Indigenous	Protected
	✔			*Lomandra filiformis*	Wattle Mat-rush	Indigenous	Unprotected
	✔	✔		*Lomandra longifolia*	Spiny-headed Mat-rush	Indigenous	Unprotected
	✔			*Lomatia silaifolia*	Crinkle Bush	Indigenous	Protected
	✔			*Marsdenia rostrata*	Common Milk Vine	Indigenous	Unprotected
	✔	✔		*Marsdenia suaveolens*	Scented Marsdenia	Indigenous	Unprotected
		✔		*Maytenus silvestris*	Narrow-leaved Orangebark	Indigenous	Unprotected
		✔	✔	*Micrantheum ericoides*	-	Indigenous	Unprotected
	✔	✔		*Microlaena stipoides*	Weeping Grass	Indigenous	Unprotected
✔				*Microtis angusii*	Angus's Onion Orchid	Indigenous	Endangered NSW, Cwlth
	✔			*Morinda jasminoides*	Morinda	Indigenous	Unprotected
			✔	*Musa acuminata*	Edible banana	Exotic	Unprotected
	✔	✔		*Nephrolepis cordifolia*	Fishbone Fern	Native	Unprotected
	✔	✔		*Notelaea longifolia*	Large Mock-olive	Indigenous	Unprotected
		✔		*Olea europaea subsp. cuspidata*	African Olive	Exotic	Noxious
			✔	*Oplismenus imbecillis*	Basket Grass	Indigenous	Unprotected
			✔	*Oxalis sp.*	Oxalis	Exotic	Unprotected
		✔		*Ozothamnus diosmifolius*	White Dogwood	Indigenous	Unprotected
		✔		*Pandorea pandorana*	Wonga Wonga Vine	Indigenous	Unprotected
	✔			*Parsonsia straminea*	Common Silkpod	Indigenous	Unprotected
			✔	*Paspalum dilatatum*	Paspalum	Exotic	Unprotected
	✔			*Paspalum urvillei*	Vasey Grass	Exotic	Unprotected
	✔			*Passiflora edulis*	Common Passionfruit	Exotic	Unprotected
		✔	✔	*Pennisetum clandestinum*	Kikuyu Grass	Exotic	Unprotected
	✔	✔		*Phebalium dentatum*	Toothed Phebalium	Indigenous	Unprotected

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✔				*Pimelea curviflora var. curviflora*	Curved Rice-flower	Indigenous	Vulnerable NSW
	✔	✔	✔	*Pimelea linifolia*	Slender Rice-flower	Indigenous	Unprotected
	✔	✔		*Pittosporum revolutum*	Yellow / Rough Fruit Pittosporum	Indigenous	Unprotected
	✔			*Pittosporum undulatum*	Native Daphne	Indigenous	Unprotected
		✔	✔	*Plantago lanceolata*	Lambs Tongue	Exotic	Unprotected
		✔		*Plectranthus parviflorus*	Cockspur	Indigenous	Unprotected
	✔	✔		*Podolobium ilicifolium*	Prickly Shaggy Pea	Indigenous	Unprotected
		✔		*Polyscias sambucifolia*	Elderberry Panax	Indigenous	Unprotected
		✔		*Pomaderris ferruginea*	Rusty Pomaderris	Indigenous	Unprotected
	✔			*Pomax umbellata*	Pomax	Indigenous	Unprotected
			✔	*Populus sp.*	Poplar	Exotic	Unprotected
	✔	✔		*Pratia purpurascens*	Whiteroot	Indigenous	Unprotected
	✔			*Prostanthera denticulata*	Rough Mint-bush	Indigenous	Unprotected
		✔		*Pseuderanthemum variabile*	Pastel Flower	Indigenous	Unprotected
	✔	✔	✔	*Pteridium esculentum*	Bracken Common	Indigenous	Unprotected
	✔			*Pultenaea dentata*	Clustered Bush-pea	Indigenous	Unprotected
	✔	✔		*Pultenaea flexilis*	Graceful Bush-pea	Indigenous	Unprotected
	✔	✔		*Rapanea variabilis*	Muttonwood	Indigenous	Unprotected
		✔	✔	*Rubus fruticosus*	Blackberry	Exotic	Unprotected
			✔	*Rumex brownii*	Swamp Dock	Indigenous	Unprotected
	✔	✔	✔	*Sarcopetalum harveyanum*	Pearl Vine	Indigenous	Unprotected
		✔	✔	*Senecio madagascariensis*	Fireweed	Exotic	Unprotected
		✔		*Senna pendula*	Cassia	Exotic	Unprotected
		✔	✔	*Sida rhombifolia*	Paddy's Lucerne	Exotic	Unprotected
	✔	✔		*Smilax australis*	Sarsaparilla	Indigenous	Unprotected
	✔	✔		*Smilax glyciphylla*	Sweet Sarsaparilla	Indigenous	Unprotected
		✔		*Solanum mauritianum*	Wild Tobacco Tree	Exotic	Unprotected

OEH Wildlife Atlas	Recorded On Site – Area A	Recorded On Site – Area B	Recorded On Site – Area C	Genus species	Common Name	Autochthony	Conservation Status
✔- Recorded, - Planted Native Species. **Unprotected / Protected** - Schedule 13 National Parks & Wildlife Act 1974 (NSW), Vulnerable **NSW / Endangered NSW / Critically Endangered NSW** - NSW Threatened Species Conservation Act 1995 (NSW), **Noxious** - Noxious Weeds Act 1993 (NSW), **Critically Endangered Cwth / Endangered Cwth** / Vulnerable **Cwth** - Environment Protection & Biodiversity Conservation Act 1999 (Cwth).							
			✔	*Solanum nigrum*	Blackberry Nightshade	Exotic	Unprotected
			✔	*Sporobolus indicus*	Parramatta Grass	Exotic	Unprotected
			✔	*Stellaria media*	Chickweed	Exotic	Unprotected
	✔	✔		*Stephania japonica*	Snake Vine	Indigenous	Unprotected
	✔			*Styphelia tubiflora*	Red Five-Corner	Indigenous	Unprotected
	✔	✔		*Syncarpia glomulifera*	Turpentine	Indigenous	Unprotected
	✔	✔		*Synoum glandulosum*	Scentless Rosewood	Indigenous	Unprotected
✔	✔			*Syzygium paniculatum*	Magenta Lillypilly	Indigenous	Vulnerable NSW
			✔	*Taraxacum officinale*	Dandelion	Exotic	Unprotected
✔				*Tetratheca glandulosa*	Glandular Pink-bell	Indigenous	Vulnerable NSW
	✔		✔	*Tradescantia fluminernsis*	Wandering Jew	Exotic	Noxious
	✔			*Trochocarpa laurina*	Tree Heath	Indigenous	Unprotected
			✔	*Verbena bonariensis*	Purple Top	Exotic	Unprotected
		✔	✔	*Veronica plebeia*	Trailing Speedwell	Indigenous	Unprotected
		✔		*Watsonia meriana cv. Bulbillifera*	Wild Watsonia	Exotic	Unprotected
	✔			*Watsonia sp.*	Watsonia	Exotic	Unprotected
	✔			*Wilkiea huegeliana*	Veiny Wilkiea	Indigenous	Unprotected
	✔			*Xanthorrhoea spp.*	Grass Tree	Indigenous	Protected
	✔			*Xanthosia pilosa*	Woolly Xanthosia	Indigenous	Unprotected
	✔	✔		*Zieria laevigata*	Smooth Zieria	Indigenous	Unprotected

3.3.2 Fauna species data

The following table identifies flora species:

- listed in the schedules of the *Environment Protection & Biodiversity Conservation Act 1999 (Cwth)* and recorded within a 10km grid square centred on the site in the Wildlife Atlas (OEH, 2010), and
- listed in the schedules of the *Threatened Species Conservation Act 1995 (NSW)* and recorded within a 10km grid square centred on the site in the Wildlife Atlas (OEH 2010), and
- recorded on the site as part of field surveys.

Wildlife Atlas DECC (2010	Recorded on Site	Class	Genus species	Common Name	Autochthony	Conservation Status
✔ - Recorded / Identified, ✔ ☆Record Highly Probable, ✔ ? Record Probable, ✔ ·:· Record Possible. **Unprotected / Protected** - National Parks & Wildlife Act 1974 (NSW), **Vulnerable NSW / Endangered NSW** - NSW Threatened Species Conservation Act 1995 (NSW), **Critically Endangered Cwlth / Endangered Cwlth / Vulnerable Cwlth** - Environment Protection & Biodiversity Conservation Act 1999 (Cwlth)						
	✔	Amphibia	*Crinia signifera*	Common Eastern Froglet	Native	Protected
✔		Amphibia	*Heleioporus australiacus*	Giant Burrowing Frog	Native	Vulnerable NSW, Cwth
✔		Amphibia	*Pseudophryne australis*	Red-crowned Toadlet	Native	Vulnerable NSW
	✔	Arachnida	*Isopedella sp.*	Common Huntsman	Native	Unprotected
	✔	Arachnida	*Ixodes holocyclus*	Paralysis Tick	Native	Unprotected
	✔	Arachnida	*Phonognatha graeffei*	Leaf-curling Spider	Native	Unprotected
	✔	Aves	*Anthochaera carunculata*	Red Wattlebird	Native	Protected
	✔	Aves	*Cacatua galerita*	Sulphur-crested Cockatoo	Native	Protected
✔		Aves	*Callocephalon fimbriatum*	Gang-gang Cockatoo	Native	Vulnerable NSW
✔		Aves	*Calyptorhynchus lathami*	Glossy Black-Cockatoo	Native	Vulnerable NSW
	✔	Aves	*Corvus coronoides*	Australian Raven	Native	Protected
	✔	Aves	*Cracticus torquatus*	Grey Butcherbird	Native	Protected
	✔	Aves	*Dacelo novaeguineae*	Laughing Kookaburra	Native	Protected
	✔	Aves	*Eolophus roseicapillus*	Galah	Native	Protected
	✔	Aves	*Eurystomus orientalis*	Dollarbird	Native	Protected
	✔	Aves	*Gallus gallus domesticus*	Domestic Chicken	Introduced	Unprotected
	✔	Aves	*Gymnorhina tibicen*	Australian Magpie	Native	Protected
	✔	Aves	*Hirundo neoxena*	Welcome Swallow	Native	Protected
✔		Aves	*Ixobrychus flavicollis*	Black Bittern	Native	Vulnerable NSW

Wildlife Atlas DECC (2010	Recorded on Site	Class	Genus species	Common Name	Autochthony	Conservation Status
✔ - Recorded / Identified, ✔ ☆ Record Highly Probable, ✔ ? Record Probable, ✔ ∴ Record Possible. **Unprotected / Protected** - National Parks & Wildlife Act 1974 (NSW), **Vulnerable NSW / Endangered NSW** - NSW Threatened Species Conservation Act 1995 (NSW), **Critically Endangered Cwlth / Endangered Cwlth / Vulnerable Cwlth** - Environment Protection & Biodiversity Conservation Act 1999 (Cwlth)						
✔		Aves	*Lathamus discolor*	Swift Parrot	Native	Endangered NSW, Cwlth
	✔	Aves	*Malurus cyaneus*	Superb Fairy-wren	Native	Protected
	✔	Aves	*Manorina melanocephala*	Noisy Miner	Native	Protected
✔		Aves	*Melithreptus gularis*	Black-chinned Honeyeater	Native	Vulnerable NSW
✔		Aves	*Ninox connivens*	Barking Owl	Native	Vulnerable NSW
✔		Aves	*Ninox strenua*	Powerful Owl	Native	Vulnerable NSW
	✔	Aves	*Oriolus sagittatus*	Olive-backed Oriole	Native	Protected
	✔	Aves	*Pardalotus punctatus*	Spotted Pardalote	Native	Protected
	✔	Aves	*Phylidonyris nigra*	White-cheeked Honeyeater	Native	Protected
	✔	Aves	*Psophodes olivaceus*	Eastern Whipbird	Native	Protected
	✔	Aves	*Rhipidura leucophrys*	Willie Wagtail	Native	Protected
	✔	Aves	*Trichoglossus haematodus*	Rainbow Lorikeet	Native	Protected
✔		Aves	*Tyto novaehollandiae*	Masked Owl	Native	Vulnerable NSW
	✔	Aves	*Vanellus miles*	Masked Lapwing	Native	Protected
	✔	Aves	*Zosterops lateralis*	Silverye	Native	Protected
	✔	Insecta	*Apis mellifera*	European Honey Bee	Introduced	Unprotected
	✔	Insecta	*Myrmecia brevinoda*	Giant Bullant (red/orange)	Native	Unprotected
	✔	Insecta	*Nasutitermes walkeri*	Niggerhead Termite	Native	Unprotected
	✔	Mammalia	*Bos sp.*	Cattle	Introduced	Unprotected
	✔	Mammalia	*Canis lupus familiaris*	Domestic Dog	Introduced	Unprotected
✔		Mammalia	*Cercartetus nanus*	Eastern Pigmy-possum	Native	Vulnerable NSW
	✔ ∴	Mammalia	*Chalinolobus morio*	Chocolate Wattled Bat	Native	Protected
✔		Mammalia	*Dasyurus maculatus*	Spotted-tailed Quoll	Native	Vulnerable NSW, Endangered Cwth
	✔	Mammalia	*Felis catus*	Cat	Introduced	Unprotected
✔		Mammalia	*Isoodon obesulus obesulus*	Southern Brown Bandicoot	Native	Endangered NSW, Cwlth
✔	✔	Mammalia	*Miniopterus schreibersii oceanensis*	Eastern Bent-wing Bat	Native	Vulnerable NSW, Cwth
	✔	Mammalia	*Oryctolagus cuniculus*	Rabbit	Introduced	Unprotected

