JAMES WARREN & Associates Pty Ltd

ENVIRONMENTAL CONSULTANTS

OVERVIEW BUFFER MANAGEMENT PLAN

COBAKI LAKES

PREFERRED PROJECT REPORT

OCTOBER 2009

A REPORT TO LEDA MANORSTEAD PTY LTD

Brisbane Office
Suite 28 Cathedral Village
115 Wickham Street
FORTITUDE VALLEY QLD 4006
PH: (07) 3257 2703
Fax: (07) 3257 2708

Head Office
105 Tamar Street
PO Box 1465
BALLINA NSW 2478
PH: (02) 6686 3858
Fax: (02) 6681 1659

Sunshine Coast Office
PH: (07) 5437 0277
Fax: (07) 5437 0922

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1 INTRODUCTION

1.1 Background

James Warren and Associates (JWA) have been engaged by LEDA Manorstead Pty Ltd to complete an Overview Buffer Management Plan (OBMP) for land at the proposed Cobaki Lakes residential development (**FIGURE 1**).

The aim of the OBMP is to describe the principles and management procedures that will guide the completion of future detailed Buffer Management Plans (BMP's). Detailed BMP's will be prepared for all stages of the proposed development, as part of related Development/Project Applications.

1.2 Locality

The Locality is defined as the area within a 10km radius of the subject site. The Locality therefore extends from North Tumbulgum in the south to Burleigh Heads in the north and from Currumbin Valley in the west to Tweed Heads in the east (**FIGURE 1**).

Prominent features in the locality include the townships of Coolangatta, Palm Beach and Banora Point and the villages of Tallebudgera, Pigabeen and Bilambil Heights. Prominent water bodies in the locality include the Cobaki Broadwater, Currumbin Creek, Cobaki Creek, Terranora Broadwater and the Coral Sea.

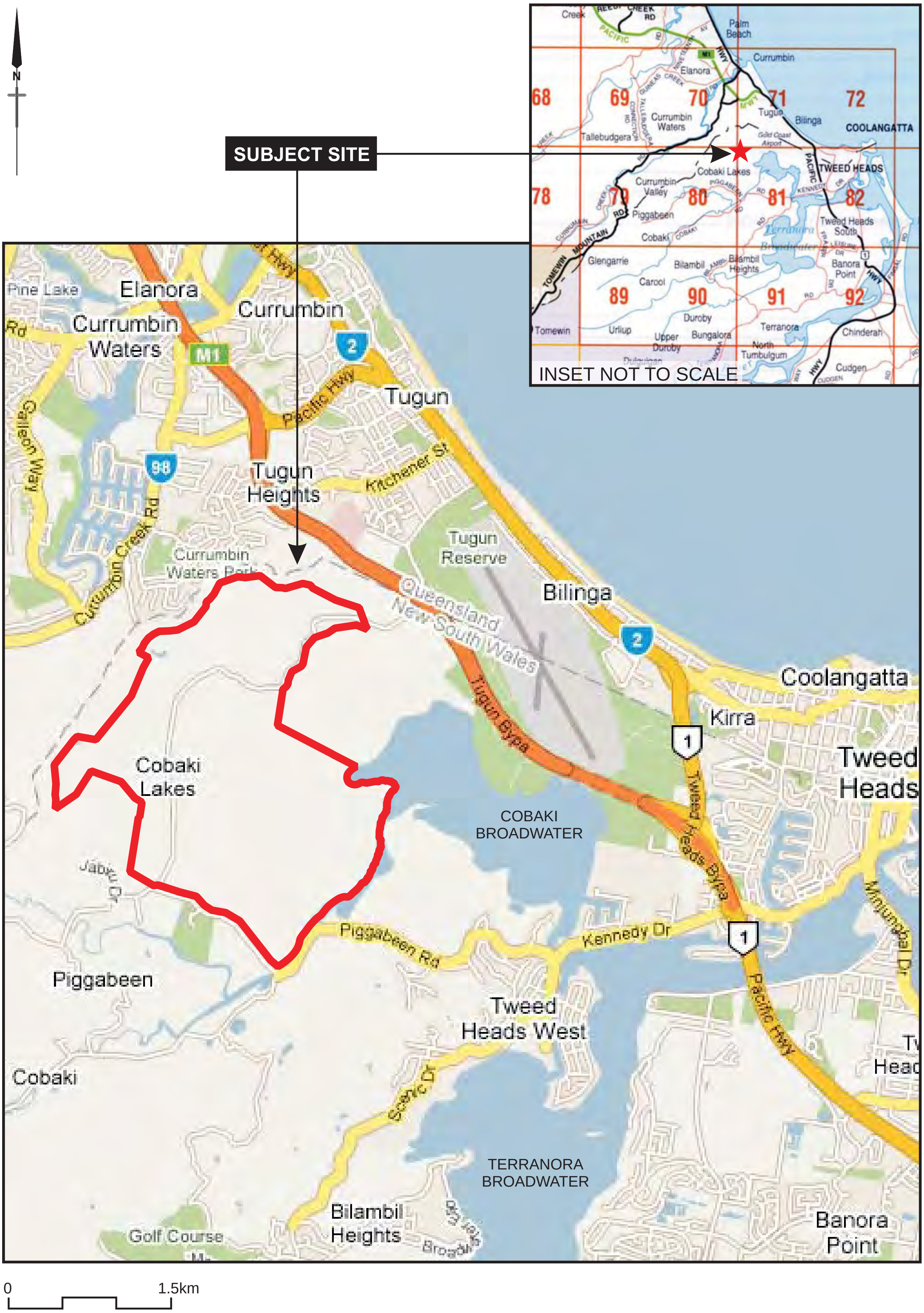
Dominant habitat types are eucalypt forest, swamp sclerophyll forest, rainforest, creeks and intertidal communities. Land uses within the locality include residential, forestry, conservation, tourism, grazing and agriculture.

There are three (3) dedicated conservation reserves in the locality:

- Tweed Estuary Nature Reserve, an area of 59 hectares to the east of the Subject site;
- Stotts Island Nature Reserve, an area of 142 hectares to the south of the Subject site; and
- Ukerebagh Nature Reserve, an area of 150 hectares to the east of the Subject site.

State Wetlands numbers 1 - 30 occur within 10km of the locality (**FIGURE 2**). A large area of SEPP 14 Wetland no. 1 is located immediately east of the subject site adjacent to Cobaki Broadwater and Cobaki Creek (**FIGURE 3**). These wetlands are protected by State Environmental Planning Policy No. 14 – Coastal Wetlands (SEPP 14).

SEPP 26 Littoral Rainforests numbers 2A, 2B, and 2C occur within the locality (**FIGURE 4**). These rainforests are protected by State Environmental Planning Policy No. 26 – Littoral Rainforest (SEPP 26).



SOURCE: Google Maps

SCALE: 1 : 50 000 @ A4

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Environmental Consultants

CLIENT
Leda Developments Pty Ltd

PROJECT
Principal Buffer Management Plan
Cobaki Lakes, Cobaki, NSW
Shire of Tweed

FIGURE 1

PREPARED: BW
DATE: 19 October 2009
FILE: 97038_BMP_Locality.cdr

TITLE

LOCALITY PLAN

Legend

Area Subject to SEPP No. 14 (with index number)

Subject Site

N

0 1500m

SOURCE: State Env. Planning Policy No. 14 Coastal Wetlands Amendment No. 14 SCALE: 1 : 60 000 @ A4 JAMES WARREN & ASSOCIATES PTY LIMITED Environmental Consultants	CLIENT Leda Developments Pty Ltd PROJECT Principal Buffer Management Plan Cobaki Lakes, Cobaki, NSW Shire of Tweed	**FIGURE 2** PREPARED: BW DATE: 19 October 2009 FILE:97038_BMP_SEPP14region.cdr	TITLE **SEPP No. 14 COASTAL WETLANDS**

LEGEND

Area subject to SEPP No. 14

Site Outline

SOURCE:
SEPP - Michel Group Services
Aerial - Qasco taken April 2008 (Cobaki_Lakes.tiff)

