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REF. NO.

VOLUME 1 REZONING REPORT MASTERPLAN

AND

STATEMENT OF ENVIRONMENTAL EFFECTS TO ACCOMPANY AN APPLICATION FOR SUBDIVISION OF

**LOT 3 SEC.F D.P.11784
LOTS 74,79,83,84,85 SEC.B D.P.11784**

**INGLESIDE ROAD
INGLESIDE**

Prepared for
Department of Infrastructure, Planning & Natural Resources

Ref. No.8566-04-Vol.1

October 2004

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1. INTRODUCTION

The Rezoning and Statement of Environmental Effects Report relates to the proposed rezoning of land at Ingleside Road, Ingleside which is owned by The Minister Administering the Environmental Planning and Assessment Act (referred to as DIPNR land in this report. DIPNR -being Department of Infrastructure, Planning & Natural Resources). The subject land is described as Lot 3 Sec.F D.P.11784 and Lots 74,79,83,84,85 Sec. B D.P.11784 as shown on Figures 1 & 2.

The proposed rezoning will provide for the subdivision of part of the subject land including the creation of 1 new rural residential allotment and a large residue lot to be acquired by Pittwater Council for Community/Open Space use as detailed in Section 6 of the report and illustrated in the Draft LEP Amendment (see **Appendix A and Figures 5 & 6**).

The proposed subdivision (**Figure 6**) includes the creation of a Right of Way across proposed Lot 1 favouring proposed Residue Lot 2. As shown on **Figure 6** proposed Lot 2 is subject to an existing Easement for Water Main 5 wide, the proposed Right of Way to be created ensures adequate access is available for the residue lot without impacting upon the existing water main.

In addition, the Draft LEP amendment will allow for the construction of a single dwelling on each of the five existing rural residential lots fronting Ingleside Road currently owned by DIPNR (i.e. Lots 74,79,83,84,85 Sec.B D.P.11784). A dwelling on each of the existing lots is in character and consistent with dwelling rights on existing adjoining privately owned rural residential lots.

This report examines the characteristics of the subject property, the nature of the surrounding locality, the current and proposed zoning of the land and details of the proposed development of the site. The report then provides a discussion as to why the rezoning of the site is appropriate and discusses the matters for consideration under Section 79C of the Environmental Planning and Assessment Act 1979 (as amended).

Source Reference

Ingham Planning prepared a detailed Environmental Assessment and application over the subject land dated December 2003 for DIPNR. The current application, also for DIPNR, is a less intensive development proposal however much of the site specific research is applicable to both the original and current proposal. The format for this report is based on the Ingham Planning's Report with sections directly reproduced with Ingham Planning's permission. With the exception of the Aboriginal Archaeological Assessment all expert report appendices have been redone to recognise the current proposal.

2. THE SITE

The site is located on the northern fringe of the Sydney metropolitan urban region in an area that is characterised by a mix of urban and semi-rural land uses. A location plan is at **Figure 1**.

The land to which the rezoning application relates encompasses the following land parcels (refer **Figure 2 – (The Subject Property)**);

Lot 3 Sec.F D.P.11784

Lots 74,79,83,84,85 Sec.B D.P.11784

The site includes a large tract of vegetated escarpment land to the south of the existing Ingleside Park land (lot 35 D.P.11784) and to the north of the Uniting Church's Elanora Conference Centre site located behind residential properties fronting Wesley Street, Elanora Heights.

The vegetation of the subject property is a mix of open forest, scrub, heath and cleared/disturbed land with weedy areas, particularly at the edges with adjoining developed land.

As illustrated in **Figure 3 – Aerial Photo & Figure 6 – Survey** the DIPNR land is relatively flat at the upper (western) end, sloping gently to the east until it reaches a broken escarpment approximately 50 to 60 metres from the rear of the existing rural residential lots fronting Ingleside Road. Elevations range from about 102 AHD to 90m AHD at the escarpment edge, and thence down to 75 to 80 AHD at the bottom of the escarpment. The land continues to fall below the escarpment to the Warriewood Valley and consists of open forest vegetation with tall, mature trees and moderately dense understorey. Rock outcrops are common in the escarpment area, and occur sporadically throughout the subject site.

An existing access track extends along the northern boundary of the site from Ingleside Road providing access to the relatively gentle sloping land at the rear of the rural residential properties fronting Ingleside Road. The relatively level land in this area of the site is generally covered with low lying scrub vegetation.

Location



FIGURE 1



Scale
1: 19,000

Source
- UBD
- Ingham Planning

Drummond Parmenter Pty Ltd

Subject Property

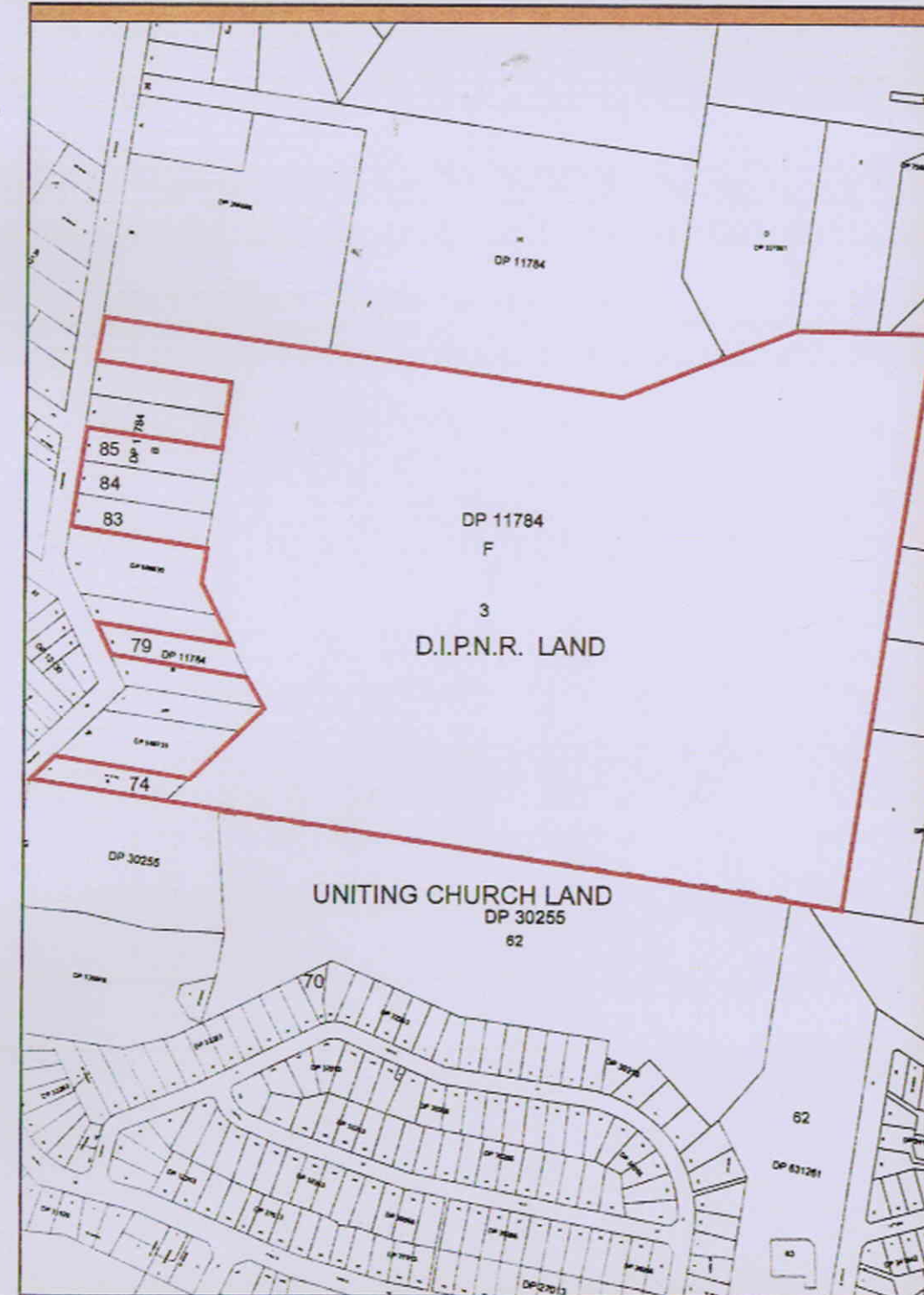


FIGURE 2



Scale
1: 6,000

Source
- Ingham Planning

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Title Search

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LAND AND PROPERTY INFORMATION NEW SOUTH WALES - TITLE SEARCH

FOLIO: 3/F/11784

SEARCH DATE	TIME	EDITION NO	DATE
20/10/2004	8:58 AM	1	4/1/2002

LAND

LOT 3 OF SECTION F IN DEPOSITED PLAN 11784
LOCAL GOVERNMENT AREA: PITTWATER
PARISH OF NARRABEEN COUNTY OF CUMBERLAND
TITLE DIAGRAM: DP11784

FIRST SCHEDULE

THE MINISTER ADMINISTERING THE ENVIRONMENTAL PLANNING &
ASSESSMENT ACT

(T 8236968)

SECOND SCHEDULE (2 NOTIFICATIONS)

1. RESERVATIONS AND CONDITIONS IN THE CROWN GRANT(S)
2. 5844213 EASEMENT FOR WATER SUPPLY WORK AFFECTING THE PART
SHOWN AS EASEMENT FOR WATERMAIN 5 WIDE AND VAR. IN
DP637078

NOTATIONS

UNREGISTERED DEALINGS: NIL

*** END OF SEARCH ***

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DX.

Title Search

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LAND AND PROPERTY INFORMATION NEW SOUTH WALES - TITLE SEARCH

FOLIO: 74/B/11784

SEARCH DATE	TIME	EDITION NO	DATE
20/10/2004	8:58 AM	1	1/8/1995

LAND

LOT 74 OF SECTION B IN DEPOSITED PLAN 11784
LOCAL GOVERNMENT AREA: PITTWATER
PARISH OF NARRABEEN COUNTY OF CUMBERLAND
TITLE DIAGRAM: DP11784

FIRST SCHEDULE

MINISTER ADMINISTERING THE ENVIRONMENTAL PLANNING AND
ASSESSMENT ACT, 1979

(DD 0421595)

SECOND SCHEDULE (1 NOTIFICATION)

1. RESERVATIONS AND CONDITIONS IN THE CROWN GRANT(S)

NOTATIONS

UNREGISTERED DEALINGS: NIL

*** END OF SEARCH ***

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Title Search

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LAND AND PROPERTY INFORMATION NEW SOUTH WALES - TITLE SEARCH

FOLIO: 79/B/11784

SEARCH DATE -----	TIME -----	EDITION NO -----	DATE -----
20/10/2004	8:58 AM	1	1/8/1995

LAND

LOT 79 OF SECTION B IN DEPOSITED PLAN 11784
LOCAL GOVERNMENT AREA: PITTWATER
PARISH OF NARRABEEN COUNTY OF CUMBERLAND
TITLE DIAGRAM: DP11784

FIRST SCHEDULE

MINISTER ADMINISTERING THE ENVIRONMENTAL PLANNING AND
ASSESSMENT ACT 1979

(DD 0421647)

SECOND SCHEDULE (1 NOTIFICATION)

1. RESERVATIONS AND CONDITIONS IN THE CROWN GRANT(S)

NOTATIONS

UNREGISTERED DEALINGS: NIL

*** END OF SEARCH ***

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LAND AND PROPERTY INFORMATION NEW SOUTH WALES - TITLE SEARCH

FOLIO: 83/B/11784

SEARCH DATE -----	TIME -----	EDITION NO -----	DATE -----
20/10/2004	8:58 AM	1	1/8/1995

LAND

LOT 83 OF SECTION B IN DEPOSITED PLAN 11784
LOCAL GOVERNMENT AREA: PITTWATER
PARISH OF NARRABEEN COUNTY OF CUMBERLAND
TITLE DIAGRAM: DP11784

FIRST SCHEDULE

MINISTER ADMINISTERING THE ENVIRONMENTAL PLANNING AND
ASSESSMENT ACT 1979

(DD 0421646)

SECOND SCHEDULE (1 NOTIFICATION)

1. RESERVATIONS AND CONDITIONS IN THE CROWN GRANT(S)

NOTATIONS

UNREGISTERED DEALINGS: NIL

*** END OF SEARCH ***

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Title Search

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LAND AND PROPERTY INFORMATION NEW SOUTH WALES - TITLE SEARCH

FOLIO: 84/B/11784

SEARCH DATE	TIME	EDITION NO	DATE
-----	-----	-----	-----
20/10/2004	8:58 AM	1	1/8/1995

LAND

LOT 84 OF SECTION B IN DEPOSITED PLAN 11784
LOCAL GOVERNMENT AREA: PITTWATER
PARISH OF NARRABEEN COUNTY OF CUMBERLAND
TITLE DIAGRAM: DP11784

FIRST SCHEDULE

MINISTER ADMINISTERING THE ENVIRONMENTAL PLANNING AND
ASSESSMENT ACT 1979

(DD 0421646)

SECOND SCHEDULE (1 NOTIFICATION)

1. RESERVATIONS AND CONDITIONS IN THE CROWN GRANT(S)

NOTATIONS

UNREGISTERED DEALINGS: NIL

*** END OF SEARCH ***

Information Provided Through
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Title Search

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LAND AND PROPERTY INFORMATION NEW SOUTH WALES - TITLE SEARCH

FOLIO: 85/B/11784

SEARCH DATE	TIME	EDITION NO	DATE
20/10/2004	8:59 AM	1	1/8/1995

LAND

LOT 85 OF SECTION B IN DEPOSITED PLAN 11784
LOCAL GOVERNMENT AREA: PITTWATER
PARISH OF NARRABEEN COUNTY OF CUMBERLAND
TITLE DIAGRAM: DP11784

FIRST SCHEDULE

MINISTER ADMINISTERING THE ENVIRONMENTAL PLANNING AND
ASSESSMENT ACT, 1979

(DD 0421618)

SECOND SCHEDULE (1 NOTIFICATION)

1. RESERVATIONS AND CONDITIONS IN THE CROWN GRANT(S)

NOTATIONS

UNREGISTERED DEALINGS: NIL

*** END OF SEARCH ***

3. SURROUNDING ENVIRONMENT

The surrounding locality of the site is on the fringe of the Sydney metropolitan region where, like other fringe areas, there are a variety of urban and semi-rural or rural interests often competing for the planning and use of the land. In the case of Ingleside, the interests include uses such as horticulture, rural residential or residential use, light industry, commercial, public works related uses, recreational purposes.

To the north

The Westpac Training College is located immediately adjoining the subject land to the north along with land zoned Existing Recreation and known as Ingleside Park. Further to the north is land which forms part of the Warriewood Escarpment and which has been recently rezoned to 7(a) Environmental Protection.

To the south

The southern boundary of the subject site adjoins land owned by the Uniting Church in Australia known as the Elanora Conference Centre site. A rezoning and development application for this site has been lodged to Council.

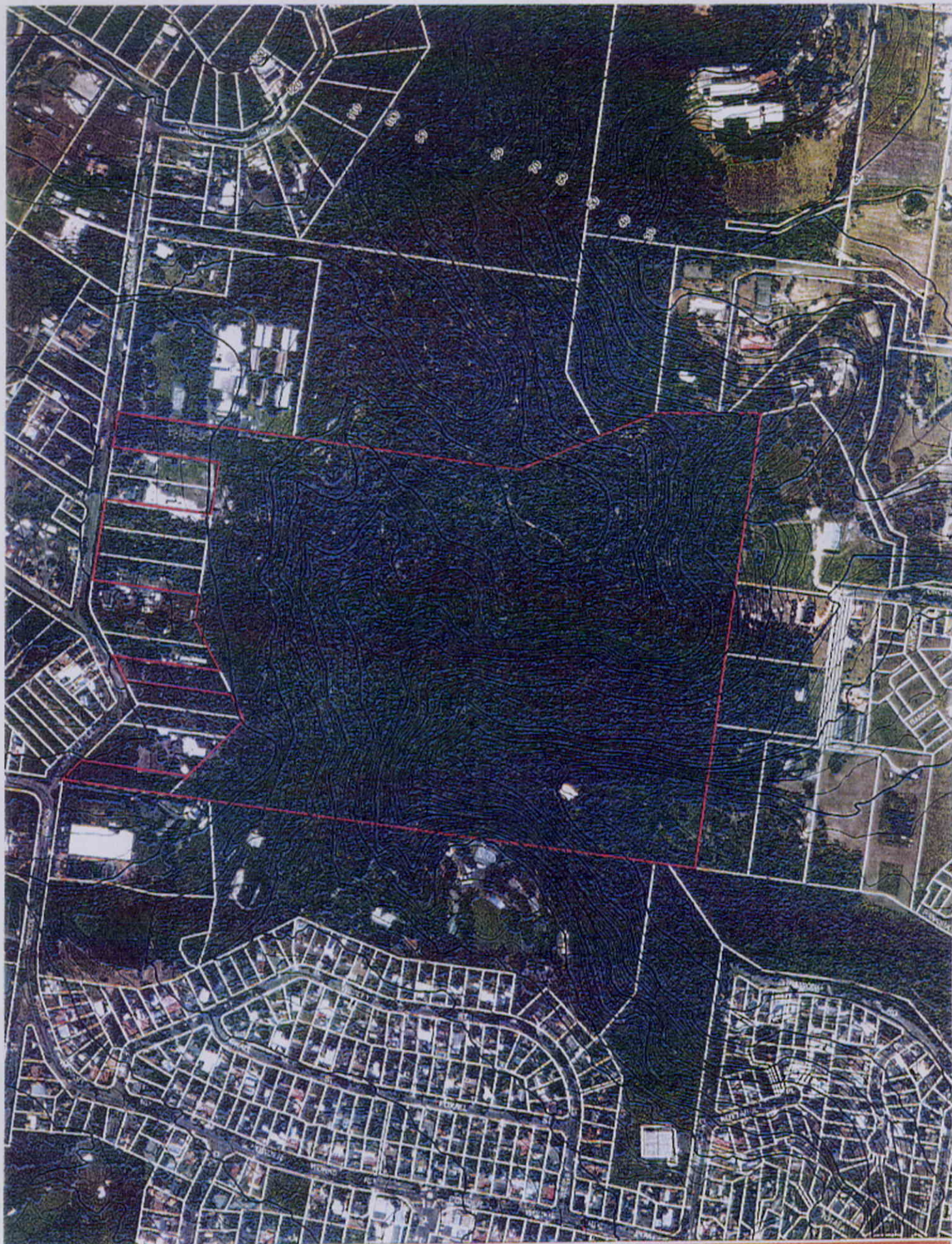
The southern boundary of the Conference Centre site is common with the rear boundary of residential allotments that front Wesley Street. These allotments are standard low density residential allotments and are all developed with dwelling houses. Land further to the south includes the residential suburb known as Elanora Heights.

To the east

Is vacant bushland in private ownership. Further to the east of the site is development within Warriewood Valley along with the Elanora Park Tennis Club, Epworth Park and a recreation reserve that encompasses the Mullet Creek tributary and extends behind the Seaside Retirement Village and Nursing Home that fronts Garden Street, Warriewood.

To the west

Land to the west of the subject property generally encompasses rural residential allotments that front Ingleside Road, Power Works Road, McLean Street and Wattle Road.



Aerial photography - March 2002.
This plan is not survey accurate.
Contour Interval - 2m

DIPNR Ingleside

AERIAL PHOTO



N

FIGURE 3

Scale
1:6,000

Source - Ingham Planning

Drummond Parmenter Pty Ltd

4. ZONING AND DEVELOPMENT CONTROLS

4.1 Pittwater Local Environmental Plan 1993

The site is currently zoned 1(a) (Non-Urban "A") under the provisions of Pittwater Local Environmental Plan 1993 (see **Figure 4 – Current Zoning**).

The zoning table of the Pittwater LEP 1993 states the following in respect to this zone:

"Zone No.1(a) (NON-URBAN "A")

1. Without development consent

Agriculture (other than pig-keeping or poultry farming); forestry.

2. Only with development consent

Any purpose other than a purpose for which development may be carried out without development consent or a purpose for which development is prohibited.

3. Prohibited

Boarding-houses; bulk stores; car repair stations; commercial premises (other than animal training or boarding establishments, caravan parks, veterinary clinics or riding schools); dwelling-houses; heliports; industries (other than rural industries; home industries; extractive industries or industries directly associated or connected with, or dependant upon, extractive industries); junk yards; motor showrooms; recreation establishments; residential flat buildings; shops; warehouses."

4.2 Urban Land Release (Draft Planning Strategy)

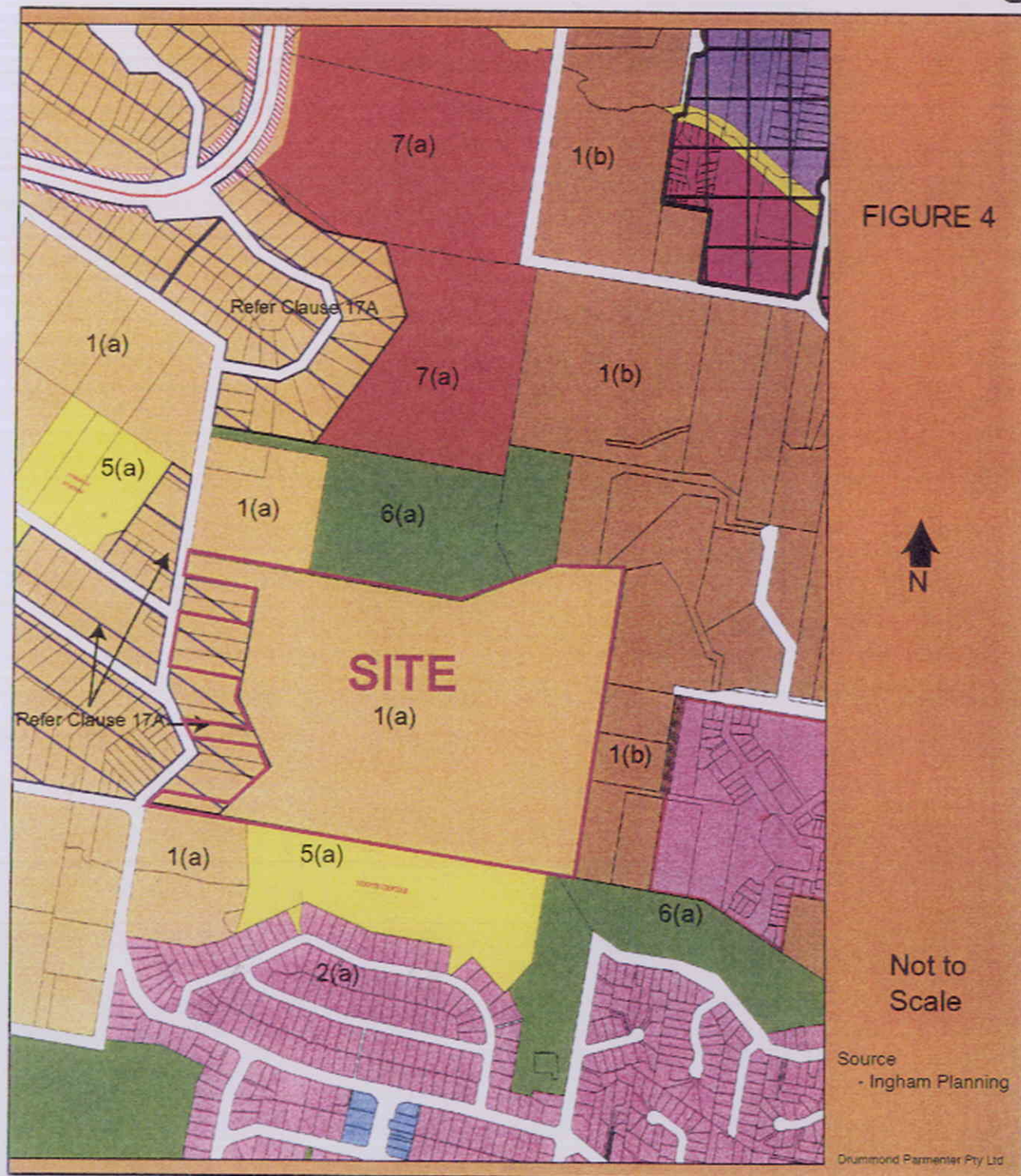
In late 1991, the Minister of Planning made the decision to include land at Ingleside and Warriewood within the State Government's Urban Development Program. With the advent of Pittwater Council, the Minister for Planning advised that the Council was to be the authority responsible for the management of the land release.

In order to achieve a co-ordinated approach, Pittwater Council formed the Ingleside/Warriewood Land Release Advisory Committee to discuss issues related to the investigations, planning and implementation of the land release process. This Committee comprised Pittwater Councillors, staff and representatives of relevant State Government departments and authorities. A Residents Consultative Committee was also formed to allow for resident participation in the planning process.

The draft Planning Strategy for the Ingleside/Warriewood Urban Land Release Area is the outcome of the comprehensive planning process undertaken and draws together all the studies and investigations undertaken with respect to the land.

The main purpose of the draft Planning Strategy was to identify what land within the release area is suitable for urban development, or other land uses including conservation, and at what levels and densities that urban development should occur. The draft Planning Strategy therefore identifies on a broad scale basis those parts of the Ingleside/Warriewood area that are suitable for development. Alternatively, the strategy also identifies that land which should be conserved and managed to preserve its environmental characteristics.

Current Zoning



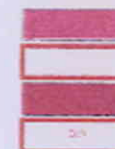
1. NON-URBAN

- 1(a) (Non-Urban "A")
- 1(a1) (Non-Urban "A1")
- 1(b) (Non-Urban "B")
- 1(c) (Non-Urban "C")



2. RESIDENTIAL

- 2(a) (Residential "A")
- 2(b) (Residential "B")
- 2(e) (Residential "E")
- 2(f) (Urban Purposes - Mixed Residential)



3. BUSINESS

- 3(a) (General Business "A")
- 3(b2) (Service Business "B2")
- 3(b3) (Waterfront Business "B3")
- 3(c) (Neighbourhood Business "C")
- 3(d) (Automotive Business "D")
- 3(e) (Office Business "E")



4. INDUSTRIAL

- 4(b) (Light Industrial "B")
- 4(b1) (Light Industrial "B1")



5. SPECIAL USES

- 5(a) (Special Uses "A")



6. OPEN SPACE

- 6(a) (Existing Recreation "A")
- 6(a1) (Waterways Recreation)
- 6(b) (Private Recreation "B")
- 6(c) (Proposed Recreation)
- 6(d) (National Park and State Recreation Area)



7. ENVIRONMENTAL PROTECTION

- 7(a) (Environmental Protection "A")
- 7(a1) (Environment Protection - Waterways)



9. RESERVATIONS

- 9(a) (Reservation - Open Space)
- 9(b) (Reservation - County Open Space)
- 9(c) (Local Road Reservation)
- 9(d) (Arterial Road Reservation)



10. WATERWAYS

- W2 (Residential Waterways)
- W3 (Recreational Boating Facilities)
- W4 (Business Boating Facilities)



11. PLEP 1993 - CLAUSES

- Clause 17A
- Clause 47



5. PROPOSED REZONING

5.1 Overview of Existing 1(a) (Non Urban "A") Zone at Ingleside

The zoning table of the Zone 1(a) Non-Urban "A" zone states the following:

"ZONE No. 1(a) (NON-URBAN "A")

1. Without development consent

Agriculture (other than pig-keeping or poultry farming); forestry

2. Only with development consent

Any purpose other than a purpose for which development may be carried out without development consent or a purpose for which development is prohibited.

3. Prohibited

Boarding-houses; bulk stores; car repair stations; commercial premises (other than animal training or boarding establishments, caravan parks, veterinary clinics or riding schools); dwelling-houses; heliports; industries (other than rural industries; home industries; extractive industries or industries directly associated or connected with or dependant upon, extractive industries); junk yards; motor showrooms; recreation establishments; residential flat buildings; shops; warehouses."

Clause 12 of Pittwater LEP 1993 relates to subdivision in non-urban zones. Sub-clause 2 states that a person shall not subdivide land within the 1(a) Non-Urban A zone unless the area of each allotment to be created is not less than 2 hectares.

In accordance with the above provision, the development of up to 13 x 2 hectare lots is permissible under the existing zoning for that part of the DIPNR land being Lot 3 Sec. F D.P.11784.

A special clause is proposed to permit the subdivision of the developable portion of the DIPNR land into one lot of 4,000 square metres or more in area.

While the land use table prohibits the construction of dwelling houses on land zoned 1(a) Non Urban A, **Clause 17 and 17A** allow for the construction of dwelling houses in certain circumstances.

These clauses state as follows:

"Dwelling-houses in Zone No.1(a), 1(a1), 1(b) or 1(c)

- 17 (1) *Except as provided by this clause, the erection of a dwelling-house on land within Zone No.1(a), 1(a1), 1(b) or 1(c) is prohibited.*
- (2) *A person may, without the consent of the council, erect a dwelling-house on an allotment of land within Zone No.1(a), 1(b) or 1(c) where the allotment-*
- (a) *was created by a subdivision which was not prohibited under clause 12;*
- (b) *is 4,000 square metres or more in area and was lawfully created prior to 13 August 1982;*
- (c) *was otherwise lawfully created before the commencement of this clause;*
- (d) *is not within that part of Zone No.1(a) shown hatched blue on the map, except as provided for in clause 17A; or*
- (e) *is not land to which clause 13 or 14 applies.*
- (3) *A person may, but only with the consent of the council, erect a dwelling-house on a parcel of land within Zone No.1(a1) which has an area of at least 20 hectares.*
- (4) *A person may, but only with the consent of the council, erect a dwelling-house on an existing parcel of land within Zone No.1(a1) having an area of less than 20 hectares but not less than 2 hectares.*
- (5) *Except as provided by subclause (6), for the purpose of subclause (4), "existing parcel of land" includes all adjacent or adjoining land held in the same ownership on 8 March 1974:*
- (6) *Subclause (5) does not apply with respect to any parcel of land within that land known as Portion 80, Parish of Narrabeen, and in existence on 8 March 1974.*
- (7) *A person may, but only with the consent of the council, erect a dwelling-house on an allotment created as a result of a subdivision referred to in clause 13 or 14."*

Specifically in regard to the existing rural residential lots in Ingleside, Clause 17A states as follows:

"Dwelling-houses on certain land at Ingleside

- 17A (1) *This clause applies to that land at Ingleside within that part of Zone No.1(a) shown hatched blue on the map and identified in Schedule 12.*
- (2) *Notwithstanding any other provision in this plan, a person may, with the consent of the council, erect a dwelling-house on land to which this clause applies.*
- (3) *The council shall not grant consent to development for the purposes of a dwelling-house unless:*
- (a) satisfactory provision has been made with the Water Board for the supply of water; and*
 - (b) satisfactory provision has been made with the Water Board for the disposal of stormwater and sewage; and*
 - (c) in the opinion of the Council adequate vehicular access is available.*
- (4) *The council shall not grant consent to the carrying out of development unless the consent includes a condition requiring that development is not to commence unless satisfactory arrangements have been made for obtaining a Section 73 compliance certificate from the Sydney Water in relation to the provision, adjustment or amplification of water, sewerage of stormwater systems, as required by that Corporation."*

5.2 Proposed Rezoning

5.2.1 Developable Land

The intention of the proposed rezoning of land is to allow subdivision of part of the subject land into one 4,000 square metre rural residential allotment (Lot.1) with a single large residual allotment (Residual Lot.2) as detailed in Section 7 of this report and illustrated in the **Figure 6**.

It is proposed that the developable portion of the DIPNR land be rezoned Non-Urban 'A' 1(a) under the provisions of the Pittwater Local Environmental Plan 1993 to allow for the rural residential development of the land in Ingleside in a manner consistent with adjoining land. The residue Lot.2 is to be rezoned 7(a) Environmental Protection under the provisions of the Pittwater Local Environmental Plan 1993 to protect the large tract of valuable escarpment land on the site. The proposed rezoning is illustrated in a map accompanying the Draft LEP Amendment (see **Appendix A – Draft LEP Amendment**)

As outlined in Section 7 of this report, the proposed rezoning of the land is intended to provide for the subdivision of undeveloped land into one new rural residential lot (Lot.1

Figure 6. A single dwelling house is to be permitted to be constructed on the new lot. Two special clauses are proposed to be included within the provisions of the LEP to allow for the intended development of the subject sites.

The new clauses are outlined below:

"Subdivision of certain land at Ingleside Road, Ingleside

- 15C (1) This clause applies to the land at Ingleside Road, Ingleside within that part of Zone No.1(a) shown edged heavy black on the map identified as Pittwater Local Environmental Plan 1993 (Amendment No.)
- (2) Notwithstanding any other provision in this plan, a person may, with the consent of council, subdivide the land to which this clause applies so as to create one new allotment with an area of at least 4,000 square metres.

"Development of certain land at Ingleside Road, Ingleside

- "17C (1) Notwithstanding any other provision in this plan, a person may, with the consent of council, erect a dwelling house on the lot created as a result of a subdivision referred to in clause 15C.
- (2) The council shall not grant consent to development for the purposes of a dwelling-house unless:
- (a) satisfactory provision has been made with Sydney Water for the supply of water; and
 - (b) in the opinion of the Council adequate vehicular access is available; and
 - (c) in the opinion of the Council adequate provision has been made for stormwater management, water quality control and effluent control
 - (d) in the opinion of Council adequate provision has been made for bush fire management.

5.2.2. Existing Rural Residential Lots fronting Ingleside Road

In addition, the Draft LEP amendment will allow for the construction of a single dwelling on each of the five existing undeveloped rural residential lots fronting Ingleside Road Ingleside currently owned by DIPNR.

Clause 17(A) of Pittwater LEP 1993 provides for the construction of dwelling houses on existing rural residential lots in Ingleside. Subclause (1) states that:

- "(1) This clause applies to that land at Ingleside within that part of Zone No.1(a) shown hatched blue on the map and identified in Schedule 12."*

While the existing DIPNR owned undeveloped lots fronting Ingleside Road are illustrated with blue hatching on the zoning map the individual lots are not identified within Schedule 12 of the Pittwater LEP 1993.

The Draft LEP Amendment proposes to include reference to Lots 74, 79, 83, 84, 85 Section B DP.11784 within Schedule 12 of the LEP.

5.2.3. Residue Lot 2 – DIPNR Land

This large tract of heavily vegetated escarpment land has an area of approximately 26.6 hectares and is proposed to be rezoned **7(a) Environmental Protection "A"** under the provisions of the Pittwater Local Environmental Plan 1993.

The zoning table of the Zone 7(a) Environment Protection 'A' zone states the following:

"ZONE No.7(a) (ENVIRONMENTAL PROTECTION "A")

1. Without development consent

Nil

2. Only with development consent

Drainage; landscaping; passive public recreation; utility installations.

3. Prohibited

Any purpose other than a purpose for which development may be carried out only with development consent."

5.3 Residual Lot 2 to be acquired by Pittwater Council

Subject to the rezoning and development consent for the proposed subdivision detailed in Section 6 of this report, it is intended that the residue Lot 2, having an area of approximately 26.6ha, will be acquired by Pittwater Council.

The rezoning and transfer of this large tract of vegetated land will complete the protection of the Warriewood Escarpment from Mona Vale Road in the north to the Uniting Church Conference Centre in the south.

The Draft LEP Amendment will make provision for the classification of the residue Lot 2 to 'community' land.

The proposed rezoning, classification and subdivision of developable land will result in a net increase of about 26.6 hectares of community land that comprises relatively undisturbed open woodlands, native fauna habitat and with high visual scenic value as part of the Warriewood Escarpment.

6. MASTERPLAN & PROPOSED SUBDIVISION

The new zoning will allow for the rural residential subdivision of part of the land in accordance with the environmental opportunities and constraints of the land. A Masterplan Concept Plan has been developed to illustrate the intended development of the DIPNR land. (see **Figure 5 – Masterplan Concept Plan**).

The Masterplan Concept Plan provides for one new rural residential lot with Ingleside Road frontage and provides the opportunity for a dwelling on each of the five existing DIPNR owned lots fronting Ingleside Road (74,79,83,84,85)

The proposed subdivision of the DIPNR land, as detailed in Volume II of this report, is the subject of a development application lodged concurrently with this rezoning application to Pittwater Council for the creation of one rural residential allotment (Lot 1) with area of 4,000 square metres and residue (Lot 2) Environmental Protection lot with area of about 26.6ha (see **Figure 6 – Proposed Subdivision**).

It must be noted that without the proposed rezoning and subdivision, the existing zoning of the larger DIPNR owned lot (Lot 3 Sec. F D.P. 11784) allows for up to 13 x 2 hectare lots with no requirement for allotments to be connected to existing sewer facilities. It is clear that the proposed development will result in a subdivision that is more sympathetic with the surrounding locality and natural qualities of the land than what is permissible under the current planning controls for the land. The proposal also creates the opportunity to preserve about 26.6ha of environmentally sensitive land in its natural state.



FIGURE 5
MASTER PLAN

IMPORTANT NOTES AND CAUTIONS

THESE NOTES FORM AN INTEGRAL PART OF THIS PLAN
CONTOURS HAVE BEEN PARTLY COMPILED
WHERE LEVELS ARE CRITICAL THEY SHOULD BE DETERMINED BY SURVEY
DATUM OF LEVELS: AHD
ORIGIN OF LEVELS: S.S.M. 3523 R.L. 82.472
CONTOUR INTERVAL: 2 METERS
AREAS AND DIMENSIONS APPROXIMATE ONLY AND ARE SUBJECT TO SURVEY

NOTE:

(A) EASEMENT FOR WATER SUPPLY WORK
AFFECTING THE PART SHOWN AS
EASEMENT FOR WATERMAIN 5 WIDE
AND VARIABLE IN DP 637078

(B) PROPOSED RIGHT OF CARRIAGEWAY
3 WIDE BENEFITING PROPOSED LOT 2

DRUMMOND PARMENTER PTY. LTD.

CONSULTING SURVEYORS & TOWN PLANNERS

371A PITT STREET, SYDNEY
AUSTRALIA 2000
TELEPHONE: (02) 9267 8255
FAX: (02) 9267 1087
EMAIL: drumppar@bigpond.net.au

REDUCTION RATIO
1:1500 @ A1
1:3000 @ A3

REF. No.: 85688

DATE:
JULY 2004

CLIENT: DEPT. I.P. & N.R.

PLAN OF PROPOSED SUBDIVISION OF LOT 3
SECTION F D.P. 11784 AND PLAN OF REZONING
OR REZONING AMENDMENT OF LOTS
74,79,83,84,85 SEC B D.P.11784 AND LOT 3
SEC F D.P.11784 INGLESIDE RD. INGLESIDE.

85688-041015 PROPOSED SUBDIVISION INGLESIDE

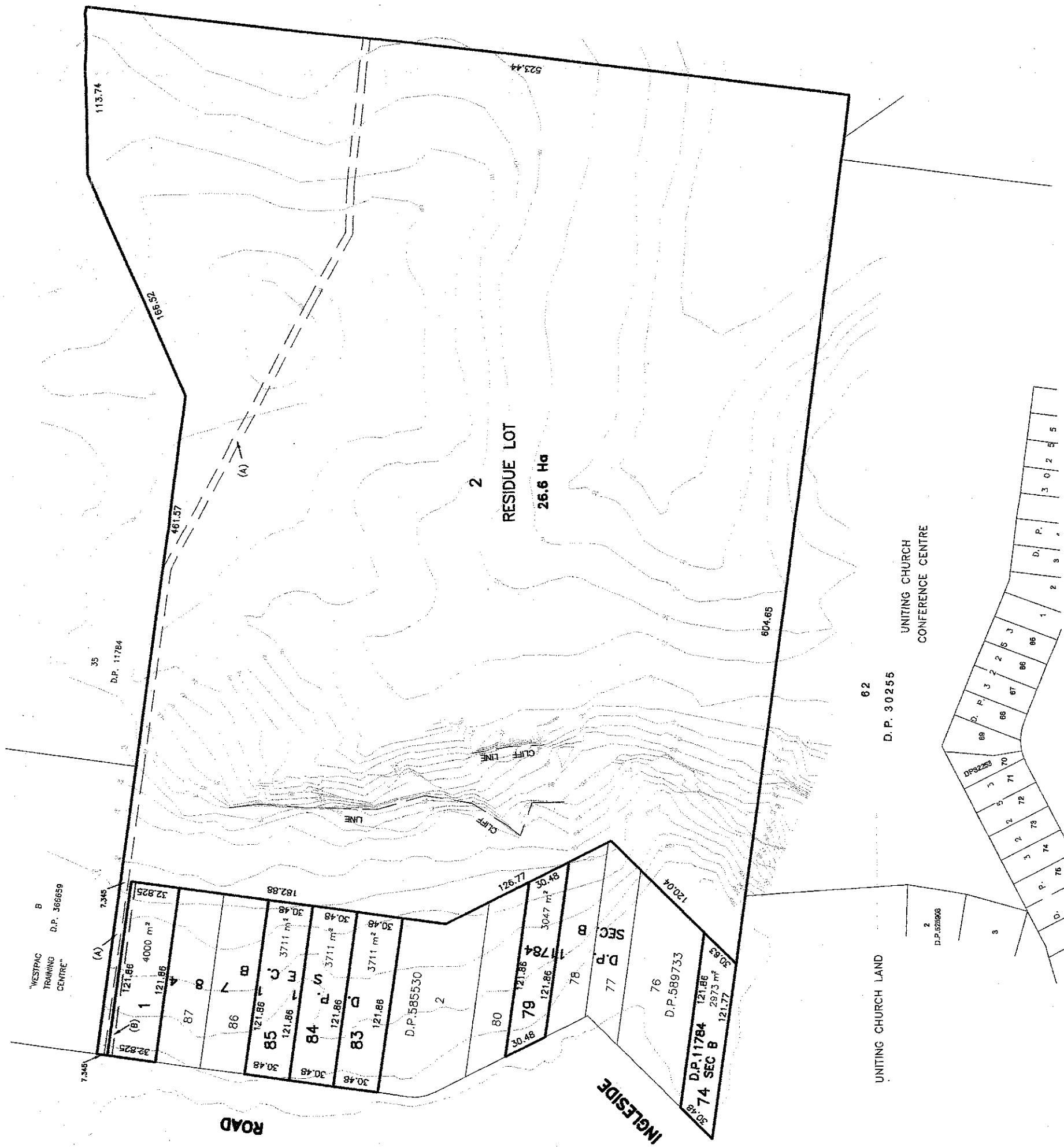


FIGURE 6

IMPORTANT NOTES AND CAUTIONS
THESE NOTES FORM AN INTEGRAL PART OF THIS PLAN
CONTOURS HAVE BEEN PARTLY COMPILED
WHERE LEVELS ARE CRITICAL THEY SHOULD BE DETERMINED BY SURVEY
DATUM OF LEVELS: AHD
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74,79,83,84,85 SEC B D.P.11784 AND LOT 3
SEC F D.P.11784 INGLESIDE RD. INGLESIDE.

7. DISCUSSION OF ISSUES

The following provides a brief assessment of the proposed development in terms of Council's requirements and other significant matters:

7.1 Ingleside- Warriewood Urban Land Release – Draft Planning Strategy

As discussed previously in this report, the subject property is located within the Ingleside Warriewood Urban Land Release area.

Ingleside was designated for future urban development in the NSW Government's Urban Development Program in the early 1990's. The site falls within the area generally known as the Ingleside/Warriewood Urban Land Release Area.

Pittwater Council is the authority responsible for the planning and management of the Ingleside/Warriewood Urban Land Release and has prepared a Draft Planning Strategy for it (undated). The draft strategy involves three phases for the release areas; Investigation Phase, Planning Phase and Implementation Phase.

As part of the Ingleside/Warriewood Urban Land Release Project a series of maps were produced with the draft planning strategy indicating potential areas for future urban development and areas for conservation. These maps indicate the subject site as being capable of supporting residential development subject to certain environmental constraints. The environmental constraints of the subject property are addressed as part of this rezoning report.

Pittwater Council's Draft Planning Strategy for the Ingleside/Warriewood Urban Land Release Area identifies that part of the subject site proposed for the one newly created rural residential subdivision lot as having *high development capability classification*. A *restricted and high development capability* rating of land applies to the existing rural residential lots fronting Ingleside Road and adjoining the subject site.

The area below and in the vicinity of the escarpment shown as Residue Lot 2 in the subdivision plan, is proposed to be rezoned 7(a) Environmental Protection, which is consistent with the *Minimal Development Capability (High Conservation Value)* rating for this part of the subject property.

It is considered that the proposed rezoning of the land to allow for one rural residential lot and one Environmental Protection residue lot on the DIPNR land is entirely consistent with the development capabilities and planning strategies of the land as illustrated in the Ingleside/Warriewood Urban Land Release Draft Planning Strategy. This rezoning report examines in detail the environmental constraints of the subject land and proposes a rural residential land use for part of the land consistent with land holdings surrounding the subject site.

7.2 Pittwater Local Environment Plan 1993

The proposed rezoning of the developable portion of the subject property to 1(a) Non Urban 'A' with a special clause to provide for one new rural residential lot will allow for the orderly and efficient use of the land. The zoning will allow the site to be developed in a manner which is compatible with the environmental capacity of the land and provide for development which has a harmonious relationship with surrounding rural and open space land.

The proposed subdivision discussed in Volume 2 of this report clearly illustrates that the subject site can be developed for one rural residential lot purpose in a manner which is sympathetic with the existing character of the surrounding locality while at the same time protecting the natural attributes of the site.

The size of the proposed lot is considered appropriate given the nature of surrounding development and characteristics of the subject site. While the rezoning will allow for a lot that is smaller than the existing statutory requirements of the 1(a) Non-Urban zone it is considered that a degree of flexibility is required for lot sizes on this land to ensure the protection of the environmental attributes of the site. The proposed lot is also consistent with adjoining lot areas.

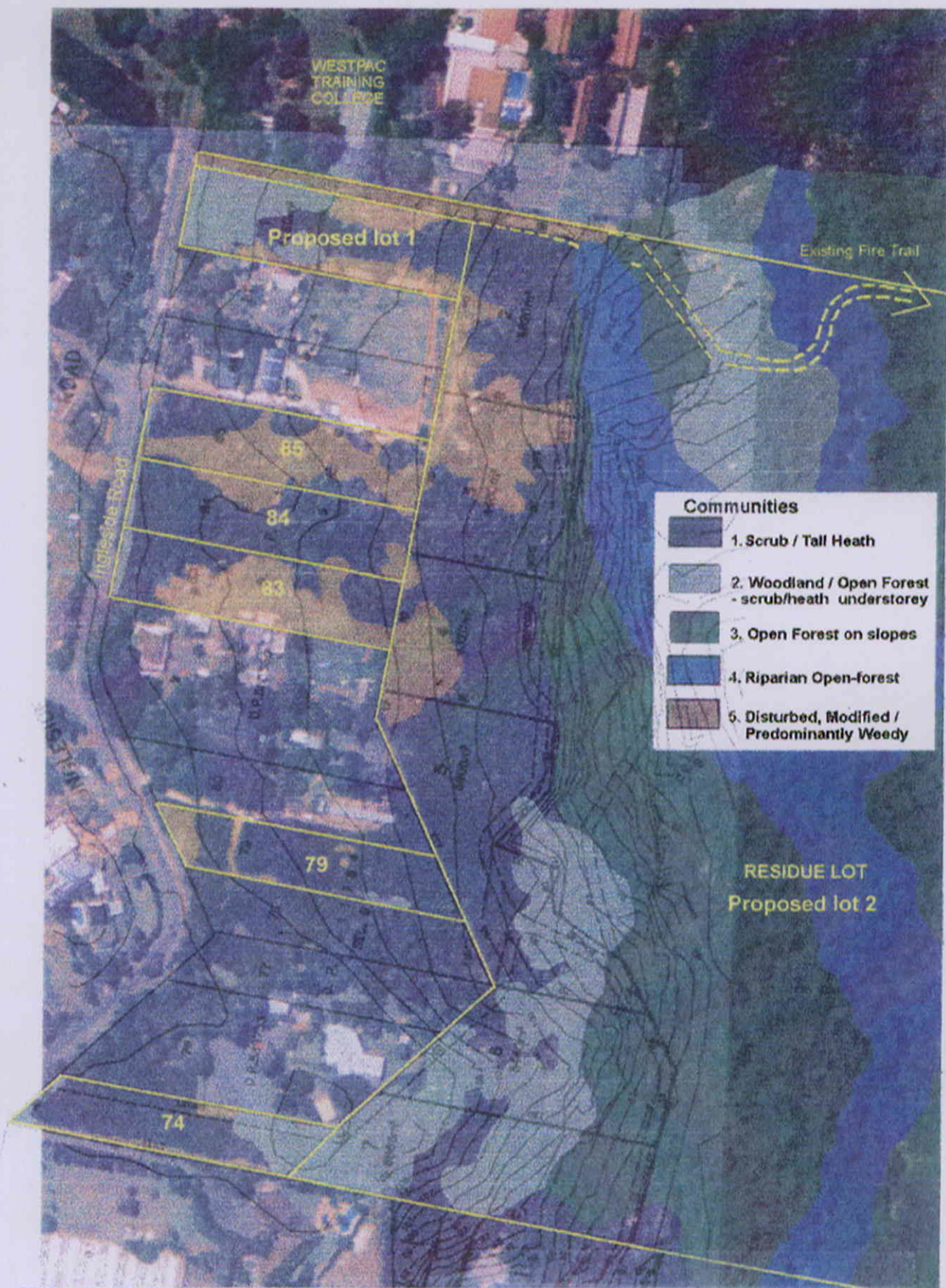
The proposed lot 1 will not have any unreasonable impacts on the rural/residential character of the surrounding locality or the natural attributes of the site. In the case of the subject property the site has substantial buffers from other development and will not create any unreasonable impacts on the character of the locality.

The subject site is adjoined:

- to the north by the existing Westpac Training Centre and Ingleside Park
- to the west by rural residential allotments,
- to the east a heavily vegetated and steep parcel of land running down to the Warriewood Valley,
- to the south by the Uniting Church Conference Centre and residential land zoned Residential 2(a) fronting Wesley Street.

It is considered that the proposed subdivision, which is the subject of a development application lodged concurrently with this rezoning application and the zoning amendment to allow a dwelling on each of DIPNR owned existing allotments (74,79,83,84,85), will allow for the construction of dwelling houses which are compatible with the existing rural/residential environment and is consistent with the findings of the Ingleside/Warriewood draft Planning Strategy.

An assessment of the environmental characteristics of the land is provided in the following sections of the report.



Ecotone Ecological Consultants Pty Ltd



VEGETATION COMMUNITIES

FIGURE 7

Drummond Parmenter Pty. Ltd.

7.3 Flora and Fauna

Ecotone Ecological Consultants have been engaged to undertake a flora and fauna impact assessment of the proposed rezoning and subdivision of the DIPNR owned land. The land parcel has been assessed in a technical Flora and Fauna Report provided in **Appendix B (Flora & Fauna Assessment)**.

The assessment undertaken for this large tract of land by Ecotone Ecological Consultants involved a review of the records of threatened species in the locality and the wider region and a description of habitat types present within the subject site. The analysis also included detailed flora and fauna field surveys and assessment. Vegetation communities on the subject site are illustrated in **Figure 7 – Vegetation Communities**.

The report prepared by Ecotone Ecological Consultants includes all assessments required under the provisions of all relevant legislation pertaining to the development including:

- Environmental Planning and Assessment Act 1979 (Section 5A)
- Threatened Species Conservation Act 1995 (TSC Act)
- Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)
- SEPP 44 – Koala Habitat Protection

The assessment undertaken by Ecotone Ecological Consultants considered the flora and fauna impacts associated with the approx. 2.12 hectares of developable land fronting Ingleside Road (see **Appendix B**). The subject site also includes a large tract (about 26.6 hectares) of land in the vicinity and below the escarpment that will be retained in a natural form on site by rezoning to an environmental protection area.

The report states as follows:

No threatened flora species listed under either the N.S.W. TSC Act or Commonwealth EPBC Act were found on the subject site or in the broader study area, although the possibility of some threatened species occurring amongst dense, inaccessible scrub vegetation within the subject site cannot be entirely eliminated. It is considered that potential (although marginal) habitat could exist on the subject site for the threatened flora species Callistemon Linearifolius and Epacris purpurascens var. purpurascens. The likelihood of these species occurring in the proposed development area is regarded as being very low.

Foraging habitat for the Powerful Owl Ninox Stremua recorded in the study area, is present on the subject site. The Grey-headed Flying-fox and Eastern Bent-wing Bat were also recorded in the study area and are considered to only visit the subject site for foraging purposes. The Eastern Pygmy-possum Cercartetus nanus, Spotted-tailed Quoll Dasyures maculates, Koala Phascolarctos cinereous, Giant Burrowing Frog Heleioporus australiacus and Red-crowned Toadlet Pseudophryne australis are all considered to have at least some potential to use the site. All these species are listed as vulnerable on the TSC Act 1995 and the Grey-headed Flying-fox, Spotted-tailed Quoll and Giant Burrowing Frog are also listed as vulnerable on the EBPC Act 1999.

It is important to consider that, as part of the proposal 26.6 hectares (92.6%) of the entire study area will be retained as a reserve and unaffected by any development. This is a core habitat area containing some of the most favourable habitat for flora and fauna, including any threatened species that were found to occur, or potentially could occur, in the study area.

Based on the results of this survey and assessment, it is considered that the subdivision and subsequent development proposed for the site is unlikely to have a significant impact on the threatened species listed above, provided suitable management measures are implemented as recommended in the following section of this report.

The recommendations provided in Section 6 of the Ecotone report are designed to maximise conservation of local flora and fauna and to ameliorate impacts of the proposal on the local natural environment. The recommendations include the following:

- (a) Building envelopes and access roads should be located, as far as possible, within previously cleared, disturbed or weedy areas (see Figure 3), or areas that would minimise the bushland clearing or modification required for bushfire protection. These locations must ultimately be consistent with the requirements for provision of the Asset Protection Zones.*
- (b) Wherever possible, clearing of native vegetation within each lot should be minimised and natural regeneration of native flora encouraged (to the extent that this is consistent with the requirements of the Asset Protection Zone for bushfire protection). This will provide some habitat for resident fauna while still complying with bushfire protection requirements.*
- (c) New residents should be encouraged to carry out landscaping using species native to the local area. Pittwater Council (2000,2003) requires that local native species should be used for at least 70% of planting's. Appropriate species to use are indicated as such in Appendix 1 of this report. This will not only further mitigate the impacts of habitat loss for fauna, but would also help to reduce the infestation of areas downslope with exotic flora.*
- (d) Runoff from new buildings and gardens/landscaping on each new Lot should be managed during both the construction and operational phases of the project, using current best practice pollution and sedimentation interception and management techniques. Of particular concern is the possibility of nutrient-rich runoff impacting on downslope vegetation and creation of conditions that would promote invasions of weeds into unaffected bushland and the creekline to the east of the site. Although not considered likely to occur in or near the development area on the basis of available habitat, breeding habitat for the Red-crowned Toadlet and Giant Burrowing Frog could be affected, if they do indeed occur in downstream habitat.*
- (e) Professional bush regeneration techniques should be implemented to control weeds in the weedy disturbed and edge areas of the site, and within the upper riparian creekline area. The most serious environmental*

Bushfire Protection Measures

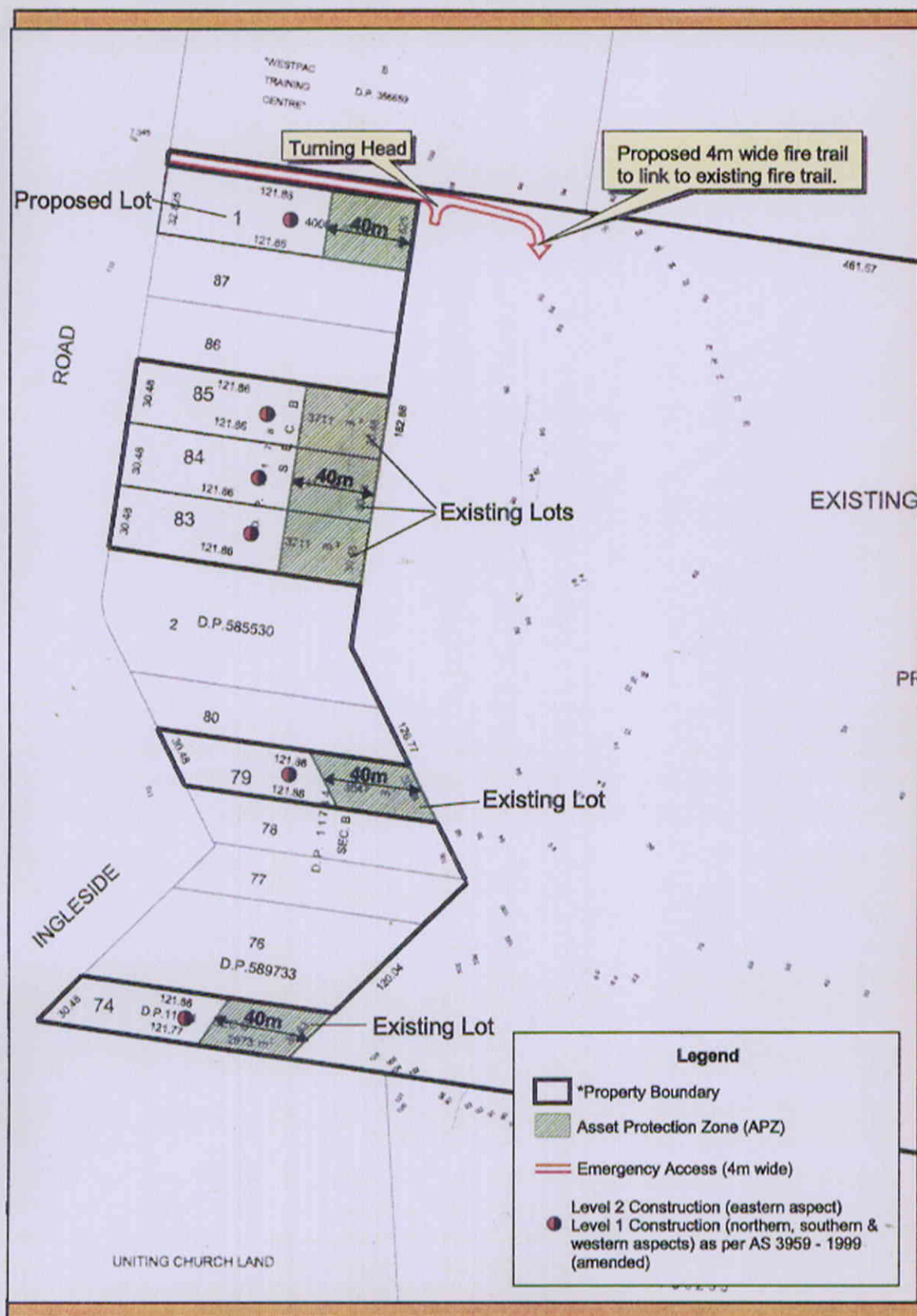


FIGURE 8



Source
- Ingham Planning

Drummond Parmenter Pty Ltd

weeds should be removed from within the immediate catchment area of the creek, and the native vegetation of each treated area allowed to regenerate as far as possible. In particular, noxious species an environmental weeds such as Pampas Grass, Blackberry, Crofton Weed and Giant Reed should be removed. Appropriate measures should be taken to prevent re-invasion of weeds following treatment. Any bare areas where natural regeneration is unlikely should be replanted with suitable locally indigenous species, preferably propagated from locally collected propagable material. Suitable species to use are indicated as such in Appendix 1.

- (f) *Any eucalyptus within the site should be avoided and retained where possible (subject to APZ requirements).*

7.4 Bushfire Threat Assessment

Representatives of DIPNR have met with Pittwater Council staff and Mr. Graham Douglas (Manager of Planning with the N.S.W. Rural Fire Service) to discuss Council's and the N.S.W. Fire Service requirements for the subject land.

The guiding document for appropriate bushfire management measures is '*Planning for Bushfire Protection - 2001*' which was prepared by the Rural Fire Service in collaboration with Planning N.S.W.

A detailed Bushfire Protection Assessment by Conacher Travers Pty. Ltd. has been undertaken for the DIPNR land. The bushfire assessment report for the DIPNR land parcel is attached (**Appendix C – Bushfire Report**).

The report discusses the topography, slope, aspect, vegetation of the site and character of surrounding land uses, identifies existing bushfire protection advantages and make an appraisal of existing bushfire hazards and risks.

The report provides an assessment of the bushfire protection requirements to future dwellings on the proposed rural residential allotments, the site-specific mitigation factors and recommends measures which will address the potential vulnerability of the proposed development to bushfires burning within the adjoining bushland. It provides an assessment of compliance with relevant bushfire planning controls, recommends provisions for appropriate Asset Protection Zones, access, water supplies and construction standards of future dwellings.

The Bushfire Protection Measures proposed to be implemented for the subject site are illustrated in **Figure 8 – Bushfire Protection Measures**.

In regard to the rural residential lots on the DIPNR land, the proposed **Asset Protection Zone** includes an Inner Protection Area (IPA) and an Outer Protection Area (OPA). The Total Asset Protection Zone width is contained within the six rural residential lot boundaries (1,74,79,83,84,85)

Town reticulated water supply is available to the site, therefore a supplementary form of water supply will not be required for fire fighting purposes.

With respect to the construction of future dwellings on the lots, the Bushfire Report prepared by Conacher Travers indicates that:

It is not expected that flame contact and or radiant heat would be a significant issue if Asset Protection Zones are applied to future dwellings within proposed Lot 1 and existing Lots 74, 79, 83-85, in accordance with the general principles of 'Planning for Bushfire Protection 2001'. However, the potential for ember attack results in the need for Level 2 construction standards applied to the eastern elevation of future dwellings on proposed Lot 1 and existing Lots 74, 79, 83-85 and Level 1 construction standards applied to all remaining elevations of the future dwellings on proposed Lot 1 and existing Lots 74, 79, 83-85 in accordance with the Australian Standard AS3959 'Construction of Buildings in Bush Fire Prone Areas'.

7.5 Visual Impact Analysis

The subject site forms part of the Warriewood Escarpment and is surrounded by the Westpac Training Centre to the north, rural residential development adjoining to the west and the residential neighbourhood of Elanora Heights to the south.

The proposed rezoning and development of the land includes the opportunity for Pittwater Council to acquire about 26.6 hectares of the subject land. The proposal will provide a community benefit in establishing the permanent conservation of the existing scenic character of this part of the escarpment land below, that will be continuous with extensive escarpment land to the north that has recently also been rezoned and acquired by Council.

When viewed in the context of this part of the Northern Beaches, it is considered that the visual exposure of the upper developable portion of the site is somewhat constrained given it's location between the vegetated ridgeline that extends across Ingleside Park and into the site and the elevated land of the Uniting Church conference centre facility to the south. The developable land is visible from a relatively narrow cone of view from certain locations in Warriewood, between the southern extremities of Mona Vale to North Narrabeen.

The potential visual impacts of the proposed development has been assessed in detail by Richard Lamb and Associates (refer **Appendix D**). This report includes an assessment of the proposed rural residential subdivision in regard to potential visual impacts upon important character, landscape and scenic qualities of the locality.

While the proposed lots could be considered as generally an extension of the rural residential development that currently exists in this locality, in terms of visual impacts the report recognise the potential for the additional dwelling development on Lots 1, 74, 79, 83, 84 & 85 and states as follows:

The combination of the introduction of buildings and the clearing of heath vegetation from part of the proposed allotments would result in substantial change in the character of the affected parts of the subject land, in particular in the short term. The part of the land proposed for

development that is presently characterised by its mostly natural appearance would become of a more residential character, albeit on large allotments. This change in character would be more reminiscent of the existing rural residential development within Ingleside Road.