Wildlife Atlas DECC (2010	Recorded on Site	Class	Genus species	Common Name	Autochthony	Conservation Status
✔ - Recorded / Identified, ✔ ☆ Record Highly Probable, ✔ ? Record Probable, ✔ ·.·. Record Possible. **Unprotected / Protected** - National Parks & Wildlife Act 1974 (NSW), **Vulnerable NSW / Endangered NSW** - NSW Threatened Species Conservation Act 1995 (NSW), **Critically Endangered Cwlth / Endangered Cwlth / Vulnerable Cwlth** - Environment Protection & Biodiversity Conservation Act 1999 (Cwlth)						
	✔	Mammalia	*Ovis aries*	Sheep (domestic)	Introduced	Unprotected
	✔	Mammalia	*Perameles nasuta*	Long-nosed Bandicoot	Native	Protected
✔		Mammalia	*Phascolarctos cinereus*	Koala	Native	Vulnerable NSW
✔		Mammalia	*Pteropus poliocephalus*	Grey-headed Flying-fox	Native	Vulnerable NSW, Cwth
	✔☆	Mammalia	*Trichosurus vulpecula*	Common Brushtail Possum	Native	Protected
	✔?	Mammalia	*Vespadelus vulturnus*	Little Forest Bat	Native	Protected
	✔	Mammalia	*Wallabia bicolor*	Swamp Wallaby	Native	Protected
	✔	Reptilia	*Hemiaspis signata*	Black-bellied Swamp Snake	Native	Protected
	✔	Reptilia	*Lampropholis delicata*	Delicate Skink	Native	Protected
	✔	Reptilia	*Morelia spilota spilota*	Diamond Python	Introduced	Protected
	✔	Reptilia	*Phyllurus platurus*	Broad-tailed Gecko	Native	Protected
	✔	Reptilia	*Physignathus lesueurii*	Eastern Water Dragon	Native	Protected
	✔	Reptilia	*Pseudonaja textilis*	Eastern Brown Snake	Native	Protected
	✔	Reptilia	*Tiliqua scincoides*	Common / Eastern Blue-tongue	Native	Protected
✔		Reptilia	*Varanus rosenbergi*	Rosenberg's Goanna /Heath Monitor	Native	Vulnerable NSW

3.3.3 Ecological Communities

Based upon the community descriptions identified by the NSW Scientific Committee and supplemented by those identified by Benson & Howell (1994), the following table identifies vegetation communities:

- listed in the schedules of the *Threatened Species Conservation Act 1995 (NSW)* as endangered ecological communities and are known to occur in the Pittwater Local Government Area,
- recorded on the site from field surveys and where possible the description is consistent with those described by Benson & Howell (1994).

DECC	Recorded On Site	Community name	Brief Description	Conservation Status
Vulnerable NSW / Endangered NSW - Threatened Species Conservation Act 1995 (NSW), **Critically Endangered Cwlth / Endangered Cwlth / Vulnerable Cwlth** - Environment Protection & Biodiversity Conservation Act 1999 (Cwlth)				
✔		Pittwater Spotted Gum Forest	The forest occurs on shale-derived soils from the Newport Formation geology of the Narrabeen group in Pittwater. Characteristic species include *Corymbia maculata, Eucalyptus punctata, Eucalyptus umbra, Angophora floribunda and Corymbia gummifera.* (NSW Scientific Committee 1998),	Endangered
✔		Duffy's Forest	The forest occurs on lateritic soils and deeply weathered shale soils typically found on lower ridges in Ku-ring-gai. Characteristic tree species include *Eucalyptus capitellata, Eucalyptus sieberi, Eucalyptus oblonga, and Angophora costata.* (NSW Scientific Committee 1998),	Endangered
✔		Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions	The ecological community associated with humic clay loams and sandy loams, on waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains. Swamp Sclerophyll Forest on Coastal Floodplains generally occurs below 20 m (though sometimes up to 50 m) elevation. The structure of the community is typically open forest and the dominant trees include *Eucalyptus robusta* (Swamp Mahogany), *Melaleuca quinquenervia* (Paperbark) and, south from Sydney, *Eucalyptus botryoides* (Bangalay) and *Eucalyptus longifolia* (Woollybutt) (NSW Scientific Committee 2005).	Endangered
✔		Littoral rainforest in the NSW North Coast, Sydney Basin and South East Corner bioregions	The Forest Littoral Rainforest generally is a closed forest, the structure and composition of which is strongly influenced by proximity to the ocean. The plant species in this ecological community are predominantly rainforest species with evergreen mesic or coriaceous leaves. Several species have compound leaves, and vines may be a major component of the canopy. The community comprises the *Cupaniopsis anacardioides - Acmena* spp. alliance of Floyd (1990) which includes five sub-alliances which include *Syzygium leuhmannii, Acmena smithii, Ficus sp, Livistona sp, & Podocarpus sp.* (NSW Scientific Committee 2004).	Endangered
	✔	Sydney Sandstone Gully Forest	The Sydney Sandstone Gully Forest is comprised of 3 recognised sub-units including; - Open forest / woodland dominated by *Eucalyptus piperita* (Sydney Peppermint), *Angophora costata* (Sydney Red Gum) and *Eucalyptus pilularis* (Blackbutt) - Tall open forest dominated by *Eucalyptus pilularis* (Blackbutt) and *Syncarpia glomulifera* (Turpentine) - Closed Forest dominated by *Ceratopetalum apetalum* (Coachwood Tree) (Benson & Howell 1994).	Relatively Common

4. habitat assessment

4.1 local & regional context

The site is on the slopes of the Warriewood / Ingleside escarpment and is set in a landscape consisting of commercial developments, rural land residential dwellings and remnant bushland.

The land immediately to the south of the site is relatively steep and contains remnant bushland, natural habitats and riparian areas along Narrabeen Creek.

To the east of the site the land is largely developed with commercial and residential buildings and a small pocket of bushland remains on the Uniting Church land 200m east of the site.

The site is bounded by Mona Vale Road to the north and west, and beyond the road the land consists of a residential development set amongst bushland habitats. .

Regional aerial photo showing the site of 120 & 122 Mona Vale Road Warriewood
not to scale

The site adjoins (south) the bushland reserves that form the Warriewood escarpment, is within 2.5km, north east, of Garigal National Park and is within 2.5km south east from Ku-ring-gai Chase National Park. .

6. site planning considerations

6.1 riparian habitat planning

6.1.1 Office of Water's Requirements

Narrabeen Creek forms part of the sites southern boundary and is considered to be a 2nd order watercourse for the purposed of the Office of Water's (2011) Controlled Activities Guidelines for Riparian Areas.

The gully line running in a west-east direction across the centre of the site provides a flow path for overland stormwater flows and is dammed in the lower parts of the site adjacent Boundary Street. Recent approval has been granted to pipe overland flows downstream of the gully on the site. Assessments made as part of the consent on the down stream allotment have not considered the drainage line to be a river/watercourse for the purposes of the *Water management Act 200 (NSW)* and the Office of Water's (2011) Controlled Activities Guidelines for Riparian Areas have not been considered applicable.

Narrabeen Creek is considered to be a 2nd order watercourse and the guidelines (OoW, 2011) recommend a 20m wide Core Riparian Zone be provided within which native vegetation and habitats should be retained or revegetated. The 20m wide Core Riparian Zone is measured from to top of the bank of the watercourse.

Beyond the Core Riparian Zone the guidelines (OoW, 2011) recommend that an additional 10m wide Vegetation Buffer should be provided to protect the Core Riparian Zone. Infrastructure such as roads, drainage, stormwater structures, services, bushfire asset protection zones etc. should be located outside the vegetation buffer area.

6.2 key habitat components on the site

6.2.1 Open Forest Habitats

The Open Forest area on the site has a number of key habitat features such as Narrabeen Creek, the creek banks and riparian vegetation, slopes containing dry sclerophyll vegetation, rock boulders and rock overhangs, dead trees and logs etc. Although the Magenta Lillypilly (*Syzygium paniculatum)* and the Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis)* were the only threatened species recorded as part of the field surveys, the Open Forest area potentially provide habitats for a number of threatened flora and fauna species.

6.2.2 Disturbed Woodland & Scrubland areas

These areas are more simplistic in vegetation structure and species diversity than the Open Forest areas on the site. Important habitat components in these areas are the lower gully line characterised by the Grey Ironbark (*Eucalyptus paniculata*) and Broad-leaved White Mahogany (*Eucalyptus umbra*) and Cabbage Palm (*Livistona australis*) and the tree canopy along the site frontage towards Boundary Street.

6.2.3 Open Paddocks & Infrastructure areas

These areas do not contain essential habitat components for threatened species however the northern paddock slopes contain a number of mature trees that do provide an ecological function and contribution to the local ecology.

5.4 site habitats and relationships to habitats of endangered ecological communities

Conservation Status	Ecological Community	Habitat	Likelihood of Occurrence on site	Relationship to the site
✗ Site not considered significant for the community, ✔ Communities potentially affected and require consideration in site planning process				
Endangered NSW	Pittwater Spotted Gum Forest	The forest occurs on shale-derived soils from the Newport Formation geology of the Narrabeen group in Pittwater. Characteristic species include *Corymbia maculata, Eucalyptus punctata, Eucalyptus umbra, Angophora floribunda* and *Corymbia gummifera*. (NSW Scientific Committee 1998),	Habitat not present	✗
Endangered, NSW	Duffy's Forest	The forest occurs on lateritic soils and deeply weathered shale soils typically found on lower ridges in Ku-ring-gai. Characteristic tree species include *Eucalyptus capitellata, Eucalyptus sieberi, Eucalyptus oblonga*, and *Angophora costata*. (NSW Scientific Committee 1998),	Habitat not present	✗
Endangered NSW	Swamp Sclerophyll Forest on Coastal Floodplains	The forest complex is found on the Cockle Bay, Tacoma Swamp and Warriewood Soil Landscapes and the vegetation structure ranges from forest to scrub to reedland and includes open-forest. Characteristic species include *Eucalyptus robusta, Eucalyptus botryoides, Livistona australis, Melaleuca linariifolia, Melaleuca styphelioides, Melaleuca ericifolia* and in some cases *Phragmites australis*.	Habitat not present	✗
Endangered NSW	Littoral rainforest in the NSW North Coast, Sydney Basin and South East Corner bioregions	The Forest Littoral Rainforest generally is a closed forest, the structure and composition of which is strongly influenced by proximity to the ocean. The plant species in this ecological community are predominantly rainforest species with evergreen mesic or coriaceous leaves. Several species have compound leaves, and vines may be a major component of the canopy. The community comprises the *Cupaniopsis anacardioides - Acmena spp.* alliance of Floyd (1990) which includes five sub-alliances which include *Syzygium leuhmannii, Acmena smithii, Ficus sp, Livistona sp, & Podocarpus sp.* (NSW Scientific Committee 2004).	Habitat not present	✗

5.5 site habitats and relationships to habitats of threatened populations

Conservation Status	Type	Population Name	Habitat	Likelihood of Occurrence on site	Relationship to the site
✗ Site not considered significant for the population, ✔ Population potentially affected and require consideration in site planning process					
Endangered NSW	Fauna	Koala, *Phascolarctos cinereus*, in the Pittwater Local Government Area.	The population occurs between Ingleside and Elanora heights to Palm Beach on the Barrenjoey Peninsula. Koalas feed on foliage from the genera Eucalyptus, Corymbia and Angophora. They appear to have a preference for feeding in *Eucalyptus punctata* (Grey Gum), however other species such as *E. haemastoma* (Scribbly Gum), *E. robusta* (Swamp Mahogany) and non endemic species such as *E. nicholii* (Narrow-leaved Black Peppermint). Other species that appear to be under-exploited include *Corymbia maculata* (Spotted Gum), *Corymbia gummifera* (Red Bloodwood) and *Angophora costata* (Sydney Red Gum) to a lesser degree other species. (Smith & Smith 2000).	Refuge & foraging habitat present in the Open Forest areas with some foraging habitat across other areas of the site.	✔

