



PREFERRED PROJECT REPORT REVISED ECOLOGICAL ASSESSMENT

ALTITUDE ASPIRE
TERRANORA, NSW

A Report Prepared for
NEWLAND DEVELOPERS PTY LTD

APRIL 2013

QUEENSLAND

Office 28, 115 Wickham Street
Fortitude Valley QLD 4006
p 07 3257 2703 f 07 3257 2708
e brisbane@jwaec.com.au

NEW SOUTH WALES

105 Tamar Street
PO Box 1465, Ballina NSW 2478
p 02 6686 3858 f 02 6681 1659
e ballina@jwaec.com.au

www.jwaec.com.au

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EXECUTIVE SUMMARY

Under Part 3A of the *Environmental Planning & Assessment Act 1979* (EPA Act 1979), a Major Projects application was lodged by Newland Developers Pty Ltd (formally Metricon QLD Pty Ltd) with the Department of Planning (DoP) (MP 09_0166), for a proposed subdivision of land at the southern end of Fraser Drive, Terranora (the Subject site).

In accordance with the Tweed LEP (2000), the predominant zoning over the Subject site is 2(c) Residential (Urban Expansion) with a small portion zoned 7(a) Environmental Protection (Wetlands and Littoral Rainforest). On the 13th December 2011 Tweed Shire Council adopted the Area E Development Control Plan (Section B24) which includes the subject site.

The proposal is a residential development of 272 Lots which includes 257 residential lots, 4 medium density lots, 8 public reserves, 1 drainage reserve, and 1 resident's lot (community association). The development also proposes to implement a Stormwater Management Plan (SMP) (G&S 2013) and a Revised Vegetation Management & Rehabilitation Plan (VMRP) (JWA 2013).

Director General's Environmental Assessment Requirements (DGEARs) were issued on the 23rd November 2009. James Warren and Associates (JWA) completed an Ecological Assessment (EA) addressing the relevant DGEARs. The Environmental Assessment, including the Ecological Assessment, was assessed by the DoP and a Test of Adequacy response issued (dated 5th November 2010). JWA subsequently amended the Ecological Assessment, dated June 2010, to address these comments.

Following submissions from the public and State Agencies, and subsequent amendments to the proposed Subdivision Layout Plan, this Ecological Assessment has been revised to provide additional information. Specific responses to State Agency and Public submissions have also been provided.

JWA have reviewed the March 2012 version so as to address further issues raised by Tweed Shire Council in their correspondence dated 20 July 2012 and the Department of Planning and Infrastructure in their correspondence dated 31 July 2012 and 7 December 2012.

The proposed development has been designed to utilise existing cleared and disturbed areas within the subject site. Some losses of native vegetation will occur, however, almost 80% of the vegetation losses will occur within the cleared agricultural land. To mitigate for the loss of small isolated and degraded patches of native vegetation, rehabilitation of the existing habitat areas and the creation of additional habitat within the proposed Conservation Areas will be completed.

Impact assessment in accordance with the "*Guidelines for Threatened Species Assessment*" (DEC & DPI, 2005), "*Threatened Species Assessment Guidelines: The Assessment of Significance*" (DECC 2007), and "*EPBC Act Policy Statement 1.1 Significant Impact Guidelines*" (DEH 2006) were undertaken on the State and Commonwealth listed threatened species and EECs. These assessments concluded that the proposed development will not result in any significant impacts on state listed threatened flora, fauna or EEC's and a Species impact Statement is not required. Similarly, referral to the Commonwealth Department of Sustainability, Environment, Water, Population and

Communities (DSEWPC) is not required as the proposed action is unlikely to result in a significant impact on any matter of NES.

A detailed VMRP was prepared by JWA and submitted as part of the major project application. Subsequent to submissions from State agencies and the public, the VMRP has been amended to reflect the revised layout. The aim of the VMRP is to direct the rehabilitation and management of proposed Open Space and Conservation areas including the 7(a) Environmental Protection zone (Wetlands and Littoral Rainforests). Proposed works include the full rehabilitation of the degraded Freshwater wetland EEC on the subject site and revegetation/regeneration works to offset the unavoidable loss of degraded Lowland rainforest and Freshwater wetland EECs from the development footprint.

The proposed development will provide appropriate buffers and habitat protection as identified in the Tweed Area E Local Environment Study. A 100m buffer will be provided to the SEPP 14 wetland to the north of the proposed residential area, and will be fully revegetated/regenerated with the exception of the existing transmission line easement. Specific details of the revegetation of this area are included in the Revised VMRP.

1 INTRODUCTION

1.1 Background

James Warren and Associates (JWA) have been engaged by Newland Developers Pty Ltd (formally Metricon QLD Pty Ltd) to prepare an Ecological Assessment as part of the Preferred Project Report for the development referred to as "Altitude Aspire".

Under Part 3A of the *Environmental Planning & Assessment Act 1979* (EPA Act 1979), a Major Project application was lodged by Newland Developers Pty Ltd (formally Metricon QLD Pty Ltd) with the Department of Planning (DoP) (MP 09_0166), for a proposed subdivision of land at the southern end of Fraser Drive, Terranora (the Subject site).

The Environmental Assessment, including the Ecological Assessment (JWA 2010), was assessed by the DoP and a Test of Adequacy response issued (dated 5th November 2010). JWA subsequently amended the Ecological Assessment, dated June 2010, to address these comments and the Environmental Assessment and accompanying documents were resubmitted to DoP.

Following submissions from the public and State Agencies, and subsequent amendments to the proposed Subdivision Layout Plan, the Ecological Assessment has now been revised to provide additional information. Specific responses are also provided to the relevant State Agency and Public submissions in Section 4 of this report.

JWA have reviewed the March 2012 version so as to address further issues raised by Tweed Shire Council in their correspondence dated 20 July 2012 and the Department of Planning and Infrastructure in their correspondence dated 31 July 2012 and 7 December 2012. These matters are also addressed in Section 4 of this report i.e. Response to Submissions. Additionally, Tweed Shire Council (TSC) has adopted the Area E Development Control Plan (Section B24) which includes the subject site. An assessment of the proposed development against the requirements of the DCP has been completed.

For ease of reference, this Ecological Assessment is comprised of the following Sections:

- Section 2 - Director Generals Environmental Assessment Requirements (DGEAR's)
- Section 3 - Responses to DGEAR's
- Section 4 - Responses to Submissions
- Section 5 - Compliance with Area E DCP

The following Appendices are also provided:

- Appendix 1 - Threatened Species Assessments (7-part tests)
- Appendix 2 - Wetland Plant Communities Response to Depth, Duration and Frequency of Flooding
- Appendix 3 - Flora Assessment
- Appendix 4 - Flora Species List
- Appendix 5 - Fauna Assessment
- Appendix 6 - Area E fauna assessment

- Appendix 7 - Aquatic Ecology in Environmental Impact Assessment (2003)
- Appendix 8 - BioBanking Assessment Methodology (BAM) Assessment (Littoral Rainforest)
- Appendix 9 - Biobanking Assessment Methodology (BAM) Assessment (Freshwater Wetland)
- Appendix 10 - Offsets Assessment Package

1.2 Locality

1.2.1 Introduction

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

Prominent features in the locality include the Tweed River, Terranora Broadwater and associated tributaries and the twin towns of Coolangatta and Tweed Heads. Dominant habitat types include tidal estuaries, wetlands, mangroves, grasslands and remnant rainforest.