The change in character however would not be extensively visible from more distant locations to the east of the site as a result of areas of taller vegetation in the immediate escarpment locations and of heath and low tree vegetation on the plateau directly to the east of the residential lots, that would be retained in its existing character and appearance. The retention of this tree canopy would screen or filter most views into the residential allotments. Given that the allotments are large in size the clearing of the 40m Inner Protection Area of vegetation in accordance with the APZ requirements can be completely contained within the residential allotments and would not affect the most visible part of the overall site, being the plateau land east of the lots and the much larger and more prominent escarpment area itself, which is within Residue Lot 2. For this reason the residential allotments, once construction has been completed, would have a visual character similar to that displayed by immediately adjacent allotments within Ingleside Road. While some of these existing dwellings are visible in long distance views from the east, they are not adversely prominent and existing vegetation both within the allotments themselves and on adjacent land extensively filter their visual exposure.

Additional landscape can be added to the properties, although it would be of a different character than the dense native vegetation that surrounds some existing dwellings. This vegetation would further add to the screening of future dwellings within the proposed allotments, along with retained elements of existing vegetation.

For these reasons, the changes to the visual character of the subject land is not considered to be significant, when viewed from both close locations within the surrounding streetscapes as well as when seen from more distant places to the east of the escarpment.

There would be some cumulative impacts as a result of the concentration of future dwellings within the subject land. While some of the vegetation within the residential allotments would be required to be cleared, it is considered that heath vegetation and low trees in the plateau land and taller canopy vegetation that is located to the immediate east of these allotments within the upper escarpment land of Residue Lot 2 would provide screening to the more distant views from the east. In this regard it is considered that while there would be some evidence of more development on this part of the escarpment, the cumulative impacts would be minimal and the visual character would not be unacceptably affected.

7.6 Aboriginal Heritage Assessment

An aboriginal Heritage Assessment of the subject site has been undertaken by Austral Archaeology (refer **Appendix E**). This assessment involved a desktop study (to establish the archaeological and environmental context of the subject property), consultation with the local Aboriginal community and a field inspection to locate archaeological surface sites and area of potential archaeological sensitivity. The field inspection was undertaken with representatives from the Metropolitan Local Aboriginal Land Council (MLALC).

The field inspection concentrated on landform features that have been found to be likely to contain archaeological site and included:

- sandstone outcrops, platforms and overhangs
- tributaries associated with Mullet Creek
- areas where the original land surface was thought to be relatively intact
- high points in the landscape which may have served as vantage points
- areas of substantial ground exposure; and
- areas where moderate and high disturbance had also occurred to establish whether archaeological material was still in evidence

A detailed analysis of the areas targeted in the field survey is provided in Section 4 of the Aboriginal Heritage Assessment.

The Aboriginal Heritage Assessment was prepared in December 2003 and related to the subject DIPNR land and to the adjoining Uniting Church in Australia land and addressed a more intensive development on the subject land than the current proposal. This report concluded that it was considered that there are no aboriginal archaeological issues that effect the proposed rezoning and development application for the subdivision of the land. Clearly this conclusion must also relate to the current less intensive proposal.

7.7 Site Facilities & Services

Sydney Water advised that the total six rural residential allotments on the DIPNR land can be serviced for water requirements by the existing Sydney Water mains system in Ingleside – Elanora Heights area.

With regard to **electricity** existing overhead (OH) power lines run down Ingleside Road and Wesley Street.

The cost of internal reticulation (for both low voltage and street lighting works) will be required to be borne by the developer. The most viable option for supply to individual lots is likely to be connection to the existing OH mains located in Ingleside Road.

Patterson Britton & Partners (Consulting Engineers) have been engaged to prepare a **water management and effluent treatment and disposal report** for the subject land that examines the site hydrology, drainage infrastructure requirements, flooding, water quality, effluent treatment and disposal issues. Details of the stormwater drainage water management measures effluent treatment and disposal proposed for the rural residential allotments has been provided as **Appendix F – Stormwater Management, Effluent Treatment & Disposal Report** with the development application for subdivision of the subject land.

Patterson Britton & Partners report concluded:

"The stormwater management measures and effluent treatment and disposal options recommended in this report are all in accordance with Councils requirements for water management on the site.

The implementation of rainwater tanks, OSD and stabilised discharge meets Councils requirements for stormwater management. In addition, BASIX requirements are estimated to be met through the implementation of these measures if AAA rated water fixtures are also installed.

The preferred on-site effluent treatment and disposal option (combined septic tanks and Ecomax evapotranspiration beds) provides relatively high effluent quality and therefore provides minimal environmental risks. This should ensure that effluent generated by the proposed land use will have minimal impacts on downstream areas.

The combination of all the above measure will minimise any likely downstream impact to sensitive bushland as a result of the proposed rezoning and subdivision.

8. CONCLUSION

Having inspected the subject site, surrounding locality and reviewed the many expert consultants reports we are of the opinion that the western upper levels of the subject land, fronting Ingleside Road is well suited for Rural Residential development which will be in character with adjoining and surrounding lots. The proposal creates the opportunity for about 26.6 hectares of environmentally sensitive land, containing the escarpment, to be rezoned Environmental Protection and to be acquired by Pittwater Council.

We request that Council place a special clause within the LEP relating to this site ensuring that one new "rural residential lot" to be created can be developed (the lot having an area of 4,000 square metres) and that the proposed lot can be developed with a dwelling house and associated structures.

We also request an amendment to Schedule 12 of Pittwater LEP 1993 to allow a dwelling to be constructed on each of the five existing DIPNR owned rural residential lots fronting Ingleside Road.

We fully support the proposed rezoning as detailed in **Appendix A – Draft LEP amendment (No.)** and respectfully request Council's favourable consideration of the application.

DRUMMOND PARMENTER PTY.LTD.

APPENDIX A

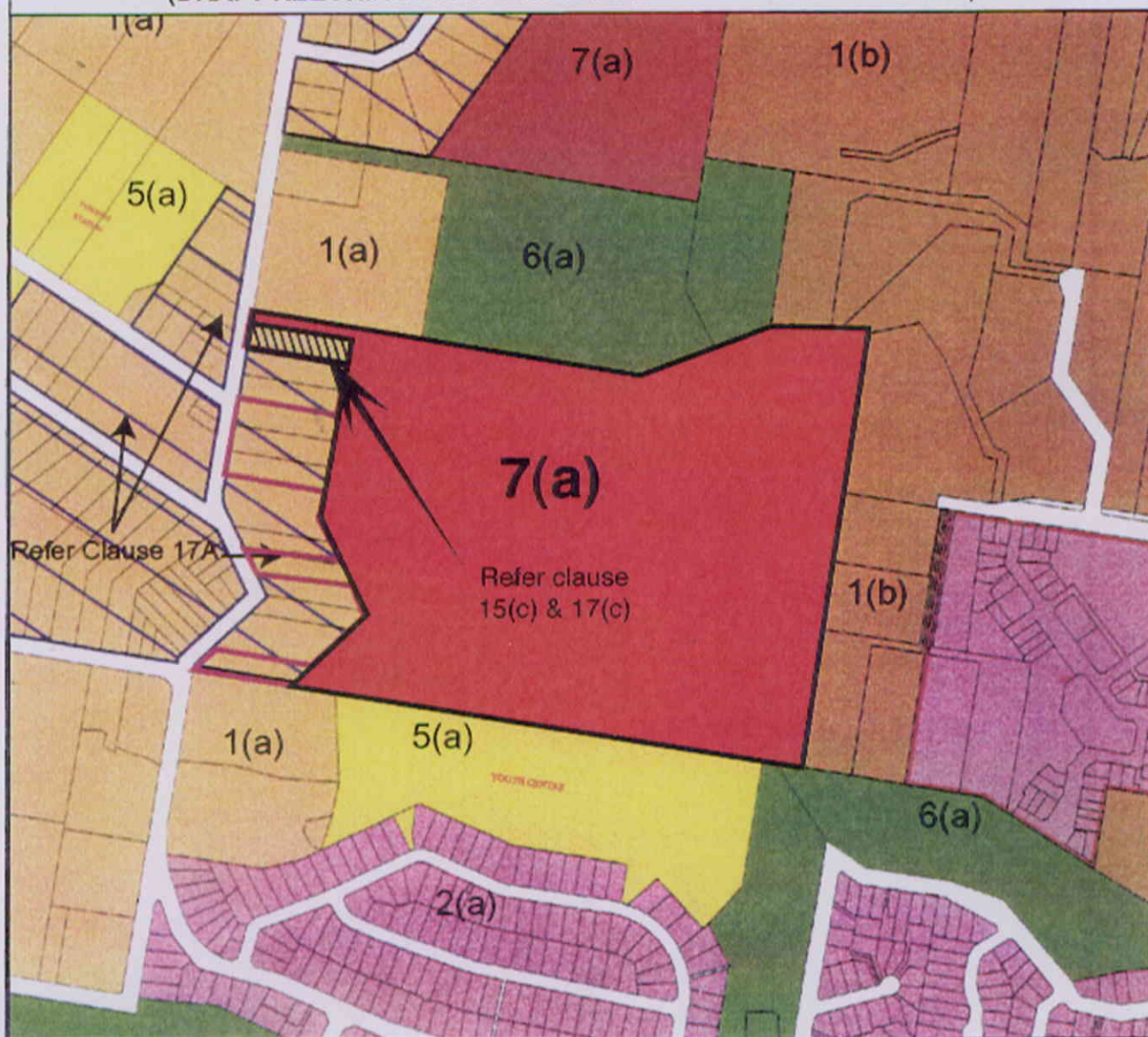
Draft LEP Amendment and Map Extract

ENVIRONMENTAL PLANNING & ASSESSMENT ACT, 1979

PITTWATER COUNCIL

DRAFT LOCAL ENVIRONMENTAL PLAN NO. ____

(DRAFT REZONING PROPOSALS FOR D.I.P.N.R AND U.C. LAND)



		STATEMENT OF RELATIONSHIP WITH OTHER PLANS	
PLANNING OFFICER		CERTIFIED IN ACCORDANCE WITH THE ENVIRONMENTAL PLANNING & ASSESSMENT ACT 1979, AND REGULATIONS	
COUNCIL FILE NO.			
DEPT. FILE NO.			
CERTIFICATE ISSUED UNDER SEC.65 E.P.A. ACT	DATE	GENERAL MANAGER	DATE
GOVT. GAZETTE NO.	DATE		

Environmental Planning & Assessment Act 1979

**Pittwater Local Environmental Plan 1993
(Amendment No. __)**

I, the Minister for Urban Affairs and Planning, in pursuance of Section 70 of the Environmental Planning & Assessment Act 1979, make the local environmental plan set out hereunder.

CRAIG KNOWLES MP

Minister for Infrastructure, Planning and Natural Resources

Sydney _____

Name of Plan

1. This plan is Pittwater Local Environmental Plan 1993 (Amendment No. __)

Aims, objectives etc.

2. This aims of the plan are:
- (a) to rezone the land to which this plan applies from Non Urban 1(a) (Non-Urban "A") to Non Urban 1(a) (Non-Urban "A") and 7(a) Environmental Protection under Pittwater Local Environmental Plan 1993;
 - (b) allow dwellings to be constructed on 5 existing rural residential lots fronting Ingleside Road and one proposed new rural residential allotment as detailed in Clause 5

Land to which plan applies

3. This plan applies to land within Pittwater Local Government Area, being Lot 3 Sec.F DP11784 and Lots 74,79,83,84,85 Sec.B D.P.11784 with frontage to Ingleside Road as shown on the map marked "Pittwater Local Environmental Plan 1993 (Amendment No. __)" deposited in the office of the Council of Pittwater

Relationship to other environmental planning instruments

4. This plan amends Pittwater Local Environmental Plan 1993 in the manner set out in Clause 5

Amendment of Pittwater Local Environmental Plan 1993

5. The Pittwater Local Environmental Plan 1993 is amended:
- (a) by inserting after the definition "the zoning Map" in Clause 5 of the Pittwater Local Environmental Plan 1993 the following words:

"Pittwater Local Environmental Plan 1993 (Amendment No. __)"

- (b) by inserting after the Clause 15B the following clause

"15.C

Subdivision of certain land at Ingleside Road, Ingleside

- (1) This clause applies to the land at Ingleside Road, Ingleside within that part of Zone No.1(a) shown edged heavy black on the map identified as Pittwater Local Environmental Plan 1993 (Amendment No.____)
- (2) Notwithstanding any other provision in this plan, a person may, with the consent of Council, subdivide the land to which this clause applies so as to create one new allotment with an area of at least 4,000 square metres

- (c) by inserting after Clause 17B the following clause:

"17.C

Development of certain land at Ingleside Road, Ingleside

- (1) Notwithstanding any other provision in this plan, a person may, with the consent of Council, erect a dwelling house on of the lot created as a result of a subdivision referred to in Clause 15C
- (2) The Council shall not grant consent to development for the purposes of a dwelling-house unless:
 - (a) satisfactory provision has been made with Sydney Water for the supply of water; and
 - (b) in the opinion of the Council adequate vehicular access is available; and
 - (c) in the opinion of the Council adequate provision has been made for stormwater management, water quality control and effluent control
 - (d) in the opinion of Council adequate provision has been made for bush fire management

- (d) by inserting within **Schedule 12 – Development of Certain Land at Ingleside** the following existing allotments:

Lot 74 Sec.B D.P.11784 Ingleside Road, Ingleside
Lot 79 Sec.B D.P.11784 Ingleside Road, Ingleside
Lot 83 Sec.B D.P.11784 Ingleside Road, Ingleside
Lot 84 Sec.B D.P.11784 Ingleside Road, Ingleside
Lot 85 Sec.B D.P.11784 Ingleside Road, Ingleside

DRUMMOND PARMENTER PTY.LTD.

APPENDIX B

**Flora & Fauna Survey
(Ecotone Ecological Consultants)**

FLORA AND FAUNA IMPACT ASSESSMENT
FOR THE PROPOSED REZONING AND SUBDIVISION
OF LAND OWNED BY DIPNR AT INGLESIDE ROAD
(Lots 74, 79, 83, 84, 85 Sec. B DP11784 and Lot 3 Sec. F
DP11784), INGLESIDE

Prepared for
Drummond Parmenter Pty Ltd
& Department of Infrastructure, Planning & Natural Resources



ECOTONE ECOLOGICAL CONSULTANTS Pty Ltd
39 Platt Street, Waratah NSW 2298
phone: (02) 4968 4901 fax: (02) 4968 4960
e-mail: ecotone@hunterlink.net.au

EEC PROJECT No. 0355DP

15 October 2004

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1.0 INTRODUCTION

This section provides background on the overall proposal, the provisions of State environmental legislation and the general aims of the study. Brief reference is made to the nature of vegetation potentially affected by the proposed development. Information relating to the nature of the abiotic and biotic environment of the study locality is provided.

1.1 Background and Scope

This Flora and Fauna Survey and Threatened Species Assessment has been prepared at the request of Drummond Parmenter Pty Ltd on behalf of the Department of Infrastructure, Planning and Natural Resources (DIPNR). It is in support of a rezoning application to allow residential development in lots 74, 79, 83, 84 and 85 and the subdividing and rezoning of Lot 3 Sec. F DP11784 to create one residential lot and one large residue lot. These activities are hereafter referred to as *the proposal*.

A previous study of the area in question was conducted in 2003. The survey results from the 2003 study have been used for this Flora and Fauna Assessment.

The general aims of this assessment are to:

- describe the existing biological environment of the study area in relation to flora and fauna;
- discuss the potential impacts of the proposal for any threatened species that occur or could be likely to occur in the subject site;
- provide discussion on measures to mitigate impacts.

The environmental studies have been conducted in three stages:

- (a) the first stage being a review of available literature pertaining to the site and surrounding locality and preliminary habitat assessment of the subject site;
- (b) the second stage being the completion of targeted field surveys for threatened species regarded as potential subject species, and surveys to investigate the inherent biological attributes of the site; and
- (c) the third stage being the assessment of impact of the proposal on flora and fauna in accordance with the relevant NSW and Commonwealth legislation and planning instruments.

Within this report, reference is given to the relevant sections of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act); NSW *Threatened Species Conservation Act 1995* (TSC Act); *National Parks and Wildlife Act 1974* (NP&W Act); *Environmental Planning and Assessment Act 1979* (EP&A Act); and subsequent amendments to these. Specific consideration is given to Section 5A of the *EP&A Act*.

For this report,

- the *subject site* is defined as the land area directly affected by the development proposal, which in this case comprises Lots 74, 79, 83, 84, 85 and proposed Lot 1 all fronting Ingleside Road.
- the *study area* consists of the subject site plus the proposed lot 2 to be rezoned Environmental Protection.
- the *study locality* is the area of land within a ten (10) kilometre radius of the centre of the subject site.

1.2 General Description of the Study Locality

The study locality is situated in the northern suburbs of Sydney. The locality includes a mosaic of sparsely to densely populated suburbs; rural residential, semi-rural and rural properties; industrial and commercial development. The locality also contains significant areas of natural bushland,

including Garigal and Ku-ring-gai Chase National Parks and a number of council reserves. Significant remnant bushland also occurs on private land.

The topography of the study locality is rugged and steeply undulating, with dissected valleys and deep gorges draining to the Hawkesbury River. Being part of the Hornsby Plateau, the geology is predominantly that of Hawkesbury Sandstone, with some embedded Wianamatta Shale lenses and lateritic material on some of the higher parts. The soils are generally shallow and podsolised, with a sandy surface on a clay base. Soil organic matter is low and the nutrient status is generally poor. Being mostly on slopes, the soils are well-drained, with some damper areas of impeded drainage and persistent runoff.

The study area is situated on an east-facing sandstone escarpment and forms part of the catchment of Mullet Creek, which flows into Narrabeen Lakes. The natural vegetation of the study area is sandstone forest or woodland in the gully to dense heath and scrub above the escarpment. Rocky outcrops and flat rock platforms occur throughout the study area.

The study locality and subject site location is illustrated in **Figure 1**.

1.3 Description of the Subject Site

The subject site covers an area of approximately 28.71 hectares immediately fronting and adjacent to Ingleside Road near its junction with Powder Works Road in the Pittwater Local Government Area. The subject site contains 6 proposed residential lots ranging in size from 2973m² to 4000m². The site is relatively flat at the upper (western) end, sloping gently to the east. The land continues to gently slope to the east of the subject site until it reaches a broken sandstone escarpment. Elevations range from about 110 m ASL at the western end to 95 metres at the escarpment edge.

Lots 74, 79, 83, 84, 85 and proposed lot 1 are currently undeveloped and front directly onto Ingleside Road. Most of lots fronting to Ingleside Road that occur between these lots are mostly cleared and developed with houses. To the north of the subject site, extending along the entire northern boundary, is the Westpac Training Centre. The southern boundary partially adjoins land owned by the Uniting Church of Australia, which currently contains some bushland.

Most of the subject site is covered by dense, scrubby natural bushland with few large trees. Some areas have been cleared and disturbed for fire buffers and extensive weedy areas occur in patches within these lots and along the boundaries of adjoining cleared lots. The site was last burnt in the 1994 bushfires and the regenerating shrub layer vegetation now consists mainly of dense *Banksia ericifolia* and *Kunzea ambigua* thickets.

Similar vegetation adjoins the subject site to the east to the escarpment. The vegetation is more open below the escarpment, and consists of open forest with tall, mature trees and a moderately dense understorey. Rock outcrops are common in the escarpment area. Further to the east a gully occurs containing Mullet Creek with a waterfall at its head at the northern end, which runs into Narrabeen Lakes. The proposed Lot 2 contains predominantly natural and pristine bushland.

1.4 Description of the Proposal

The proposal involves rezoning lots 74, 79, 83, 84 and 85 to permit one dwelling per existing lot consistent with adjoining and surrounding privately owned lots. The proposal also includes the subdivision of Lot 3 Sec. F DP11784 into two lots. Proposed lot 1 would be 4000m², fronting Ingleside Road and permit one dwelling consistent with adjoining existing lots. Proposed Lot 2

would be the residue lot of 26.6 hectares containing the escarpment. Proposed lot 2 is to be rezoned 7(a) Environmental Protection and transferred to council for community use. Any future dwellings will connect to the existing water supply, however will require on site effluent disposal.

In order to meet the requirements for bushfire protection under the NSW *Rural Fires Act 1997* and the *Environmental Assessment Legislation Amendment Act 2002*, a bushfire Asset Protection Zone (APZ) will be allocated within the boundaries of each lot to be developed.

Details of the bushfire protection requirements are provided in the Bushfire Protection Assessment (Conacher Travers, 2004).

A plan of the proposal has been included as **Figure 2**.



Figure 1. Study Locality and Study Area Location

Base Map: Sydney 9130 1:100 000 Topographic

Flora and Fauna Impact Assessment:
Proposed Subdivision at Ingleside
Road, Ingleside

October 2004



Ecotone Ecological Consultants Pty Ltd



Subject Site — Study Area



Ecotone Ecological Consultants Pty Ltd

Figure 2. Plan of the Proposal

Flora and Fauna Impact Assessment
Proposed subdivision and rezoning
Ingleside Rd, Ingleside

October 2004

2.0 FIRST STAGE ECOLOGICAL INVESTIGATION – PRELIMINARY ASSESSMENT

This section documents the methodology and results of all stage one ecological investigation. This involved a review of the records of threatened species in the locality and wider region and a description of the habitat types present within the subject site. Through analysis of the habitats present within the study area, and known habitat requirements of local threatened species, an assessment was made of the relative likelihood of each threatened species previously recorded within the study locality, occurring in the study area. As a result a list of subject species was generated.

2.1 Review of Local Threatened Species and Other Records

A review of the documented records of the locations of threatened flora and fauna species within the study locality has been undertaken. Threatened species records were accessed from the NPWS Atlas of NSW Wildlife Database for the Sydney 1: 100 000 map sheet (updated to April, 2004).

2.1.1 Flora

Threatened species

From the review, a total of thirty-five (35) rare, threatened or regionally significant flora species are known to occur within the study locality. These are listed in **Table 1** below. Seven (7) of these species (*Acacia bynoeana*, *Asterolasia elegans*, *Chamaesyce psammogeton*, *Grammatis stenophylla*, *Grevillea caleyi*, *Haloragodendron lucasii* and *Microtis angusii*) are classified as Endangered on Schedule 1, Part 1 and eleven (11) species are classified as Vulnerable on Schedule 2 of the *TSC Act*. In terms of national listings, four (4) of the species are listed as Endangered by the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*, and ten (10) are listed as Vulnerable. All but four of the species are also listed under the national database known as ROTAP *Rare or Threatened Australian Plants* (Briggs & Leigh 1996).

Table 1. Rare or Threatened Flora previously recorded within the Study Locality

Scientific Name	Status (TSC)	Status (EPBC)	ROTAP Risk Code	Earliest/latest record	Number of records within 10km of site	Number of records within 2.5km of site
<i>Acacia bynoeana</i>	E1	V	3VC-	1911	1	0
<i>Asterolasia elegans</i>	E1	E	2ECa	2001	1	0
<i>Callistemon linearifolius</i>	V	-	2RCi	2002	1	0
<i>Chamaesyce psammogeton</i>	E1	-	-	1987	1	0
<i>Cryptostylis hunteriana</i>	V	V	3VC-	1954	1	0
<i>Epacris purpurascens</i> var. <i>purpurascens</i>	V	-	2KC-	1997-2000	3	0
<i>Eucalyptus camfieldii</i>	V	V	2VCi	1954-2003	17	0
<i>Grammatis stenophylla</i>	E1	-	-	2001-2003	2	0
<i>Grevillea caleyi</i>	E1	E	2ECi	1892-2002	63	6
<i>Haloragodendron lucasii</i>	E1	E	2ECi	1986-1992	6	0
<i>Kunzea rupestris</i>	V	V	2VCa	1991-1992	2	0
<i>Lasiopetalum joyceae</i>	V	V	2RC-	1998	1	0
<i>Leptospermum deanei</i>	V	V	2V	1989	2	0
<i>Melaleuca deanei</i>	V	V	3RC-	1962-1997	2	0
<i>Microtis angusii</i>	E1	E	-	1992	1	0
<i>Pimelea curviflora</i> var. <i>curviflora</i>	V	V	-	1999-2000	4	0
<i>Syzygium paniculatum</i>	V	V	3VCi	2002-2003	3	0
<i>Tetraloche glandulosa</i>	V	V	2VC-	1920-2002	36	2
<i>Amperea xiphoclada</i> var. <i>papillata</i>	U	-	3KC-	2000	1	0
<i>Angophora crassifolia</i>	U	-	2RCa	1992-2002	37	0

<i>Arthrochilus prolixus</i>	U	-		2000	1	0
<i>Boronia fraseri</i>	P13	-	2RCa	1922-1998	5	0
<i>Boronia serrulata</i>	P13	-	2RC-	1997-2002	8	1
<i>Corybas undulatus</i>	U	-	3KC-	1953-1976	5	0
<i>Darwinia diminuta</i>	U	-	2RCi	1919-1991	4	0
<i>Darwinia procera</i>	U	-	2RCa	1984-2002	24	1
<i>Eucalyptus luehmanniana</i>	U	-	2RCa	1915-2003	49	1
<i>Euphorbia pulcherrima</i>	U	-	-	2002	1	0
<i>Genoplesium baueri</i>	U	-	3RC-	1788-1996	3	0
<i>Gonocarpus salsoloides</i>	U	-	3RCa	1931-1996	2	0
<i>Hibbertia hermanniifolia</i>	U	-	3RCa	1940-1974	1	0
<i>Hibbertia nitida</i>	U	-	2RC-	1926	1	0
<i>Lomandra brevis</i>	U	-	2RC-	1997-2001	49	3
<i>Lomandra fluviatilis</i>	U	-	3RCa	1936-1992	3	0
<i>Rulingia hermanniifolia</i>	U	-	3RCa	1788-1996	3	0

Notes:

340000 E and 6271000 N are the closest co-ordinates of the subject site.

Nomenclature follows Harden (1990-2002) and Harden & Murray (2000).

Status (TSC): refers to the NSW *Threatened Species Conservation Act 1995* (TSC) or *National Parks and Wildlife Act 1974*

E1 – Schedule 1, Part 1: Endangered Species

V – Schedule 2: Vulnerable Species

P13 – Protected Native Plants (listed in Schedule 13 of the NPW Act 1974)

U – Unprotected Flora (listed in Schedule 11 of the NPW Act 1974)

Status (EPBC): refers to the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC)

E - Endangered Species

V - Vulnerable Species

ROTAP coding (Briggs and Leigh 1996)

2 Geographic range in Australia less than 100 km

3 Geographic range in Australia greater than 100 km

E Endangered Species: at risk of disappearing from the wild within 10-20 years if present land use and other threats continue to operate

V Vulnerable Species: not presently endangered, but possibly at risk in future due to continuing depletion or land-use change

R Rare Species: rare in Australia, but currently without any identifiable threat

K Poorly Known: accurate field distribution information is inadequate

C Reserved: indicates taxon has at least one population within a national park, or other proclaimed conservation reserve or in an area otherwise dedicated for the protection of flora

a indicates that 1000 plants or more are known to occur within a conservation reserve(s)

i indicates that less than 1000 plants are known to occur within a conservation reserve(s)

- indicates that the reserved population size is not accurately known

Please note: These records are based on information supplied by the National Parks and Wildlife Service and other sources, and may contain errors or omissions.

Flora Species of Regional or Local Conservation Significance

Flora species that are not listed on any rare or threatened species databases, but are regionally significant by virtue of their local rarity or limits of their distribution could occur in the study area. These are listed in Pittwater Council's Development Control Plan No. 25 – Conservation of Biodiversity (Pittwater Council 2000). Those that are listed by ROTAP (Briggs and Leigh 1996) but not shown in Table 1 as having been recorded within the study locality, are also included in Table 2 below.

Table 2. Significant Flora Species in Pittwater LGA - modified from Pittwater Council (2000)

Scientific Name	Common Name	Reason for Significance
<i>Abrophyllum ornans</i>		Significant in Sydney Region
<i>Acacia falcata</i>	Sickle Wattle	Locally significant in Pittwater
<i>Acacia prominens</i>	Gosford Wattle	Significant in Sydney Region
<i>Acronychia oblongifolia</i>	Common Acronychia	Significant in Sydney Region
<i>Alectryon subcinereus</i>	Wild Quince	Significant in Sydney Region
<i>Alocasuarina verticillata</i>	Drooping She-oak	Significant in Sydney Region
<i>Arthrochilus prolixus</i>	Elbow Orchid	Only Sydney location (Angophora Reserve), southern limit
<i>Bertya brownii</i>	Wild Quince	ROTAP 2RC-, southern limit
<i>Blechnum camfieldii</i>		Locally significant in Pittwater
<i>Bossiaea prostrata</i>		Locally significant in Pittwater
<i>Callitris rhomboidea</i>	Port Jackson Cypress	Locally significant in Pittwater
<i>Cassine australis</i>	Red Olive Plum	Locally significant in Pittwater
<i>Craspedia variabilis</i>		Significant in Sydney Region
<i>Daviesia umbellata</i>		Significant in Sydney Region (RBG)
<i>Diplazium dilatatum</i>		Only Sydney location Irrawong Reserve, southern limit
<i>Eriostemon buxifolius</i> subsp. <i>buxifolius</i>	Box-leaf Wax-flower	Significant in Sydney Region, northern limit
<i>Eucalyptus capitellata</i>	Brown Stingybark	Significant in Sydney Region (RBG)
<i>Eucalyptus robusta</i>	Swamp Mahogany	Significant in Sydney Region (RBG)
<i>Eucalyptus scias</i>	Large-fruited Red Mahogany	Significant in Sydney Region (RBG)
<i>Eupomatia laurina</i>	Bolwarra	Locally significant in Pittwater
<i>Flagellaria indica</i>	Whip Vine	Only Sydney location Barrenjoey Head
<i>Guoia semiglaucula</i>	Guoia	Locally significant in Pittwater
<i>Logania pusilla</i>		Significant in Sydney Region (RBG)
<i>Parachidendron pruinosum</i>	Snow-wood	Significant in Sydney Region
<i>Persoonia isophylla</i>		Significant in Sydney Region
<i>Planchonella australis</i>	Black Apple	Locally significant in Pittwater
<i>Playtsace clelandii</i>		ROTAP 2RCa
<i>Pomaderris</i> species B		Undescribed species restricted to headlands at Bulli and Pittwater
<i>Prostanthera denticulata</i>	Rough Mint-bush	Endemic and significant in Sydney region (RBG)
<i>Pultenaea hispidula</i>		Significant in Sydney Region (RBG)
<i>Schizomeria ovata</i>	Crab Apple	Locally significant in Pittwater

RBG = Royal Botanic Gardens

In addition, a number of species are regarded as being regionally significant by Sheringham and Sanders (1993), because of their restricted local distribution, local rarity or local limits to their distribution. These all occur in Garigal National Park and include:

Acianthus cordatus
Allocasuarina nana
Chiloglottis reflexa
Chiloglottis trapeziformis
Eucalyptus squamosa
Patersonia sp. aff. *fragilis*
Pultenaea microphylla
Psedanthus pimelioides

Pterostylis daintreana
Rimacola elliptica

Endangered Populations of Plants

No listed endangered populations of flora occur within the study locality.

Endangered Ecological Communities

The following Endangered Ecological Communities all occur in the Pittwater LGA, and some examples of each community are known to occur within the study locality:

- *Duffys Forest Ecological Community*;
- *Pittwater Spotted Gum Forest*; and
- *Sydney Coastal Estuary Swamp Forest Complex*.

Of these communities, *Pittwater Spotted Gum Forest* is unlikely to occur because of the absence of shale-derived soils and lack of the key diagnostic species in the area. *Sydney Coastal Estuary Swamp Forest Complex* is unlikely to occur because of the lack of any swamp or estuarine habitat in the subject site (although the community is known to occur further downstream along Mullet Creek).

It is possible that *Duffys Forest Ecological Community* could form a component of the vegetation on the site since it occurs on Hawkesbury Sandstone. Small, fragmented stands of the community occur around the Baha'i Temple at Ingleside, and on the opposite side of Mona Vale Road in Garigal National Park (Smith and Smith 2000). However, the community typically occurs on ridges in association with laterite soils and soils derived from shale and laminite lenses (NSW Scientific Committee 2002). Although some laterite occurs immediately adjacent to Ingleside Road, this soil type appears to be generally absent from the bulk of the subject site.

2.1.2 Fauna

Threatened Species

A total of thirty (30) threatened terrestrial fauna species have previously been recorded within the study locality, including fourteen (14) bird, five (5) flying mammal, six (6) arboreal or terrestrial mammals, three (3) amphibians and two (2) reptiles. Of these, seven species are currently regarded as Endangered on Schedule 1, Part 1 of the *TSC Act 1995* (Bush Stone-curlew, Swift Parrot, Regent Honeyeater, Eastern Quoll, Southern Browned Bandicoot, Green and Golden Bell Frog and Broad-headed Snake) and the remainder as Vulnerable on Schedule 2 of the Act. The Regent Honeyeater is also listed as Endangered and Migratory and the Swift Parrot and Southern Brown Bandicoot as Endangered by the Commonwealth *EPBC Act 1999*. The Osprey is listed as migratory and a further five species as Vulnerable under the Commonwealth legislation. The local threatened fauna species are listed below in **Table 3**.

Table 3. Threatened Fauna previously recorded within the Study Locality

Scientific Name	Common Name	Status (TSC)	Status (EPBC)	Earliest/latest record	Number of records within 10km of site	Number of records within 2.5km of site
Birds						
<i>Botaurus poiciloptilus</i>	Australasian Bittern	V	-	1984	1	0
<i>Burhinus grallarius</i>	Bush Stone-curlew	E1	-	1981-2003	11	0
<i>Calyptrorhynchus lathamii</i>	Glossy Black-Cockatoo	V	-	1982-2003	31	4
<i>Ixobrychus flavicollis</i>	Black Bittern	V	-	1983-2000	6	0
<i>Lathamus discolor</i>	Swift Parrot	E1	E	1986	1	1
<i>Melithreptus gularis</i>	Black-chinned Honeyeater	V	-	1992	1	0
<i>Neophema pulchella</i>	Turquoise Parrot	V	-	1983	1	0
<i>Ninox connivens</i>	Barking Owl	V	-	1998-2002	8	0
<i>Ninox strenua</i>	Powerful Owl	V	-	1977-2003	42	11
<i>Pandion haliaetus</i>	Osprey	V	Mi	1988-1997	6	1
<i>Ptilinopus magnificus</i>	Wompoo Fruit-Dove	V	-	1985	2	0
<i>Ptilinopus superbus</i>	Superb Fruit-Dove	V	-	1969-1992	7	0
<i>Tyto novaehollandiae</i>	Masked Owl	V	-	1992-2000	3	0
<i>Xanthomyza phrygia</i>	Regent Honeyeater	E1	E, Mi	1938-1998	6	2
Flying Mammals						
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V	-	1997	1	0
<i>Miniopterus schreibersii oceanensis</i>	Eastern (Common) Bentwing-bat	V	-	1996-2003	12	3
<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	V	-	2002	1	0
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V	-	1996	1	0
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	V	1970-2003	22	4
Terrestrial and Arboreal Mammals						
<i>Cercartetus nanus</i>	Eastern Pygmy-possum	V	-	1969-2003	10	0
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	V	V	1975-1998	15	5
<i>Dasyurus viverrinus</i>	Eastern Quoll	E1	-	1981	1	0
<i>Isodon obesulus</i>	Southern Brown Bandicoot	E1	E	1967-2003	48	1
<i>Petaurus norfolcensis</i>	Squirrel Glider	E2,V	-	2002	1*	0
<i>Phascolarctos cinereus</i>	Koala	E2, V	-	1900-1997	115	11
Ampibians and Reptiles						
<i>Heleioporus australiacus</i>	Giant Burrowing Frog	V	V	1969-1996	17	2
<i>Litoria aurea</i>	Green and Golden Bell Frog	E1	V	1975-2002	3	0
<i>Pseudophryne australis</i>	Red-crowned Toadlet	V	-	1966-2003	34	1
<i>Hoplocephalus bungaroides</i>	Broad-headed Snake	E1	V	2003	1	1
<i>Varanus rosenbergi</i>	Heath Monitor	V	-	1999-2003	11	1

Notes:

340000 E and 6271000 N are the closest co-ordinates of the subject site.

Status (TSC): refers to the NSW *Threatened Species Conservation Act 1995* (TSC)

E1 – Schedule 1, Part 1: Endangered Species

E2 – Schedule 1, Part 2: Endangered Population

V – Schedule 2: Vulnerable Species

Status (EPBC): refers to the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC)

E – Endangered Species

V – Vulnerable Species

Mi – Migratory Species

Excluded Fauna: Fauna records within 10 km that have been excluded from further consideration because the habitat is clearly unsuitable (mostly marine, shoreline or estuarine species) include: Australo-African Fur-seal, Green Turtle, Leathery Turtle, Dugong, Southern Right Whale, Humpback Whale, Sperm Whale, Greater Sand Plover, Lesser Sand Plover, Sanderling, Great Knot, Wandering Albatross, Beach Stone-curlew, Little Tern, Sooty Tern, White Tern, Sooty Oystercatcher, Pied Oystercatcher, Southern Giant-Petrel, Northern Giant-Petrel, Little Shearwater, Flesh-footed Shearwater, Shy Albatross, Sooty Albatross, Black-browed Albatross.

Please note: These records are based on information supplied by the National Parks and Wildlife Service and other sources, and may contain errors or omissions.

Endangered Fauna Populations

Two Endangered Populations of fauna occur in Pittwater LGA, within the study locality:

- The Squirrel Glider (*Petaurus norfolcensis*) population on Barrenjoey Peninsula, north of Bushrangers Hill; and
- The Koala population (*Phascolarctos cinereus*) in the Pittwater Local Government Area.

The population of Koalas occurs predominantly on the Barrenjoey Peninsula between Ingleside and Elanora Heights in the south and Palm Beach in the North. The population appears to have declined from an estimated 123 individuals in the 1970's to 6 in 1993 and less than six in 1998. This population was listed in 1998 when considered in immediate danger of extinction (NPWS, 1998).

The Squirrel Glider population also occurs on Barrenjoey Peninsula. This population is distributed on the peninsula north of Bushrangers Hill. Bushrangers Hill is approximately 3.5km NE of the site, therefore the study area is outside the known distribution of the endangered Squirrel Glider population.

A record of a single Squirrel Glider also exists from the Elanora Heights area as listed on the Australian Museum database. This was from a specimen that is held by the Australian Museum. We have checked with the Australian Museum regarding the authenticity of its identification. An expert from the Museum re-examined the specimen, and identified it as in fact being that of a Sugar Glider (*Petaurus breviceps*).

2.2 Habitat Assessment of the Subject Site

Investigations for the preliminary habitat assessment comprised site inspections on the 9th and 15th of April 2003 and 11th of August 2004, noting floral and faunal habitat types and features. The possible factors investigated and assessed for the study area included:

- Flora:**
- Overall Type and Structure of Vegetation and Communities Present;
 - Dominant Species;
 - Subjective assessment of Floristic Diversity;
 - Disturbance Regime, both past and ongoing
 - Extent of Weed Invasion;
 - Potential occurrence of Local Threatened and Significant Flora Species
- Fauna:**
- Presence and Frequency of Large Mature Trees, Dead Trees and Hollow-bearing Trees;
 - Height of Upper Strata
 - Density of Shrub and Ground Cover;
 - Presence of Fallen Timber and Rock Outcrops;
 - Presence of Wet Areas or Waterbodies;
 - Assessment of Previous and Present Land Use and Disturbance Regimes;
 - Extent of Connectivity, Movement Corridors and Refugia;
 - Presence of Critical Habitat Elements for Local Threatened Species;

- Searches for evidence of the presence of Threatened Species; and
- Fauna species diversity (all fauna observed or signs of fauna were recorded).

From these site assessments it was possible to:

- identify those parts of the subject site that contain potentially significant habitats for threatened species and local biodiversity;
- determine the areas of the study area that require detailed field survey;
- identify potential constraints from an ecological perspective within the subject site; and
- generate a list of local and regional threatened species regarded as subject species.

Habitat Features

Overall Type and Structure of Vegetation and Communities Present

The natural vegetation of the subject site is predominantly dense Scrub to Tall Heath with minor areas of Woodland and Open-forest with a scrub understorey. This vegetation type grows in shallow, poor soil derived from Hawkesbury Sandstone. Some areas of vegetation are in good condition and weed-free, however there are large cleared patches and edge areas into which weeds have invaded.

Presence of Large Trees, Dead and Mature Trees and Hollow-bearing Trees

Few large or mature trees occur in the subject site, as this is predominantly Tall Heath/Scrub. There are a few larger trees (Scribbly Gum and Silver-top Ash) along Ingleside Road and in properties adjacent to the subject site. Other tree species include Grey Gum, Red Bloodwood, She-oaks and Swamp Mahogany. Younger eucalypts were also scarce with less than 10 individuals in each lot, with the exception of the proposed lot 1, where there is a band of trees along Ingleside Road. No hollows were observed in the trees on the subject site.

Density of Shrub and Ground Cover

The Tall Heath/Scrub is extremely dense, with up to 90 % canopy cover. The community is dominated by *Banksia ericifolia*, *Kunzea ambigua*, *Leptospermums*, *Hakeas* and *Allocasuarinas*, reaching a height of approximately 4 – 5 m. Beneath this dense canopy the ground cover is sparse.

Presence of Fallen Timber and Rock Outcrops

Some fallen timber was observed on the subject site. In the subject site some patches shrubs have been pushed over to create piles of fallen timber. The escarpment and below to the east contains a high proportion of exposed rock faces, benches and crevices. However there are no rock outcrops in the subject site.

Presence of Wet Areas and Water-bodies

There are no water-bodies or wet areas on the subject site. There are however some seepage points along the rock benches near the escarpment, during periods of rain.

Impacts of Disturbance Regimes

Some areas of the site have been previously cleared or disturbed. In these areas there is significant weed infestation. Some clearing / disturbance has occurred behind some of the properties along Ingleside Road, at the edges of proposed Lot 1 and within Lots 83, 84 and 85.

Extent of Potential Movement Corridors and Refugia

The subject site represents the western edge of a bushland corridor, with cleared land, houses and their residential gardens to the west. Bushland continues to the north-east and east. A small area of vegetation continues to the south-east, however this is also currently proposed for development. This proposal will not isolate any area of bushland. The subject site only represents a relatively small proportion of the area of bushland and is therefore unlikely to represent a significant area of refugia for most of the potential threatened species, as they are mobile and have a large home range. However for a species that is relatively immobile with a small home range, e.g. frogs and Southern Brown Bandicoot, this area may be more significant.

2.3 Determination of Local Threatened Flora and Fauna as Subject Species

A list of subject species has been compiled. Potential subject species are defined as those threatened species considered likely to occur in the habitats present within the subject site (NPWS 1996). Therefore, such species would be potentially impacted by the proposal.

2.3.1 Threatened Flora

An assessment of the relative likelihood of the threatened flora species previously recorded in the study locality occurring within the subject site is provided below in **Table 4**.

Table 4. Assessment of the Potential for Local Threatened Flora Species to occur within the Subject Site.

Scientific Name	No. of records within 10 (2.5) km of the study area	Preferred Habitat and comments*	Likelihood Of Occurrence
<i>Acacia bynoeana</i>	1	Heath on sandstone outcrops and sclerophyll forest on sandy soils	Low to Moderate – suitable habitat does occur on site but no nearby records exist.
<i>Asterolasia elegans</i>	1	Grows in wet sclerophyll forest on moist hillsides.	Low – habitat is unsuitable in the subject site and only one record for the locality.
<i>Amperea xiphoclada</i> var. <i>papillata</i>	1	Woodland and forest on low fertility soils	Low to Moderate – habitat is marginal and no nearby records occur.
<i>Angophora crassifolia</i>	33 (1)	Common on lateritic tops ^a . Locally frequent but restricted to the Ku-ring-gai Plateau region	Low – Although a number of records occur in the locality, including one nearby, no lateritic tops occur in the site.
<i>Bertya brownii</i>	2	Deep, moist sandstone gullies in rainforest and eucalypt forest.	Low – No suitable habitat on the subject site.
<i>Boronia fraseri</i>	5	Mainly in wet sclerophyll forest and in rainforest in gullies on sandstone	Low – No suitable habitat on the subject site.
<i>Boronia serrulata</i>	8 (1)	Moist heath in sandy situations on Hawkesbury Sandstone	Low to Moderate – habitat is marginal as the tall heath may be too dense.
<i>Callistemon linearifolius</i>	1	Open forest and scrubland in damp places ^c .	Moderate – suitable habitat may be available, however there is only one record for the locality.
<i>Chamaesyce psammogeton</i>	1	Sand dunes near the sea	None – no sand dune habitat occurs in or near the study area.
<i>Corybas undulatus</i>	5	Moist areas of sclerophyll forest in coastal and near-coastal regions. Widespread but rarely common.	Low – unsuitable habitat and no nearby records occur.
<i>Cryptostylis hunteriana</i>	1	Swamp-heath on sandy soils – chiefly in coastal districts	Low – Little or no swamp-heath habitat occurs; only one record for the locality.
<i>Darwinia diminuta</i>	4	Heath or dry sclerophyll forest in poorly drained soil; chiefly in coastal sites.	Low to Moderate – habitat is marginal and no nearby records occur.
<i>Darwinia procera</i>	24 (1)	Dry sclerophyll forest and scrub at the head of sheltered gullies on sandstone	Low to Moderate – only marginal habitat on the subject site, but several records for the locality occur including one nearby.
<i>Epacris purpurascens</i> var. <i>purpurascens</i>	3	Prefers damp areas in woodland on sandstone. Also sclerophyll forests, scrubs and swamps	Moderate – suitable habitat exists but records for the locality are scarce and no nearby records occur.
<i>Eucalyptus camfieldii</i>	17	Shallow-soiled sandstone or lateritic tops ^a in heath on sandstone	Low to Moderate – marginally suitable habitat may exist but no nearby records occur.
<i>Eucalyptus luehmanna</i>	45 (1)	Mallee heath on shallow infertile sandy soils of poor drainage on sandstone	Moderate – suitable habitat exists and numerous records for the locality occur including one nearby.
<i>Genoplesium baueri</i>	3	Grows in sparse sclerophyll forest and moss gardens over sandstone.	Low – Scrub vegetation is generally too dense, although some moss areas could occur on rock platforms.

Scientific Name	No. of records within 10 (2.5) km of the study area	Preferred Habitat and comments*	Likelihood Of Occurrence
<i>Gonocarpus salsoloides</i>	2	Swampy areas on sand in coastal districts	Low – Swampy, sandy areas are absent.
<i>Grammatis stenophylla</i>	2	Grows on rocks in rainforest and wet sclerophyll forest.	Low – Unsuitable habitat in the study area.
<i>Grevillea caleyi</i>	63 (6)	Restricted to deeply eroded Narrabeen Shale	Low to Moderate – Numerous records occur in the locality, including some nearby (Baha'i Temple area), but the soil type of the subject site is unsuitable.
<i>Haloragodendron lucasii</i>	6	Sheltered gullies with a fern understorey and often at the base of rock faces ^c .	Low – unsuitable habitat on site.
<i>Hibbertia hermanniifolia</i>	1	Open forest on sandstone	Low – Vegetation is generally too closed, and only one record for the locality exists.
<i>Hibbertia nitida</i>	1	Widespread in heath and woodland on sandstone in the Sydney district	Low – Habitat is generally unsuitable, and only one record for the locality exists.
<i>Kunzea rupestris</i>	2	Heath on rock platforms	Low – Nominally suitable habitat occurs, but only two records for the locality exist.
<i>Lasiopetalum joyceae</i>	1	Heath and open woodland on sandy soils	Low – marginal habitat could occur, but only one record for the locality exists.
<i>Leptospermum deanei</i>	2	Usually found in creek lines and associated lower slopes	Low– Unsuitable habitat in the subject site.
<i>Lomandra brevis</i>	37 (3)	Dry sclerophyll forest on sandstone-derived soils in the Sydney region	Low– Unsuitable habitat in the subject site.
<i>Lomandra fluviatilis</i>	3	Grows in creek beds on sandy soils	Low– Unsuitable habitat in the subject site.
<i>Melaleuca deanei</i>	2	Found on coastal sandstone plateaux in marshy heath	Low to Moderate – suitable habitat could exist, but only two records for the locality exist.
<i>Microtis angusii</i>	1	Unknown, due to the disturbed nature of its only known location. Its likely natural habitat could be Duffys Forest Ecological Community ^b .	Low – Only one population is known for Pittwater in a disturbed area. It may well have been transported to the site as seeds in dumped soil ^b .
<i>Persoonia hirsuta</i> subsp. <i>hirsuta</i>	1(1)	Woodland or scrub/heath to dry sclerophyll forest on sandstone, often where there is a clay influence at a shale/sandstone ecotone.	Low to Moderate – Site is at the edge of a shale/sandstone transition area, but only one record (an individual plant near the Baha'i Temple in 1994) exists.
<i>Pimelea curviflora</i> var. <i>curviflora</i>	4	Woodland on shaley/lateritic soils over sandstone, or shale/sandstone transition of low nutrients. Ridgetops and upper slopes	Low to Moderate – Site is at the edge of a shale/sandstone transition area, but few records for the locality exist.
<i>Rulingia hermanniifolia</i>	3	Often spreads 1-2 m across ground or pendent down rock faces, mostly on sandstone cliffs or along gullies	Low– Unsuitable habitat on site
<i>Syzygium paniculatum</i>	3	Subtropical and littoral rainforest or stabilized dunes near the sea	Low – littoral rainforest habitat is absent

Scientific Name	No. of records within 10 (2.5) km of the study area	Preferred Habitat and comments ^a	Likelihood Of Occurrence
<i>Tetratheca glandulosa</i>	36 (2)	Sandy heath and woodland in Sydney's North Shore and an area North of the Hawkesbury River	Low to Moderate – Areas of suitable habitat may occur and a number of records occur for the locality – including two nearby, however, the vegetation is probably too dense.

^aHarden (1990 – 2002), Harden & Murray (2000) – unless otherwise indicated

^aRobinson (1991)

^bSmith and Smith (2000)

^cFairley and Moore (1995)

In spite of nominally suitable habitat being present for a number of the rare or threatened species previously recorded in the locality, none are regarded as having a high likelihood of occurring in the subject site. There is a greater likelihood that some could occur in the more open forest and woodland below the escarpment, particularly those species that are usually found in gullies and by streams.

The species regarded as having at least a moderate likelihood of occurrence, in the subject site include *Callistemon linearifolius*, *Epacris purpurascens* var. *Purpurascens* and *Eucalyptus leuhmanniana*. Of these only *Callistemon linearifolius* and *Epacris purpurascens* var. *Purpurascens* are listed by legislation, and therefore might require assessment as subject species under section 5A of the *TSC Act 1995* or as Matters of National Environmental Significance under the *EPBC Act 1999*.

Other threatened or significant species with a lesser (low to moderate) likelihood of occurring in the subject site are *Acacia bynoeana*, *Amperea xiphoclada* var. *papillata*, *Boronia serrulata*, *Darwinia diminuta*, *Darwinia procera*, *Eucalyptus camfieldii*, *Melaleuca deanei*, *Persoonia hirsuta* subsp. *hirsuta*, *Pimelea curviflora* var. *Curviflora*, *Grevillea caleyi* and *Tetratheca glandulosa*.

2.3.2 Threatened Fauna

An assessment of the likelihood of the threatened fauna species previously recorded in the study locality occurring within the subject site is provided below in **Table 4**. Seven threatened fauna species are considered to be subject species and these are listed below.

Table 5. Assessment of the Potential for Local Threatened Fauna Species to occur within the Subject Site.

Species	Number of records within 10km (2km) of site/ latest record	Habitat Requirements	Likely Presence
Australasian bittern	1 / 1984	Inhabits freshwater wetlands and occasionally estuarine with dense vegetation.	Unlikely - Habitat is unsuitable. Not considered a potential Subject Species.
Bush-stone Curlew	11 / 2003	Open woodland, lightly timbered and wetlands. Prefers sparse shrub layer, with grass or litter. Avoids dense habitat.	Low - Habitat is unsuitable. Not considered a potential Subject Species.
Glossy Black-Cockatoo	31 (4) / 2003	Feed in open casuarina woodland, primarily where the Forest Oak <i>Allocasuarina torulosa</i> occurs. Large tree hollows are required for nesting.	Low - Habitat is unsuitable. Not considered a potential Subject Species.
Black Bittern	6 / 2000	Require dense riparian vegetation	Unlikely - Habitat unsuitable. Not considered a potential Subject Species.
Swift Parrot and Regent Honeyeater	1 (1) / 1986 6 (2) / 1998	The migratory nature of these species makes them difficult to assess, although they are known to frequent densely blossoming winter flowering trees such as Swamp Mahogany on an opportunistic basis in coastal NSW	Low to moderate - The available habitat is marginal, with areas of better quality habitat for this species occurring within the wider locality. The Swamp Mahogany's occurring on site are young individuals. Not considered to be Subject Species.
Black-chinned Honeyeater	1 / 1992	Forests and woodlands of eucalypts and paperbarks, as well as tree lined creeks in arid areas.	Unlikely - Habitat unsuitable. This species generally prefers drier habitats. Not considered a potential Subject Species.
Turquoise Parrot	1 / 1983	Feeds on the ground on grasses at the edge of woodland.	Unlikely - No grassland habitat on the subject site. Not considered a Subject Species.
Barking Owl	8 / 2002	Open forests, woodlands, dense scrubs, foothills; river red gums, other large trees near watercourses, penetrating otherwise open country; paperbark woodlands.	Low - Some roosting habitat is present to the east of the subject site. The paucity of near by records of this species and availability of better quality habitat in the locality, suggests the Barking Owl is unlikely to occur. The subject site is likely to be too dense for foraging. Not considered a potential Subject Species.
Powerful Owl	42 (11) / 2003	Occur in Open Forest and Woodland. Roost in dense tree foliage, feed on possums, birds and fruit-bats and nest in large tree hollows.	Moderate to High - Only foraging habitat is available on the subject site. However habitat in the gully east of the site is suitable for foraging, roosting and most likely nesting. There is a high abundance of Ringtail possums in the study area including the subject site. Also many records occur within locality, including a pair of owls that were recorded less than 1km north of the site. The Powerful Owl is considered a Subject Species .

Species	Number of records within 10km (2km) of site/ latest record	Habitat Requirements	Likely Presence
Osprey	6 (1) / 1997	Require large open water-bodies for feeding on fish etc., and a large tree in an open area for nesting.	Unlikely - Habitat unsuitable. Not considered a Subject Species.
Wompoo Fruit-dove and Superb Fruit-dove	2 / 1985 7 / 1992	Prefers rainforest habitat but occasionally vagrants appear at fruiting rainforest and ornamental trees in the Sydney area.	Unlikely - Habitat unsuitable. Not considered a Subject Species.
Masked Owl	3 / 2000	Reported from dry open forest types, with sparse understorey. The Masked Owl predominantly preys on ground dwelling fauna, in particularly rodents, both native and introduced.	Low - Some limited potential foraging and roost/nest habitat is present within the subject site, however it is extremely marginal, as the understorey is generally too dense. Also the low number of records from the locality suggest that the Masked Owl is unlikely to occur. Not considered a Subject Species.
Eastern False Pipistrelle, Eastern Freetail-bat and Greater Broad-nosed Bat	1 / 1997 1 / 2002 1 / 1996	Forage for insects over a variety of vegetated habitats and require tree hollows or other cavities for roosting. Usually associated with tall open forest.	Low - The habitat on the site is highly marginal for these species to forage and a low number of records for the local region. No potential roost sites are present on the subject site. The ultrasonic calls attributed to the Eastern False Pipistrelle may be that of the Eastern Broad-nosed Bat and therefore the Pipistrelle may not occur in the local region. Not Considered Subject Species
Eastern Bent-wing Bat	12 (3) / 2003	Wide ranging species known to frequent a variety of habitat types. Generally considered cave or culvert roosting species.	Moderate - Could potentially make use of the site for foraging purposes. However, potential foraging habitat occurs widely throughout the area. Given the absence of potential roosting sites, the subject site cannot be considered significant, however with nearby records the Eastern Bent-wing Bat is considered to be a potential Subject Species .
Grey-headed Flying Fox	22 (4) / 2003	Occur along the eastern coastal plain through NSW. They are a canopy feeding frugivore and nectivore of rainforests, open forests, woodlands and swamps. Gather in large camps to roost during the day in trees.	Moderate - The occasional Flying-fox is likely to visit a flowering eucalypt on the site. However trees are scarce on the site and most of the eucalypts are young individuals that would be unlikely to currently supply a significant food resource. No Flying-fox camps are present in the study area. Considered a potential Subject Species .
Eastern Pygmy Possum	10 / 2003	Forages on the nectar and pollen of banksias, eucalypts and bottlebrushes, insects and soft fruits. Create nests in small tree hollows, behind bark and birds nests.	Moderate - Suitable habitat exists on the site and there are some records within the locality. Considered a potential Subject Species .

Species	Number of records within 10km (2km) of site/ latest record	Habitat Requirements	Likely Presence
Spotted-tailed Quoll	15 (5) / 1998	Inhabits a variety of habitat types from moist and wet sclerophyll through to dry forests and woodlands on the edge of open grasslands. Requires large hollowed logs on the ground for den sites.	Moderate - Suitable habitat does occur in the study area. Suitable den sites most likely occur in the gully below the escarpment. Quolls may potentially forage within the subject site. Although there are nearby records, sightings are few in number and sporadic. Considered a potential Subject Species
Eastern Quoll	1 / 1981	Use a variety of habitats including dry sclerophyll forest, scrub, heath land and cultivated land.	Low - Suitable habitat does occur in the study area. However, this species is thought to be extinct in mainland Australia and therefore is not considered to be potential Subject Species.
Southern Brown Bandicoot	48 (1) / 2003	Largely confined to woodland with a dense heath under-story on sandstone ridge-tops. Nest made under dense vegetation or under rock outcrops on the upper slopes of plateau ridge tops where it primarily forages.	Low to moderate - The heath habitat on the subject site may be suitable for this species, however the shrubs are extremely dense and the ground cover sparse and has obviously not been burnt for ten years. The Southern Brown Bandicoot appears to prefer more open plateaus for foraging and a dense ground cover on upper slopes for nesting. Therefore it is considered that the present habitat is marginal. Although not considered to be potential Subject Species, this species will still be targeted with the field surveys, due to the large number of records in the locality and one within 2.5km
Squirrel Glider	1 (1) / 2002	Usually inhabits dry open sclerophyll forest and woodlands, but has also been observed in moist regenerating forest and moist gullies. This species forages on Acacia gum, Eucalypt sap, nectar, honeydew, manna invertebrates and pollen. Requires tree hollows with a small entrance for den sites	Low - Suitable foraging habitat does occur throughout the study area, however roost sites appear to be absent from the subject site. Furthermore the species appears to be confined to the Barrenjoey Peninsula, where its status is unknown. A nearby Aust Museum record from Elanora Heights has since been identified as a Sugar Glider. The Squirrel Glider is not considered a potential Subject Species
Koala	115 (11) / 1997	Requires the presence of particular feed tree species. Within the study locality, the Grey Gum <i>Eucalyptus punctata</i> and Swamp Mahogany are preferred food trees. The Scribbly Gum <i>Eucalyptus haemastoma</i> is also listed as a food tree in Schedule 2 of SEPP 44.	Moderate - Some Grey Gum, Swamp Mahogany and Scribbly Gum do occur in the study area, with some small to medium individuals on the subject site, therefore there is some potential for Koalas to pass through the study area. There are many records from the locality including some near by, although very few are recent. Considered a potential Subject Species

Species	Number of records within 10km (2km) of site/ latest record	Habitat Requirements	Likely Presence
Giant Burrowing Frog	17 (2) / 1996	Riparian areas in heath, woodland and open forest on sandstone ridges and upper slopes.	Moderate - Suitable habitat may exist on the subject site, however vegetation may be too dense. There are a reasonable number of records within the locality. This species has been recorded in the same tract of bushland less than 1km to the north (Ecotone 1993 and recently by Pittwater Council (Mia Dalby-Ball <i>pers. comm.</i>). Considered a potential Subject Species
Green & Golden Bell Frog	3 / 2002	Require well-vegetated creeks, dams and swamps.	Unlikely - Habitat unsuitable. Not considered a potential Subject Species.
Red-crowned Toadlet	34 (1) / 2003	Suitable habitat is periodically wet drainage lines, particularly where dense Coral Fern growth occurs on sandstone escarpments just below the ridge-top.	Moderate - Suitable habitat of wet drainage lines with dense vegetation does not occur on the subject site. However habitat is present along the escarpment directly east of the site and may be indirectly impacted by the near by development. This species has been recorded in the same tract of bushland less than 1km to the north (Ecotone 1993). Considered a Subject Species .
Broad-headed Snake	1 (1) / 2003	Sandstone ridges in forested areas. Shelters under large slabs of rock or in a hollow limb. Largely confined to Hawkesbury sandstone.	Low - Habitat on site is unsuitable. Not considered a subject species.
Heath Monitor	11 (1) / 2003	Require heath, open forest or woodland on sandstone ridges.	Low to moderate - The rock outcrops to the east provide suitable habitat for shelter. The subject site may be suitable foraging habitat, however in most areas vegetation may be too dense. This species has been recorded in the same tract of bushland less than 1km to the north (Ecotone 1993). Not considered a Subject Species.

*Compiled from: Churchill (1998); Cogger (1995); Slater et al (1998); Strahan (1995); Swan et.al, (2004); Morcombe (2000); NPWS Website.

2.3.3 Potential Subject Species to be assessed

The following listed species are considered to have potential to occur within the subject site and are considered subject species in this assessment:

Flora

- *Callistemon linearifolius*
- *Epacris purpurascens* var. *purpurascens*

Fauna

- Powerful Owl
- Eastern Bent-wing Bat
- Grey-headed Flying-fox
- Eastern Pygmy Possum
- Spotted-tailed Quoll
- Koala
- Giant Burrowing Frog
- Red-crowned Toadlet

Field survey techniques were designed to target these subject species and are discussed in section 3. The potential impacts on these subject species as a result of the proposed development are presented in Section 4.0 of this report.

2.4 Review of relevant local studies and reports

In a study of habitat and wildlife corridors, Pittwater Council (1995) identified the entire study area as a "Major Habitat Area" for wildlife. This was determined on the basis of the area having a wide diversity of habitat types and fauna species. It is important that Major Habitat Areas be linked to other major habitat areas by wildlife corridors. The study also recommended that development controls be adopted to conserve habitat values in Warriewood / Ingleside release area.

More recently the study area has been categorised in DCP 25 – Conservation of Biodiversity (Pittwater Council 2000) as Core Bushland – Priority 1 (most of the site), Fragmented Bushland – Priority 1 or Cleared Land Within Wildlife Corridor – Priority 2 (Figure 5).

Two studies have been conducted examining the flora (Geoff Cunningham Natural Resource Consultants 1994) and fauna (ICF and The Australian Museum 1994) issues constraining proposed development of the Warriewood / Ingleside Land Release Area. From these studies, land was classified into different categories according to its capacity to support development in relation to these constraints.

Ecotone Ecological Consultants Pty Ltd conducted fauna and flora surveys and prepared a Species Impact Statement on the adjacent land along the escarpment to the north (Ecotone, 1993 & 1999). Threatened fauna species recorded were the Powerful Owl, Eastern Bent-wing Bat, Heath Monitor, Red-crowned Toadlet and Giant Burrowing Frog. Despite detailed flora surveys by Steve Douglas, no threatened flora species were recorded.

3.0 SECOND STAGE ECOLOGICAL INVESTIGATION – FIELD SURVEYS

This section documents stage two of the ecological investigation within the study area specifically detailing the methodology and results of the flora and fauna field surveys. A brief description on the biodiversity assemblages in the study area is also provided.