Conservation Status (NSW)	Class	Genus species	Common Name	Habitat	Likelihood of Occurrence on site	Relationship to the site
✗ Site not considered significant for the species, ✔ Species habitats potentially affected and require consideration in site planning process						
Vulnerable NSW	Mammalia	*Phascolarctos cinereus*	Koala	Koalas feed on foliage from the genera Eucalyptus, Corymbia and Angophora. They appear to have a preference for feeding in *Eucalyptus punctata* (Grey Gum), however other species such as *E. haemastoma* (Scribbly Gum), *E. robusta* (Swamp Mahogany) and non endemic species such as *E. nicholii* (Narrow-leaved Black Peppermint). Other species that appear to be under-exploited include *Corymbia maculata* (Spotted Gum), *Corymbia gummifera* (Red Bloodwood) and *Angophora costata* (Sydney Red Gum) to a lesser degree other species. (Smith & Smith 2000).	Refuge & foraging habitat present in the Open Forest areas with some foraging habitat across other areas of the site.	✔
Vulnerable NSW, Cwth	Mammalia	*Pteropus poliocephalus*	Grey-headed Flying-fox	The species has 2 permanent maternal colonies in Sydney at Gordon and at Cabramatta. Other temporary colonies exist at the Botanical Gardens. The species predominately feeds on nectar and when blossoms are unavailable it feeds on fruit.	Not considered to be core breeding / roosting habitat, foraging opportunities present	✔
Vulnerable NSW	Reptilia	*Varanus rosenbergi*	Rosenberg's Goanna /Heath Monitor	Mostly a terrestrial species inhabits burrows logs and rock crevices (Cogger 2000). It is a mobile species that occupies a home range of about 20 ha (King & Green, 1999) and typically inhabits woodland and heath found on sandstone ridge tops and plateaus. It feeds on a range of species, including invertebrates, small lizards, snakes and bird eggs. Associated with termites, the mounds of which this species nests in; termite mounds are a critical habitat component	Limited breeding habitat in the Open Forest area, some foraging habitat present across the site.	✔

Conservation Status (NSW)	Class	Genus species	Common Name	Habitat	Likelihood of Occurrence on site	Relationship to the site
✗ Site not considered significant for the species, ✔ Species habitats potentially affected and require consideration in site planning process						
Vulnerable NSW	Aves	*Ninox strenua*	Powerful Owl	The species has a range of 400 -1500ha (Davey 1993) and is known to nest in hollows in Eucalypts between 9-37m above ground usually in secluded well-vegetated gullies and usually occupying the largest emergent trees. Powerful Owls live alone or in pairs which occupy a permanent territory containing a number of roost sites and one or more nesting sites. The species feeds over a large range on small to medium sized mammals, including gliders, ringtail possum and immature brushtail possums.	Breeding & roosting habitat present in the Open Forest areas and foraging habitat in other areas of the site.	✔
Vulnerable NSW	Aves	*Tyto novaehollandiae*	Masked Owl	It is generally considered as a bird of forest margins recorded in wet and dry open forests and woodlands and urban areas (Debus & Rose 1994). The southern subspecies occupies a home range of 5 -10 km2 within a diverse range of habitats that provide large hollow-bearing trees for roosting and nesting (Kavanagh & Murray 1996) often in riparian forests. It has also been known to roost and nest in caves and preys on mammals typically less than 600g such as rats, mice, rabbits, sugar gliders and ringtail possums (Slater 1993, Debus & Rose 1996).	Breeding & roosting habitat present in the Open Forest areas and foraging habitat in other areas of the site.	✔
Vulnerable NSW	Mammalia	*Cercartetus nanus*	Eastern Pigmy-possum	Is found in a range of habitats from rainforest, sclerophyll forests to sclerophyll tree heath and the species range extends from south eastern Qld to south eastern SA and Tasmania (Turner & Ward 2000). It feeds on insects including spiders, termites, beetles and moths as well as nectar and pollen from banksias, eucalypts and callistemon. It is generally nocturnal and whilst preferring to nest in small tree hollows it has been found in small constructed nests of shredded bark. It appears to be solitary with males having a range of about 0.68 ha and females having a range of 0.35 ha (Turner & Ward 2000).	Habitats likely to be restricted to the Open Forest areas of the site.	✔
Vulnerable NSW, Endangered Cwth	Mammalia	*Dasyurus maculatus*	Spotted-tailed Quoll	Found in a range of habitats and generally preying on medium size mammals and birds such as possums, small wallabies, rats, birds, domestic fowl, bandicoots, rabbits and also feed on insects and carrion. It is estimated that the range of the species is in the order of 500 – 3000ha using hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites.	Habitats likely to be restricted to the Open Forest areas of the site.	✔
Endangered NSW, Cwth	Mammalia	*Isoodon obesulus*	Southern Brown Bandicoot	Has a patchy distribution along the southeast coast in NSW and reaches its most northern limit at the Hawkesbury River and has been recorded in the larger tracts of bushland in Ku-ring-gai Chase, Garigal National Parks and in Nadgee Nature Reserve. This species prefers sandy soil with scrubby vegetation and /or areas of low ground cover that is periodically burnt (Braithwait 1995). The species displays a preference for regenerating sites following disturbance (OEH, 2006) The species is known to feed on ants, beetle larvae and plant material and some fungal species and whilst recorded in Ku-ring-gai Chase and Garigal National Parks. The species is not known to occur in small patches of bushland	Habitats likely to be restricted to the Open Forest areas of the site.	✔
Vulnerable NSW, Cwth	Mammalia	*Miniopterus schreibersii oceanensis*	Eastern Bent-wing Bat	The species has been recorded along the north coast of Australia from Qld to Vic and parts of northern WA and NT. Having been recorded in a variety of habitats it is typically found in well-timbered valleys. It roosts during the daylight hours in caves and has been recorded roosting in large storm water pipes. They fly quickly above tree tops in valleys, making fast dives to catch prey which are insects, mostly moths.	Roosting habitats restricted to the Open Forest areas of the site.	✔
Vulnerable NSW	Mammalia	*Mormopterus norfolkensis*	Eastern Freetail Bat	The species has a range along the eastern coastal strip of Australia extending from southern Queensland to southern NSW. Has been recorded roosting in tree hollows and feeds on flying insects. They forage above the tree canopy in forests or along the edges of forests, (Allison & Hoye 1995). The habitat preference of this species is unclear. It has been predominantly recorded in dry eucalypt forest and woodland, but has been recorded in moist and edge environments. The wing morphology indicates that this species is adapted to the more open habitats.	Roosting habitat mainly restricted to the Open Forest areas with some limited potential in other areas of the site.	✔

Conservation Status (NSW)	Class	Genus species	Common Name	Habitat	Likelihood of Occurrence on site	Relationship to the site
✗ Site not considered significant for the species, ✔ Species habitats potentially affected and require consideration in site planning process						
Vulnerable NSW	Aves	*Calyptorhynchus lathami*	Glossy Black-Cockatoo	Considered rare in a national context, but moderately common in N.S.W. Because of its dependence on one type of food it is considered to be vulnerable. It nests in large hollows of dead trees and roosts in both wet and dry eucalypts, feeding on Casuarina and Allocasuarina seeds. Feed in open Casuarina woodland, primarily where the Forest Oak (*Allocasuarina torulosa)* occurs.	Breeding, roosting and foraging habitat present in the Open Forest areas.	✔
Vulnerable NSW	Aves	*Ixobrychus flavicollis*	Black Bittern	Is known to inhabit mangroves and streamside vegetation including small creeks. Feeding is mostly undertaken at night where they stand and wait for small insects, crustaceans and small fish.	Not considered to be suitable core breeding or foraging habitat - unlikely to occur.	✗
Endangered NSW, Cwlth	Aves	*Lathamus discolor*	Swift Parrot	The Swift Parrot inhabits eucalypt forests and breeds in hollows of mature and senescing trees in Tasmania. On the mainland it feeds off winter flowering Eucalypts although it will also feed on lerps, honeydew, Banksia nectar, fruits, seeds and other plant material as well as insects and their larvae (Forshaw & Cooper 1981, Garnett 1992). In New South Wales important foraging tree species include, *Eucalyptus macrocarpa* (Grey Box), *Eucalyptus sideroxylon* (Mugga Ironbark) on the western slopes and *Eucalyptus tereticornis* (Forest Red Gum), *Eucalyptus fibrosa* (Red Iron Bark), *Corymbia maculata* (Spotted Gum), *Eucalyptus robusta* (Swamp Mahogany) and *Corymbia gummifera* (Red Bloodwood) (Swift Parrot Recovery Team, 2000). Since 1980 there have been some 60 sightings recorded in the Wildlife Atlas database (OEH 2010) within the Sydney Metropolitan Areas and locally small flocks were reported at Ingleside in 1986 (Cooper 1990). In 1938 hundreds of Swift Parrots were reported feeding in *Eucalyptus robusta* (Swamp Mahogany) in Warriewood (Hindwood 1939).	No core breeding habitat present, very limited foraging habitat - unlikely to occur.	✗
Vulnerable NSW	Aves	*Melithreptus gularis*	Black-chinned Honeyeater	The eastern subspecies species is predominantly found west of the Great Dividing Range in a narrow belt through NSW into southern Queensland, and south into Victoria and South Australia where it occupies eucalypt woodlands within an approximate annual rainfall range of 400-700mm (Blakers et al. 1984) and is rarely recorded east of the Great Dividing Range, although regularly observed from the Richmond River district. The species is mainly found in woodlands containing box-ironbark associations and River Red Gum. Black-chinned Honeyeaters and occurred in drier coastal woodlands of the Cumberland Plain, Western Sydney (NSW Scientific Committee, 2001). Black-chinned Honeyeaters are likely to experience high levels of competition from aggressive honeyeater species such as Noisy Miners and increased nest predation is expected from increasing populations of predators such as Pied Currawongs and Australian Ravens, particularly in small remnants (Major et al. 1998). The species is usually seen in pairs and small groups of up to 12 birds which have large home ranges of at least 5 hectares where they foraging rapidly along outer twigs, underside of branches and trunks, probing for insects. Nectar is taken from flowers and honeydew is gleaned from foliage.	The species is unlikely to occur and is often be displaced by more aggressive urban fauna species.	✗
Vulnerable NSW	Aves	*Ninox connivens*	Barking Owl	The species can be found inhabiting eucalypt forests, paperbark and other woodlands, dense scrubs, foothills; river red gums and other large trees near watercourses. The species is dependant on large hollows of mature eucalypts for nests. The bird feeds on prey such as rabbits, rats, gliders and birds such as Rosella and starlings (Smith & Smith 2000).	Breeding & roosting habitat present in the Open Forest areas and foraging habitat in other areas of the site.	✔

Conservation Status	Genus species	Common Name	Habitat Requirements	Likelihood of Occurrence on site	Relationship to the site
✗ Site not considered significant for the species, ✔ Species habitats potentially affected and require consideration in site planning process					
Vulnerable NSW, Cwlth	*Pimelea curviflora var. curviflora*	Curved Rice-flower	This species is confined to the coastal areas around Sydney found growing on Hawkesbury sandstone (Harden 2000) or on lateritic soils in similar habit to that occupied by the Duffys Forest association (Smith & Smith 2000).	Not considered to be suitable habitat - unlikely to occur.	✗
Vulnerable NSW, Cwth	*Syzygium paniculatum*	Magenta Lillypilly	The species has been known to be associated with coastal dunes and Littoral Rainforest and is also found in riparian habitats (Payne 1997). The species has been commercially propagated and sold and is known to have been planted in a variety of urban habitats. The species has been recorded growing on moist slopes on Narrabeen Group geology (Smith & Smith 2000).	Habitat present in the Open Forest riparian areas & drainage lines.	✔
Vulnerable NSW, Cwth	*Tetratheca glandulosa*	Glandular Pink-bell	This species typically grows on dryer open sites of Hawkesbury sandstone and can be found in open forests, woodlands and scrub. Grows in sandy or rocky heath or scrub (Gardner & Murray ex. Harden 1992) and is often found in deeper soils.	Habitat present in the Open Forest Areas	✔