There are three (3) dedicated conservation reserves in the locality: Ukerabagh NR, Cudgen NR and Stott's Island NR.

State Wetlands numbers 1-33 occur in the locality (**FIGURE 2**). Wetland Number 23 occurs immediately adjacent to the northern boundary of the subject site, while the other wetlands occur within a 2-4 km radius. These wetlands are protected by State Environmental Planning Policy No. 14 - Coastal Wetlands (SEPP 14) (**FIGURE 3**).

SEPP 26 Littoral Rainforests numbers 2A, 2B and 2C occur in the locality. These rainforests are protected by State Environmental Planning Policy No. 26 - Littoral Rainforest (SEPP 26). SEPP 26 Rainforests in the locality are located to the south-east of Banora Point and at Fingal Head (**FIGURE 4**).

Land uses within the locality include residential, agricultural (predominantly sugar cane and bananas) conservation and recreational.

1.2.2 The Subject site

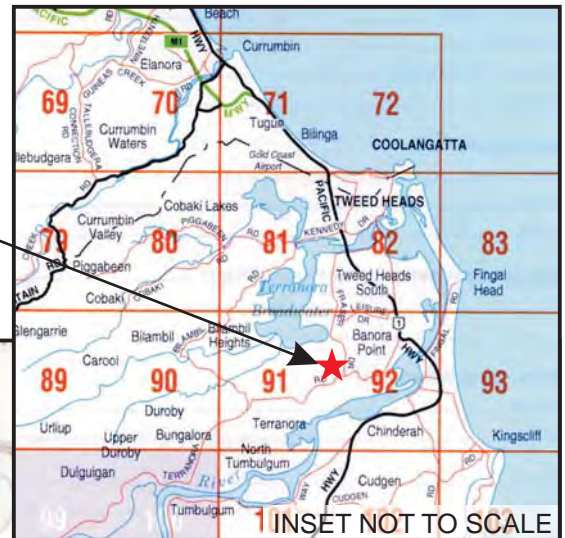
The subject site encompasses several land parcels consisting of: Lot 1 DP 304649; Lot 1 DP 175235; Lot 1 DP 781687; Lot 2 DP 778727; Lot 1 DP 781697; Lot 1 DP 169490; and Lots 40 & 43 DP 254416.

A SEPP 14 wetland occurs to the immediate north of the site, Fraser Drive (a major connector road) and residential development occurs along the western boundary, residential development occurs along the southern boundary, and mostly cleared agricultural land occurs along the western boundary.

The majority of the site has been cleared of native vegetation and is comprised of grazing land and abandoned crops (**FIGURE 5**). A small, narrow area of mixed eucalypt



SUBJECT SITE



SOURCE: Topographic Map 'Tweed Heads'

SCALE: 1 : 25 000 @ A4

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Environmental Consultants

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PROJECT
Ecological Assessment
Altitude Aspire
Fraser Drive, South Terranora, NSW
Shire of Tweed

FIGURE 1

PREPARED: BW
DATE: 13 April 2012
FILE: N09031_Locality.cdr

TITLE

**LOCALITY
PLAN**



- Legend**
- Area subject to SEPP No. 14 (with index number)
 - Subject Site



0 1500m

SOURCE: State Env. Planning Policy No. 14
Map 1 Amendment 14

SCALE: 1 : 60 000 @ A4

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Shire of Tweed



FIGURE 2

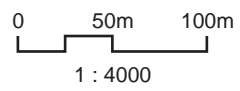
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TITLE