0 500m
SCALE: 1 : 12 500 @ A3

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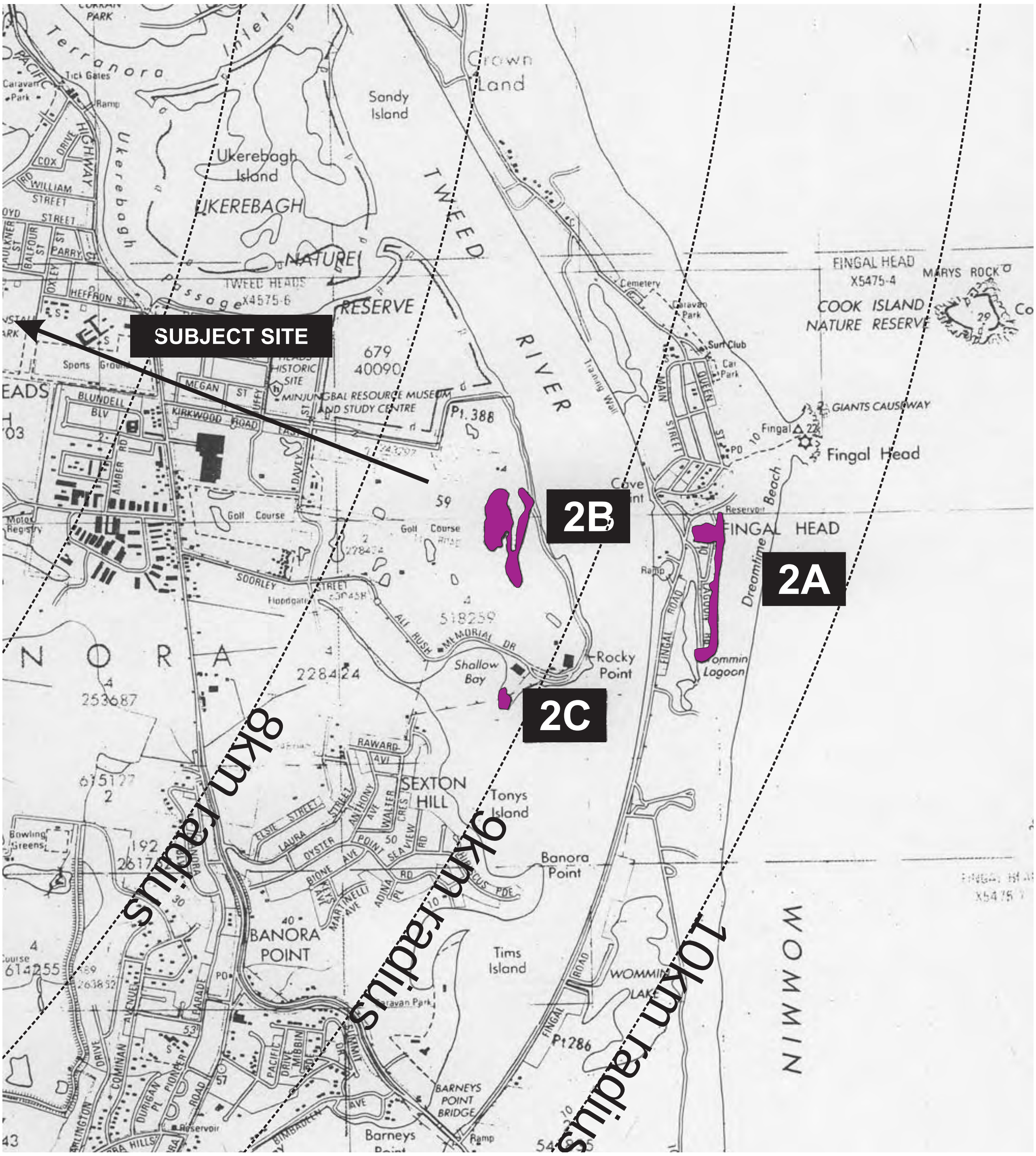
Principle Buffer Management Plan
Cobaki Lakes, Cobaki, NSW
Shire of Tweed

FIGURE 3

PREPARED: BW
DATE: 19 October 2009
FILE: 97038_BMP_Base.dwg

TITLE
SEPP 14
COASTAL
WETLANDS



Legend

Area Subject to SEPP No. 26 (with index number)

Subject Site

N

0 1000m

SOURCE: State Env. Planning Policy No. 26 Littoral Rainforests SCALE: 1 : 25 000 @ A4 JAMES WARREN & ASSOCIATES PTY LIMITED Environmental Consultants	CLIENT Leda Developments Pty Ltd PROJECT Principal Buffer Management Plan Cobaki Lakes, Cobaki, NSW Shire of Tweed	**FIGURE 4** PREPARED: BW DATE: 19 October 2009 FILE: 97038_BMP_SEPP26.cdr	TITLE **SEPP No. 26 LITTORAL RAINFOREST**

1.3 Site Description

The subject site covers approximately 598 hectares and consists of land described as Lot 1 DP 570076, Lot 2 DP 566529, Lot 1 DP 562222, Lot 1 DP 570077, Lot 1 823679, Lots 46, 54, 55, 199, 200, 201, 202, 205, 206, 209, 228 & 305 DP 755740, Cobaki Lakes, off Piggabeen Road, Tweed Heads (**FIGURE 5**).

The site lies adjacent to private landholdings to the north-west and south-east, and comprises a large portion of land cleared for agricultural purposes (i.e. grazing) throughout which a number of vegetation communities occur. Extensive clearing and subsequent slashing over the drainage basin has resulted in the recruitment of a combination of native and introduced grass species in place of native plants. Forested Crown lands which form the NSW-QLD border also form the northern and western boundary of the Cobaki Lakes site.

1.4 Landuse Zones

The Environmental zoning process on the Cobaki Lakes site has been in progress for over 15 years. A large number of environmental assessments over this period of time have informed the environmental zoning process.

The Subject site currently contains the following landuse zones:

- 2(c) Urban Expansion
- 2(e) Residential Tourist Zone
- Recreation (Special Purposes)
- Environmental Protection (Scenic Escarpment)
- Environmental Protection (Habitat)

The current zoning plan is shown in **FIGURE 6**. It is worth noting that the Concept Plan proposes amendments to the current zoning of the site based on the results of the numerous environmental assessments completed over the site. These amendments fall into five categories as follows:

1. Amendments in accordance with Clause 52 of the Tweed LEP 2000;
2. Amendments to zonings contemplated by existing Development Consents;
3. Other proposed additions to the 2(c) Urban Expansion zone;
4. Proposed additions to the 7(l) Environmental Protection (Habitat) zone; and
5. Proposed additions to the 6(b) Recreation zone.

The proposed amended zoning plan is shown in **FIGURE 7**.

1.5 Proposed Development

The site covers an area of approximately 598 hectares and is proposed to be developed into a master planned residential community. A concept plan for the development is shown as **FIGURE 8**. The proposed development will include the following:

N

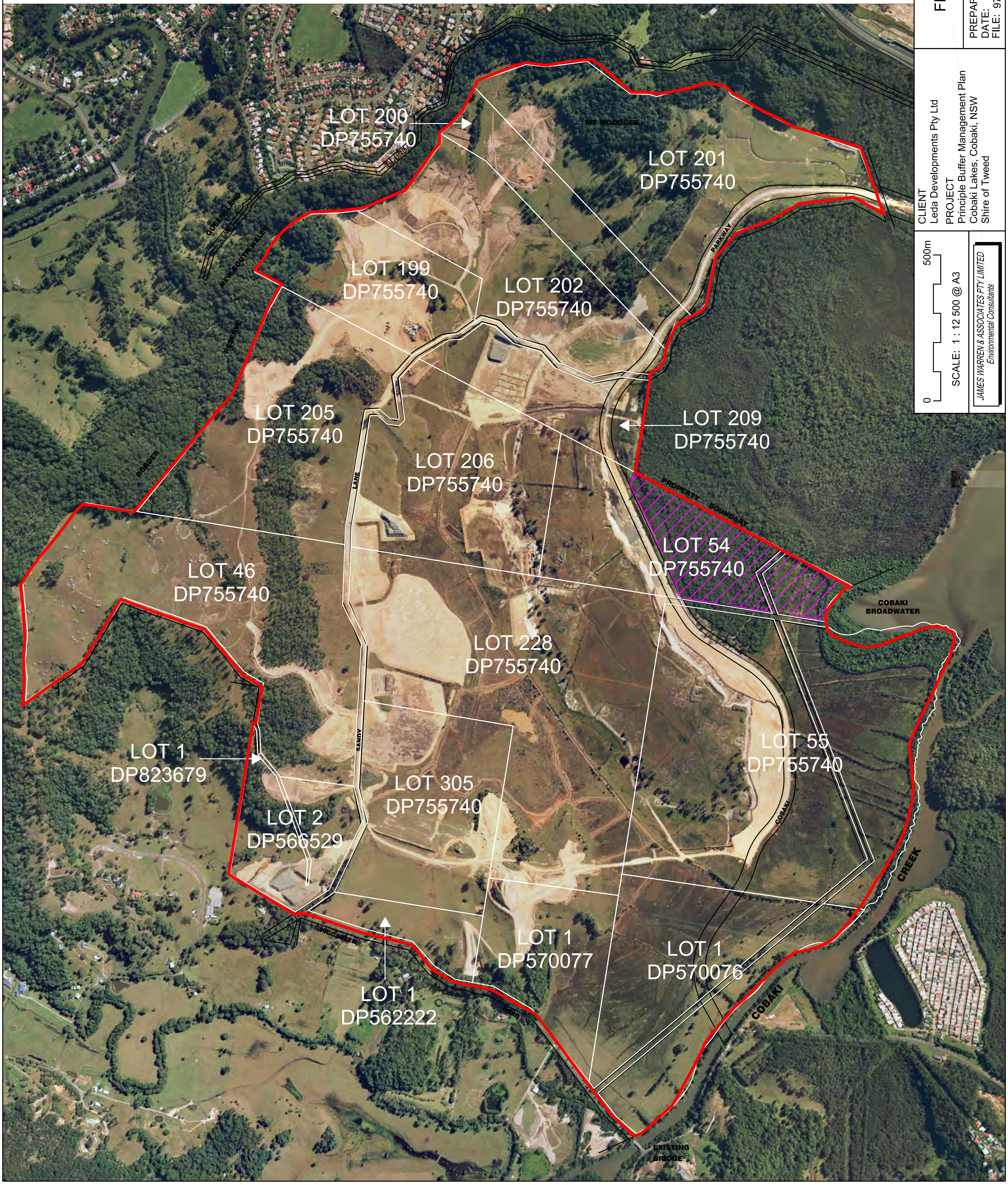
LEGEND

Cadastral Boundaries

Restriction on Use Area

Site Outline

SOURCE:
Aerial - Qasco taken April 2008 (Cobaki_Lakes.tiff)



TITLE

SUBJECT SITE

FIGURE 5

PREPARED: BW
DATE: 19 October 2009
FILE: 97038_BMP_Base.dwg

CLIENT
Leda Developments Pty Ltd

PROJECT
Principle Buffer Management Plan
Cobaki Lakes, Cobaki, NSW
Shire of Tweed

0 500m

SCALE: 1 : 12 500 @ A3

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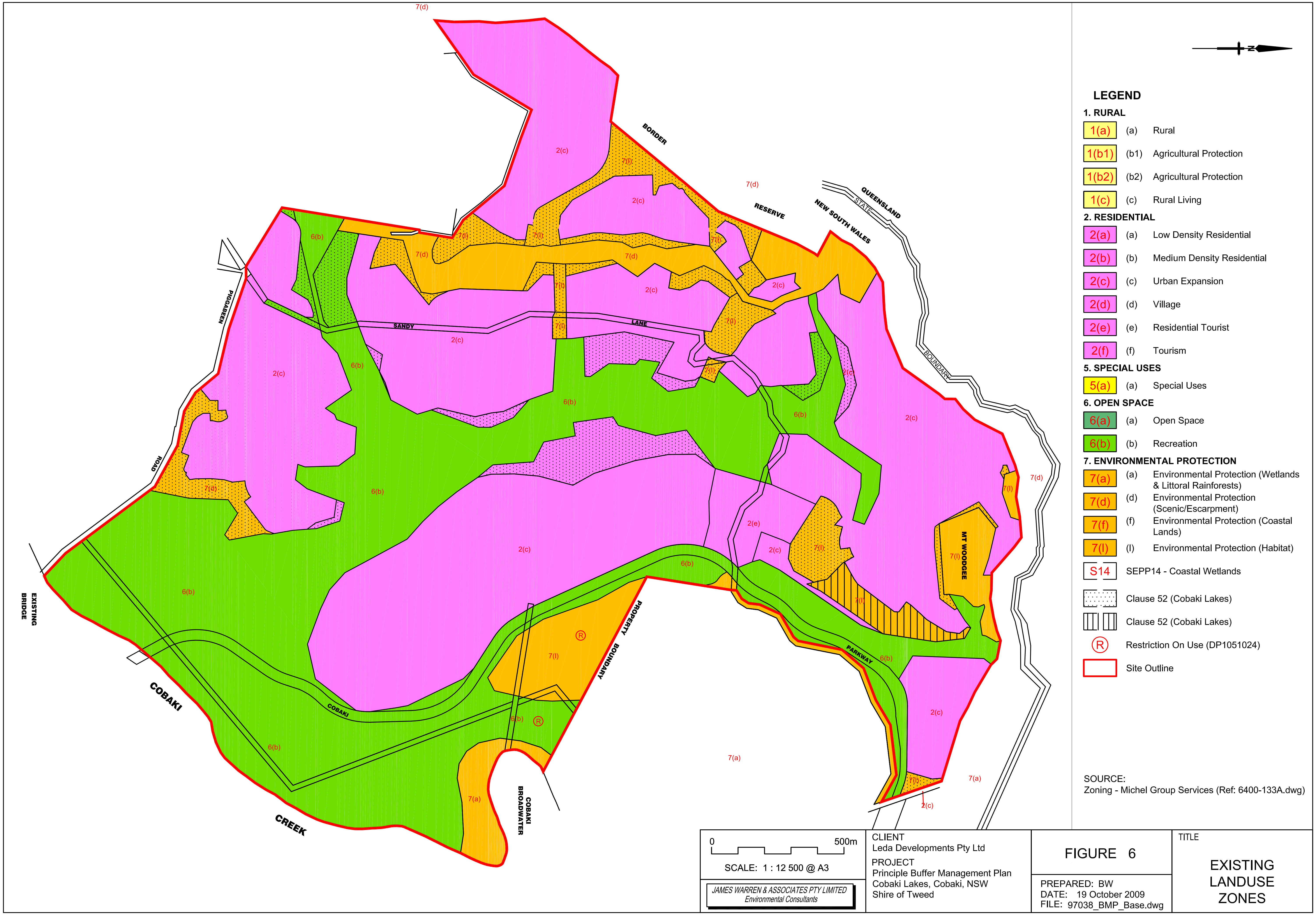
Environmental Consultants