3.1 Floral Investigations

3.1.1 Methodology

Comprehensive flora field surveys were undertaken over the study area on the 9th of April 2003, with follow-up surveys through the wider study area (i.e. the gully area east of the study area on 15th April and 21st of May 2003. Following inclusion of additional lots fronting Ingleside Road into the proposed development area, a supplementary survey of the relevant areas was conducted on 24th September 2003. The survey methodology involved three components:

- A general traverse through the entire subject site using the random meander method (Cropper, 1993) to assess the range of floristic variation, vegetation structure, extent of modification, disturbance, weed invasion and condition of the vegetation generally;
- A transect through representative vegetation types in the upper gully area to the east of the subject site (the proposed reserve lot); and
- A targeted search for threatened species as listed in the *TSC Act 1995* or *EPBC Act 1999*. Any regionally significant species encountered during these searches were also noted.

A small sample of any unknown plant species was obtained for further examination and identification.

3.1.2 Results

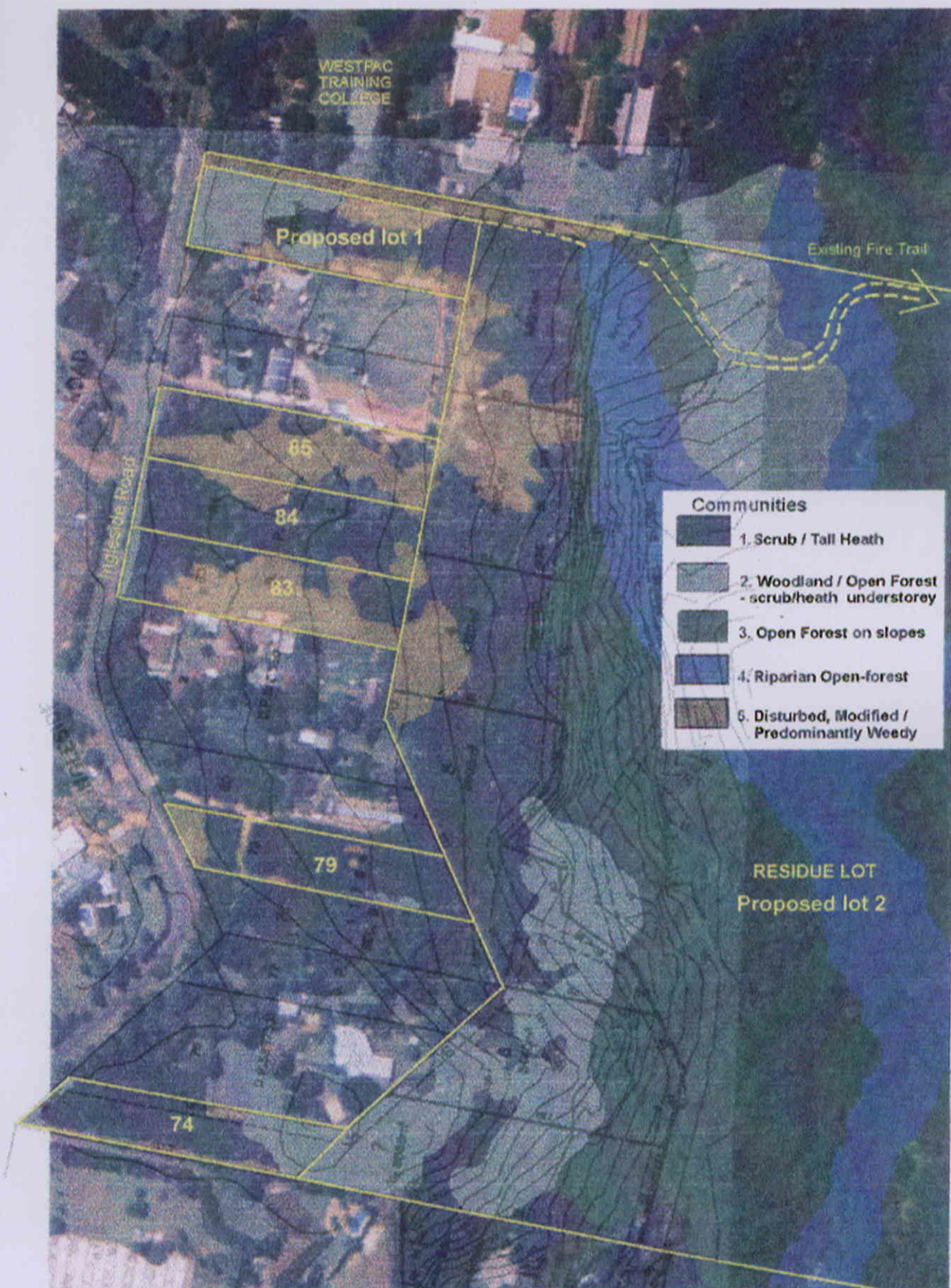
Vegetation Communities

Five distinct, identifiable vegetation communities occur in the wider study area:

1. Banksia / Hakea / Allocasuarina Scrub / Closed-scrub to Tall Heath
2. Red Bloodwood / Smooth-barked Apple / Scribbly Gum Woodland to Open Forest with a scrub / heath understorey
3. Sydney Peppermint / Smooth-barked Apple / Red Bloodwood Open-forest
4. Riparian Open-forest to Closed-forest
5. Disturbed, Modified and predominantly weedy areas

The subject site and area above the escarpment is predominantly covered by Community 1. Areas of Community 5 as well as small areas containing elements of Community 2 also occur. Communities 2, 3 and 4 occur below the escarpment.

Descriptions of the structure and floristics of these three vegetation communities within the site are given in Table 6, and the distribution of each community within the subject site is given in Figure 3.



Ecotone Ecological Consultants Pty Ltd



Figure 3. Vegetation Communities

Aerial Photo: LPI Graphic Services. Photo taken 18.3.2002

Flora and Fauna Impact Assessment
Proposed subdivision and rezoning at
Ingleside Road, Ingleside

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Floral Diversity

Total species diversity was found to be high within the entire study area, with 172 flora species from 63 families being identified. This total included 12 ferns, two conifers, 126 dicotyledons and 32 monocotyledons. Of the total species recorded, 40 species of introduced flora were identified, representing approximately 24% of the total species.

In relation to the subject site alone the species richness was reduced as the dense scrub species dominated this area.

A list of all flora species recorded and identified from within the study area is included as Appendix 1.

Threatened or Significant Flora Species and Endangered Ecological Communities

No threatened flora species listed under the NSW TSC Act, Commonwealth EPBC Act or ROTAP were recorded in the study area. It was, however, impossible to thoroughly search every part of the study area in the time available. The subject site was extremely difficult to access in places owing to the density of the scrub vegetation. Therefore, the minor possibility that one or more small threatened species were not detected during the field surveys must remain open. Accordingly, section 5A assessments (eight-part tests) on those species that were determined in the previous section as having a realistic possibility of occurring have been carried out in the following section using a precautionary approach.

Otherwise, one significant non-listed flora species, the Swamp Mahogany (*Eucalyptus robusta*) was identified within the subject site. This species is regarded as being significant in the Sydney region by the Royal Botanic Gardens (Table 2) and is a recognised winter food source for many species of bird and mammalian fauna, including threatened fauna. A few small to moderate-sized Swamp Mahogany trees were identified within the northern access part of Lot 74) and within Lots 83 – 85 near the edge of Ingleside Road. It is highly likely that these have seeded from artificially planted adult trees along Ingleside Road, since no suitable natural habitat for this species occurs in the subject lots. The species has probably opportunistically responded to more favourable conditions created by increased runoff from the road near its edge. No formal assessment under legislation is required for this regionally significant species.

Only one endangered ecological community listed under the NSW TSC Act, *Duffys Forest Ecological Community*, has potential to occur in the study area. The nearest documented occurrence of this community is in the vicinity of the Baha'i Temple, where small, fragmented patches occur on either side of Mona Vale Road (Smith and Smith 2000). The typical habitat of the community is ridgetops on lateritic soil derived from shale lenses. This soil type is generally absent from the study area. About half of the 73 species listed as characterising the community (NSW Scientific Committee 2002) were recorded within the study area. However, most of these species are common within other communities. The only part of the subject site that has soil and vegetation characteristics approaching those that define the community is a thin strip of flat land immediately fronting Ingleside Road, in the vicinity of the proposed Lot 1. This minor part of the subject site is characterised by the presence of some laterite in the soil, and Silver-Top Ash (*Eucalyptus sieberi*) trees, which can be indicative of the community. The vegetation of the subject site, however, differs from the predominant structural form of the community, which is stated as being open-forest to woodland. The combination of this fact together with the marginal soil characteristics suggest that *Duffys Forest Ecological Community* does not occur within the subject site or study area.

Overall Significance of the Vegetation

The vegetation of the subject site is a good example of Scrub or Tall Heathland vegetation on Hawkesbury Sandstone. Much of the vegetation (with the exception of highly disturbed and edge areas within the scrub community) is pristine and in good condition.

Connectivity with natural vegetation in the area is excellent, with natural vegetation to the east, north-east and south-east of the site. The vegetation to the east and north-east is a large tract of natural bushland in the Mullet Creek catchment which ultimately connects with Ingleside Park, and is classified as a "Major Habitat Area" by Pittwater Council (1995). This level of connectivity provides good opportunities for genetic exchange between all native species, and wildlife corridors for movement of native fauna.

Table 6. Description of the vegetation communities within the Study Area

Stratum	Height	% cover*	Dominant species	Comments
Community 1: SCRUB / CLOSED SCRUB – Banksia / Hakea / Allocasuarina / Kunzea				
Tall Shrub layer	4 - 5 m	60 - 90	<i>Banksia ericifolia</i> <i>Hakea teretifolia</i> <i>Hakea gibbosa</i> <i>Allocasuarina distyla</i> <i>Kunzea ambigua</i> <i>Angophora hispida</i>	This community occupies most of the area on the flat land above the escarpment running north-south through the subject site. The community most closely conforms to Map Unit 21g of Benson and Howell (1994): Coastal Sandstone Heath. Of the Pittwater vegetation communities into which this map unit has been divided (Lembit 1997), the community includes mostly Hawkesbury Sandstone Heath (PC09). The species composition of the site closely resembles that of this community, the major difference being the height of the vegetation which is much taller than heath (mostly over 2 metres), thus more appropriately being classified as Scrub. The community occurs on areas of impeded drainage in many areas resulting in wet, swampy patches with species reflecting these conditions (e.g. sedges). The community includes sporadic occurrences of taller trees, either isolated or in clumps of a few individuals. These include <i>Angophora costata</i> , <i>Corymbia gummifera</i> , <i>Eucalyptus acmenoides</i> , <i>E. capitellata</i> , <i>E. haemastoma</i> and <i>E. sieberi</i> . The height of these trees is 20 – 25 metres maximum, and the understorey more open. Because of their presence in such a limited, marginal form these areas are not identified as a separate community. However, where present they are tending towards Map Unit 10ar of Benson and Howell (Sydney Sandstone Ridgetop Woodland) or Pittwater vegetation community PC07 (Red Bloodwood-Scribbly Gum Woodland).
Low shrub and Ground layer	To 2 m	5 - 10	<i>Leptospermum squarrosum</i> <i>L. trinervium</i> <i>Gahnia sieberiana</i> <i>Grevillea sericea</i> <i>Grevillea buxifolia</i> <i>Darwinia fascicularis</i> <i>Dodonaea triquetra</i> <i>Actinotus minor</i> <i>Xanthosia pilosa</i> <i>X. tridentata</i> <i>Dianella caerulea</i> <i>Dillwynia retorta</i> <i>A. longifolia</i> <i>A. oxycedrus</i> <i>A. terminalis</i> <i>Entolasia stricta</i> <i>Lepyrodia scariosa</i> <i>Isolepis nodosa</i> <i>Xanthorrhoea resinifera</i> <i>Angophora hispida</i> <i>Persoonia lanceolata</i> <i>Phebalium squamulosum</i> <i>Crowea saligna</i>	

Community 2: WOODLAND / OPEN FOREST – Smooth-barked Apple/Red Bloodwood/Scribbly Gum with a Scrub Understorey				
Tree Layer	12 – 20 m	10 - 35	<i>Angophora costata</i> <i>Corymbia gummifera</i> <i>Eucalyptus capitellata</i> , <i>E. haemastoma</i> <i>E. sieberi</i>	This community is a variant of Community 1, the only major difference being the presence of a eucalypt tree layer (which is often sparse). It occupies minor parts of lot 74, 79 and the road frontage of lots 83-85, but predominantly occurs in proposed lot 1, and to the east of lots 74 to 80. The community is characterised by the presence of taller eucalypts, bloodwoods and angophoras, often isolated or in small clumps at the edges of the scrub. The community most closely represents Map Unit 10ar of Benson and Howell (1994): Sydney Sandstone Ridgetop Woodland or Pittwater vegetation community PC07 (Red Bloodwood-Scribbly Gum Woodland). Some native tree species that are probably planted, occur near the Ingleside Road end of the western lots, including Brush Box and a few small Swamp Mahoganies, that have probably self-seeded from planted ones along Ingleside Road.
Shrub and Ground Layers	Similar in structure and species composition to that of Community 1, but tends to be shorter and more open, particularly where the tree layer is relatively more dense.			

Community 3: OPEN-FOREST: Sydney Peppermint / Smooth-barked Apple / Red Bloodwood				
Tree layer	20 - 25 m	30 - 40	<i>Eucalyptus piperita</i> <i>E. umbra</i> <i>Angophora costata</i> <i>Corymbia gummifera</i> <i>Syncarpia glomulifera</i>	This community is largely confined to the slopes below (to the east of) the escarpment. The community type corresponds to Map Unit 10ag of Benson and Howell (1994): Sydney Sandstone Gully Forest. The corresponding Pittwater vegetation community sub-types include a combination of Hawkesbury Sandstone Open-forest (PC05) and Ingleside Escarpment Forest. The community is taller than Communities 1 or 2 but is generally more open with a much sparser shrub and ground layer. Species richness within the community is higher due to the lack of domination by dense scrubby vegetation composed of only a few species. The condition of the community is generally excellent, with little disturbance and weed invasions limited to wet patches immediately below the escarpment.
Sub-canopy layer	7 - 12 m	5 - 30	<i>Allocasuarina torulosa</i> <i>Elaeocarpus reticulatus</i> <i>Ceratopetalum gummiferum</i> <i>Banksia serrata</i> <i>Endiandra sieberi</i>	
Shrub layer	1 - 3 m	10 - 40	<i>Leptospermum squarrosum</i> <i>Banksia ericifolia</i> <i>Acacia terminalis</i> <i>A. longifolia</i> <i>A. oxycedrus</i> <i>Pultenaea flexilis</i> <i>Hakea teretifolia</i> <i>H. sericea</i> <i>Grevillea sericea</i> <i>G. buxifolia</i> <i>Persoonia levis</i> <i>P. lanceolata</i> <i>Platylobium formosum</i> <i>Gahnia sieberiana</i> <i>Pultenaea daphnoides</i> <i>P. elliptica</i> <i>Acacia ulicifolia</i> <i>Dodonaea triquetra</i> <i>Pimelea linifolia</i> <i>Leionema dentatum</i> <i>Xanthorrhoea arborea</i> <i>X. resinifera</i>	
Ground layer	To 1 m	30 - 70	<i>Podocarpus spinulosus</i> <i>Actinotus minor</i> <i>Platysace linearifolia</i> <i>Caustis flexuosa</i> <i>Xanthosia</i> spp. <i>Entolasia marginata</i> <i>Dianella caerulea</i> <i>Hibbertia linearis</i> <i>Leucopogon microphyllus</i> <i>Micrantheum ericoides</i> <i>Calochlaena dubia</i> <i>Lasiopetalum ferrugineum</i> <i>Zieria pilosa</i>	
Climbers / Twiners			<i>Cassytha pubescens</i> <i>Hibbertia dentata</i> <i>Stephania japonica</i> <i>Smilax glyciphylla</i> <i>Billardiera scandens</i>	

Community 4: RIPARIAN OPEN FOREST to CLOSED FOREST– Sydney Peppermint / Turpentine / Coachwood / Cabbage Tree Palm / Black Wattle				
Tree layer	20 – 25 m	40 - 80	<i>Eucalyptus piperita</i> <i>Angophora costata</i> <i>Syncarpia glomulifera</i> <i>Ceratopetalum apetalum</i> <i>Livistona australis</i>	This community occurs along the floodplain by the upper reaches of Mullet Creek, from the north-eastern part of the study area and running in a south-easterly direction. The community is confined entirely to the area below the escarpment and further east. Some understorey components also occur in damp seepage areas running into the creek. The vegetation is generally in good condition and weed-free, although some parts (particularly in upper areas) are showing signs of early weed invasion. These are mainly minor herbaceous weeds, but also include more serious environmental weeds such as Blackberry, Lantana, Crofton Weed, Giant Reed and Ginger Lily. The more natural parts of the community extend into wet seepage and draining lines throughout the lower part of the study area that eventually run into the creek. These areas are dominated by ferns and moist-adapted native species.
Sub-canopy layer	4 - 12 m	10 - 40	<i>Callicoma serratifolia</i> <i>Elaeocarpus reticulatus</i> <i>Ceratopetalum gummiferum</i> <i>Tristaniopsis laurina</i> <i>Ficus rubiginosa</i>	
Shrub layer	1 - 3 m	5 - 50	<i>Leptospermum polygalifolium</i> <i>Leptospermum squarrosus</i> <i>Banksia ericifolia</i> <i>Callistemon citrinus</i> <i>C. salignus</i> <i>Cyathea australis</i> <i>Gahnia clarkei</i> <i>Synoum glandulosum</i> <i>Pittosporum undulatum</i> <i>Omalanthus populifolius</i>	
Ground layer	To 1 m	10 - 75	<i>Calochlaena dubia</i> <i>Gleichenia dicarpa</i> <i>Christella dentata</i> <i>Bauera rubioides</i> <i>Epacris longiflora</i> <i>Woollsia pungens</i> <i>Hydrocotyle laxiflora</i> <i>Isolepis nodosa</i> <i>Viola hederacea</i> <i>Restio dimorphus</i> <i>Commelina cyanea</i> <i>Lomandra longifolia</i> <i>Schoenus melanostachys</i> <u>Weeds:</u> <i>Ageratina adenophora</i> <i>Rubus fruticosus</i> <i>Lantana camara</i> <i>Arundo donax</i> <i>Hedychium gardnerianum</i> <i>Nephrolepis cordifolia</i>	
Climbers / Twiners			<i>Cissus hypoglauca</i>	
Community 5: DISTURBED/MODIFIED AND PREDOMINANTLY WEED-INFESTED AREAS				
This community type occurs in distinct patches of previously-cleared vegetation, mainly on proposed Lot 1 and Lots 79, 83, 84 and 85 and behind lots 82, 83, 85 and 86. The community has no particular structure. It is characterised by the lack of a tree layer, and the proliferation of noxious and environmental weeds. For example, Pampas Grass has formed large clumps of mature, tall plants within lot 85 and to the east of this lot.				

3.2 Faunal Investigations

3.2.1 Methodology

Fauna field surveys were undertaken within the study area during April and May 2003. The area surveyed included both the land owned by DIPNR as well as the adjoining land owned by the Uniting Church (see **Figure 4**). The Subject site was also visited on the 11th of August 2004.

The field surveys included:

- hair tubes
- Elliott and cage trapping
- ultrasonic bat call detection
- spotlighting
- nocturnal call playback
- frog searches
- diurnal bird surveys

Hair Tubes – targeting the Southern Brown Bandicoot, Eastern Pygmy Possum and Spotted-tailed Quoll

Hair tubes were set at the study area from the 7th – 22nd of May 2003. Hair tubes are constructed from PVC pipe and for this survey two sizes were used (small- 4cm diameter, medium- 12cm diameter). Double-sided tape is placed around the top of each entrance to the tube to capture a few hairs of any mammal that comes in contact with the tape. The small hair tubes were baited with the standard peanut butter bait, screwed to a tree and the tree trunk sprayed with honey water. The medium hair tubes were baited with fish cat food and peanut butter sandwiches and placed on the ground along possible tracks. In total 24 medium and 24 small hair tubes were set across the study area. The hair samples collected were forwarded to Barbara Triggs ('Dead Finish', Genoa, Victoria) for analysis.

Elliott and cage trapping – targeting the Southern Brown Bandicoot, Eastern Pygmy Possum and Spotted-tailed Quoll

Trapping took place between the 6th and 13th of May. Lines A, B, C and E were open on the nights of 6th, 7th, 8th, 11th & 12th of May. Line D was open on the nights of 7th, 8th, 11th & 12th of May. Elliott traps are aluminium live traps of which two sizes were used (A size Elliott trap-10 x 8 x 32cm; B size Elliott traps - 46 x 15 x 15cm). Positioned on the ground, along possible animal tracks, the base of trees and logs or amongst rock outcrops, these Elliott traps are designed to capture small mammals such as rodents and marsupial dasyurids. B Elliott traps may also capture medium sized mammals such as bandicoots. A-Type Elliott traps were also positioned in shrubs to target the Pygmy Possum. B-Type Elliott traps were also mounted in trees on a platform attached to a selected tree at a height of approximately 2 metres to target arboreal mammals. Cage traps are larger wire traps (22 x 22 x 80cm) designed to capture mammals in the medium size range i.e. bandicoots. Cage traps were placed on the ground along possible animal tracks.

The quantity and combination of traps and tubes, as well as transect lines used are presented in **Table 7**. These combinations were chosen as a result of the habitat type present in each transect line. A summary of the bait used for each trapping method is provided in **Table 8**.

All traps were positioned so as to avoid the morning sun and were covered with a plastic bag to reduce the risk of exposure (due to rain) to any captured animal. Bedding material, usually dry

leaves gathered on site was also provided. All traps were checked in the morning and rebaited once during the survey period.

The locations of survey methods are illustrated on **Figure 4**.

Table 7. Summary of trapping and hair tube transects

Trap line	Number and combination of traps and tubes	Location description
A	5 A type Elliott ground 5 A type Elliott tree 10 B Elliott ground 5 small tubes 5 medium tubes	DIPNR land on top of the escarpment. Behind lots 79 to 86.
B	8 A type Elliott ground 5 B type Elliott tree 3 cage 5 small tubes 5 medium tubes	DIPNR land below the escarpment. Northern portion of the study area.
C	8 A type Elliott ground 5 B type Elliott tree 3 cage 5 small tubes 5 medium tubes	DIPNR land, along and below the escarpment. Central portion of the study area.
D	7 A type Elliott ground 3 A type Elliott tree 5 B Elliott ground 3 cage 4 small tubes 4 medium tubes	Uniting Church development area. South of the study area.
E	4 A type Elliott ground 5 A type Elliott tree 5 cage 5 small tubes 5 medium tubes	DIPNR land on top of the escarpment. Proposed lot 1 and to the east of this lot. Northern boundary of study area.

Table 8. Summary of bait used for each survey method

Trap type	Trap position	Bait used
A Elliott	Ground	Rolled oat and peanut butter balls
A Elliott	Tree	Rolled oat and peanut butter balls Creamed honey in paper towel
B Elliott	Ground	Fish cat food and peanut butter sandwiches
B Elliott	Tree	Creamed honey in paper towel Tree trunk sprayed with honey water daily
Cage	Ground	Fish cat food and peanut butter sandwiches
Small tube	Tree	Rolled oat and peanut butter mixture Tree trunk sprayed with honey water
Medium tube	Ground	Fish cat food and peanut butter sandwiches

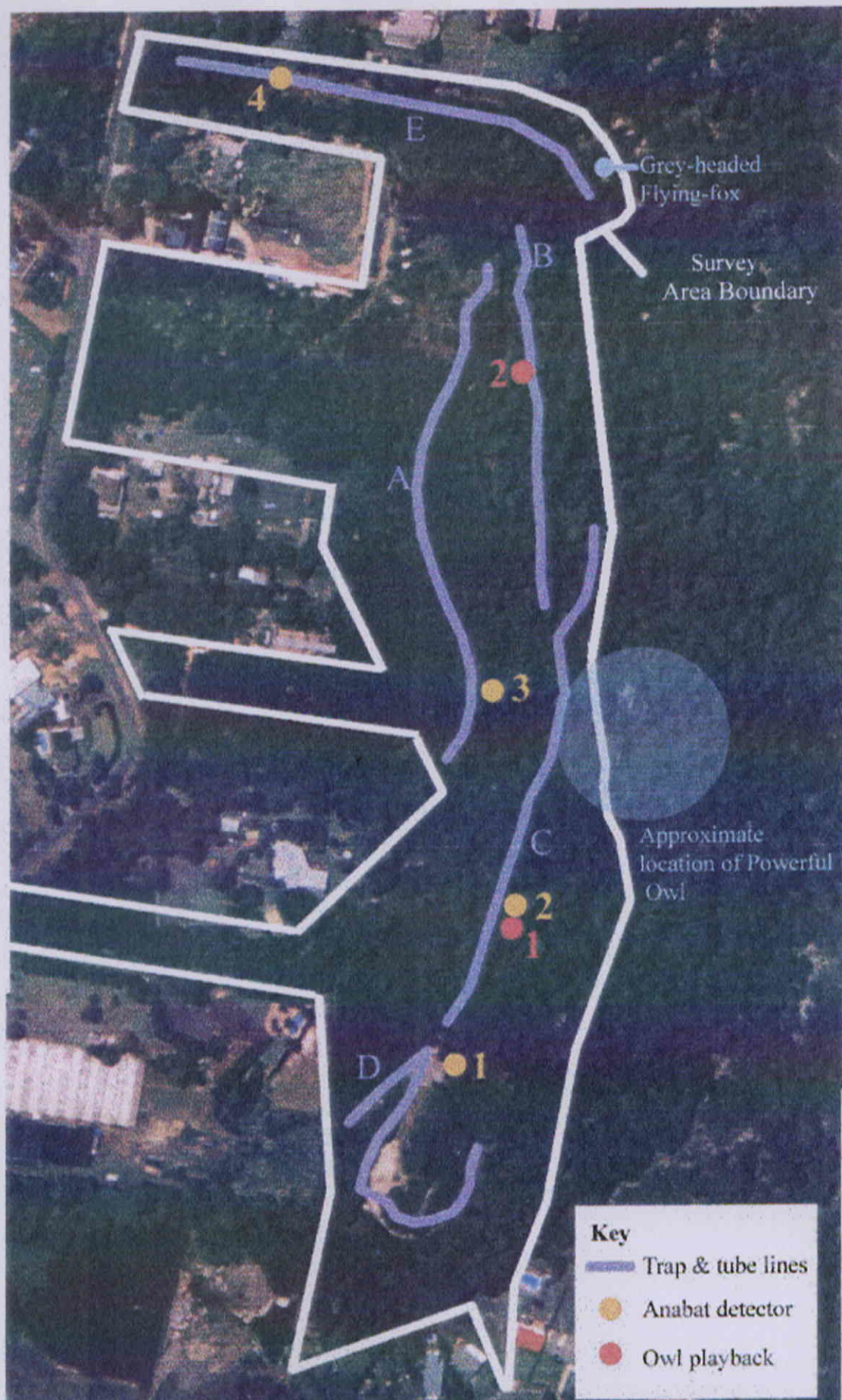


Figure 4. Location of Fauna Survey Methods

Base Photo: IPI Graphic Services - Taken March, 2002

Flora and Fauna Impact Assessment:
Proposed Subdivision at
Ingleside Road, Ingleside

October 2004



Ecotone Ecological Consultants Pty Ltd

Ultrasonic bat call detection – targeting the Eastern Bent-wing Bat and Greater Broad-nosed Bat

Insectivorous bats were surveyed on the 6th, 7th and 12th of May 2003. Anabat II detectors (Titley Electronics, Ballina, NSW) were used to collect ultrasonic calls of the bat species using the site. Bats emit ultrasonic calls as a method of navigating and searching for food. These calls are often at a higher frequency than calls audible to the human ear. In order to make the calls audible, bat detectors convert the call to a lower frequency. These calls are recorded onto an audio tape and later analysed with a computer package Anabat 5.7i, to identify the species recorded. Ultrasonic call detectors have proved useful for recording species that are difficult to capture. However, owing to variations in call strength and frequency within and between species and the difficulty in identifying short or poor quality calls, the identity of species recorded by a bat detector cannot always be guaranteed. Some bats are difficult to detect due to their quiet calls (e.g. *Nyctophilus* sp., *Kerivoula papuensis*) and bats with extremely similar calls are sometimes difficult to differentiate (e.g. *Miniopterus schreibersii* and *Vespadelus darlingtoni*). Therefore, bat detectors cannot always provide positive species identification. Bat detection surveys should not be conducted during cold, wet or windy conditions.

The detector systems were set on the ground at a 45° angle and were connected to a time and delay device which records the time of each call and only activates the tape recorder when a call is received allowing the entire night to be sampled.

Spotlighting and frog searches – targeting Giant Burrowing Frog, Red-crowned Toadlet, arboreal mammals and terrestrial mammals.

Evening surveys for nocturnal fauna were conducted on the 17th of April for frogs and the 6th and 22nd of May for general spotlighting. Spotlighting was undertaken for all small, medium and large-sized mammals and nocturnal birds, reptiles and frogs within the subject site. Spotlighting was conducted on foot by two observers using 50W hand-held spotlights powered by 12-volt batteries. Both arboreal and terrestrial nocturnal animals were targeted during the spotlighting surveys. The specific frog search was conducted by one observer with a 6V head torch. Any vocal frogs were also identified by their characteristic calls. The spotlighting covered trap lines B, C, D and E.

Nocturnal call playback – specifically targeting large forest owls

Nocturnal call playback was conducted on the 6th and 22nd of May. Recorded calls of the Squirrel Glider, Bush-stone Curlew, Powerful Owl, Barking Owl, Masked Owl and Sooty Owl were played through a loud hailer to induce a response call from any individuals of these species using the area. After an initial 10 minute listening period, call sequences were played for 5 minutes each with a 5 minute listening period between each call.

Diurnal bird surveys

Birds were identified either by direct visual observation or by characteristic call during all site activities. Particular attention was given to this fauna group in the early morning while checking trap lines.

Opportunistic surveying – particularly targeting Heath Monitor and other reptiles

All fauna observed or heard during the field surveys was recorded. Characteristic signs, tracks, trails and other indirect evidence of fauna species from all fauna groups was also recorded. Scats

(faecal pellets) of predator species (if detected) were collected and analysed for evidence of fauna species.

A supplementary visual survey and habitat assessment for fauna was conducted on 24th September 2003 within Lots 79, 83, 84 and 85, following the inclusion of these additional lots into the 2003 proposal. Since habitat was deemed to be similar to that of adjoining previously-investigated areas, no particular fauna-detection methods were employed in these lots.

2004 Field Survey

The subject site was revisited on the 11th of August 2004 and all opportunistic observations were recorded.

3.2.2 Results

A list of all species recorded in the study area during this survey is presented in **Appendix 2** and **Appendix 3** contains detailed results from the fauna survey.

Mammals

Thirteen mammals have been recorded in the study area, including eleven native and two introduced species.

Trapping and hair tubes revealed the presence of five common native mammalian species. The Bush Rat *Rattus fuscipes* resulted in the highest number of captures, being trapped in both A and B Elliott traps. Both sized Elliott traps captured Brown Antechinus *Antechinus stuartii* and Swamp Rats *Rattus lutreolus*. Both ground and tree traps captured Bush Rats and Brown Antechinus, however, the ground traps were more successful. The Common Brushtail Possum *Trichosurus vulpecula* was captured in cage traps and the Long-nosed Bandicoot *Perameles nasuta* were captured in a B Elliott trap and cage traps. Hair tubes were successful in that 42 out of the 48 tubes set over the whole study area (Uniting Church and DIPNR land) collected a hair sample. No new species were however recorded, with four species, the Common Brushtail Possum, Long-nosed Bandicoot, Brown Antechinus and Bush Rat, identified.

A Bush Rat and Long-nosed Bandicoots were also observed during spotlighting and Bandicoot diggings were observed over much of the site including Lots 74, 75, 79, 83-85 and proposed lot 1. Common Ringtail Possums *Pseudocheirus peregrinus* and rabbits were observed including several Ringtail dreys on lots in the tall heath. The Grey-headed Flying-fox *Pteropus poliocephalus* and White-striped Freetail-bat *Tadarida australis* were heard during spotlighting.

Bat activity was extremely low during the survey period, with only a small number of passes recorded. However, the ultrasonic detectors positively identified three species of insectivorous bats, the Gould's Wattled Bat *Chalinolobus gouldii*, Eastern Bent-wing Bat *Miniopterus schreibersii oceanensis* and White-striped Freetail-bat.

Swamp Wallaby *Wallabia bicolor* faecal pellets were identified and Dog footprints were observed.

Some marks on a Red Bloodwood that resemble glider sap feeding scars may have been caused by gliders, however they are not characteristic enough to make a positive conclusion. No other evidence of gliders was observed during the survey.

There was no response to the nocturnal call playback by the Koala. Three Grey Gums present at the rear of lot 85 were searched for evidence of Koala on the 11th of August 2004. One tree contained one set of scratches that could potentially have been made by a Koala. These trees also contained many possum scratches. No faecal pellets or other possible Koala evidence was observed in the study area.

Reptiles

Eight reptile species were identified during the fauna surveys. These include the Eastern Water Dragon *Physignathus leseurii*, five skinks (Copper-tailed Skink *Ctenotus taeniolatus*, Cunningham's Skink *Egernia cunninghamia*, Red-throated Skink *Eulepis platynota*, Dark-flecked Garden Sunskink *Lampropholis delicata*, Pale-flecked Garden Sunskink *L. guichenoti*) and a Yellow-faced Whip Snake *Demansia psammophis*. A Cunningham's Skink was captured in an A-size elliott trap. A Diamond Python (*Morelia spilota*) was observed crossing Ingleside Road near Lot 79 on 24th September. No Heath Monitors were observed in the study area.

Frogs

Only two frog species were identified in the study area, the Common Eastern Froglet *Crinia signifera*, and the Brown-striped Frog *Limnodynastes peronii*. The Common Eastern Froglet was heard in a number of places across the study area. There appeared to be many individuals and were heard calling on numerous occasions both during the day and evening. A single Striped Grass Frog was observed swimming in the southern watercourse during the frog search.

No Red-crowned Toadlets *Pseudophryne australis* or Giant Burrowing Frogs *Heleioporus australiacus* were heard calling in the study area, despite three evening surveys. As Red-crowned Toadlets usually call during winter, the wet conditions should have been suitable for the species to be active. A Giant Burrowing Frog was recorded recently in Tall heath/Scrub in Laurel Road, north of the Westpac Training Centre (Mia Dalby-Ball, Pittwater Council, *pers. comm.*). Although significant rain fell during the survey period, it is considered that the evening temperatures were not warm enough to induce activity for many frog species. It is considered that a survey during the warmer months would identify further frog species.

Birds

Thirty-nine bird species were recorded in the study area during the field surveys. Three of these species, the Tawny Frogmouth, Southern Boobook and Powerful Owl are nocturnal. Both the Frogmouth and Boobook were observed during spotlighting. The **Powerful Owl** *Ninox strenua* (TSC Act: Vulnerable) responded to the nocturnal call playback with a series of characteristic calls. All birds recorded are listed in **Appendix 2**.

3.2.3 Fauna Diversity

Fauna diversity was moderately high, with a total of 62 identified species in the whole study area (Uniting Church and DIPNR land). These include thirteen mammal, eight reptile, 2 amphibian and thirty-nine birds. A reasonably high diversity was expected, as the study area is composed of several different habitat types / vegetation communities.

Most of the common mammals expected in the study area were recorded. The result of the bat survey indicated that species diversity and activity was extremely low during the survey period.

Although the weather conditions during the survey period were not considered adequate for surveying insectivorous bats, as temperatures were too low, adequate surveys in similar habitats in the local area have had similar results. For example a survey for Ingleside/ Warriewood Urban Land Release found extremely low levels of bat activity (only two species) in good survey conditions (ICF Pty Ltd and The Australian Museum, 1994). A survey conducted in the same tract of bushland as the study area, less than 1km to the north, recorded low bat activity, with only three species positively identified, despite suitable weather conditions (Ecotone, 1999).

There are quite a few common reptiles and frogs that would be expected to use the study area, but were not detected during the survey. Some examples are the Blue-tongued Lizard, Lace Monitor and Red-bellied Black Snake, Peron's Tree Frog and Leaf-green Tree Frog. Again the surveys were not carried out during optimum conditions for this fauna group. It is expected that more species would be recorded during the warmer months of the year, particularly nocturnal species such as the Southern Leaf-tailed Gecko.

A reasonable diversity of birds was recorded, however it is expected that more species would be identified with further surveys over a greater seasonal range.

3.2.4 Significant Fauna Species

Three threatened fauna species were recorded within the study area. The **Grey-headed Flying-fox**, **Powerful Owl** and the **Eastern Bent-wing Bat** are listed as vulnerable under the NSW *Threatened Species Conservation Act* 1995 (TSC). The Grey-headed Flying-fox is also listed as Vulnerable under the *EPBC Act* 1999.

Grey-headed Flying Fox

Pteropus poliocephalus

The Grey-headed Flying Fox presently occurs along the east-coast from Bundaberg in Queensland to Melbourne, Victoria (NSW National Parks and Wildlife Service, 1999). Regular movements have been recorded over the Great Dividing Range to the western slopes of NSW and QLD (NSW National Parks and Wildlife service, 2001). This species utilises subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths swamps and mangroves, as well as urban gardens and fruit crops for foraging (Churchill, 1998; NSW National Parks and Wildlife Service, 1999). The Grey-headed Flying Fox has been recorded to forage on more than 80 plant species of which eucalypt blossom is considered the major food source and figs to be the most common fruit consumed (Churchill, 1998). These bats will disperse and commute up to 50km daily to foraging areas from their day roost (Strahan, 1995). Grey-headed Flying Fox roost in large colonies of up to tens of thousands (Churchill, 1998; NSW National Parks and Wildlife Service, 1999). Colonies are usually formed in gullies with a dense vegetation canopy and a water source nearby. Camps have also been formed in modified vegetation in urban areas (NSW National Parks and Wildlife service, 2001). This species migrates (up to hundreds of km) to where a suitable food source is available. The population concentrates in May and June in northern NSW and Queensland where animals exploit winter-flowering trees such as Swamp Mahogany, Forest Red Gum and Paperbark, dispersing south during the summer (NSW National Parks and Wildlife service, 2001). It is estimated that the population of this species has declined by 30% over the last 10 years. Presently less than 15% of suitable habitat and 5% of present roost sites occur in conservation reserves.

The nearest known colony is located at Gordon, approximately 13.5km south-west of Ingleside. The Grey-headed Flying-fox observed on site was foraging on a flowering eucalypt.

Powerful Owl

Ninox strenua

This species ranges over a broad coastal and sub-coastal strip in south-eastern Australia. Within NSW, the majority of records have been located within open forests, but woodland, ecotones with cleared areas,

riparian habitats and closed forests are also utilised (Debus & Chafer 1994). This species apparently reaches optimum population densities in gullies in dense, undisturbed mountain eucalypt forest, but is not confined to this habitat (Australian Museum Business Services 1995). Powerful Owls have been observed to inhabit and breed in forested areas within major urban centres such as Sydney and Brisbane.

Powerful Owls are sedentary, living either alone or in pairs, and occupying a permanent territory which contains a number of roost sites. A typical roost is on a horizontal limb several metres from the ground, uncluttered laterally but screened from above by dense foliage (Australian Museum Business Services 1995). These owls require a large home range to obtain sufficient abundance of prey items and the size of the territory appears to be related to the availability of prey (Blakers *et al* 1984). Medium-sized arboreal mammals, particularly Ringtail and Brushtail Possums, Greater Gliders, Sugar Gliders, and birds are commonly taken. Breeding records in New South Wales suggest that nesting generally occurs within open forest, in large live eucalypts with hollow entrances 9 - 37 metres above the ground. Each pair is known to breed in the same nest over many years.

The low annual reproductive rate and dependence upon suitable prey items, which are obtained in an extensive home range, suggests that this species is vulnerable to human pressures arising from reductions in nest sites or prey availability. Furthermore, habitat fragmentation may cause problems for young owls dispersing and successfully finding a mate (Debus & Chafer 1994).

A Powerful Owl responded to the second nocturnal call playback survey. The Owl responded with a series of characteristic calls shortly after the recorded Powerful Owl calls were played, as well as a series of calls during and after the recorded calls of the Barking Owl were played. It is likely that this owl forages throughout the entire study area, particularly on the abundant Common Ringtail Possums. A breeding pair of Powerful Owls were recorded less than 1km north of the site in 1998 (Ecotone, 1999). It is highly likely that the Owl heard calling during the current survey is from the same pair or an offspring.

Eastern Bent-wing Bat

Miniopterus schreibersii oceanensis

This sub species is widely distributed from the coast and ranges of eastern Australia, extending from Cape York Peninsula, through eastern Queensland, New South Wales and eastern Victoria. In New South Wales, it is found from the coast to the western slopes of the Great Dividing Range. This species is widespread and can be locally common where suitable caves or tunnels are available as roost sites. The major threat to this species is the loss or disturbance of roost sites, particularly maternity roosts. Recorded nursery caves are few in number and widespread, which leaves this species vulnerable should any of these areas be destroyed (Dwyer 1995). Habitat loss through clearing for development or agriculture and subsequent reductions in insect prey availability may also adversely affect this species. The Eastern Bent-wing Bat is reportedly preyed upon by feral Cats and occasionally Foxes, particularly in or as they leave their roost. Eastern Bent-wing Bats are known to forage within a variety of habitat types adjoining roost sites. This appears to include rainforest, moist and dry eucalypt forest, swamp sclerophyll forest as well as heath.

As no suitable roost sites occur within the study area, this Large Bent-wing Bat would only be using the area for foraging purposes.

Seven other threatened species were considered to have some likelihood of using the subject site at least on occasion. Little evidence of the **Koala** was observed during the surveys, suggesting that it is unlikely that this species has used the site in recent years. Although the field surveys did not record the **Eastern Pygmy Possum**, **Spotted-tailed Quoll** or **Giant Burrowing Frog** it is still possible that these species may be present or may visit the subject site on occasion. Although no suitable habitat for the **Red-crowned Toadlet** occurs on the subject site, this species may potentially occur in the area below and including the escarpment. Unsuitable run-off from the proposed development may therefore effect this Toadlet. The Giant Burrowing Frog and Red-

crowned Toadlet have been recorded on adjacent land just to the north-east (Ecotone, 1999) and a Giant Burrowing Frog was recorded at Laurel Road, a few hundred metres north of the site recently (Mia Dalby-Ball, Pittwater Council, *pers. comm.*). Therefore, this species has could have potential to occur in the subject site, although habitat in the proposed development area is marginal.

A suspected **Squirrel Glider** record from a specimen collected nearby at Elanora Heights has now been confirmed by the Australian Museum as that of a **Sugar Glider** (*Petaurus breviceps*). A Sugar Glider (sighting and chew marks on a tree) was recorded in 2003 at 6 Ingleside Road, in a lot adjoining the study area (Mia Dalby-Ball, Pittwater Council, *pers. comm.*). It is therefore now considered more likely that the Sugar Glider rather than the threatened Squirrel Glider is present in the study area.

Six 'non threatened' species recorded during the survey are considered to be significant fauna by Pittwater Council (Pittwater Council, 2000). The Bar-shouldered Dove and Long-nosed Bandicoot are considered significant in the Sydney Region and the Brown Antechinus, Bush Rat, White-striped Freetail Bat and Swamp Wallaby are considered significant in Pittwater LGA.

4.0 ASSESSMENT OF THE PROPOSAL

This section includes all assessments required under the provisions of all relevant legislation pertaining to the development. This includes assessment under the EP&A Act 1979; TSC Act 1995 and SEPP No. 44.

4.1 Overview of Potential Impacts Associated with the Proposal

The proposed development would result in clearing of specific areas of native or weedy vegetation for building envelopes on each proposed Lot. In addition to this, a 40m wide Inner Protection Area adjacent to the eastern boundary comprising Tall Heath/Scrub vegetation within Lots 74, 79, 83, 84, 85 and proposed Lot 1 will need to be removed as part of the fuel reduction recommendations in the Bushfire Protection Assessment (Conacher Travers, 2004).

Most of the eucalypts currently occurring on each of these lots may be retained due to their low density. Although Swamp Mahogany (*E. robusta*) is a locally significant species, the saplings and small trees at the edge of Ingleside Road are considered to have artificially seeded and would not normally establish in the area in the absence of artificially changed conditions. They are therefore regarded as being of low conservation significance in this situation.

The proposal may also cause secondary impacts on the local flora and fauna if care is not taken during and after construction (e.g. heavy machinery damaging vegetation outside building envelopes). An additional consideration could be nutrient-rich and polluted water run-off from the residential gardens. This may also result in the transportation of weed propagules to the bushland below and ultimately increased nutrient levels down stream in the watercourses, although this has already largely occurred in the study area immediately east of the developed lots on Ingleside Road, extending to below the escarpment. This could have a detrimental effect on both flora and fauna species that utilise this habitat.

An assessment of impact on threatened species considered as potential subject species under the provisions of Section 5A of the *Threatened Species Conservation Act* 1995 has been addressed below.

4.2 Threatened Species Assessment (Section 5A of the EP&A Act 1979)

The *TSC Act* was gazetted in late 1995 and aims to conserve threatened species, populations and ecological communities of animals and plants. Specific objectives of the *Act* are to: -

- a) conserve biological diversity and promote ecologically sustainable development;
- b) prevent the extinction and promote the recovery of threatened species, populations and ecological communities that are endangered;
- c) protect critical habitat of those threatened species, populations and ecological communities;
- d) eliminate or manage certain processes that threaten the survival or evolutionary development of those threatened species, populations and ecological communities;
- e) ensure that the impact of threatening actions are properly assessed; and
- f) encourage the conservation of threatened species, populations and ecological communities by the adoption of measures involving co-operative management.

Section 5A ('eight part test') of the *EP&A Act 1979* was amended by the *TSC Act 1995*. This Section aims to improve the standard of consideration and protection afforded to threatened species, populations and communities, and their

habitats in the planning process. The outcome of any threatened species assessment should be that developments and activities are undertaken in an environmentally sensitive manner, and that appropriate measures are undertaken to minimise adverse effects on threatened species or their habitats. Determining authorities have an obligation under the *EP&A Act* to consider whether a proposal is likely to significantly affect threatened species, populations or ecological communities, or their habitats. In this regard, the determining authority must take into account the 'eight part test.' Discussions of species investigated under the provisions of Section 5A have been detailed below:

4.2.1 Threatened Flora

None of the threatened flora species regarded as potential subject species, nor any other threatened flora species listed on the TSC Act were detected within the study area during the field survey. As discussed in the previous section, however, the possibility must remain that one or more threatened species could occur amongst some of the more inaccessible dense vegetation. Because the scrub vegetation is so dense and the ground layer very sparse and species-poor, this possibility is considered to be very low.

Nevertheless, using a precautionary approach, eight-part tests are presented for two of the potential subject species, *Callistemon linearifolius* and *Epacris purpurascens* var. *purpurascens*.

- (a) *in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.*

Callistemon linearifolius

Since this species was not recorded in the study area during the field surveys, the likelihood of significant impact on any local viable population of the species is considered to be minimal. This species prefers damp places and therefore if present, is most likely to occur closer to the escarpment where there are some seepage points and damp areas on the rock benches after rain. This area is outside the development area (subject site) therefore any works proposed for the site are unlikely to cause a locally-occurring viable population of the species to be placed at risk of extinction.

Epacris purpurascens var. *purpurascens*

This species was not recorded in the study area during the field surveys. Potentially suitable habitat within the study area is represented by several damp areas such as drainage lines and seepage areas within Communities 1 and 2. Most of this habitat type (damp areas) would be retained under the current proposal. Since the species appears to be absent from the subject site, and the most potentially suitable habitat would be maintained under the proposal (assuming runoff would not significantly impact on the seepage areas), any locally-occurring viable population of the species is unlikely to be placed at risk of extinction.

- (b) *in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.*

Not applicable

- (c) *in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.*

No known habitat for any of the threatened flora species considered to be potential subject species occurs anywhere within the study area. Disturbance, clearing and fire-protection activities related to the proposal are expected to be largely confined to discrete areas which are unlikely for the most part to contain suitable habitat for any of the potential subject species. Therefore, little or no potential habitat for any threatened species within the study area is likely to be affected by the current proposal.

- (d) *whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas for a threatened species, population or ecological community.*

No known habitat for any threatened flora species will become isolated by the proposal. Because the proposed development of each lot and provision of APZ is intended to be confined to discrete areas, and connectivity of the remaining natural bushland can be maintained, no fragmentation or severance of potential habitat for any threatened species is likely.

- (e) *whether critical habitat will be affected.*

No areas of critical habitat declared to date under the TSC Act are applicable to the subject site.

- (f) *whether a threatened species, population or ecological community, or their habitats are adequately represented in conservation reserves (or other similar protected areas) in the region.*

Callistemon linearifolius

There are currently only 5-6 known populations of *Callistemon linearifolius* in the Sydney area. Of these, three are reserved in Kuring-gai Chase National Park, Lion Island Nature Reserve and Spectacle Island Nature Reserve. Further North it has been recorded from Yengo National Park (NPWS Website-Final Determinations). Therefore it is unlikely that this species is adequately represented in conservation reserves.

Epacris purpurascens var. *purpurascens*

This species is known to occur in only one conservation reserve, Brisbane Water National Park (Briggs and Leigh 1996). The species is thus poorly conserved both locally and regionally, with no populations represented in conservation reserves in the Sydney area (Benson and McDougall (1995).

- (g) *whether the development or activity proposed is of a class of development or activity that is recognised as a key threatening process.*

With respect to the threatened subject species, 'clearing of native vegetation' is listed on Schedule 3 of the TSC Act as a Key Threatening Process and would be of most relevance. The proposed development and fire protection area would remove or modify only a proportion of vegetation that could constitute marginally suitable habitat for any threatened species. The chances that this level of clearing or habitat modification would directly threaten any listed endangered or vulnerable species, or cause any other species to become vulnerable or endangered, is remote. The ultimate contribution by the proposal to this key threatening process should thus be minor with respect to the subject site.

Over-frequent fire has the potential to adversely affect many relevant threatened species. With the provision of an Asset Protection Zone (APZ) for fire protection, however, it is more likely that the frequency of fire within the site would decrease rather than increase, provided fire was not used regularly to maintain the APZ.

In terms of additional (but as yet unlisted) threatening processes, all potential subject species could be indirectly affected by increased nutrient enrichment and weed invasion due to runoff and propagule transport from gardens in the developed areas. With careful planning and implementation of appropriate mitigation measures, however, these processes can be adequately controlled.

- (h) *whether any threatened species, population or ecological community is at the limit of its known distribution.*

Callistemon linearifolius

Callistemon linearifolius occurs from the Georges River in the South, North to the Nelson Bay area (NPWS Website-Final Determinations). The study area is not at the limit of the distribution for this species in the Ingleside area.

Epacris purpurascens var. *purpurascens*

This species is distributed from Gosford to the Blue Mountains (including northern Sydney). The study area is not at the limit of the distribution for this species in the Ingleside area.

Conclusion for threatened flora:

None of the threatened subject flora species were recorded on the subject site, therefore the eight-part test of significance has been based on the presence of potential (mostly marginal) habitat on the site. It can be concluded that the scale of vegetation loss or modification resulting from the proposal would be unlikely to result in local populations of any hypothetically-occurring threatened species being placed at risk of extinction.

4.2.2 Threatened Fauna

Three threatened fauna species, the Powerful Owl, Eastern Bent-wing Bat and Grey-headed Flying-fox have been recorded in the study area during the current field surveys. Five other threatened fauna, the Eastern Pygmy Possum, Spotted-tailed Quoll, Koala, Giant Burrowing Frog and Red-crowned Toadlet are considered to have most potential to occur on the site (on the basis of suitable habitat and/or recent nearby records). These eight species will therefore be assessed with an 8-part test.

- (a) *in the case of a threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction.*

Powerful Owl

A Powerful Owl was recorded in the study area during the field surveys. Both foraging and nesting habitat does occur in the study area. The Common Ringtail Possum appears to be a major food source for the Powerful Owl (T. Williams Pers. Comm.). The spotlighting results indicate that Common Ringtail Possums are highly abundant on the subject site and surrounding vegetation and it is therefore reasonable to suggest that the site itself may be a part of the local Powerful Owls foraging range. When considering the vegetation removal proposed for the entire study area, some reduction in prey availability may occur, although, given the area of bushland along the escarpment, this loss is unlikely to jeopardise the future breeding success of the local pair of Powerful Owls. No nest hollows occur in the development area, however, they are likely to be available in the gully vegetation down slope. It is, therefore, considered that this species will not be placed at risk of local extinction as a result of the proposal.

Eastern Bent-wing Bat

The Eastern Bent-wing Bat was recorded foraging over the study area during this survey. This species is known to roost in caves, tunnels and similar structures and given the absence of these features from the site, local populations would not be significantly reliant on the habitat on site for roosting purposes. As this species has a large home range, travelling up to 30 km per night in search of food, the subject site only represents a minor part of the total foraging area. It is, therefore, considered that this species will not be placed at risk of local extinction as a result of the proposal.

Grey-headed Flying-fox

A Grey-headed Flying-fox was heard foraging in a eucalypt at the northern end of the study area. The proposal will result in very little reduction of foraging habitat for the local Grey-headed Flying-fox as

relatively few eucalypts will be removed. Most of the eucalypts on the subject site are young individuals and most may be retained. Therefore, the proposal is unlikely to place the local population at risk of extinction.

Eastern Pygmy Possum

The Eastern Pygmy Possum was not recorded during the surveys, however, given the difficulties in observing this small species and the fact that ideal habitat occurs across most of the subject site, it is considered to be a potential species. Although this species has been recorded from a variety of habitats, it appears to favour open Woodland and Heath in the local region. It mainly feeds on nectar producing plants within the shrub layer, particularly Banksias, Grass trees *Xanthorrhoea* sp. and Mountain Devil *Lambertia formosa*. There is some evidence that Pygmy Possums may feed on Sundews and their insect prey following fires (Ray Williams, pers. obs.). Small tree hollows are favoured as day nesting sites, but nests have also been found under bark, in old bird nests and in the branch forks of tea-trees (Turner and Ward, 1995). Nest building appears to be confined to mothers with young.

When considering the proposed development for the study area, a relatively small area of bushland is to be removed and includes less than 50% of that vegetation community present in the study area. It is therefore unlikely that the proposal itself would place a local population at risk of extinction, however we can not be sure as we do not know whether this species does or does not occur and if so what areas of the site are being used. Being one of the less mobile species smaller areas of habitat may be more significant.

Spotted-tailed Quoll

The Spotted-tailed Quoll is quite secretive and rarely observed. This Quoll forages on a range of prey from insects to small wallabies (Strahan, 1995). Den sites have been recorded in caves, rock crevices and hollow logs. Competition with introduced predators, secondary poisoning from baits, land clearance and being hunted for taking domestic chickens threaten the survival of this species. The proposal is unlikely to have a significant impact on a local population of Spotted-tailed Quolls, as the development area is only a small area of potential foraging habitat. Den sites for the Quoll are only present outside the development area, below the escarpment. Due to the level of development adjacent to the southern and western boundaries of the study area it is likely that, if indeed present, any Quolls would rarely visit the development area.

Giant Burrowing Frog

This species is known to breed on adjacent land to the north, with tadpoles sighted in ephemeral or permanent pools in the upper reaches of creek lines (Ecotone, 1999). The species was recorded in 2003 from Tall-heath vegetation near Laurel Road, a few hundred metres north of the subject site (Mia Dalby-Ball, Pittwater Council, pers. comm.). The creek line in the south of the study area is too disturbed to be likely breeding habitat for the Giant Burrowing Frog. However, contaminated run-off flowing from the development area into the surrounding gullies, both during and after construction may impact on the quality of potential breeding habitat down slope. As this species is known to forage over a relatively large area, the site may be used for foraging. However, the loss of a relatively small and partially disturbed area of foraging habitat is considered unlikely to place a local population at risk of extinction.

Red-crowned Toadlet

The available potential habitat is limited to moist areas at the base or within rock benches, preferably with a dense cover of vegetation. Preferred breeding habitat appears to be within the first talus slope within 100m of the ridge top (Thumm and Mahony, 1999). The study area was surveyed during suitable conditions and at a seasonal time when Red-crowned Toadlets are known to call. As we did not record this species it is likely that it is not a significant location for the species. Even in the unlikely event of a colony being present, a local population should not be significantly impacted as suitable habitat is outside the subject site and provided that run off is adequately controlled.

- (b) *in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised.*

Koala

Although three Koala feed tree species (Swamp Mahogany, Scribbly Gum and Grey Gum) occur within the subject site, trees young and sparse across most of the subject site. No evidence of Koalas was observed in the study area (with the exception of one possible scratch) and there are no recent records for the locality. Between the 1940s and 1970s the population was the largest koala population in the Sydney area, estimated at 123 individuals in the 1970s. This population declined significantly to an estimated size of six individuals in 1993. The 1998 population is estimated to be less than this number (NPWS website – Final Determinations). Therefore it is unlikely that the study area is currently significant habitat for a local population of Koalas and consequently the loss of this area should not place a local population at risk of extinction. Furthermore many of the eucalypts may be retained allowing any local Koalas to still visit providing that yards are not fenced and do not contain dogs.

- (c) *in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed.*

The small area of habitat that would be impacted by this development proposal alone is not significant given the large area of known habitat within the locality (i.e. Kuring-gai Chase and Garigal National Parks and the nearby reserve along the escarpment). This is particularly the case for the more mobile species with larger home ranges (i.e. Powerful Owl, Eastern Bent-wing Bat, Grey-headed Flying-fox and Spotted-tailed Quoll).

- (d) *whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas for a threatened species, population or ecological community.*

No known habitat for any threatened fauna species will become isolated by the proposal. Because the proposed development of each lot and provision of APZ is intended to be confined to discrete areas, and connectivity of the remaining natural bushland can be maintained, no fragmentation or severance of potential habitat for any threatened species is likely.

- (e) *whether critical habitat will be affected.*

Not applicable

- (f) *whether a threatened species, population or ecological community, or their habitats are adequately represented in conservation reserves (or other similar protected areas) in the region.*

Powerful Owl

Extensive areas of potential Powerful Owl habitat occur within the National Parks and Council reserves in the region. Many records for this species in the region are from conservation reserves. The Powerful Owl does appear to be adequately represented in conservation reserves within the region.

Eastern Bent-wing Bat

The Eastern Bent-wing Bat has been found roosting within man made structures, although recorded maternity roosts occur in limestone cave systems. There is some recent information that disused mine workings in the Hunter region may also be used as maternity roosts, (Glenn Hoyer, Fly by Night Bat Surveys, pers. com.). Other than this, the only known protected maternity roosts for the Eastern Bent-wing Bat in the region occur in the Blue Mountains N.P. The species has been recorded from Ku-ring-

gai Chase National Park and Berowra Valley Bushland Park, where it is known to roost in small numbers in storm water drains and road culverts (Ray Williams, pers. obs.). Other known roosts occur within sea caves on the Barrenjoey Peninsula (Peter and Judy Smith, consultants, pers. comm.). Whether this species and its habitat requirements, are adequately represented within the reserve system is unknown, particularly given the lack of known major roost sites.

Grey-headed Flying-fox

The Grey-headed Flying-fox is a widespread species, migrating to seasonal food resources, usually Eucalypt blossom. Suitable camp sites are particularly important, especially maternity sites. Although some well known camps are within reserved land (e. g. Cabramatta, Gordon, Matcham, Blackbutt Reserve) others are situated in private property. Such camps are often under pressure to be moved as a result of being a perceived nuisance to the local community. The loss of a camp is likely to reduce the ability of this species to locally colonise an area. Whether this species and its habitat requirements are adequately represented within the reserve system is unknown but given apparent reductions in overall population numbers (NPWS, 2001b), it is considered highly unlikely.

Eastern Pygmy Possum

The Eastern Pygmy Possum has been found to be locally common within Ku-ring-gai Chase N.P. and Muogamarra Nature Reserve (Conroy, 1987 and Ray Williams, pers. obs.) in the local region. Regionally the species is also known from Royal and Heathcote National Parks south of Sydney. It is considered likely that this species and its preferred habitat is well represented in reserves of the region, however, whether this is adequate is unknown.

Spotted-tailed Quoll

This medium sized carnivore is known to occur within all the larger tracts of reserved bush land within the region. Records are, however, few in number and occur irregularly over time. Population sizes are therefore, difficult to determine and it is unclear whether its' required habitats are well conserved, at least in the local region.

Koala

Habitat for the Koala population in Pittwater is not considered to be adequately conserved (NPWS Website – Final Determinations).

Giant Burrowing Frog

The Giant Burrowing Frog has been recorded in all the larger reserves in the region. It is therefore, concluded that the species and its required habitats are well conserved, at least in the local region.

Red-crowned Toadlet

The Red-crowned Toadlet is known from Berowra Valley Regional Park (Smith and Smith, 1990), Muogamarra Nature Reserve, Ku-ring-gai Chase National Park and most National Parks and reserves in the Sydney region, where sandstone environments occur. Therefore, it would appear that this species is adequately represented in reserves within the local and wider region.

- (g) *whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process.*

With respect to these species and the proposal, the following Key Threatening Processes are listed on Schedule 3 of the TSC Act:

- Clearing of native vegetation

- Predation by the Feral Cat
- Predation by the Red Fox

Clearing of native vegetation may potentially impact on any individuals of the eight species being assessed. Species that visit to forage (e.g. Powerful Owl, Eastern Bent-wing Bat, Grey-headed Flying-fox, Spotted-tailed Quoll and Koala) would be less impacted than those that potentially could both forage and shelter, and perhaps nest on site (e.g. Eastern Pygmy Possum, Giant Burrowing Frog). Although the development area alone may not represent a significant area of habitat for most of these species in terms of species survival, clearing the site will still contribute to the cumulative loss of habitat for all native fauna.

Predation by the Feral Cat and Red Fox may potentially increase as a result of the proposed development. The clearing process will remove shelter for the Eastern Pygmy-possum and Giant Burrowing Frog, increasing the chance of being caught by these introduced predators. The disturbance will also encourage foxes and cats to roam deeper into the proposed reserve. Cats do not need to be feral to prey upon native fauna. The increased number of domestic cats and dogs introduced to the study area as the result of the proposed dwellings, may also have an impact on resident fauna.

(h) *whether any threatened species, population or ecological community is at the limit of its known distribution.*

None of the species assessed in this 8-part test are at the limit of their known distribution at the study site. The Koala population in Pittwater is at its southern limit at Ingleside.

Conclusions from the eight-part tests

Although potential and known foraging habitat for the assessed threatened species will be lost or modified as a result of the proposal, it is considered unlikely that a significant impact on these species will occur. This assumption is based on the relatively small size and past disturbance of the development area and the retention of a large parcel of the adjoining proposed Residue Lot land, which will be retained as a reserve. This residue lot does contain similar habitat to that currently present on the subject site. Measures must be taken to manage run-off from the dwellings and associated garden to prevent contamination of potential habitat for the Giant Burrowing Frog and Red-crowned Toadlet down slope.

4.3 Environment Protection & Biodiversity Conservation Act 1999 (EPBC Act)

The EPBC Act was gazetted on the 16th July 2000 replacing several earlier Commonwealth statutes. This Act focuses Commonwealth interests on matters of national environmental significance including integrated biodiversity conservation and the management of important protected areas. The Act also establishes a streamlined environmental assessment and approvals process.

The matters of national environmental significance as identified in the Act which require assessment and approval to be addressed by the Commonwealth include:

- World Heritage properties
- Ramsar wetlands
- Nationally threatened species and ecological communities (Part 13, Division 1, Subdivision A of the EPBC Act)
- Migratory species
- Commonwealth Marine areas
- Nuclear actions (including uranium mining)

The assessment and approval process complies with any action that has, will have or is likely to have a significant impact on a matter of national environmental significance. An 'action' is defined as a project, development, undertaking or an activity or series of activities.

Neither of the two subject **flora** species for the site are listed under the *EPBC Act 1999*.