**SEPP 14
COASTAL
WETLANDS**



LEGEND
 SEPP14 Coastal Wetland
 Site Outline

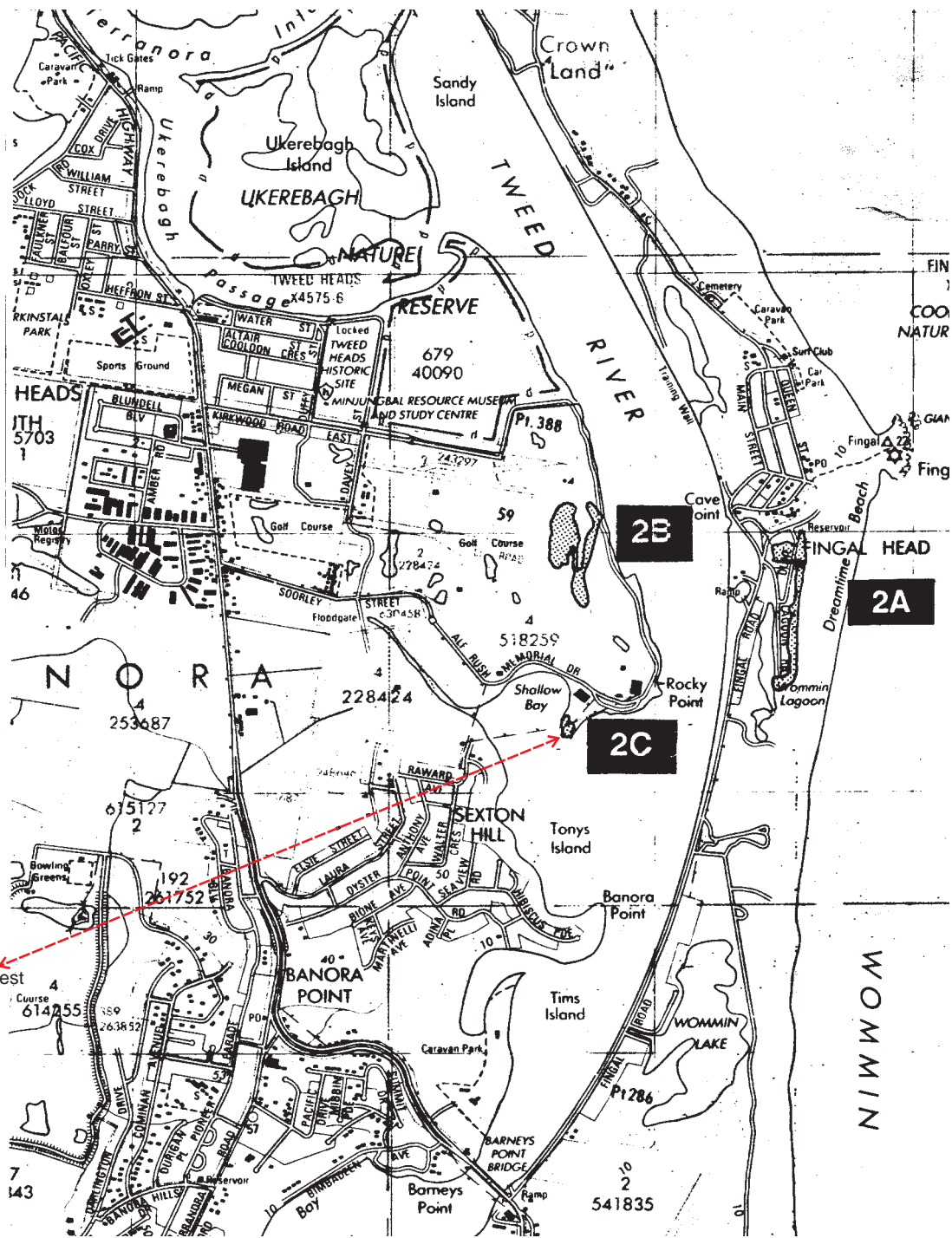


SOURCE: State Env. Planning Policy No. 14;
 Near Map Nov 2011 Aerial Photograph
 SCALE: 1 : 4000 @ A3
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FIGURE 3
 PREPARED: BW
 DATE: 13 April 2012
 FILE: N09031_SEPP14.cdr

TITLE
**SEPP 14
 COASTAL
 WETLANDS**



Legend

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



SOURCE: State Env. Planning Policy No. 26
Littoral Rainforests Map 1 Amendment 1
SCALE: 1 : 25 000 @ A4
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Ecological Assessment
Altitude Aspire
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FIGURE 4
PREPARED: BW
DATE: 13 April 2012
FILE: N09031_SEPP26.cdr

TITLE
**SEPP 26
LITTORAL
RAINFORESTS**

forest occurs in the north-west corner of the site. A small degraded patch of freshwater wetland occurs midway along the northern boundary. This sedgeland lies adjacent to the SEPP 14 wetland area.

A number of small farm dams occur in the centre of the site associated with an ephemeral drainage line.

1.2.3 The Study area

The Study area consists of any proximate areas of habitat which may be affected, whether indirectly or directly, by the proposed development. The Study area thus consists of the Subject site, an adjacent SEPP 14 Wetland, the Terranora Broadwater, and adjacent areas of native vegetation.

1.3 Landuse Zones

In accordance with the Tweed LEP (2000), the predominant zoning over the subject site is 2(c) Residential (Urban Expansion). The eastern portion of the subject site contains areas of SEPP 14 Coastal Wetlands, which are zoned 7(a) Environmental Protection (**FIGURE 6**).

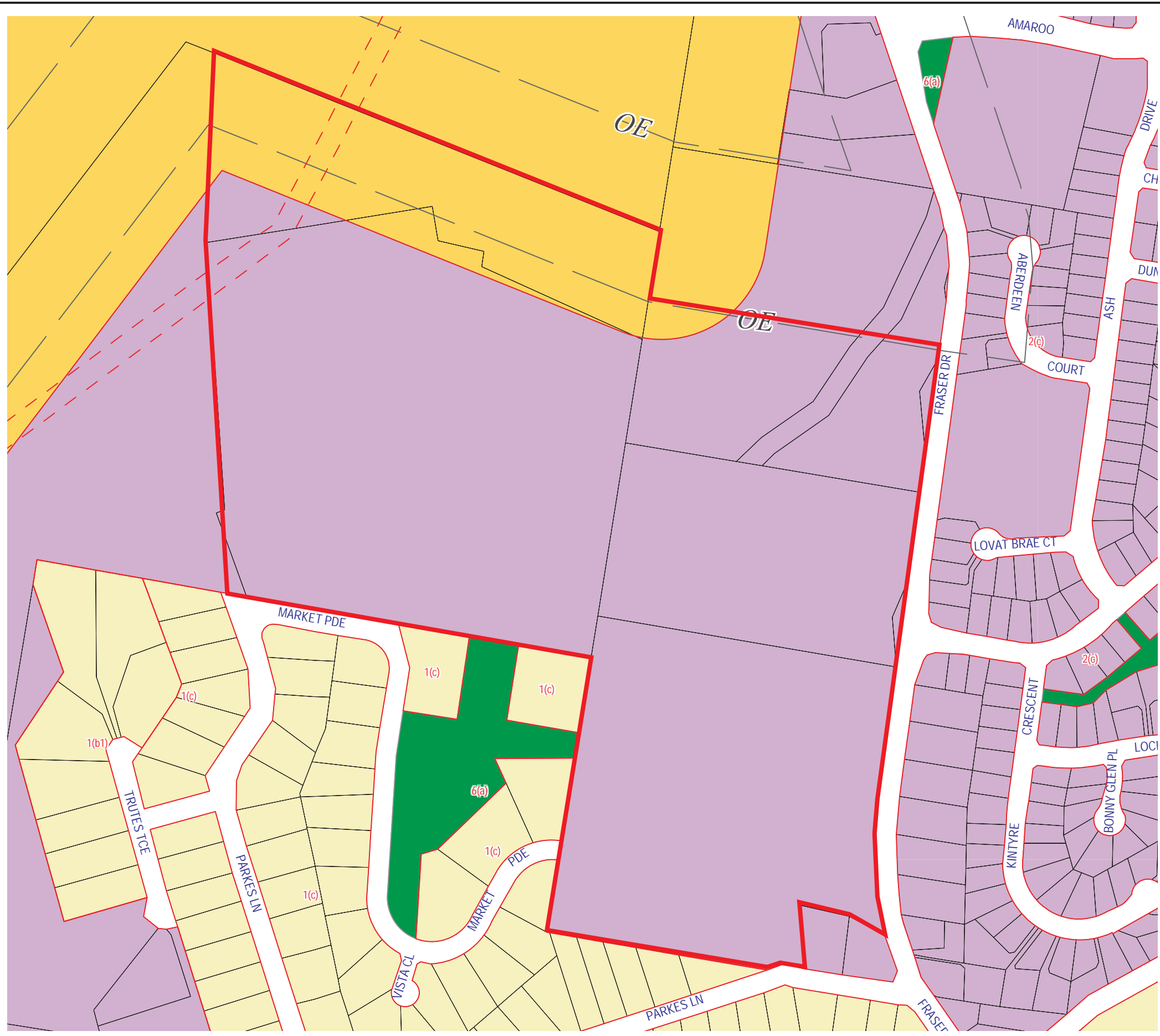
On the 13th December 2011 Tweed Shire Council adopted the Area E Development Control Plan (Section B24) which includes the subject site (**FIGURE 7**).

1.4 The Proposed Development

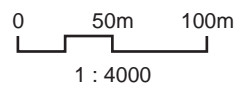
The proposal is a residential development of 272 Lots which includes:

- 257 residential lots;
- 4 medium density lots;
- 9 public reserves;
- 1 drainage reserve; and
- 1 resident's lot (community association).

The proposed development is shown in **FIGURE 8**.