5.3 site habitats and relationships to habitats of threatened fauna

Conservation Status (NSW)	Class	Genus species	Common Name	Habitat	Likelihood of Occurrence on site	Relationship to the site
✗ Site not considered significant for the species, ✔ Species habitats potentially affected and require consideration in site planning process						
Vulnerable NSW, Cwth	Amphibia	*Heleioporus australiacus*	Giant Burrowing Frog	Sandy soil on sandstone ridges where sandy creek banks provide opportunities for burrowing. Tadpoles are typically found in rocky pools in the upper reaches of permanent and ephemeral creeks (Mahoney 1993)	Not considered to be suitable habitat - unlikely to occur.	✗
Vulnerable NSW	Amphibia	*Pseudophryne australis*	Red-crowned Toadlet	Red-crowned Toadlets do not usually live along permanent flowing water courses such as occur in gullies, instead preferring permanently moist soaks, areas of dense ground vegetation or litter along or near head-water stream beds. The species is known to inhabit upper forested slopes and ridges on Hawkesbury sandstone or Narrabeen group preferring moist sandstone habitats with grass and debris near ephemeral watercourses. Red-crowned Toadlets have not been recorded breeding in permanently flowing streams or waters that are even mildly polluted (OEH, 2001).	Marginal habitat present in the Open Forest areas & drainage lines.	✔
Vulnerable NSW	Aves	*Callocephalon fimbriatum*	Gang-gang Cockatoo	With a range restricted to south eastern NSW and south eastern Victoria the species feeds on terminal leaves of eucalypts or in hawthorn hedges and nests in deep hollows in eucalypts (Slater 1993). The species occurs in a variety of forests and woodlands and the last known breeding population in the metropolitan Sydney area is in the Hornsby/ Ku-ring-gai area. The species shows a strong nest site fidelity (NSW Scientific Committee 2001). .	Breeding & roosting habitat present in the Open Forest areas and foraging habitat in other areas of the site.	✔

5.2 site habitats and relationships to habitats of threatened flora

Conservation Status	Genus species	Common Name	Habitat Requirements	Likelihood of Occurrence on site	Relationship to the site
✗ Site not considered significant for the species,			✔ Species habitats potentially affected and require consideration in site planning process		
Vulnerable NSW	*Callistemon linearifolius*	Netted Bottle Brush	The species has been recorded growing in dry sclerophyll forest on the coast and adjacent ranges. Its known distribution occurs from the Georges River to Hawkesbury River in the Sydney area and north to Nelson Bay. Other records in 2000 have been from Coal Cliffs in the Southern Rivers CMA. Within the Sydney area, recent records are predominately limited to the Hornsby Plateau area near the Hawkesbury River and 2 records of the species also occur within Pittwater. Currently only 5-6 populations of the previous 22 populations remain. Three of these populations occur within Ku-ring-gai Chase National Park, Lion Island Nature Reserve, and Spectacle Island Nature Reserve.	Very marginal suitable habitat - unlikely to occur	✗
Vulnerable NSW, Cwth	*Darwinia biflora*	-	Occurs on the edges of weathered shale capped ridges particularly at the intergrade with Hawkesbury sandstone. Most sites are on Lucas Heights Soil Landscape. The vegetation association often includes *Eucalyptus haemastoma, Corymbia gummifera and or E. squamosa* and the structure is usually woodland, open forest or scrub-heath (OEH, 2003).	Not considered to be suitable habitat - unlikely to occur.	✗
Vulnerable NSW	*Epacris purpurascens var. purpurascens*	-	*Epacris purpurascens var. purpurascens* is found at 30 locations in and around Sydney extending from Gosford in the north, Narrabeen in the east, Silverdale in the west and Avon Dam vicinity in the south. Its habitat consists of ridgetop drainage depressions supporting wet heath within or adjoining shale cap communities such as Stringybark and Ironbark woodlands and various shale/sandstone transition forest (OEH, 2002)	Not considered to be suitable habitat - unlikely to occur.	✗
Vulnerable NSW, Cwth	*Eucalyptus camfieldii*	Heart-Leaved Stringybark	This species is found on lateritic soils of the Mittagong formation and in Hawkesbury sandstone. Usually located on upper slopes and ridge tops its habitat is characterized by well drained soils and associated with dry sclerophyll woodlands and scrub.	Not considered to be suitable habitat - unlikely to occur.	✗
Vulnerable NSW	*Eucalyptus nicholii*	Narrow-Leaf Peppermint	The species is endemic on the northern tablelands of NSW however it is widely planted as an urban street tree and in gardens It is quite rare in the wild and is confined to the New England Tablelands of NSW, where it occurs from Nundle to north of Tenterfield, largely on private property. The species grows in dry grassy woodland, on shallow and infertile soils, mainly on growing on porphyry or granite soils (Brooker & Kleinig, 1999).	The site is well beyond the natural distribution of the species.	✗
Vulnerable NSW, Endangered Cwlth	*Eucalyptus scoparia*	Willow Gum	Occurring mainly in Queensland, the species reaches its southern natural distribution limits in northern NSW. There are only 3 known natural locations where small populations occur. All 3 locations occur in the Tenterfield area none of which occur in conservation reserves (NSW Scientific Committee 2002). The species has been used in the horticultural industry and has been planted widely as a street tree and as an ornamental species around Sydney.	The site is well beyond the natural distribution of the species.	✗
Endangered NSW	*Grammitis stenophylla*	Narrow-leaf Finger Fern	The species is an epiphyte or lithophyte and is known to occur in Queensland and eastern New South Wales. Its habitat includes moist areas on rocks or in trees, usually near streams, in rainforest and moist eucalypt forest. .	Habitat present in the Open Forest riparian areas.	✔
Endangered NSW, Cwlth	*Grevillea caleyi*	Caley's Grevillea	This species typically grows on Mittagong soil landscapes characterized by lateritic soils rich in iron and can be associated with the Duffy's Forest vegetation association.	Not considered to be suitable habitat - unlikely to occur.	✗
Vulnerable NSW, Cwth	*Leptospermum deanei*	-	Found in Devlin's Creek in Pennant Hills Park, Cheltenham, amongst sandstone rocks in sandy soil adjacent creek/watercourse.	Habitat present in the Open Forest riparian areas.	✔
Endangered NSW, Cwlth	*Microtis angusii*	Angus's Onion Orchid	The habitat is somewhat unclear occurring west of Lithgow NSW near Sunny Corner and at Ingleside in an old roadside soil dump stockpile area. It is thought that the local habitat of this species is similar to that of the Duffy's Forest association on lateritic soils.	Not considered to be suitable habitat - unlikely to occur.	✗

4.3 critical habitat

Critical habitat is declared under the provisions of the Threatened Species Conservation Act 1995. This site is not listed as being part of any gazetted critical habitat. Currently the critical habitats listed in the schedules of the Act are

- Gould's Petrel;
- Little Penguin habitat in Sydney's North Harbour;
- Mitchell's Rainforest Snail in Stott's Island Nature Reserve;
- *Wollemia nobilis* (The Wollemi Pine):
- *Bomaderry zieria* within the Bomaderry bushland - critical habitat recommendation;
- Eastern Suburbs Banksia Scrub Endangered Ecological Community - critical habitat recommendation, and

The site is not considered to be critical habitat for the purposes of the *Threatened Species Conservation Act 1995 (NSW).*

5. consideration of the site habitats & habitats of threatened species

5.1 threatened species habitat assessment

The following assessment is made with regards to threatened species, populations and ecological communities identified in the survey data tables in this report despite whether they were recorded on the site as part of the field assessments or whether they have been recorded previously within a 10 kilometres grid square centres on the site (OEH, 2010). The following habitat assessment takes into account;

- the potential habitats on the site, and
- the relationship between the habitats of species, communities and populations to the habitats on this site.

The large prominent, senescing Red Gum (*Angophora costata*) within the disturbed area has several habitat hollows. During the course of the surveys the tree was used as a diurnal roost site by Laughing Kookaburra (*Dacelo novaeguineae*) and Rainbow Lorikeet (*Trichoglossus haematodus*) with Rainbow Lorikeet (*Trichoglossus haematodus*) and Sulphur-crested Cockatoo (*Cacatua galerita*) using the hollows on dusk.

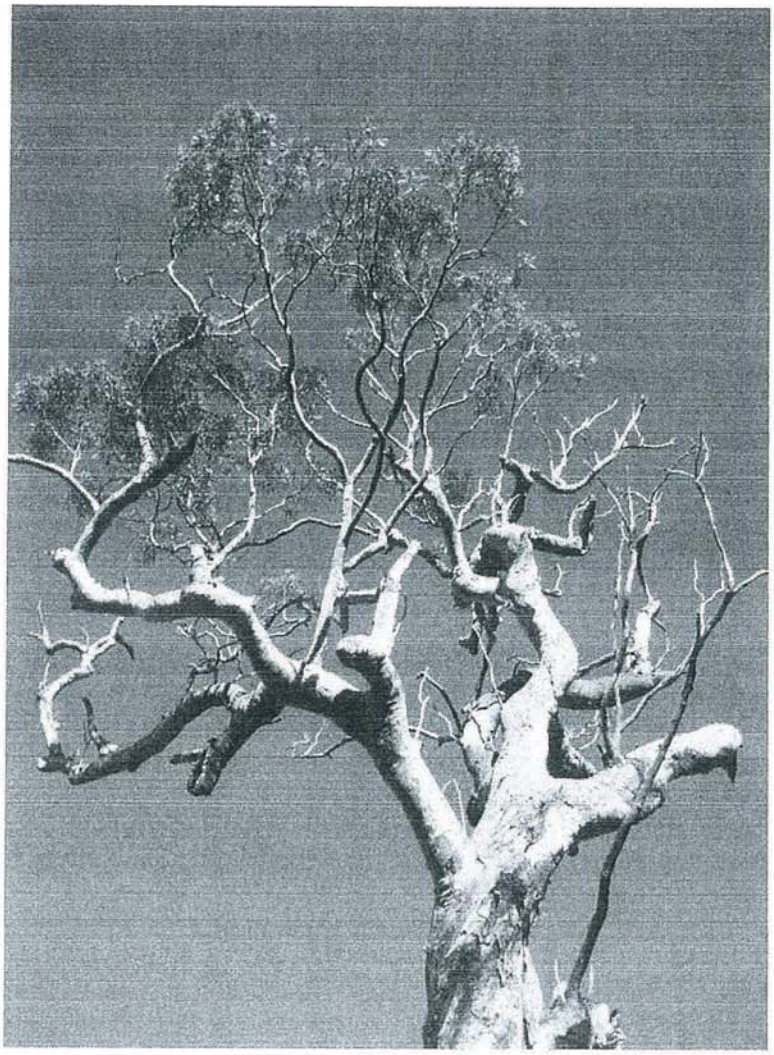


Figure 4.5 The large prominent, senescing Red Gum (*Angophora costata*) with habitat hollows being used by Rainbow Lorikeets *Trichoglossus haematodus*) and Sulphur-crested Cockatoos (*Cacatua*

The range and population size of several native hollow-using species such as Sulphur-crested Cockatoo (*Cacatua galerita*) and Rainbow Lorikeet (*Trichoglossus haematodus*) has increased significantly since European settlement (Gibbons & Lindenmayer, 2002). These species are known to displace other more sensitive species that use small hollows as refuge and/ or breeding. Aggressive species such as Noisy Miners (*Manorina melanocephala*) have also been known to displace more sensitive species (Franklin et al., 1989, Grey et al., 1998).

4.2.5 Fauna habitats

The Open Forest area contains a variety of habitat features including the riparian habitats of Narrabeen Creek, the banks and bed of the creek itself, rock boulders, rock ledges and rock overhangs, 2 main waterfalls, dead trees with a dense understorey and natural ground cover layers that include logs and leaf litter. These habitats accommodate a range of fauna including small insectivorous birds such as *Spotted Pardalote (Pardalotus punctatus) and Superb Fairy-wren (Malurus* cyaneus) reptiles such as Eastern Water Dragon (*Physignathus lesueurii*) and Broad-tailed Gecko (*Phyllurus platurus*) and several mammals including Common Brushtail Possum (*Trichosurus vulpecula*) and Long-nosed Bandicoot (*Perameles nasuta*). The rock overhangs associated with the waterfalls may also provide refuge habitat for Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*).

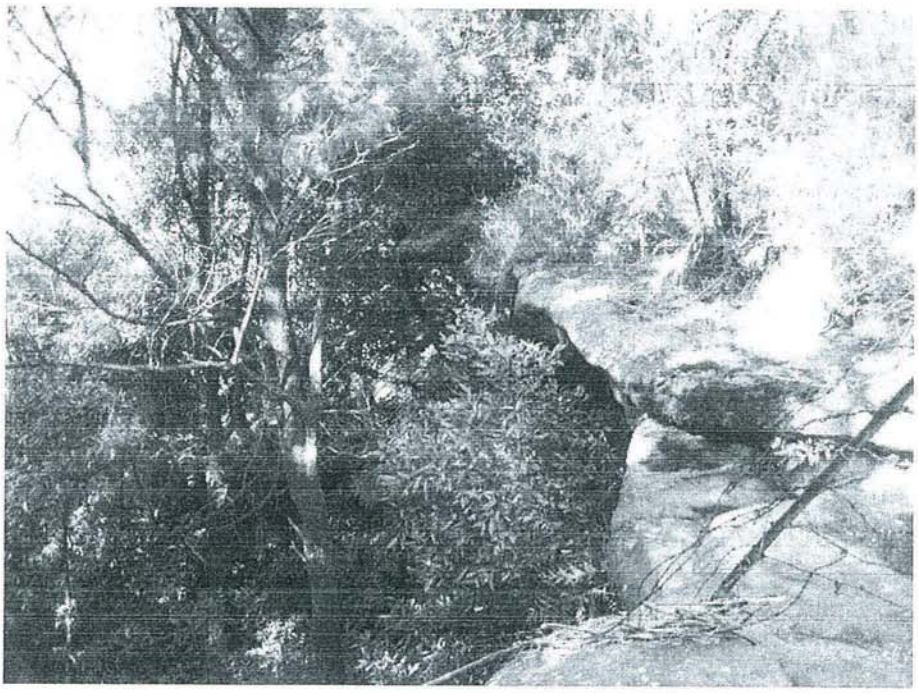


Figure 4.4 Upper waterfall & rock overhangs of Narrabeen Creek in the south western corner of the site.