One of the locally recorded threatened or migratory **fauna** species, the Grey-headed Flying-fox, listed in the *EPBC Act 1999* was found to occur on the site. Based on the assessment process and representation of habitats on the site, it is concluded that the Giant Burrowing Frog and Spotted-tailed Quoll, listed as 'vulnerable', are considered to have at least some potential use the site. However, the extent of use by these three species is not regarded as being significant for the survival of the species.

Therefore a specific assessment process under the provisions of the *EPBC Act 1999* is unlikely to be required for the proposed development, since it does not constitute an action that is likely to have a significant impact upon a matter of National Environmental Significance.

4.4 SEPP 44 – Koala Habitat Protection

SEPP 44 was implemented on the 13th of February, 1995, with the reasoning that the current known distribution of the Koala in NSW is fragmented, with most colonies appearing to be small and isolated. Many of these populations are in locations that are under increased pressure from habitat loss or modification, predation and exposure to drought, disease and bushfire. These facts are the reason for the Koala being listed as 'Vulnerable' in Schedule 2 of the Threatened Species Conservation Act, 1995.

Prior to a Development Application for bushland areas being approved, the following considerations need to be assessed:

- a) identification of "potential Koala Habitats" within the proposed development area; if the total tree cover contains 15% or more of the koala food tree species listed in Schedule 2 of SEPP 44 then it is deemed to be "potential" koala habitat;
- b) identification of "core Koala habitat" within the development area. "Core Koala habitat" is defined as an area of land with a resident population of koalas, evidenced by attributes such as breeding females (females with young), recent sightings and historical records of a Koala population;
- c) identification of "core Koala habitat" will require that a plan of management must accompany the DA application;
- d) if the rezoning of lands, other than to environmental protection, involves potential of core Koala habitat then the Director of planning may require a local environmental study be carried out.

In order to decide whether the subject land represents "potential" or "core" Koala habitat as defined under SEPP44, a visual assessment of the percentage of Koala food tree species present on the subject land was carried out. Koala food tree species were identified as those listed in schedule 2 of SEPP 44. Food trees sighted were inspected for possible Koala scratches and the ground under such trees was searched for their characteristic scats.

Broad-leaved Scribbly Gum *Eucalyptus haemastoma*, Grey Gum *Eucalyptus punctata* and Swamp Mahogany *Eucalyptus robusta* were recorded within the subject site and are listed as major Koala food trees. Feeding trials on captive Koalas suggest that the Scribbly Gum is only favoured on a seasonal basis in the Hornsby region (R. Williams *pers. comm.*). More than 15% of the trees on the subject site with a DBH greater than 10cm are these species. Therefore the subject site is considered to be "potential Koala habitat" by definition of SEPP 44. No evidence of Koalas, with the exception of one possible scratch was found during a search of the study area. This scratch was inconclusive and may have just as potentially been made by another species, such as a large Brushtail Possum or a Lace Monitor. Hence further action under SEPP 44 is not required.

4.5 Pittwater Council Assessment Requirements

This section addresses the draft guidelines for Environmental Impact Assessment in Pittwater (Pittwater Council 2003), and existing council planning policies such as DCP 25 (Pittwater Council 2000). Many of the requirements in the draft guidelines have already been addressed above. These include:

- Applicability of State Government legislation;
- Description of the site and site details;
- Flora and fauna species lists and surveys for targeted species;
- Regionally and locally significant flora and fauna;
- Requirement for assessment of locally-occurring threatened species etc.

Since the proposed development would result in over 500 m² of vegetation being disturbed or modified, an EIA is required.

Habitat Classification and Corridors

The habitat classification of the study area is mostly "Core Bushland - Priority 1" (**Figure 5**). Most of this land (about 92.6%) would be reserved and free from development in the 26.6 hectare Residue Lot (proposed Lot 2). All Asset Protection Zones will be within each lot and will not encroach further into the residue lot. The only other category of habitat classification relevant to the site is "Cleared Land within Wildlife Corridor - Priority 2", which is confined to the development area. This category applies to narrow, disturbed strips of land along the northern and southern boundaries of proposed Lot 1, and along the southern boundary of existing Lot 83.

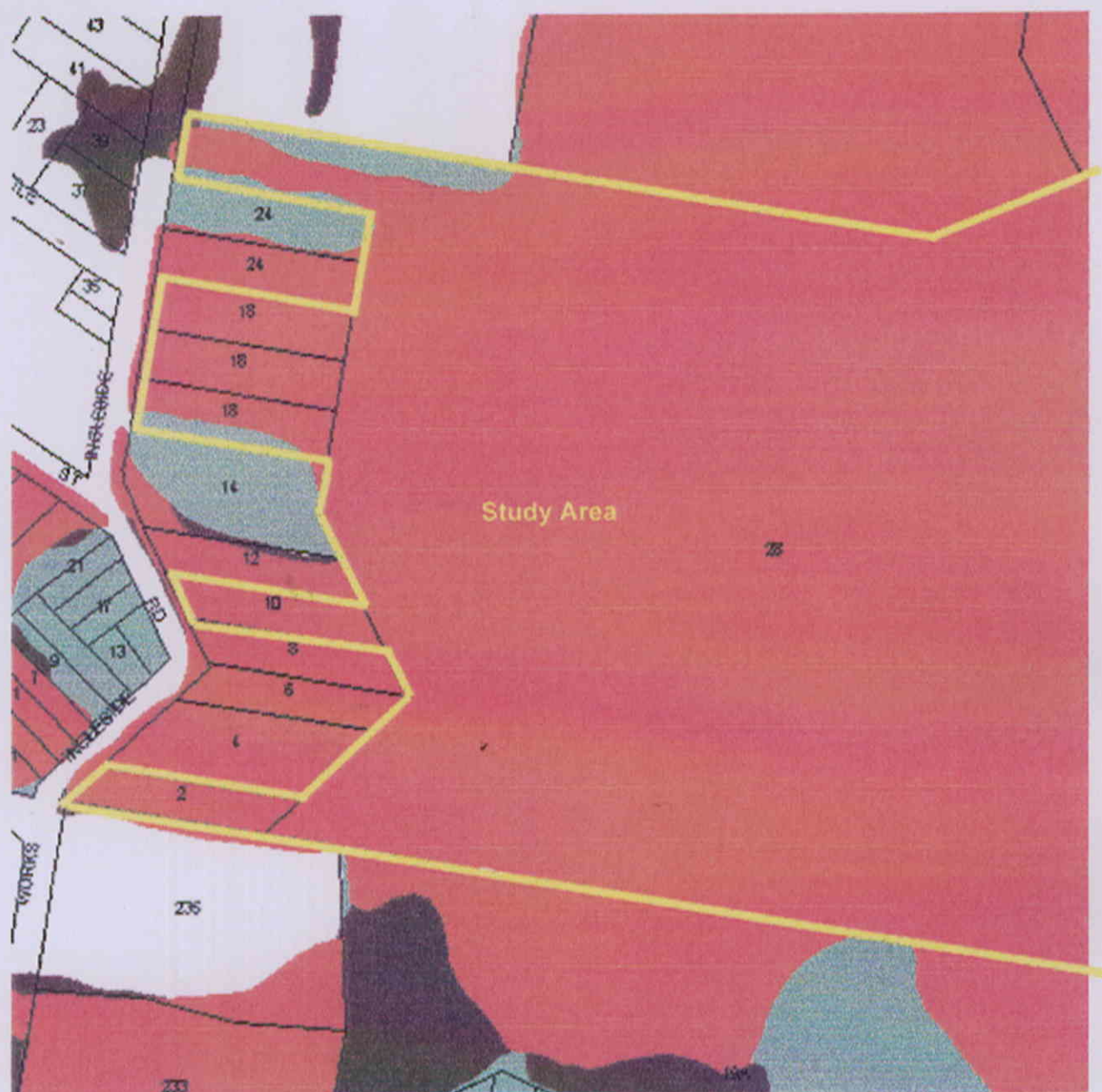
The classification shown on the current maps is not entirely accurate relative to the current site conditions, since Lots 83, 84 and 85 also have large cleared and weedy areas (see Figure 3) which would be more appropriately classified as Priority 2 than Priority 1. Lot 76, 77, 78 and 86 (which are not part of the subject site) are also cleared and developed with remnant trees but is classified as Core Bushland.

The large area of bushland (Core Bushland) in the residue lot to the east of the subject site would form a major corridor for wildlife movement. All of this core bushland area will be retained and not developed under the current plans. Some wildlife movement is also likely to occur between lot 79 and the proposed Lot 1, and the undeveloped bushland to the west of Ingleside Road. Movement would also occur through the Uniting Church land to the south of the subject site.

Nearby council bushland reserves include Ingleside Park (adjoins the subject site along part of its northern boundary), Epworth Park (a short distance south-east of the subject site), and Katandra Bushland Sanctuary (approximately 1.5 kilometres north of the subject site to the north of Mona Vale Road). There is no direct vegetative link between the study area and the last reserve. The nearest National Park is Garigal National Park (within 1.5 km of the site boundary to the west) and Ku-ring-gai Chase National Park (within 2 km to the north-west of the subject site). No direct vegetative connection exists between these National Parks and the study area.

Site Coverage

The total area that the proposed development would occupy within the subject site (including the the Asset Protection Zones) is 2.12ha.



LEGEND

-  Cleared Land Within Wildlife Corridor - Priority 2
-  Core Bushland - Priority 1
-  Fragmented Bushland - Priority 1



Approx. Scale

222.7 m



Ecolane Ecological Consultants Pty Ltd

Figure 5. DCP 25 Categories In and Around the Study Area. Base Map : Pittwater Council

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Landscaping

Bush regeneration, including weed control and replanting of native species where necessary is recommended. However within individual lots, most weeds would be removed as a matter of course as part of the Asset Protection requirements and general landscaping plans by individual owners. It would be beneficial to ensure that as much native vegetation, especially eucalypts, as is permissible within the framework of the bushfire protection requirements (retention west of the building line is acceptable) is retained within the development lots. Any remaining weeds following vegetation clearing or under-scrubbing, should also be controlled (particularly noxious and environmental weeds). Plantings within development lots should use locally native species (appropriate species to use are identified in Appendix 1 of this report) for at least 70% of plantings.

Sewage

Each future dwelling will require on site effluent disposal.

Stormwater

Current best practice runoff and pollution control measures should be implemented both during the construction phase and beyond, to intercept nutrient-rich stormwater from the development area and prevent proliferation of weeds in downslope areas.

Domestic Animals

There is no compelling reason to exclude animals (pets) from the site from a native fauna protection perspective. However, as in any bushland suburb, residents should be encouraged to practise responsible pet ownership.

5.0 CONCLUSION

An assessment of the potential effects on flora and fauna by the proposed residential subdivision and rezoning at Ingleside Road, Ingleside has been made, based on a combination of literature review and field survey. The resulting information has been used to address the requirements of Section 5A of the *Environmental Planning and Assessment Act 1979*.

No threatened flora species listed under either the NSW *TSC Act* or Commonwealth *EPBC Act* were found on the subject site or in the broader study area, although the possibility of some threatened species occurring amongst dense, inaccessible scrub vegetation within the subject site cannot be entirely eliminated. It is considered that potential (although marginal) habitat could exist on the subject site for the threatened flora species *Callistemon linearifolius* and *Epacris purpurascens* var. *purpurascens*. The likelihood of these species occurring in the proposed development area is regarded as being very low.

Foraging habitat for the Powerful Owl *Ninox strenua* recorded in the study area, is present on the subject site. The Grey-headed Flying-fox and Eastern Bent-wing Bat were also recorded in the study area and are considered to only visit the subject site for foraging purposes. The Eastern Pygmy-possum *Cercartetus nanus*, Spotted-tailed Quoll *Dasyurus maculatus*, Koala *Phascolarctos cinereus*, Giant Burrowing Frog *Heleioporus australiacus* and Red-crowned Toadlet *Pseudophryne australis* are all considered to have at least some potential to use the site. All these species are listed as vulnerable on the *TSC Act 1995* and the Grey-headed Flying-fox, Spotted-tailed Quoll and Giant Burrowing Frog are also listed as vulnerable on the *EPBC Act 1999*.

It is important to consider that, as part of the proposal 26.6 hectares (92.6%) of the entire study area will be retained as a reserve and unaffected by any development. This is a core habitat area containing some of the most favourable habitat for flora and fauna, including any threatened species that were found to occur, or potentially could occur, in the study area.

Based on the results of this survey and assessment, it is considered that the subdivision and subsequent development proposed for the site is unlikely to have a significant impact on the threatened species listed above, provided suitable management measures are implemented as recommended in the following section of this report.

6.0 RECOMMENDATIONS

In order to maximise conservation of local flora and fauna and to ameliorate impacts of the proposal on the local natural environment (including potential habitat for threatened or significant species), it is recommended that the following steps be taken within the subject site:

- a) Building envelopes and access roads should be located, as far as possible, within previously cleared, disturbed or weedy areas (see Figure 3), or areas that would minimise the bushland clearing or modification required for bushfire protection. These locations must ultimately be consistent with the requirements for provision of the Asset Protection Zones.
- b) Wherever possible, clearing of native vegetation within each lot should be minimised and natural regeneration of native flora encouraged (to the extent that this is consistent with the requirements of the Asset Protection Zone for bushfire protection). This will provide some habitat for resident fauna while still complying with bushfire protection requirements.
- c) New residents should be encouraged to carry out landscaping using species native to the local area. Pittwater Council (2000, 2003) requires that local native species should be used for at least 70% of plantings. Appropriate species to use are indicated as such in Appendix 1 of this report. This will not only further mitigate the impacts of habitat loss for fauna, but would also help to reduce the infestation of areas downslope with exotic flora.
- d) Runoff from new buildings and gardens/landscaping on each new Lot should be managed during both the construction and operational phases of the project, using current best practice pollution and sedimentation interception and management techniques. Of particular concern is the possibility of nutrient-rich runoff impacting on downslope vegetation and creation of conditions that would promote invasions of weeds into unaffected bushland and the creekline to the east of the site. Although not considered likely to occur in or near the development area on the basis of available habitat, breeding habitat for the Red-crowned Toadlet and Giant Burrowing Frog could be affected, if they do indeed occur in downstream habitat.
- e) Professional bush regeneration techniques should be implemented to control weeds in the weedy disturbed and edge areas of the site, and within the upper riparian creekline area. The most serious environmental weeds should be removed from within the immediate catchment area of the creek, and the native vegetation of each treated area allowed to regenerate as far as possible. In particular, noxious species and environmental weeds such as Pampas Grass, Blackberry, Crofton Weed and Giant Reed should be removed. Appropriate measures should be taken to prevent re-invasion of weeds following treatment. Any bare areas where natural regeneration is unlikely should be replanted with suitable locally indigenous species, preferably propagated from locally collected propagule material. Suitable species to use are indicated as such in Appendix 1.
- f) Any eucalypts within the site should be avoided and retained where possible (subject to APZ requirements).

7.0 REFERENCES

- Australian Museum Business Services. 1995, *Fauna Impact Statement for the Gloucester and Chichester Management Areas*. Report prepared for State Forests of NSW.
- Benson, D. & Howell, J. 1994. The natural vegetation of the Sydney 1:100 000 map sheet. *Cunninghamia* 3: 677-787.
- Benson, D. & McDougall, L. 1995. Ecology of Sydney plant species. Part 3: Dicotyledon families Cabombaceae to Eupomatiaceae. *Cunninghamia* 4: 217-43.
- Briggs, J. D. & Leigh, J. H., 1996. *Rare or Threatened Australian Plants*. CSIRO Publications.
- Blakers, M., Davies, S. J. J. F. & Reilly, P. N. 1984, *The Atlas of Australian Birds*. Royal Australasian Ornithologists Union and Melbourne University Press.
- Cogger, H.G., 1995. *Reptiles and Amphibians of Australia*. Reed Books, Sydney.
- Churchill, 1998. *Australian Bats*. Reed New Holland, Sydney.
- Conacher Travers, 2003. *Draft Bushfire Protection Assessment for the Proposed Subdivision and Residential Development of Lot 74 SECB (DP 11784) and Lot 3 SECF (DP 11784) and the Proposed Residential Development of Lots 79, 83, 84, & 85 SECB (DP 11784) at Ingleside Road, Ingleside*.
- Cropper, S. 1993. *Management of Endangered Plants*. CSIRO, Canberra.
- Debus S. and Chafer, C. 1994. *The Powerful Owl Ninox Strenua in New South Wales*. Pp.21-38 in Large Forest Owls of New South Wales, Aust Birds, Vol 28 Supplement. Journal of the NSW Field Ornithologists Club Inc.
- Dwyer, P. D. 1995, Common Bent-wing Bat. pp. 494 - 495 in *The Mammals of Australia*, ed. R. Strahan. Australian Museum and Reed, Sydney.
- Ecotone, 1993. Proposed Subdivision of C. T. Vol. 2267, Folio 101, Forest and Boundary Roads, Ingleside, Municipality of Pittwater. Report prepared by Ecotone Ecological Consultants Pty Ltd for G.J. Weyton and Associates.
- Ecotone, 1999. Species Impact Statement for the Proposed Burrawang Ridge Estate, Ingleside. Report prepared by Ecotone Ecological Consultants Pty Ltd for Healesville Holdings Pty Ltd and Byrnes & Associates Pty Ltd.
- Fairley, A. & Moore, P. 1989, *Native Plants of the Sydney District: An identification guide*. Kangaroo Press, Kenthurst.
- Geoff Cunningham Natural Resource Consultants 1994. *Ingleside/Warriewood Land Release Project: Final Vegetation Conservation Study*. Document tabled at the Pittwater Environmental Committee Meeting 8.8.1994
- Harden, G.J. (ed) 1990. *Flora of New South Wales* Volume 1. Royal Botanic Gardens and New South Wales University, Sydney
- Harden, G.J. (ed) 1992. *Flora of New South Wales* Volume 3. Royal Botanic Gardens and New South Wales University, Sydney
- Harden, G.J. (ed) 1993. *Flora of New South Wales*. Volume 4. Royal Botanic Gardens and New South Wales University, Sydney.
- Harden, G.J. (ed) 2002. *Flora of New South Wales*. Volume 2. Revised Edition. Royal Botanic Gardens and New South Wales University, Sydney.
- Harden, G.J. & Murray, L.J. (eds) 2000. *Supplement to Flora of New South Wales Volume 1*. Royal Botanic Gardens and New South Wales University, Sydney.
- ICF Pty Ltd and the Australian Museum 1994. *Ingleside/Warriewood Urban Land Release: Fauna Conservation Study*. Prepared for Pittwater Council.

- Lembit, R. 1997. Vegetation Overview. Pp. 1-9 in *Urban Bushland Inventory and Action Plan, Volume 2: South Ward Reserves*. Prepared for Pittwater Council, Warriewood.
- NPWS 1996. *Threatened Species Management information circular No. 2*. Threatened species assessment under the EP&A Act: The '8 Part Test' of Significance.
- NPWS, 1999. Threatened Species Information.
- NSW Scientific Committee 2002. *Final Determination to list Duffys Forest Ecological Community in the Sydney Basin Bioregion as an endangered ecological community and, as a consequence, to omit reference to Duffys Forest Vegetation Community*.
- Pittwater Council 1995. *Conservation Strategy No. 1: Habitat and Wildlife Corridors*. Prepared by Pittwater Council from a Discussion Paper by Paul Burcher.
- Pittwater Council 2000. *Development Control Plan No. 25: Conservation of Biodiversity*. Prepared by Pittwater Council.
- Pittwater Council 2003. *Draft Information and Templates for writing Environmental Reports including Ecological Sustainability Plans in the Pittwater Council LGA*. Prepared by the Natural Resources Unit, Pittwater Council.
- Robinson L. 1991. *Field Guide to the Native Plants of Sydney*. Kangaroo Press, Roseville, NSW.
- Sheringham, P.R. and Sanders, J.M. 1993. *Vegetation Survey of Garigal National Park and Surrounding Crown Lands*. National Parks and Wildlife Service.
- Slater, P. Slater P. and Slater R. 1998. *The Slater Field Guide to Australian Birds*. Landsdowne Publishing Pty Ltd, Sydney.
- Smith, P. and Smith, J., 2000. *Management Plan for Threatened Fauna and Flora in Pittwater*. Prepared for Pittwater Council by Judy Smith and Peter Smith.
- Strahan, R. 1995, *The Mammals of Australia. Second Edition*. Reed Books and Australian Museum, Sydney.
- Swan, G. Shea G. and Sadlier R. 2004. *A Field Guide to Reptiles of New South Wales*. Reed New Holland, Sydney.
- Thumm, K. and Mahony, M., 1999. Loss and Degradation of Red-crowned Toadlet Habitat in the Sydney Region. In *Declines and Disappearances of Australian Frogs* Ed. Alistair Campbell, Environment Australia, Canberra
- Turner, V. and Ward, S., 1995. Eastern Pygmy Possum *Cercartetus nanus*. In *The Mammals of Australia*, Ed. R. Strahan, pp 217-218. Reed Books, Sydney.

8.0 APPENDICES**Appendix 1. Flora Species Recorded in the Study Area**Notes:

* indicates an exotic or introduced native species

R indicates locally indigenous species that are potentially suitable for revegetation or replanting works

Nomenclature follows Harden (1991 - 2002), Harden & Murray (2000) and subsequent recent revisions.

Area/Habitat

1 = Subdivision Area

2 = Below Escarpment

3 = Riparian/Creekline

4 = Reserve Lot further to East (Representative species only – not a comprehensive inventory)

CLASS/FAMILY/Scientific Name		Common Name	Area/Habitat			
			1	2	3	4
			(see Notes)			

CLASS FILICOPSIDA (Ferns)**ASPLENIACEAE**

<i>Asplenium australasicum</i>	R	Bird's Nest Fern				4
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BLECHNACEAE

<i>Blechnum cartilagineum</i>	R	Gristle Fern				4
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CYATHEACEAE

<i>Cyathea australis</i>	R	Rough Treefern			3	4
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DAVALLIACEAE

<i>Nephrolepis cordifolia</i> *		Fishbone Fern		2		4
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DENNSTAEDTIACEAE

<i>Pteridium esculentum</i>		Bracken	1	2		4
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DICKSONIACEAE

<i>Calochlaena dubia</i>	R	False Bracken Fern		2	3	4
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GLEICHENIACEAE

<i>Gleichenia dicarpa</i>	R	Pouched Coral Fern			3	4
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<i>Sticherus flabellatus</i>	R	Umbrella Fern				4
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LINDSAEACEAE

<i>Lindsaea linearis</i>	R	Screw Fern				4
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OSMUNDACEAE

<i>Todea barbara</i>	R	King Fern				4
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POLYPODIACEAE

<i>Pyrrosia rupestris</i>	R	Rock Felt-fern				4
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THELYPTERIDACEAE

<i>Christella dentata</i>	R	-			3	
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CLASS CONIFEROPSIDA (Conifers)**PINACEAE***Pinus radiata**

Radiata Pine

1

PODOCARPACEAE*Podocarpus spinulosus*

R

Podocarpus

2

4

CLASS MAGNOLIOPSIDA (Flowering Plants)**Subclass Magnoliidae (Dicotyledons)****APIACEAE***Actinotus minor*

R

Lesser Flannel Flower

1

2

*Hydrocotyle bonariensis**

Kurnell Curse

1

2

3

Hydrocotyle laxiflora

Stinking Pennywort

1

Platysace lanceolata Broad-leaved form

R

Native Parsnip

1

2

4

Platysace linearifolia

R

Carrot Tops

2

Xanthosia pilosa

R

Woolly Xanthosia

2

Xanthosia tridentata

R

Rock Xanthosia

1

ARALIACEAE*Astrotricha floccosa*

R

Flannel Leaf

4

ASCLEPIADACEAE*Asclepias curassavica**

Blood Flower

1

Marsdenia suaveolens

R

Sweet-scented Doubah

4

ASTERACEAE*Ageratina adenophora**[#]

Crofton Weed

1

2

3

4

*Bidens pilosa**

Cobblers Pegs

1

2

3

*Coryza sp.**

Fleabane

1

4

*Coreopsis lanceolata**

Coreopsis

1

*Gnaphalium coarctatum**

Cudweed

1

4

*Hypochaeris radicata**

Catsear

1

3

Olearia tomentosa

R

A Daisy Bush

4

*Senecio madagascariensis**

Fire Weed

1

*Sonchus oleraceus**

Common Sowthistle

1

BRASSICACEAE*Rorippa nasturtium-aquaticum**

Watercress

3

CASUARINACEAE*Allocasuarina distyla*

R

Scrub She-oak

1

2

Allocasuarina littoralis

R

Black She-oak

1

2

Allocasuarina torulosa

R

Forest Oak

4

CUNONIACEAE*Callicoma serratifolia*

R

Black Wattle

3

4

Ceratopetalum apetalum

R

Coachwood

4

Ceratopetalum gummiferum

R

NSW Christmas Bush

2

4

DILLENACEAE*Hibbertia dentata*

R

Twining Guinea Flower

4

Hibbertia linearis

R

Showy Guinea Flower

2

4

DROSERACEAE*Drosera peltata*

R

Pale Sundew

1

ELAEocarpaceae*Elaeocarpus reticulatus*

Blueberry Ash

2

4

EPACRIDACEAE

<i>Epacris longiflora</i>	R	Native Fuchsia	1	2	4
<i>Epacris pulchella</i>	R	NSW Coral Heath		2	
<i>Leucopogon microphyllus</i>	R	Small-leaved White-beard	1		4
<i>Styphelia tubiflora</i>	R	Red Five-corners	1		
<i>Woollsia pungens</i>	R	Snow Wreath		2	

EUPHORBIACEAE

<i>Glochidion ferdinandi</i> var. <i>ferdinandi</i>		Cheese Tree	1		
<i>Micrantheum ericoides</i>	R	-	1		
<i>Omalanthus populifolius</i>		Bleeding Heart		2	4
<i>Phyllanthus hirtellus</i>	R	Thyme Spurge		2	

FABACEAE - Subfamily Caesalpinoideae

<i>Senna pendula</i> var. <i>glabrata</i> *#		Cassia	1	2	
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FABACEAE - Subfamily Faboideae

<i>Bossiaea scolopendria</i>	R	-	1		
<i>Dillwynia retorta</i>	R	Heathy Parrot Pea		2	4
<i>Genista monspessulana</i> *#		Montpellier Broom	1		
<i>Phyllota grandiflora</i>	R	Phyllota			4
<i>Phyllota phyllicoides</i>	R	Common Phyllota		2	
<i>Platylobium formosum</i>	R	Handsome Flat-Pea		2	
<i>Pultenaea daphnoides</i>	R	Large-leaf Bush Pea		2	4
<i>Pultenaea elliptica</i>	R	A Bush Pea	1	2	
<i>Pultenaea flexilis</i>	R	Graceful Bush Pea		2	4
<i>Pultenaea stipularis</i>	R	Fine-leaf Bush Pea		2	
<i>Trifolium repens</i> *		White Clover	1	2	

FABACEAE - Subfamily Mimosoideae

<i>Acacia echinula</i>	R	Hooked Wattle			4
<i>Acacia longifolia</i> subsp. <i>longifolia</i>	R	Sydney Golden Wattle	1	2	
<i>Acacia longifolia</i> subsp. <i>sophorae</i>	R	Coastal Wattle	1		
<i>Acacia oxycedrus</i>	R	Spike Wattle		2	
<i>Acacia terminalis</i> subsp. <i>angustifolia</i>	R	Sunshine Wattle	1	2	
<i>Acacia ulicifolia</i>	R	Prickly Moses		2	

LAMIACEAE

<i>Hemigenia purpurea</i>	R	Narrow-leaved Hemigenia	1		
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LAURACEAE

<i>Cassytha pubescens</i>		Devil's Twine	1	2	4
<i>Cinnamomum camphora</i> *#		Camphor Laurel	1		
<i>Endiandra sieberi</i>		Hard Corkwood			4

MALVACEAE

<i>Sida rhombifolia</i> *		Paddy's Lucerne	1		
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MELIACEAE

<i>Synoum glandulosum</i>		Scentless Rosewood			4
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MENISPERMACEAE

<i>Stephania japonica</i> var. <i>discolor</i>	R	Snake Vine	1		
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MORACEAE

<i>Ficus rubiginosa</i>	R	Port Jackson Fig	1		4
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MYRTACEAE

<i>Angophora costata</i>	R	Smooth-barked Apple	1	2	4
<i>Angophora hispida</i>	R	Dwarf Apple	1		

<i>Callistemon citrinus</i>	R	Crimson Bottlebrush	1		
<i>Callistemon linearis</i>	R	Narrow-leaved Bottlebrush	1		
<i>Callistemon rigidus</i>	R	Stiff Bottlebrush	1		
<i>Callistemon salignus</i>	R	Willow Bottlebrush	1		
<i>Corymbia gummifera</i>	R	Red Bloodwood	1	2	4
<i>Darwinia fascicularis</i> subsp. <i>fascicularis</i>	R	Bread and Meat	1		
<i>Eucalyptus capitellata</i>	R	Brown Stringybark		2	
<i>Eucalyptus haemastoma</i>	R	Scribbly Gum	1	2	
<i>Eucalyptus piperita</i>	R	Sydney Peppermint		2	4
<i>Eucalyptus punctata</i>	R	Grey Gum	1	2	
<i>Eucalyptus robusta</i>		Swamp Mahogany	1		
<i>Eucalyptus sieberi</i>	R	Silver Top Ash	1		4
<i>Eucalyptus umbra</i>	R	Bastard White Mahogany	1	2	
<i>Kunzea ambigua</i>	R	Tick Bush	1	2	
<i>Leptospermum polygalifolium</i> subsp. <i>polygalifolium</i>	R	Lemon-scented Tea-tree	1	2	3
<i>Leptospermum squarrosum</i>	R	Pink Tea-tree	1	2	4
<i>Leptospermum trinervium</i>	R	Paperbark Tea-tree		2	
<i>Lophostemon confertus</i>		Brush Box	1		
<i>Melaleuca armillaris</i>		Giant Honeymyrtle	1		
<i>Melaleuca hypericifolia</i>	R	A Paperbark	1		
<i>Syncarpia glomulifera</i>	R	Turpentine	1	2	4
<i>Tristanopsis laurina</i>	R	Water Gum/Kanuka			3 4
OLEACEAE					
<i>Jasminum polyanthum</i> *		Jasmine	1		
OXALIDACEAE					
<i>Oxalis corniculata</i> *		A Wood Sorrell	1		
PITTOSPORACEAE					
<i>Billardiera scandens</i> var. <i>scandens</i>	R	Apple Dumplings		2	4
<i>Pittosporum undulatum</i>		Sweet Pittosporum	1		3 4
PLANTAGINACEAE					
<i>Plantago lanceolata</i> *		Common Plantain	1	2	
POLYGONACEAE					
<i>Rumex crispus</i> *		Curly Dock	1		
PROTEACEAE					
<i>Banksia ericifolia</i>	R	Heath-leaved Banksia	1	2	3 4
<i>Banksia serrata</i>	R	Old Man Banksia	1	2	
<i>Grevillea buxifolia</i> subsp. <i>buxifolia</i>	R	Grey Spider Flower	1	2	
<i>Grevillea linearifolia</i>	R	White Spider Flower		2	
<i>Grevillea sericea</i>	R	Pink Spider Flower		2	
<i>Hakea gibbosa</i>	R	A Hakea	1		
<i>Hakea sericea</i>	R	Bushy Needlebush		2	
<i>Hakea teretifolia</i>	R	Dagger Hakea	1	2	
<i>Persoonia lanceolata</i>	R	Lance-leaved Geebung	1	2	
<i>Persoonia levis</i>	R	Broad-leaved Geebung			4
RHAMNACEAE					
<i>Pomaderris elliptica</i> var. <i>elliptica</i>	R	Smooth Pomaderris		2	4
ROSACEAE					
<i>Rubus fruticosus</i> species aggregate*#		Blackberry	1		3
RUBIACEAE					
<i>Opercularia aspera</i>	R	Thin Stink Weed			4
<i>Opercularia varia</i>	R	A Stink Weed			4

RUTACEAE

<i>Asterolasia correifolia</i>	R	Star-bush			4
<i>Boronia mollis</i>	R	Soft Boronia			4
<i>Boronia pinnata</i>	R	A Boronia			4
<i>Crowea saligna</i>	R	Crowea	2		4
<i>Eriostemon australasius</i> subsp. <i>australasius</i>	R	Pink Wax Flower			4
<i>Leionema dentatum</i>	R	Toothed Phebalium	2		4
<i>Phebalium squamulosum</i> subsp. <i>squamulosum</i>	R	Phebalium	2		4
<i>Zieria pilosa</i>	R	Hairy Zieria	1		4
<i>Zieria smithii</i>	R	Sandfly Zieria	1		

SAPINDACEAE

<i>Dodonaea triquetra</i>	R	Common Hop Bush	1	2	4
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SOLANACEAE

<i>Solanum mauritianum</i> *		Wild Tobacco Tree			
<i>Solanum nigrum</i> *		Blackberry Nightshade	1		

STERCULIACEAE

<i>Lasiopetalum ferrugineum</i> var. <i>ferrugineum</i>	R	Rusty Petals	2		4
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THYMELACEAE

<i>Pimelea linifolia</i> subsp. <i>linifolia</i>	R	Rice Flower	2		
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VERBENACEAE

<i>Lantana camara</i> *#		Lantana	1	2	3	4
<i>Verbena bonariensis</i> *		Purpletop	1	2		

VIOLACEAE

<i>Viola hederacea</i>	R	Native Violet	1			
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VITACEAE

<i>Cissus hypoglauca</i>		Five-leaf Water Vine				4
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Subclass Liliidae (Monocotyledons)

AMARYLLIDACEAE

<i>Agapanthus</i> sp.*		Lily of the Nile	1			
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ANTHERICACEAE

<i>Chlorophytum comosum</i> *		Spider Plant	1			
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ARECACEAE

<i>Livistona australis</i>	R	Cabbage-tree Palm	2	3	4	
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ASPARAGACEAE

<i>Protasparagus aethiopicus</i> *#		Asparagus Fern	1			
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COMMELINACEAE

<i>Commelina cyanea</i>		Scurvy Weed	1		3	
<i>Tradescantia albiflora</i> *		Wandering Jew	1		3	

CYPERACEAE

<i>Caustis flexuosa</i>	R	Old Man's Beard	1	2		
<i>Cyperus polystachyos</i>		-	1			
<i>Fimbristylis dichotoma</i>	R	-	1	2		
<i>Gahnia clarkei</i>	R	Tall Saw Sedge		2	3	4
<i>Gahnia sieberiana</i>	R	Red-fruited Saw Sedge	1	2		
<i>Isolepis nodosa</i>	R	Knobby Club-rush	1		3	
<i>Lepidosperma laterale</i>	R	Flat Sword-sedge				4
<i>Schoenus melanostachys</i>	R	Black Bog-rush				4

LOMANDRACEAE

<i>Lomandra longifolia</i>	R	Spiny-headed Mat-rush	1	2	4
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PHORMIACEAE

<i>Dianella caerulea</i> var. <i>producta</i>	R	Blue Flax Lily	1	2	4
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POACEAE

<i>Arundo donax</i> [#]		Giant Reed			3
<i>Andropogon virginicus</i> *		Whisky Grass	1		3
<i>Cortaderia selloana</i> [#]		Pampas Grass	1	2	
<i>Cynodon dactylon</i> *		Couch	1		
<i>Eleusine indica</i> *		Crowsfoot Grass	1		
<i>Entolasia marginata</i>	R	Bordered Panic		2	
<i>Imperata cylindrica</i> var. <i>major</i>		Blady Grass	1	2	
<i>Paspalum urvillei</i> *		Tall Paspalum	1		
<i>Pennisetum clandestinum</i> *		Kikuyu	1		
<i>Setaria gracilis</i> *		Slender Pigeon Grass	1		

RESTIONACEAE

<i>Lepyrodia scariosa</i>	R	A Scale-rush	1	2	4
<i>Restio dimorphus</i>	R	A Scale-rush			4

SMILACACEAE

<i>Smilax glycyphylla</i>	R	Native Sarsaparilla		2	4
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XANTHORRHOEACEAE

<i>Xanthorrhoea arborea</i>	R	Broadleaf Grass-tree		2	4
<i>Xanthorrhoea resinifera</i>	R	A Grass-tree	1	2	4

ZINGIBERACEAE

<i>Hedychium gardnerianum</i> *		Ginger Plant	1		
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Appendix 2. Fauna recorded within the Study Area

Note: * indicates introduced / non-endemic species, V - Vulnerable, E - Endangered T S C Act 1995.

Mammals

Family / Scientific Name	Common Name
Family: <i>DASYURIDAE</i> <i>Antechinus stuartii</i>	Brown Antechinus
Family: <i>PHALANGERIDAE</i> <i>Trichosurus vulpecula</i>	Common Brushtail Possum
Family: <i>PSEUDOCHEIRIDAE</i> <i>Pseudocheirus peregrinus</i>	Common Ringtail Possum
Family: <i>PERAMELIDAE</i> <i>Perameles nasuta</i>	Long-nosed Bandicoot
Family: <i>MACROPODIDAE</i> <i>Wallabia bicolor</i>	Swamp Wallaby
Family: <i>MURIDAE</i> <i>Rattus fuscipes</i> <i>Rattus lutreolus</i>	Bush Rat Swamp Rat
Family: <i>CANIDAE</i> <i>Canis familiaris</i> *	Dog
Family: <i>LEPORIDAE</i> <i>Oryctolagus cuniculus</i> *	Rabbit
Family: <i>PTEROPODIDAE</i> <i>Pteropus poliocephalus</i> (V)	Grey-headed Flying-fox
Family: <i>MOLOSSIDAE</i> <i>Tadarida australis</i>	White-striped Freetail-bat
Family: <i>VESPERTILIONIDAE</i> <i>Chalinolobus gouldii</i> <i>Miniopterus shreibersii oceanensis</i> (V)	Gould's Wattled Bat Eastern Bent-wing Bat

Amphibians

Family / Scientific Name	Common Name
Family: <i>MYOBATRACHIDAE</i> <i>Crinia signifera</i> <i>Limnodynates peronii</i>	Common Eastern Froglet Striped Grass Frog

Reptiles

Family / Scientific Name	Common Name
Family: AGAMIDAE <i>Physignathus leseurii</i>	Eastern Water Dragon
Family: SCINCIDAE <i>Ctenotus taeniolatus</i> <i>Egernia cunninghamia</i> <i>Eulepis platynota</i> <i>Lampropholis delicata</i> <i>Lampropholis guichenoti</i>	Copper-tailed Skink Cunningham's Skink Red-throated Skink Grass Skink Garden Skink
Family: BOIDAE <i>Morelia spilota</i>	Diamond Python
Family: ELAPIDAE <i>Demansia psammophis</i>	Yellow-faced Whip Snake

Avifauna

Family / Scientific Name	Common Name
Family: THRESKIORNITHIDAE <i>Threskiornis molucca</i>	Australian White Ibis
Family: CHARADRIIDAE <i>Vanellus miles</i>	Masked Lapwing
Family: COLUMBIDAE <i>Geopelia humeralis</i> <i>Streptopelia chinensis</i>	Bar-shouldered Dove Spotted Turtle-dove
Family: CACATUIDAE <i>Cacatua galerita</i> <i>Calyptrorhynchus funereus</i>	Sulphur-crested Cockatoo Yellow-tailed Black Cockatoo
Family: PSITTACIDAE <i>Trichoglossus haematodus</i> <i>Platycercus eximius</i>	Rainbow Lorikeet Eastern Rosella
Family: CENTROPODIDAE <i>Centropus phasianinus</i>	Pheasant Coucal
Family: CUCULIDAE <i>Cacomantis flabelliformis</i> <i>Chrysococcyx lucidus</i>	Fan-tailed Cuckoo Shining Bronze-cuckoo
Family: STRIGIDAE <i>Ninox boobook</i> <i>Ninox strenua</i> (V)	Southern Boobook Powerful Owl
Family: PODARGIDAE <i>Podargus strigoides</i>	Tawny Frogmouth
Family: MALURIDAE <i>Malurus lamberti</i>	Variegated Fairy-wren

Family / Scientific Name	Common Name
Family: <i>PARDALOTIDAE</i>	
<i>Sericornis frontalis</i>	White-browed Scrubwren
<i>Gerygone mouki</i>	Brown Warbler
<i>Acanthiza pusilla</i>	Brown Thornbill
<i>Pardalotus punctatus</i>	Spotted Pardalote
Family: <i>MELIPHAGIDAE</i>	
<i>Anthochaera carunculata</i>	Red Wattlebird
<i>Anthochaera lunulata</i>	Little Wattlebird
<i>Manorina melanocephala</i>	Noisy Miner
<i>Meliphaga lewinii</i>	Lewins Honeyeater
<i>Lichenostomus chrysops</i>	Yellow-faced Honeyeater
<i>Phylidonyris novaehollandiae</i>	New Holland Honeyeater
<i>Phylidonyris nigra</i>	White-cheeked Honeyeater
<i>Acanthorhynchus tenuirostris</i>	Eastern Spinebill
Family: <i>PYCNONOTIDAE</i>	
<i>Pycnonotus jocosus</i> *	Red-whiskered Bulbul
Family: <i>PETROICIDAE</i>	
<i>Eopsaltria australis</i>	Eastern Yellow Robin
Family: <i>PSOPHODIDAE</i>	
<i>Psophodes olivaceus</i>	Eastern Whipbird
Family: <i>MONARCHIDAE</i>	
<i>Rhipidura leucophrys</i>	Willie Wagtail
<i>Rhipidura fuliginosa</i>	Grey Fantail
<i>Grallina cyanoleuca</i>	Magpie-lark
Family: <i>CAMPEPHAGIDAE</i>	
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike
Family: <i>ARTAMIDAE</i>	
<i>Cracticus torquatus</i>	Grey Butcherbird
<i>Gymnorhina tibicen</i>	Australian Magpie
Family: <i>PASSERIDAE</i>	
<i>Neochmia temporalis</i>	Red-browed Firetail
Family: <i>ZOSTEROPIDAE</i>	
<i>Zosterops lateralis</i>	Silvereye
Family: <i>STURNIDAE</i>	
<i>Acridotheres tristis</i> *	Common Myna

Appendix 3. Field Survey Results

All birds and species opportunistically recorded are listed in **Appendix 2**.

Table A3-1. Trapping Results

Date (trap checked)	Trap number	Trap type*	Species	Sex	Notes
7/5/03	E3	Ag	Bush Rat	M	
	B5	Ag	Brown Antechinus	F	
	B6	Ag	Brown Antechinus	F	
	B11	Ag	Bush Rat	F	
	B8	C	Common Brushtail Possum	F	
	B8	C	Common Brushtail Possum	?	young
	B12	Ag	Bush Rat	M	
	B14	C	Common Brushtail Possum	M	
	C16	Ag	Brown Antechinus	F	
	C13	Ag	Bush Rat	F	
	C4	Ag	Bush Rat	F	
	A2	Ag	Bush Rat	F	
	A6	Ag	Brown Antechinus	F	
	A9	Bg	Bush Rat	M	
	A13	Bg	Bush Rat	F	
	A14	Ag	Brown Antechinus	F	
	A20	At	Brown Antechinus	M	
8/5/03	D1	Bg	Bush Rat		
	D2	Ag	Bush Rat		
	D12	Ag	Brown Antechinus	M	
	C6	Ag	Bush Rat		
	C9	Ag	Bush Rat		
	C11	Ag	Bush Rat		
	C15	Ag	Brown Antechinus	F	
	C16	Ag	Bush Rat		
	C14	C	Common Brushtail Possum		
	B5	Ag	Bush Rat		
	E3	Ag	Bush Rat		
	A4	At	Brown Antechinus		
	A6	Ag	Bush Rat		
	A7	Bg	Bush Rat		
	A9	Bg	Bush Rat		
	A11	Bg	Brown Antechinus		
	A14	Ag	Brown Antechinus	F	
	A17	Bg	Swamp Rat		
	A18	Ag	Swamp Rat	M	
	A20	At	Brown Antechinus		
	A19	Bg	Bush Rat		
	A1	Bg	Bush Rat	F	
	A2	Ag	Brown Antechinus	M	
	A3	Bg	Bush Rat		Unwell, died after a few hours

Table A3-1 continued

Date (trap checked)	Trap number	Trap type*	Species	Sex	Notes
9/5/03	D2	Ag	Bush Rat		
	D3	C	Long-nosed Bandicoot	F	
	D4	Bg	Brown Antechinus	F	
	D6	At	Brown Antechinus	M	
	D12	Ag	Bush Rat		
	D13	Bg	Bush Rat		
	D15	Ag	Bush Rat		
	C6	Ag	Bush Rat		
	C16	Ag	Brown Antechinus	F	
	B14	C	Common Brushtail Possum		
	B9	Ag	Bush Rat		
	B8	C	Common Brushtail Possum	F	
	B5	Ag	Bush Rat		
	B4	Bt	Brown Antechinus		
	E1	Ag	Bush Rat		
	E2	Ag	Bush Rat		
	E3	C	Long-nosed Bandicoot	M	
	E3	Ag	Brown Antechinus	F	Dead
	E4	Ag	Bush Rat		
	E5	C	Long-nosed Bandicoot	F	
	A2	Ag	Bush Rat		
	A5	Bg	Bush Rat		
	A6	Ag	Bush Rat		
	A9	Bg	Bush Rat		
	A11	Bg	Brown Antechinus	F	
	A14	Ag	Bush Rat		
	A17	Bg	Swamp Rat		
	A20	At	Brown Antechinus	M	
12/5/03	D4	Bg	Long-nosed Bandicoot	SA	
	D7	Bg	Bush Rat		
	D11	Ag	Brown Antechinus	M	
	C4	Ag	Bush Rat		
	C6	Ag	Brown Antechinus		
	C15	Ag	Bush Rat		
	B15	Ag	Bush Rat		
	B12	Ag	Bush Rat		
	B6	Ag	Bush Rat		
	B5	Ag	Bush Rat		
	E1	At	Bush Rat		
	E2	At	Brown Antechinus		
	E3	Ag	Swamp Rat		
	E4	C	Long-nosed Bandicoot	F	
	A4	At	Brown Antechinus	F	
	A3	Bg	Bush Rat		
	A5	Bg	Bush Rat	M	
	A10	Ag	Bush Rat		
	A12	At	Brown Antechinus		
	A13	Bg	Brown Antechinus	F	
	A18	Ag	Bush Rat		
	A20	At	Bush Rat	M	

Table A3-1 continued

Date (trap checked)	Trap number	Trap type*	Species	Sex	Notes
13/5/03	A4	At	Brown Antechinus		
	A12	At	Bush Rat		
	A2	Ag	Bush Rat		
	A20	At	Bush Rat	M	
	C1	C	Long-nosed Bandicoot	M	Sub adult
	C4	Ag	Bush Rat		
	D15	Ag	Brown Antechinus	M	
	E5	At	Brown Antechinus		
	E4	At	Brown Antechinus		
	E3	Ag	Bush Rat		
	E2	Ag	Bush Rat		
	C15	Ag	Cunningham Skink		
	B5	Ag	Brown Antechinus		
	B14	C	Bush Rat		
	D2	Ag	Bush Rat		
	B11	Ag	Bush Rat		
	B14	Ag	Bush Rat		

* A - A size Elliott; B- B size Elliot; C- cage trap; g - positioned on ground; t- position in a tree / bush

Table A3- 2. Anabat detector results.

Date	Recording number	Species recorded			
		Species	Number of passes		
			Definite	Probable	Possible
6/5/03	1	Gould's Wattled Bat <i>Chalinolobus gouldii</i>	1	1	
		Eastern Bent-wing Bat <i>Miniopterus schreibersii</i>		1	
7/5/03	2	Eastern Bent-wing Bat	1	1	1
		<i>Vespadelus sp.</i>			1
		Gould's Wattled Bat	1	1	1
		White-striped Freetail-bat <i>Tadarida australis</i>	1		
	3	Eastern Bent-wing Bat	1		
		Gould's Wattled Bat		1	
12/5/03	4	Interference throughout tape. No calls.			

Table A3-3. Spotlighting results

Date	Species		Number of individuals
	Common name	Scientific name	
17/4/03	Common Eastern Froglet	<i>Crinia signifera</i>	many
	Striped Grass Frog	<i>Limnodynastes peronii</i>	1
	Rabbit		1
	Bush Rat	<i>Rattus fuscipes</i>	1
6/5/03	Common Ringtail Possum	<i>Pseudocheirus peregrinus</i>	3
	Common Eastern Froglet	<i>Crinia signifera</i>	many
	Long-nosed Bandicoot	<i>Perameles nasuta</i>	1
	Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>	1
	White-striped Freetail Bat	<i>Tadarida australis</i>	1
22/5/03	Dog foot prints		
	Common Eastern Froglet	<i>Crinia signifera</i>	a few
	Southern Boobook	<i>Ninox novaeseelandiae</i>	1
	Common Ringtail Possum	<i>Pseudocheirus peregrinus</i>	3

Table A3-4. Nocturnal call playback results

Date	Species played	Species recorded during call playback
6/5/03	Squirrel Glider	
	Bush-stone Curlew	
	Powerful Owl	
	Barking Owl	
	Masked Owl	
	Sooty Owl	
22/5/03	Squirrel Glider	
	Bush-stone Curlew	
	Powerful Owl	Powerful Owl
	Barking Owl	
	Masked Owl	
	Sooty Owl	

Table A3-5. Hair tube results

Tube number	Species recorded	
	Definite	Probable
M100	Brush-tail Possum sp.	Common Brushtail Possum
M95	(one fine hair)	(rodent)
M91	Long-nosed Bandicoot	
M97	-	
M96	(one fine hair)	(rodent)
M92	Long-nosed Bandicoot	
S50	Antechinus sp.	Brown Antechinus
S41	Antechinus sp.	Brown Antechinus
S51	(one fine hair)	(rodent)
M101	Brush-tail Possum sp.	Common Brushtail Possum
M98	Brush-tail Possum sp.	Common Brushtail Possum
M102	Brush-tail Possum sp.	Common Brushtail Possum
M94	Long-nosed Bandicoot	
M93	Rattus sp. (2 hairs)	
M99	Brush-tail Possum sp.	Common Brushtail Possum
S57	Antechinus sp.	Brown Antechinus
S59	Antechinus sp.	Brown Antechinus
S60	Rattus sp.	Bush Rat
S56	Bush Rat	
S34	Bush Rat	
S31	Brown Antechinus	
S32	Rattus sp.	Bush Rat
M73	Long-nosed Bandicoot	
M71	Rattus sp.	Bush Rat
M105	-	
M103	Brush-tail Possum sp.	Common Brushtail Possum
M109	Brush-tail Possum sp.	Common Brushtail Possum
M108	Long-nosed Bandicoot	
S54	Brown Antechinus	
S53	Rattus sp.	Bush Rat
M106	(few rodent hairs)	Rattus sp.
M110	(few rodent hairs)	Rattus sp.
M107	Long-nosed Bandicoot	
S58	Rattus sp.	Bush Rat
S55	Antechinus sp.	Brown Antechinus
S48	Antechinus sp.; few rodent hairs	Brown Antechinus; Rattus sp.

Table A3-5 continued.

Tube number	Species recorded	
	Definite	Probable
S46	(few rodent hairs)	Rattus sp.
S44	(few rodent hairs)	Rattus sp.
S43	Rattus sp.	Bush Rat
S42	Bush Rat	
S45	Bush Rat	
S47	Bush Rat	

Table A3-6. Weather conditions during trapping survey

Date	Notes
17/4/03	Evening – 95% cloud; 0 wind; light-heavy continuous rain; full moon; 15-16°C
6/5/03	Clearing showers early morning Evening- 10-90% cloud; no wind; no rain; approx. 17 °C
7/5/03	Fine
8/5/03	Fine
9/5/03	Fine
10/5/03	Fine
11/5/03	Evening- light sprinkle of rain
12/5/03	Heavy rain overnight
22/5/03	Evening – 0 cloud; 0 –light wind; 0 moon; 0 rain; approx 18 °C down to 15 °C

Appendix 4. Project Personnel

REPORT COMPONENT	STUDY TEAM MEMBERS	QUALIFICATIONS
Overall Project Management	Mr. Brian Wilson	B. App. Sc (Env. Biol.), MAIBiol, MEIA, MECA
Flora Field Surveys, Flora Descriptions, Report Writing	Mr Stefan Rose	B.Sc (Biol. Sci), M.Env.Stud., MAIBiol, MECA
NPWS Atlas Search, Fauna Field Surveys, Fauna Descriptions, Report Writing	Mrs Amy Rowles (formerly Williams)	B.Sc. (Hons)
Fauna Field Surveys	Narawan Williams	
Analysis of Bat Detector Tapes, Report Writing	Mr. Ray Williams	Biol. Techn. Cert., MECA

DRUMMOND PARMENTER PTY.LTD.

APPENDIX C

**Bush Fire Threat Assessment
(Conacher Travers Consultants)**

CONACHER



TRIVERS

*environmental
consultants*

BUSHFIRE PROTECTION ASSESSMENT

FOR

**THE TWO (2) LOT SUBDIVISION OF
LOT 3 SECF (DP 11784) AND REZONING OF
PROPOSED LOT 1 INGLESIDE ROAD, INGLESIDE
TO PERMIT RESIDENTIAL DEVELOPMENT**

AND

**THE PROPOSED REZONING OF
LOTS 74, 79, 83, 84 & 85 SECB (DP 11784)
INGLESIDE ROAD, INGLESIDE
TO PERMIT RESIDENTIAL DEVELOPMENT ON EACH LOT**

**AUGUST 2004
(REF: 4341B)**

Conacher Travers Pty Ltd - ABN 49 083 610 173

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BUSHFIRE PROTECTION ASSESSMENT
FOR
THE TWO LOT SUBDIVISION OF
LOT 3 SECF (DP 11784) AND REZONING OF
PROPOSED LOT 1 INGLESIDE ROAD, INGLESIDE
TO PERMIT RESIDENTIAL DEVELOPMENT
AND
THE PROPOSED REZONING OF
LOTS 74, 79, 83, 84 & 85 SECB (DP 11784)
INGLESIDE ROAD, INGLESIDE
TO PERMIT RESIDENTIAL DEVELOPMENT ON EACH LOT

AUGUST 2004

Conacher Travers

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4341B	August 2004	Final	August 2004	NA	GLS

EXECUTIVE SUMMARY

A Bushfire Protection Assessment has been prepared by *Conacher Travers Pty Ltd* at the request of *Drummond Parmenter Pty Ltd* for the two lot subdivision of Lot 3 SECF (DP 11784) and rezoning of proposed Lot 1 Ingleside Road, Ingleside to permit residential development and the proposed rezoning of Lots 74, 79, 83, 84 & 85 SECB (DP 11784) Ingleside Road, Ingleside to permit residential development on each lot.

The proposal involves two avenues of residential development, firstly the proposed subdivision of Lot 3 SECF (DP 11784) resulting in the creation of two (2) lots. Lot 1 (4000m²) on which residential development is proposed and Lot 2 (26.6 ha) which is proposed to be zoned 7(a) Environmental Protection for transfer to Pittwater Council for community use (residual land).

The residential subdivision within the development is classified as integrated development within a Bushfire Prone Area and falls under Section 91(1) of the *Environmental Planning and Assessment Act*.

Under Section 100B of the *Rural Fires Act* the development application must therefore be submitted to the Commissioner of the Rural Fire Service for approval and issue of a 'Bushfire Safety Authority'.

The 'Bushfire Safety Authority' authorises development to the extent that it complies with matters considered by the Commissioner to be necessary to protect persons, property or the environment for the danger that may occur from a bushfire.

Secondly, a rezoning application for existing Lots 74, 79, 83, 84 & 85 SECB (DP 11784) to allow residential development is proposed. The proposal seeks to gain the inclusion of these lots within the existing Planning Scheme for the local area, under a schedule permitting with consent one residential dwelling per lot.

The provision of a 40 metre asset protection zone contained wholly within the rear of these allotments will provide adequate protection from the potential bushfire threat that exists within the vegetation of the proposed residual Lot 2, which adjoins the eastern boundary of the existing lots

The proposed development on existing Lots 74, 79, 83, 84 & 85 SECB (DP 11784) is not residential subdivision and therefore not integrated development as defined by Section 91(1) of the *Environmental Planning and Assessment Act*.

The future development of residential dwellings on these lots falls within the requirements of 79BA of the *Environmental Planning and Assessment Act* which requires a consent authority to consider if the development complies with the requirements of 'Planning for Bushfire Protection 2001'

This report provides an assessment of the bushfire protection requirements to both the future dwelling within the proposed subdivision of Lot 3 SECF (DP 11784) and the future dwellings within the existing Lots 74, 79, 83, 84 & 85 SECB (DP 11784), providing recommendations on the provision of Asset Protection Zones, access, water supplies and construction standards of the future dwellings within the subdivision.

Therefore, providing these recommendations are implemented and maintained, the proposed development provides compliance with the requirements of '*Planning for Bushfire Protection 2001*'.

Graham Swain
Manager - Fire Planning
CONACHER TRAVERS PTY LTD

Nathan Ahearn- B.Sc.
Fire Planner
CONACHER TRAVERS PTY LTD

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SECTION 1

INTRODUCTION

Conacher Travers Pty Ltd has been requested by *Drummond Parmenter Pty Ltd* to provide a Bushfire Protection Assessment to assess the bushfire protection requirements affecting the two lot subdivision of Lot 3 SECF (DP 11784) and rezoning of proposed Lot 1 Ingleside Road, Ingleside to permit residential development and the proposed rezoning of Lots 74, 79, 83, 84 & 85 SECB (DP 11784) Ingleside Road, Ingleside to permit residential development on each lot.

Schedule 1 provides an aerial view of the property and its surrounds.

1.1 AIMS OF THE ASSESSMENT

The aims of the bushfire protection assessment are to:

- Review the overall bushfire threats;
- Review the capability of the site to provide a safe development;
- Review the potential to carry out hazard management over the landscape;
- Provide advice on mitigation measures including the provision of Asset Protection Zones and Construction Standards;
- Review the evacuation capability of the area

1.2 PLANNING RELATIONSHIPS

This report has been prepared having regard to the following legislative and planning requirements.

1.2.1 Legislation

Environmental Planning and Assessment Act (EPA Act)

- Section 79 BA requires Councils to be satisfied that developments in bushfire prone areas (other than those dealt with under Section 100B of the RFA) comply with 'Planning for Bushfire Protection 2001' before granting development consent.
- Section 91(1) - defines residential subdivision and special protection development as integrated development which requires authorisation under Section 100B of the Rural Fires Act 1997.
- *Rural Fires Act 1997 (Amended)*
- Section 100B provides for the issue by the Commissioner of the NSW Rural Fire Service of bushfire safety authorities for subdivision of bushfire prone land that could lawfully be used for residential or rural residential purposes.
- Sections 63 (1) and 63 (2) require public authorities and owners/occupiers of land to take all practicable steps to prevent the occurrence of bushfires on, and to minimise the danger of the spread of bushfires.

1.2.2 Planning Policies

- Planning for Bushfire Protection - 2001 Rural Fire Service/Planning NSW - This document was prepared by the Rural Fire Service in collaboration with Planning NSW and provides guidance on the planning and development control processes in relation to bushfire protection measures for subdivision and residential developments in bushfire prone areas.

1.3 PROJECT SYNOPSIS

The proposal involves two avenues of residential development, firstly the proposed subdivision of Lot 3 SECF (DP 11784) resulting in the creation of two (2) lots. Lot 1 encompasses an area of 4000m² to which a future residential dwelling is proposed. Lot 2 will form the residual land in the east, encompassing 26.6 hectares (ha), which is proposed to be zoned 7(a) Environmental Protection for transfer to Pittwater Council for community use.

Secondly, a rezoning application for existing Lots 74, 79, 83, 84 & 85 SECB (DP 11784) is proposed, to permit residential development. The proposal seeks to gain the inclusion of these lots within the existing Planning Scheme for the local area, under a schedule permitting one residential dwelling per lot with consent.

All lots proposed for residential development have direct frontage to Ingleside Road, which will provide access to the development. The residual Lot 2, formed in the east, receives access to Ingleside Road via an access handle between proposed Lot 1 and the northern site boundary.

1.4 INFORMATION COLLATION

To achieve the aims of this report, a review of the information relevant to the property was undertaken prior to the initiation of field surveys. Information sources reviewed include the following:

- Subdivision Plans prepared by *Drummond Paramenter Pty Ltd* dated July 2004;
- Sydney Aerial Photo DLPI of NSW 1:25,000 Run 6. 16-03-02;
- Mona Vale Topographical Map DLPI of NSW 1:25,000 9130-1S;
- Australian Standard AS3959 '*Construction of Buildings in Bushfire Prone Areas*' (1999);
- '*Planning for Bushfire Protection 2001*' prepared by the NSW Rural Fire Service and Planning NSW.

Graham Swain of *Conacher Travers Pty Ltd* visited the site in February and July 2004.

An inspection of the proposed development site and surrounds was undertaken to assess the topography, slopes, aspect, drainage, vegetation and adjoining land use. The identification of existing bushfire protection advantages and a visual appraisal of bushfire hazard and risk were also undertaken. (Bushfire protection advantages are those landscape features which act to suppress or mitigate a fire eg. escarpments, creeks, road and fire breaks etc.)

1.5 SITE DESCRIPTION

Location and Surrounding Land Use

The development area is located to the east of Ingleside Road with Lot 3 SECB (DP 11784) adjoining residential development to the east along Orchard Street. Proposed Lot 1 and existing Lots 74, 79, 83-85 have frontage to Ingleside Road. The residual land contained within proposed Lot 2 is situated to the rear of these residential allotments and extends east to the site boundary, adjoining the existing residential development off Orchard Street. The property is within the Pittwater Local Government Area (LGA) with approximate MGA co-ordinates of 340500E and 6271000N.

The property is bounded to the north by the Westpac Training Centre and/or Ingleside Park; to the west by Ingleside Road and beyond to existing residential development; to the south by existing residential development and or the existing Uniting Church Conference Centre and lastly to the east by existing residential development.

Topography

The development area consists of the mid slopes of a ridge, situated to the west of the property. The land within the development site falls to the east at an average slope of 8-10%, into the Mullet Creek Valley. The land beyond the western boundary gently rises to a ridge at approximately 8%, while to the north the land levels out as it traverses ridge side. To the east of the proposed development area the land falls at various degrees between 6-10% before a sharp decline associated with a localised escarpment, while the land rises beyond the southern property boundary of the development at approximately 10%.

Vegetation

The vegetation within the development area predominately consists of Woodland with a dense Heath understorey (Group 2 vegetation), grading into Open Forest within the residual land (proposed Lot 2) to the east (Group 1 vegetation).

The proposed development area adjoins Ingleside Road and or existing residential development in the west, within which maintained gardens and lawns occur. Managed curtilage also adjoins the western portion of the northern boundary within the Westpac Training Centre, to which Open Forest adjoins, extending along the remaining portion of this northern boundary. To the south of the development area occurs managed curtilage associated with existing residential development.

At a broader scale, much of the area surrounding the property consists of existing residential development and or cleared land. Open Forest vegetation (Group 1 classification) occurs to the north of the property within Ingleside Park.

SECTION 2

BUSHFIRE PROTECTION ASSESSMENT

2.1 BUSHFIRE PROTECTION ASSESSMENT

'Planning for Bushfire Protection' (Rural Fire Service, 2001) provides concepts for Class 1, 2 & 3 buildings in bushfire prone areas and guidance on planning and development control processes in relation to bushfire protection measures and states that *'overall the intension of bushfire protection measures should be to prevent flame contact to a structure, reduce radiant heat to below the ignition thresholds for various elements of a building, to minimise the potential for embers to cause ignition and reduce the effects of smoke on residents and fire fighters'*.

The document provides a methodology for determining setback distances (Asset Protection Zones) and Bushfire Attack/Construction Standards required for habitable buildings in development for residential purposes that are designated as bushfire-prone.

The following section uses this methodology to determine asset protection zones and construction standards required for future dwellings within Lot 1 of the proposed subdivision and within the existing Lots 74, 79, 83-85.