- LEGEND**
- 1(b1) Agricultural Protection
 - 1(c) Rural Living
 - 2(c) Urban Expansion
 - 6(a) Open Space
 - 7(a) Environmental Protection (Wetlands & Littoral Rainforests)
 - Site Outline

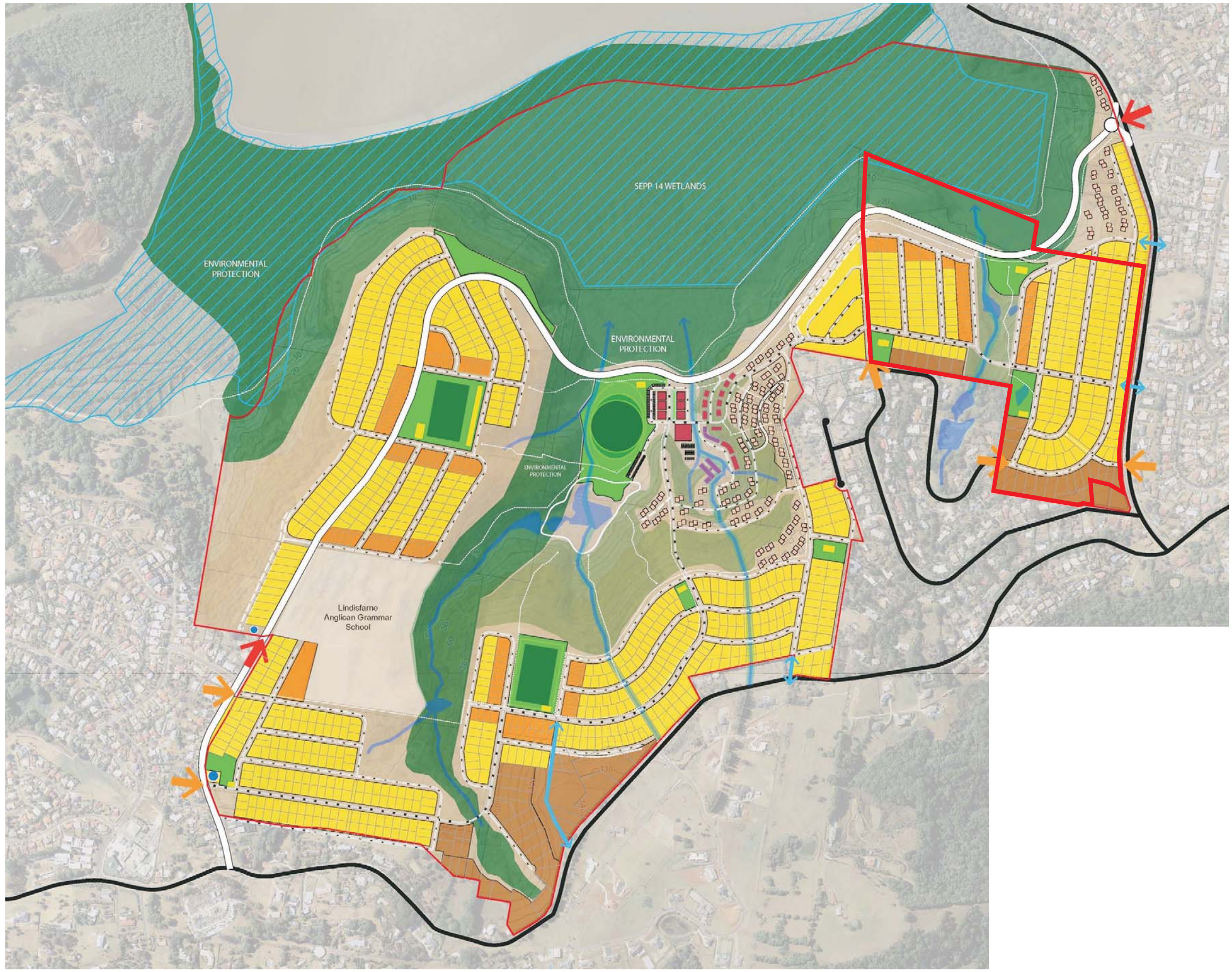


SOURCE: Tweed LEP 2000
 SCALE: 1 : 4000 @ A3
JAMES WARREN & ASSOCIATES PTY LIMITED
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 PROJECT
 Ecological Assessment
 Altitude Aspire
 Fraser Drive, South Terranora, NSW
 Shire of Tweed

FIGURE 6
 PREPARED: BW
 DATE: 13 April 2012
 FILE: N09031_LEP.cdr

TITLE
TWEED LOCAL ENVIRONMENT PLAN



- LEGEND**
- SEPP 14 Wetland
 - LEP 2000 - Environmental Protection Zone
 - Draft LEP 2010 - Bushland
 - Village Centre, Shop Top, RFB, Aged Care
 - Sports Clubs
 - Community Buildings
 - Environmental Centre
 - Casual Open Space
 - Landscape Buffer
 - Sports Fields
 - Community Garden
 - Criterion & Bike Track
 - Walk & Mountain Bike, Bushtracks
 - Drainage Reserve
 - Watercourses, Dams, Springs
 - Water Reservoir RL 130 & RL 105 (Indicative Location Only)
 - Broadwater Parkway
 - Indicative Road
 - Aged Care
 - Residential Flat Building
 - Small Lot & Medium Density - Plexes, Row House, Town House, Dual Occupancy
 - Low Density 600-1200sqm
 - Large Lot >1200sqm
 - Topographically Constrained Development (Community Title Development)
 - Primary Vehicular Access
 - Secondary Vehicular Access
 - Site Pedestrian Access
 - Site Outline