The Disturbed Woodland & Scrubland areas also provide refuge habitats for Common Brushtail Possum (*Trichosurus vulpecula*) and Long-nosed Bandicoot (*Perameles nasuta*) however the bird species that forage in the open are typically Australian Raven (*Corvus coronoides*), Willie Wagtail (*Rhipidura leucophrys*), and Noisy Miner (*Manorina melanocephala*).

Around the drainage line, dams and their peripheral areas in the disturbed Woodland & Scrubland, a colony of Common Eastern Froglet (*Crinia signifera*) were commonly heard calling. Despite nocturnal and diurnal call backs in favourable conditions, no calls of Red-crowned Toadlet (*Pseudophryne australis*) and Giant Burrowing Frog (*Heleioporus australiacus*) were noted.

Swamp Wallaby (*Wallabia bicolour*) scats and evidence of Long-nosed Bandicoot (*Perameles nasuta*) were observed across the site.

4.2.4 Open Paddocks & Infrastructure areas

These areas consist of the roads, tracks, glasshouses, sheds and the dwelling and include areas that are mown, slashed and grazed. The allotment is grazed by free ranging cattle and sheep. Goats and pigs are also confined to areas of the site.

The open areas over much of the site are cleared of trees however the northern paddocks contain isolated remnant tree cover predominately Grey Ironbark (*Eucalyptus paniculata*) and Broad-leaved White Mahogany (*Eucalyptus umbra*).

The ground covers vary across this area ranging from high levels of Kikuyu Grass (*Pennisetum clandestinum*) typically around the existing dwelling to areas of Blady Grass (*Imperata cylindrica*), Weeping Grass (*Microlaena stipoides*) with African Love Grass (*Eragrostis curvula*) and Panic Veldtgrass (*Ehrharta erecta*). Regrowth of Slender Rice-flower (*Pimelea linifolia*) also occurs in the northern open paddocks.

Figure 4.3 Typical views of the open paddocks grazed by cattle and sheep.

4.2.3 Disturbed Woodland & Scrubland areas

These habitats occur in isolated patches over the site primarily in the moderate slopes on the site and along the northern central drainage line. The tree canopy in these areas varies from being absent, consisting of isolated trees or containing stands of trees. These areas are characterised by having little or no understorey vegetation and ground covers being dense thickets of Bracken (*Pteridium esculentum*).

Along the drainage line and in particular the lower gully, the vegetation structure retains canopy trees of Bangalay (*Eucalyptus botryoides*), Grey Ironbark (*Eucalyptus paniculata*) and Broad-leaved White Mahogany (Eucalyptus umbra) with other sub-canopy species such as Cabbage Palm (*Livistona australis*) being present.

Figure 4.2 Vegetation & habitats drainage gully in the Disturbed Woodland & Scrubland areas.

Other areas of the Disturbed Woodland & Scrubland are scattered across the site where maintenance slashing is not regularly carried out. These areas are generally on moderately steep slopes or where rocky boulders occur.

Within these habitats, towards the Open Forest, there is a large, prominent, senescing Red Gum (*Angophora costata*) with several habitat hollows present

Along the northern part of site's boundary fronting Boundary Street there is a band of trees consisting of Turpentine (*Syncarpia glomulifera*), Bangalay (*Eucalyptus botryoides*) and others along with the typical Bracken (*Pteridium esculentum*) ground cover.

4.2 site habitats

4.2.1 Habitats on the site

For the purposes of this report the site has been considered in 3 main habitat units based upon similarities in the vegetation's physical structure, floristic composition, level of disturbance and the current land use.

- Area A - Open Forest,
- Area B – Disturbed Woodland & Scrubland areas
- Area C – Open Paddocks & Infrastructure areas

4.2.2 Open Forest habitats

The open forest habitats cover the undeveloped portions of the site and are primarily associated with the steeper land adjacent Narrabeen Creek.

The vegetation has an open forest structure and is dominated by Broad-leaved White Mahogany (*Eucalyptus umbra*), Sydney Red Gum (*Angophora costata*), Bangalay (*Eucalyptus botryoides*), and Grey Gum (*Eucalyptus punctata*). Other species in the canopy and sub-canopy include Forest Oak (*Allocasuarina torulosa*), Sydney Peppermint (*Eucalyptus piperita*).

In the riparian areas and sheltered parts of this area species such as Grey Myrtle (*Backhousia myrtifolia*), Turpentine (*Syncarpia glomulifera*), Coachwood Tree (*Ceratopetalum apetalum*), Black Wattle (*Callicoma serratifolia*), Tree Heath (*Trochocarpa laurina*) and Magenta Lillypilly (*Syzygium paniculatum*) can be found. On the drier upper slopes species including Old Man Banksia (*Banksia serrata*) and Broad-leaved Hakea (*Hakea dactyloides*) are evident.

The riparian areas occur along the incised gully and a number of sandstone rock outcrops occur. The watercourse itself cascades over 2 main scarps on the site and sandstone boulders occur along the length of the watercourse. The 2 main scarps in this area have several rock overhangs that provide shelter and faunal refuges. Several trees in this area also contain habitat hollows.

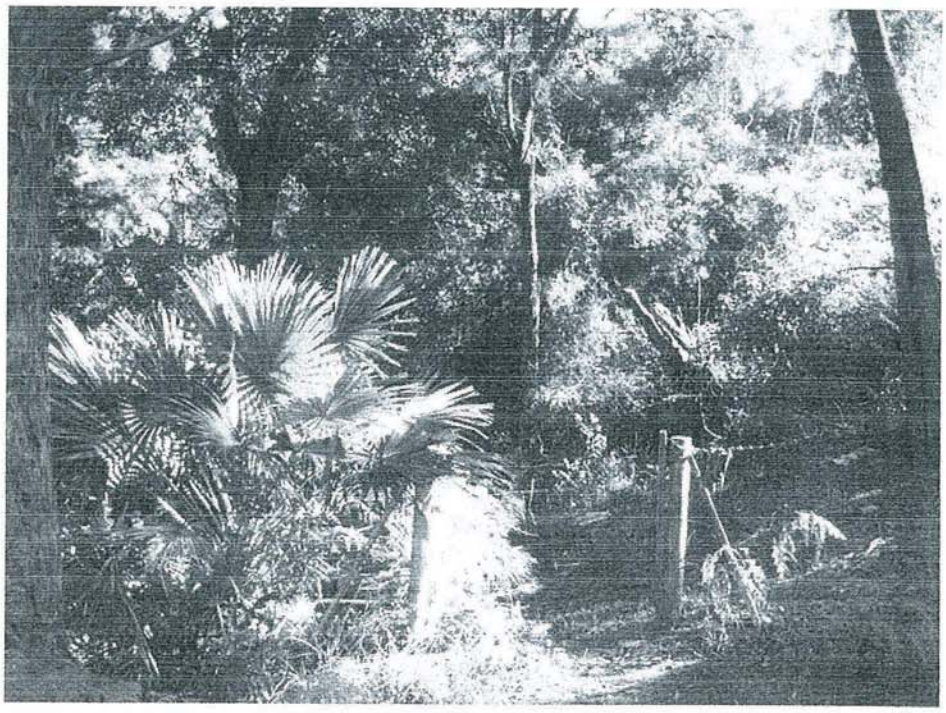
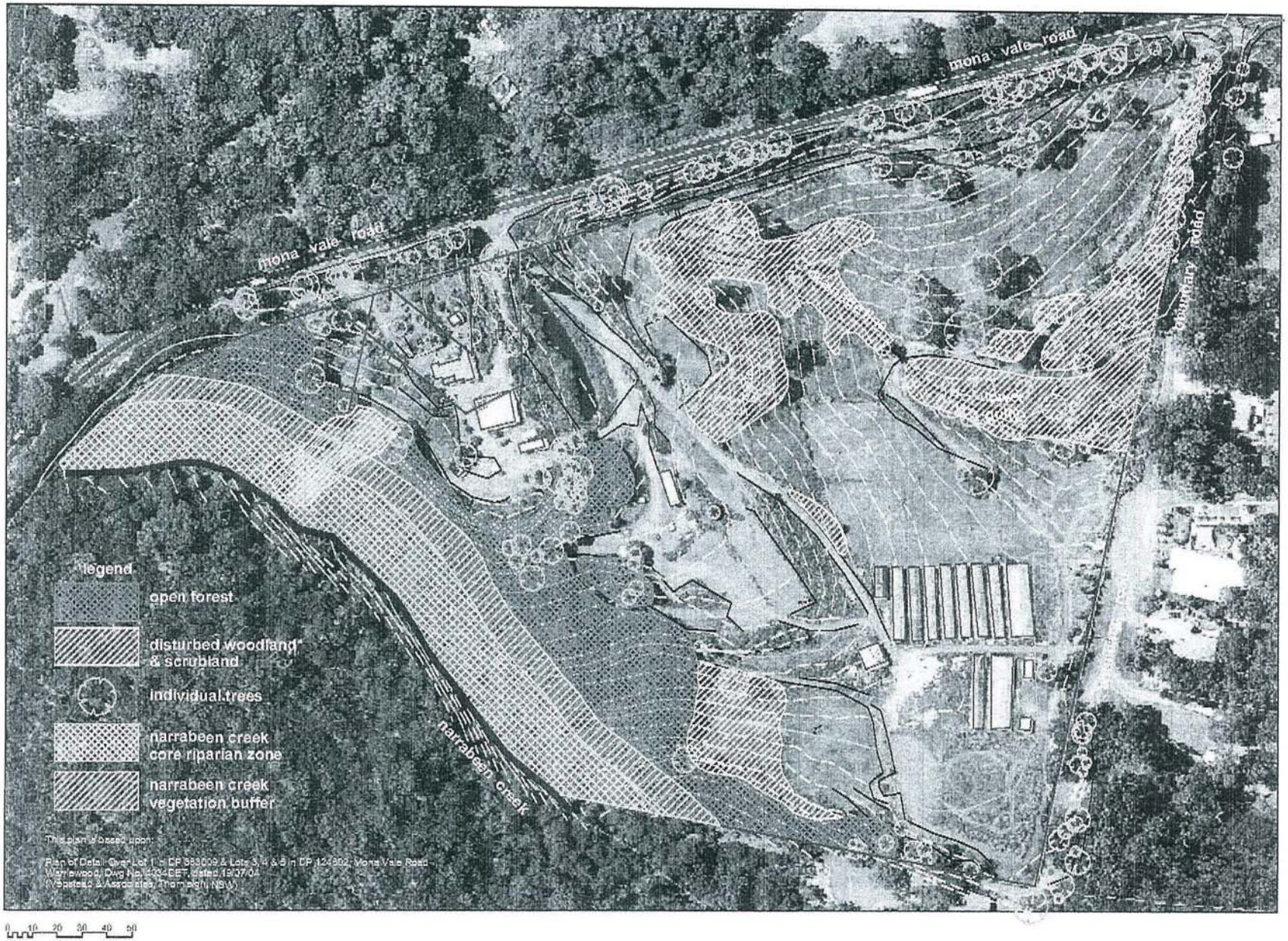


Figure 4.1 Vegetation & habitats in the Open Forest.



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Ecological, Environmental & Horticultural Consultants

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project
preliminary site planning -
120 mona vale road, warriewood

drawing title
key habitat components

6.3 site planning guidelines based upon ecological principals

To minimise the impacts on threatened species and the local ecology and to comply with the requirements of the Office of Water' guidelines (2011) the following site planning priorities are listed in order of importance.

- Retain the vegetation and habitats in the riparian areas (30m from top of bank) along Narrabeen Creek;
- Maximise the retention of vegetation and habitats within the Open Forest area;
- Maximise the retention of vegetation and habitats in the lower gully line in the Disturbed Woodland & Scrubland;
- Maximise the retention of other areas of the Disturbed Woodland & Scrubland, and
- Maximise the retention of indigenous trees in the Open Paddocks & Infrastructure areas of the site.