2.2 BUSHFIRE PROTECTION ASSESSMENT METHODOLOGY

Section A2.3.1 of *'Planning for Bushfire Protection 2001'* provides a methodology for determining setback distances (Asset Protection Zones). Tables 1 to 4 provide a summary of this assessment.

TABLE 1 - Bushfire Protection Assessment

Proposed Lot 1 within the subdivision of Lot 3 SECF DP 11784

Aspect	Vegetation within 140m of Development	Predominant Vegetation Class (Fig A2.2 and Table A2.1)	Average Slope of Land	Recommended Width of Asset Protection Zone (Table A2.2 and 2.4)	Width of Asset Protection Zone Provided
North	Managed Curtilage (Westpac Training Centre)	No classification	Level	No requirement	No requirement
East	Open Forest (Residual Lot 2)	Group 1	9% (5°) downslope	40 metres	40 metres
South	Managed Curtilage (Residential Development)	No classification	Level	No requirement	No requirement
West	Ingleside Road, Managed Curtilage (Residential Development)	No classification	8% (4°) upslope	No requirement	No requirement

TABLE 2 - Bushfire Protection Assessment

Existing Lot 74

Aspect	Vegetation within 140m of Development	Predominant Vegetation Class (Fig A2.2 and Table A2.1)	Average Slope of Land	Recommended Width of Asset Protection Zone (Table A2.2 and 2.4)	Width of Asset Protection Zone Provided
North	Managed Curtilage (Residential Development)	No classification	Level	No requirement	No requirement
East	Open Forest (Residual Lot 2)	Group 1	6% (3°) downslope	40 metres	40 metres
South	Managed Curtilage (Residential Development)	No classification	Level	No requirement	No requirement
West	Ingleside Road, Managed Curtilage (Residential Development)	No classification	8% (4°) upslope	No requirement	No requirement

TABLE 3 - Bushfire Protection Assessment

Existing Lot 79

Aspect	Vegetation within 140m of Development	Predominant Vegetation Class (Fig A2.2 and Table A2.1)	Average Slope of Land	Recommended Width of Asset Protection Zone (Table A2.2 and 2.4)	Width of Asset Protection Zone Provided
North	Managed Curtilage (Residential Development)	No classification	Level	No requirement	No requirement
East	Open Forest (Residual Lot 2)	Group 1	10% (5°) downslope	40 metres	40 metres
South	Managed Curtilage (Residential Development)	No classification	Level	No requirement	No requirement
West	Ingleside Road, Managed Curtilage (Residential Development)	No classification	8% (4°) upslope	No requirement	No requirement

TABLE 4 - Bushfire Protection Assessment**Existing Lots 83-85**

Aspect	Vegetation within 140m of Development	Predominant Vegetation Class (Fig A2.2 and Table A2.1)	Average Slope of Land	Recommended Width of Asset Protection Zone (Table A2.2 and 2.4)	Width of Asset Protection Zone Provided
North (Lot 85)	Managed Curtilage (Residential Development)	No classification	Level	No requirement	No requirement
East (Lot 83-85)	Open Forest (Residual Lot 2)	Group 1	7% (4°) downslope	40 metres	40 metres
South (Lot 83)	Managed Curtilage (Residential Development)	No classification	Level	No requirement	No requirement
West (Lot 83-85)	Ingleside Road, Managed Curtilage (Residential Development)	No classification	8% (4°) upslope	No requirement	No requirement

2.3 BUSHFIRE ATTACK ASSESSMENT

Section A3.3 of 'Planning for Bushfire Protection 2001' provides a methodology for assessing bushfire attack at construction stage for a building within a designated bushfire prone area.

Tables 5-8 provide a summary of the Bushfire Attack and the resultant construction standards.

TABLE 5 – Bushfire Attack Assessment**Proposed Lot 1 within the subdivision of Lot 3 SECF DP11784**

Aspect	Vegetation within 140m of Development	Predominant Vegetation Class (Fig A2.2 and Table A2.1)	Average Slope of Land	Separation Distance (IPA)	Level of Bushfire Attack (Table A3.3)	Construction Standard Recommended
North	Managed Curtilage (Westpac Training Centre)	No classification	Level	No requirement	Low	None required (refer Note 1)
East	Open Forest (Residual Lot 2)	Group 1	9% (5°) downslope	40 metres	High	Level 2 (AS 3959)
South	Managed Curtilage (Residential Development)	No classification	Level	No requirement	Low	None required (refer Note 1)
West	Ingleside Road, Managed Curtilage (Residential Development)	No classification	8% (4°) downslope	No requirement	Low	None required (refer Note 1)

Note 1: Whilst the bushfire attack to the proposed dwelling has been assessed as Low to these aspects *Conacher Travers Pty Ltd* recommends, due to the potential ember attack from remote bushfires, that the northern, southern and western elevations of the future dwelling should be constructed to comply with Level 1 construction standards in accordance with Australian Standard AS3959-1999 (amended).

TABLE 6 – Bushfire Attack Assessment

Existing Lot 74

Aspect	Vegetation within 140m of Development	Predominant Vegetation Class (Fig A2.2 and Table A2.1)	Average Slope of Land	Separation Distance (IPA)	Level of Bushfire Attack (Table A3.3)	Construction Standard Recommended
North	Managed Curtilage (Residential Development)	No classification	Level	No requirement	Low	None required (refer Note 2)
East	Open Forest (Residual Lot 2)	Group 1	6% (3°) downslope	40 metres	High	Level 2 (AS 3959)
South	Managed Curtilage (Residential Development)	No classification	Level	No requirement	Low	None required (refer Note 2)
West	Ingleside Road, Managed Curtilage (Residential Development)	No classification	8% (4°) upslope	No requirement	Low	None required (refer Note 2)

Note 2: Whilst the bushfire attack to the proposed dwelling has been assessed as Low to these aspects *Conacher Travers Pty Ltd* recommends, due to the potential ember attack from remote bushfires, that the northern, southern and western elevations of the future dwelling should be constructed to comply with Level 1 construction standards in accordance with Australian Standards AS3959-1999 (amended).

TABLE 7 – Bushfire Attack Assessment

Existing Lot 79

Aspect	Vegetation within 140m of Development	Predominant Vegetation Class (Fig A2.2 and Table A2.1)	Average Slope of Land	Separation Distance (IPA)	Level of Bushfire Attack (Table A3.3)	Construction Standard Recommended
North	Managed Curtilage (Residential Development)	No classification	Level	No requirement	Low	None required (refer Note 3)
East	Open Forest (Residual Lot 2)	Group 1	10% (5°) downslope	40 metres	High	Level 2 (AS 3959)

TABLE 7 – Bushfire Attack Assessment (Cont.)

Existing Lot 79

Aspect	Vegetation within 140m of Development	Predominant Vegetation Class (Fig A2.2 and Table A2.1)	Average Slope of Land	Separation Distance (IPA)	Level of Bushfire Attack (Table A3.3)	Construction Standard Recommended
South	Managed Curtilage (Residential Development)	No classification	Level	No requirement	Low	None required (refer Note 3)
West	Ingleside Road, Managed Curtilage (Residential Development)	No classification	8% (4°) upslope	No requirement	Low	None required (refer Note 3)

Note 3: Whilst the bushfire attack to the proposed dwelling has been assessed as Low to these aspects *Conacher Travers Pty Ltd* recommends, due to the potential ember attack from remote bushfires, that the northern, southern and western elevations of the future dwelling should be constructed to comply with Level 1 construction standards in accordance with Australian Standards AS3959-1999 (amended).

TABLE 8 – Bushfire Attack Assessment

Existing Lots 83-85

Aspect	Vegetation within 140m of Development	Predominant Vegetation Class (Fig A2.2 and Table A2.1)	Average Slope of Land	Separation Distance (IPA)	Level of Bushfire Attack (Table A3.3)	Construction Standard Recommended
North	Managed Curtilage (Residential Development)	No classification	Level	No requirement	Low	None required (refer Note 4)
East	Open Forest (Residual Lot 2)	Group 1	7% (4°) downslope	40 metres	High	Level 2 (AS 3959)
South	Managed Curtilage (Residential Development)	No classification	Level	No requirement	Low	None required (refer Note 4)
West	Ingleside Road, Managed Curtilage (Residential Development)	No classification	8% (4°) upslope	No requirement	Low	None required (refer Note 4)

Note 4: Whilst the bushfire attack to the proposed dwelling has been assessed as Low to these aspects *Conacher Travers Pty Ltd* recommends, due to the potential ember attack from remote bushfires, that the northern, southern and western elevations of the future dwellings on these lots should be constructed to comply with Level 1 construction standards in accordance with Australian Standards AS3959-1999 (amended).

SECTION 3

ISSUES ARISING FROM THE PROTECTION ASSESSMENT IN RELATION TO THE PROPOSED DEVELOPMENT

3.1 BUSHFIRE PROTECTION MEASURES

'*Planning for Bushfire Protection 2001*' provides a methodology for determining the setback requirements (Asset Protection Zones) and construction standards for habitable buildings in developments for residential purposes that are located within a designated bushfire prone area.

Section 2.2 of this report uses this methodology and has identified that the location of the allotments to be developed (proposed Lot 1, existing Lots 74, 49, 83-85) in relation to the vegetation within the proposed residual Lot 2 requires an asset protection zone to be provided between the future dwellings and the eastern boundary of the lots.

The recommended separation distance is in accordance with the required separation distance as defined in Table A2.2 (Forests Group 1 vegetation) of '*Planning for Bushfire Protection 2001*'.

Therefore the asset protection requirements of the development satisfy Section 100B of the *Rural Fires Act* and 79BA of the *Environmental Planning and Assessment Act*.

3.2 BUILDING PROTECTION

The Bushfire Attack Assessment (Tables 5-8) has found that the eastern aspect to the future dwellings on proposed Lot 1 and existing Lots 74, 79, 83-85 has a High level of exposure to bushfire attack, requiring a Level 2 Construction Standard (AS3959) to be applied to this aspect.

The Bushfire Attack to the remaining aspects of the future dwelling on proposed Lot 1 and existing Lots 74, 79, 83-85 is deemed to be Low. However *Conacher Travers* recommends that the northern, southern and western aspects to the future dwelling on proposed Lot 1 and existing Lots 74, 79, 83-85 should be constructed to comply with Level 1 Construction Standards as defined by Australian Standard AS 3959 – 1999 (amended).

In addition to these construction standards, gutters and valleys should be fitted with a protection device, which prevents the build up of combustible material, or other debris within the gutters and valleys. These measures provide additional protection against potential bushfire threat.

3.3 LEGISLATIVE RESPONSIBILITY TO MANAGE HAZARDOUS FUELS

Section 63(2) of the *Rural Fires Act* requires that '*it is the duty of the owner or occupier (including Councils) of land to take the notified steps (if any) and any other practicable steps to prevent the occurrence of fires on, and to minimise the danger of the spread of fires on or from that land*'.

The future owners of proposed lots within the subdivision will have an ongoing liability to ensure the management of the lands within the property to prevent the build up of combustible fuel.

There is no physical reason that could constrain hazard management from being successfully carried out by normal means e.g. mowing / landscape management.

3.4 EVACUATION SAFETY

The need to consider evacuation of the development is based on the 1994-1996 Coroner's Inquiry into the 1994 bushfires in NSW. The Coroner recommended that in the assessment of a development for urban areas, due consideration should be given to access for fire fighters and egress for residents during bushfire events.

Access/egress to proposed Lot 1 and existing Lots 74, 79, 83-85 will be provided by private driveways directly off Ingleside Road in the west. These access/egress points are unlikely to be impacted directly by fire due to the proposed Asset Protection Zones provided within the lots, affording separation from the major bushfire threat within proposed residual Lot 2 in the east.

3.5 AVAILABILITY OF FIRE FIGHTING SERVICES

There is a Rural Fire Service Brigade located at Elanora Heights approximately 1 kilometre to the north west of the site (road distance). The Elanora Heights RFS Brigade would have a response time of approximately 5 minutes to service the development if they are not assisting elsewhere.

There is a NSW Fire Brigade located at Mona Vale approximately 3 kilometres to the north east of the site (road distance). The Mona vale NSW Fire Brigade would have a response time of approximately 5-10 minutes to service the development if they are not assisting elsewhere.

3.6 ACCESS FOR FIRE FIGHTING OPERATIONS

Access/egress within proposed Lot 1 and existing Lots 74, 79, 83-85 should adhere to the requirements of *'Planning for Bushfire Protection 2001'*. Also vehicular access should be provided to the rear of each lot, providing access for emergency vehicles between the future dwellings constructed and the major bushfire threat to the east.

A fire trail is to be constructed to the north of proposed Lot 1, providing access to the residue Lot 2. This fire trail shall be constructed to a width of 4 metres within a 6 metre wide x 6 metre high corridor clear of bushes/grasses and overhanging branches. The surface of the trail shall be constructed to carry a vehicle with a 14 tonne G.V.M. The trail should link with the existing fire trail and incorporate a turning head to the rear of Lot 1.

3.7 WATER SUPPLIES

Town reticulated water supply is available to the site therefore a supplementary form of water supply will not be required for fire fighting purposes.

SECTION 4

CONCLUSION AND RECOMMENDATIONS

4.1 CONCLUSION

In the assessment of bushfire prone lands the fundamental question is whether or not an area is safe for the occupation of people in residential dwellings. The proposed development is within a bushfire prone area therefore the requirements of *'Planning for Bushfire Protection 2001'* apply.

It is not expected that flame contact and or radiant heat would be a significant issue if Asset Protection Zones are applied to future dwellings within proposed Lot 1 and existing Lots 74, 79, 83-85, in accordance with the general principles of *'Planning for Bushfire Protection 2001'*. However, the potential for ember attack results in the need for Level 2 construction standards applied to the eastern elevation of future dwellings on proposed Lot 1 and existing Lots 74, 79, 83-85 and Level 1 construction standards applied to all remaining elevations of the future dwellings on proposed Lot 1 and existing Lots 74, 79, 83-85 in accordance with the Australian Standard AS3959 *'Construction of Buildings in Bush Fire Prone Areas'*.

Therefore, in accordance with the potential bushfire threat the following recommendations provide compliance with the requirements of *'Planning for Bushfire Protection 2001'*.

4.2 RECOMMENDATIONS

Recommendation 1 - Asset Protection Zones should be provided to the proposed development. They shall take the form of Inner Protection Areas, measured from the extremities of the buildings. The Asset Protection Zones shall be as nominated in Table 9 and also as depicted in Schedule 1.

Table 9 - Asset Protection Zones

Aspect	Inner Protection area (fuel free)	Outer protection area (fuel reduced)	Total asset protection zone
East (proposed Lot 1 and existing Lots 74, 79, 83-85)	40 metres	Nil	40 metres

Recommendation 2 - Fuel management within the Asset Protection Zones should be provided by regular maintenance of the landscaped areas/mowing of lawns in accordance with the guidelines provided in Appendix 1.

Recommendation 3 - Level 2 construction in accordance with Australian Standard AS3959 *'Construction of Buildings in Bush Fire Prone Areas'*, in accordance with Part 2.3.4 of the *'Building Code of Australia'* should be applied to the eastern aspect of the future dwellings within proposed Lot 1 and existing Lots 74, 79, 83-85.

Recommendation 4 - Level 1 construction in accordance with Australian Standard AS3959 *'Construction of Buildings in Bush Fire Prone Areas'*, in accordance with Part 2.3.4 of the *'Building Code of Australia'* should be applied to the northern, southern and western aspect of the future dwelling within proposed Lot 1 and existing Lots 74, 79, 83-85.

Recommendation 5 - Roof gutters and valleys to all proposed dwellings should be leaf proofed by the installation of an external gutter protection shroud or a gutter system that denies all leaves from entering the gutter and building up on that gutter. Any material used in such a system should have a flammability index of no greater than 5 (as measured against AS 1530.2).

Recommendation 6 - Access should be in accordance with '*Planning for Bushfire Protection 2001*'. Private access roads are required to be a minimum trafficable width of 4 metres with an additional 1 metre wide strip on each side of the road kept clear of long grass and bushes. Also a minimum vertical clearance of 6 metres to any overhanging obstructions, including tree branches should be provided.

The capacity of road surfaces should be sufficient to carry a fully laden Category 1 firefighting vehicle (14 tonne G.V.M.).

Recommendation 7 - A four (4) metre wide compacted gravel access road should be provided to the rear of each lot. A turning head should be provided, where required, adjacent to the future dwelling on each lot and to the termination of this access road. Turning heads are required to be 10 metres deep to each arm and a minimum radius of 6 metres on each curve.

Recommendation 8 - The fire trail on proposed Lot 2 should be constructed in compacted gravel to a 4 metre width and a carrying capacity of 14 tonnes G.V.M.

The access trail should be constructed within a 6m wide x 6m high corridor free of combustible vegetation and constructed to link with the existing fire trail with a turning head provided to the rear of proposed Lot 1.

Recommendation 9 - The landowners should be made aware of their liability to manage their development lands for the ongoing protection of themselves and their neighbours (refer Section 63(2) Rural Fires Act).

REFERENCES

1. NSW Rural Fire Service (2001) - *'Planning for Bushfire Protection - A Guide for Councils, Planners, Fire Authorities, Developers and Home Owners'*. NSW Rural Fire Service
2. Travers, J (1994) Hazard and Threat Assessment Training Module. JTA.
3. Walker, J. (1984) Fuel Dynamics in Australian Vegetation. In *'Fire and the Australian Biota'* Australian Academy of Science.
4. Australian Building Codes Board (1996) – Building Code of Australia, Class 1 and Class 10 Buildings Housing Provisions Volume 2.
5. Councils of Standards Australia AS3959 (1999) – Australian Standard *'Construction of buildings in bushfire-prone areas'*.
6. Councils of Standards Australia AS1530.2 (1993) – *'Methods of Fire Test on Building Materials'*.
7. Warringah/Pittwater Bushfire Management Committee – Bush Fire Risk Management Plan 2001.

SCHEDULE 1

PLAN OF BUSHFIRE PROTECTION MEASURES

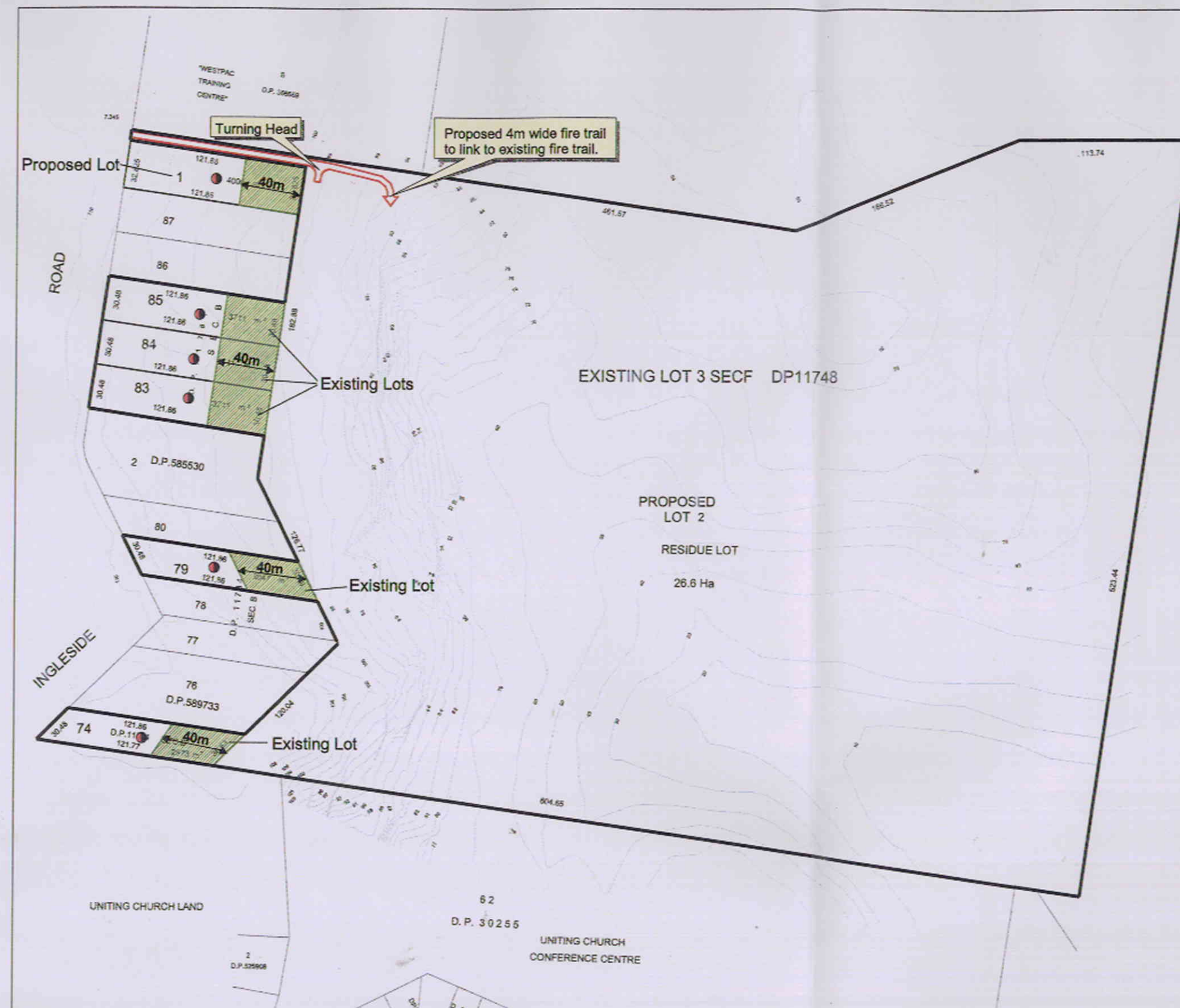


*Property boundary subject to final survey
Source: DLWC 1:25 000 Aerial Photograph
Sydney NSW4727 (M2302) Run 5,
Frame 0170, 18-03-02; CT ref: PIT3



Legend

- *Property Boundary
- Asset Protection Zone (APZ)
- Emergency Access (4m wide)
- Level 2 Construction (eastern aspect)
- Level 1 Construction (northern, southern & western aspects) as per AS 3959 - 1999 (amended)

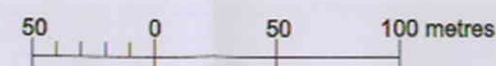


*Property boundary subject to final survey



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Scale 1:3 000

Original plan produced in A3 colour

Drawing No.	4341/S1	Date
Drawn By	KS	23/08/04
Amendment		Date
A		
B		
C		

Schedule 1 - Bushfire Protection Measures

to proposed subdivision of Lot 3 SECF DP11784
and plan of rezoning of Lots 74, 79, 83-85 SECB
DP11784 and Lot 3 SECF DP11784, Ingleside Road, Ingleside

Source: CAD by Drummond Parmenter Pty. Ltd., 2004 ref: 8563B.

APPENDIX 1

DETAILS OF ASSET (FIRE) PROTECTION ZONES

APPENDIX 1 – DETAILS OF ASSET (FIRE) PROTECTION ZONES

1.0 INTRODUCTION

The major mitigating factor that limits the effects of wildfire is the amount of fuel available to burn. By reducing the amount of fuel there will be a reduction in the intensity of the fire.

The area in which the fuel reduction occurs is referred to as an Asset Protection Zone. Asset Protection Zones are areas that are usually shown on 'plans' adjacent to either cultural or natural assets (eg. dwelling, rainforest). They act to significantly lessen the impact of intense fire. The Asset Protection Zone can be further identified by two sub-zones.

Each has a specific role to play within an asset protection zone. These sub-zone areas are called the Inner Protection Area (Fuel Free Zone) and the Outer Protection Area (Fuel Reduced Zone). The sub-zones characterise the physical appearance of the landscape and in particular the way the combustible fuels shall appear after they are modified. (See Photos 1 - 6).

The Inner Protection Area is always located immediately adjacent to the asset/value at risk. The Outer Protection Area is located between the Inner Protection Area and the bushland.

When considering bush fire fuel it is important to understand that it occurs in our native bushland in three vertical layers – see Table 1.

Table 1 – Fuel Layers

Fuel Layer Name	Location of Layer in vertical Column	Type of Fuel
Ground Fuels	Below ground level	Peatmoss (always below the surface)
Surface Fuels	0-200 mm	Litter layer (leaves & twigs)
Aerial Fuels	200 – 3000 mm	Shrubs and grasses
Canopy Fuels	> 3000 mm	Tree canopy

2.0 INNER PROTECTION AREA (I.P.A)

This area is *almost free* of all fuels, it usually takes the form of grassy areas, car parks, roads, concrete areas, track or trails. It does not imply the wholesale removal of all or every tree - see Table 2 for guidelines on the extent of trees that can occur within this zone.

Rationale: By its very nature this zone is intended to stop the transmission of flame and reduce the transmission of radiated heat by the elimination of available fuel. Thus its Inner Protection Area name. This area also allows airborne embers to fall safely thus stopping further outbreaks of fire to begin.

Fire Fighting Advantage: This zone allows safe fire fighting operations to occur and clear fire control lines to be implemented by fire fighters.

Measurability: A fuel free Inner Protection Area is measured in two ways. The weight of the fuel and the width of the zone. Practitioners measure fuel load in *tonnes per hectare*. It is assessed by measuring the weight of fuel in a small quadrat eg. 300mm by 300mm and equating that to a hectare. The width of the zone is the separating distance between an asset and the bushland.

Performance Standard: A safe load is between 0-3 t/Ha.

Photographic Montage Depicting Inner Protection Area

PHOTO - 1



Site Description: The site is a paved roadway. It separates two areas of bushland and is normally called in this instance a fire break.

Fire Behaviour: No fire could occur on this fire break but the narrow nature of the break would allow fire to pass between the two bushland areas without difficulty.

Maintenance: None required due to paved surface. Do not allow shrubs to grow.

Fuel Weight: Zero

PHOTO - 2



Site Description: The site is mineral earth. There is no fuel on this narrow strip. The narrow strip forms a narrow fire break between two areas of unmanaged bushland.

Fire Behaviour: No fire could occur on this mineral earth but the narrow nature of the fire break would allow fire to pass between the two bushland areas without difficulty.

Maintenance: Regular raking and removal of litter layer. Do not allow shrubs to grow.

Fuel Weight: Zero

PHOTO - 3



Site Description: This is a grassed fire trail on level land adjacent to unmanaged bushland. The grass height on the level lands is 20-50 mm.

Fire Behaviour: This area, if mowed regularly, would exhibit flame heights not above 300 mm (12 inches). Note: The grass in the bushland zone is approx' 400-500mm in height and would achieve flame heights approximate to 750 -1200mm (depending on fuel loadings and Fire Danger Index).

Maintenance: This fuel free zone is able to be managed by normal mowing means. Raking and removal of litter layer; and/or mowing of grasses; and raking and/or mowing. Fuel Weight in photo 4: < 2 T/Ha.

Fuel Weight: < 2 T/Ha.

PHOTO - 4



Site Description: This is a grassed Inner Protection Area with scattered trees, no shrub larger and minimal understorey. The grass height is maintained to provide < 3 tonnes per hectare.

Fire Behaviour: This area, if maintained regularly, would exhibit flame height not above 300mm.

Maintenance: This Inner Protection Area is managed by mowing, raking and removal of the litter layer.

Fuel Weight: < 3 tonnes/hectare.

Photographic Montage Depicting Inner Protection Area

PHOTO - 5



Site Description: The site is a grassed Inner Protection Area with large smooth barked tree 5 metres clear of the dwelling. The grass height is maintained to provide < 3 tonnes per hectare.

Fire Behaviour: This area, if maintained regularly, would exhibit flame height not above 300mm.

Maintenance: This Inner Protection Area is managed by mowing, raking and removal of the litter layer.

Fuel Weight: < 3 tonnes/hectare

PHOTO - 6



Site Description: This site shows a grassed Inner Protection Area with rock and landscaped areas constituting approximately 15% of the Inner Protection Area. Tree more than 5 metres from dwelling with no canopy connection to adjoining trees.

Fire Behaviour: This area, if maintained regularly, would exhibit flame height not above 300mm.

Maintenance: This Inner Protection Area is managed by mowing, raking and removal of the litter layer.

Fuel Weight: < 3 tonnes/hectare to grass areas landscaped areas 3-4 tonnes/hectare.

PHOTO - 7



Site Description: This site shows an Inner Protection Area which includes a paved Access/Fire Trail. Smooth barked trees < 5 metres from fire aspect of dwelling.

Fire Behaviour: Fires impacting the bushland to the left of the Access/Fire Trail would loose intensity with the provision of the Inner Protection Area.

Maintenance: This Inner Protection Area is managed by mowing, raking and removal of the litter layer.

Fuel Weight: Nil to Access/Fire Trail. 3 tonnes/hectare to grassed area.

PRESENCE OF SHRUBS IN AN INNER PROTECTION AREA

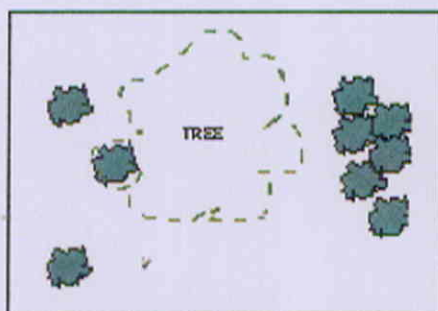
Shrubs may occur within an Inner Protection Area, but only where it is recommended by an experienced bush fire protection manager.

Thus landscaping works within the Inner Protection Area may occur in some instances. Where it is approved to occur, some 10-15 % and in some cases up to 30% of the Inner Protection Area may be able to be landscaped but always away from glass in buildings.

The design of the Inner Protection Area will be dependent on species selection and spatial arrangement.

Note: eg. 10 % means that for every 100 square metres (eg. 10 metres x 10 metres) only 10 % of that area may have a shrub component. The remainder would be free of shrubs see Figure 1. A 10 % landscaped shrub layer would add a further 1.5 tonnes of fuel to the overall hazard weight. To maintain the aggregate below 3 t/ha the ground fuels must be mown grass, or similar.

Figure 1 – Example of Spatial Arrangement in a Inner Protection Area



If a shrub layer is present the following table shows the additional fuel weights that should be added to the calculated surface fuels.

Shrub cover	Fuel Weight
10-30 %	2.5 tonnes / ha
35-50 %	5.0 tonnes / ha
55-75%	7.5 tonnes / ha

PRESENCE OF TREES WITHIN AN INNER PROTECTION AREA

A tree may occur within an Inner Protection Area if the canopy does not form a link with shrubs. The reason is to lessen any chance for 'vegetation linking' and the capability for fire to extend into the canopy.

It is a basic premise in fire behaviour understanding that fire cannot occur in the canopy unless surface fuels such as grasses or shrubs are burning. This merging creates opportunity for fire to link with the canopy and therefore increase fire intensity by some significant amount.

Trees that have a canopy beginning near the ground (such as Forest Oaks *Allocasuarina*) form a continuous link with the tree canopy and shrubs. A forest canopy cannot therefore burn without fuel to feed that fire. In a 'tall open forest' where the trees are generally above 20 metres in height the canopy is separated from the land surface by some distance. In an 'open woodland' the low canopy height (usually < 5 metres) merges with the shrubland layer.

Knowing the relationship between the shrub layer and the tree canopy allows fire managers to design safer areas in the asset protection zones. It is for this reason that vegetation such as Forest Oaks are usually excluded from an Inner Protection Area.

Similarly in 'open forests' the height of the forest is sufficiently removed from the shrub layer. As a general rule trees are allowed within an Inner Protection Area where the density of those trees is commensurate with Table 2 below and located on slopes up to 20% with a Westerly aspect.

In respect of trees that can be located in a Inner Protection Area Table 2 provides guidelines.

Table 2 – Tree Density in Inner Protection Area

Distance from dwelling wall	Trees permitted on the exposed side of a dwelling	Trees permitted on the non exposed side of a dwelling
within 5 metres	No trees	No trees
between 5-10 metres	One tree per 100 m ²	2 trees per 100 m ²
Between 10-20 metres	<10 tree per 400 m ² .	<10 trees per 400 m ²

There are variations to Table 2.

- Trees vary in height and tree crown width /depth. Some trees have canopies that extend close to the ground (eg < 5 metres from the ground) whilst other trees have canopies that area high off the ground (> 15 metres off the ground). In some cases these tall trees do not have canopies that are affected by undergrowth / tall shrubs that could cause fire to burn into the canopy. Therefore if trees are isolated they do not form a significant risk.
- Similarly smooth barked trees are less of a hazard than heavily barked trees. The latter can cause fire to run up into the canopy and if there is sufficient wind the resulting fire can be of high intensity.
- Similar to the above, the number of trees per 100 m² depends on an individual assessment being undertaken to determine the 'type / size of tree', and its resultant potential impact upon a dwelling.
- The exposed side of a dwelling is the side that is directly affected by a moving fire particularly when fanned by wind. The non-exposed side of a dwelling is the side where fire is unlikely to come from either from a lack of wind, slope or other factors such as a lack of hazardous fuel.

3.0 OUTER PROTECTION AREA (O.P.A)

Rationale: This zone is designed to stop the development of 'intense' fires and the transmission of 'severe' radiated heat.

Physical Appearance: This area assumes all trees will remain but with a modified shrub / grass and litter layer. In some sparse vegetation communities the shrub layer may not require modification.

Fire Fighting Advantage: Reduced fire intensity. It achieves this by denying fire a significant proportion of the fuel to feed upon. Fuels containing small (or fine) leaves such as *Forest Oaks* (or similar) are targeted for removal due to the capacity to burn quickly and therefore feed fire up into adjacent trees.

Measurability: Practitioners measure fuel load in *tonnes per hectare*. It is assessed by way of measuring the load in a given small quadrat eg. 300mm by 300mm and equating that to a hectare.

Performance Standard: A safe load is between 4-6 T/Ha.

Note: An experienced / qualified bush fire protection practitioner should undertake an individual assessment of a site to determine the requirements within an Asset Protection Zone.

Photographic Montage Depicting Outer Protection Area

PHOTO - 1



Site Description: This area has a low tree and shrub density but a high presence of native grasses. Almost no litter layer present.

Fire Behaviour: The lack of shrubs means that fire behaviour will be less but the presence of the sloping lands and the heavy presence of grass means that fire can burn quickly up the slope with flame heights between 1200-1800mm.

Maintenance: Maintain the grass height. Shrubs can grow to what is pictured in Photo 1.

Fuel Weight: 2-3 T/Ha

PHOTO - 2



Site Description: This area has increased shrub density and the beginnings of those shrubs linking with the tree canopy. Litter layer is present, but less than 3 T/Ha. The shrub layer is approx' 3 T/Ha.

Fire Behaviour: The increase in shrubs means that fire behaviour will be high. Flame heights would be expected to be between 2000mm - 6000mm (depending on fuel loadings and Fire Danger Index).

Maintenance: Maintain the grass height and current density of shrubs.

Fuel Weight: 6 T/Ha.

PHOTO - 3



Site Description: This area has a low tree and shrub density but a high presence of native grasses.

Fire Behaviour: The heavy presence of native grass means that fire can burn quickly through the outer protection area with flame heights of between 1200-3m.

Maintenance: Remove and maintain grass layer/leaf litter by slashing/hand removal.

Fuel Weight: 6-8 tonnes/hectare

PHOTO - 4



Site Description: Outer Protection Area above dwelling showing large rock outcrops, low shrub and tree density.

Fire Behaviour: Fires impacting this area would burn down slope to the dwelling. Flame heights in the order of 1-2 metres.

Maintenance: Management of this area by slashing/hand removal/burning to maintain fuel loading to < 8 tonnes/hectare.

Fuel Weight: < 6 tonnes/hectare
Nil on rock ledges.

APPENDIX 2

**SUMMARY OF AUSTRALIAN STANDARD
AS3959 (1999 – AMENDED)**

**CONSTRUCTION OF BUILDINGS
IN BUSHFIRE PRONE AREAS**

AUSTRALIAN STANDARD AS3959 (1999 – AMENDED)

CONSTRUCTION OF BUILDINGS IN BUSHFIRE-PRONE AREAS

Levels of Construction:

Three levels of construction are given which correspond to the category of bushfire attack determined for the site of the building:

Level 1 Construction – For the category of **medium** bushfire attack.

Level 2 Construction – For the category of **high** bushfire attack.

Level 3 Construction – For the category of **extreme** bushfire attack.

ITEM	LEVEL 1	LEVEL 2	LEVEL 3
FLOORING SYSTEMS	The requirements for a floor in a Level 1 construction shall be one, or a combination, of the following: (a) A concrete slab-on-the-ground. (b) A suspended floor, which may be one, or a combination of the following, supported by posts, columns, stumps, piers, or poles complying with Clause 3.4 or walls complying with Clause 3.5: (i) A concrete floor. (ii) A framed floor where the underside of any one bearer at any point is greater than 600mm above the finished ground level. (c) A suspended timber floor, framed with timber or metal, where the underside of any one bearer, at any point, is not greater than 600mm above the finished ground level and which has – (i) The subfloor space unenclosed and any timber flooring, bearers and joists of fire-retardant-treated timber; or (ii) The subfloor space fully enclosed, either by a wall that complies with Clause 3.5.1(a), or by the use of non-combustible sheet material which extends for at least 400mm above the finished ground level. Where non-combustible fibre-reinforced cement sheets are used to enclose the subfloor space, the material shall have a minimum thickness of 6mm and all material shall meet the bottom of the cladding material to ensure there are no gaps on the exterior face of the building.	The requirements for a floor in a Level 2 construction shall be as for Level 1 construction (see Clause 3.3.1) NOTE: The protection of subfloor openings against the entry of burning debris by way of introducing non-combustible material, such as fibre-reinforced cement sheeting to effectively enclose the subfloor space, may conflict with the requirements for termite protection and should therefore, take into consideration of the provisions of AS 3660.1.	The requirements for a floor in a Level 3 construction shall be as for Level 2 construction (see Clause 3.3.2) Except that in the case of a framed floor, where any bearer or joist is greater than 600mm above finished ground level and the floor is not enclosed as described in Clause 3.3.1 (c)(ii), the bearer, joists and flooring shall be of fire-retardant-treated timber or sheeted underneath with non-combustible material.

ITEM	LEVEL 1	LEVEL 2	LEVEL 3
SUPPORTING POSTS, COLUMNS, STUMPS, PIERS AND POLES	The requirements for supporting posts, columns, stumps, piers and poles in a Level 1 construction shall be one, or a combination, of the following: (a) Non-combustible. (b) Fire-retardant-treated timber for a minimum of 400 mm above the finished ground level. (c) Timber mounted on galvanized metal shoes with a clearance of not less than 75 mm above the adjacent finished ground level or paving level (see Figure 3.2). The above do not apply where the subfloor space is totally enclosed as described in Clause 3.3.1(c) (ii).	The requirements for supporting posts, columns, stumps, piers and poles in a Level 2 construction shall be as for Level 1 construction (see Clause 3.4.1)	Except in enclosed subfloor spaces, the requirements for supporting posts, columns, stumps, piers and poles in a Level 3 construction shall be as for Level 2 construction (see Clause 3.4.2) except that all timber shall be fire-retardant-treated to full height.

ITEM	LEVEL 1	LEVEL 2	LEVEL 3
EXTERNAL WALLS	The requirements for external walls in a Level 1 construction shall be as follows: (a) External walls shall be one, or a combination, of the following: i) A wall having an external leaf of masonry, concrete, pise, rammed earth or stabilized earth. ii) A framed wall that incorporates either – A) breather-type sarking complying with AS.NZS 4200.1 and with a flammability index of not more than 5 (see AS 1530.2) installed immediately behind the external cladding; or B) an insulation material conforming to the appropriate Australian Standard for that material. NOTE: No restrictions apply to the cladding material. (iii) A wall of timber logs that have the butting faces of adjacent logs, gauge-planed, and the space between the logs sealed in a manner that prevents the entry of burning debris and which allows for building movement. (b) Where the external leaf or cladding is of a combustible sheet material and is less than 400 mm above finished ground level, the cladding shall be protected for not less than 400 mm above the adjacent finished ground level (see Figure 3.3) (i) by covering it with a suitable non-combustible material, or fire-retardant-treated timber suitably sealed to the existing cladding so as to prevent the entry of burning debris (see Figures 3.3 (a) and 3.3(b)); (ii) by substituting with a suitable non-combustible sheet material, or fire-retardant-treated timber (see Figure 3.3 (c)); or (iii) where the external cladding is timber, by using fire-retardant-treated timber.	The requirements for walls in a Level 2 construction shall be as for Level 1 construction (see Clause 3.5.1), except that PVC cladding is not permitted and all external timber wall cladding shall be of fire-retardant-treated timber.	The requirements for external walls in a Level 3 construction shall be as for Level 2 construction (see Clause 3.5.2).

ITEM	LEVEL 1	LEVEL 2	LEVEL 3
WINDOWS	All operable windows, including louvres, in a Level 1 construction shall be screened with corrosion-resistant steel, bronze or aluminium mesh with a maximum aperture size of 1.8 mm in such a way that the entire opening remains screened when the window is open.	The requirements for all windows, including louvres, in a Level 2 construction shall be as for Level 1 construction (see Clause 3.6.1) except that aluminium mesh shall not be used. In addition to the above, the following applies: (a) Where timber is used, it shall be fire-retardant-treated timber except where protected by non-combustible shutters. (b) Where leadlight windows are used, they shall be protected by shutters constructed of a non-combustible material or of toughened glass.	The requirement for windows in a Level 2 construction shall be as for Level 1 construction (see Clause 3.6.2) except that where the windows are not protected by non-combustible shutters, they shall be glazed with toughened glass.

ITEM	LEVEL 1	LEVEL 2	LEVEL 3
EXTERNAL DOORS	External doors in a level 1 construction are to be fitted with – (a) weather strips or draught excluders to prevent the penetration or build-up of burning debris beneath the door; and (b) tight fitting door screens fitted with corrosion-resistant steel, bronze or aluminium mesh with a maximum aperture size of 1.8 mm.	The requirements for external doors in a Level 2 construction shall be as for Level 1 construction except that aluminium shall not be used for the mesh (see Clause 3.7.1). If leadlight glazing panels are incorporated in the doors, they shall be protected by shutters constructed of a non-combustible material or of toughened glass.	The requirements for external doors in a Level 3 construction shall be as for Level 2 construction (see Clause 3.7.2) except that – (a) timber doors shall be fire-retardant-treated or shall have a non-combustible covering on the exterior surface; or (b) doors shall be protected by shutters of non-combustible material; or (c) doors shall be solid-core having a thickness not less than 35 mm.
VENTS AND WEEPHOLES	Vents and weepholes in a Level 1 construction shall be protected with spark guards made from corrosion-resistant-steel, bronze or aluminium mesh with a maximum aperture size of 1.8 mm (see Figure 3.4).	The requirements for Level 2 construction vents and weepholes shall be as for Level 1 construction (see Clause 3.8.1), except that aluminium mesh shall not be used.	The requirements for vents and weepholes in a Level 3 construction shall be as for Level 2 construction (see Clause 3.8.2)

ITEM	LEVEL 1	LEVEL 2	LEVEL 3
ROOFS	The following general requirements shall apply to all types of roofing systems in a Level 1 construction: (a) Timber shakes or shingles shall not be used for the roof covering. (b) The roof/wall junction shall be sealed either by the use of fascias and eaves linings, or by sealing the gaps between the rafters with a suitable non-combustible material. (c) Sarking shall have a flammability index of not more than 5 (see AS1530.2). Tiled roofs Tiled roofs shall be fully sarked (see Clause 3.9.1.1(c)). The sarking shall be located directly below the tiling battens and shall cover the entire roof area including the ridge Sheeted roofs The requirements for sheeted roofs in a Level 1 construction are as follows: (a) Only metal or fibre-cement sheet shall be used. (b) All gaps under the corrugations or ribs of the roofing material where it meets the fascia or wall line shall be sealed or protected- (i) by fully sarking the roof; or (ii) by providing corrosion-resistant steel or bronze mesh, with a maximum aperture size of 1.8 mm, profiled metal sheet, neoprene seal, compressed mineral wool or similar material.	The requirements for a roof in a Level 2 construction shall be as for Level 1 construction (see Clause 3.9.1), except that all roof sheeting shall be non-combustible and sarked, and rooflight glazing shall be of wired glass. Thermoplastic material or toughened glass shall not be used as the glazing for rooflights. The case of the evaporative cooler shall be manufactured from a non-combustible material.	The requirements for roof covering in a Level 3 construction shall be as for Level 2 construction (see Clause 3.9.2) except that no fibre-reinforced cement or aluminium sheet shall be used.

ITEM	LEVEL 1	LEVEL 2	LEVEL 3
ROOFS (Cont.)	NOTES: 1) The method of protection in Item (b)(ii) can only be achieved on a roof without valleys and having the deck fixed directly to, but not structurally supported by, the fascia. 2) It is generally recognized that where compressed mineral wool is used for sealing against bushfire attack or for other purposes, adequate ventilation should be provided to stop condensation on the mineral fibre causing corrosion in the roof sheeting or supporting structure. (c) Rib caps and ridge capping shall be sealed in accordance with Clause 3.9.1.3 (b) (see Figure 3.5(a)), or preformed rib caps or ridge capping shall be used (see Figures 3.5(b) and (c)). Rooflights The requirements for rooflights in a Level 1 construction are as follows: (a) All penetrations of the roof space for the installation of rooflights and associated shafts shall be sealed with a non-combustible sleeve or lining. Thermoplastic sheet in a metal frame may be used for a rooflight, but the diffuser installed at ceiling level shall be of wired or toughened glass in a metal frame NOTE: AS 1288 and AS 4285 sets out specific requirements for glazing and skylights. (b) Vented rooflights shall be provided with corrosion-resistant steel or bronze mesh having a maximum aperture size of 1.8 mm.		

ITEM	LEVEL 1	LEVEL 2	LEVEL 3
ROOFS (Cont.)	Roof ventilators All components of roof ventilators, including the rotary type, in a Level 1 construction shall be constructed of non-combustible material and shall be sealed against the entry of sparks and embers with corrosion-resistant steel or bronze mesh having a maximum aperture size of 1.8 mm. Roof-mounted evaporative cooling units Roof-mounted evaporative cooling units shall only be used if the openings to the cooling unit are encased in corrosion-resistant steel or bronze mesh with a maximum aperture size of 1.8 mm.		
EAVES	All eaves in a Level 1 construction shall be enclosed, and the fascia or the gaps between the rafters shall be sealed (see Clause 3.9.1.1)	The requirements for eaves in a Level 2 construction shall be as for Level 1 construction (see Clause 3.10.1), except that all timber eaves lining and joining strips shall be of fire-retardant-treated timber.	The requirements for eaves in a Level 3 construction shall be as for Level 2 construction (see Clause 3.10.2) except that aluminium shall not be used.
FASCIAS	There are no requirements for fascias in a Level 1 construction.	All materials used for fascias in a Level 2 construction shall be either non-combustible or of fire-retardant-treated timber.	The requirements for fascias in a Level 3 construction shall be as for Level 2 construction (see Clause 3.11.2) except that no fibre-reinforced cement or aluminium sheet shall be used.

ITEM	LEVEL 1	LEVEL 2	LEVEL 3
GUTTERS AND DOWNPIPES	Any materials or devices used to stop leaves collecting in the gutters of a Level 1 construction shall have a flammability index of not greater than 5 when tested in accordance with AS 1530.2.	The requirements for gutters and downpipes in a Level 2 construction shall be as for Level 1 construction (see Clause 3.14.1).	The requirements for gutters and downpipes in a Level 3 construction shall be as for Level 2 construction (see Clause 3.12.2).
VERANDAS AND DECKS	Verandas, decks, and the like, forming part of a building required to be Level 1 construction shall comply with one, or a combination, of the following: (a) <i>Slab</i> - A reinforced concrete suspended slab floor, supported by posts or columns complying with Clause 3.4 or walls complying with Clause 3.5, or a slab-on-the-ground floor complying with Clause 3.3. (b) <i>Sheeted or tongued and grooved solid flooring</i> - The requirements for flooring are as follows: (i) Compliance with the flooring requirements shall be in accordance with Clause 3.3 (ii) Where the clearance between the finished ground level and the underside of the floor is not greater than 400 mm above finished ground level, all joints in the flooring shall be covered (above the floor level) or shall be sealed. (c) <i>Spaced decking</i> - The requirements for spaced decking are as follows: (i) The decking timbers shall be fixed with a clearance of not less than 5 mm between adjacent timbers.	The requirements for verandas and decks in a Level 2 construction shall be as for Level 1 construction (see Clause 3.11.1) except that if spaced decking is used, fire-retardant-treated timber shall be used for the decking material.	The requirements for verandas and decks in a Level 3 construction shall be as for Level 2 construction (see Clause 3.13.2) except that all materials shall be non-combustible or where timber is used, it shall be fire-retardant-treated (including any balustrades).

ITEM	LEVEL 1	LEVEL 2	LEVEL 3
VERANDAS AND DECKS (Cont.)	(ii) The external perimeter beneath the decking shall not be enclosed nor shall access to the space beneath the decking be impeded. NOTE: This requirement is designed to ensure that access to extinguish fires and remove burning material is maintained. Any supports for the decking shall be treated as set out in Clause 3.4. (iii) (iv) Decking timbers shall not be allowed to connect with the remainder of the building unless measures are used to prevent the spread of fire into the building.		
SERVICE PIPES (WATER AND GAS)	All exposed piping, for water and gas supplies, in a Level 1 construction shall be metal. Pipes of other materials shall be buried to a depth of at least 300 mm below the finished ground level.	The requirements for service pipes in a Level 2 construction shall be as for Level 1 construction (see Clause 3.12.1).	The requirements for service pipes in a Level 3 construction shall be as for Level 2 construction (see Clause 3.14.2).

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APPENDIX D

**Visual Impact Assessment
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Proposed Subdivision & Rezoning Ingleside Road, Ingleside

Visual Impact Assessment

Prepared for Department of Infrastructure Planning &
Natural Resources

Report Prepared by Dr Richard Lamb

September 2004

Executive Summary

- The purpose of this report was to assess the potential visual impacts of the subdivision and rezoning of land at Ingleside Road, Ingleside.
- The study assesses the proposed subdivision and rezoning in regard to the development of a small part of the land for residential purposes, with regard to the landscape values of that part of the land and its contribution to the local and regional landscape.
- The visual exposure of the land overall is considered high, both locally and regionally. Its close range visibility is moderate, other than on the boundaries with Ingleside Road. There is high visibility to the escarpment component and plateau above on the subject land from distant locations to the east including both residences and public recreational areas, over a part of the area between North Narrabeen and South Mona Vale.
- The land proposed for residential development is of lesser visual exposure to views from distant locations to the east because of its lower slope and the screening effect of existing vegetation cover.
- The subject land forms a significant part of the scenic landscape of the wider local and sub regional area, with this part of the escarpment forming the background in distant views. From some locations the part of the site proposed for residential development forms the visual horizon.
- The majority of the sloping land within the eastern part of the site (Proposed Residual Lot 2) would be retained in its present state and appearance. Also retained would be the escarpment itself and a large part of the plateau land above it. This is the predominant scenic element of the views in terms of overall area.
- A 40m wide APZ would be required within the eastern extremities of the residential lots and the understorey vegetation that is located within this would be cleared or thinned in compliance with bushfire protection measures. Vegetation, including some large canopy trees on the boundaries of the area to be developed would be retained and would screen and filter views toward future dwellings when seen from distant viewing locations to the east of the site.
- The proposed subdivision would be of a similar character to rural residential development in its immediate vicinity, when viewed from close locations such as within the surrounding streetscape of Ingleside Road.
- There would be a significant change in the visual character of the developed part of the site when viewed from close locations as a result of the increased density of buildings and the clearance of some of the vegetation in accordance with the bushfire protection measures. Overall there would be little change to the character of the affected allotments when viewed from distant locations.
- There would be some potential visual impacts of development, but these have to be balanced with the over-riding benefit of the permanent conservation of the existing scenic character of the escarpment land including the plateau area to its immediate west and the land below. This land is continuous with extensive areas to the north, recently also dedicated to public ownership.
- There is the potential for minor cumulative impacts as a result of the clearing of vegetation from the residential allotments. However it is considered that the minimal number of allotments, the scale of the allotments and the retention of vegetation to the east of the residential allotments would limit the potential for any significant cumulative impacts to occur.
- In the fullness of time, vegetation screening that is acceptable within the APZ around houses would have the effect of further softening the appearance of new buildings.

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Section 1.0 Introduction

1.1 Purpose of this Report

This report was commissioned by the Department of Infrastructure Planning and Natural Resources (the Department) to investigate potential visual impacts resulting from the rezoning and subdivision of land at Ingleside Road, Ingleside. The report aims to assist in the assessment of the landscape values of the land and the potential impacts to these values that may result from the residential development of the subdivided lots, with the exception of the residual Lot 2, including possible adverse impacts upon views to the Warriewood Escarpment from places near the coast. The report also includes an assessment of the rezoning and subdivision in regard to its potential visual impacts upon important local character, landscape and scenic values. A plan of the proposed subdivision is appended to this report.

We have been involved in a previous rezoning and subdivision application for the same land. This study was completed in October 2003. The fieldwork and analysis that was conducted by us at this time was extensive especially as the previous application was for more allotments located closer to the edge of the escarpment than is the circumstances with this application. The fieldwork conducted at this time is also being used as the basis on which this report is being written. We understand that little has changed since the time of our previous site visits. We understand that a dwelling has recently been approved by Council on one of the adjoining privately owned allotments.

1.2 Document Consulted

During the process of carrying out this study, the authors consulted the following documents:

- Plan of Proposed Subdivision prepared by Drummond Parmenter Pty Ltd, dated July 2004.
- Bushfire Protection Assessment prepared by Conacher Travers, dated August 2004.

1.3 The Proposal

This report focuses on land under the ownership of the Department of Infrastructure Planning and Natural Resources. This land is comprised of Lot 3 SECF DP 11784, and Lots 74, 79, 83, 84, 85, SECB DP 11784. These parcels of land are directly accessed from Ingleside Road.

The proposal is for the rezoning of existing lots 74, 79, 83, 84, 84 Sec.B – DP 11784 so that one dwelling per allotment would be a permissible use of the land. This use would be the same as development that is adjacent to and in the immediate vicinity of these allotments. The second component of the proposal is for the subdivision of Lot 3 – Sec. F – DP 11784 into two allotments. The first allotment, proposed Lot 1, would be a minimum of 4000m² and a single dwelling would be permissible within its boundaries. The residual allotment, Lot 2, is the lot containing the escarpment and the plateau area to its immediate west. This

allotment would be zoned 7(a) Environmental Protection and its ownership would be transferred to the Council for community use.

There would need to be fire hazard reduction measures incorporated into any future development of the land, as outlined within the Conacher Travers report (dated August 2004). The hazard reduction measures would incorporate a fuel-free inner protection area extending 40m from future dwellings toward the east, which would act as the total APZ. A fire trail would be required connected to Ingleside Road within Lot 2, which in turn would connect to the existing fire trail serving the adjacent escarpment. While there would be some clearing associated with the protection measures, significant trees would be retained depending on their proximity to the future dwellings and overall the character of the land, especially when viewed from more distant locations, would remain similar to its appearance at present. It would however be necessary for heath and shrubby understorey to be cleared within the inner protection area, extending eastwards 40m from the proposed future dwellings.

1.4 Visual Impact Assessment Methodology

The methodology used consisted of five steps as briefly described below:

Identification and description of the visual context and character of the landscape within which the proposal would be seen.

- Analysis and evaluation of the visibility of and visual access to the proposal, so as to assess:
 1. The extent of change to the intrinsic character of the site
 2. The visual absorption capacity of the surrounding environment
 3. The visual sensitivity of viewing places
- Analysis of the specific visual effects of the subdivision with reference to each of the proposed allotments.
- Evaluation and assessment of the overall extent of the visual exposure of the subject land and the significance of the impacts that would be produced.
- Assessment of the potential cumulative impacts as a result of the proposal.

Section Assessment 2.0

2.1 Visual context and character of the environs

Natural and built context

The landscape setting of the site is within the eastern margin of the geological structure known as the Hornsby Plateau land system, a series of dissected sedimentary landscapes which form the northern part of the greater Sydney region. The site is situated in the eastern fringe of a part of the plateau occupied by the northern beaches suburbs of Mona Vale and Warriewood. To the east of the site is the coastal plain of the Warriewood Valley. A series of hills and coastal headlands occur to the east of the valley, becoming more prominent eastward as the Turrimetta and Narrabeen Headlands.

The landscape to the immediate west of the site shows the typical landform and vegetation associated with Hawkesbury sandstone geology. Below the plateau surface and upper slopes of the site, there is a clear change in landscape character caused by a change in the underlying geology to the Narrabeen Group (Newport Formation). These sediments erode more readily and produce foot slopes covered with colluvium fallen from above and have less exposed rock. The soil landscapes of the site reflect the geological influences and slopes, with Lambert soils at the crest, Hawkesbury on the upper, Watagan soils on the lower side slopes and Warriewood soil landscapes on the lowest slopes. The vegetation reflects these changes also, with heath and low forest on the Lambert soils, woodland on the Hawkesbury and tall woodland and open forest on the Watagan soils.

The subject land is located on the upper parts of the Warriewood escarpment and adjacent to Ingleside Road. The land slopes gently down from Ingleside Road in generally in eastern direction in the location of the proposed residential lots. The proposed allotments are separated from the edge of the escarpment itself by a minor change of slope and areas of flatter land, which comprises the western part of Residue Lot 2 and are called the plateau area in this study. This part of Lot 2 supports dense heath vegetation and slopes more gently to the east until it meets with the escarpment. Rock outcrops are another feature of this part of the subject land.

Most of the subject site is extensively vegetated. The vegetation responds to the underlying geology and topography of the land and varies considerably across the site. The upper parts of the land, especially the more gently sloping land in the vicinity of Ingleside Road contains mostly heath vegetation with scattered emergent trees of various sizes. This vegetation type is also found on the edge of the Plateau which separates the subject allotments themselves from the edge of the escarpment. Taller native trees are more commonly found in areas among the rock outcrops in the general vicinity of the escarpments edge. The parts of the residue lot below the escarpment are vegetated with woodland and open forest tree species and a more consistent canopy cover is characteristic of this part of the site.

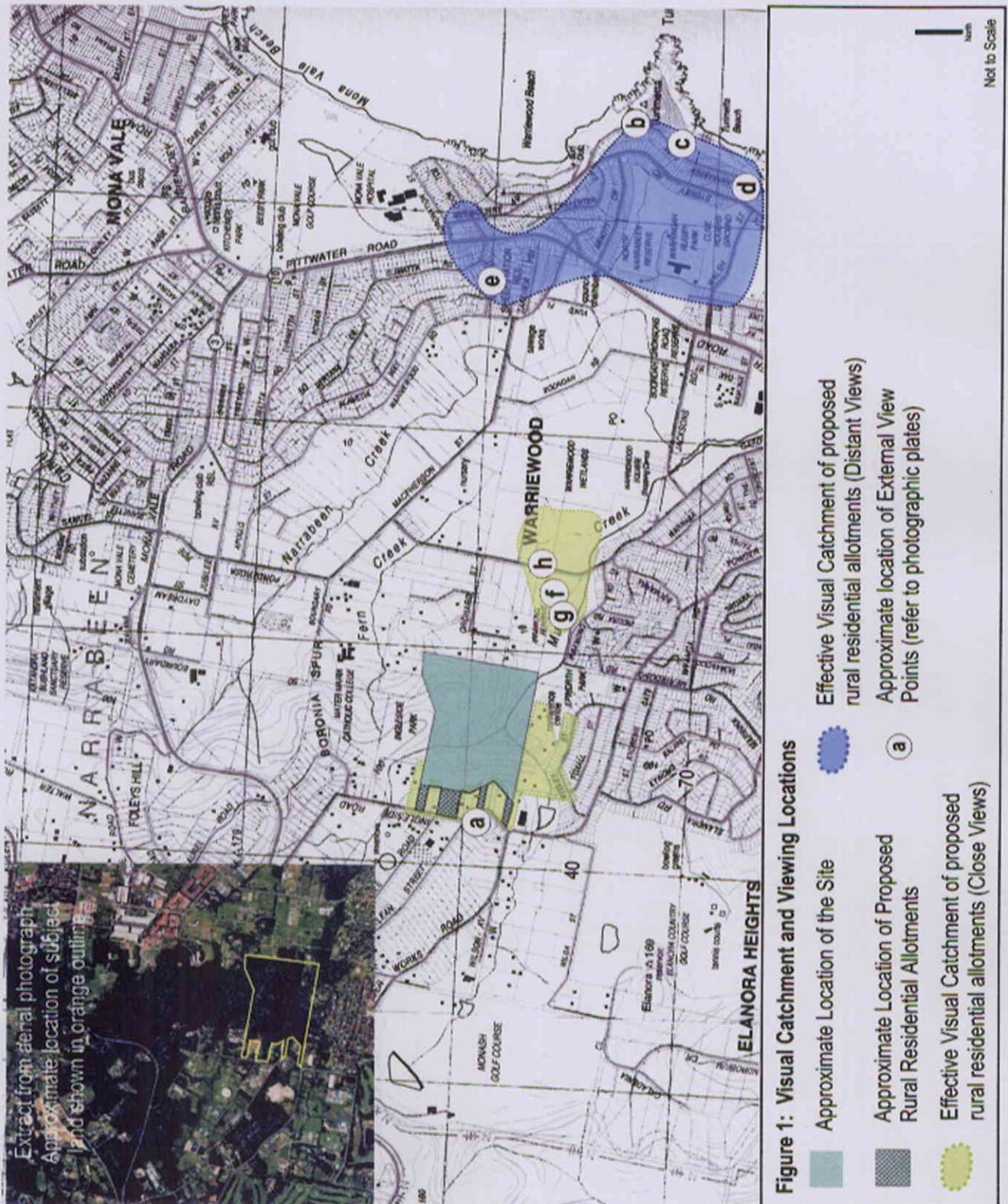
The land surrounding the subject site varies in its visual character. To the south of the subject land is the residential area of Elanora Heights. As shown on the survey plan this development is located on relatively large allotments which contain modest dwellings of a suburban character. To the north of the site is the Westpac Training Centre which is a collection of buildings within a large site. The existing allotments along Ingleside Road that are not the subject of this study are a mix of some rural residential development, while some lots remain undeveloped and mostly retain the heath vegetation that exists within them. The western side of Ingleside Road is characterised by a mix of residential development as well as some larger allotments that appear as either mostly vegetated or of a more rural character when viewed from the road. The land further to the west of Ingleside Road continues to slope upwards and contains a mix of rural residential and rural small holdings development. Much of the rural activity appears to have been abandoned and the area is changing in its visual character as a result.

2.2 Visibility

Viewing places (visual catchment)

To assess the potential visual impacts that would be experienced by viewers, a view point analysis was conducted. This consisted of visiting the site and locality and assessing the likely impact on views from a selected series of locations. The locations were selected to represent the kinds of viewers' experience of the development that would exist in the immediate area. The main kinds of viewing areas and locations that were considered to represent the view exposure of the land were visited and photographed and/or documented. The photographs taken were 50mm focal length to approximate the correct size and proportions of the views as experienced by the human eye. Some of these are included in this report. A variety of other locations were also visited to ascertain the extent of the catchment and characteristics of the views.

The total visual catchment is primarily determined by the topography of the area. The escarpment on which the subject site is located constrains the visual catchment. Depending on relative level of the viewing position, the plateau land or vegetation on the proposed residential lots provides part of the background and visual horizon in views towards the site. Most of the views to the subject land are from the east, especially more elevated and distant locations near the coast. The visual catchment is confined by slope and vegetation and occupies a cone from approximately North Narrabeen to south Mona Vale. Existing views from this direction contain some of the dwellings on the allotments adjacent to the site on Ingleside Road as well as minimal views to dwellings on the western side of Ingleside Road. Existing rural residential development in some lots is not distinguishable in the views because of the effect of residual trees on the lots that screen the dwellings and associated buildings. The vegetation on the sites is generally the most dominant component of these views. This vegetation, consisting of heath and taller trees, screens and filters views to the land when viewed from most locations and it is presently difficult to distinguish different



parts of the site and the lands that surround it as a result of the density of this cover.