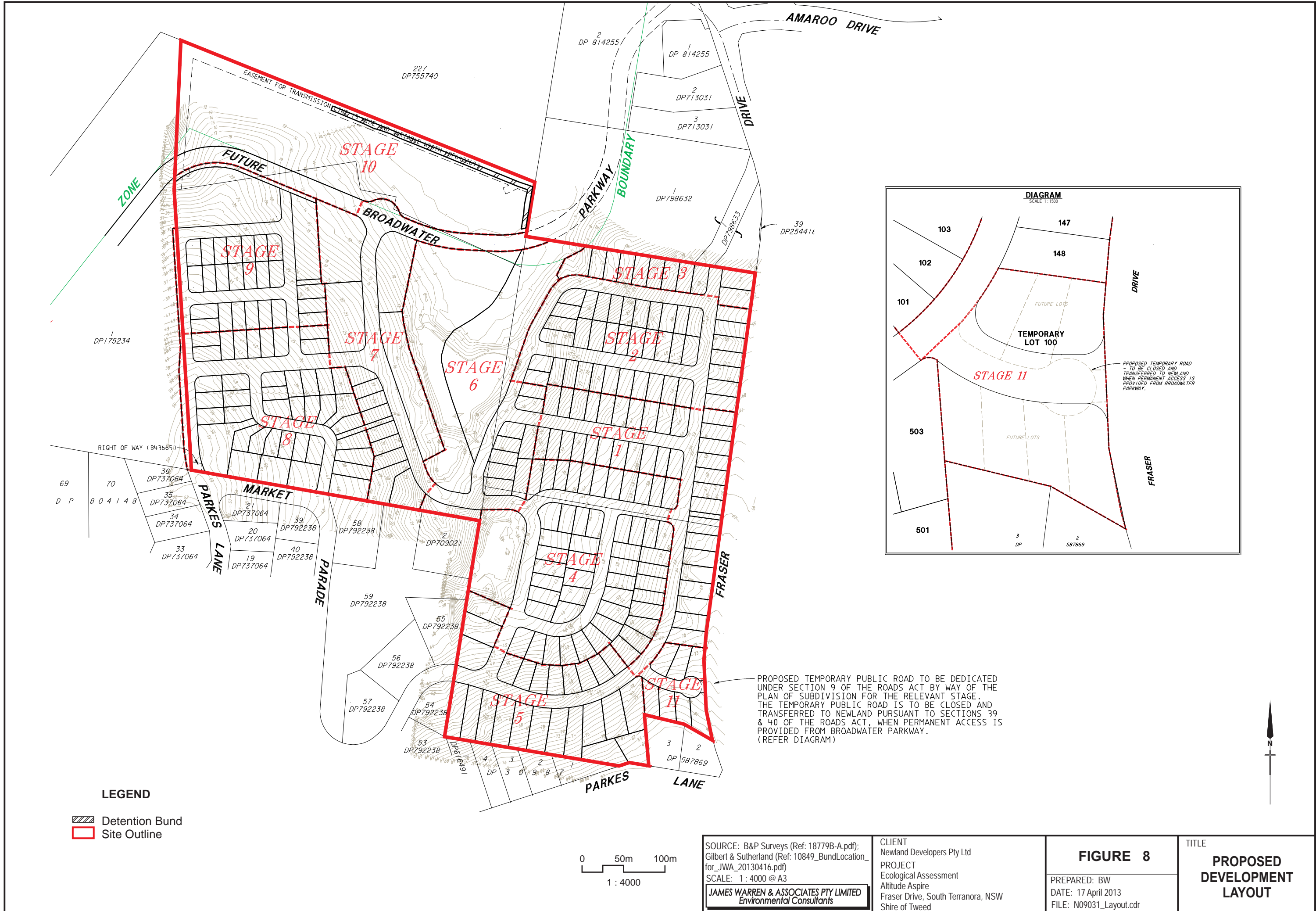
0 300m
1 : 10 000

SOURCE: Area E Urban Release Development Code - Figure 2.2 Indicative Structure Plan
SCALE: 1 : 10 000 @ A3
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Ecological Assessment
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Shire of Tweed

FIGURE 7
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DATE: 13 April 2012
FILE: N09031_Area E DCP.cdr

TITLE
**AREA E DCP
INDICATIVE
STRUCTURE PLAN**



2 DIRECTOR GENERAL'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

2.1 Introduction

Under Part 3A of the *Environmental Planning & Assessment Act 1979* (EPA Act 1979), a major projects application was lodged with the Department of Planning. Director General's Environmental Assessment Requirements (DGEARs) were issued dated 23rd November 2009 (MP 09_0166).

Following submissions from the public and State Agencies, and subsequent amendments to the proposed Subdivision Layout Plan, the responses to the DGEARs have now been revised.

The DGEARs are listed below and each addressed in Section 3 of this report in accordance with the following legislative documents:

- *Guidelines for Threatened Species Assessment* (DEC & DPI, 2005);
- *Threatened Species Assessment Guidelines: The Assessment of Significance* (DECC 2007); and
- EPBC Act Policy Statement 1.1 Significant Impact Guidelines (DEH 2006).

2.2 Relevant DGEARs to be addressed

The following DGEAR's have been addressed in this report:

General requirements

- 6 Consideration of impacts, if any, on matters of National Environmental Significance under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

Subdivision Design, Layout and Designed Future Character

- 2.7 Outline the long-term management and maintenance of any areas of open space or conservation including ownership and control, management and maintenance funding, public access, revegetation and rehabilitation works and bushfire management.

Transport and Accessibility

- 5.12 Ensure environmental objectives are not significantly compromised by the design and layout of the proposed road network, including the proposed Broadwater Parkway's interaction with the SEPP 14 wetland.

Riparian Areas

- 10.5 Identify all riparian areas on site including any creeks, wetlands, drainage lines etc., and outline the intended management, protection and restoration of these areas, including monitoring and mitigation measures. The protection and restoration; of riparian zones will maintain the

ecological functions of watercourses and forms a key part of ensuring appropriate water quality is achieved. If any works are, proposed within the riparian areas (such as bridges, culverts, stormwater outlets, walking tracks etc...) then this should be identified.

Flora and fauna

- 13.1 Provide an up-to-date assessment of any potential direct and indirect impacts of the development on flora and fauna, taking into consideration impacts on any threatened species, populations, ecological communities and/or critical habitat and any relevant recovery plan in accordance with the draft *Guideline for Threatened Species Assessment (Part 3A)* and *Threatened Species Assessment Guideline: The Assessment of Significance*. Describe the actions that will be taken to avoid or mitigate impacts or compensate unavoidable impacts, where relevant.
- 13.2 A field survey of the site should be conducted as part of this assessment in accordance with DECCW's Threatened Biodiversity Survey and Assessment Guidelines.
- 13.3 Likely impacts on threatened species and their habitat need to be assessed, evaluated and reported on. The assessment should specifically report on the guiding principles for threatened species assessment at section 1.2 of the draft *Guideline for Threatened Species Assessment (Part 3A)*. Identify measures to protect remaining native fauna and flora on the site where appropriate.
- 13.4 Provide an assessment of the proposal that ensures (if possible) adverse impacts on identified areas of ecological significance are avoided or mitigated (including the adjacent SEPP 14 wetland, Endangered Ecological Communities, threatened species habitat etc...);
- 13.5 Outline measures for the conservation of existing wildlife corridor values and/or connective importance of any vegetation on the subject land. Address measures to protect and manage the riparian corridor and adjacent aquatic habitats.
- 13.6 Provide appropriate buffers and habitat protection measures for known significant ecological habitats as identified in the constraints map contained in Figure 3.4 of the Tweed Area E Local Environment Study (Parsons Brinckerhoff, 2004).
- 13.8 Provide a detailed Vegetation Management Plan (VMP) for that area of the site zoned 7(a) Environmental Protection (Wetlands and Littoral Rainforests) and for future dedication to the Tweed Shire Council. As a minimum the VMP should incorporate scoped and appropriate performance requirements for any habitat/wetland rehabilitation works (e.g. in relation to the diversity and density of plantings, seedling survival and growth rates, cumulative crown coverage, and the abundance and diversity of weed species) referenced to appropriate benchmarks (such as comparable, undisturbed vegetation communities).

Biting insects

- 14.2 Provide evidence of consultation with Tweed Shire Council regarding a recently, submitted project entitled 'Fish Move In, Mosquitoes Move Out' and discuss the implications for this project for the development within the assessment.