7. threatened species assessment

7.1 NSW assessment process

The potential impacts of the proposed development on species, populations and communities listed in the schedules of the *Threatened Species Conservation Act 1995 (NSW),* are considered against the criteria in Part 1 section 5A(2) of the *Environmental Planning and Assessment Act 1979 (NSW).* This criteria is designed to determine "whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats", and consequently, whether a Species Impact Statement is required.

Whilst no subdivision master plan has been prepared further consideration will be required for the following species:

- Narrow-leaf Finger Fern (,*Grammitis stenophylla);*
- *Leptospermum deanei;*
- Magenta Lillypilly (*Syzygium paniculatum);*
- Glandular Pink-bell (*Tetratheca glandulosa);*
- Red-crowned Toadlet (*Pseudophryne australis);*
- Gang-gang Cockatoo (*Callocephalon fimbriatum);*
- Glossy Black-Cockatoo (*Calyptorhynchus lathami);*
- Barking Owl (*Ninox connivens);*
- Powerful Owl (*Ninox strenua);*
- Masked Owl (*Tyto novaehollandiae)*
- Eastern Pigmy-possum (*Cercartetus nanus);*
- Spotted-tailed Quoll (*Dasyurus maculates);*
- Southern Brown Bandicoot (*Isoodon obesulus);*
- Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis);*
- Eastern Freetail Bat (*Mormopterus norfolkensis);*
- Grey-headed Flying-fox (*Pteropus poliocephalus),* and
- Rosenberg's Goanna /Heath Monitor (*Varanus rosenbergi)*

7.2 EPBC Act, 1979 (Commonwealth) assessment

Part 13 Division 1 of the *Environment Protection & Biodiversity Act 1999 (Cwlth)* (EPBC) lists flora, fauna and ecological communities that are considered to be "matters of national environmental significance". Under the Act consideration must be given as to whether the proposed actions will, or is likely to have a "significant impact" on "matters of national environmental significance".

To minimise duplication in the environmental assessment procedures, a bilateral agreement was made in January 2007 between the Commonwealth & NSW Governments giving accreditation of New South Wales assessment processes in relation to threatened species, populations and ecological communities.

The agreement provides for "Controlled Actions" as defined in the *Environment Protection & Biodiversity Act 1999 (Cwlth)* relating to threatened species, to no longer require assessment under Part 8 of the *Environment Protection & Biodiversity Act 1999 (Cwlth)* where they are assessed under Part 3A, 4 or 5 of the *Environmental Planning and Assessment Act 1979 (NSW)*.

The NSW assessment process, in particular Part 1 section 5A (2) of the *Environmental Planning and Assessment Act 1979 (NSW),* is acknowledged in the bilateral agreement and it is deemed to satisfies the requirements for assessments of "Controlled Actions". It is therefore logical to assume that the NSW assessment process equally satisfies the assessment requirements for actions that are not considered to be "Controlled Actions".

8. summary

8.1 conclusion

This report has been prepared to present the findings of detailed flora and fauna surveys and habitat assessments carried out over the site known as 120 & 122 Mona Vale Road, Warriewood. This report also incorporates species and ecological communities known to occur within the local area which have been identified through database and literature searches.

Specific assessment has been undertaken to identify potential habitats of threatened species, populations and ecological communities known to occur in the local area and listed in the schedules of the *Threatened Species Conservation Act (NSW) 1995.*

The site is located on the southern side of Mona Vale Road and the topography ranges from moderately- steeply sloping to undulating slopes. The site is currently used for rural activities and contains a number of greenhouses, detached sheds, open paddocks with remnant trees and indigenous vegetation along the steeper riparian areas of Narrabeen Creek

A detailed flora survey was conducted on the site and a range of fauna survey techniques have been carried out on and adjacent the site. In addition to this a habitat assessment and database / literature search has been carried out to identify threatened flora and fauna that potentially could occur on the site.

The site has been considered in 3 main habitat units based upon similarities in the vegetation's physical structure, floristic composition, level of disturbance and the current land use.

- Area A - Open Forest,
- Area B – Disturbed Woodland & Scrubland areas
- Area C – Open Paddocks & Infrastructure areas.

Despite extensive field survey the Magenta Lillypilly (*Syzygium paniculatum)* and the Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis)* were the only threatened species recorded on the site.

To minimise the impacts on threatened species and the local ecology and to comply with the requirements of the Office of Water' guidelines (2011) the following site planning priorities are listed in order of importance.

- Retain the vegetation and habitats in the riparian areas (30m from top of bank) along Narrabeen Creek;
- Maximise the retention of vegetation and habitats within the Open Forest area;
- Maximise the retention of vegetation and habitats in the lower gully line in the Disturbed Woodland & Scrubland;
- Maximise the retention of other areas of the Disturbed Woodland & Scrubland, and
- Maximise the retention of indigenous trees in the Open Paddocks & Infrastructure areas of the site.

At the time of producing this report the subdivision master plan for the site has not been finalised. The site contains potential habitat of the following threatened species and once the final design plans are documented further consideration will be required to assess the impacts on the following species:

- Narrow-leaf Finger Fern (,*Grammitis stenophylla);*
- *Leptospermum deanei;*
- Magenta Lillypilly (*Syzygium paniculatum);*
- Glandular Pink-bell (*Tetratheca glandulosa);*
- Red-crowned Toadlet (*Pseudophryne australis);*
- Gang-gang Cockatoo (*Callocephalon fimbriatum);*
- Glossy Black-Cockatoo (*Calyptorhynchus lathami);*
- Barking Owl (*Ninox connivens);*
- Powerful Owl (*Ninox strenua);*
- Masked Owl (*Tyto novaehollandiae)*
- Eastern Pigmy-possum (*Cercartetus nanus);*
- Spotted-tailed Quoll (*Dasyurus maculates);*
- Southern Brown Bandicoot (*Isoodon obesulus);*
- Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis);*
- Eastern Freetail Bat (*Mormopterus norfolkensis);*
- Grey-headed Flying-fox (*Pteropus poliocephalus),* and
- Rosenberg's Goanna /Heath Monitor (*Varanus rosenbergi)*

References

Allison, F.R. and Hoye, G.A. (1995) Eastern Freetail-bat Mormopterus norfolkensis pp 484-5 in Strahan, R. (ed.). The Mammals of Australia. Reed Books, Sydney.

Atkins, K. (1998). Habitat and distribution of *Perameles nasuta* and *Isoodon obesulus* in Bushland Remnants in Sydney. MSc Thesis, School of Biological Sciences, Macquarie University.

Benson, D. & Howell, J. (1994) *Cunninghamia,* The natural vegetation of the Sydney 1:100 000 map sheet, Volume 3(4) 1994 Royal Botanical Gardens Sydney.

Blakers, M., Davies, S.J.J.F. & Reilly, P.N. (984) *The Atlas of Australian Birds.* RAOU and Melbourne University Press, Melbourne.

Braithwait R, W. (1995), Southern Brown Bandicoot, pp176-177in *Mammals of Australia*. Ed. R Strahan, Australian Museum & Reed Books.

Brooker M.I & Kleinig D.A. (1999) *Field Guide to Eucalypts, Volume 1 South-eastern Australia*, Bloomings Books, Victoria.

Brunner, H. & Coleman, B.J. (1974), *The identification of Mammalian Hair*, Inkata Press, Melbourne

Chapman, G.A., & Murphy, C.L. (1989), *Soil Landscapes of the Sydney 1:100 000 sheet,* Soil Conservation Service of NSW., Sydney

Cogger H.G. (2000), *Reptiles & Amphibians of Australia 6th ed.* Reed Holland, Sydney.

Cooper, R.M. (1990), (1986) New South Wales Bird Report. *Australian Birds* 23: 68-101.

Cropper (1993) *Management of Endangered Plants*. CSIRO Publishing, Melbourne

Davey S M (1993). Notes on the habitat of four Australian owl species. Pp. 126-142 in Olsen, P (ed.),*Australian Raptor Studies*. Australasian Raptor Association, RAOU, Melbourne.

Debus S.J.S. & Rose, A.B. (1994) The Masked Owl - Tyto novaehollandiae in New South Wales. *Australian Birds 28 (supplement),* pp40-64)

Forshaw, J.M. & Cooper, W.T. (1981) *Australian Parrots*. 2nd edition, Lansdown Editions, Melbourne.

Franklin, D.C., Menkhorst, P.W. & Robinson, J.L. (1989). Ecology of the Regent Honeyeater *Xanthomyza phrygia*. *Emu* 89:140-154.

Garnett, S. (1992) Threatened and Extinct Birds of Australia. *RAOU Report No.82*, Royal Ornithologists Union of Australia & Australian National Parks & Wildlife Service.

Gibbons P. & Lindenmayer D. (2002) *Tree Hollows and Wildlife Conservation in Australia*, CSIRO Publishing, Collingwood, Vic.

Grey, M.J., Clarke, M.F. & Loyn, R.H. (1998). Influence of the Noisy Miner *Manorina melanocephala* on avian biodiversity and abundance in remnant Grey Box woodland. *Pac. Conserv. Biol.* 4:55-69.

Harden, G. (2000) *Flora of NSW: Volume 1,* New South Wales University Press, Kensington.

Harden, G. (2002) *Flora of NSW: Volume 2,* New South Wales University Press, Kensington.

Harden, G. (1992) *Flora of NSW Volume 3,* New South Wales University Press, Kensington.

Harden, G. (1993) *Flora of NSW Volume 4,* New South Wales University Press, Kensington.

Herbert, C. (1983), *Geology of the Sydney 1:100 000 Sheet 9130,* New South Wales Department of Mineral Resources, Sydney

Hindwood, K.A. (1939). Nectar-feeding birds near Sydney. *Emu* 34; 40-44.

Kavanagh, R.P. & Murray, M. (1996) Home range, habitat and behaviour of the Masked Olw *Tyto novaehollandiae* near Newcastle, New South Wales. *Emu* 96: pp 250 – 257 Birds Austraila.

King, D. & Green, B. (1999) Goannas - The biology of varanid lizards, 2nd edition, University of New South Wales Press, Sydney

Mahoney, M.J. (1993), The Status of Frogs in the Watagan Mountains area, the Central Coast of N.S.W. pp 257 –264, *Herpetology in Australia – A Diverse Discipline*, ed D. Lunney & D. Ayres, Trans. Of the Royal Zool. Soc. NSW, Mosman

NSW Scientific Committee (2000) *Final Determinations 2000, Sydney Coastal Estuary Swamp Forest Complex in the Sydney Basin Bioregion*, 22/12/2000, NSW National Parks & Wildlife Service.

NSW Scientific Committee (2002) *Final Determinations, Eucalyptus scoparia* (a tree) - vulnerable species listing, NSW National Parks & Wildlife Service, August 2002.

NSW Scientific Committee (2001) Black-chinned honeyeater (eastern subspecies) - vulnerable species listing NSW Scientific Committee - final determination, 30/11/01

NSW Scientific Committee (2001) *Gang-gang Cockatoo, Callocephalon fimbriatum in the Hornsby and Ku-ring-gai Local Government Areas – endangered population listing*, 23/02/01 NSW National Parks & Wildlife Service

NSW Scientific Committee (2002) *FInal Determination Duffys Forest vegetation community in the Sydney Basin Bioregion- Endangered ecological communityl,* NSW National Parks & Wildlife Service, June 2002

NSW Scientific Committee (2004) *Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner Bioregions – endangered ecological community listing*, 04/06/04 NSW National Parks & Wildlife Service.

NSW Scientific Committee (2004) River-flat Eucalypt Forest on Coastal Floodplains on the North Coast, Sydney basin and South Eastern Corner

Bioregions - endangered ecological community listing, 17/12/04, NSW Scientific Committee, Department of Environment, Climate Change & Water.

NSW Scientific Committee (2005) *Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions* - endangered ecological listing, 28/01/05 NSW Department of Environment & Climate Change, Sydney NSW.

NSW Scientific Committee (2005) Listing Lowland Rainforest in the NSW North Coast and Sydney Basin bioregions - endangered ecological community

OEH (1999) *Threatened Species Information* Spotted-tailed Quoll, Department of Environment & Climate Change, September 1999, NSW National Parks & Wildlife Service, Hurstville

OEH, (2000) *Threatened Species Information Tetratheca glandulosa*, New South Wales, Department of Environment Climate Change & Water, May 2000, NSW National Parks & Wildlife Service, Hurstville.

OEH (2001) *Red-crowned Toadlet Pseudophryne australis (Gray 1835)* – profile, Department of Environment & Climate Change, May 2001, NSW National Parks & Wildlife Service, Hurstville.

OEH (2002) *Threatened Species Information Epacris purpurascens var. purpurascens*, May 2002, NSW Department of Environment, Climate Change & Water

OEH, (2003) *Threatened Species Information Darwinia biflora*, May 2003, NSW Department of Environment, Climate Change & Water, NSW National Parks & Wildlife Service.