7(d)
BORDER
RESERVE
QUEENSLAND
STATE
NEW SOUTH WALES
BOUNDARY
2(c)
7(l)
7(d)
6(b)
2(e)
SANDY
LANE
MT WOODGEE
PIGGABEEN
ROAD
EXISTING BRIDGE
COBAKI
CREEK
COBAKI BROADWATER
PROPERTY
BOUNDARY
PARKWAY
7(a)
R
LEGEND
1. RURAL
1(a) (a) Rural
1(b1) (b1) Agricultural Protection
1(b2) (b2) Agricultural Protection
1(c) (c) Rural Living
2. RESIDENTIAL
2(a) (a) Low Density Residential
2(b) (b) Medium Density Residential
2(c) (c) Urban Expansion
2(d) (d) Village
2(e) (e) Residential Tourist
2(f) (f) Tourism
5. SPECIAL USES
5(a) (a) Special Uses
6. OPEN SPACE
6(a) (a) Open Space
6(b) (b) Recreation
7. ENVIRONMENTAL PROTECTION
7(a) (a) Environmental Protection (Wetlands & Littoral Rainforests)
7(d) (d) Environmental Protection (Scenic/Escarpment)
7(f) (f) Environmental Protection (Coastal Lands)
7(l) (l) Environmental Protection (Habitat)
S14 SEPP14 - Coastal Wetlands
Clause 52 (Cobaki Lakes)
Clause 52 (Cobaki Lakes)
R Restriction On Use (DP1051024)
Site Outline
SOURCE:
Zoning - Michel Group Services (Ref: 6400-133A.dwg)
0 500m
SCALE: 1 : 12 500 @ A3
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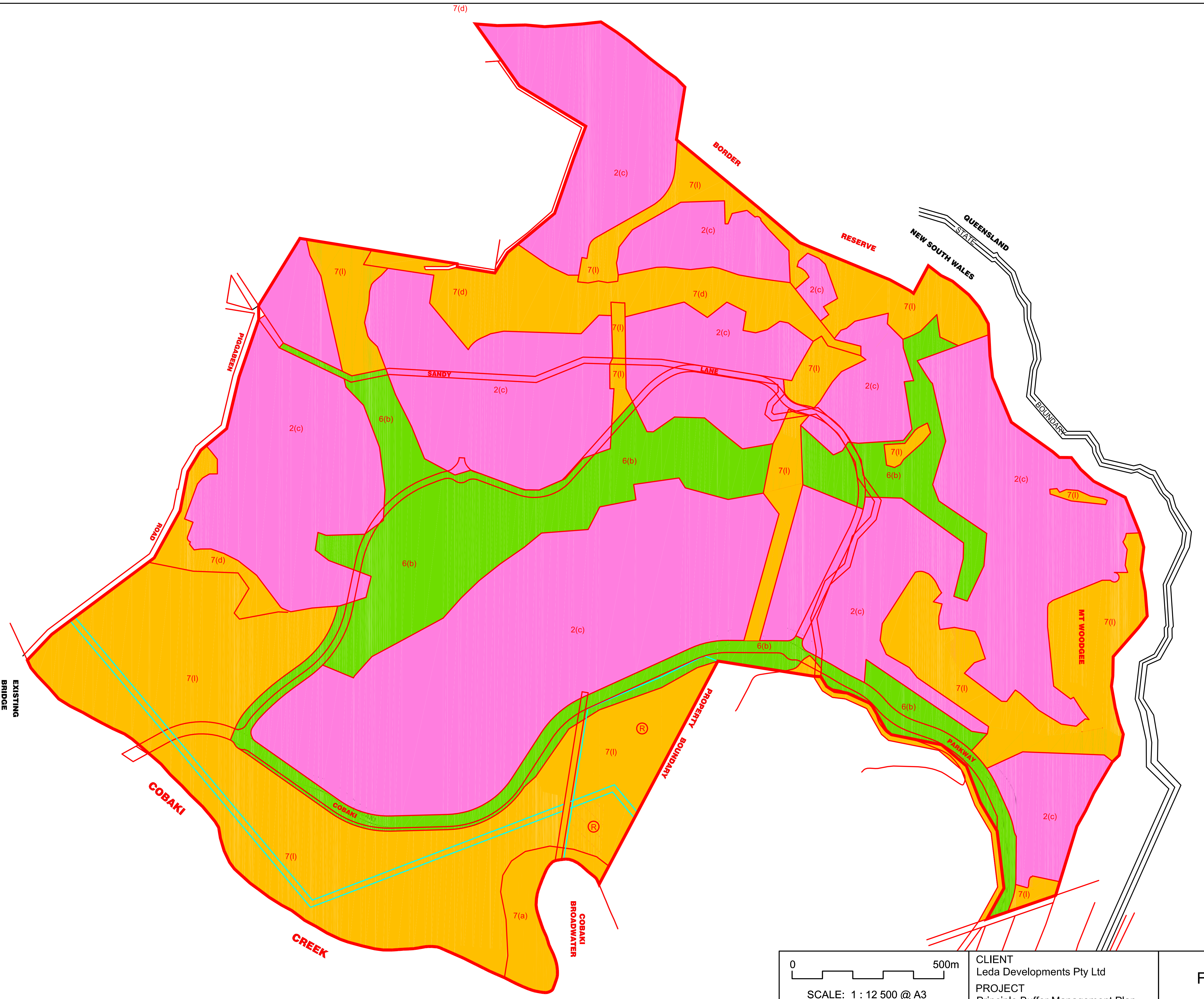
Environmental Consultants
CLIENT
Leda Developments Pty Ltd
PROJECT
Principle Buffer Management Plan
Cobaki Lakes, Cobaki, NSW
Shire of Tweed
FIGURE 6
PREPARED: BW
DATE: 19 October 2009
FILE: 97038_BMP_Base.dwg
TITLE
EXISTING LANDUSE ZONES



LEGEND

1. RURAL

1(a)	(a)	Rural
1(b1)	(b1)	Agricultural Protection
1(b2)	(b2)	Agricultural Protection
1(c)	(c)	Rural Living

2. RESIDENTIAL

2(a)	(a)	Low Density Residential
2(b)	(b)	Medium Density Residential
2(c)	(c)	Urban Expansion
2(d)	(d)	Village
2(e)	(e)	Residential Tourist
2(f)	(f)	Tourism

5. SPECIAL USES

5(a)	(a)	Special Uses

6. OPEN SPACE

6(a)	(a)	Open Space
6(b)	(b)	Recreation

7. ENVIRONMENTAL PROTECTION

7(a)	(a)	Environmental Protection (Wetlands & Littoral Rainforests)
7(d)	(d)	Environmental Protection (Scenic/Escarpment)
7(f)	(f)	Environmental Protection (Coastal Lands)
7(l)	(l)	Environmental Protection (Habitat)
S14		SEPP14 - Coastal Wetlands
		Clause 52 (Cobaki Lakes)
		Clause 52 (Cobaki Lakes)
R		Restriction On Use (DP1051024)
		Site Outline

SOURCE:
Zoning - Michel Group Services (Ref: 6400-155B.dwg)

0 500m
SCALE: 1 : 12 500 @ A3

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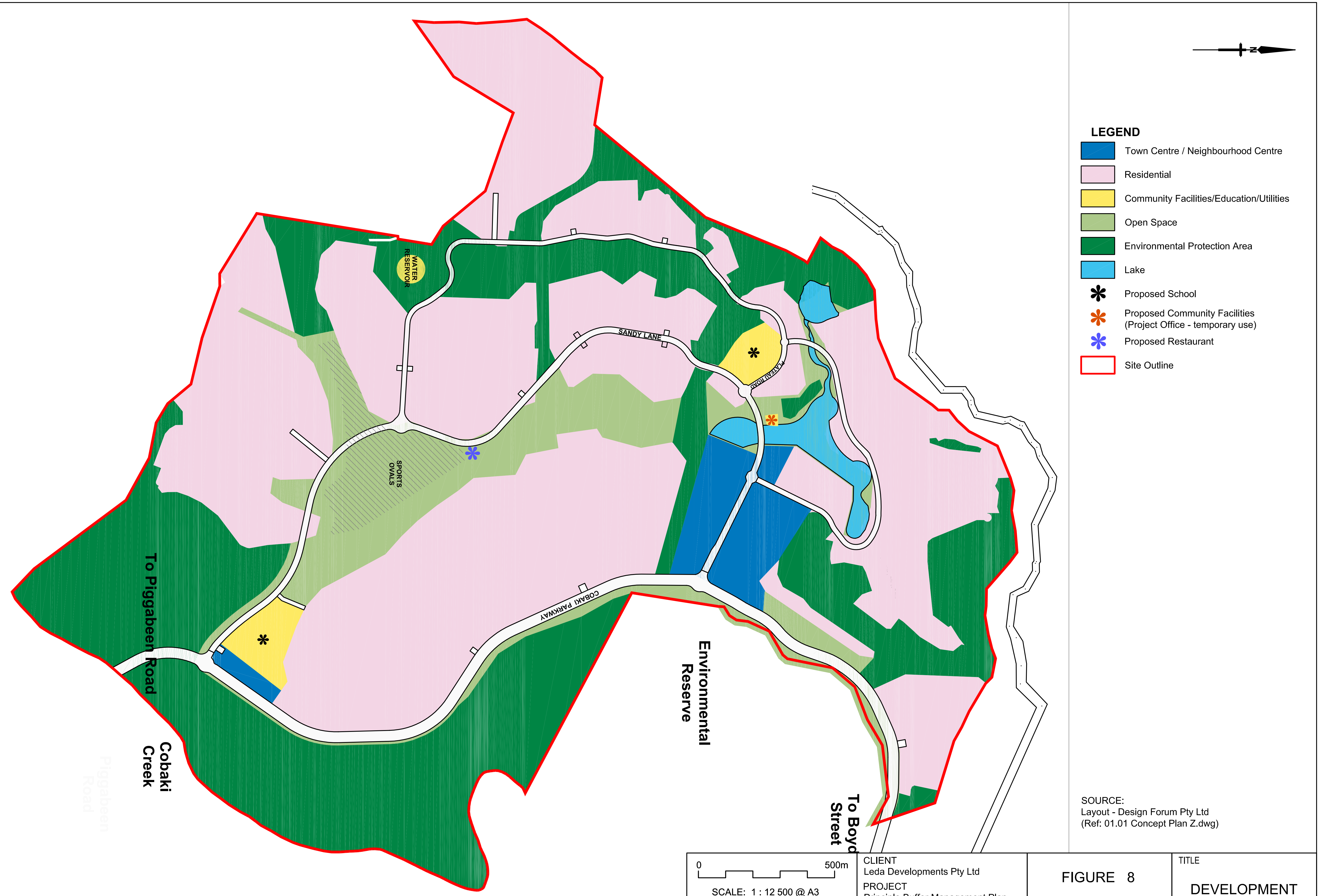
Principle Buffer Management Plan
Cobaki Lakes, Cobaki, NSW
Shire of Tweed