Close range views to the subject land are limited to the streetscape of Ingleside Road and a very limited part of Wesley Street, as well as from existing residences located in the immediate area.

View composition

There are generally two types of view compositions available. The first is the view from distant locations to the east of the site. The escarpment on which the subject site is located is the most prominent component in the composition of these views in terms of its area and scenic quality. The land proposed for development is less prominent, even though on the horizon or very close to the visual horizon in these distant views. The mostly natural appearance of the escarpment land below both the plateau area and the future residential lots is the dominant scenic element. Some existing development in the vicinity of the future residential lots is visible in these views. The prominence of this development varies across the top of the escarpment and is dependent upon the position of the buildings in relation to the topography, the land use, screening ability of retained vegetation and the density of dwellings, as well as the height, scale, colour and construction materials of individual buildings.

The second type of views are those from close locations, including roads and existing dwellings, in the immediate vicinity of the subject land. From these locations it is difficult to view the site in its entirety as a result of the screening effects of existing vegetation and the changes in the slope of the land. For example, from Ingleside Road, only buildings on those allotments directly adjacent to the road are visible. Due to the density of the heath vegetation that is located within these allotments there is little visibility to their interior at present or across the land.

2.3 Visual Character and Exposure of the Proposed Allotments

The table below assesses the visual character and the visual exposure of each of the allotments individually and makes some comment as to the contribution that these allotments make to the character and the scenic quality of the area generally following fire hazard reduction measures. The table assesses the likely visual exposure of dwellings and other structures on the lots following fire hazard reduction work. It is assumed that following the initial clearing of heath vegetation on the development sites as required in the Bushfire Protection Assessment and the development of those sites with housing, that subject to the requirements of an APZ, non hazardous vegetation could be planted associated with dwellings that would further mitigate their visibility over time.

Table 2.1: Impact of proposed subdivision allotments upon the visual character of the subject land

Allotment No.	Existing Visual Character of the Proposed Lots	Visual Exposure of the Proposed Lots to the Surrounding Landscape	Effect of Fire Hazard Reduction Measures on Visual Exposure
74	Dominated by heath vegetation that screens most views into the interior of the allotment when viewed from Ingleside Road.	There is some visibility of the allotment from Ingleside Road. There is minimal visibility of the site when viewed from the east as a result of taller vegetation located within Residue Lot 2.	There are few canopy trees located within this allotment. Some of the heath vegetation within the allotment would be cleared to maintain an APZ for the dwellings as part of the hazard reduction measures. The taller vegetation to the immediate east of the allotment is likely to remain and would provide screening to any future dwelling.
79	Dominated by heath vegetation that obscures views to the east from Ingleside Road.	Visible from Ingleside Road. Taller vegetation in Residue Lot 2 filters views to the eastern part of this allotment when viewed from distant locations to the east.	There are few canopy trees located within this allotment, which contains mostly heath. Some understorey vegetation within this allotment would be cleared to maintain an APZ for a dwelling. Taller canopy trees to the east of the lot provide some screening and would be likely to remain after hazard reduction.
83, 84, and 85	Dominated by heath vegetation with few taller trees.	Visible from Ingleside Road. Limited visibility in distant views from the east as a result of the heath vegetation above the escarpment in the plateau area within Residue Lot 2.	There are few canopy trees located within these allotments. Some of the heath vegetation within the allotments would be cleared to maintain an APZ for the dwellings as part of the hazard reduction measures. Heath vegetation to the immediate east of the site would provide some screening of views inward. Dwellings on these allotments would have potentially the most visual exposure to places to the east, at least until an appropriate landscape scheme was established.
1	This allotment is characterised by a mix of heath and taller tree vegetation. Taller trees and canopy are located more in the eastern part of the allotment.	Visible from Ingleside Road. Limited visibility in distant views from the east As a result of the heath vegetation above the escarpment and within Residue Lot 2	This allotment is separated from the other lots adjacent to Ingleside Road by existing dwellings to the south and the Westpac Training Centre to the north. Some of the vegetation would be cleared from this site to maintain an APZ for the dwelling. Some of the taller trees could remain as long as they did not have overlapping canopies. The canopy of these trees would supply some screening to any future dwelling within this allotment.

Allotment No.	Existing Visual Character of the Proposed Lots	Visual Exposure of the Proposed Lots to the Surrounding Landscape	Effect of Fire Hazard Reduction Measures on Visual Exposure
2	Steep land comprising the escarpment, part of the plateau above and the bulk of the escarpment slopes below. Vegetation on this allotment varies from heath on the plateau to densely vegetated slopes with trees and understorey vegetation below the escarpment.	Highly visible throughout the area generally and of high scenic quality.	The natural appearance of this part of the escarpment is a major contributor to the visual character and scenic quality of the area generally. The appearance of this vegetation would be retained as part of the proposal

2.4 Assessment of visual absorption capacity

The capacity of the site to absorb the development visually was judged to be Moderate. This was based on the following considerations:

- The escarpment component of the subject land, including the eastern part of the plateau and the slope below, overall have a high visibility to places to the east, although some parts of the site are more visible than others.
- The most scenically significant part of the land would be conserved in its existing form, increasing the visual absorption capacity overall.
- The proposed subdivision would not result in development in the immediate vicinity of the escarpments edge, but rather would limit it to the flatter land adjacent to Ingleside Road. This area would be significantly screened by existing vegetation to the east of the lot boundaries in proposed Lot 2.
- The affected land is relatively easy to manage in terms of mitigating potential visual exposure of future development.
- There are some residential buildings in the immediate vicinity of the site. This would increase the visual absorption capacity of the site when viewed at close range.
- The addition of residences into the existing context would increase the potential of cumulative impacts when viewed from more distant locations to the east of the site, however buildings would be likely to be substantially screened by vegetation.
- The measures required to control the potential for bushfire would result in the removal of much of the lower growing vegetation across part of each of the allotments with the exception of Residue Lot 2. This would create a substantial change in the internal visual character of the residential lots. However, the effect would be limited in visibility from outside them.

While this assessment of the visual absorption capacity of the site is toward the middle of the five point scale used, this does not indicate that development of the site is inappropriate. It does however indicate that any future development has to reflect the higher constraints upon the land, especially with regard to the scenic contribution of the escarpment to the character of the area overall and to the visual exposure of much of the land.

2.5 Assessment of visual sensitivity

Sensitivity relates to the number of viewers who would be likely to see the site and their likely expectations for visual quality. It is usually considered that a visual impact on a sensitive location in the public domain is more important than one of a similar quality on a less sensitive site.

The overall visual sensitivity of the subject land was judged in summary to be High. The reasons for the assessment, both matters that increase and decrease sensitivity, are summarised below:

- The subject land forms part of the scenic escarpment in distant views from places to the east and near the coast. At present the natural appearance of the land in these views contributes to the character of the area overall.
- The escarpment, including the eastern part of the plateau above, has been the subject of considerable interest and activity to promote its conservation over many years. The appearance of the plateau, escarpment and sloping land below, would not be affected by the proposal.
- The subject land is visible from some residential areas. Most of these are at places distant to the subject land, although some are from places close to or adjacent to the land.
- The subject land is visible from some public recreational areas such as parkland associated with Turimetta and Narrabeen Headlands.
- The retention of the tree canopy on the lower parts of the site and of heathland on the plateau land would retain most of the prominent visual character of the land when viewed from places outside the subject land.

2.6 Summary of Potential Visual Impacts

The combination of the introduction of buildings and the clearing of heath vegetation from part of the proposed allotments would result in substantial change in the character of the affected parts of the subject land, in particular in the short term. The part of the land proposed for development that is presently characterised by its mostly natural appearance would become of a more residential character, albeit on large allotments. This change in character would be more reminiscent of the existing rural residential development within Ingleside Road.

The change in character however would not be extensively visible from more distant locations to the east of the site as a result of areas of taller vegetation in

the immediate escarpment locations and of heath and low tree vegetation on the plateau directly to the east of the residential lots, that would be retained in its existing character and appearance. The retention of this tree canopy would screen or filter most views into the residential allotments. Given that the allotments are large in size the clearing of the 40m Inner Protection Area of vegetation in accordance with the APZ requirements can be completely contained within the residential allotments and would not affect the most visible part of the overall site, being the plateau land east of the lots and the much larger and more prominent escarpment area itself, which is within Residue Lot 2. For this reason the residential allotments, once construction has been completed, would have a visual character similar to that displayed by immediately adjacent allotments within Ingleside Road. While some of these existing dwellings are visible in long distance views from the east, they are not adversely prominent and existing vegetation both within the allotments themselves and on adjacent land extensively filter their visual exposure.

Additional landscape can be added to the properties, although it would be of a different character than the dense native vegetation that surrounds some existing dwellings. This vegetation would further add to the screening of future dwellings within the proposed allotments, along with retained elements of existing vegetation.

For these reasons, the changes to the visual character of the subject land is not considered to be significant, when viewed from both close locations within the surrounding streetscapes as well as when seen from more distant places to the east of the escarpment.

2.7 Cumulative Impacts

There would be some cumulative impacts as a result of the concentration of future dwellings within the subject land. While some of the vegetation within the residential allotments would be required to be cleared, it is considered that heath vegetation and low trees in the plateau land and taller canopy vegetation that is located to the immediate east of these allotments within the upper escarpment land of Residue Lot 2 would provide screening to the more distant views from the east. In this regard it is considered that while there would be some evidence of more development on this part of the escarpment, the cumulative impacts would be minimal and the visual character would not be unacceptably affected.

Section 3.0 Conclusions

It is considered that the proposed subdivision of the subject land would result in an initial change to the visual character of some of the upper parts of the subject land in the vicinity of Ingleside Road. The proposed development of the site would be visible in close views, especially from Ingleside Road. However the resultant change in character would have resonance with the residential and rural residential development that already exists within the immediate streetscapes and not be out of character with it. There would be some visual exposure of future dwellings from more distant locations to the east initially, however it is expected that these views would be filtered or screened by both existing vegetation as well as, over time, by landscaping associated with the new dwellings. The context would be essentially similar to the adjacent existing situation, leading to no significant differences visible over time.

The predominant character of the overall site would remain, due to the dedication of Residue Lot 2 including the eastern part of the plateau, the escarpment and the slopes below, to the permanent benefit of by far the majority of the land visible from the east. The benefits of this far outweigh any impacts of development of the new lots, the appearance of which will merge with the existing context in a satisfactory way and make no significant difference to the character of the views.

The residential allotments in themselves, would be altered in their existing character and would become of a more rural residential character and as such would have very minor short term cumulative impacts. The visibility of these effects however will be minimised by confining this development to the relatively flatter parts of the subject land west of the escarpment. The escarpment, plateau and residual vegetation within lots will provide effective screening to the interior of the allotments. As such the natural appearance of the land, including the totally unaltered and vast escarpment area and unaffected character of the plateau will remain the most dominant feature in the views.



Plate 1: View to the east from the north western part of Residue Lot No. 2
The foreground vegetation would retain its natural appearance and the taller vegetation would provide some screening and filtering of views to the proposed residential allotments.



Plate 2: View to the north east from the north western part of Residue Lot No. 2
This vegetation would not be affected by the proposed development and the overall character of the land seen from the east would be essentially unchanged.



Plate 3: View to the subject land from the driveway of No. 13 Ingleside Road toward the approximate location of Lot 79 (View point a)
Development of the lot would be of a similar character to other rural residential lots adjacent, subject to maintaining an Asset Protection Zone on the land. Dwellings could be screened from view along the road.



Plate 4: View to the subject land from No. 74 Narrabeen Park Parade (View point b)
From this distant location some of the future dwellings within the subject land would be visible, close to the visual horizon. The visibility of the dwellings would be filtered by existing vegetation located on the upper parts of the escarpment. In this regard future development would be of a similar character as that existing on neighbouring allotments.



Plate 7: View from the driveway of No. 7 Hill Street, Warriewood (View point e)

From this location several of the existing dwellings opposite the site in Ingleside Road are visible, as is some of the heath vegetation within the upper portions of the subject land.



Plate 5: View from No. 38 Narrabeen Park Parade (View point c)

From this and similar locations the subject land forms the background element of most views towards the west. Most of the vegetation within the site would be retained within the residue lots and would provide some screening and filtering of views towards future dwellings.



Plate 6: View toward the site from near the intersection of Narrabeen Park Parade and Sydney Road (View point d)

The natural appearance of the escarpment in this and similar views is a major contributor to the character of the area generally. While most of the subject land would retain this appearance, the upper parts of the land would be partly cleared creating potential for filtered views to future dwellings.



Plate 9: View from the corner of Acacia Circuit and Banksia Parade, Warriewood (View point g)
Most of the land is screened by intervening vegetation and topography in views from this location. Any available views would be screened by future residences to be constructed in the foreground.



Plate 8: View from Acacia Circuit, Warriewood (View point f)
The canopy of trees below the escarpment screen views to most of the land from this location.



Plate 10: View from Garden Street, Warriewood (View point h)

There is no significant visibility to the proposed rural residential allotments from this location as a result of intervening vegetation and topography.



Richard Lamb & Associates

Appendix
Subdivision and Rezoning Plan A



IMPORTANT NOTES AND CAUTIONS
THESE NOTES FORM AN INTEGRAL PART OF THIS PLAN
CONTOURS HAVE BEEN PARTLY COMPILED
WHERE LEVELS ARE CRITICAL THEY SHOULD BE DETERMINED BY SURVEY
DATUM OF LEVELS: AHD
ORIGIN OF LEVELS: 55.5M 3523 R.L. 82.472
CONTOUR INTERVAL: 2 METERS
AREAS AND DIMENSIONS APPROXIMATE ONLY AND ARE SUBJECT TO SURVEY

8583A PROPOSED SUBDIVISION INGLESIDE

REDUCTION RATIO	1:3000
REF. No.	B963B
DATE	JULY 2004

CLIENT: DEPT. I.P. & N.R.

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PLAN OF PROPOSED SUBDIVISION OF LOT 3
SECTION F D.P. 11784 AND PLAN OF REZONING
OF LOTS 74, 79, 83, 84, 85 SEC B D.P. 11784 AND
3 SEC F D.P. 11784 INGLESIDE RD. INGLESIDE.

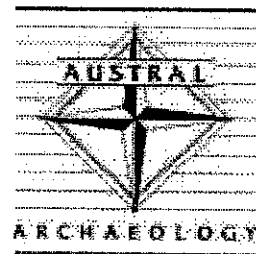
DRUMMOND PARMENTER PTY. LTD.

APPENDIX E

**Aboriginal Heritage Assessment
(Austral Archaeology)**

INGLESIDE SUBDIVISION
Heritage Assessment
of
Aboriginal Heritage Values

FINAL REPORT



Prepared by
Austral Archaeology Pty Ltd
Archaeological and Cultural Heritage Consultants

For

Drummond Parmenter Pty Ltd

on behalf of

Department of Infrastructure Planning & Natural Resources
&
Uniting Church in Australia

December 2003

EXECUTIVE SUMMARY

The Department of Infrastructure, Planning and Natural Resources (DIPNR) and the Uniting Church in Australia (UCA) is proposing the rezoning and rural residential development of a large tract of land between Ingleside Road and Wesley Street, Ingleside.

In preparation for a combined development application (DA), plan of management and rezoning application for the subject land, Austral Archaeology Pty Ltd was commissioned by Drummond Parmenter Pty Ltd to undertake an Aboriginal heritage assessment of the 14 subject Lots. The assessment involved a desktop study to establish the archaeological and environmental context of the study area, consultation with the local Aboriginal community and a field inspection to locate archaeological surface sites and areas of potential archaeological sensitivity.

While no archaeological sites were identified during survey, banks of the creeklines contained within the study area were identified as areas of archaeological sensitivity and as a result, should be avoided where possible. On the basis of the desktop study, Aboriginal community consultation and field survey, the remainder of the study area is considered to have low archaeological potential because of its steep topography, lack of quality sandstone and substantial overhangs.

As a result, there are currently no cultural heritage constraints to the development proposal.

Recommendations

The following recommendations are provided for the development proposal:

1 – Limitation of works

In an effort to maintain the environmental integrity of the area, it is recommended that natural landscape features such as creeklines, their surrounds and substantial sandstone outcrop formations be avoided where possible to preserve the natural values of the landscape. Creeklines are considered areas of potential Aboriginal archaeological and cultural sensitivity as places frequented by Aboriginal people for food, water and raw materials where cultural material may remain undetected and as such, these areas should be avoided where possible.

2 – Vehicle and walking tracks

Proposed foot and vehicle access tracks through the site should where possible, follow existing paths and tracks to avoid further impact on the landscape. Where formal paths are established, the use of natural local materials should be considered in keeping with the surrounding bushland. If formal roads are proposed that impact archaeologically sensitive areas, then specific inspection of these routes and any alternate routes, may be required. Advice should be sought from a qualified archaeologist if situation should arise.

3 – Stop work provision

As required by the *NSW National Parks and Wildlife Service Act, 1974* in the event that Aboriginal archaeological material or deposits are encountered during any ground disturbance activities, works must cease immediately to allow an archaeologist to make an assessment of the find. The archaeologist may need to consult with the NSW National Parks and Wildlife Service regarding the finds.

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1.0 INTRODUCTION

1.1 Background

Drummond Parmenter Pty Ltd commissioned Austral Archaeology Pty Ltd to undertake an Aboriginal Heritage Assessment for the combined subdivision, rezoning and plan of management application for land encompassing approximately 72 hectares located at Ingleside in Pittwater local government area (LGA) (Figure 1.1). The land is currently owned by the Department of Infrastructure, Planning & Natural Resources (DIPNR) and the Uniting Church in Australia (UCA). The DIPNR land consists of Lot 3 Sec. F DP 11784 and Lots 74,79,83,84, 85 Sec. B DP 11784 while the UCA land includes Lot 62 DP 30255 and Lot 70 DP 32253 (including Lots 6-11).

The assessment did not include Lot 7 and 13 as they are proposed to be designated Open Space. However, the area proposed as a walking track along the western boundary of Lot 7, was considered as it will be impacted by the proposal.

The site is adjoined to the north by the Westpac Training Centre and Ingleside Park, to the west by rural residential allotments, to the east a heavily vegetated and steep Lots running down to the Warriewood Valley and to the south by the Uniting Church Conference Centre and residential land fronting Wesley Street.

The Aboriginal heritage assessment involved a desktop study, consultation with the Metropolitan Local Aboriginal Land Council and a field inspection. This report details the aims of the project, the methodology utilised and the study findings and heritage recommendations based on the outcomes of the study.

1.2 Objectives

The objectives of the heritage assessment as outlined in this report were to:

1. establish and document the history of Aboriginal and historic occupation of the study area through the identification of known Aboriginal heritage items and sites, and landscapes of archaeological and cultural sensitivity;
2. identify and consult with relevant stakeholders with an interest in the study area, to establish areas of archaeological and cultural sensitivity and assess their significance. Aboriginal community groups to be consulted with regard to Aboriginal heritage may include, but not be limited to, local Aboriginal land councils (LALC) and registered Native Title claimants;
3. conduct a field survey to locate and document surface Aboriginal archaeological/cultural heritage sites and identify any areas of potential archaeological sensitivity within the study area. Previously recorded sites listed on the NPWS AHIMS, Register of the National Estate, the State Heritage Register and the Pittwater LEP to be described as relocated within the study area;
4. assess the significance of all items and sites recorded with in the study area on the basis of the desktop study and field survey, in accordance with established significance criteria; and
5. provide appropriate strategies and mitigation measures to minimise development impact (where possible) to significant sites in consultation with relevant stakeholders as required by legislative requirements and archaeological best practice.

1.3 Proposed Development

The Ingleside proposal comprises land rezoning to allow subdivision creating ten rural residential blocks and the provision of an access road connecting Wesley Street and Ingleside Road. This road would include rights of vehicle access for Rural Fire Service and Pittwater Council. The proposal allows for the construction of dwellings on the four existing

rural residential lots (Lots 79, 83, 84, 85 DP 11784) fronting Ingleside Road. The combined rezoning and development application of the Ingleside properties will allow for the rural residential subdivision of part of the Lots in accordance with heritage and environmental opportunities and constraints of the relatively undisturbed site. The proposed subdivision layout is presented in Figure 1.2. The subdivision aims to preserve as much of the natural values of the land, including the retention of existing creeklines which run through the centre of the site and along the southern site boundary near Wesley Street.

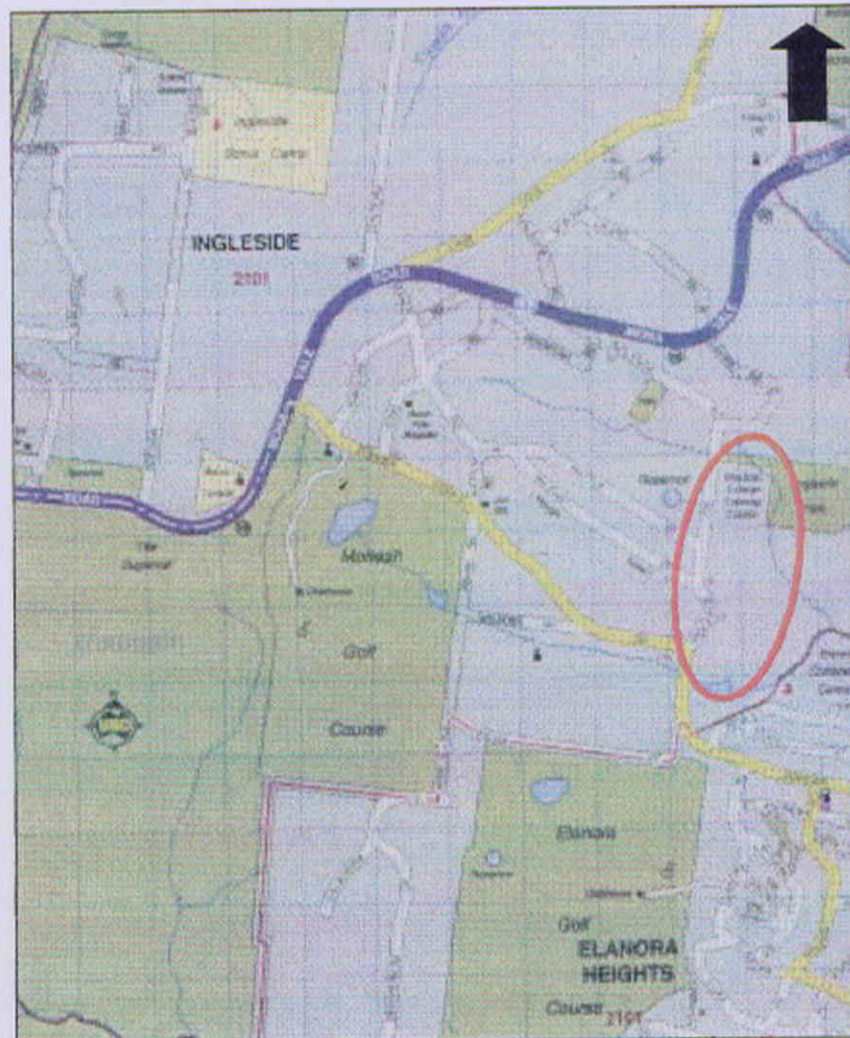


Figure 1.1 Location of the Study Area (Source: Map 137, 2004 Sydney Street Directory)

1.4 Stakeholder Consultation

Consultation with key stakeholder groups has been ongoing throughout the heritage assessment. Discussions have occurred with Drummond Parmenter, Ingham Planning, the Uniting Church in Australia and Metropolitan Local Aboriginal Land Council (MLALC).

Initial consultation was conducted by phone and fax. Discussions were held with Kevin Drummond (Drummond Parmenter), David Winley (Ingham Planning) and Michael Barr (the Uniting Church in Australia) in relation to project background and specific proposal details.

A search of the National Native Title Tribunal records (15/9/03) did not identify any claims on the Register of Native Title Claims which have been accepted for registration. As such, Aboriginal community consultation was limited to MLALC.

The consultants informed MLALC of the heritage assessment and Allan Madden, Cultural & Educational Officer, and Adam Madden (Aboriginal Sites Officer) participated in the fieldwork with Austral Archaeology. On site discussions were held with Allan and Adam with regards to the archaeological potential of the subject land and proposed heritage recommendations. On the basis of the site inspection and these discussions, Austral requested a letter report from the MLALC to be included in the final archaeological report. A draft archaeological report was also reviewed by the Client and MLALC prior to its submission to NPWS.

Appendix A details the consultant's correspondence with the MLALC. Numerous phone messages were also left for Mr Madden through the MLALC office, however, at the time of writing, a report had not been received from MLALC.

1.5 Aboriginal Heritage Legislative Framework

Aboriginal cultural heritage in Australia is protected and managed under the Australian Heritage Commission Act, 1975, Aboriginal and Torres Strait Islander Heritage Protection Amendment Act 1987. Aboriginal cultural heritage in NSW is also protected by the *National Parks and Wildlife Act 1979*. Aboriginal sites in New South Wales are commonly investigated and assessed under the *Environmental Planning and Assessment Act 1979*. Principles for assessment and conservation management are provided by the non-statutory *ICOMOS Australia Burra Charter (1999)*.

Australian Heritage Commission Act, 1975

The Australian Heritage Commission (AHC) identifies and advises the Commonwealth Government on the protection of Australia's National Estate, which is defined as:

4. (1) *those places, being components of the natural environment of Australia or the cultural environment of Australia, that have aesthetic, historic, scientific or social significance or other special value for future generations, as well as for the present community.*

Aboriginal sites and places may be listed on the Register of the National Estate (RNE) as significant in terms of their association with a particular community or social group for social, cultural or spiritual reasons. The powers of the Commission and Act do not extend to State authorities/owners or private individuals. The AHC maintains the RNE which lists all sites and places of significance to the nation (note that items of local level significance may be included on the RNE).

Aboriginal and Torres Strait Islander Heritage Protection Amendment Act 1987

This federal Act administered by the Aboriginal and Torres Strait Islander Commission, provides blanket protection for Aboriginal heritage in circumstances where such protection is not available at a state level. This Act comes under Commonwealth jurisdiction which means that it can override state and territory provisions (Pearson & Sullivan 1999: 52-53).

New South Wales National Parks and Wildlife Act 1974

All Aboriginal Objects (formerly "relics" prior to amendment of the Act [Amendment Act 2001 No. 130]) are protected under Section 90 of the *National Parks and Wildlife Act 1974*. Sites of traditional Aboriginal significance that do not necessarily contain archaeological materials may be gazetted as Aboriginal places and are also protected under Section 90. This protection applies to all Aboriginal Objects, regardless of their significance or land tenure.

Under Section 90, it is an offence for a person to destroy, deface, damage or desecrate an Aboriginal Object or Aboriginal Place without the prior issue of a Heritage Impact Permit (formerly "Consent to Destroy") by the Director-General of the National Parks and Wildlife Service (NPWS). The amended Act requires that due diligence must be taken to avoid impacts on Aboriginal Objects.

Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) requires that impacts on the environment, including cultural heritage, are considered prior to land development. Local environmental plans (LEPs) prepared in accordance with the EP&A Act provide guidance on the level of environmental assessment required.

Parts IV and V of the EP&A Act stipulate the manner by which consent authorities (i.e. Department of Infrastructure, Planning and Natural Resources and local councils) approve development applications by ensuring that consideration of potential impacts on the environment, inclusive of Aboriginal heritage, are addressed prior to development commencement. This usually involves the preparation of a review of environmental factors (REF) or an environmental impact statement (EIS) including a full archaeological assessment.

The Burra Charter 1999

The Burra Charter (1999) also provides guidance for the conservation and management of places of cultural significance (cultural heritage places). The Charter was adopted by Australia ICOMOS (the Australian National Committee of ICOMOS) in 1979 with recent revisions adopted in 1999. The Charter sets a standard of practice for those who provide advice, make decisions about, or undertake works to places of cultural significance, including owners, managers and custodians.

In summary, Aboriginal Objects, (including "sites") in New South Wales are protected. A Heritage Impact Permit for Aboriginal sites must be obtained from the NSW NPWS prior to impact on a site. Heritage Impact Permit applications are determined on the basis of the significance of the heritage object or place according to the Burra Charter (1999). NPWS requires local Aboriginal groups play an active role in the heritage assessment process and are given the opportunity comment on each application with their views taken into consideration by NPWS when determination of the application takes place.

1.6 Project Team and Acknowledgements

This project was directed by Charles Parkinson (NSW Manager, Austral Archaeology). The Aboriginal heritage assessment was managed, conducted and written by Megan Mebberson (Senior Archaeologist). Charles Parkinson reviewed the draft report. Austral Archaeology would like to acknowledge the participation of the following people who have contributed to the preparation of this report.

David Winley	Ingham Planning
Allan Madden	Metropolitan Local Aboriginal Land Council
Adam Madden	Metropolitan Local Aboriginal Land Council
David Gordon	National Parks & Wildlife Service Aboriginal Heritage Information Management System

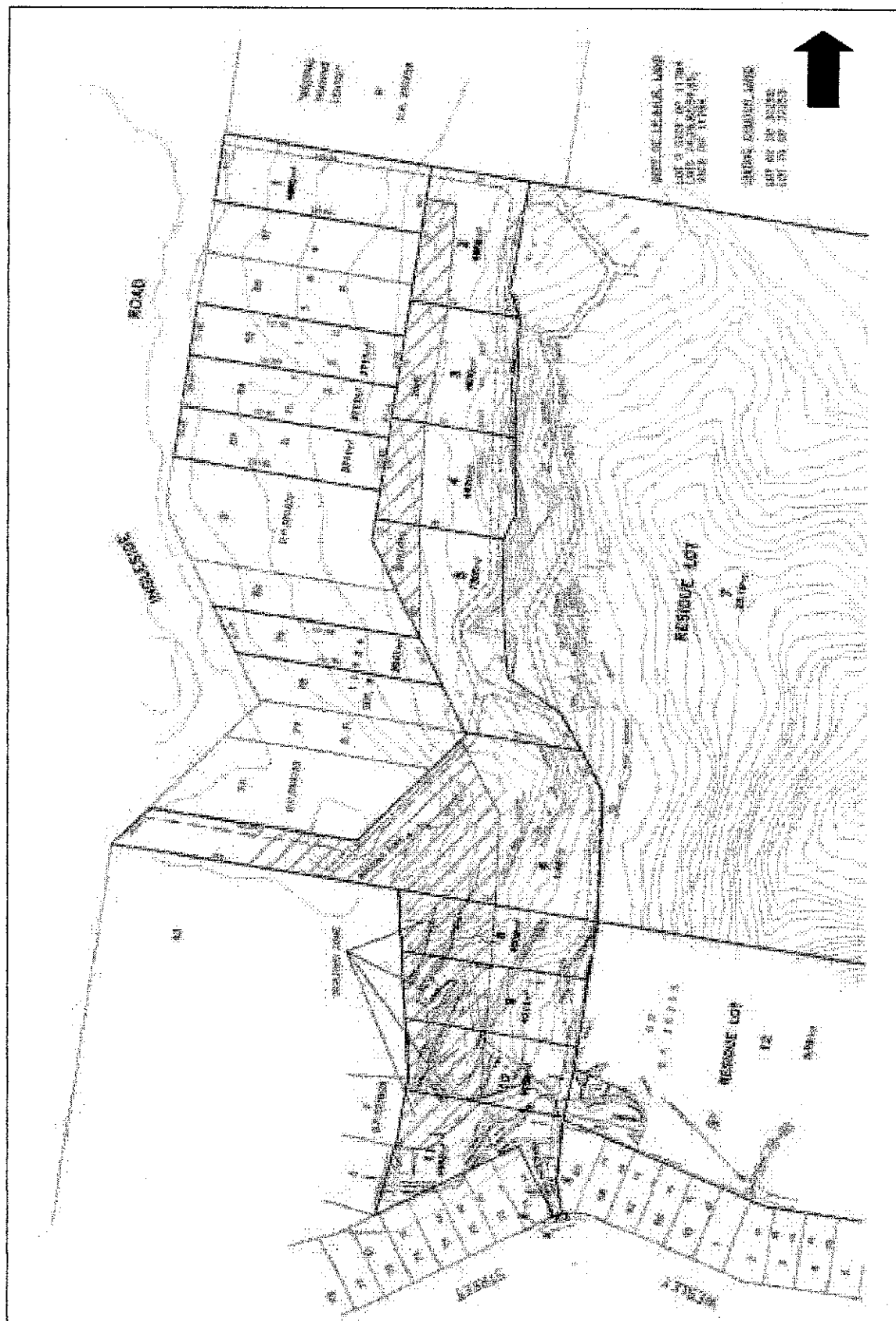


Figure 1.2 Proposed Sub-Division of the Study Area

2.0 ENVIRONMENTAL BACKGROUND

2.1 The Study Area

The Ingleside study area is located approximately three kilometres west of the coastline at Warriewood and two kilometres north west of Narrabeen Lakes in the Pittwater LGA. Ingleside is situated along Sydney's Northern Beaches and approximately 30 minutes north of the Sydney CBD. The Pittwater LGA comprises a diverse range of terrain characteristics, due to its location on a large peninsula. The LGA includes stretches of coastline, rugged headlands and sandstone sea cliffs, abundant waterways and substantial tracts of native bushland including two National Parks. The study area is located south east of Ku-ring-gai National Park which contains many Aboriginal engraving and art sites due to the propensity of Hawkesbury Sandstone outcrops.

The subject site is also underlain by Hawkesbury sandstone which outcrops as an escarpment running north-south through the area which descends steeply into the valley below and the coastal plain. Three small tributaries of Mullet Creek, which drains into Narrabeen Lakes, are located within the study area. The southern tributary, which runs through Lot 11, has been dammed at two locations along the Wesley Street property boundary. The two remaining drainage lines run over the escarpment through sandstone boulders within Lot 6 and Lot 3 and join the main branch of Mullet Creek just east of the study area before emptying into Narrabeen Lakes. These small drainage lines may have been used by Aboriginal people in the past as areas where food and raw materials were accessible.

Apart from the damming of the creekline, no other major developments have occurred within the study area and its immediate surrounds which consist of relatively intact bushland. Limited land clearance has occurred on site, mainly in Lot 11 where a large concrete slab and an adjoining cleared area are remnants of a scout hall that once occupied the site. An access road connects this area with Wesley Street. A disconnected power line to the Scout Hall still remains on this site. Another fire trail in Lot 79 connects with Ingleside Road. Narrow walking tracks have also been established throughout the study area from the Uniting Church's Elanora Conference Centre amongst the bushland.

The following sections outline the environmental context of the study area and the historic land uses which have affected the landscape since settlement. The degree to which the original soil context has been disturbed has ramifications for the preservation of archaeological deposits. The archaeological potential of the study area is then considered in terms of past land disturbance (see Section 3.0).

2.2 Geological Context and Soil Landscapes

The study area, located on a steep escarpment above the Warriewood Valley within the Sydney Basin is underlain by Hawkesbury Sandstone which consists of medium to coarse grained quartz sandstone with minor shale and laminite lenses. Hawkesbury Sandstone outcrops throughout the Sydney Basin and was commonly utilised by Aboriginal people for shelter, to sharpen tools and as sites to produce engravings and art.

The local topography of the study area comprises rolling to steep hills with sandstone outcropping common. Local relief also varies between 40 to 200 m with convex and narrow crest and ridges running into narrow incised valleys.

The immediate study area is located within two soil landscapes, namely Hawkesbury (ha) and Oxford Falls (of) (Chapman & Murphy, 1989:45).

Topsoils within the Hawkesbury unit are generally loose, coarse quartz sand with a colour that varies from brownish black to dull yellow orange depending on the quantities of organic matter within the soil. The underlying B horizon is an earthy, yellowish-brown with an apedal massive or occasionally weakly pedal structure and the C horizon consists of a pale, strongly pedal light clay.

Soils of the Oxford Falls unit also found in the study area. Similarly, the topsoil retains a large amount of organic matter and as a result, they consist of generally dark brown loose loamy sand (A_1), bleached loose sandy loam (A_2); and black organic loam (A_3). Sandstone and quartz gravel fragments are common in all units however, A_1 soils are quite water repellent whereas A_2 is generally waterlogged. The B horizon is usually earthy yellowish-brown clayey sand and it is often moist to water-saturated. Underlying both horizons is deeply weathered soft friable sandstone (Chapman & Murphy, 1989:45).

In general, these soils are quite shallow on Hawkesbury Sandstone. As such, the study area is not predicted to yield deep archaeological deposits. Conversely, the underlying sandstone surfaces which cover much of the site, are likely to be located just under the topsoil in places and may have been damaged by agricultural ploughing which occurred in the area. Similarly, this has ramifications for engraving sites which have been covered by topsoil.

2.3 Study Area Topography

The DIPNR owned land to the north west, is relatively flat, sloping gently to the east until it reaches a broken sandstone escarpment approximately 60 to 75 metres from the rear of the existing rural residential lots on Ingleside Road. Elevations range from 102 to 90m AHD at the escarpment edge down to 75 to 80 AHD at the escarpment base. The topography continues to fall below the escarpment to the Warriewood Valley and is covered by open forest vegetation with tall, mature trees and a moderately dense understorey. Rock outcrops are common in the escarpment area, and occur throughout the subject site.

The remainder of the study area on UCA owned land is similar topographically to the rest of the site however the escarpment levels out in land Lots 10 and 11 towards the southern Mullet Creek tributary and Wesley Street. It also comprises dense scrub with some weedy vegetation and rocky sandstone outcrops.

2.3 Flora and Fauna

The local vegetation comprises mainly open-forests on sheltered sites, lower hillslopes and along creek lines, and woodlands on ridges. Localised changes in soil and drainage, often related to interbedded shale lenses in the sandstone may also result in permanently wet soils with sedge land or wet heath occurring (Bensen & Howell 1990:130). Extensive areas of the natural vegetation that occur on the Hawkesbury Sandstone have been preserved in the Pittwater area in conservation reserves that include Davidson Park State Recreation Area, Manly-Warringah War Memorial Park and Ku-ring-gai Chase National Park.

Ecotone Ecological Consultants have recently undertaken a flora and fauna impact assessment of the study area. Their assessment included developable land along Ingleside Road and at the rear of existing allotments on the same road and a large area below the escarpment (approx. 25 ha) to be retained as open space.

No threatened flora species were found in the study area or in the immediate surroundings, although potential habitat may exist within the site for threatened flora species *Epacris purpurascens* var. *pupurascens*, *Grevillea caleyi* and *Tetratheca glandulosa*. Foraging and nesting habitat of the Powerful Owl was also recorded in the study area. The Grey-headed Flying-fox and Eastern Bent-wing Bat were present in the study area and the Eastern Pygmy-possum, Squirrel Glider, Spotted-tailed Quoll, Giant Burrowing Frog, Heath Monitor and Red-crowned Toadlet may all visit the site (Ecotone Ecological Consultants, 2003).

Additionally, the Brown Stringybark and Swamp Mahogany, regarded as significant in the Sydney region, are present to the east of the old Scout Hall site. The Ecotone report states that Swamp Mahogany is unlikely to occur naturally in this habitat and were probably planted in the Scout Hall garden, or were self seeded from a group of the same species which occur on Ingleside Road. Scaly Bark which is local significant in the Pittwater area, occurs sporadically throughout the site and is seen in nearby Garigal National Park (Ecotone Ecological Consultants, 2003).

2.4 Past Land Use Practices

Information concerning past land use practices in the study area vicinity has been based on available environmental data and aerial maps supplied by Ingham Planning and Land and Property Information. This data was collected to ascertain the degree to which recent land use is likely to have affected the development impact area. A summary of the past land use history is given below.

The immediate study area and its surrounds has been subject to a variety of agricultural and developmental impacts, mainly as a result of local farming practices, residential and commercial development, and associated urban road and services infrastructure.

The earliest photographic record dates to 1947. Land between Wesley Street and Ingleside Road is mainly treed but the vegetation is not dense suggesting vegetation thinning or some land clearance may have taken place prior to this date. In contrast, a large property at the intersection of Wattle Street and Ingleside Road has been extensively cleared and ploughed.

By 1961, a large portion of land south of the intersection of Powderworks and Ingleside Roads has undergone major land clearance and appears to be a quarry and/or sand mine. This area is immediately adjacent to a dam which has been constructed along the Mullet Creek tributary along the southern boundary of the study area on Wesley Street. There are also several houses on blocks fronting Ingleside Road near McLean Street and Wattle Street which are set within cleared areas which are associated with small grazing paddocks. The remainder of the study area is still quite densely vegetated with small tracks running through the treed area.

In 1970, the cleared properties at the intersection of Ingleside and McLean Street appear to be slowly revegetating while more land further north near the Wattle Street intersection have been cleared and built on. This semi-rural residential development stretches along Ingleside Road to the current Westpac Training Centre boundary, accounting for a total of six new residential properties. There are still tracts of land in between these developed blocks which roughly correspond to land Lots 76-78 and possibly 83-85. A large reservoir has also been constructed on the western side of Ingleside Road off Wattle Street.

Most of the top of the escarpment has been cleared by 1978 although there are portions of land along Ingleside Road which appear to be relatively undisturbed bushland although they are not dense and again, may have been thinned or burnt out. A large development area is seen at the northern end of Ingleside Road which may represent the Westpac Training Centre. This area consists of several built up areas and a large car park.

The large quarry area immediately adjacent to the study area seen in 1961 has by 1986 has ceased operation and appears to be farmed. A number of building are visible on the northern boundary of this area and what seem to be hothouses have been built suggesting the cultivation of exotic plants. There is also evidence of cultivation along Ingleside Road to beginning of the escarpment. The cultivated land seen in the 1947 photo at the Wattle Street intersection is now fallow. The large development established north of the residential blocks on Ingleside (Westpac) by 1986 has a swimming pool and tennis courts and a track through bushland on the southern boundary of this property extend east down the escarpment through to the Warriewood Valley subdivision below.

In 1994, the quarry is covered with hot houses and associated buildings while properties north of here have thinned tree cover or are cleared and grassed. In comparison, areas where there is substantially more tree cover also look as if they been thinned. The area below the escarpment is more densely vegetated with creeklines visible as a result of their dense tree cover. The east-east track seen ten years before is still visible and several new tracks crisscrossing the site are seen through the bushland. This picture remains the same in the 2002 photo with an amount of vegetation regrowth defining the top of the escarpment. The vegetation seems to be a mix of older trees and new plants with most of the land on Ingleside Road developed for residential purposes.

In summary, some parts of the study area have been subject to a variety of agricultural and rural-residential impacts. Continual farming practices such as grazing and cultivation are evident along properties on Ingleside Road and a quarry/mining operation has resulted

moderate to high land disturbance in the immediate area in the last 56 years. Consequently, the archaeological resource in the western portion of the study area within the strip of residential properties on Ingleside Road, in the vicinity of the quarry/mine and along the dammed portion of Mullet Creek off Wesley Street, is likely to have been affected by these land uses. Much of the site east of the escarpment however, remains relatively undisturbed. No development has evidently taken place across the steep slope at the base of the escarpment within the study area since 1947. Consequently, this area, including the ephemeral watercourses (with the exception of the dammed portions of the southern tributary) is more likely to have retained its environmental and heritage values. This issue is considered further in Section 3.0.

3.0 ARCHAEOLOGICAL BACKGROUND

3.1 Regional Archaeological Context

Within the Sydney region, over 1700 art sites have been recorded on sandstone rock platforms and in rockshelter, mainly on Hawkesbury sandstone. These include approximately 840 engravings and 875 rockshelter sites which total almost 36% all recorded archaeological components at identified sites in the Sydney area (Attenbrow, 2002: 146). Numerous examples of rock art and engraving sites are found locally in Ku-ring-gai Chase National Park and Garigal National Park to the north west and south west of the Ingleside study area. These areas have been subject to intensive archaeological investigation in the last ten years and as a result, the archaeology of this region is well-researched. In this respect, the likelihood of the study area yielding archaeological material is moderate to high given the demonstrated archaeological potential of the region.

A regional overview of the Warringah Shire was completed by Haglund in 1986, presenting a wider picture of the area. Haglund's work drew on previous cultural heritage surveys in the area resulting in a synopsis of site types and location and distribution patterns of sites within the region. Haglund concluded that:

- occupation sites and art sites are characteristically associated with the sandstone overhangs;
- engravings tend to be found on sandstone ledges and open platforms;
- axe grinding grooves may be located in sandstone creekbeds, ledges and platforms; and
- shell middens are generally located along coast and estuaries & within the bays and inlets.

A search of National, State and local heritage databases undertaken to establish the archaeological context of the study area, confirms Haglund's predictions. The results of these searches are presented below.

3.1.1 Aboriginal Heritage Information Management System Search Results

A search of the NSW NPWS Aboriginal Heritage Information Management System (AHIMS) was conducted on 15th September 2003, searching an area approximately 16 km² around the study area.

A total of 35 recorded Aboriginal objects and places were listed and site types are presented in Table 3.1 below. The majority of sites were rock engravings (85% of the total sites) which occurred throughout the local area (see Figure 3.1). Shelter sites with art and/or deposit have also been recorded south of Mona Vale Road in the vicinity of Narrabeen Creek, immediately north of the study area.

Site Type	Frequency	% of Total Site Numbers
Rock Engraving	29	85%
Axe Grinding Groove and Rock Engraving	1	3%
Axe Grinding Groove and Water Hole/Well	1	3%
Shelter with Deposit	1	3%
Shelter with Art	1	3%
Shelter with Art and Deposit	1	3%
Total	35	100%

Table 3.1 Summary of results of NPWS AHIMS search.

3.1.2 Other Heritage Register Search Results

Searches of the RNE, SHI/SHR databases did not identify any recorded Aboriginal objects or places in or around the study area. Similarly, no Aboriginal sites were listed on the Pittwater LEP in the Ingleside local area.

3.2 Previous Investigations in the Study Area Vicinity

Several investigations have been carried out around Ingleside over the last twenty years. These include surveys by Koettig (1981), Byrne (1984), Dallas (1997) and Oakley (1998) conducted as part of the D.A. process for proposed developments. A summary of these investigations is presented below.

3.2.1 Archaeological Survey for Aboriginal sites – Mona Vale Road

In 1981 Koettig conducted an archaeological survey for Aboriginal sites along Mona Vale Road between McCarr's Creek Road and Alan Street to the west of the current study area. Previously recorded sites in the area were relocated and two additional art sites were recorded during the course of investigations. These sites are described in Table 3.2 below.

Site ID	Description
Site 1	A very weathered, single, "female" figure engraving located on an open sandstone plateau. It is visible only with oblique lighting i.e. morning or afternoon. The figure is 1.25m long and 50 cm wide. The engraving was not described in any further detail as it was beyond the study area.
Site 2	Located on an elevated exposure of sandstone with a fairly even surface was another engraving site, commonly referred to as whale rock. This site comprises four figures; however, only one was visible at the time of survey. A fuller description of the site, has been compiled from historical sources. Campbell described the site as follows: "this remarkable figure is probably a shark, and it has a wide and smooth groove; near the underside of the shark is the figure of a man flourishing a waddy; a curious protuberance is shown below his uplifted arm; a few feet away is a portion of a wallaby; the rest of it has been weathered away" (1899:32 in Koettig 1981). In 1954, McCarthy published an amendment to this, noting that "the additional figures, all incomplete, comprise (1-2) two indeterminate objects; (3) a small man; and (4) a larger man 5ft high. The latter is at the head of the whale, and he has a horizontal bar just above his penis. As no.4 is only a foot away from the whale, it is probable that Campbell disregarded this and Nos. 1-3 because of their weathered and faint state of preservation. They appear to represent an earlier series than Campbell's (1954:16 in Koettig 1981).
Site 3	Information about this site was provided by DMR, however, no site was identified at the specified location during the field survey. There was no site listed at this location on the NPWS AHIMS Register and it appears that this site location is incorrect.
Site 4	Located on a sandstone exposure which is dissected by Mona Vale Road is an open art site previously recorded by I. Sim. On the southern side of the road, the engravings included two "echidnas", 3 ovals and 1 possible "snake". Extending over an area of approximately 3 x 2 m, the site lies 20 m from the edge of the shallow cutting for Mona Vale Road. During the survey, re-identification of this site led to the discovery of another small engraving as part of this group. The additional engraving was of an unidentified form consisting of several holes, some of which had been joined to form a groove. On the northern side of Mona Vale Road, on a small island of sandstone elevated a metre above the road surface, are two small engravings. These figures include an anthropomorph at the eastern extremity of the exposure, on a lower piece of sandstone, and an unidentified form 17m to the west of this. Both figures are about 6m away from the edge of the road and, although fairly weathered, are quite clearly visible in oblique light.
Site 5 # 45-6-1616	This small shelter is located south of Mona Vale Road below the edge of an expanse of sandstone that caps a knoll at the end of the ridge. Cavernous weathering has created a rounded cavity about 4m long, 2.5m deep and at

	least 2m high. The back wall is quite smooth, with a few shallow depressions above the ridge that starts about 1.5 m above the floor. These areas have a total of eight red hand stencils on them, of which only three are complete. The panel starts 1.65 m above the floor and extends over a length of 2.10 m. A little European graffiti is present in white chalk, but on the whole the site is quite undisturbed, especially considering its proximity to the road. A large exposure of sandstone occupied much of the floor area within the overhang, however, potential archaeological deposit was identified along the dripline, extending for 2 m beyond the shelter. The surface in this area was quite level, consisting of unsorted sediment more than 30 cm in depth. This area was considered to possess good potential for cultural remains.
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Table 3.2 Koettig's Recorded Sites

3.2.2 Archaeological Survey at Ingleside

Byrne (1984) conducted a survey over a 3 ha study area on the north-east side of a north-west/south-east oriented spur roughly 3 km west of Mona Vale Beach. The area of investigation lies to the west of the Ingleside Road study area. Background research identified several sites within the region. These are summarised in Table 3.3 below.

Site ID	Description
Foleys Hill # 45-6-827	An open art site with engraved motifs. "This group comprises a large emu, six shields, a boomerang adjoining it, a large leaf-shaped figure, almost too broad for a boomerang; there are three figures of what may be deities, seven footprints, an eel, and a fish with a spear in it, and a portion of some large fish which has nearly weathered away" (Campbell 1899:34 in Byrne 1984).
Foleys Hill # 45-6-826	An open art site of 4 engravings. "...four men, the largest man holding a fish in his left hand, and a boomerang is below the right arm" (Campbell 1899:33 in Byrne 1984)
Foleys Hill # 45-6-95	This is presumably another open art site, however, there is some confusion as to the nature of the site, which has not been relocated since it's initial (partial) recording in 1899 (Byrne 1984)
Foleys Hill # 45-6-828	An open art site of three engravings. The engravings included a cicada – 4 feet long (the wing on the right was deeply cut but the remainder badly weathered), a kangaroo – 4 feet 6 inches long, and a fragment – may be a kangaroo.

On the basis of his research, Byrne predicted higher potential for rock engravings in the north-western portion of the study area. This section was characterised by suitable rock outcrops and was in close proximity to a previously recorded, significant engraving site (# 45-6-827) occur. An intensive foot survey of the area identified one previously unrecorded site, this being an open art site composed of a pair of small (15 x 11 cm) engraved ovals 30 cm apart, and two short (70 cm) parallel grooves 12cm apart. The site was considered by Byrne to be of only slight archaeological significance. No lithic artefacts or shelters were identified within the study area.

3.2.3 Archaeological Survey of the Burrawang Ridge Estate at Ingleside, NSW.

Mary Dallas (1997) undertook survey work at the Burrawang Ridge Estate, Ingleside, in 1997 to the north of the current study area. Comprising 28.7 ha of vacant bushland, the study area was bordered by Ingleside Park, existing housing and farms and Mona Vale and Boundary Roads. The development of the land proposed to sub-divide the area into 14 x 1 ha lots with the remaining 14.7 ha remaining as common open space. The 14 x 1 ha lots were comprehensively surveyed, whilst the proposed area of open space was subject to a sample survey. The survey identified three Aboriginal sites, these consisting of a shelter with occupation deposit, and two art sites with Potential Archaeological Deposits (PAD).

Site ID	Description
BR1 # 45-6-2590	Located within a sandstone overhang 12m in length x 2m deep x 4 m high, site BR1 contained a waterworn black basalt manuport and a surface scatter of fragmented shell. The site also included substantial undisturbed deposit, which was assessed as having potential to yield further archaeological remains.
BR2 # 45-6-2592	Site BR2 was identified within a sandstone overhang on north facing rocky midslopes above Narrabeen Creek. Overhang dimensions of 21 m in length x 3 m deep x 2.5 m high protected a small panel of charcoal drawings, including a fish, a possible boomerang and two indeterminate figures. The shelter floor included two areas of PAD (potential occupation areas), which were recommended for test excavation to determine the presence or absence of a cultural deposit. The site appeared in exceptional condition with no evidence of disturbance.
#45-6-1616	During the survey, Dallas also relocated a previously recorded Shelter with Art. Situated near Mona Vale Road, the site contained complete and partial red hand stencils on a rear wall panel and a small area of PAD (refer to site 5 in Koettig summary above). Minimal levels of disturbance were recorded within the shelter.

All three sites were assessed as significant given their relative rarity. Within the Sydney Basin, sheltered overhangs with undisturbed potentially archaeological bearing subsurface remains are considered a depleted resource. The sites located and relocated by Dallas have been rated as having high archaeological significance due to the potential for such undisturbed archaeological deposit. In addition, sites 45-6-1616 and BR2 are also considered to be a rare as the majority of art sites in the region are open engravings.

The proposal was assessed to impact on the sites as development would increase the levels of visitation to open space areas. Mitigation measures included test excavation to determine the extent of subsurface cultural resources within the study area and deterrent plantings to reduce access (and therefore vandalism) to the sites. The implementation of a periodic monitoring programme was also recommended.

3.2.4 *Aboriginal and European Heritage Assessment, Proposed Upgrade of Mona Vale Road Ingleside.*

In 1998 another survey was conducted by Bobbie Oakley and Associates for the proposed upgrade/widen of Mona Vale Road. No new sites were identified as a result of the survey work. There was one registered aboriginal engraving site (# 45-6-71) within the study area, which was not impacted by the proposal.

3.2.5 *Summary*

The majority of known sites in the Ingleside area are engravings; however, this is a likely reflection of historic survey and recording patterns. W.D. Campbell, Surveyor for the Colony of New South Wales, identified and recorded many engravings in the Sydney Basin, publishing a monograph of the sites he had recorded in 1899. Subsequent surveys by F.D. McCarthy and Ian Sim expanded the corpus on engraving sites within the region. According to Koettig (1981) and Dallas (1997) their work, though extensive, was not exhaustive. Dallas notes that comprehensive archaeological surveys, such as that by Gunn (1992), generally result in the identification of further sites. Gunn's work in Garigal National Park identified 31 sites previously unrecorded sites, thirteen of which were considered to possess significant elements based on known site types in the immediate vicinity. The wide range of site types located by Gunn support that the recorded predominance of engravings may not reflect an Aboriginal site patterns (Dallas 1997:11).

Previous studies have also identified geology and topography as a determining factor in site location. Sandstone formations are highly suitable for painted and engraved art and grinding surfaces, consequently the distribution of these types of sites is often limited to areas with an appropriate geology. Additionally, weathering patterns of geological formations also influences site distribution. Sandstone may weather to overhangs, with occupation sites

commonly found in such areas as the resultant shelters provide cover from the elements. Slopes of less than 5% are likely to have been favoured for camping, thus the extensive areas of steep slopes within the region have low potential for open camp sites. Proximity to water may also influence site distribution. Stone grinding is a process often enhanced by water, hence stone grinding surfaces are usually found adjacent to, or near waterholes.

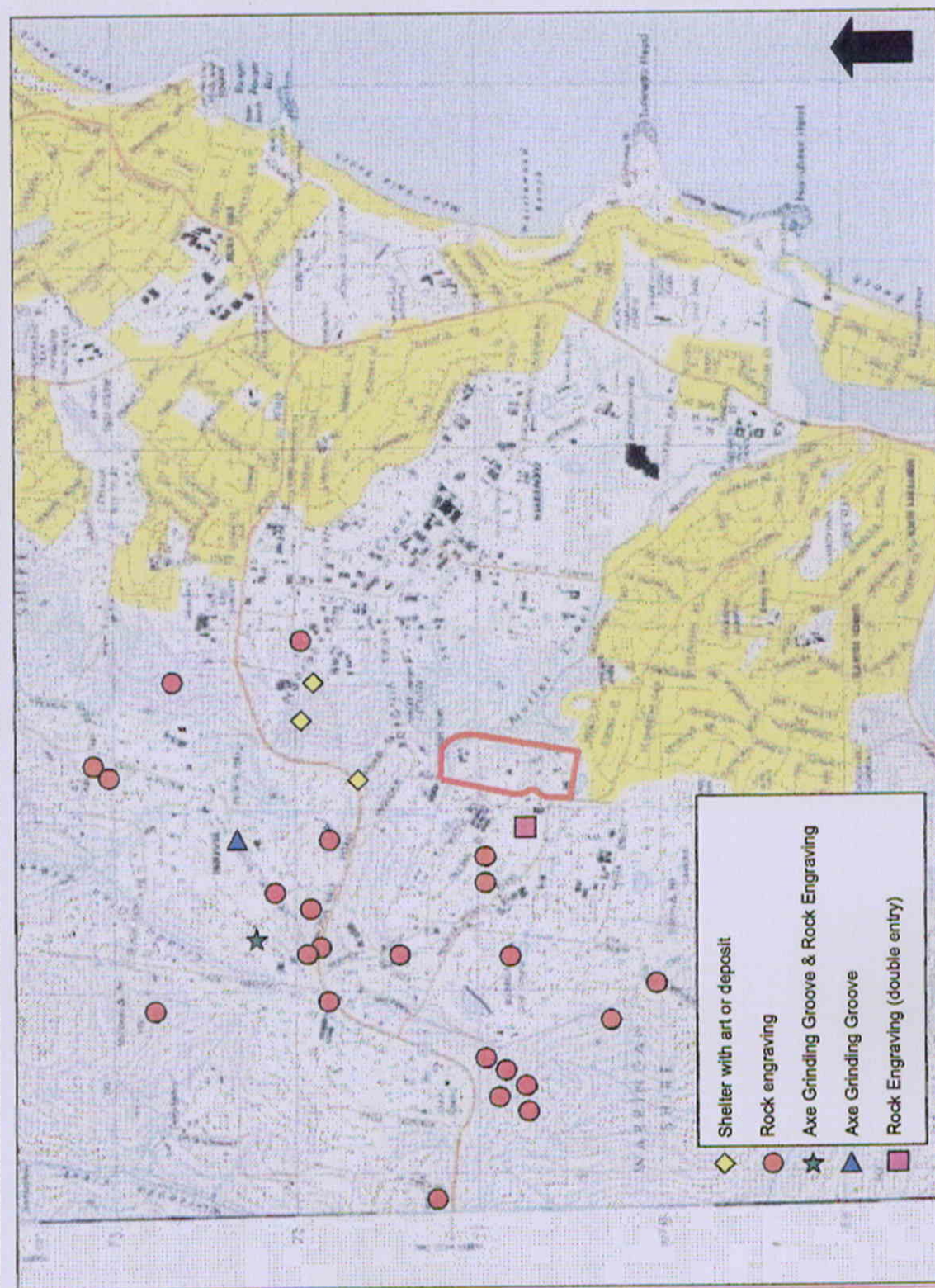


Figure 3.1

Registered Aboriginal Sites within the vicinity of the Study Area

3.4 Summary of Site Types Common in the Pittwater Area

On the basis of registered archaeological sites in the local area and the results of past archaeological investigations, a number of site types are likely to occur in the study area. These include:

- **Art Sites**

The distribution of art sites relates to the occurrence of suitable rock outcrops and surfaces. Painted or drawn art may be located on ceilings or rear walls of shelters. Motifs may be drawn in charcoal or painted in ochres or white clays. Shelters may have associated archaeological deposit containing occupation debris.

- **Shelters Sites with Archaeological Deposit**

Sheltered overhangs result where weathering has resulted in suitable caves or recesses in boulder outcrops or cliff lines. Weathered Hawkesbury sandstone formations commonly produce shelter sites which are usually defined as having sufficient headroom and depth to afford protection from the elements. These sites which may also contain art, often contain occupation evidence such as hearths, stone artefacts and/or shell midden deposit incorporated in the depositional layer.

- **Axe Grinding Grooves**

These are grooves which result from the manufacture or the maintenance of the working edge of a ground edge stone tool. They are often found where suitable sandstone is exposed in or adjacent to creeklines on flat stone platforms to enable the wet-grinding technique.

- **Rock Engravings**

Engraving may be produced on flat, even rock surfaces in either open or sheltered locations. They are often situated on vantage points along ridge lines and at creek headwaters but can also occur on any suitable fine grained sandstone surface. Engraved designs include depictions of animals, fish, birds, humans, mythical beings and footprints.

While open camp sites and isolated finds are not recorded in the area, these are commonly found across the landscape on all landforms. Open camp sites are surface sites commonly referred to as open artefact scatters. They may include archaeological remains such as stone artefacts, faunal and shell remains, charcoal and baked clay. Occasionally, such sites contain hearths. Surface scatters are usually exposed by erosion, agricultural events and vehicle and animal tracks in areas where surface visibility is increased due to lack of vegetation. Surface sites can also be indicators of associated subsurface archaeological deposits which may remain intact dependant on the degree of land disturbance which has occurred in the past.

Isolated artefacts which have no associated archaeological context. Isolated finds may be the result of either opportunistic resource use or discard.

3.6 Impact of Past Land Use Practices on the Archaeological Resource

Within the study area, it is noted that properties along the western boundary on Ingleside Road have undergone the greatest degree of land disturbance through residential development, the installation of associated water and power services and road construction and agricultural and quarrying activities. Beyond the escarpment to the east however, the landscape has remained relatively intact probably because of its steep topography and rugged terrain.

As a result of previous land use practices in the study area, the archaeological resource in the western half of the site, atop the escarpment is likely to have been affected by vegetation clearance, associated erosion, stock grazing, ploughing practices and more severe quarrying activities. Land clearance is commonly responsible for the removal of remnant scarred trees which may have survived natural destruction through bushfire. Vegetation clearance may also cause localised disturbance of surface and subsurface archaeological deposits while ploughing may affect the archaeological integrity of a site by mixing material in the top 10-15cm of topsoil (depending on the depth of the ploughshare). Ploughing may also damage subsurface rock engravings where topsoil is very shallow.

3.7 Predictive Statement

In general, locational data for sites is based on local topography, access to and distance from permanent water, and degree of previous land disturbance.

The landscape within which the study area is located, may have supported a rich resource base. The local area contains several reliable watercourses that would have been primarily utilised by Aboriginal people for food, medicines and raw materials for tools, utilitarian items and decorative items. The area is however, is constricted by its steep topography and rocky landscape sloping sharply towards the Warriewood Valley below. The local sandstone geology however, may have provided suitable shelter from the elements and the escarpment may have served as a vantage point over the valley below.

Based on site types, frequencies and distribution across the wider landscape, rock engraving sites, grinding grooves and shelter sites are the site type most likely to occur within the Ingleside study area.

The potential for intact Aboriginal cultural remains to exist in the study area is predicted to be higher in undisturbed areas (i.e. the eastern half of the site) on fine grained sandstone outcrops and/or in shelters with easy access to fresh water and protection from the weather. The extent of any associated subsurface potential archaeological deposits (PAD) however, remains dependent on the suitability of overhangs for shelter and whether the shelter floors are soil or sandstone based.

4.0 ABORIGINAL ARCHAEOLOGICAL SURVEY

4.1 Survey Methodology

On the basis of the predictive statement which linked archaeological site distribution with creeklines and Hawkesbury sandstone outcrops, and land disturbance information, the one day inspection aimed to cover areas considered to have archaeological potential.