OEH (2006), *Southern Brown Bandicoot Isoodon obesulus*, *Recovery Plan*, November 2006, Department of Environment & Climate Change, Sydney

OEH (2010), *Wildlife Atlas*, (search within 5km of AMG co-ordinates AMG(56) 340700 E and 6272300 N), Department of Environment Climate Change & Water, NSW National Parks & Wildlife Service, Hurstville.

Payne, R. (1997) *The Distribution and Reproductive Ecology of Syzygium paniculatum and Syzygium australe (Myrtaceae) in the Gosford-Wyong Region*. Unpublished Thesis prepared for the award of Masters of Natural Resources, University of New England. Armidale NSW.

Slater, P., Slater P. & Slater R. (1993) The *Slater field guide to Australian Birds*. Revised edition Reed New Holland.

Smith, J. & Smith, P. (2000) *Management Plan for Threatened Fauna & Flora in Pittwater*, prepared for Pittwater Council.

Swift Parrot Recovery Team (2000) Swift Parrot Recovery Plan 2000-2005, Department of Primary Industries, Water and Environment, Hobart.

Turner, V. & Ward, S.J. (2000), Eastern Pygmy Possum, pp217-218in *Mammals of Australia*. Ed. R Strahan, Australian Museum & Reed New Holland.

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25th September 2012

Mr Sam Mustaca
Vogue Agency
4 Vuko Place

WARRIEWOOD NSW 2102

Dear Mr Mustaca,

Re: 122 & 120 Mona Vale Road & 4 Boundary Street Warriewood– Comments Proposed Road Access Options 1 & 2 and Rezoning

In response to your request the following comments are made in relation to the proposed rezoning and subdivision and the Preferred Options 1 & 2 (GMU, 2012). Option 1 involves the provision of road access from Mona Vale Road and Option 2 involves the provision of road access from Jubilee Avenue.

The proposed rezoning and subsequent subdivision will result in construction of residential infrastructure and the creation of residential allotments. The residential infrastructure involves construction of roads, services and drainage as well as the provision of bushfire asset protection zones. To provide this infrastructure the vegetation and habitats will need to be modified and will result in the removal of individual trees, removal & modification of open forest bushland, removal & modification of partially cleared woodland/open forest, modification of drainage lines and removal of rural land.

Depending upon the preferred Option, the subject site potentially encompasses 6 allotment or portions of allotments being, 122 & 120 Mona Vale Road, 4 Boundary Street, part 10 Jubilee Avenue, Boundary Street road reserve, Mona Vale Road road reserve

Key Habitat features
The vegetation and habitats within the allotments potentially affected are generally described below.

122 & 120 Mona Vale Road contains approximately:
- 18,680 m^2 of open forest bushland;
- 11,570 m^2 of modified woodland /open forest, and
- remainder being residential or rural land.

4 Boundary Street contains approximately:
- 3,940 m^2 of open forest bushland:
- 290 m^2 of modified woodland /open forest, and
- remainder being developed or residential garden.

Part 10 Jubilee Avenue potentially affected by road works contains approximately:
- 4, 440 m^2 of open forest bushland:

Part Boundary Street road reserve potentially affected by road works contains approximately:
- 1,630 m^2 of open forest bushland;
- 870 m^2 of modified woodland /open forest,and
- remainder being road pavement of mown/slashed nature strip

part Mona Vale Road road reserve potentially affected by road works contains approximately:
- 1,910 m^2 of open forest bushland;
- 100 m^2 of modified woodland /open forest, and
- remainder being road pavement and slashed road verges

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project
concept site planning & ecological issues - 120 mona vale road, warriewood

drawing title
existing key habitat components, potentially affected areas and surrounding landuses

existing habitat components & potentially affected areas

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concept site planning & ecological issues - 120 mona vale road, warriewood

drawing title
existing key habitat components & potentially affected areas

Option 1- road access provided from Mona Vale Road

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project
concept site planning & ecological issues - 120 mona vale road, warriewood

drawing title
likely resultant habitat components subdivision concept - option 1

Option 2- road access provided from Jubilee Avenue

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project
concept site planning & ecological issues - 120 mona vale road, warriewood

drawing title
likely resultant habitat components subdivision concept - option 2

Subdivision proposal Option 1
The impact of Option 1 on the key habitat components is summarised in the following table.

Option 1 – Road Access Provided from Mona Vale Road				
Key habitat feature	**Existing**	**Retain**	**Modify** (asset Protection Zone)	**Remove**
Open Forest / Bushland (m^2)	30,600	10,270	8,970	11,360
Modified Open Forest / Woodland (m^2)	12,830	3,660		9,170
Narrabeen Creek (m)	230	230		
Minor drainage lines (m)	253	133		120

Subdivision proposal Option 2
The impact of Option 2 on the key habitat components is summarised in the following table.

Option 2 – Road Access Provided from Jubilee Avenue				
Key habitat feature	**Existing**	**Retain**	**Modify** (asset Protection Zone)	**Remove**
Open Forest / Bushland (m^2)	30,600	8,600	9,870	12,130
Modified Open Forest / Woodland (m^2)	12,830	3,660		9,170
Narrabeen Creek (m)	230	230		
Minor drainage lines (m)	253	102		151

Preferred Option
Based upon the information provided in the tables above, it is considered that Option 1, provision of road access from Mona Vale Road, would require the least removal and modification of native vegetation and habitats and therefore Option 1 is considered to be the preferred option from an ecological perspective.

Flora & Fauna Surveys and Impact Assessment

Currently 2 flora & fauna surveys have been carried out to date, these being:

- Ecological Site Analysis 120 & 122 Mona Vale Road (Footprint Green, 13/07/11), and
- Flora & Fauna Impact Assessment Proposed Private Road (Footprint Green, 29/01/10),

The Ecological Site Analysis (2011) covered the main body of the site and involved detailed flora and fauna surveys and a range of fauna survey techniques. In addition to this a habitat assessment and database / literature search were carried out to identify threatened flora and fauna that potentially occur on the site. Despite extensive field survey the Magenta Lillypilly (*Syzygium paniculatum)* and the Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis)* were the only threatened species recorded on the site.

To minimise the impacts on threatened species and the local ecology and to comply with the requirements of the Office of Water's guidelines (2011) The Ecological Site Analysis (2011) recommended the following site planning priorities are listed in order of importance:

- Retain the vegetation and habitats in the riparian areas (30m from top of bank) along Narrabeen Creek;
- Maximise the retention of other vegetation and habitats within the Open Forest area;
- Maximise the retention of vegetation and habitats in the lower gully line in the Disturbed Woodland & Scrubland;
- Maximise the retention of other areas of the Disturbed Woodland & Scrubland, and
- Maximise the retention of indigenous trees in the Open Paddocks & Infrastructure areas of the site.

In July 2012 the Office of Water amended its Guidelines for Riparian Corridors on Waterfront Land (2011) which had the affect of reducing the overall width of the riparian zone to a distance of 20m from the top of bank of Narrabeen Creek. In light of these amendments the first point in the recommendation in the Ecological Site Analysis (2011) should also be amended to incorporate:

- Retention of the vegetation and habitats in the riparian areas (20m from top of bank) along Narrabeen Creek.

Currently no impact assessment has been carried out on the proposed rezoning and subdivision however the Ecological Site Analysis (2011) highlights the threatened species that will need to be considered under Part 1 sec. 5A (assessment of significance) of the *Environmental Planning and Assessment Act 1979 (NSW).* The subject species requiring assessment are:

- Narrow-leaf Finger Fern (,*Grammitis stenophylla);*
- *Leptospermum deanei;*
- Magenta Lillypilly (*Syzygium paniculatum);*
- Glandular Pink-bell (*Tetratheca glandulosa);*
- Red-crowned Toadlet (*Pseudophryne australis);*
- Gang-gang Cockatoo (*Callocephalon fimbriatum);*
- Glossy Black-Cockatoo (*Calyptorhynchus lathami);*
- Barking Owl (*Ninox connivens);*
- Powerful Owl (*Ninox strenua);*
- Masked Owl (*Tyto novaehollandiae)*
- Eastern Pigmy-possum (*Cercartetus nanus);*
- Spotted-tailed Quoll (*Dasyurus maculates);*
- Southern Brown Bandicoot (*Isoodon obesulus);*
- Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis);*
- Eastern Freetail Bat (*Mormopterus norfolkensis);*
- Grey-headed Flying-fox (*Pteropus poliocephalus),* and
- Rosenberg's Goanna /Heath Monitor (*Varanus rosenbergi)*

Flora & Fauna Impact Assessment Proposed Private Road (29/01/10) was prepared separately and considered the impact of the proposed private road through part of 10 Jubilee Avenue and part of 4 Boundary Street.

This report involved detailed flora and fauna surveys and considered the impact of the construction of the road on threatened species. The report concluded that "based upon the assessment criteria outlined in Part 1, section 5A of the *Environmental Planning and Assessment Act 1979 (NSW)* it is considered that the proposed development will not have a significant impact on threatened species listed in the schedules of the *Threatened Species Conservation Act 1995 (NSW)* and the following recommendations were made:

- All trees not identified as being removed in the arboricultural report (Footprint Green, 2011) are to be retained and protected prior to and during construction;
- All vegetation with the exception of noxious and environmental weeds within 2m of the proposed development footprint is to be protected and retained prior to and during construction;
- All noxious and environmental weeds within 10m of the proposed works and within the works areas are to be removed using standard bush regeneration techniques;
- The nest / roosting boxes currently on the site are to be relocated to trees that are to be retained within the allotment known as 10 Jubilee Avenue;
- An additional 3 microchiropteran bat roosting boxes are to be installed in trees to be retained within the allotment known as 10 Jubilee Avenue;
- Subject to engineering designs where earthen road batters are constructed they shall be revegetated using species currently recorded on the site.

At this point in time no flora and fauna surveys and impact assessments have been carried out within the Open Forest / Bushland areas of 4 Boundary Street, nor within the Boundary Street road reserve and along the Mona Vale Road verge where infrastructure works are required including the establishment of asset protection zones. Based upon the vegetation types and habitats in these areas, the list of threatened species identified as requiring consideration in the Ecological Site Analysis 120 & 122 Mona Vale Road (13/07/11), is expected to be equally relevant in these areas.

Conclusion

Based upon the extent of key habitat features on the site and the potential areas affected it is considered that Option 1, provision of road access from Mona Vale Road, is the preferred option from an ecological perspective.

Whilst no impact assessment has been carried out, based upon the current land use and the flora and fauna surveys carried out to date, it is likely that some form of development on 122 & 120 Mona Vale Road and 4 Boundary Street can occur without having a significant impact on threatened species listed in the schedules of the *Threatened Species Conservation Act 1995 (NSW)* and the *Environment Protection & Biodiversity Act 1999 (Cwlth)*.

Yours sincerely

M.B. Couston

Mark Couston
Director & Principal Ecologist

Reference

Footprint Green (2010) *Flora & Fauna Assessment, Impact of Proposed Private Road for use by land known as 120 Mona Vale Road, Warriewood* 29th January 2010, Footprint Green Pty Ltd, Avalon Beach NSW

Footprint Green (2011) *Ecological Site Analysis 120 & 122 Mona Vale Road, Warriewood*, 13th July 2011, Footprint Green Pty Ltd, Avalon Beach NSW

Attachments

Plans on pages 2-5 of this report reproduced on A3 sheets

Building Code & Bushfire Hazard Solutions

(Pty. Limited) ABN 19057 337 774

PO Box 124 Berowra, NSW 2081
Telephone: 61 02 9456.2288 Facsimile: 61 02 9456.2277
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PLANET WARRIEWOOD
C/o Glendinning Minto and Associates
PO Box 225
Thornleigh NSW 2120

16th December 2005
Our Ref. 60189

Attention: Mr. Andrew Minto,

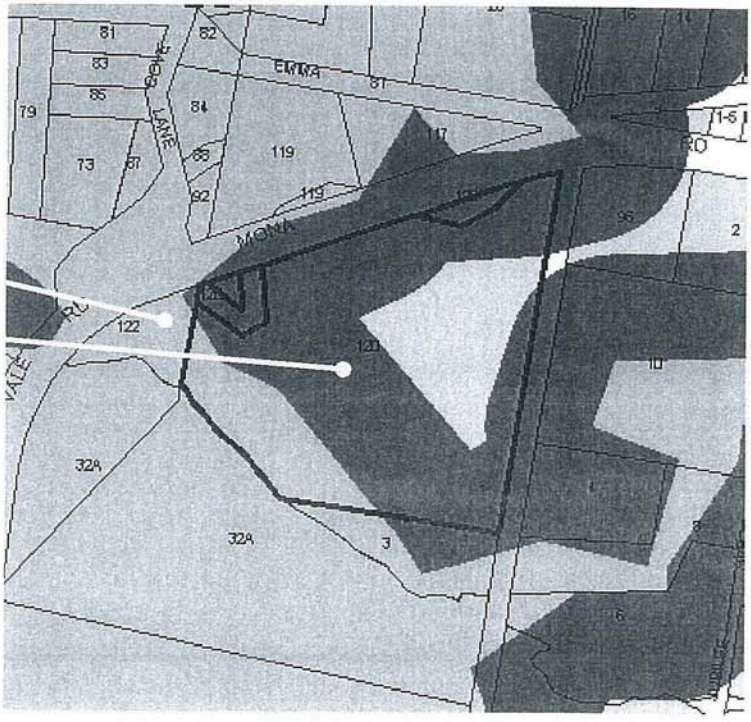
Re: INTEGRATED RESIDENTIAL DEVELOPMENT
Lot 1 DP 383009 & Lots 3, 4, 5 DP 124602
BUSHFIRE HAZARD ASSESSMENT PRELIMINARY COMMENT

We thank you for the opportunity of undertaking this assessment for you.