FIGURE 7

PREPARED: BW
DATE: 19 October 2009
FILE: 97038_BMP_Base.dwg

TITLE
PROPOSED ZONING AMENDEMNTS



SOURCE:
Layout - Design Forum Pty Ltd
(Ref: 01.01 Concept Plan Z.dwg)

0 500m SCALE: 1 : 12 500 @ A3 JAMES WARREN & ASSOCIATES PTY LIMITED Environmental Consultants	CLIENT Leda Developments Pty Ltd PROJECT Principle Buffer Management Plan Cobaki Lakes, Cobaki, NSW Shire of Tweed	FIGURE 8 PREPARED: BW DATE: 19 October 2009 FILE: 97038_BMP_Base.dwg	TITLE DEVELOPMENT CONCEPT PLAN

- Town centre (19.6 hectares);
- Residential (293.5 hectares);
- Education/Community facilities/Utilities (8.5 hectares);
- Open space (78 hectares);
- Environmental protection areas (196.5 hectares); and
- Constructed lakes (9.3 hectares).

2 LITERATURE REVIEW

2.1 Introduction

A buffer is defined by the Macquarie Dictionary as something designed to neutralise the shock of opposing forces. Buffers are used in environmental management to protect areas of environmental value from negative impacts. Buffers are usually defined in spatial terms, as a zone or strip that acts to absorb a negative impact associated with an adjacent land use. Buffer zones or strips are usually, but not necessarily, vegetated. However, a buffer may also be some other form of impediment, such as a fence or area of water. Vegetated buffer zones may be especially planted or may consist of a retained area of existing vegetation.

2.2 Types of Buffers

A buffer may take any of a number of forms, depending upon the nature of the environmental value to be protected, the impacts associated with nearby land use and the interaction between these factors. The management context within which the buffer exists is also an important consideration. Examples of buffers include:

- Riparian buffers
- Vegetated barriers
- Filter strips
- Shelterbelts and windbreaks
- Distance buffers (i.e. open space)
- Restrictive barriers (i.e. fences, impenetrable vegetation, water etc.)

2.3 Purposes of Buffers

2.5.1 Rationale

Buffers may be employed for a range of conservation purposes, to protect a specific environmental value (such as water quality in a stream) or a range of values (such as buffering an area of National Park from an urban area). In the majority of cases, buffers are used because of the multiple environmental benefits they provide.

Wetlands or vegetation communities subject to periodic inundation, in particular, can be subjected to a variety of stressors resulting from human actions. Stressors potentially occurring in these environments include:

- Enrichment/eutrophication
- Organic loading and reduced dissolved oxygen
- Contaminant toxicity
- Acidification
- Salinisation
- Sedimentation/burial
- Turbidity/shade
- Vegetation removal

- Thermal alteration
- Dehydration
- Inundation
- Fragmentation of habitat
- Other human presence

Examples of situations where buffers are used to protect specific environmental values are discussed in the following sections.

2.5.2 Protection of Water Quality

Buffer zones are often used to remove nutrients, sediment and/or contaminants from runoff, especially along the banks of watercourses or margins of wetlands. Riparian buffer zones improve water quality in different ways depending upon the pathway of delivery of water to the buffer (Correll 1997). Groundwater passing through the buffer zone may be cleansed of nitrate and acidity due to a combination of de-nitrification, bio-storage and changes in soil composition (Correll 1997). Overland storm flows entering laterally from uplands may be cleansed of suspended particulates, with adhering nutrients, inorganic toxins and pesticides as well as some dissolved nutrients and toxins (Correll 1997). When a stream is in flood, waters flooding out into the buffer zone may also be cleansed of sediments, nutrients and toxic materials as a result of particulate trapping and binding of materials on leaf litter and soils (Correll 1997). Correll (1997) notes a number of external and internal factors that limit the effectiveness of the functions of a riparian buffer zone. Factors external to the buffer zone include: watershed area and gradient; stream channel morphology, soil mineralogy and texture; bedrock type and depth and climate. Internal factors include: the width and type of vegetation, waterlogging and organic content of soils; hydraulic conductivity; soil nutrient content and geochemistry (Correll 1997).

According to the US Department of Agriculture (NCBC 1999a), properly installed, well-maintained buffers can reduce nutrient and pesticide runoff into water bodies by 50% or more, sediment loadings by 75% and pathogen loadings by 60%.

Leishman (1986) has shown that stormwater outlets are significant sources of high nutrient levels. This research also showed that water moving through a vegetated creek bank will drop most of its total phosphorus between 15 and 30 metres away form the pollutant source. The research also showed that water with 600ppm of total phosphorus at a road edge will drop to 250ppm 10 metres down slope of the road edges and to near background level 30metres down slope.

The relationship between pollutant removal and buffer width is nonlinear, with ever greater width required to achieve ever smaller increases in pollutant removal efficiency (Desbonnet *et al* 1994). Desbonnet *et al* (1994) has shown that a 25 metre vegetated buffer will remove 80% of sediment, a 20 metre buffer will remove 70% of Suspend Solids, a 23 metre vegetated buffer will remove 70% of Nitrogen and a 35 metre buffer will remove 70% of Phosphorus. Their research also showed that vegetated buffers of 15-30 metres will protect wetland habitat from low-intensity disturbances whist a 30-45 metre vegetated buffer will protect wetland habitat from high intensity disturbances. According to the work of

Desbonnet *et al* (1994) vegetated buffer width would need to be increased to 600 metres to achieve 99% sediment and pollutant removal.

Correll (1997) cautions that the efficacy of Riparian Buffer Zones in removing pollutants from surface and groundwater is highly dependent upon hydrology. For effective removal of particulates, dissolved nutrients and toxic materials, surface flow must occur as sheet flow rather than highly focused flows and vegetation in the buffer zone must provide enough friction to surface flows.

Additional benefits of riparian buffer zones include:

- Shading and evaporative cooling of the stream channel (Correll 1997);
- Provision of litter and large woody debris to stream channel communities (Correll 1997).
- Provision of unique habitat to wildlife (Belt *et al* 1992).

2.5.3 Control of Human Access

Buffers can be used to restrict access of people to areas of environmental value. Areas of open space provide a distance buffer and can provide a psychological and social restriction on negative human behaviours such as dumping of rubbish or weeds. Buffers can also be designed to provide a physical barrier to access through the use of fencing, impenetrable vegetation, areas of water and so on.

2.5.4 Control of Animal Access

Feral fauna species such as Dogs, Cats, Foxes and Cane toads are known to access new areas by utilising man-made and disturbed areas. A well managed native forested buffer zone may reduce access by these species to the main conservation zone.

2.5.5 Protection of Significant Plants, Nests etc.

Buffers may be used to protect a particular feature of environmental value, such as a significant plant or the nest of a significant bird. In this case, the buffer will have a number of purposes, such as restriction of access by humans or pets and reducing visual and aural disturbance to an acceptable level.

2.5.6 Reduction of Edge Effect

Three types of edge effects characterise the interface between remnant bushland and other land uses.