Prior to inspection, the degree of previous land disturbance within the study area was calculated to assist with inspection methodology. Archaeological site destruction is likely to have already occurred throughout the western half of the study area on the escarpment due to previous land use, particularly along Ingleside Road and along the dammed tributary of Mullet Creek near Wesley Street.

4.1.1 Degree of Disturbance

For the purposes of assessing the archaeological potential of the proposed Ingleside study area, the degree of disturbance across the site has been estimated. Four categories have been assigned (refer to Table 4.1) with associated impacts of past land use practices on the archaeological resource summarised for each category.

Degree of Disturbance	Impact Description	Impact on Archaeological Resource
Undisturbed	No apparent disturbance to original land surface	<i>In situ</i> archaeological surface sites and subsurface cultural deposits may be present
Low	Non-mechanical vegetation clearance and stock grazing	Some archaeological surface sites such as scarred trees may be removed. Artefact scatters and subsurface archaeological material will retain some spatial integrity although localised displacement is expected.
Moderate	Mechanical vegetation clearance and cultivation (ploughing), sheet/gully erosion	Archaeological subsurface engraving sites may be damaged by ploughing or exposed to the elements by erosion. Archaeological subsurface deposits may be present, although localised spatial displacement and artefact damage likely; <i>in situ</i> deposits may remain beyond plough zone.
Severe	Removal of topsoil via excavation for residential development, road and infrastructure construction, landscaped gardens, sheer erosion through natural causes and development	While archaeological sites may be destroyed, remnant dispersed archaeological material may survive. The context of such material may be unknown.

Table 4.1 Disturbance Categories

The study area is characterised by a high sandstone escarpment and an associated steep rocky slope, interspersed with three small creeklines. Six broad survey units were identified within the study area based on landform and degree of land disturbance. These were:

1. Lot 11
2. Escarpment edge through Lots 10, 9, 8 and 6
3. Steep eastern slope through Lots 10, 9, 8 and 6
4. Lot 1 and proposed walking track route
5. Escarpment edge through Lots 2 and 3 in the vicinity of the northern tributary of Mullet Creek
6. Lot 79

The current proposal is focussed on the development of land atop the escarpment (Lots 2 to 5, 79 and 83 to 85 which forms the highest point within the study area. The remaining properties (Lots 6, 8-11) are located south of the main escarpment and contain large sandstone boulders which give way to gentler terrain closer to the dammed creekline on Wesley Street. As discussed, this general half of the site represents the area of greatest disturbance within the study area. While the eastern portion of the study area will remain undeveloped, a walking track will be established across the steep slope below the escarpment. This walk will cross the small tributaries which flow eastward to the main branch of Mullet Creek.

The inspection therefore concentrated on landform features likely to contain archaeological sites which included:

- sandstone outcrops, platforms and overhangs;
- tributaries associated with Mullet Creek;
- areas where the original land surface was thought to be relatively intact;
- high points in the landscape which may have served as vantage points;
- areas of substantial ground exposure; and
- areas where moderate and high disturbance had also occurred to establish whether archaeological material was still in evidence.

4.1.2 Ground Surface Visibility

As part of the survey methodology, the level of ground surface visibility for each survey unit is estimated to assist in calculation of the effectiveness of survey coverage across the study area. Ground surface visibility (gsv) refers to the amount of ground surface which can be observed during the survey. Visibility can be influenced by natural processes such as erosion or the character of native vegetation (such as seasonal die back). Visibility can also be influenced by land use practices such as ploughing or grading. Visibility is expressed in terms of percentage of the ground surface that is visible to the observer on foot. An assessment of the surface visibility is useful in describing the general conditions of the area surveyed.

Obtrusiveness is used to describe to how conspicuous a site is within a particular landscape, and thus the chances of finding a particular site. For example, an artefact scatter is generally not obtrusive, especially in areas of high vegetation or scrub cover, yet a scar tree or chimney generally is obtrusive.

The following table (Table 4.2) provides a guide to the assessment of ground surface visibility based on a percentage rating. It is by no means an objective method of assessment, and it is open to the assessment and interpretation of the field observer. However, it can be regarded as simply a guide to describing the ground surface visibility in a standard format.

Ground Surface Visibility	Percentage Rating
Very Poor – heavy vegetation, scrub, foliage or debris cover, dense tree or scrub cover. Soil surface of the ground difficult to see.	0-9% ground surface visible
Poor – moderate level of vegetation, scrub, and/or tree cover. Some small patches of soil surface visible in the form of animal tracks, erosion, scalds, blowouts etc, in isolated patches. Soil surface visible in random patches	10-29% ground surface visible
Fair – moderate levels of vegetation, scrub and/or tree cover. Moderate sized patches of soil surface visible, possibly associated with animal /stock tracks, unsealed walking tracks, erosion, blowouts etc. Soil surface visible as moderate to small patches, across a larger section of the study area.	30-49% ground surface visible
Good – moderate to low level of vegetation, tree or scrub cover. Greater amount of areas of soil surface visible in the form of erosion, scalds, blowouts, recent ploughing, grading or clearing.	50-69% ground surface visible

Very Good – low levels of vegetation/scrub cover. Higher incidence of soil surface visible due to past or recent land-use practices such as ploughing, grading, mining etc.	70-89% ground surface visible
Excellent – very low to non-existent levels of vegetation/scrub cover. High incidence of soil surface visible due to past or recent land use practices, such as ploughing, grading, mining etc.	90-100% ground surface visible

Table 4.2 Ground Surface Visibility

An Aboriginal heritage survey of the study area was carried out on 16th October 2003. Megan Mebberson (Senior Archaeologist, Austral Archaeology), Allan Madden (MLALC Cultural and Education Officer) and Adam Madden (MLALC Sites Officer) conducted the field survey on foot. The inspection was undertaken mid morning in sunny conditions.

Survey pegs defining the boundaries of each Lot and the route of the surveyors through bushland assisted the inspection. A topographic map showing the proposed lot layout and probable building locations supplied by Drummond Parmenter was also used in the field to guide inspection.

Overall, survey was restricted to rough pedestrian and vehicle tracks throughout the site and newly established routes across the western boundary of Lots 8 to 11 and through Lots 2 to 5 created by the surveyors whilst pegging the extent of each lot. The vegetation encountered was very dense and the terrain quite rugged as a result of the abundant sandstone outcrops along the main escarpment. All accessible sandstone platforms, boulders and overhangs were inspected in naturally filtered sunlight. A section of each of the three tributaries, which were all very narrow (less than a metre wide) was also inspected. The two northern creeklines had steeply sloping banks, the middle tributary being completely covered along the inspected section by large sandstone boulders. Inspection route through the study area are shown in Figure 4.1.

While survey was hindered by the rugged terrain and dense vegetation, the major landform features which occur within the study area were sampled. These included the main escarpment area, the small tributaries of Mullet Creek, and both the steep easterly facing slope below the escarpment and the hilltop above this feature.

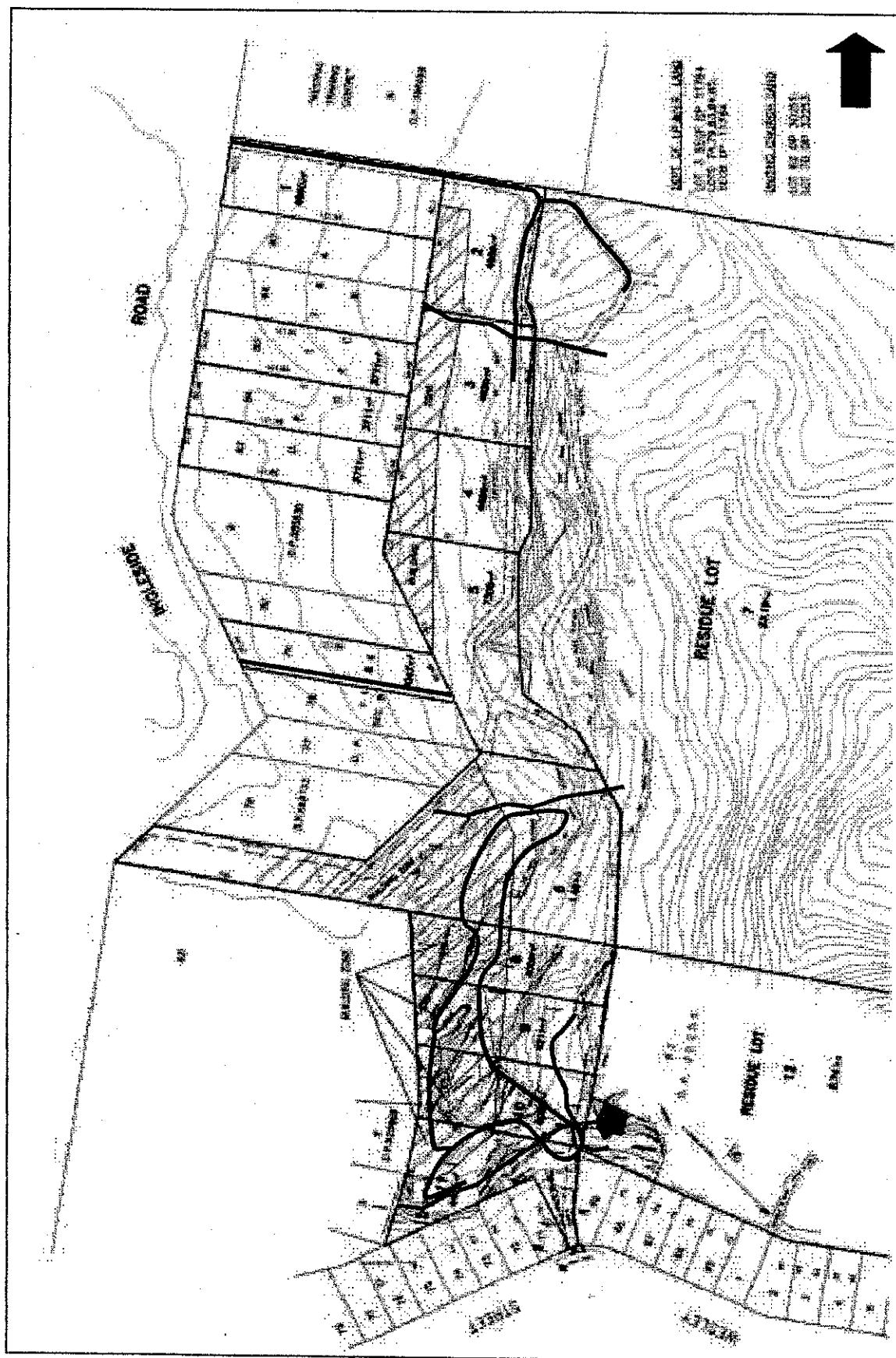


Figure 4.1 Survey Transects

4.2 Survey Results

Survey of the study area is now outlined by individual survey units with specific areas of archaeological sensitivity subject to detailed inspection (Area 1, 2 etc) described within each unit.

Survey Unit Descriptions

4.2.1 Unit 1 – Lot 11

The southern part of the site is defined by a modified creek line and its surrounding sandstone platforms and a gentle southerly facing slope close to the western property boundary. This slope is densely vegetated and inspection of this area was limited to narrow walking tracks (approximately 1 m wide) which crossed the creekline close to the access way off Wesley Street and headed west up slope. A wider fire trail/access road leading to the scout hall site was also inspected where sandy topsoil was exposed through vegetation and leaf litter. This route will probably be followed by the proposed access road into the site from Wesley Street. The cleared area surrounding the cement footing of the hall was also inspected.

Area 1 Banks of southern Mullet Creek tributary and associated slope

Topography flat expanses of sandstone and a gently southern facing slope

GSV	excellent – 90-100% on sandstone exposures very poor - <10% on vegetated slope
Disturbance	moderate - severe

This area was targeted for inspection as one of archaeological sensitivity by the presence of a small tributary of Mullet Creek where sandstone outcropping was evident. The proposed access road from Wesley Street will cross this creekline continuing north through this Lot to a disturbed building site where a scout hall once stood.

The first order creek tributary has been modified by the construction of two small dams just behind residences on Wesley Street. The dams suggests the drainage line is a reliable water source. The southern bank has also been modified, probably at the time of dam construction and was grassed and mown. The surrounding sandstone outcrops lining the northern bank were medium to coarsely grained sandstone (Plates 5.1 and 5.2). The immediate creek surrounds have obviously been affected by the dam construction and its proximity to residential development. It is unclear, however, how high the water level has been raised by the dam modification however, the breadth of the creekline has changed substantially in the dammed section. Further downstream the creekline is no more than a metre wide and it is difficult to estimate the original dimensions of the drainage line.

The exposed sandstone creek surrounds were inspected by the three field walkers. No surface Aboriginal archaeological features or sites were located in Area 1 in the dammed area or further east down stream around the Wesley Street access lane. There were substantial sandstone sheets within the creekline however, when viewed in filtered light, no engravings or grinding grooves were observed. The proposed building development will not impact this creekline however the access road from Wesley Street will cross it. The general area where the crossing is likely to occur was inspected on either side of the creek line and no archaeological evidence was found.



Plate 4.1 View of upper concrete dam wall on western boundary of Lot 11 from northern creek bank

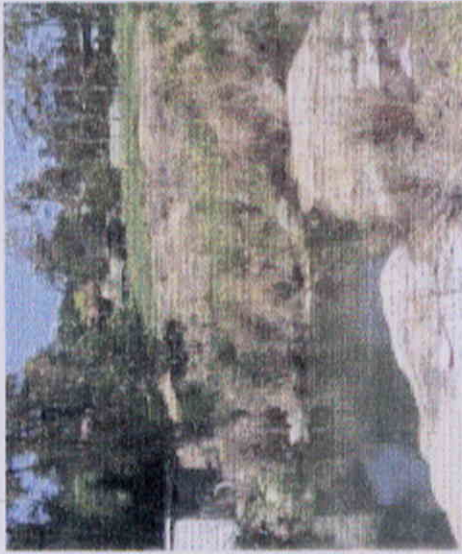


Plate 4.2 View of dammed portion of southern tributary looking south to Wesley Street showing modified creek bank

Area 2 exposed area of sandstone and remnant building block in north west corner of Lot 11 at edge of escarpment

Topography	flat expanses of sandstone to edge of escarpment
GSV	good – excellent 80-100% on sandstone exposures
Disturbance	very good - 80% in cleared scout hall grounds moderate - severe

A rough vehicle track from the Wesley Street property entrance was traversed to the highest point along the escarpment edge where a cleared area and a concrete building pad were encountered. The site, on which a scout hall was originally built, was powered by a transmission line (power poles still visible) running south to Wesley Street. Only the concrete foundation pad remains however, subsurface drainage connections are evident, suggesting the site has been excavated to some degree. The cleared area south of the building pad has exposed sandstone beneath the sandy light brown soil. The extent of this modified area was approximately 30 x 15 m with the building pad roughly less than 10 m from the edge of the escarpment which drops off very steeply (Plates 5.3 and 5.4). No overhangs were observed beneath the cliff face in this area.

From the edge of the escarpment, there is a clear view of the coastline and the valley below making this an ideal vantage point. The remainder of the escarpment and the free standing sandstone boulders associated with this feature would afford the same views.

The exposed sandstone platforms and the exposures created within the vehicle track were inspected. No surface Aboriginal archaeological features or sites were located in Area 2 and the building pad was considered highly disturbed.



Plate 4.3 View from the concrete building pad looking south across scout hall grounds



Plate 4.4 View over the escarpment looking east to the coastline from the building pad

4.2.2 Unit 2 Escarpment edge through Lots 10, 9, 8 and 6
Inspection of these properties was limited to the surveyors' track cut through the bush along the eastern edge of the escarpment. The terrain here was very rocky and difficult to traverse easily. Generally the topography was rugged and contained large rock platforms and boulders with intermittent views of the coastline possible through the vegetation. The western boundary of the Lots was approximately 10m away from the inspection area. Through Lot 9, the three field walkers made their way down through a rock split (see Plate 4.5) and walked below the escarpment through Lot 8 to Area 4 in Lot 6.

The proposal includes the construction of dwellings in all four Lots. While construction plans are only indicative at this stage, it is assumed that dwelling design would consider the conservation of the massive sandstone formations and have minimal impact on the landscape in terms of foundations, given the rugged nature of the topography.

Area 3 sandstone boulders and rock faces along western property boundary

Topography	massive sandstone boulder, small weathered ledges and rock faces
GSV	good – excellent 80-100% on sandstone exposures
Disturbance	relatively undisturbed

This area was targeted for inspection as one of archaeological sensitivity due to the propensity of sandstone outcropping. All sandstone platforms, ledges and rock faces were inspected in filtered light for engravings and art. The sandstone encountered along the inspection route was quite coarse with small pebbles visible within the stone. A few flat surfaces were observed and inspected (Plate 4.6) but no evidence of engravings found. The grey sandstone was deemed to be of poor quality sandstone for producing art sites (Allan Madden, pers. comm. 22.10.03). There was a clear view to the coast though from the boulder seen in this photo in Lot 9.

The eastern face of the escarpment was viewed while descending the steep slope below the main rock formations in Lots 8 and 9. There were small areas of weathered sandstone along this face but no evidence of Aboriginal drawings and/or engravings was found.



Plate 4.5 Eastern edge of escarpment in Lot 9 where the rock face was searched for engravings and/or art in weathered sections



Plate 4.6 Rock platform inspected by Allan Madden immediately east of escarpment edge in Lot 9

Area 4 middle tributary of Mullet Creek

Topography massive sandstone boulders, small weathered ledges and rock faces, steeply side creekline

GSV Disturbance fair - 40% relatively undisturbed

From Area 3, field walkers made their way through the scrub below the escarpment, to a drainage line in Lot 6. The terrain was very rugged and consisted almost entirely of sandstone boulders. Adam Madden investigated the tributary higher upslope and reported that a small waterfall was visible running over weathered sandstone. Allan Madden commented that he had investigated this area several years ago and located two small overhangs under the waterfall however, no evidence of Aboriginal engravings, drawings or grinding grooves were identified (pers. comm. 22.10.03). Further downstream the creekline is hidden under moss covered boulders and the immediate creek area is very rocky and difficult to negotiate. No grinding grooves were identified along the sandstone banks.

The terrain around the steep rugged around the creekline suggests that while Aboriginal may have utilised the area for resources, it seems unlikely that they would have camped here or stayed for any length of time given the lack of level ground and the closed in nature of the creekline.

4.2.3 Unit 3 - Steep eastern slope through Lots 10, 9, 8 and 6

The inspection of this slope was guided by a narrow pedestrian path which ran south of the middle creekline along the length of this steep slope. The majority of the route passes through free standing sandstone boulders below the escarpment. The path traversed was less than a metre wide and was covered in leaf litter. A shallow rock overhang was inspected near the boundaries of Lots 9 and 10. No other overhangs were observed below the escarpment or elsewhere within the study area.

Area 5 shallow rock overhang

Topography weathered sandstone ledge on steeply sloping hillside

GSV Disturbance good - excellent 80-100% on sandstone exposures relatively undisturbed

As discussed, this was the only overhang encountered in the study area and was located several metres upslope of the established walking track. The face of the escarpment in the southern half of the site dropped quite severely with very few areas where overhangs or ledges had occurred. The rock rusty yellow coloured sandstone overhang inspected during

survey was approximately 3 m long and less than 1 m deep. While it was about 2 m high, a water trickle ran over the shallow overhang and thin soil floor was uncomfortably wet. The field walkers agreed that the overhang was unsuitable for camping and was highly unlikely to contain undetected subsurface archaeological deposits. No evidence of drawings or engravings were observed on the back of ceiling of the easterly facing overhang.



Plate 4.7 Shallow overhang observed from walking track in Lot 9/10

4.2.4 Unit 4 - Lot 1 and proposed walking track route

An existing rough walking track running along the northern boundary of Lot 1 on Ingleside Road heading down slope in an easterly direction was inspected. This Lot will be developed and a formal track established along the northern boundary which runs around the more gently sloping end of the escarpment to join Wesley Street. The track will cross all three tributaries on the steep slope below the escarpment.

Again, survey of this area was guided by existing and newly cut tracks through the dense bushland (Plate 4.8) with minimal land surface visibility. The track followed was less than a metre wide with areas of sandy topsoil and exposed sandstone observed. Overall, ground surface visibility was very poor along the tracks and non-existent beyond this. An established vehicle track veered north around the eastern boundary of the Westpac Training Centre (outside the study area) crossing a more substantial creekline which had been concreted as a stabilising measure, probably for use by fire vehicles (Plate 4.9). The surrounds of this creek were also inspected but no archaeological material found. The proposed walking track which heads south from the edge of Lot 2 was not marked during survey. As the vegetation was so dense and ground surface visibility nil as a result, the northern section of this track was not surveyed.



Plate 4.8 Dense vegetation in the vicinity of Lots 1 and 2. Adam Madden is standing on the rough track cut by surveys to mark land boundaries.



Plate 4.9 The modified creekline outside the study area to the north which had been concreted, probably to allow vehicle access.

4.2.5 Unit 5 - Escarpment edge through Lots 2 and 3 in the vicinity of the northern tributary of Mullet Creek

A small section of these Lots was inspected due to the inaccessibility created by the vegetation. Ground surface visibility was nil and thus, inspection of this area which began from the northern boundary of Lot 2, was abandoned at the creekline in Lot 3. As a result of the thick vegetation, Lots 4 and 5 were not inspected.

Area 6 creekline and associated southern facing slope

Topography moderately sloping easterly facing slope, narrow creekline with sharply sloping banks.

GSV very poor - <10%
Disturbance relatively undisturbed

The roughly cut surveyors' track was followed to the creekline located in Lot 3. Vegetation surrounds the creekline which is less than a metre wide. No ground surface exposures were identified along the creekline as the immediate banks were covered in leaf litter. No evidence of Aboriginal occupation was located. The potential for the area to yield archaeological material is considered low, given the size of the stream and the unsuitability of the immediate surrounds as a camping place.

4.2.6 Unit 6 - Lot 79

Four Lots fronting Ingleside Road are proposed for development. These are Lots 79, 83, 84 and 85 of which only Lot 79 was accessible through a vehicle track. The remaining three Lots were densely vegetated and inspection was not attempted on the basis of limited ground surface visibility as experienced in Lots 1 to 3.

Area 7 fire trail along southern boundary of Lot 79

Topography relatively flat to gently sloping area atop main escarpment

GSV fair - 40%
Disturbance low

This Lot is next to an established residential property. On the basis of aerial photos, it is probable that this and the other three Lots along Ingleside Road have been subject to land clearance and other possible ground disturbance associated with local agricultural practices. The shrubbery within the Lot is relatively young suggesting land clearance. Several older trees along Ingleside Road appear to be planted (Plate 4.10).

The vehicle trail which runs along the southern Lot boundary was approximately 2 m wide and was generally sandy with patches of sandstone exposed through the shallow topsoil (Plate 4.11). Apart from this area of exposure, no further ground exposures were observed. The track ended about 10 metres west of the steep break of slope north of the escarpment. This track also intersected with the surveyor's route through Lot 5 which extended across the western edge of all Lots on the escarpment.

No Aboriginal sites or features were identified. It is considered unlikely, given the extent of current ground cover and dense vegetation, that Aboriginal people would have camped in an area which was probably more thickly vegetated in the past away from running water. In addition, no large areas of suitable sandstone for engravings were encountered along this track or that on the northern boundary of Lot 1.



Plate 4.10 view north from Lot 79 on Ingleside Road



Plate 4.11 Fire trail running along the southern boundary of Lot 79, looking east to escarpment

4.3 Effective Survey Coverage

The effective survey coverage represents an estimate of the level ground surface visually examined during the field survey. It can be estimated by dividing the amount of area actually surveyed by the estimated ground surface visibility rating. It does not reflect the amount of the area that was surveyed, but represents an estimate of the area in which the ground was examined. The effective survey coverage for the current study is presented in Table 4.3 below.

Survey Unit	Ground Surface Visibility Rating	Size of Survey Unit	Effective Survey Coverage
1: Lot 11	40%	4 455 m ²	1 336 5m ²
2: Escarpment in Lots 10, 9, 8 and 6	10%	13 539.5m ² (approximately 0.5 of total Lot area)	1 354 m ²
3: Steep eastern slope in Lots 10, 9, 8 and 6	10%	13 539.5m ² (approximately 0.5 of total Lot area)	1 354 m ²

4: Lot 1 and proposed walking track route	5%	4 890 m ²	244.5 m ²
5: Escarpment in Lots 2 and 3 around tributary of Mullet Creek	<5%	9 100 m ²	455 m ²
6: Lot 79	5%	4 890 m ²	244.5 m ²

Table 4.3 Summary of Effective Survey Coverage

Overall, while effective survey coverage was limited as a result of the inaccessibility of the study area, the major landform features were sampled and a broad picture of the area's potential to yield archaeological sites gained despite minimal ground surface visibility.

4.4 Archaeological Survey Results

As discussed, no identified Aboriginal features or sites were recorded during survey.

This does not indicate that Aboriginal sites are not present in the area. Ground surface visibility across the study area was variable but overall, the inspected areas had limited ground surface exposures however, within these exposures, visibility was fair to good. The results of the survey are therefore not unexpected.

Despite this, the small tributaries of Mullet Creek are considered to have limited archaeological sensitivity as places where Aboriginal people may have visited for resources (see Figure 4.2). While it is unlikely that substantial occupation areas are present within the study area, evidence of visitation to these waterways cannot be ruled out and therefore direct impact to should be avoided where possible. The low level of previous ground disturbance across the eastern section of the study area below the escarpment should also be considered when estimating the potential for intact archaeological sites to remain within the study area. Consequently, this half of the site, which will largely remain as open space, retains more potential, although limited given the rugged terrain and steep topography, than the western half of the site along Ingleside Road.

The potential archaeological and environmental values of the site should therefore be considered when determining specific housing locations and design.



Figure 4.2 Areas of Archaeological Sensitivity

4.5 Conclusions

Of the six areas inspected, no Aboriginal objects or sites were located. The three tributaries which run through the study area however, were identified as having limited Aboriginal archaeological sensitivity. These results are summarised in Table 4.4.

Survey Area	Summary of Heritage Results
1: Lot 11	No surface Aboriginal heritage sites identified within the proposed development area. The modified creek line along the southern boundary of this Lot has limited archaeological sensitivity and impact should be avoided
2: Escarpment in Lots 10, 9, 8 and 6	No surface Aboriginal heritage sites identified within the proposed development area. The creek line within Lot 6 has limited archaeological sensitivity and impact should be avoided
3: Steep eastern slope in Lots 10, 9, 8 and 6	No surface Aboriginal heritage sites identified within the proposed development area. No areas of potential archaeological sensitivity identified.
4: Lot 1 and proposed walking track route	No surface Aboriginal heritage sites identified within the proposed development area. No areas of potential archaeological sensitivity identified.
5: Escarpment in Lots 2 and 3 around tributary of Mullet Creek	No surface Aboriginal heritage sites identified within the proposed development area. The creek line within Lot 3 has limited archaeological sensitivity and impact should be avoided
6: Lot 79	No surface Aboriginal heritage sites identified within the proposed development area. No areas of potential archaeological sensitivity identified.

Table 4.4 Summary of Results in Survey Units.

5.0 ASSESSMENT OF CULTURAL SIGNIFICANCE

5.1 Introduction to the Heritage Assessment Process

An assessment of significance seeks to determine and establish the importance or value that a place, site or item may have to the community at large. The concept of cultural significance is intrinsically connected to the physical fabric of the item or place, its location, setting and relationship with other items in its surrounds. The assessment of cultural significance is ideally a holistic approach that draws upon the response these factors evoke from the community. These standardised aspects of significance assessments are generally applied to sites, places or items that have tangible historic structures or relics visible at the site, and where there is a general understanding of the extent of the historic resources.

Archaeological sites require a different approach to significance assessment because the extent of the heritage resource and the degree to which it can contribute to our understanding of history is not fully known at the outset. It is the significance of the potential of the site to reveal information about the past that needs to be assessed when establishing the cultural significance of archaeological deposits. Similarly, it is the significance of the type of information that can be revealed by the archaeological deposits, especially where the information is not available through any other source and the contribution it can make to our understanding of a place, which may also be of cultural heritage significance.

Despite these differences the same general set of criteria are used to assess cultural significance of different types of heritage resources.

5.2 Basis for Assessment of Aboriginal Sites

The NSW National Parks and Wildlife Service assessment criteria for archaeological significance are based on the criteria established by the AHC for assessment of items for inclusion on the RNE. The AHC criteria have been developed to deal specifically with archaeological resources and have been refined to:

- A) **Research Potential.** This criterion is designed to qualify the significance of potential research which may be carried out at a site. Significance is apportioned according to the amount of new information which might be contained in the deposit, rather than the potential to yield a large number of artefacts. A site may have high significance under this criterion if it has an intact stratigraphic sequence and good integrity, the potential to provide a chronology extending into the past, or if it is connected to other sites within the region. Within this criterion are the subsets of representativeness and rarity. Representativeness is the ability of the site to demonstrate a representative type of site or deposit. This is important to maintain a contingency sample of all site types. Rarity is often described within the framework of representativeness as it relates to the distinctive features of a site which set it apart from similar sites.
- B) **Educational Potential.** This criterion allows the educational value of a site to be considered as a component of significance. Under this criterion, an archaeologist may assess the potential of a site to educate the general public. NPWS has acknowledged that this criterion is open to misinterpretation by archaeologists who have the ability to convey the value of a site to other archaeologists. NPWS recommends that, in cases where significance is determined on educational potential, the onus is on the archaeologist go to the public for an assessment of this value.
- C) **Aesthetic Significance.** Aesthetic significance is not inherent in a place, but arises from the response that people have to it. It is pertinent to remember that this response can vary dramatically between cultures and social groups, therefore an assessment of significance based on aesthetic value should incorporate the views of different cultures.

For a full description of assessment procedures refer to the Aboriginal Cultural Heritage: Standards and Guidelines Kit (NPWS 1997). These criteria have been designed to deal specifically with the archaeological resource, however they do not provide a framework for the assessment of social significance to the Aboriginal community. For this reason, the criteria for assessment provided in the *Australia ICOMOS charter for the conservation of places of*

cultural significance (the Burra Charter) are sometimes also used to assess significance as they provide a framework for a more holistic assessment of significance.

5.2.1 *Aboriginal Landscape Values*

Allan Madden (MLALC) did not identify any potential landscape values in the study area.

5.2.2 *Assessment of Aboriginal Sites*

No Aboriginal objects or sites were located during survey that require assessment. It should be noted that all Aboriginal objects and places are protected under the provisions of the *NSW National Parks and Wildlife Act 1974*.

6.0 STATEMENT OF HERITAGE IMPACT

6.1 The Development Application and Potential Heritage Impacts

The current proposal for the rezoning of the subject site to allow subdivision thus creating ten rural residential blocks and provision of an access track connecting Wesley Street and Ingleside Road. This track would provide access for the Rural Fire Service, Pittwater Council and the general public. The proposal allows for the construction of dwellings on the four existing rural residential lots (Lots 79, 83, 84, 85 DP 11784) fronting Ingleside Road.

There are current no heritage constraints to the development application and as such, known heritage impacts. The creek lines have been identified as areas of sensitivity which should be avoided. As such, any track construction through the site should consider the preservation of their natural context to avoid further modification to these drainage lines.

8.0 RECOMMENDATIONS

The following recommendations and management strategies are recommended for the Ingleside site:

Recommendations

The following recommendations are provided for the development proposal:

1 – Limitation of works

In an effort to maintain the environmental integrity of the area, it is recommended that natural landscape features such as creeklines, their surrounds and substantial sandstone outcrop formations be avoided where possible to preserve the natural values of the landscape. Creeklines are considered areas of potential Aboriginal archaeological and cultural sensitivity as places frequented by Aboriginal people for food, water and raw materials where cultural material may remain undetected and as such, these areas should be avoided where possible.

2 – Vehicle and walking tracks

Proposed foot and vehicle access tracks through the site should where possible, follow existing paths and tracks to avoid further impact on the landscape. Where formal paths are established, the use of natural local materials should be considered in keeping with the surrounding bushland. If formal roads are proposed that impact archaeologically sensitive areas, then specific inspection of these routes and any alternate routes, may be required. Advice should be sought from a qualified archaeologist if situation should arise.

3 – Stop work provision

As required by the *NSW National Parks and Wildlife Service Act, 1974* in the event that Aboriginal archaeological material or deposits are encountered during any ground disturbance activities, works must cease immediately to allow an archaeologist to make an assessment of the find. The archaeologist may need to consult with the NSW National Parks and Wildlife Service regarding the finds.

9.0 REFERENCES

Publications

- Australia ICOMOS. 1999. *Australia ICOMOS charter for the conservation of places of cultural significance [the Burra Charter]*. Australia ICOMOS, Canberra.
- Byrne, D. 1984. *Archaeological Survey at Ingleside*. Unpublished technical report prepared for Warringah Shire Council.
- Chapman, G.A. and C.L. Murphy. 1989. *Soil Landscapes of the Sydney 1:100 000 Sheet*. Soil Conservation Service of NSW, Sydney.
- Dallas, M. 1997. *Archaeological Survey of the Burrawang Ridge Estate at Ingleside, NSW*. Unpublished technical report prepared for Deacons, Graham and James.
- Gunn, B. 1992. *Garigal National Park Aboriginal Heritage Study*. Unpublished technical report prepared for NSW NPWS.
- Haglund, L. 1986. *Assessment of the Prehistoric Heritage of the Warringah Shire*. Unpublished technical report prepared for Don Fox Planning Pty Ltd.
- Koettig, M. 1981. *Archaeological Survey for Aboriginal sites – Mona Vale Road (McCarrs Creek Road – Alan Street)*. Unpublished technical report prepared for Department of Main Roads.
- McCarthy, F. D. 1983. *Catalogue of Rock Engravings in the Sydney Hawkesbury District NSW (2 Volumes)*. NPWS, Hurstville.
- NSW National Parks and Wildlife Service, 1997(?). *Aboriginal Cultural Heritage, Standards and Guidelines Kit*. NSW NPWS, Hurstville.
- Oakley, B. 1998. *Aboriginal and European Heritage Assessment, Proposed Upgrade of Mona Vale Road Ingleside*. Unpublished technical report prepared for the RTA.

Acts

- Australian Heritage Commission Act, 1975*
- Aboriginal and Torres Strait Islander Heritage Protection Amendment Act, 1987*
- Environmental Planning and Assessment Act 1979*
- NSW Heritage Act 1977 (amended 1999)*
- New South Wales National Parks and Wildlife Act 1974*

APPENDIX A **CORRESPONDENCE WITH MLALC**



CONFIDENTIAL

ATTENTION: Allan Madden
Metropolitan Local Aboriginal Land Council
Suite 9/245 Chalmers Street
Redfern NSW 2016

FAX No. 02 8394 9733

FROM: Megan Mebberson
Austral Archaeology Pty Ltd
96 Palace Street
Petersham NSW 2049

Date: 26/09/2003

Telephone (02) 9568 6701

Facsimile (02) 9568 6702

No. of pages including this one: 4

Dear Allan,

Austral Archaeology has been commissioned by Drummond Parmenter Pty Ltd to undertake an Aboriginal cultural heritage assessment for the proposed subdivision of 14 parcels of land fronting Ingleside Road and Wesley Street at Ingleside (Lots 1-6, 8-11, 79 and 83-85) as indicated on the plan provided. The assessment will not include Lot 7 and the majority of Lot 12 as they will be designated Open Space, however, the area proposed as a walking track along the western boundary of Lot 12, will be investigated as it will be impacted by the proposal.

After consideration of the Brief, we noted several heritage issues that may shape the investigation. These include:

- the study area falls within three kilometres of the coast at Narrabeen, a landscape which is known to be archaeologically rich. The wider Pittwater area has been subject to extensive archaeological investigation in the last twenty years and as a result, the archaeology of this region is well-researched. In this respect, the likelihood of the study area yielding archaeological material is moderate to high given the demonstrated archaeological potential of the region;
- a tributary of Mullet Creek which drains into Narrabeen Lakes to the south east, is located within the study area. As such, the presence of a watercourse increases the potential for the presence of surface archaeological sites and associated subsurface deposits;
- the subject site is also underlain by Hawkesbury sandstone which outcrops as an escarpment along the boundaries of Lots 2 to 6 and 8 to 11. Consequently, there remains the potential for Aboriginal art sites and engravings which are known to occur within this geological formation;
- the local area also has the potential to yield "contact" sites where evidence of interaction between Aboriginal and non-Aboriginal people took place, thus providing a record of habitation continuity; and

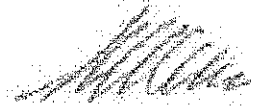
- the area to be assessed appears to be relatively undisturbed and as a result, there is a strong likelihood that the archaeological context of any remnant archaeological sites within the study area may remain intact.

At this stage, I am conducting the desktop study. I would like to survey the proposed subdivision area in the next two weeks depending on your availability.

Please let me know if Metro has any initial thoughts on the proposal and the archaeological and cultural significance of the study area, and how Metro is placed to undertake the survey.

You can reach me in the office on tel. 9658 6701, fax. 9568 6702 or by mobile on 0438 849056.

Thanks Allan,



Megan Mebberson
Senior Archaeologist
Austral Archaeology

FACSIMILE TRANSMISSION



CONFIDENTIAL

ATTENTION: Allan Madden
Metropolitan Local Aboriginal Land Council
Suite 9/245 Chalmers Street
Redfern NSW 2016

FAX No. 02 8394 9733

FROM: Megan Mebberson
Austral Archaeology Pty Ltd
96 Palace Street
Petersham NSW 2049

Date: 23/10/2003

Telephone (02) 9568 6701

Facsimile (02) 9568 6702

No. of pages including this one: 2

Dear Allan,

As requested, I am sending you the Lot and DP numbers for the properties we inspected and a plan of the area. The Lots are as follows:

Lots 1 to 6 (proposed lots);
Lots 79, 83 to 85 Sec. B-D.P. 11784 (existing lots); and
Lots 8 to 11 (uniting Church land).

These lots are all marked on the plan.

Our client is Drummond Parmenter Pty Ltd. The contact there is Malcolm Drummond. I would advise sending your invoice c/- Malcolm at the following address:

Level 3
371 A Pitt Street
Sydney, NSW 2000.

Thanks again for your assistance and I will be sending you a draft report late next week. You can reach me in the office on tel. 9658 6701, fax. 9568 6702 or by mobile on 0438 849056 if you have any question.

Cheers,

Megan Mebberson
Senior Archaeologist
Austral Archaeology

FACSIMILE TRANSMISSION



CONFIDENTIAL

ATTENTION: Allan Madden
Metropolitan Local Aboriginal Land Council
Suite 9/245 Chalmers Street
Redfern NSW 2016

FAX No. 02 8394 9733

FROM: Megan Mebberson
Austral Archaeology Pty Ltd
96 Palace Street
Petersham NSW 2049

Date: 27/10/2003

Telephone (02) 9568 6701

Facsimile (02) 9568 6702

No. of pages including this one: 1

Dear Allan,

I had an email from the Client late Friday requesting a draft report by Tuesday (tomorrow) to be lodged at Pittwater Council on Thursday. Is it possible to get a copy of your report faxed over to me today or early tomorrow for inclusion in my report? It would be greatly appreciated.

You can reach me in the office on tel. 9658 6701, fax. 9568 6702 or by mobile on 0438 849056 if you have any question.

Cheers,

Megan Mebberson ©
Senior Archaeologist
Austral Archaeology



6th November 2003

Allan Madden
Metropolitan Local Aboriginal Land Council
Suite 9/245 Chalmers Street
Redfern NSW 2016

Dear Allen,

RE: DRAFT ABORIGINAL ARCHAEOLOGICAL REPORT FOR ABORIGINAL CULTURAL HERITAGE INVESTIGATIONS AT INGLESIDE

Please find enclosed a copy of the abovementioned report for your comment. It would be greatly appreciated if you could send me your comments about the proposed development, our field investigations, your thoughts on the archaeological and cultural values of the site and our recommendations, in a letter to be included in the final report.

Please do not hesitate to contact me if you wish to discuss any aspect of this report. I can be contacted during business hours on Telephone 02 9568 6701, Mobile 0438 849 056

Yours Sincerely,

Megan Mebberson
Senior Archaeologist
Austral Archaeology Pty Ltd

-----Original Message-----

From: Megan Mebberson [mailto:megan@australarchaeology.com.au]

Sent: Friday, 28 November 2003 11:20 AM

To: 'Amadden@metrolalc.org.au'

Subject: Ingleside report

Allan,

I haven't received a report from you regarding the Ingleside survey we did over a month ago. Got a call from the client yesterday wanting to finalise this by Monday. Could you get me something ASAP please?

Most appreciated.

Cheers

Megan Mebberson
Senior Archaeologist
Austral Archaeology Pty Ltd
96 Palace Street Petersham NSW 2049
Telephone 02 9568 6701
Facsimile 02 9568 6702
Mobile 0438 849 056

-----Original Message-----

From: Megan Mebberson [mailto:megan@australarchaeology.com.au]

Sent: Tuesday, 2 December 2003 3:49 PM

To: 'Amadden@metrolalc.org.au'

Cc: 'Ingham planning'; 'Michael Barr'; Drummond Parmenter

Subject: Ingleside report

Allan,

Left a message for you in the office today. With your report, could you send an invoice please addressed to:

Department of Infrastructure, Planning and Natural resources
c/- Megan Mebberson, Austral Archaeology Pty Ltd
96 Palace Street Petersham NSW 2049

I will send a final version of the report to Ingham Planning by C.O.B. tomorrow and would like to include your letter.

Thanx Allan.

Megan Mebberson
Senior Archaeologist
Austral Archaeology Pty Ltd
96 Palace Street Petersham NSW 2049
Telephone 02 9568 6701
Facsimile 02 9568 6702
Mobile 0438 849 056

DRUMMOND PARMENTER PTY. LTD.

APPENDIX F

**Stormwater Management Effluent Treatment
& Disposal Report
(Patterson Britton)**

D.I.P.N.R.

Ingleside Rd, Ingleside Rezoning & Part Subdivision

Issue No. 1
OCTOBER 2004

Document Amendment and Approval Record

Issue	Description of Amendment	Prepared by [date]	Verified by [date]	Approved by [date]
1	Final Report	DS	MS	MT 8.10.04

Note: This document is preliminary unless it is approved by a principal of Patterson Britton & Partners.

Document Reference: rp5161-01dns_cc040929report.doc
Time and Date Printed 7 October 2004, 4:45 PM

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**Patterson Britton
& Partners Pty Ltd**

consulting engineers

1 INTRODUCTION

The proposed development involves the rezoning of five vacant lots and part subdivision of one lot in Ingleside. The lots (*Lots 74, 79, 83, 84, 85 Sec. B – DP11784 and Lot 3 Sec. F. – DP11784*) are owned by the Department of Infrastructure Planning and Natural Resources (DIPNR) and are located on Ingleside Road between the Uniting Church land and Westpac Training Centre as shown in **Appendix A**.

Under this rezoning/subdivision application, permission is sought to enable one residential dwelling per lot in the same arrangement as the adjoining and surrounding privately owned lots. It is understood that the six lots are currently not sewered.

Patterson Britton & Partners (PBP) was engaged by Drummond Parmenter Pty Ltd on behalf of DIPNR to investigate the appropriate stormwater management options for the lots and onsite treatment and disposal options to manage wastewater generated from future dwellings that would be constructed on these lots.

The lots are located on a plateau, bounded by Ingleside Road to the west and a valley to the east. The topography of the lots falls naturally from west to east with a gradient of approximately 6 to 7%. It is envisaged that run-off from the lots will drain to the valley immediately to the eastern lot boundary.

2 STORMWATER MANAGEMENT

The stormwater management requirements of Council are outlined in *Pittwater 21 DCP* (December 2003). Rainwater tanks and on-site detention (OSD) are required for developments where the new hard surface area exceeds 25m^2 which it is envisaged will be the case for each of the proposed lots. It has been assumed that the total hard surface area will not exceed 1000m^2 as any proposed development should be similar in nature to the existing development in surrounding lots.

The required capacity of rainwater tanks is dependent on the size of the proposed hard surface area. Section B5.2 of the DCP provides a table of values and is included in **Appendix B**. It is proposed that the development would provide rainwater tanks on each lot in accordance with this requirement. Water collected in the rainwater tanks would be used for toilet flushing, garden irrigation and the laundry. It may also be used for fire fighting purposes.

The required capacity of OSD facilities is also dependent on the size of the proposed hard surface areas. OSD is designed to bring the increase in peak flows that results from increasing the hard surface area as part of any development back to existing levels. Section B5.3 of the DCP provides a table of values with specifications for size and discharge rate and is included in **Appendix B**. Councils requirements should ensure that peak discharge from the site is not increased. It is proposed that the development would provide OSD facilities on each lot in accordance with this requirement.

Stormwater discharge from all lots is proposed to be via a stabilised discharge point at the eastern boundary of each lot (*refer Figure 1*). A level spreader is proposed to be used to widen the discharge area and reduce the velocity of flows. This can either consist of a small depression followed by a low earth bank or a right angle turn in the flow path at the outlet and widening of the downstream channel. Each outlet would be located at least 5 metres inside the lot boundary. Armour located immediately downstream of the outlet would prevent any erosion from occurring. Other discharge techniques, such as infiltration trenches, are considered impractical given the close proximity of bedrock to the surface. Similarly, piping flows to the nearest watercourse is considered impractical due to the disturbance to adjoining bushland that would result.

A water balance was undertaken on an average rainfall year (*the long term average annual rainfall is 1230mm/yr*) to determine how often the proposed discharge system is likely to operate. It was assumed rainwater would be used for toilet flushing, laundry and garden irrigation.

It was found that the system would only be discharging off-site on 60 days in an average year. This should not create a situation where the ground is permanently saturated. If no rainwater tanks were installed there would be discharge off-site on an average of 142 days per year. The water balance assumed a 1000m^2 hard surface area and a 10 000L rainwater tank. Full results of the water balance are included in **Appendix C**.

The implementation of the above measures, combined with the installation of AAA rated water fittings, is estimated to achieve the BASIX requirement of a 40% reduction in potable water demand.

3 EFFLUENT TREATMENT & DISPOSAL

3.1 INTRODUCTION

Pittwater 21 DCP requires all properties to be connected to the centralised sewage waste disposal system where available. However, in this case, there is no direct access to a centralised system and on-site treatment and disposal is therefore proposed, as is the situation with a number of other properties in the area.

This section of the report:

1. outlines various commonly used onsite treatment and disposal technologies;
2. develops options to manage the wastewater based on these technologies, and
3. recommends an option that is most suitable for this application.

3.2 WASTEWATER LOADING

Based on Sewerage Code of Australia (*WSA 02 – 2002 Sydney Water Edition*) and the plan of the proposed development, the design wastewater loads for the six lots are taken as 735 L/d. This is based on an occupancy rate of 3.5 persons per lot and a wastewater generation rate of 210 L/capita/day.

3.3 ON-SITE TREATMENT AND DISPOSAL TECHNOLOGIES

Two categories of on-site wastewater treatment technology have been considered, namely waterborne and waterless. These systems are discussed further in the sections below.

3.3.1 Waterless Systems

Waterless systems include pans, pit latrines, pour-flush toilets, aquaprivies and composting toilets. Details of these systems are described in **Appendix D**.

Waterless systems only provide treatment to black water, therefore a separate grey water system (*refer Appendix D*) would be required to handle the non-toilet wastewater stream. The treated effluent would need to be disposed of by land application.

Waterless systems are not considered practical for this application for the following reasons:

- ❑ high maintenance requirements for waterless and grey water systems;
- ❑ waterless systems are not practical for multi-storey buildings;
- ❑ higher capital cost than waterborne systems, due to the need for a separate grey water system; and
- ❑ similar irrigation land requirement to a waterborne system.

Therefore, they are not considered further in this report.

3.3.2 Waterborne Systems

Waterborne wastewater treatment systems are almost exclusively used in areas where town water is provided. Two waterborne treatment systems have been considered, namely, septic tanks and aerated wastewater treatment systems (AWTS). Details of these systems are included in **Appendix E**.

The treated effluent from the waterborne treatment systems would need to be disposed of appropriately. For septic tanks, the partially treated effluent is typically disposed of in absorption trenches or evapotranspiration beds, such as Ecomax cells (*refer Appendix E*).

The success of adsorption trenches has been mixed, because the performance of the trenches is greatly influenced by the soil type in the area. As septic tanks produce low quality, non-disinfected effluent, failures of adsorption trenches can pose significant risks to public health and the environment. Therefore, adsorption trenches are not considered further. However, evapotranspiration bed type systems can be provided in sensitive areas as they are able to produce effluent with substantially reduced nutrient concentrations.

Evapotranspiration beds are sub-surface systems designed to dispose effluent by the combined effect of water removal from direct evaporation and plant transpiration. For the purpose of this report, only Ecomax cells are considered as they also offer nutrient removal capability.

For AWTS, effluent disposal is typically via irrigation (*surface or sub-surface*), as AWTS produce disinfected effluent of a higher quality than that produced from septic tanks. For the purpose of this report, it is assumed that treated effluent would be applied via sub-surface irrigation to minimise contact between effluent and householders.

3.4 DEVELOPMENT OF SHORT-LISTED OPTIONS

Based on the on-site treatment and disposal technologies presented above, two options are proposed:

1. AWTS and sub-surface Irrigation; and
2. Septic tank and evapotranspiration bed.

Option 1 involves providing an AWTS unit for each lot. All wastewater from the dwelling would be directed to the AWTS unit by gravity. The treated wastewater would be distributed to an irrigation area, where the effluent would be introduced into the soil close to the surface.

Preliminary nutrient and hydraulic loading calculations based on the worst scenario (*aggressive influent and poor soil conditions*) show that the land area required for irrigation could be as much as 2,500 m² per lot (*refer Appendix F*). This represents more than half the area of a lot. It is noted the land requirement may be less, depending on the soil type at the site.

The irrigation area would be located at least 3 m down gradient from any building, driveway, etc.

Approximately 90m³ of wet-weather storage would also need to be provided onsite to cater for periods, when wastewater cannot be applied to land during wet weather and whenever the soil is saturated. This is equivalent to 122 days storage.

Option 2 involves providing septic tanks for each lot for preliminary treatment of wastewater from the dwelling. The septic tanks would consist of two pre-cast concrete tanks with approximate dimensions of 1.8 m diameter × 1.5 m deep and 1.5 m diameter × 1.5 m deep respectively.

Effluent from the septic tanks would then drain to the Ecomax evapotranspiration cells. The land uptake by the Ecomax cells would be in the order of 135 m².

No wet weather storage is required under **Option 2**, as any wet weather overflows from Ecomax cells would be high quality effluent (*reduce organics and nutrients*).

3.5 COST ESTIMATES FOR SHORT-LISTED OPTIONS

Preliminary capital cost estimates have been prepared for **Options 1** and **2**. These estimates are presented in the following table:

Table 1 Preliminary Cost Estimates per Lot

Option 1 AWTS + Sub-surface Irrigation		Option 2 Septic Tank + Ecomax Evapotranspiration Bed	
Items	Cost per Lot	Items	Cost per Lot
AWTS + Sub-surface Irrigation System	\$ 8,500	Primary Tank + Ecomax Cells	\$ 13,000
Wet Weather Storage Tank (91000 litres tank, 7.4 dia)	\$ 6,950	Miscellaneous Pipework	\$ 2,500
Miscellaneous Pipework	\$ 2,500		
<i>Sub-total</i>	\$ 17,950	<i>Sub-total</i>	\$ 15,500
Contingencies, Survey, Investigation & Design (35%)	\$ 6,283	Contingencies, Survey, Investigation & Design (35%)	\$ 5,425
Total Capital Cost	\$ 24,233	Total Capital Cost	\$ 20,925
Say	\$ 25,000	Say	\$ 21,000

The operating and maintenance cost associated with **Option 1** is in the order \$775 per lot per annum. This cost includes maintenance contract fee, power cost, equipment replacement and de-sludging primary sedimentation chamber.

The operating and maintenance cost associated with **Option 2** is also in the order of \$775 per lot per annum. The cost includes costs to de-sludge a septic tank, equipment replacement, and inspection and monitoring.

Note that the cost estimates are based on Patterson Britton's experience and judgement as a firm of practicing professional engineers familiar with the construction industry. The cost estimates can not be guaranteed as we have no control over Contractor's prices, market forces and competitive bids from tenderers.

3.6 RECOMMENDATION

The recommended on-site wastewater treatment and disposal option is **Option 2**, which involves the use of septic tanks and Ecomax evapotranspiration beds.

Option 2 is preferred, because:

- ☐ it has a lower capital cost;
- ☐ requires a smaller land application area for disposal of effluent;
- ☐ is a passive treatment system not requiring high power usage;
- ☐ quarterly maintenance under a Council approved maintenance contract is not required;
- ☐ no mechanical and electrical parts, therefore less prone to break-down;
- ☐ removes nutrients and provides higher effluent quality, therefore poses less environmental risks.

4 CONCLUSION

The stormwater management measures and effluent treatment and disposal options recommended in this report are all in accordance with Councils requirements for water management on the site.

The implementation of rainwater tanks, OSD and stabilised discharge meet Councils requirements for stormwater management. In addition, BASIX requirements are estimated to be met through the implementation of these measures if AAA rated water fixtures are also installed.

The preferred on-site effluent treatment and disposal option (*combined septic tanks and Ecomax evapotranspiration beds*) provides relatively high effluent quality and therefore provides minimal environmental risks. This should ensure that effluent generated by the proposed land use will have minimal impacts on downstream areas.

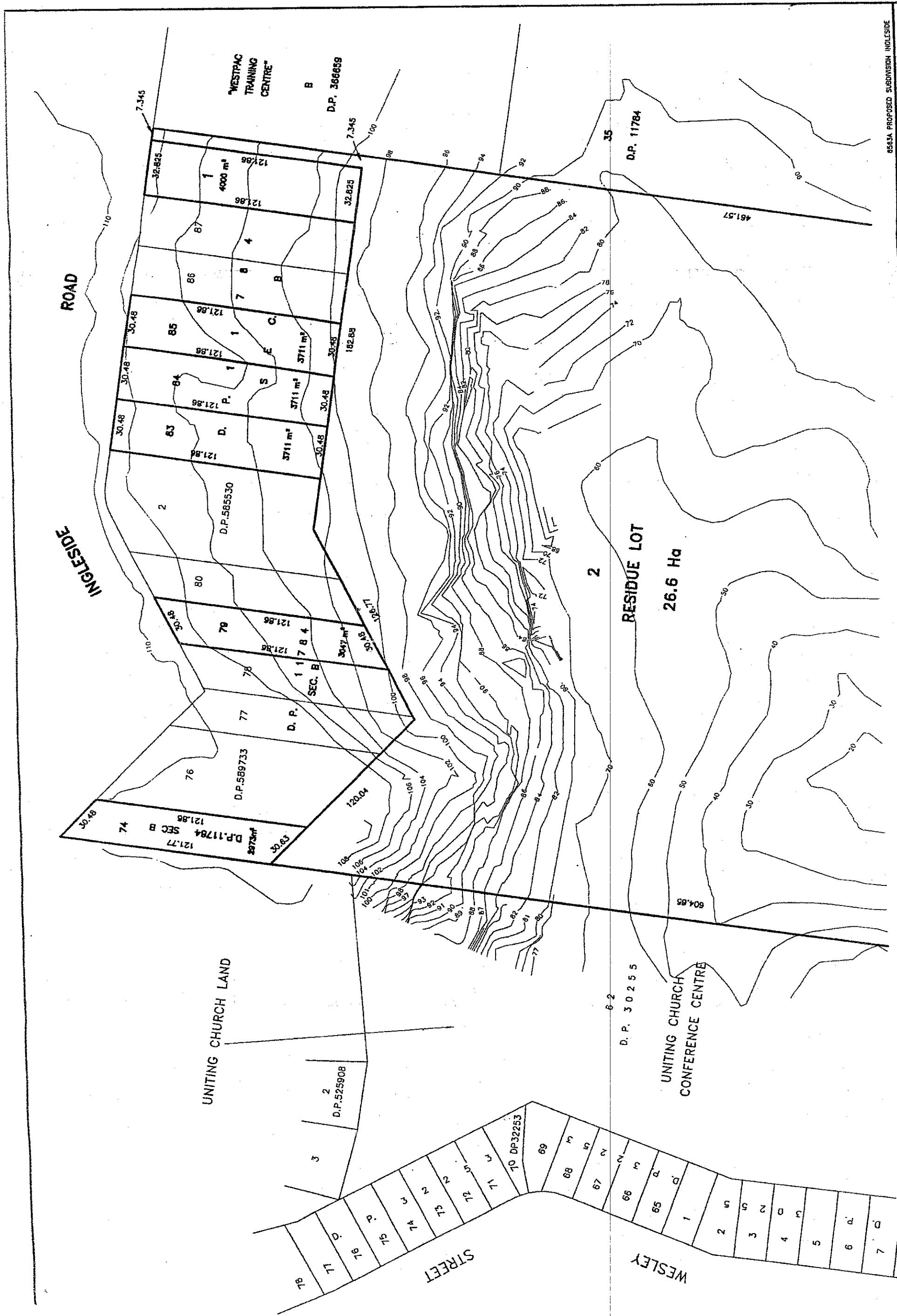
The combination of all of the above measures will minimise any likely downstream impacts to sensitive bushland as a result of the proposed rezoning and subdivision.

FIGURES

FIGURE 1



APPENDIX A



IMPORTANT NOTES AND CAUTIONS
THESE NOTES FORM AN INTEGRAL PART OF THIS PLAN
CONTOURS HAVE BEEN PARTLY COMPILED
WHERE LEVELS ARE CRITICAL THEY SHOULD BE DETERMINED BY SURVEY
DATUM OF LEVELS: AHD
ORIGIN OF LEVELS: S.S.M. 3323 R.L. 82.472
CONTOUR INTERVAL: 2 METERS
AREAS AND DIMENSIONS APPROXIMATE ONLY AND ARE SUBJECT TO SURVEY



DRUMMOND PARMENTER PTY. LTD.
CONSULTING SURVEYORS & TOWN PLANNERS
371A PITT STREET, SYDNEY
AUSTRALIA 2000
TELEPHONE: (02) 9287 8255
FAX: (02) 9287 1057
EMAIL: drummond@bigpond.net.au

REDUCTION RATIO
1:2000
REF. No.: 8563A
DATE: JULY 2004

CLIENT: DEPT. I.P. & N.R.
PLAN OF PROPOSED SUBDIVISION OF LOT 3
SECTION F D.P. 11784 AND PLAN OF REZONING
OF LOTS 74, 79, 83, 84, 85 SEC B D.P. 11784 AND
3 SEC F D.P. 11784 INGLESIDE RD. INGLESIDE.

8563A PROPOSED SUBDIVISION INGLESIDE



IMPORTANT NOTES AND CAUTIONS
THESE NOTES FORM AN INTEGRAL PART OF THIS PLAN
CONTOURS HAVE BEEN PARTIALLY COMPILED
WHERE LEVELS ARE CRITICAL THEY SHOULD BE DETERMINED BY SURVEY
DATUM OF LEVELS: AHD
ORIGIN OF LEVELS: 5.5M, 3923 R.L. 82.472
CONTOUR INTERVAL: 2 METERS
AREAS AND DIMENSIONS APPROXIMATE ONLY AND ARE SUBJECT TO SURVEY

DRUMMOND PARMENTER PTY. LTD.
CONSULTING SURVEYORS & TOWN PLANNERS
371A PITT STREET, SYDNEY
AUSTRALIA 2000
TELEPHONE: (02) 9267 8255
FAX: (02) 9267 1087
EMAIL: drummond@bigpond.net.au

REDUCTION RATIO	1:3000
REF. NO.	8543B
DATE	JULY 2004
CLIENT	DEPT. I.P. & N.R.
PLAN OF PROPOSED SUBDIVISION OF LOT 3 SECTION F D.P. 11784 AND PLAN OF REZONING OF LOTS 74, 79, 83, 84, 85 SEC B D.P. 11784 AND 3 SEC F D.P. 11784 INGLESIDE RD. INGLESIDE.	

8543A PROPOSED SUBDIVISION INGLESIDE

APPENDIX B

B5 WATER MANAGEMENT

NOTE: Controls B5.1, B5.2, B5.3, B5.4, B5.5, B5.6 and B6.1, B6.2, B6.3, B6.4, B6.5, B6.6 and C4.7 have been adopted as interim policy and are on statutory public exhibition with written submissions invited until 23 January 2003 in accordance with the Environmental Planning and Assessment Regulation 2000. Enquiries: Pittwater 21 Team 9970 1111.

B5.1 Wastewater Management

Outcomes

Effective management of sewage and wastewater systems and disposal to central reticulation system. (En, S)

Effective management of on-site sewage and effluent systems to ensure environmental standards. (En, S)

Land to which this control applies

All land in Pittwater LGA including the Pittwater waterway (MDCP001)

Development to which this control applies

- *Specified Residential Development*
 - Dwelling house (new)
 - Dwelling house (alterations & additions)
 - Attached dual occupancy
 - Detached dual occupancy
 - Multi-unit housing
 - Shop-top housing (residential portion only)
- *Unspecified Residential Development*
 - Includes all other residential development not individually specified above
- *Business Development*
- *Light Industrial Development*
- *Land Subdivision*
- *Other Development*
 - Includes development not included in residential development, business development, light industrial development, or land subdivision.

Controls

All premises shall be connected to the centralised sewage waste disposal system operated by Sydney Water where available.

Variations

Council may consider approval of onsite treatment and/or disposal of wastewater from development on existing land parcels (and up to three new subdivision lots on Non urban land other than the Western Foreshores or Scotland Island) provided that wastewater generated by the development does not exceed 10 equivalent persons.

On-site wastewater treatment systems shall have a current accreditation from the NSW Health Department.

B5.2 Stormwater Management - Rainwater tanks

Outcomes

The conservation and recycling of water. (En)

An alternative safe water supply is provided for properties not connected to a Sydney Water main. (S)

Land to which this control applies

All land in the Pittwater LGA not including the Pittwater waterway or Warriewood Valley land release area (MDCP037)

Development to which this control applies

- *Specified Residential Development*
 - Dwelling house (new)
 - Dwelling house (alterations & additions)
 - Attached dual occupancy
 - Detached dual occupancy
 - Multi-unit housing
 - Shop-top housing (residential portion only)
- *Unspecified Residential Development*
 - Includes all other residential development not individually specified above
- *Business Development*
- *Light Industrial Development*
- *Land Subdivision*
- *Other Development*
 - Includes development not included in residential development, business development, light industrial development, or land subdivision.

Controls

All development creating a new hard surface area of greater than 25m² must provide a rainwater tank for non-potable use connected to at least one external tap for garden watering purposes etc and/or for internal uses such as toilet flushing.

For new industrial or commercial development, or residential development creating more than 2 new dwellings, the rainwater tank must be connected to a functional water recycling system including toilet flushing water supply.

Rainwater tank storage capacities should be in accordance with the following table: -

New Hard Surface Area m ²	Tank Storage Capacity
0 - 25	Nil
26 - 50	600 litres or (total site hard surface area m ² x 10 = storage capacity in litres) whichever is the lesser
51 - 75	1000 litres or (total site hard surface area x10 = storage capacity in litres) whichever is the lesser
76 - 100	2000 litres or (total site hard surface area x10 = storage capacity in litres) whichever is the lesser
101 - 150	3000 litres or (total site hard surface area x10 = storage capacity in litres) whichever is the lesser
151 - 200	4000 litres or (total site hard surface area x10 = storage capacity in litres) whichever is the lesser
201 - 1000	4000 litres or (total site hard surface area x10 = storage capacity in litres) whichever is the greater
Above 1000	An integrated strategy is to be prepared for the development proposal by a Registered Professional

New Hard Surface Area m ²	Tank Storage Capacity
	Engineer NPER with Water Engineering as a core competency, which provides for overall water management including Stormwater storage for reuse having a capacity of 10 litres per m ² of new hard surface area.