Properties considered to be affected by possible bushfire impact are determined from the local Bushfire Prone Lands Map as prepared by Council and or the Rural Fire Service that identify properties which contain designated Vegetation Category 1 or 2 or buffer zones associated with those Categories. All property development within affected areas are subject to the conditions detailed in the legislated document 'Planning for Bushfire Protection - 2001' (*PfBP*). Set back distances for the purpose of creating Asset Protection Zones (APZ's) may be required and any buildings must then conform to corresponding constructional requirements detailed in Australian Standard 3959 – 1999 'Construction of buildings in bushfire prone areas'.

In this instance the subject property is depicted on Councils Bushfire Prone Land Map as containing Category 1 Bushfire Prone Vegetation and its associated Buffer Zone.

Extract from Pittwater Councils Bushfire Prone Lands Map.



We understand that the proposal is to rezone the land for residential purposes and will ***not*** be subject to State Environmental Planning Policy (Seniors Living) 2004. The allotment borders Mona Vale Road to the North and Boundary Road to the East. A private residential property is adjacent part of the southern boundary and Warriewood Escarpment adjoins the remaining boundaries. The vegetation within Warriewood Escarpment and along Narrabeen Creek within the property was identified on site as being the potential bushfire source in this instance.

ASSET PROTECTION ZONES:

The average slope within any hazard and the type of vegetation determine the extent of Asset Protection Zones. The limiting factor will be that the Rural Fire Service does not support Asset Protection Zones on gradients greater than 18 degrees.

In this instance it is difficult to determine the interpretation of slope analysis that will be implied by the assessing officer at the Rural Fire Service. If we were to average the slope for 100 metres (strictly as per P*f*BP A2.3.3 Paragraph 1) from the ridge line the calculation would indeed indicate that the hazard was greater than 5 degrees upslope. This methodology ignores the 40 metres of vegetation along the slope down to Narrabeen Creek. If we were to assume that the slope for the first 40 metres was that that mostly influences a fires behavior (as per P*f*BP A2.3.3 Paragraph 2) then a 70 metre Asset Protection Zone would be required. This methodology ignores the short period the fire is traveling upslope and the fact that the majority of the hazard is upslope further west. In our analysis we have therefore assumed that a compromise between the two can put forward as part of any future DA and we recommend the creation of a 40 metre Asset Protection Zones along/from the ridge line and 20 metre Asset Protection Zones along the flanks of the ridge in the southern portion of the property.

Attachment 01 depicts the size and location of the Asset Protection Zones in green.

The requirements of any APZ that will apply to this development will depend heavily on any environmental constraints that may affect the extent to which clearing or management of the vegetation within the property can be undertaken. Should the vegetation within the property be reduced and or the ground fuels managed or removed then the requirements for APZ's could be reduced. If a geotechnical expert can provide supportive evidence that the ground fuels beyond the ridge line (on slopes greater than 18 degrees) can be removed and the area under scrubbed, and if a perimeter fire trail can be constructed below the ridgeline to enable access to this area for future management, then we feel that there may be cause to reduce the proposed Asset Protection Zones. The limiting factor will then be the location of a riparian zone associated with Narrabeen Creek. It is our experience that a 20 metre riparian zone may be enforced in this situation; however this will need to be confirmed with an ecologist and Council as the DA proceeds. Assuming a 20 metre riparian corridor then there will be 20 metres of fuel reduced area between the creek and the ridge line. This area could be considered an "Outer Protection Area" and may enable a reduction of the Asset Protection Zones to 20 metres.

Attachment 02 depicts the size and location of the Asset Protection Zones in green based upon these assumptions.

If, however, environmental constraints such as location of protected species (flora or fauna), larger riparian creek corridors, location of Aboriginal relics, or geotechnical issues due to gradients greater than 18 degrees prohibit vegetation management and or the under scrubbing of the area beyond the ridgeline then any development would be restricted to beyond 40 metres of the ridge line above Narrabeen Creek as detailed in attachment 01.

External to the site and north across Mona Vale Road is another area of forest that is mapped as bushfire prone land and the creation of Asset Protection Zones from this area is also warranted. These APZ would be 20 metres and can include the formed portion of Mona Vale Road and the cleared verge (NB. only 1 clear verge will exist for most of its length on the subject property side of Mona Vale Road). This area totals approximately 15 metres and therefore a 5 metre setback within the allotment along the length of Mona Vale Road is required.

CONSTRUCTIONAL REQUIREMENTS:

The minimum required APZ's determined from Table A2.2 are based upon the need to conform to Level 3 construction. Where the minimum APZ can be exceeded then the category of bushfire impact and the resultant construction Level can be determined from Table A3.3. In this instance and based upon Attachment 01 with 40 metre Asset Protection Zones the following will apply:

- The first row of dwellings adjacent or with direct line of sight to the ridgeline and Mona Vale Road will require Level 3 construction as detailed in AS3959 – 1999.
- Any other dwelling within 80 metres of the ridgeline or 50 metres from Mona Vale Road will require Level 2 construction as detailed in AS3959 – 1999.
- Any dwelling within 80 metres of Mona Vale Road will require Level 1 construction as detailed in AS3959 – 1999.

An abridged list of these construction considerations is attached to this statement. This detail is not critical during the rezoning process and can be addressed when a DA to construct the dwelling is put to Council. We will overlay the areas and construction levels on a plan for submission to Council in our report.

ACCESS PROVISIONS:

Planning for Bushfire Protection also addresses design considerations for access roads for properties determined to be bushfire prone. These restrictions are applicable to properties where the hazard is within or immediately adjacent to the development site.

As the hazard is within the subject property then access roads providing access to more than 4 dwellings should comply with the requirements for Public Roads and all other internal roads with the requirements for Property Access Roads as detailed within section 4.3 P*f*BP.

The RFS are currently in the process of reviewing these requirements and it is likely that main access roads can be reduced to 5.5 metre internal road infrastructure with passing bays and hardstand areas adjacent the hazard interface for parking fire fighting vehicles. Turning areas should be provided for and dead end roads should be minimised. At the minimum a perimeter road along the hazard interface will be required.

Although we have submitted repeated requests to the RFS for a detailed description of their current assessment process for access provisions they have not as yet released a list of their amended requirements. We have been informed that the release of this information is expected in the near future and will forward this to you as soon as it becomes available. The following lists are for the current information available only.

Public Roads (Providing access to more that 4 dwellings)

- Roads should be two-wheel drive, all weather roads;
- Roads should be two-way, that is, at least two traffic lane widths (8m minimum) with shoulders on each side, allowing traffic to pass in opposite directions;
- The perimeter road should be linked to the internal road system at an interval of no greater than 500 metres in urban areas;
- Restrict the use speed humps and chicanes to control traffic;
- Roads should be **through** roads. Dead end roads are not recommended, but if unavoidable, dead ends should be not more than 200m in length, incorporate a minimum 12m radius turning circle, and should be clearly sign posted as dead ends;
- The capacity of road surfaces and bridges should be sufficient to carry fully loaded firefighting vehicles (approximately 28 tonnes or 9 tonnes per axle);
- Curves should have a minimum inner radius of 6m and be minimal in number to allow for rapid access and escape;
- The minimum distance between inner and outer curves should be 6m;
- Maximum grades should not exceed 15° and preferably not more than 10° or gradient specified by road design standards, whichever is the lesser gradient;
- There must be a minimum vertical clearance to a height of 6 metres above the road at all times;
- Roads should provide sufficient width to allow firefighting vehicle crews to work with firefighting equipment about the vehicle.
- Roads should be clearly sign-posted (with easily distinguished names) and buildings should be clearly numbered. Bridges should clearly indicate load rating;
- Roads should have a minimum total reserve width
of 20m where they are a perimeter road as defined in section 4.2.2(c) of this document; and
- Roads should not traverse through a wetland or other land potentially subject to periodic inundation

Property Access Roads (and other internal roads)

- A minimum trafficable width of 4m with an additional 1m wide strip on each side of the road kept clear of bushes and long grass.
- The road should have a passing bay about every 200m where possible, which should be 20m long by 3m wide, making a minimum trafficable width of 7m at the passing bay.
- The capacity of road surfaces and bridges should be sufficient to carry fully loaded firefighting vehicles (approximately 28 tonnes or 9 tonnes per axle).
- A minimum vertical clearance of 6m to any overhanging obstructions, including tree branches.
- Curves should have a minimum inner radius of 6m and be minimal in number to allow for rapid access and escape.
- The minimum distance between inner and outer curves should be 6m.
- Maximum grades should not exceed 15° and preferably not more than 10°.
- Roads should provide sufficient width to allow firefighting vehicle crews to work with firefighting equipment about the vehicle.
- Dwellings not sited within 200m of the road system should have an alternative access road providing emergency egress to the through road system; and
- Roads should be clearly sign-posted. Bridges should clearly indicate load rating.

Fire Trails

- Where a fire trail forms part of the Inner Protection Area it must be constructed to the specifications outlined in section 4.2.2(c) property access roads.
- A minimum trafficable width of 4m with an additional 1m wide strip on each side of the road kept clear of bushes and long grass.
- A maximum grade of 15°.
- A minimum clearance of 6m to any overhanging obstructions, including tree branches.
- The road should have the capacity for passing either by:
    1. reversing bays using the access to properties to reverse fire tankers, which are 6m wide and 8m deep to any gates with an inner minimum radius of 6 m and outer minimum radius of 12m; and/or
    2. a passing bay about every 200m, which is 20m long by 3m wide, making a minimum trafficable width of 7m at the passing bay.
- Appropriate drainage and erosion controls;
- A fire trail system which is connected to the property access road and/or to the through road system at frequent intervals;
- Must be maintained in a serviceable condition by the owner of the land;
- Fire trails should not traverse through a wetlands or other land potentially subject to periodic inundation;
- Must be trafficable under all weather conditions; and
- Trail should be inspected annually by authorities.

At the time of subdivision, if fire trails are part of the development then the fire trails should be under council administration to ensure that maintenance occurs. From time to time this may not be possible in which case they can occur as easements and rights of way over private land.

SERVICES:

Hydrants will be required to be installed throughout the property as part of the supply of services to the site. The installation of hydrants should be in accordance with AS2419. All hydrants must be installed on the pavement side of a road and not in the roadway. Your hydraulic engineer should consider these requirements as part of the future design.

MOVING FORWARD:

In summary it is important for an environmental investigation of this site to be undertaken prior to any definitive requirements on Asset Protection Zones being made along the ridge line. This assessment must be considered along with geotechnical issues and the extent to which cut and fill or management of the area north of the ridge line can occur. Some relaxation of the APZ depicted on Attachment 01 may be applicable to this aspect.

It may be beneficial to undertake pre-lodgment negotiations with the RFS regarding the assessment methodology of slope analysis across Narrabeen Creek as the required APZ are based upon this slope determination. Without an active DA it is difficult to undertake these negotiations however we can persue this avenue if considered necessary.

Any future survey work should include an accurate marking of the ridge line to enable accurate plotting of the APZ's. We could meet on site with necessary parties and highlight points of interest if necessary. Alternately we could overlay a GPS plot of the ridgeline onto the existing plan using standard GPS equipment and OzeExplore mapping Software and we can provide you with a costing to complete this work if requested. It must be remembered that this technique, while relatively accurate and proven useful in the past, is not as accurate as experienced surveyors work.

CONCLUSION:

Residential development within the property is possible and can comply with the legislated requirements of Planning for Bushfire Protection – 2001 with respect to bushfire mitigation matters. The application for rezoning to allow resident use should therefore receive concurrence from the NSW Rural Fire Service.

Should you have any further questions regarding this project at this stage please do not hesitate to contact myself at this office.

Yours faithfully,
Building Code & Bushfire Hazard Solutions P/L

Wayne Tucker Wayne Tucker for

David McMonnies M. I. Fire E; M Cons Mgt.
F: 60189 Warriewood residential subdivision – Comment