1. Abiotic effects are those changes in light, temperature, humidity and wind that occur when a remnant edge is formed by the creation of new surrounding land uses, such as clearing land for grazing or agriculture.
2. Direct biological effects include changes in the number and abundance of species brought about by changed environmental conditions. For example, the spread of species that adapt well to the altered climatic conditions, and the reduction in recruitment of species that do not prosper.

3. Indirect biological effects are changes in the way species interact, in particular modified patterns of competition, pollination, and the dispersal of seeds (Donatiu 2001).

Edges and canopy gaps in remnant forests are the sites where weed species are able to establish and persist. Lateral light penetration along the edges and increased light levels from canopy gaps can result in the establishment of early successional rainforest trees and weed species (Kooyman 1996).

A vegetated buffer zone can reduce the impacts of edge effect on retained areas of vegetation.

2.5.7 Visual and Noise Buffers

Buffers can be used to obscure incompatible scenery, such as areas of housing, from natural areas (Davies & Lane 1995). Vegetated buffers or other physical screens reduce the amount of visual (especially lighting) and noise disturbance to buffered habitats. These forms of disturbance can have a range of detrimental impacts to wildlife, including disruption of foraging, breeding and nesting and increases in stress levels. Distance buffers can be effective in reducing disturbance to wildlife sensitive to human intrusion, such as birds nesting on beaches.

2.5.8 Spray Drift Buffers

Marrs *et al* (1993) note an increasing need to protect semi-natural vegetation from the potential effects of herbicide drift. They note that earlier estimates using established perennials suggested zones needed to be 6-10m wide. Marrs *et al* (1993) found that seedlings of some species were affected at greater distances than established plants and, on sites where seedling establishment is an important mechanism for community regeneration, buffer zones may need to be 20m wide.

2.4 Benefits of a Buffer Zone

Buffer zones, particularly vegetated buffers, can provide a range of benefits above and beyond the neutralising of the particular impact for which they were designed. These values include:

- Providing corridors for wildlife movement (Davies & Lane 1995);
- Provision of habitat for wildlife. Desbonnet *et al* (1994) report that even vegetated buffers of 15m in width have value as habitat, with narrower buffers still providing resting and feeding habitat for a variety of species, particularly birds;
- Providing a transition between upland and lowland habitats (Davies & Lane 1995);
- Provision of a future economic benefit (e.g. timber) (USDA 2000);
- Provision of a visible, tangible example of land stewardship (NCBC 1999b);
- Prevention of invasion by exotic plants; and
- Being aesthetically pleasing (Desbonnet *et al* 1994; Lismore City Council undated).

3 ECOLOGICAL VALUES OF THE COBAKI LAKES SITE

3.1 Background

Cobaki Lakes has been comprehensively studied over the last twenty-five (25) years. The following significant ecological values have been recorded on the site:

- Three (3) broad vegetation associations comprising twenty-four (24) vegetation communities;
- Six (6) Endangered Ecological Communities;
- Eight (8) Threatened flora species; and
- Twelve (12) Threatened fauna species.

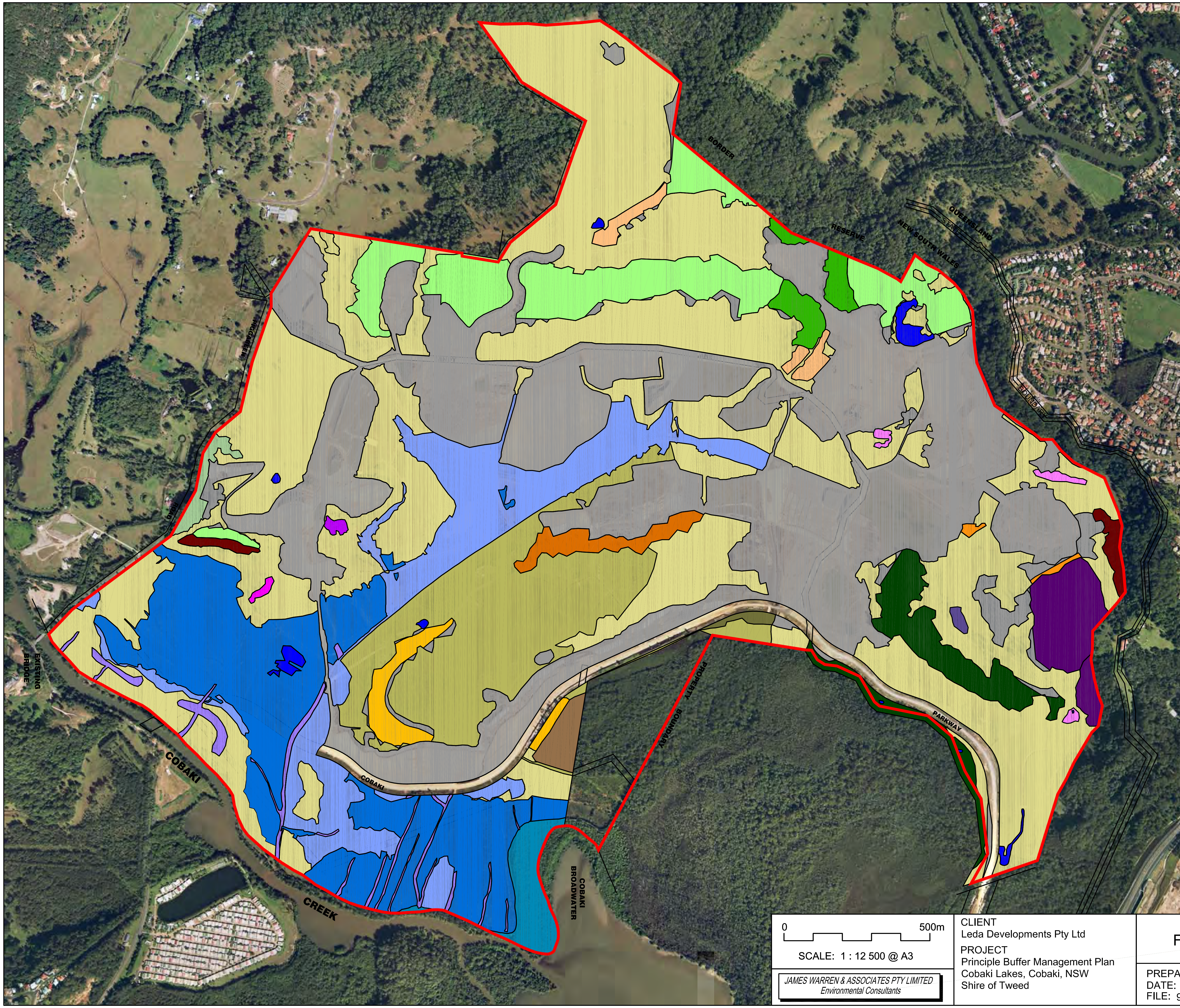
3.2 Vegetation

The vegetation mapping for Cobaki Lakes was completed by JWA (2008) (**FIGURE 9**). Vegetation communities identified on site are as follows:

- **Dry Sclerophyll Communities**
  - Very Tall Open/Closed Sclerophyll Forest (*Eucalyptus pilularis*, +/- *E. microcorys*, +/- *E. propinqua*, +/- *Corymbia intermedia*)
  - Tall Open/Closed Sclerophyll Forest (*E. propinqua*)
  - Tall Open Sclerophyll Woodland (*E. pilularis)*
  - Tall Open Sclerophyll Forest (*E. pilularis, +/- E. siderophloia +/- E. tereticornis)*

- **Rainforest Communities**
  - Tall Closed Forest (Lophostemon confertus, +/- *Araucaria cunninghamii*)
  - Tall Open Forest (Archontophoenix cunninghamiana)
  - Very Tall Closed Forest (*Araucaria cunninghamii*)
  - Mid-high Open/Closed Forest (Riparian species +/- Mixed species)

- **Other Communities**
  - Tall/Very Tall Open/Closed Forest (*Lophostemon confertus* +/-Mixed rainforest species)
  - Tall Open Woodland (Araucaria cunninghamii +/- Mixed species)
  - Closed Scrub (*Banksia aemula, E. racemosa* +\- *Leptospermum* spp.)
  - Mid-high Open Woodland (Mixed rainforest species)
  - Mid-high Open Woodland (*Eucalyptus robusta*
  - Mid-high Open Woodland (*Eucalyptus racemosa*)
  - Mid-high Open Woodland (*Eucalyptus siderophloia*)
  - Tall Closed Grassland/Fernland/Sedgeland (Mixed Species)