Some of the above DGEARs require additional input from other consultants and have thus been addressed in reports from other firms. In these instances the reader is directed to refer to reports from others.

3 RESPONSES TO DGEARS

3.1 Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

3.1.1 Introduction

DGEAR 6 - "Consideration of impacts, if any, on matters of National Environmental Significance under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)."

The *Environment Protection & Biodiversity Conservation (EPBC) Act (1999)* was passed by Commonwealth Parliament in June 1999 and came into force on 16 July, 2000. A person must not, without an approval under the Act, take an action that has or will have, or is likely to have, a significant impact on a matter of National Environmental Significance (NES). These matters are listed as:

- (a) the world heritage values of a declared World Heritage property;
- (b) the ecological character of a declared Ramsar wetland;
- (c) a threatened species or endangered community listed under the Act;
- (d) a migratory species listed under the Act; or
- (e) the environment in a Commonwealth marine area or on Commonwealth land.

The Act also prohibits the taking, without an approval under the Act, of:

- (a) a nuclear action; or
- (b) an action in a Commonwealth marine area or on Commonwealth land that has or will have, or is likely to have, a significant impact on the environment.

An action includes a project, development, undertaking or an activity or series of activities. An action does not require approval if it is a lawful continuation of a use of land, sea or seabed that was occurring before the commencement of the Act. An enlargement, expansion or intensification of a use is not a continuation of a use.

The *EPBC Act (1999)* does not require Commonwealth approval for the rezoning of land. It does, however, suggest that when rezoning land, planning authorities should consider whether to allow actions that could significantly affect NES matters or the environment of Commonwealth land.

Relevant matters of NES are:

- Listed Threatened Species;
- Listed Ecological Communities in New South Wales;
- Listed migratory species (JAMBA and CAMBA).

3.1.2 Occurrence of Matters of NES on Subject Site

3.1.2.1 Background

A Commonwealth Assessment will be required for proposed activities on the subject site if they affect a matter of NES. Matters of NES in NSW were identified in the previous section. There are no declared World Heritage Areas or Ramsar Wetlands in the Locality, Study area or Subject site.

3.1.2.2 Listed Threatened species

No Commonwealth Threatened flora species were recorded on the Subject site.

No Commonwealth Threatened fauna species were recorded on the Subject site, however, one such listed fauna species is considered a possible occurrence on the site over time - Grey-headed flying-fox (*Pteropus poliocephalus*) - Vulnerable (see Section 3.5.2).

3.1.2.3 Listed Ecological Communities

No Commonwealth Threatened Ecological Communities were recorded on the Subject site.

3.1.2.4 Listed Migratory Species

Listed migratory species in NSW are considered predominantly in the Japan-Australia Migratory Bird Agreement (JAMBA) and China-Australia Migratory Bird Agreement (CAMBA).

No migratory species as listed within schedules of the EPBC Act (1999) were recorded on site or are considered as possible occurrences on site.

3.1.3 Assessment against EPBC Act Principal Significant Impact Guidelines

3.1.3.1 Background

The Assessment against the EPBC Act is made using Principal Significant Impact Guidelines 1.1 (DEH 2006). The guidelines outline a self-assessment process to assist in determining whether an action should be referred to the Department of Environment Water Heritage and the Arts (DEWHA) for a decision on whether Commonwealth assessment and approval is required under the Act. The following sections assess the proposed development (the action) against these guidelines.

3.1.3.2 Vulnerable Species

Significant Impact Criteria

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

- lead to a long-term decrease in the size of an important population of a species;

- reduce the area of occupancy of an important population;
- fragment an existing important population into two or more populations;
- adversely affect habitat critical to the survival of a species;
- disrupt the breeding cycle of an important population;
- modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;
- result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;
- introduce disease that may cause the species to decline; or
- interfere substantially with the recovery of the species.

Assessment of Proposed Action

The Grey-headed flying fox, listed as vulnerable within schedules of the EPBC Act (1999), is considered a possible occurrence on the subject site. An assessment of the potential impacts of the proposed development on this species and its habitat is provided in **APPENDIX 1**. It is considered that the proposed development will not result in any of the above impacts on the Grey-headed flying-fox.

It is considered that the subject site does not support an important population of any species listed in the *EPBC Act (1999)* and a significant impact on these species will not occur.

3.1.4 Requirement for Commonwealth Referral

Based on the assessment provided above, Referral to the Commonwealth Department of Environment Water Heritage and the Arts (DEWHA) is not required. The proposed action is unlikely to result in a significant impact on any matter of NES. It is concluded that Commonwealth Assessment is not required for the Proposed development of the subject site.

3.2 Long-term management and maintenance of open space and conservation areas

DGEAR 2.7 - "Outline the long-term management and maintenance of any areas of open space or conservation including ownership and control, management and maintenance funding, public access, revegetation and rehabilitation works and bushfire management."

A Revised Vegetation Management & Rehabilitation Plan (VMRP) has been prepared outlining proposed revegetation and rehabilitation works on the subject site (JWA 2013). The Revised VMRP includes details of the long-term management of the conservation areas and recommendations regarding public access.

Maintenance funding and bushfire management are outside the scope of the Revised VMRP and are dealt with in other reports.

3.3 Broadwater Parkway and the SEPP 14 Wetland

3.3.1 Introduction

DGEAR 5.12 "Ensure environmental objectives are not significantly compromised by the design and layout of the proposed road network, including the proposed Broadwater Parkway's interaction with the SEPP 14 wetland".

3.3.2 Significant Environmental Values

Environmental objectives of the proposed development include:

1. avoid and mitigate direct and indirect impacts on significant environmental values of the site; and
2. enhance the significant environmental values of the site and the surrounding area.

The following Significant Environmental Values have been recorded on and immediately adjacent to the subject site:

- two (2) heavily degraded EECs (i.e. Lowland Rainforest and Freshwater wetlands - FIGURE 9); and
- A SEPP 14 Wetland is also located to the north of the Subject site (FIGURE 4); and
- two (2) stems of the Threatened species Rough-shelled bush nut (*Macadamia tetraphylla*).