Where connection to a Sydney Water main is not able to be provided, rainwater tanks must be provided for potable (ie. drinking, bathing, cooking, washing etc) and non-potable (ie. toilet flushing, watering garden, irrigation, firefighting etc) uses.

On such land, the minimum capacity requirements are:

- (a) for new dwellings and major additions to existing dwellings: minimum capacity 45,000 litres of which up to 10,000 litres may be non-potable stored in a separate system; or
- (b) for all other development: in accordance with relevant Australian Standards.

Variations

Council may consider a variation where a rainwater tank of this size already exists or a tank of this size is not appropriate and it can be demonstrated that the outcomes of this control are achieved

B5.3 Stormwater Management – On-Site Detention

Outcomes

Reduction in rate of stormwater discharge into the public drainage system. (En)

Land to which this Control Applies

All land in the Pittwater LGA which is not flood prone or not capable of appropriately discharging it's stormwater directly into a receiving water not including the Pittwater waterway or Warriewood Valley land release area (MDCP037)

Development to which this Control Applies

- *Specified Residential Development*
 - Dwelling house (new) Detached dual occupancy
 - Dwelling house (alterations & additions) Multi-unit housing
 - Attached dual occupancy Shop-top housing (residential portion only)
- *Unspecified Residential Development*
 - Includes all other residential development not individually specified above
- *Business Development*
- *Light Industrial Development*
- ~~*Land Subdivision*~~
- *Other Development*
 - Includes development not included in residential development, business development, light industrial development, or land subdivision.

Controls

An On-Site Detention (OSD) facility is to be installed where the development results in new hard surface area of 25m² or greater.

All new hard surface area (or an equivalent area) is to be drained to the rainwater tank and the OSD facility.

Council will ensure that ongoing maintenance of the on-site detention facility is achieved through application of a Restriction on Use of Land / Positive Covenant to be applied to the Land Title prior to Occupation Certificate.

On-site detention facilities must have a storage capacity in accordance with the following table: -

(Note: In calculating this table a discount has already been applied for rainwater tank storage)

New Hard Surface Area	On-Site Detention Tank Capacity litres	Discharge Rate litres / sec
0 – 50	Nil	
51 – 75	1500	3
76 – 100	2000	4
101 – 150	3000	6
151 – 200	4000	7
201 – 250	5000	9
251 – 300	6000	11
301 – 400	8000	15
401 – 500	10 000	18

New Hard Surface Area	On-Site Detention Tank Capacity litres	Discharge Rate litres / sec
501 – 600	12 000	22
601 – 700	14 000	26
701 – 800	16 000	30
801 – 900	18 000	33
Greater than 1000	An integrated water management strategy is to be prepared for the development proposal by a Registered Professional Engineer NPER with Hydraulic Engineering as a core competency which provides for overall water management including on site detention with a storage capacity of 30 litres per m ² of new hard surface area, and a discharge rate which replicates the discharge from the site were it to be undeveloped. The Strategy and accompanying design should include water quality treatment facilities which ensure that stormwater discharged from the site has a nutrient and gross pollutant load equivalent to what would occur if the site was to be in a natural state. The strategy should examine the capability of the downstream drainage system to accommodate and generated flows.	

Note: These detention volumes incorporate an allowance for Stormwater reuse storage.

Discharge Rate

The discharge rate of stormwater from the OSD structure needs to be limited to achieve a rate that is equivalent to what would have occurred if the development site remained in a natural state.

In order to achieve this, an orifice size for the OSD tank outlet will need to be specified prior to release of any Construction Certificate. This information is NOT REQUIRED at Development Application stage however, it can be determined from the following table : -

Discharge Rate Litres/sec	Depth of tank above Centreline of orifice																			
	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0
3	67	57	51	48	45	43	41	40	39	38	37	36	36	35	34	34	33	33	32	32
4	78	65	59	55	52	50	48	46	45	44	43	42	41	40	40	39	38	38	37	37
6	95	80	72	67	64	61	59	57	55	54	52	51	50	49	48	48	47	46	46	45
7	103	87	78	73	69	66	63	61	59	58	57	55	54	53	52	51	51	50	49	49
9	117	98	89	83	78	75	72	69	67	66	64	63	61	60	59	58	58	57	56	55
11	129	109	98	91	86	82	79	77	75	73	71	69	68	67	66	65	64	63	62	61
15	151	127	115	107	101	96	93	90	87	85	83	81	79	78	77	75	74	73	72	71
18	165	139	125	117	110	106	102	98	95	93	91	89	87	85	84	83	81	80	79	78
22	183	154	139	129	122	117	112	109	105	103	100	98	96	94	93	91	90	89	87	86
26	198	167	151	140	133	127	122	118	115	112	109	107	105	103	101	99	98	96	95	94
30		179	162	151	143	136	131	127	123	120	117	115	112	110	108	107	105	104	102	101
33		188	170	158	150	143	137	133	129	126	123	120	118	116	114	112	110	109	107	106
37		199	180	167	158	151	146	141	137	133	130	127	125	122	120	118	117	115	113	112

Rainwater tanks and OSD facilities may be combined in an integrated system and may be either above or below ground and should an 'oversize' water tank be used, then 50% of the excess storage volume (above that specified in Control B5.2) Can be credited towards the OSD tank capacity.

All Stormwater Management facilities must be located on the private lands.

An overflow facility and surface flowpath from the OSD structure to the offsite disposal pit should be provided.

Variations

Nil

B5.4 Stormwater Discharge into Public Domain

Outcomes

All new development to be adequately and legally drained. (En, S)

Stormwater discharge not to have an adverse impact. (En, S)

Land to which this Control Applies

All land in the Pittwater LGA not including the Pittwater waterway or Warriewood Valley land release area (MDCP037)

Development to which this Control Applies

- *Specified Residential Development*
 - Dwelling house (new) Detached dual occupancy
 - Dwelling house (alterations & additions) Multi-unit housing
 - Attached dual occupancy Shop-top housing (residential portion only)
- *Unspecified Residential Development*
Includes all other residential development not individually specified above
- *Business Development*
- *Light Industrial Development*
- ~~*Land Subdivision*~~
- *Other Development*
Includes development not included in residential development, business development, light industrial development, or land subdivision.

Controls

Collected stormwater from a development is to be directed to the public drainage system to which it would naturally flow.

Where the development has legal access to the public drainage system, (a piped drainage system within easements benefiting the land), a natural watercourse, a constructed public road within a road reserve adjacent to the site, all concentrated stormwater must be discharged directly to that system.

Where the development does not have existing legal access to the public drainage system, a private drainage system linking to the public drainage system (i.e. an inter-allotment drainage system easements through private lands) must be provided at the full cost to the applicant.

All conveyance of stormwater required to traverse a public land other than a road easement, piped drainage systems, natural watercourses, estuary and lagoon may be permitted, but will require the prior approval in writing by the Council or the relevant Statutory State Authority and in some instances the creation of an easement.

Adequate overflow facilities or surface flowpaths must be provided to cater for major storm events or blockage within the drainage system serving the development to the public drainage system.

All water management facilities must be located on the development site.

Variations

Where the development does not have legal access to the public drainage system and is unable to gain alternative access through drainage easements as required, Council will consider approval of:

-
- (i) An On-site Infiltration system (with the exception of landslip affected land)
 - (ii) Redirection of stormwater flow
 - (iii) A split system
 - (iv) An Alternative discharge approach

If such a variation is sought it must be accompanied by a supporting report by a Registered Professional Engineer (NP&R with Hydraulic Engineering as a core competency), outlining the disposal method and demonstrating that it will provide an acceptable standard of safety, will not have any adverse impact on adjoining properties and will not adversely impact on the downstream drainage system.

Information to be Submitted

Details of the site water management system demonstrating that it complies with the Water Management Policy and Specification for Pittwater as adopted by Council are to be submitted with the application.

B5.5 Stormwater Discharge into Waterways and Coastal areas

Outcomes

All new development to be adequately and legally drained. (En, S)

Stormwater discharge not to have an adverse impact. (En, S)

Land to which this control applies

All land adjacent to a river system, foreshore or coastline (MDCP038)

Development to which this control applies

- *Specified Residential Development*
 - Dwelling house (new) Detached dual occupancy
 - Dwelling house (alterations & additions) Multi-unit housing
 - Attached dual occupancy Shop-top housing (residential portion only)
- *Unspecified Residential Development*
 - Includes all other residential development not individually specified above
- *Business Development*
- *Light Industrial Development*
- ~~*Land Subdivision*~~
- *Other Development*
 - Includes development not included in residential development, business development, light industrial development, or land subdivision.

Controls

The discharge of stormwater into the waterways (including Pittwater, Narrabeen Lagoon and creek systems) or any of its tributary watercourses and coastal areas will only be permitted from land directly adjoining a waterway or coastal area provided that:

- (a) discharge to the public drainage system is not available
- (b) discharge over any bluff or cliff area will not cause slope instability
- (c) the discharge system does not result in cliff/bluff/dune or shoreline erosion, sedimentation, water quality impacts and must minimise the visual/environmental impact of any drainage discharge structure along the foreshore.

Variations

Nil

B5.6 Stormwater Easements and Watercourses

Outcomes

The integrity of stormwater easements and natural watercourses are maintained.
(En)

Stormwater flows including overland flow are not disrupted. (En)

Land to which this control applies

All land in the Pittwater LGA not including the Pittwater waterway or Warriewood Valley land release area (MDCP037)

Development to which this control applies

- *Specified Residential Development*
 - Dwelling house (new)
 - Dwelling house (alterations & additions)
 - Attached dual occupancy
 - Detached dual occupancy
 - Multi-unit housing
 - Shop-top housing (residential portion only)
- *Unspecified Residential Development*
 - Includes all other residential development not individually specified above
- *Business Development*
- *Light Industrial Development*
- ~~*Land Subdivision*~~
- *Other Development*
 - Includes development not included in residential development, business development, light industrial development, or land subdivision.

Controls

Development is not to obstruct the flow of stormwater through lands containing easements, piped drainage, natural watercourses or natural drainage paths including overland flow due to a 1% AEP

Stormwater Drainage Systems:

- (a) must remain as an open water course where practical
- (b) alternatively be piped with the stormwater piped system designed for the 5% AEP flow and the remaining flow to the 1% AEP carried overland

The floor level of all development must be at the Flood Planning Level (being 500mm above the 1% AEP) or the PMF event, which ever is the greater.

Development is not to obstruct the ability to undertake maintenance operations on drainage facilities within an easement or within the cross sectional area of natural watercourses.

Structural support elements are not permitted within an easement or within the cross sectional area of a natural watercourse.

Structural support elements adjacent to an easement, piped drainage or natural watercourse located on the development site or on adjacent lands must be founded on stable foundations to prevent undermining due to water erosion or maintenance operations.

All development of lands affected by overland flooding must comply with: -

- DCP30 – Pittwater Flood Risk Management

Variations

Easements, piped drainage system and natural watercourses may be diverted around proposed development where it can be demonstrated that: (a) the diversion is wholly contained within the property, (b) that the flows are not diverted to alternative watercourses and (c) flow capacities are maintained. Any alteration to an easement, piped drainage system or natural watercourse including all legal and consultant costs shall be at the full cost to the applicant.

APPENDIX C

Data - Developed With Rainwater Tanks - Ingleside Rezoning				
		Area (m2)	To Inf (%)	
1.0 General Catchment Data				
1.1 - Impervious Area to Rainwater Tanks		1000	0%	
1.2 - Impervious Area not to Rainwater Tanks		0	0%	
1.3 - Pervious Area to be Irrigated		500	0%	
1.4 - Pervious Area not to be irrigated		2200	0%	
1.5 - Forested Area		0	0%	
1.6 - Infiltration system (inf)		0	-	
1.7 - wetland (assumes all site drains to wetland)		0	-	
1.8 - Total Area		3700	0%	
2.0 Interception				
2.1 - Proportion of irrigated Pervious Area as Canopy		0%		
2.2 - Proportion of No Irrigated Pervious Area as Canopy		25%		
2.3 - Proportion of Forested Area as Canopy		25%		
2.4 - Maximum Canopy Storage		1.5 mm		
3.0 Depression Storage				
3.1 - Impervious Depression Storage		1.5 mm		
3.2 - Pervious Depression Storage		0.5 mm		
3.3 - Forested Depression Storage		1 mm		
4.0 Forest Soil Moisture Storage				
4.1 - Maximum Storage		80 mm		
4.2 - Initial Moisture Storage		70 mm		
4.3 - Storage Before Infiltration Occurs		60 mm		
4.4 - Deep Infiltration Rate		24 mm/day		
5.0 Pervious Soil Moisture Storage				
5.1 - Maximum Storage		80 mm		
5.2 - Initial Moisture Storage		70 mm		
5.3 - Storage Before Infiltration Occurs		60 mm		
5.4 - Deep Infiltration Rate		24 mm/day		
5.5 - Storage Before Watering		5 mm		
5.6 - Water Until Storage Reaches...		8 mm		
6.0 Infiltration System				
6.1 - Volume of Infiltration Storage		0	m ³	
6.2 - Initial Storage		0	m ³	
6.3 - Infiltration Rate		2400	mm/day	
7.0 Wetland Storage				
7.1 - Volume to Macrophyte Bed Depth		0	m ³	
7.2 - Volume of Deep Zone		0	m ³	
7.3 - Maximum Storage		0	m ³	
7.4 - Initial Storage		0	m ³	
7.5 - Total Surface Area		0	m ²	
7.6 - Surface Area of Deep Zone		0	m ²	
8.0 Rainwater Tank and Internal Reuse				
8.1 - Maximum Rainwater Tank Volume		10	m ³	
8.2 - Initial Rainwater Tank Volume		5	m ³	
8.3 - Number of Equivalent Tenements with Toilet Use		1	ET	
8.4 - Estimated Daily Demand per ET		504	L	
9.0 Average Aerial Evapotranspiration (daily)				
		Pervious	Forest	Water
9.1	January	5.65	5.65	5.65
9.2	February	4.82	4.82	4.82
9.3	March	4.03	4.03	4.03
9.4	April	2.83	2.83	3.3
9.5	May	1.94	1.94	2.72
9.6	June	1.45	1.45	2.26
9.7	July	1.45	1.45	2.54
9.8	August	2	2	3.11
9.9	September	2.9	2.9	3.69
8.10	October	4.19	4.19	4.51
8.11	November	5	5	5
8.12	December	5.32	5.32	5.32

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Year	Month	Day	Time	Location	Activity	Duration	Frequency	Intensity	Priority	Notes
2023	January	1	08:00	Room 101	Meeting	1h	Weekly	High	1	Initial planning session
2023	January	2	09:00	Room 102	Training	2h	Daily	Medium	2	Project management basics
2023	January	3	10:00	Room 103	Workshop	3h	Monthly	High	3	Team building exercise
2023	January	4	11:00	Room 104	Conference	4h	Quarterly	High	4	Client presentation
2023	January	5	12:00	Room 105	Workshop	5h	Weekly	Medium	5	Product development
2023	January	6	13:00	Room 106	Meeting	6h	Daily	Low	6	Team check-in
2023	January	7	14:00	Room 107	Training	7h	Monthly	High	7	Advanced project management
2023	January	8	15:00	Room 108	Workshop	8h	Quarterly	High	8	Client presentation
2023	January	9	16:00	Room 109	Conference	9h	Weekly	Medium	9	Product development
2023	January	10	17:00	Room 110	Meeting	10h	Daily	Low	10	Team check-in
2023	January	11	18:00	Room 111	Training	11h	Monthly	High	11	Advanced project management
2023	January	12	19:00	Room 112	Workshop	12h	Quarterly	High	12	Client presentation
2023	January	13	20:00	Room 113	Conference	13h	Weekly	Medium	13	Product development
2023	January	14	21:00	Room 114	Meeting	14h	Daily	Low	14	Team check-in
2023	January	15	22:00	Room 115	Training	15h	Monthly	High	15	Advanced project management
2023	January	16	23:00	Room 116	Workshop	16h	Quarterly	High	16	Client presentation
2023	January	17	00:00	Room 117	Conference	17h	Weekly	Medium	17	Product development
2023	January	18	01:00	Room 118	Meeting	18h	Daily	Low	18	Team check-in
2023	January	19	02:00	Room 119	Training	19h	Monthly	High	19	Advanced project management
2023	January	20	03:00	Room 120	Workshop	20h	Quarterly	High	20	Client presentation
2023	January	21	04:00	Room 121	Conference	21h	Weekly	Medium	21	Product development
2023	January	22	05:00	Room 122	Meeting	22h	Daily	Low	22	Team check-in
2023	January	23	06:00	Room 123	Training	23h	Monthly	High	23	Advanced project management
2023	January	24	07:00	Room 124	Workshop	24h	Quarterly	High	24	Client presentation
2023	January	25	08:00	Room 125	Conference	25h	Weekly	Medium	25	Product development
2023	January	26	09:00	Room 126	Meeting	26h	Daily	Low	26	Team check-in
2023	January	27	10:00	Room 127	Training	27h	Monthly	High	27	Advanced project management
2023	January	28	11:00	Room 128	Workshop	28h	Quarterly	High	28	Client presentation
2023	January	29	12:00	Room 129	Conference	29h	Weekly	Medium	29	Product development
2023	January	30	13:00	Room 130	Meeting	30h	Daily	Low	30	Team check-in
2023	January	31	14:00	Room 131	Training	31h	Monthly	High	31	Advanced project management
2023	February	1	15:00	Room 132	Workshop	1h	Quarterly	High	1	Client presentation
2023	February	2	16:00	Room 133	Conference	2h	Weekly	Medium	2	Product development
2023	February	3	17:00	Room 134	Meeting	3h	Daily	Low	3	Team check-in
2023	February	4	18:00	Room 135	Training	4h	Monthly	High	4	Advanced project management
2023	February	5	19:00	Room 136	Workshop	5h	Quarterly	High	5	Client presentation
2023	February	6	20:00	Room 137	Conference	6h	Weekly	Medium	6	Product development
2023	February	7	21:00	Room 138	Meeting	7h	Daily	Low	7	Team check-in
2023	February	8	22:00	Room 139	Training	8h	Monthly	High	8	Advanced project management
2023	February	9	23:00	Room 140	Workshop	9h	Quarterly	High	9	Client presentation
2023	February	10	00:00	Room 141	Conference	10h	Weekly	Medium	10	Product development
2023	February	11	01:00	Room 142	Meeting	11h	Daily	Low	11	Team check-in
2023	February	12	02:00	Room 143	Training	12h	Monthly	High	12	Advanced project management
2023	February	13	03:00	Room 144	Workshop	13h	Quarterly	High	13	Client presentation
2023	February	14	04:00	Room 145	Conference	14h	Weekly	Medium	14	Product development
2023	February	15	05:00	Room 146	Meeting	15h	Daily	Low	15	Team check-in
2023	February	16	06:00	Room 147	Training	16h	Monthly	High	16	Advanced project management
2023	February	17	07:00	Room 148	Workshop	17h	Quarterly	High	17	Client presentation
2023	February	18	08:00	Room 149	Conference	18h	Weekly	Medium	18	Product development
2023	February	19	09:00	Room 150	Meeting	19h	Daily	Low	19	Team check-in
2023	February	20	10:00	Room 151	Training	20h	Monthly	High	20	Advanced project management
2023	February	21	11:00	Room 152	Workshop	21h	Quarterly	High	21	Client presentation
2023	February	22	12:00	Room 153	Conference	22h	Weekly	Medium	22	Product development
2023	February	23	13:00	Room 154	Meeting	23h	Daily	Low	23	Team check-in
2023	February	24	14:00	Room 155	Training	24h	Monthly	High	24	Advanced project management
2023	February	25	15:00	Room 156	Workshop	25h	Quarterly	High	25	Client presentation
2023	February	26	16:00	Room 157	Conference	26h	Weekly	Medium	26	Product development
2023	February	27	17:00	Room 158	Meeting	27h	Daily	Low	27	Team check-in
2023	February	28	18:00	Room 159	Training	28h	Monthly	High	28	Advanced project management
2023	February	29	19:00	Room 160	Workshop	29h	Quarterly	High	29	Client presentation
2023	February	30	20:00	Room 161	Conference	30h	Weekly	Medium	30	Product development
2023	February	31	21:00	Room 162	Meeting	31h	Daily	Low	31	Team check-in
2023	March	1	22:00	Room 163	Training	32h	Monthly	High	1	Advanced project management
2023	March	2	23:00	Room 164	Workshop	33h	Quarterly	High	2	Client presentation
2023	March	3	00:00	Room 165	Conference	34h	Weekly	Medium	3	Product development
2023	March	4	01:00	Room 166	Meeting	35h	Daily	Low	4	Team check-in
2023	March	5	02:00	Room 167	Training	36h	Monthly	High	5	Advanced project management
2023	March	6	03:00	Room 168	Workshop	37h	Quarterly	High	6	Client presentation
2023	March	7	04:00	Room 169	Conference	38h	Weekly	Medium	7	Product development
2023	March	8	05:00	Room 170	Meeting	39h	Daily	Low	8	Team check-in
2023	March	9	06:00	Room 171	Training	40h	Monthly	High	9	Advanced project management
2023	March	10	07:00	Room 172	Workshop	41h	Quarterly	High	10	Client presentation
2023	March	11	08:00	Room 173	Conference	42h	Weekly	Medium	11	Product development
2023	March	12	09:00	Room 174	Meeting	43h	Daily	Low	12	Team check-in
2023	March	13	10:00	Room 175	Training	44h	Monthly	High	13	Advanced project management
2023	March	14	11:00	Room 176	Workshop	45h	Quarterly	High	14	Client presentation
2023	March	15	12:00	Room 177	Conference	46h	Weekly	Medium	15	Product development
2023	March	16	13:00	Room 178	Meeting	47h	Daily	Low	16	Team check-in
2023	March	17	14:00	Room 179	Training	48h	Monthly	High	17	Advanced project management
2023	March	18	15:00	Room 180	Workshop	49h	Quarterly	High	18	Client presentation
2023	March	19	16:00	Room 181	Conference	50h	Weekly	Medium	19	Product development
2023	March	20	17:00	Room 182	Meeting	51h	Daily	Low	20	Team check-in
2023	March	21	18:00	Room 183	Training	52h	Monthly	High	21	Advanced project management
2023	March	22	19:00	Room 184	Workshop	53h	Quarterly	High	22	Client presentation
2023	March	23	20:00	Room 185	Conference	54h	Weekly	Medium	23	Product development
2023	March	24	21:00	Room 186	Meeting	55h	Daily	Low	24	Team check-in
2023	March	25	22:00	Room 187	Training	56h	Monthly	High	25	Advanced project management
2023	March	26	23:00	Room 188	Workshop	57h	Quarterly	High	26	Client presentation
2023	March	27	00:00	Room 189	Conference	58h	Weekly	Medium	27	Product development
2023	March	28	01:00	Room 190	Meeting	59h	Daily	Low	28	Team check-in
2023	March	29	02:00	Room 191	Training	60h	Monthly	High	29	Advanced project management
2023	March	30	03:00	Room 192	Workshop	61h	Quarterly	High	30	Client presentation
2023	March	31	04:00	Room 193	Conference	62h	Weekly	Medium	31	Product development
2023	April	1	05:00	Room 194	Meeting	63h	Daily	Low	1	Team check-in
2023	April	2	06:00	Room 195	Training	64h	Monthly	High	2	Advanced project management
2023	April	3	07:00	Room 196	Workshop	65h	Quarterly	High	3	Client presentation
2023	April	4	08:00	Room 197	Conference	66h	Weekly	Medium	4	Product development
2023	April	5	09:00	Room 198	Meeting	67h	Daily	Low	5	Team check-in
2023	April	6	10:00	Room 199	Training	68h	Monthly	High	6	Advanced project management
2023	April	7	11:00	Room 200	Workshop	69h	Quarterly	High	7	Client presentation
2023	April	8	12:00	Room 201	Conference	70h	Weekly	Medium	8	Product development
2023	April	9	13:00	Room 202	Meeting	71h	Daily	Low	9	Team check-in
2023	April	10	14:00	Room 203	Training	72h	Monthly	High	10	Advanced project management
2023	April	11	15:00	Room 204	Workshop	73h	Quarterly	High	11	Client presentation
2023	April	12	16:00	Room 205	Conference	74h	Weekly	Medium	12	Product development
2023	April	13	17:00	Room 206	Meeting	75h	Daily	Low	13	Team check-in
2023	April	14	18:00	Room 207	Training	76h	Monthly	High	14	Advanced project management
2023	April	15	19:00	Room 208	Workshop	77h	Quarterly	High	15	Client presentation
2023	April	16	20:00	Room 209	Conference	78h	Weekly	Medium	16	Product development
2023	April	17	21:00	Room 210	Meeting	79h	Daily	Low	17	Team check-in
2023	April	18	22:00	Room 211	Training	80h	Monthly	High	18	Advanced project management
2023	April	19	23:00	Room 212	Workshop	81h	Quarterly	High	19	Client presentation
2023	April	20	00:00	Room 213	Conference	82h	Weekly	Medium	20	Product development
2023	April	21	01:00	Room 214	Meeting	83h	Daily	Low	21	Team check-in
2023	April	22	02:00	Room 215	Training	84h	Monthly	High	22	Advanced project management
2023	April	23	03:00	Room 216	Workshop	85h	Quarterly	High	23	Client presentation
2023	April	24	04:00	Room 217	Conference	86h	Weekly	Medium	24	Product development
2023	April	25	05:00	Room 218	Meeting	87h	Daily	Low	25	Team check-in
2023	April	26	06:00	Room 219	Training	88h	Monthly	High	26	Advanced project management
2023	April	27	07:00	Room 220	Workshop	89h	Quarterly	High	27	Client presentation
2023	April	28	08:00	Room 221	Conference	90h	Weekly	Medium	28	Product development
2023	April	29	09:00	Room 222	Meeting	91h	Daily	Low	29	Team check-in
2023	April	30	10:00	Room 223	Training	92h	Monthly	High	30	Advanced project management
2023	April	31	11:00	Room 224	Workshop	93h	Quarterly	High	31	Client presentation
2023	May	1	12:00	Room 225	Conference	94h	Weekly	Medium	1	Product development
2023	May	2	13:00	Room 226	Meeting	95h	Daily	Low	2	Team check-in
2023	May	3	14:00	Room 227	Training	96h	Monthly	High	3	Advanced project management
2023	May	4	15:00	Room 228	Workshop	97h	Quarterly	High	4	Client presentation
2023	May	5	16:00	Room 229	Conference	98h	Weekly	Medium	5	Product development
2023	May	6	17:00	Room 230	Meeting	99h	Daily	Low	6	Team check-in
2023	May	7	18:00	Room 231	Training	100h	Monthly	High	7	Advanced project management
2023	May	8	19:00	Room 232	Workshop	101h	Quarterly	High	8	Client presentation
2023	May	9	20:00	Room 233	Conference	102h	Weekly	Medium	9	Product development
2023	May	10	21:00	Room 234	Meeting	103h	Daily	Low	10	Team check-in
2023	May	11	22:00	Room 235	Training	104h	Monthly	High	11	Advanced project management
2023	May	12	23:00	Room 236	Workshop	105h	Quarterly	High	12	Client presentation
2023	May	13	00:00	Room 237	Conference	106h	Weekly	Medium	13	Product development
2023	May	14	01:00	Room 238	Meeting	107h	Daily	Low	14	Team check-in
2023	May	15	02:00	Room 239	Training	108h	Monthly	High	15	Advanced project management
2023	May	16	03:00	Room 240	Workshop	109h	Quarterly	High	16	Client presentation
2023	May	17	04:00	Room 241	Conference	110h	Weekly	Medium	17	Product development
2023	May	18	05:00	Room 242	Meeting	111h	Daily	Low	18	Team

Year	Month	Day	Time	Location	Activity	Duration	Participants	Facilitator	Notes
2023	Jan	1	09:00	Room 101	Orientation	1h	10	John Doe	First day of the year.
2023	Jan	2	10:00	Room 101	Workshop	2h	15	Jane Smith	Introduction to the course.
2023	Jan	3	11:00	Room 101	Lecture	1h	12	John Doe	Continuation of the course.
2023	Jan	4	12:00	Room 101	Workshop	2h	18	Jane Smith	Hands-on experience.
2023	Jan	5	13:00	Room 101	Lecture	1h	14	John Doe	Discussion on the topic.
2023	Jan	6	14:00	Room 101	Workshop	2h	16	Jane Smith	Group activities.
2023	Jan	7	15:00	Room 101	Lecture	1h	17	John Doe	Guest speaker.
2023	Jan	8	16:00	Room 101	Workshop	2h	19	Jane Smith	Case study analysis.
2023	Jan	9	17:00	Room 101	Lecture	1h	20	John Doe	Review of the week.
2023	Jan	10	18:00	Room 101	Workshop	2h	21	Jane Smith	Final project presentation.

Year	Month	Day	Time	Room	Activity	Duration	Frequency	Intensity	Impact	Notes
2023	January	1	08:00	Room 101	Classroom	120	1	Low	Minor	First day of school
2023	January	2	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	January	3	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	January	4	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	January	5	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	January	6	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	January	7	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	January	8	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	January	9	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	January	10	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	January	11	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	January	12	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	January	13	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	January	14	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	January	15	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	January	16	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	January	17	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	January	18	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	January	19	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	January	20	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	January	21	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	January	22	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	January	23	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	January	24	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	January	25	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	January	26	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	January	27	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	January	28	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	January	29	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	January	30	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	January	31	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	February	1	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	February	2	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	February	3	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	February	4	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	February	5	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	February	6	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	February	7	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	February	8	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	February	9	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	February	10	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	February	11	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	February	12	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	February	13	08:00	Room 101	Classroom	120	1	Low	Minor	
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2023	February	16	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	February	17	08:00	Room 101	Classroom	120	1	Low	Minor	
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2023	February	22	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	February	23	08:00	Room 101	Classroom	120	1	Low	Minor	
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2023	February	25	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	February	26	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	February	27	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	February	28	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	February	29	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	February	30	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	February	31	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	March	1	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	March	2	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	March	3	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	March	4	08:00	Room 101	Classroom	120	1	Low	Minor	
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2023	March	10	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	March	11	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	March	12	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	March	13	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	March	14	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	March	15	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	March	16	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	March	17	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	March	18	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	March	19	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	March	20	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	March	21	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	March	22	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	March	23	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	March	24	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	March	25	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	March	26	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	March	27	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	March	28	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	March	29	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	March	30	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	March	31	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	April	1	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	April	2	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	April	3	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	April	4	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	April	5	08:00	Room 101	Classroom	120	1	Low	Minor	
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2023	April	8	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	April	9	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	April	10	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	April	11	08:00	Room 101	Classroom	120	1	Low	Minor	
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2023	April	13	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	April	14	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	April	15	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	April	16	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	April	17	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	April	18	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	April	19	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	April	20	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	April	21	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	April	22	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	April	23	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	April	24	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	April	25	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	April	26	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	April	27	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	April	28	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	April	29	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	April	30	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	April	31	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	May	1	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	May	2	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	May	3	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	May	4	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	May	5	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	May	6	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	May	7	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	May	8	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	May	9	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	May	10	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	May	11	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	May	12	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	May	13	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	May	14	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	May	15	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	May	16	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	May	17	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	May	18	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	May	19	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	May	20	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	May	21	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	May	22	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	May	23	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	May	24	08:00	Room 101	Classroom	120	1	Low	Minor	
2023	May	25	08:00	Room 101	Classroom	120	1	Low		

[illegible]

Event Planning - Water Balance Details									
Event Date	Event Name	Location	Duration (hrs)	Participant Count	Food & Beverage	Water Usage (Liters)	Waste Generation (kg)	CO2 Emissions (kg)	Notes
2023-01-01	New Year's Eve Party	Grand Ballroom	12	500	High	15000	200	100	Special event, high water usage
2023-01-02	Winter Solstice Celebration	Outdoor Plaza	4	200	Medium	5000	50	20	Outdoor event, lower water usage
2023-01-03	Corporate Training Session	Conference Room A	8	100	Low	2000	10	5	Standard business event
2023-01-04	Product Launch Event	Convention Center	6	300	Medium-High	8000	100	40	Large audience, moderate water usage
2023-01-05	Charity Gala Dinner	Ballroom B	10	400	High	12000	150	70	Formal dinner, high water usage
2023-01-06	Networking Breakfast	Breakfast Room	3	150	Low	3000	20	10	Small group, low water usage
2023-01-07	Workshop Series	Workshop Room	5	80	Low	4000	30	15	Hands-on session, moderate water usage
2023-01-08	Guest Lecture	Auditorium	2	50	Low	1000	5	2	Single speaker, low water usage
2023-01-09	Team Building Exercise	Outdoor Field	3	120	Low	2500	15	8	Outdoor activity, lower water usage
2023-01-10	Press Conference	Press Room	1	30	Low	500	2	1	Short event, minimal water usage
2023-01-11	Networking Reception	Reception Area	2	60	Low	1500	10	5	Small gathering, low water usage
2023-01-12	Workshop Series	Workshop Room	5	80	Low	4000	30	15	Hands-on session, moderate water usage
2023-01-13	Guest Lecture	Auditorium	2	50	Low	1000	5	2	Single speaker, low water usage
2023-01-14	Team Building Exercise	Outdoor Field	3	120	Low	2500	15	8	Outdoor activity, lower water usage
2023-01-15	Press Conference	Press Room	1	30	Low	500	2	1	Short event, minimal water usage
2023-01-16	Networking Reception	Reception Area	2	60	Low	1500	10	5	Small gathering, low water usage
2023-01-17	Workshop Series	Workshop Room	5	80	Low	4000	30	15	Hands-on session, moderate water usage
2023-01-18	Guest Lecture	Auditorium	2	50	Low	1000	5	2	Single speaker, low water usage
2023-01-19	Team Building Exercise	Outdoor Field	3	120	Low	2500	15	8	Outdoor activity, lower water usage
2023-01-20	Press Conference	Press Room	1	30	Low	500	2	1	Short event, minimal water usage
2023-01-21	Networking Reception	Reception Area	2	60	Low	1500	10	5	Small gathering, low water usage
2023-01-22	Workshop Series	Workshop Room	5	80	Low	4000	30	15	Hands-on session, moderate water usage
2023-01-23	Guest Lecture	Auditorium	2	50	Low	1000	5	2	Single speaker, low water usage
2023-01-24	Team Building Exercise	Outdoor Field	3	120	Low	2500	15	8	Outdoor activity, lower water usage
2023-01-25	Press Conference	Press Room	1	30	Low	500	2	1	Short event, minimal water usage
2023-01-26	Networking Reception	Reception Area	2	60	Low	1500	10	5	Small gathering, low water usage
2023-01-27	Workshop Series	Workshop Room	5	80	Low	4000	30	15	Hands-on session, moderate water usage
2023-01-28	Guest Lecture	Auditorium	2	50	Low	1000	5	2	Single speaker, low water usage
2023-01-29	Team Building Exercise	Outdoor Field	3	120	Low	2500	15	8	Outdoor activity, lower water usage
2023-01-30	Press Conference	Press Room	1	30	Low	500	2	1	Short event, minimal water usage
2023-01-31	Networking Reception	Reception Area	2	60	Low	1500	10	5	Small gathering, low water usage
2023-02-01	Workshop Series	Workshop Room	5	80	Low	4000	30	15	Hands-on session, moderate water usage
2023-02-02	Guest Lecture	Auditorium	2	50	Low	1000	5	2	Single speaker, low water usage
2023-02-03	Team Building Exercise	Outdoor Field	3	120	Low	2500	15	8	Outdoor activity, lower water usage
2023-02-04	Press Conference	Press Room	1	30	Low	500	2	1	Short event, minimal water usage
2023-02-05	Networking Reception	Reception Area	2	60	Low	1500	10	5	Small gathering, low water usage
2023-02-06	Workshop Series	Workshop Room	5	80	Low	4000	30	15	Hands-on session, moderate water usage
2023-02-07	Guest Lecture	Auditorium	2	50	Low	1000	5	2	Single speaker, low water usage
2023-02-08	Team Building Exercise	Outdoor Field	3	120	Low	2500	15	8	Outdoor activity, lower water usage
2023-02-09	Press Conference	Press Room	1	30	Low	500	2	1	Short event, minimal water usage
2023-02-10	Networking Reception	Reception Area	2	60	Low	1500	10	5	Small gathering, low water usage
2023-02-11	Workshop Series	Workshop Room	5	80	Low	4000	30	15	Hands-on session, moderate water usage
2023-02-12	Guest Lecture	Auditorium	2	50	Low	1000	5	2	Single speaker, low water usage
2023-02-13	Team Building Exercise	Outdoor Field	3	120	Low	2500	15	8	Outdoor activity, lower water usage
2023-02-14	Press Conference	Press Room	1	30	Low	500	2	1	Short event, minimal water usage
2023-02-15	Networking Reception	Reception Area	2	60	Low	1500	10	5	Small gathering, low water usage
2023-02-16	Workshop Series	Workshop Room	5	80	Low	4000	30	15	Hands-on session, moderate water usage
2023-02-17	Guest Lecture	Auditorium	2	50	Low	1000	5	2	Single speaker, low water usage
2023-02-18	Team Building Exercise	Outdoor Field	3	120	Low	2500	15	8	Outdoor activity, lower water usage
2023-02-19	Press Conference	Press Room	1	30	Low	500	2	1	Short event, minimal water usage
2023-02-20	Networking Reception	Reception Area	2	60	Low	1500	10	5	Small gathering, low water usage
2023-02-21	Workshop Series	Workshop Room	5	80	Low	4000	30	15	Hands-on session, moderate water usage
2023-02-22	Guest Lecture	Auditorium	2	50	Low	1000	5	2	Single speaker, low water usage
2023-02-23	Team Building Exercise	Outdoor Field	3	120	Low	2500	15	8	Outdoor activity, lower water usage
2023-02-24	Press Conference	Press Room	1	30	Low	500	2	1	Short event, minimal water usage
2023-02-25	Networking Reception	Reception Area	2	60	Low	1500	10	5	Small gathering, low water usage
2023-02-26	Workshop Series	Workshop Room	5	80	Low	4000	30	15	Hands-on session, moderate water usage
2023-02-27	Guest Lecture	Auditorium	2	50	Low	1000	5	2	Single speaker, low water usage
2023-02-28	Team Building Exercise	Outdoor Field	3	120	Low	2500	15	8	Outdoor activity, lower water usage
2023-02-29	Press Conference	Press Room	1	30	Low	500	2	1	Short event, minimal water usage
2023-03-01	Networking Reception	Reception Area	2	60	Low	1500	10	5	Small gathering, low water usage
2023-03-02	Workshop Series	Workshop Room	5	80	Low	4000	30	15	Hands-on session, moderate water usage
2023-03-03	Guest Lecture	Auditorium	2	50	Low	1000	5	2	Single speaker, low water usage
2023-03-04	Team Building Exercise	Outdoor Field	3	120	Low	2500	15	8	Outdoor activity, lower water usage
2023-03-05	Press Conference	Press Room	1	30	Low	500	2	1	Short event, minimal water usage
2023-03-06	Networking Reception	Reception Area	2	60	Low	1500	10	5	Small gathering, low water usage
2023-03-07	Workshop Series	Workshop Room	5	80	Low	4000	30	15	Hands-on session, moderate water usage
2023-03-08	Guest Lecture	Auditorium	2	50	Low	1000	5	2	Single speaker, low water usage
2023-03-09	Team Building Exercise	Outdoor Field	3	120	Low	2500	15	8	Outdoor activity, lower water usage
2023-03-10	Press Conference	Press Room	1	30	Low	500	2	1	Short event, minimal water usage
2023-03-11	Networking Reception	Reception Area	2	60	Low	1500	10	5	Small gathering, low water usage
2023-03-12	Workshop Series	Workshop Room	5	80	Low	4000	30	15	Hands-on session, moderate water usage
2023-03-13	Guest Lecture	Auditorium	2	50	Low	1000	5	2	Single speaker, low water usage
2023-03-14	Team Building Exercise	Outdoor Field	3	120	Low	2500	15	8	Outdoor activity, lower water usage
2023-03-15	Press Conference	Press Room	1	30	Low	500	2	1	Short event, minimal water usage
2023-03-16	Networking Reception	Reception Area	2	60	Low	1500	10	5	Small gathering, low water usage
2023-03-17	Workshop Series	Workshop Room	5	80	Low	4000	30	15	Hands-on session, moderate water usage
2023-03-18	Guest Lecture	Auditorium	2	50	Low	1000	5	2	Single speaker, low water usage
2023-03-19	Team Building Exercise	Outdoor Field	3	120	Low	2500	15	8	Outdoor activity, lower water usage
2023-03-20	Press Conference	Press Room	1	30	Low	500	2	1	Short event, minimal water usage
2023-03-21	Networking Reception	Reception Area	2	60	Low	1500	10	5	Small gathering, low water usage
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2023-03-30	Press Conference	Press Room	1	30	Low	500	2	1	Short event, minimal water usage
2023-03-31	Networking Reception	Reception Area	2	60	Low	1500	10	5	Small gathering, low water usage
2023-04-01	Workshop Series	Workshop Room	5	80	Low	4000	30	15	Hands-on session, moderate water usage
2023-04-02	Guest Lecture	Auditorium	2	50	Low	1000	5	2	Single speaker, low water usage
2023-04-03	Team Building Exercise	Outdoor Field	3	120	Low	2500	15	8	Outdoor activity, lower water usage
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2023-05-22	Guest Lecture	Auditorium	2	50	Low	1000	5		

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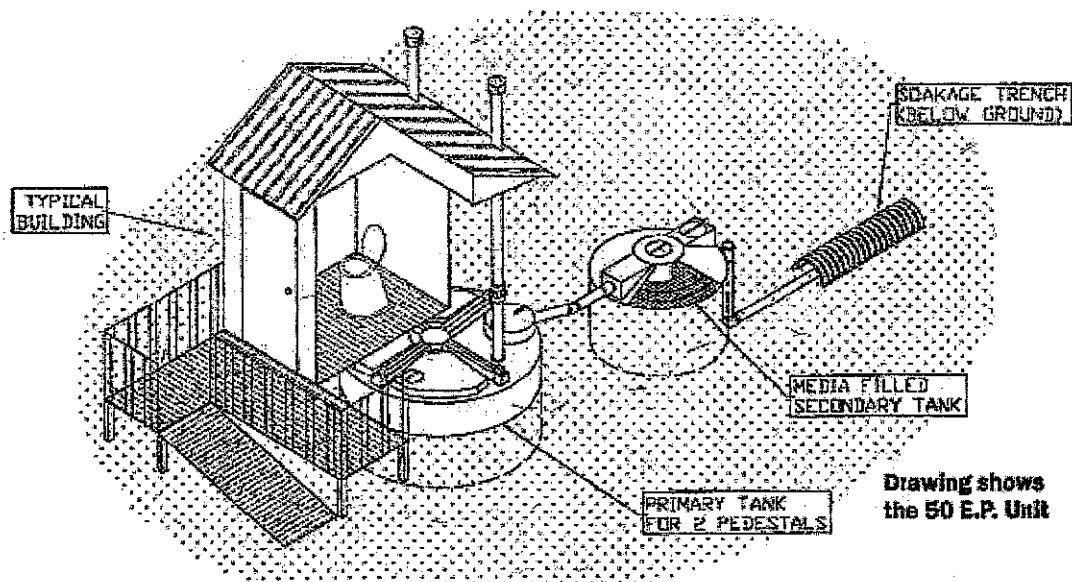
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APPENDIX D

WATERLESS SYSTEMS



source: The Hybrid Toilet System, 2000

The term "waterless systems" applies to a range of low water use toilet systems that are mostly used in areas of inadequate water supply. Types of "waterless systems" include:

- pans The pan is removed and emptied when full, contents commonly referred to as "nightsoil".
- pit latrines Toilet seat located over pit or "long drop". Toilet is relocated when full.
An improvement to the basic pit latrine that involves adding an external vent, known as a ventilated improved pit (VIP) latrine.
- Pour-flush toilets Use a water seal in the discharge pipe to the pit, rather than direct discharge, and the wastes are flushed by manually pouring water into the toilet bowl.
- Aquaprivies Employ direct discharge via a drop pipe into a septic tank soil absorption system. Sometimes referred to as a "hybrid system" as it combines a non-flush toilet with a septic system (refer to diagram above).
- Composting toilet Designed to treat faeces, urine and paper. Composting is a biological process that uses micro-organisms to break down the wastes to form an innocuous relatively dry humus that is capable of being mixed with soil as a conditioner for gardens and landscaped areas. Generally require addition of organic material, such as sawdust, to provide carbon and nutrients for the micro-organisms. The sawdust also acts as a bulking agent to improve penetration of air. Mechanical ventilation provides oxygen to the composting process and

- Chemical toilets

draws odours to a vent above the roofline.

Toilet seat located over a holding tank dosed with chemicals to control odour.

Commonly used on construction sites.

Typical Applications, Advantages and Disadvantages

- ❑ Suited to remote areas where water and power may be scarce;
- ❑ When retrofitting composting toilets to existing buildings, extensive plumbing modifications are required, including installation of the unit below the house. Structural changes may be required depending on the location of footings and toilet;
- ❑ Easy access is required to the composting unit for general maintenance;
- ❑ Not considered to be appropriate technology for existing dwellings unless houses are designed to incorporate composting toilets;
- ❑ Retrofitting to existing houses may be seen as a retrograde step by the community;
- ❑ National Parks experience on non-domestic sized applications has been mixed. Main problems associated with excessive moisture and maintenance requirements; and
- ❑ Need separate greywater treatment and disposal system (eg. for showers, laundries, kitchens, etc).

GREYWATER REUSE

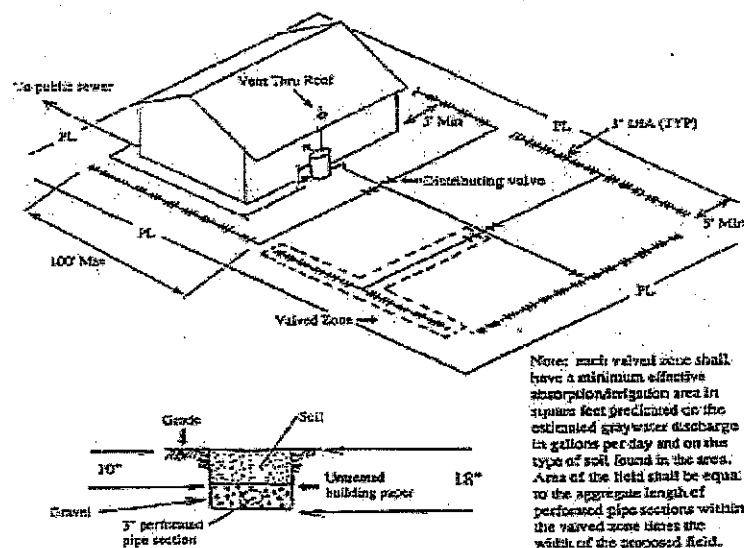
Household wastewater (sewage) is divided into two distinct streams:

- blackwater, which is grossly contaminated by faeces or urine (includes toilet and urinal wastes); and
- greywater, which is not grossly contaminated by faeces or urine (includes hand basin, shower, bath, spa bath, clothes washing machine, laundry tub, dish washer and kitchen sink).

There are two types of greywater reuse practice, namely:

- greywater diversion devices which simply divert greywater (excluding kitchen wastewater) without storage or treatment
- greywater treatment systems which collect, store and treat greywater to a higher standard and may include kitchen wastewater
 - ⇒ treatment standard 1 with disinfection suitable for sub-surface irrigation and surface irrigation
 - ⇒ treatment standard 2 with disinfection suitable for sub-surface irrigation, surface irrigation, toilet flushing and laundry use

GRAYWATER SYSTEM Typical Irrigation Layout



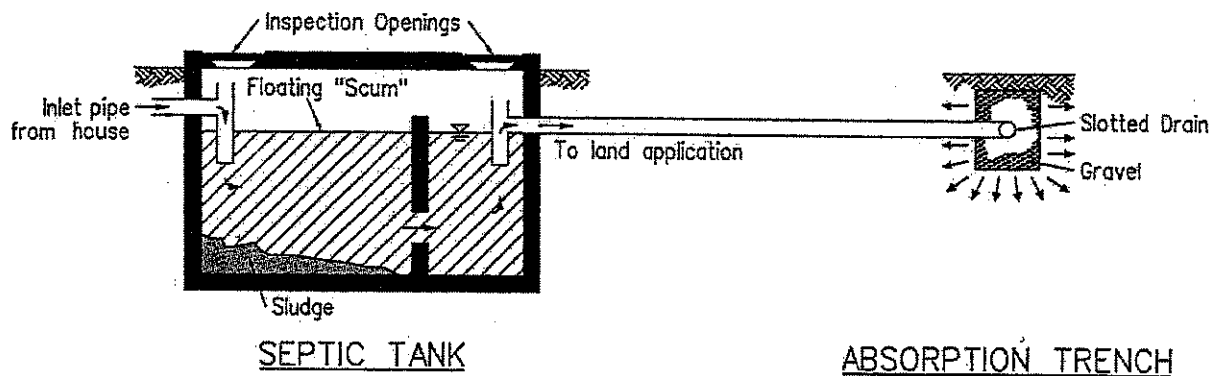
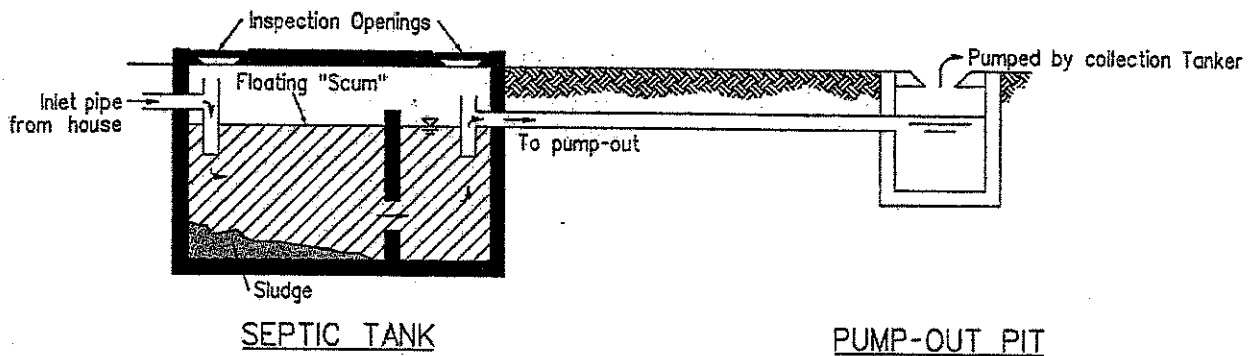
source: US EPA, 1991

Typical Applications, Advantages and Disadvantages

- ❑ Conserves water, particularly advantageous in areas without town water;
- ❑ NSW Health have developed guidelines for greywater reuse for sewerred single domestic premises. The sewer connection is required to act as an overflow during wet weather or when excess greywater cannot be utilised;
- ❑ Requires careful site assessment and design to ensure sustainability of system. For example, some soils are not suitable for irrigation with greywater. A geotechnical engineer or soil scientist may be required to prepare the site assessment and application to the local authority. Technical issues such as soil salinity, permeability, pH, electrical conductivity, sodicity, cation exchange, phosphorus sorption capacity and dispersiveness need to be assessed by appropriate specialists; and
- ❑ Adequate space must be available to prevent waterlogging, overflows off the site or excessive application of nutrients that can affect nearby waterways (eg. by contributing to algal blooms).

APPENDIX E

SEPTIC TANKS



source: SWC, 2000

Septic tanks provide a relatively low level of treatment, consisting of settlement of solids, floatation of oils and fats, some biological breakdown of solids and storage of solids. The level of treatment, termed "primary treatment", is insufficient for surface irrigation.

Septic tank effluent is usually drained into absorption trenches or evapotranspiration beds. If site conditions are not suitable effluent may be required to be pumped out by vacuum tanker for further treatment and disposal off-site.

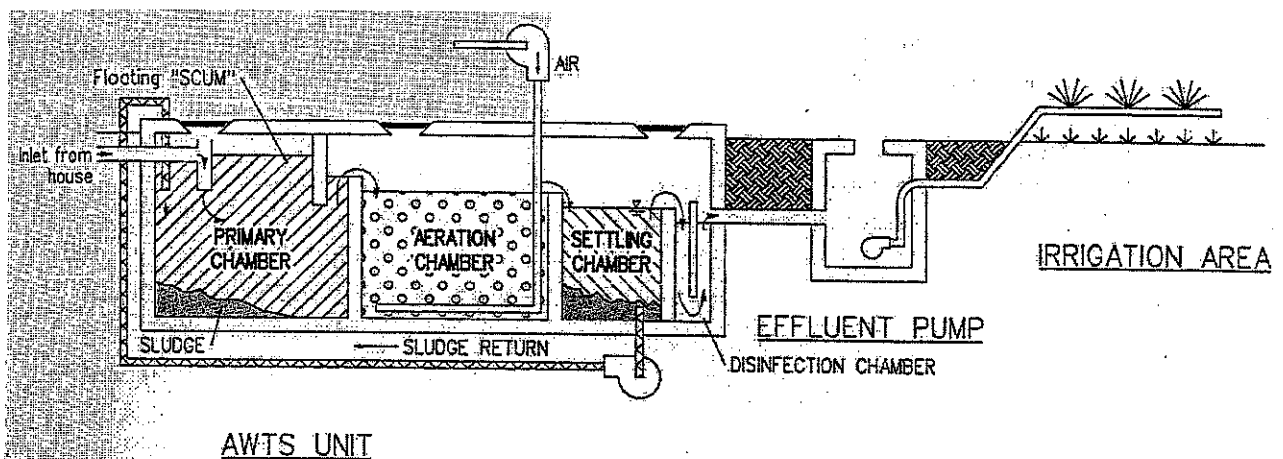
Absorption trenches comprise a series of perforated pipes within a trench filled with crushed rock (typically 600 mm deep and 500 mm wide). The length of the trench depends on the absorption characteristics of the soil. The septic tank effluent is often passed through a distribution box into the trenches. Effluent seeps into the soil where bacteria and oxygen degrade the contaminants in the wastewater.

Evapotranspiration beds are lined with an impervious membrane to prevent seepage into the groundwater. The effluent is distributed through a series of perforated pipes into the fill soil (sand) where it is taken up by vegetation and transpired through leaves to the atmosphere. The size of the beds depends on rainfall.

Typical Applications, Advantages and Disadvantages

- ❑ Septic tanks are the most common form of on-site system within the unsewered areas;
- ❑ There has been a high frequency of failure of these systems and many are located in environmentally sensitive areas. This situation poses unacceptable risks to public health and the environment;
- ❑ Not all areas are suitable for on-site effluent disposal. Environmental and Health Protection Guidelines, published in 1998, are utilised by local government for assessment of on-site sewage management systems for single households;
- ❑ On-site disposal requires careful site assessment and design to ensure sustainability of these systems. Refer to discussion of greywater reuse;
- ❑ Inexpensive, low energy and low maintenance costs;
- ❑ Septic tanks require regular pump-outs of sludge (2 to 4 years);
- ❑ Produce a low quality, non-disinfected effluent;
- ❑ Can be odourous, if overloaded; and
- ❑ Pumpout systems are very expensive to operate.

AEROBIC WASTEWATER TREATMENT SYSTEMS (AWTS)



source: SWC, 2000

Aerobic (or aerated) wastewater treatment systems are an enhanced form of septic tank treatment system. These systems either treat septic tank effluent or provide an integral primary sedimentation chamber, which serves the same function of settling out heavy sewage solids prior to further biological treatment.

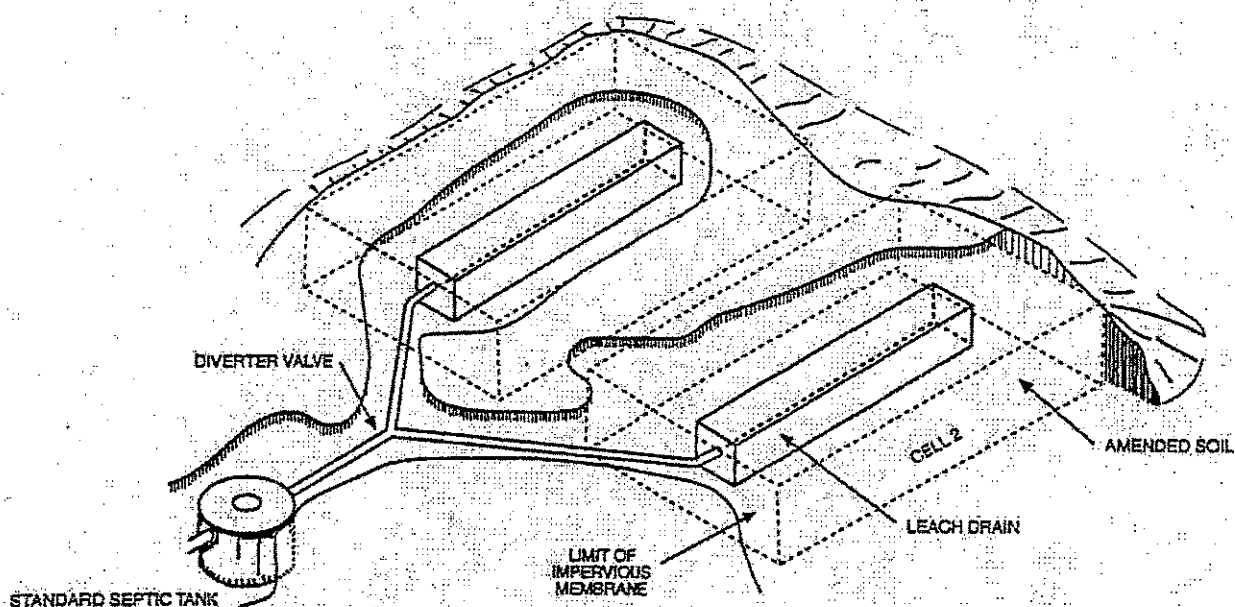
Air is supplied to a second chamber that accepts settled sewage. The conditions in this chamber suit micro-organisms that feed on the organic matter in sewage. The partially treated aerated wastewater enters another chamber where the biological solids (ie. the micro-organisms) are allowed to settle. Clear effluent is drawn from the settlement chamber and is disinfected by chlorination prior to disposal. Disinfected, (secondary) treated effluent may be disposed of above ground via a surface irrigation system. Most AWTS's are provided with an irrigation pump and pipework/hoses.

The biological solids are collected in the settlement chamber and returned to the aeration chamber to continue to breakdown the incoming organic matter. The growth of the micro-organisms results in a build-up of sludge (biological solids) in the system. Desludging of the system is required on a regular basis.

Typical Applications, Advantages and Disadvantages

- ❑ AWTs produce a disinfected, good quality effluent suitable for surface irrigation;
- ❑ Aerobic systems should not produce odours when operated properly;
- ❑ Relatively high capital and operating costs;
- ❑ Regular maintenance is required, including de-sludging and provision of chlorine. Reliability of these systems in very sensitive locations (eg. near oyster beds, water catchment areas, etc) is therefore a legitimate concern;
- ❑ The aerobic process is susceptible to inactivation, or failure, due to the introduction of toxic chemicals or long absence of the owner/occupier;
- ❑ Effluent quality can fall when the system is subjected to shock loads (ie., time of sudden increases of flow);
- ❑ NSW Health guidelines require a dedicated landscaped area to be set aside for spray irrigation. The minimum size of the irrigation area is 200 m² and this area is not suitable for active recreation. Most residential sized blocks would not have sufficient space for a dedicated area of this size; and
- ❑ In periods of extended rainfall, runoff from irrigation areas can contribute to the nutrient loads on local waterways (ie. contributing to algal growth).

ECOMAX



source: Ecomax

Ecomax is a passive treatment system that accepts effluent from a septic tank, treats the contaminants and removes the nutrients (ie. phosphates and nitrates), pathogens and other contaminants at a high efficiency. It has been in commercial use in Western Australia since 1992, and the first system in NSW was installed in 1994. There are 500 systems in service ranging from single residence to 100 persons (at 16500 L/d).

In a standard Ecomax design two cells are used in rotation. Effluent from a septic tank drains to a central leach drain (tunnel) for storage and leaching through a mound of amended-soil medium. The mound is underlain by an impervious membrane and covered by a layer of topsoil and grass cover.

The principle active ingredient is an industrial by-product, which is high in iron, and aluminium sesquioxides, which have strong P adsorption capacity. The treatment processes applied to the effluent through the cell include:

- filtration
- pH adjustment
- ion exchange
- adsorption
- precipitation
- oxidation and reduction
- biological water and nutrient uptake
- nitrification / de-nitrification
- volatilisation
- detention (20 days)
- evaporation

Both phosphorus and nitrogen (problematic nutrients in waterways) are substantially reduced. Micro-organisms are killed off by filtration, detention, natural die-off under inhospitable cell conditions (slightly alkaline) and by predation by microfauna.

Typical Applications, Advantages and Disadvantages

- ❑ Can produce a disinfected, high quality effluent suitable for discharge to sensitive waters or groundwater, where nutrient loadings are of concern;
- ❑ Should not produce odours unless overloaded;
- ❑ Relatively high capital cost but low power costs;
- ❑ Relatively high land take of up to 30 m² / person;
- ❑ Regular maintenance is required, including de-sludging of septic tank but chlorine is not used;
- ❑ Life is limited by adsorption capacity. May need replacement on a 15 to 20 year basis; and
- ❑ Performance generally better than AWTs's, particularly in terms of nutrient reduction.

APPENDIX F

Subsurface Irrigation - Hydraulic Loading Calculation
(use Sydney rates for precipitation and evaporation)

Design Flow 735 L/d
Design Percolation Rate 5 mm/wk assumed

Parameter	Units	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Total
Days in Months	Day	30	31	30	31	31	29	31	30	31	31	30	31	366
Precipitation	mm/month	6	103	109	60	51	129	101	101	86	39	43	153	913
Evaporation (sydney)	mm/month	178	162	195	212	240	192	177	132	249	99	83	113	2033
Crop Factor		1	1	1	1	1	1	1	1	1	1	1	1	8

Outputs

Evapotranspiration	mm/month	125	113	136	149	168	135	124	93	175	69	58	79	1423
Percolation	mm/month	21	22	21	22	22	21	22	22	22	21	22	22	261
Output	mm/month	146	135	158	171	190	155	146	114	197	90	81	101	1685

Inputs

Precipitation	mm/month	6	103	109	60	51	129	101	33	86	39	43	153	913
Possible Effluent Irrigation	mm/month	140	33	49	111	139	26	45	81	111	51	38	52	772
Actual Effluent Production	mm/month	76	76	76	76	76	76	76	76	76	76	76	76	913
Inputs	mm/month	82	179	185	136	127	205	177	109	162	115	119	229	1825

Storage	mm/month	-64	44	27	-35	-63	50	31	-5	-35	25	39	128	140
Cumulative Storage	mm	0	44	71	35	0	50	81	76	41	66	104	233	801

Irrigation Area	m ²	348
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Storage	Largest Storage	mm	233
		m ³	

Sub-surface Irrigation Calculations

Nutrient Balance

Nitrogen Loading	Low		High	
Concentration of total nitrogen in treated effluent (AWTS)	50	mg/L	60	mg/L
Treated Wastewater Flow Rate per Lot	735	L/d	735	L/d
critical loading rate of nitrogen	36	mg/m ² /day	18	mg/m ² /day

Irrigation Area	1021	m ²	2450	m ²
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Phosphorus Loading	Low		High	
Concentration of total phosphorus in treated effluent (AWTS)	10	mg/L	12	mg/L
Treated Wastewater Flow Rate per Lot	735	L/d	735	L/d
critical loading rate of nitrogen	4	mg/m ² /day	2	mg/m ² /day
Phosphorus sorption capacity	6000	kg/ha	2000	kg/ha
P _{adsorbed} (assumed a third of phosphorus sorped)	0.20	kg/m ²	0.07	kg/m ²
P _{uptake}	0.073	kg/m ²	0.0365	kg/m ²
P _{generated}	134.1375	kg	160.965	kg

Irrigation Area	491	m ²	1560	m ²
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