LEGEND

Community 1 - Dry sclerophyll communities
- Community 1a - Very tall open/closed sclerophyll forest (*Eucalyptus pilularis* +/- *E. microcorys* +/- *E. propinqua* +/- *Corymbia intermedia*)
- Community 1b - Tall open/closed sclerophyll forest (*E. propinqua*)
- Community 1c - Tall open sclerophyll woodland (*E. pilularis*)
- Community 1d - Tall open sclerophyll forest (*E. pilularis* +/- *E. siderophloia* +/- *E. tereticornis*)

Community 2 - Rainforest communities
- Community 2a - Tall closed forest (*Lophostemon confertus* +/- *Araucaria cunninghamii*)
- Community 2b - Tall open forest (*Archontophoenix cunninghamiana*)
- Community 2c - Very tall closed forest (*A. cunninghamii*)
- Community 2d - Mid-high open/closed forest (Riparian species +/- Mixed species)
- Community 3 - Tall/very tall open/closed forest (*L. confertus* +/- Mixed rainforest species)
- Community 4 - Tall open woodland (*A. cunninghamii* +/- Mixed species)
- Community 5 - Low closed forest (Heathland)
- Community 6 - Mid-high open woodland (Mixed rainforest species)
- Community 7 - Mid-high open woodland (*E. robusta*)
- Community 8 - Mid-high open woodland (*E. racemosa*)
- Community 9 - Mid-high open woodland (*E. siderophloia*)
- Community 10 - Tall closed grassland/fernland/ sedgeland (Mixed species)
- Community 11 - Low closed forest (Revegetation areas +/- Mixed *Eucalyptus* species)
- Community 12 - Low closed grassland with scattered trees (Pastoral grassess +/- Mixed species)
- Community 13 - Low closed grassland (*Sporobolus virginicus*, *Triglochin striata* +/- *Casuarina glauca*)
- Community 14 - Rushland/sedgeland/ grassland (Mixed aquatic species)
- Community 15 - Low to mid-high open mangrove forest (*Avicennia marina* var *australasica* / *Aegiceras corniculatum* +/- *Casuarina glauca*)
- Community 16 - Dams & drainage lines (Mixed aquatic species)
- Community 17 - Low open forest/woodland (*Casuarina glauca* +/- Mixed species)
- Community 18 - Slashed grassland/ heathland/sedgeland (Mixed Species)
- Unvegetated land
- Site Outline

SOURCE:
Vegetation - James Warren & Associates Pty Ltd
July/Sept 2007 & May 2008
Aerial - Qasco taken April 2008 (Cobaki_Lakes.tiff)

0 500m

SCALE: 1 : 12 500 @ A3

JAMES WARREN & ASSOCIATES PTY LIMITED
Environmental Consultants

CLIENT
Leda Developments Pty Ltd

PROJECT
Principle Buffer Management Plan
Cobaki Lakes, Cobaki, NSW
Shire of Tweed

FIGURE 9

PREPARED: BW
DATE: 19 October 2009
FILE: 97038_BMP_Base.dwg

TITLE

VEGETATION COMMUNITIES

- o Low Closed Forest (Re-vegetation areas +\- Mixed *Eucalyptus* species)
- o Low Closed Grassland with Scattered Trees (Pastoral grasses +/- Mixed species)
- o Low Closed Grassland (*Sporobolus virginicus*, *Triglochin striata*, + /- Casuarina glauca)
- o Brackish Area (Mixed aquatic species)
- o Low to Mid-high Open Mangrove Forest (Avicennia marina var australasica / *Aegiceras corniculatum* +/- *Casuarina glauca*)
- o Dam & Drainage Lines (Mixed aquatic species)
- o Low open forest/woodland (*Casuarina glauca* +/- Mixed species)
- o Slashed Grassland/Heath land/Sedgeland (Mixed species)
- o Unvegetated land

3.3 Endangered Ecological Communities

Six (6) Endangered Ecological Communities (EECs)[1] are considered to occur on the site (JWA 2008) (**FIGURE 10**). These are as follows:

- Swamp sclerophyll forest on coastal floodplain - which occurs as an isolated clump of scattered Swamp mahogany in the central eastern of the Subject site;
- Lowland rainforest on floodplain - occurring at various locations generally in association with drainage lines and depressions;
- Lowland rainforest - occurring on Mt. Woodgee and on lower slopes in the northern portion of the subject site;
- Freshwater wetlands - occurring in the central and eastern portions of the site;
- Swamp oak floodplain forest – occurring in association with drainage lines in the south-east of the site; and
- Coastal saltmarsh in the NSW North Coast bioregion - occurring in the south-east of the site.

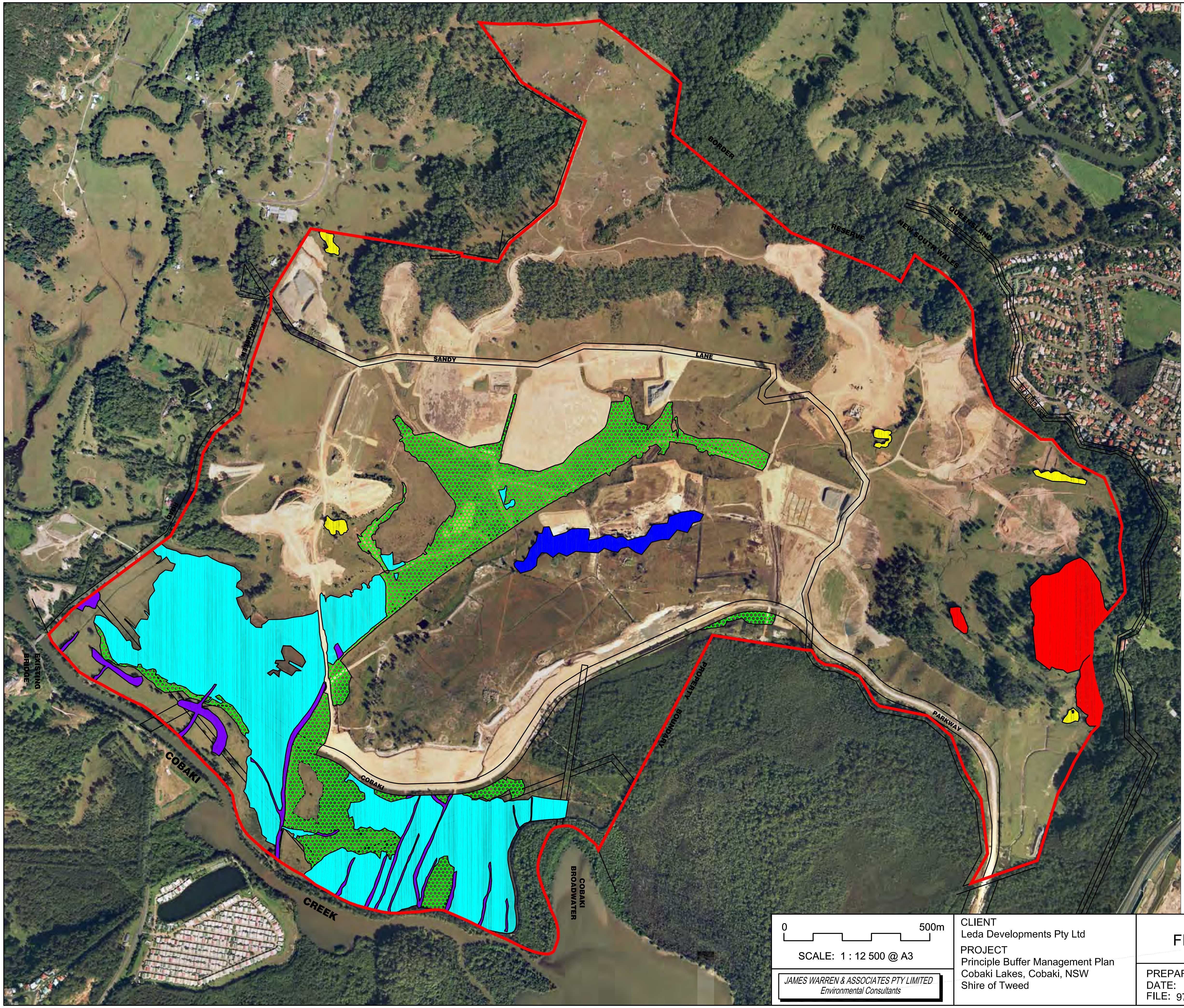
3.4 Threatened Species

3.5.1 Flora

Eight (8) Threatened[2] flora species have been recorded in the most recent vegetation survey (JWA 2008) (**FIGURES 11, 11a & 11b**). Threatened flora recorded includes the following species:

- White yiel yiel (*Grevillea hilliana*) Endangered (TSC Act);
- Scented acronychia (*A. littoralis*) - Endangered (TSC Act & EPBC Act);

[1] As listed within schedules of the TSC Act (1995).
[2] As listed within schedules of the TSC Act (1995) and EPBC Act (1999).