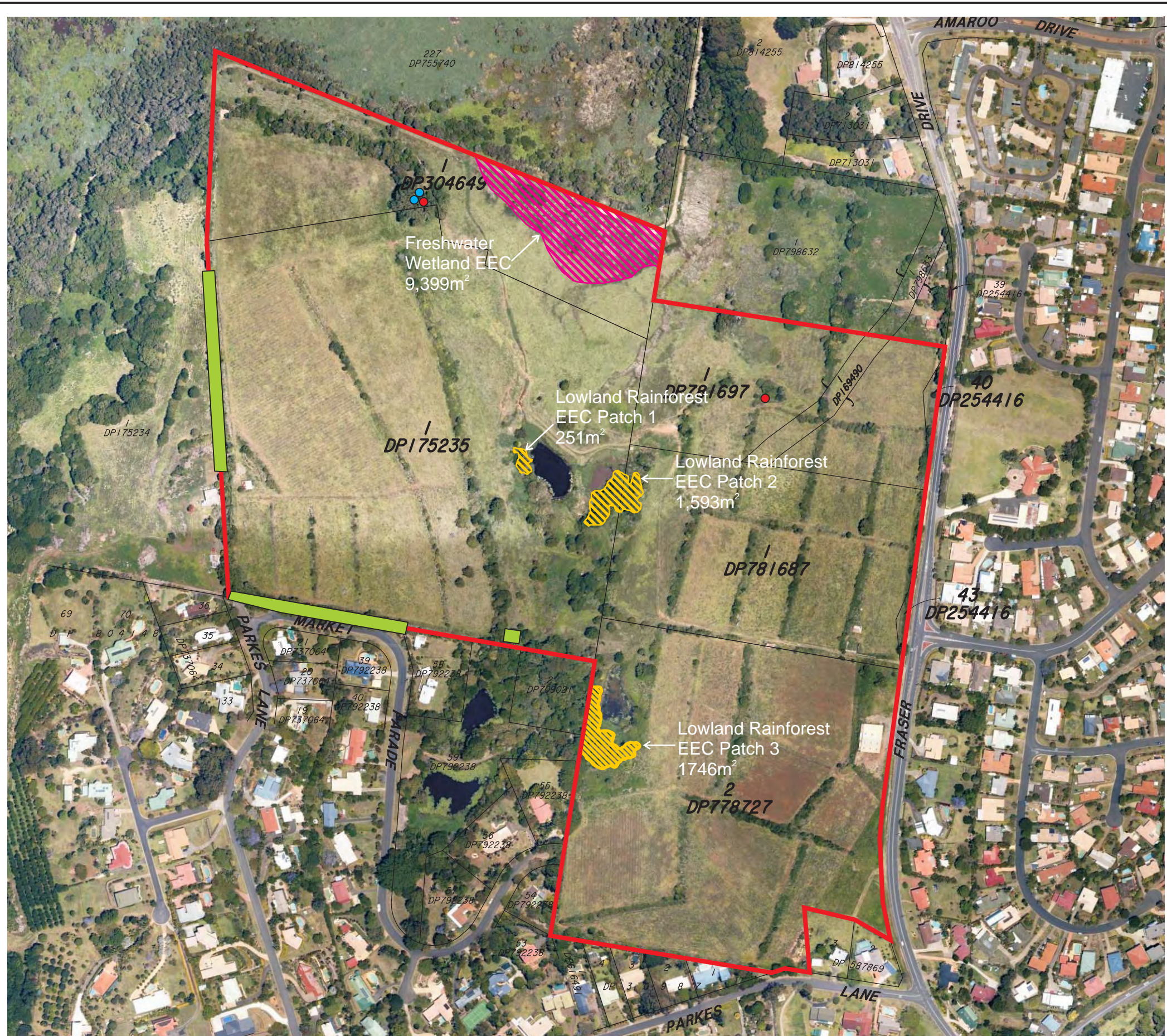
It was previously thought that several additional stems of Rough-shelled bush nut (*Macadamia tetraphylla*) occurred on the site. Further surveys have revealed that numerous individuals occur immediately adjacent to the western and southern boundaries (FIGURE 9). These individuals occur in rows, and it is obvious they have been planted. Furthermore, it appears that the majority of specimens occurring on and adjacent to the subject site are orchard specimens, and are therefore not covered by the schedules of the *Threatened Species Conservation Act (1995)*.







FIGURE 10 illustrates the impacts of the proposed development on the identified significant environmental values of the site.

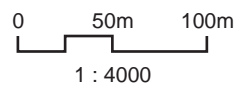
The following section will discuss these objectives in the context of the internal road network and the proposed Broadwater Parkway.

3.3.3 Internal Road Network

Due to the topography of the site, the proposed development (which includes the internal road network) will require the removal of the majority of existing vegetation from the subject site. However, this vegetation occurs as isolated and degraded stands primarily within areas of degraded agricultural land. The internal road network will impact on the subject site in the following ways:



- LEGEND**
-  Lowland Rainforest Endangered Ecological Community (EEC)
 -  Freshwater Wetland Endangered Ecological Community (EEC)
 -  Rough-shelled bush nut (*Macadamia tetraphylla*)
 -  Planted Macadamia (Hybrid Species)
 -  Veiny lace flower (*Archidendron muellerianum*) (ROTAP)
 -  Site Outline



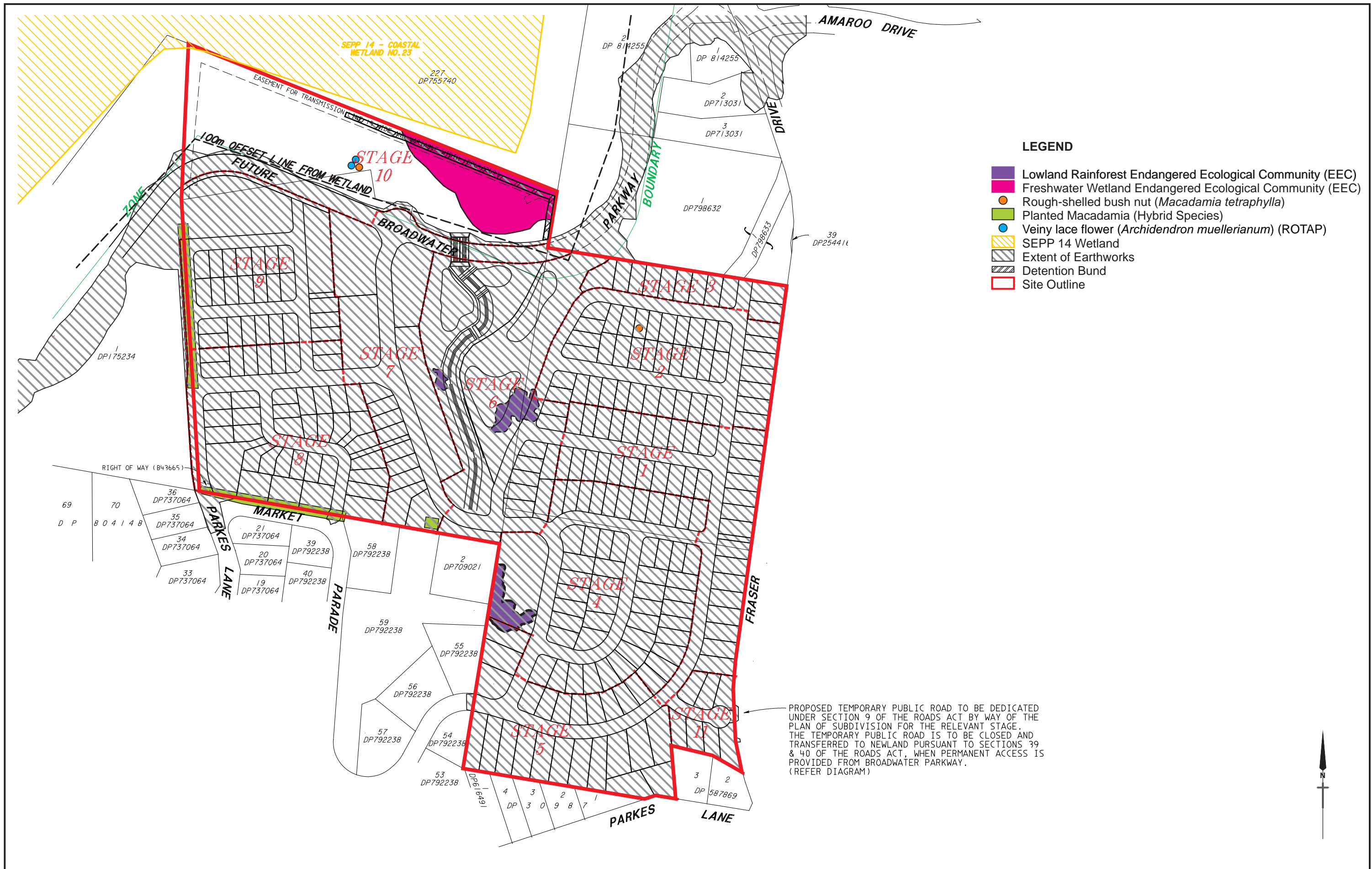
SOURCE: JWA Site Investigations;
Near Map Nov 2011 Aerial Photograph;
SCALE: 1 : 4000 @ A3
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FIGURE 9
PREPARED: BW
DATE: 13 April 2012
FILE: N09031_EECs.cdr