LEGEND

- Lowland Rainforest
- Lowland Rainforest on Floodplain
- Swamp Sclerophyll Forest on Floodplain
- Swamp Oak Floodplain Forest
- Freshwater Wetland (Degraded)
- Saltmarsh
- Site Outline

SOURCE:
EEC's - James Warren & Associates Pty Ltd
Aerial - Qasco taken April 2008 (Cobaki_Lakes.tiff)

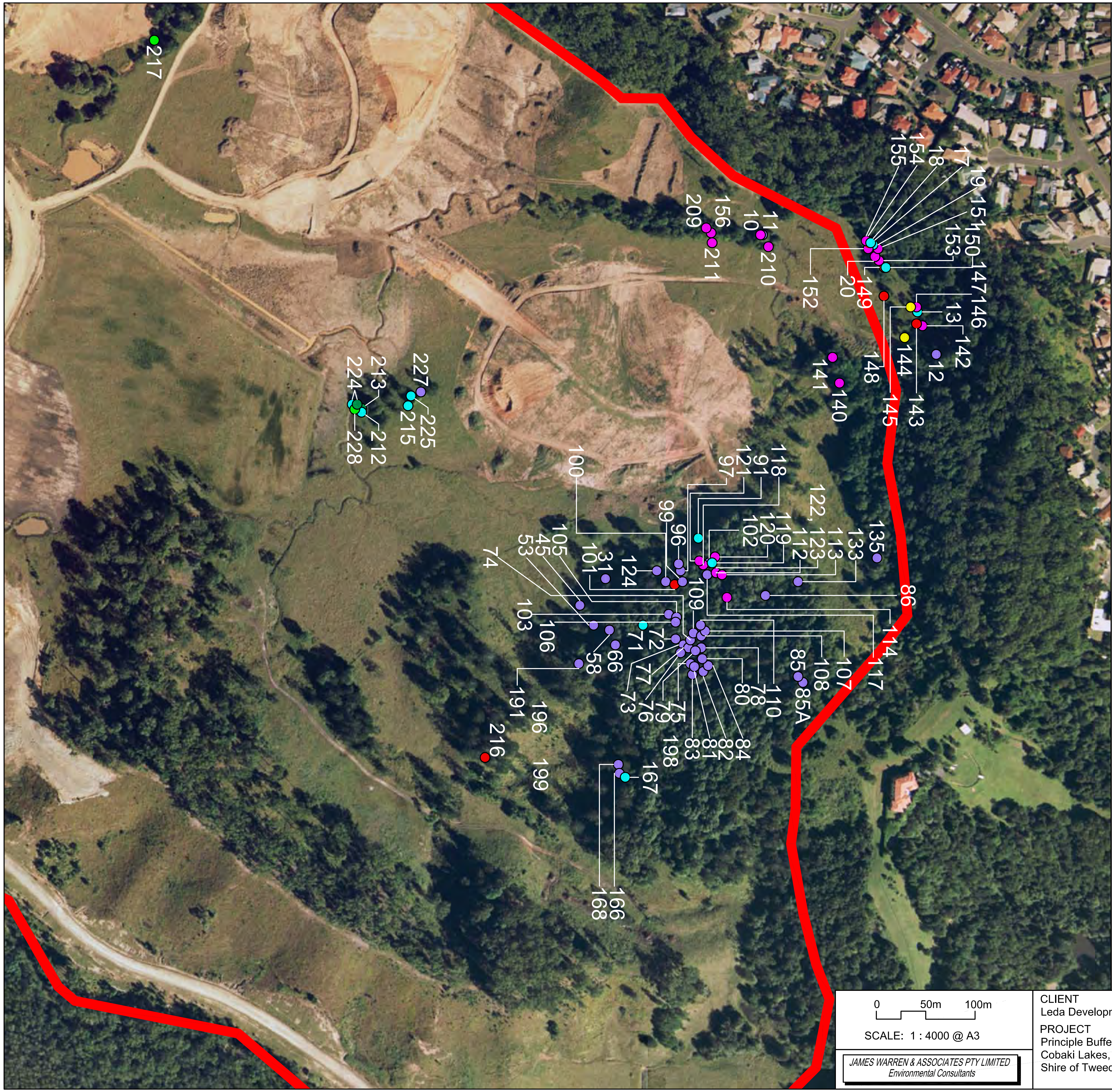
0 500m SCALE: 1 : 12 500 @ A3 JAMES WARREN & ASSOCIATES PTY LIMITED Environmental Consultants	CLIENT Leda Developments Pty Ltd PROJECT Principle Buffer Management Plan Cobaki Lakes, Cobaki, NSW Shire of Tweed	FIGURE 10 PREPARED: BW DATE: 19 October 2009 FILE: 97038_BMP_Base.dwg	TITLE ENDANGERED ECOLOGICAL COMMUNITIES

LEGEND

- Marblewood (*Acacia bakeri*)
- Fine-leaved tuckeroo (*Lepiderema pulchella*)
- Spiny gardenia (*Randia moorei*)
- Yiel yiel (*Grevillea hilliana*)
- Coolamon (*Syzygium moorei*)
- Brush cassia (*Cassia brewsteri* var. *marksiana*)
- Scented acronychia (*Acronychia littoralis*)
- Green-leaved rose walnut (*Endiandra muelleri* subsp. *bracteata*)
- Site Outline

SOURCE:
Flora - James Warren & Associates Pty Ltd
June/July 2004, July 2006, July/Sept 2007 & Feb 2008
Aerial - Qasco taken April 2008 (Cobaki_Lakes.tiff)

0 — 500m SCALE: 1 : 12 500 @ A3 JAMES WARREN & ASSOCIATES PTY LIMITED Environmental Consultants	CLIENT Leda Developments Pty Ltd PROJECT Principle Buffer Management Plan Cobaki Lakes, Cobaki, NSW Shire of Tweed	FIGURE 11 PREPARED: BW DATE: 19 October 2009 FILE: 97038_BMP_Base.dwg	TITLE LOCATION OF THREATENED FLORA



LEGEND

- Marblewood (*Acacia bakeri*)
- Fine-leaved tuckeroo (*Lepiderema pulchella*)
- Spiny gardenia (*Randia moorei*)
- Yiel yiel (*Grevillea hilliana*)
- Coolamon (*Syzygium moorei*)
- Brush cassia (*Cassia brewsteri* var. *marksiana*)
- Scented acronychia (*Acronychia littoralis*)
- Green-leaved rose walnut (*Endiandra muelleri* subsp. *bracteata*)
- Site Outline

SOURCE:
Flora - James Warren & Associates Pty Ltd
June/July 2004, July 2006, July/Sept 2007 & Feb 2008
Aerial - Qasco taken April 2008 (Cobaki_Lakes.tiff)

0 50m 100m

SCALE: 1 : 4000 @ A3

JAMES WARREN & ASSOCIATES PTY LIMITED
Environmental Consultants

CLIENT
Leda Developments Pty Ltd
PROJECT
Principle Buffer Management Plan
Cobaki Lakes, Cobaki, NSW
Shire of Tweed

FIGURE 11A

PREPARED: BW
DATE: 19 October 2009
FILE: 97038_BMP_Base.dwg

TITLE

LOCATION OF THREATENED FLORA