TITLE
**ENDANGERED
ECOLOGICAL
COMMUNITIES &
SIGNIFICANT PLANTS**





SOURCE: JWA: B&P Surveys (Ref: 18779B-A.pdf); Bradlees (Ref: x-09-374-base-final.dwg); G&S (Ref: 10849_BundLocation_for_JWA_20130416.pdf)
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FIGURE 10
PREPARED: BW
DATE: 17 April 2013
FILE: N09031_Impacts EECs.cdr

TITLE
**IMPACTS ON
EEC, SIGNIFICANT
PLANTS &
SEPP 14 WETLANDS**

- Removal of a small amount of degraded native vegetation;
- Earthworks during construction may increase soil erosion; and
- Constructed road network will increase stormwater runoff.

The subject site currently shows some evidence of soil erosion. A number of factors may have contributed such as the steepness of the site, the alluvial soils, high rainfall, and past land management practices. Earthworks will potentially increase soil erosion and soil dispersal, alter the habitat and microclimatic conditions for flora and fauna, and alter the water quality of aquatic habitats downstream from the subject site. Mitigation measures devised to prevent/reduce erosion during construction should be implemented (G & S 2013). Such devices should include silt fences, surface drains and temporary sedimentation ponds.

Upon construction, the internal road network will increase stormwater runoff. To mitigate against this impact, the Stormwater Management Plan (G & S 2013) incorporates the following objectives:

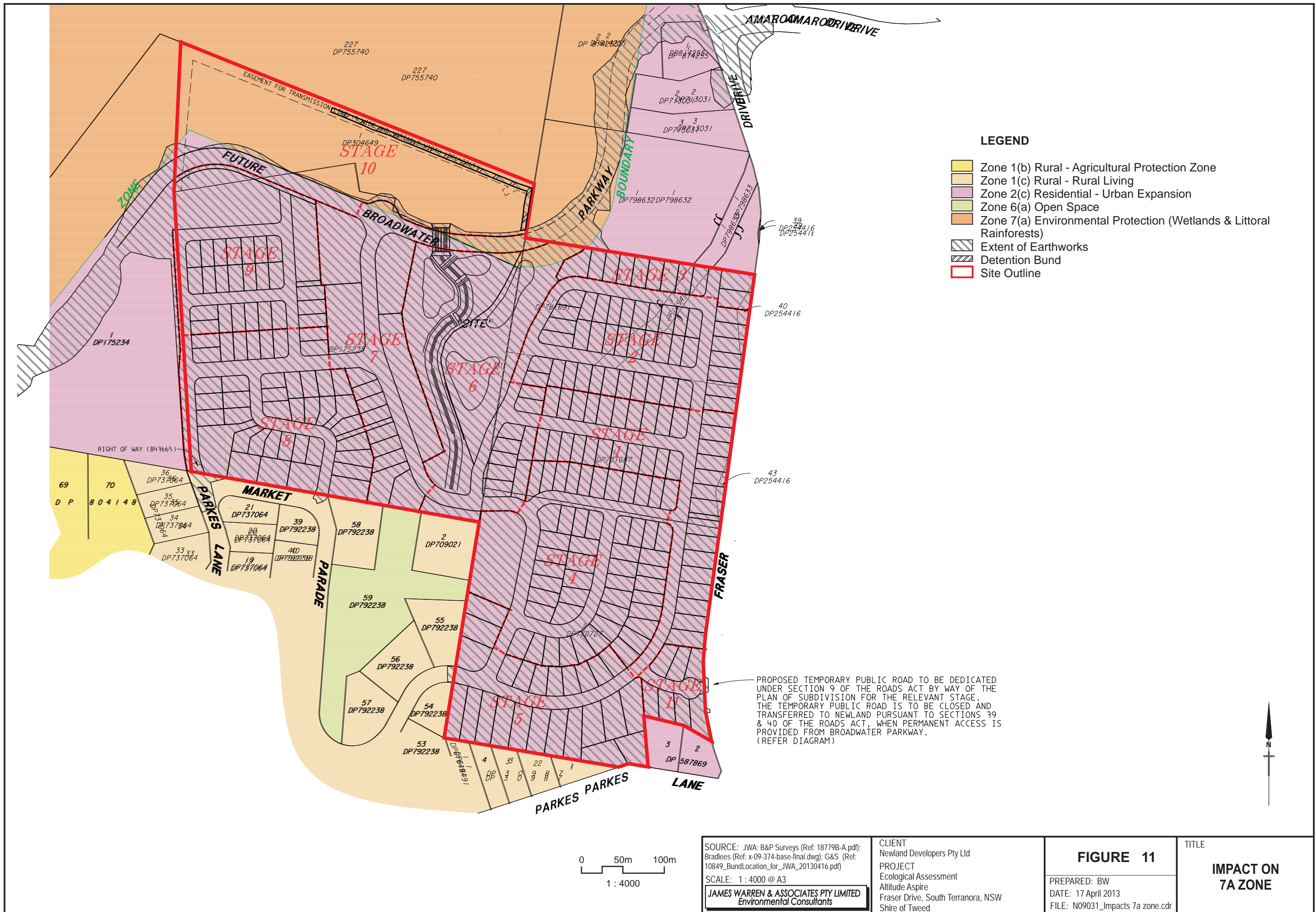
- Prevention of erosion and sedimentation into the riparian areas on site and the SEPP 14 Wetlands;
- Prevention of nutrient transport;
- Prevention of poor quality water flowing into the riparian areas on site and the SEPP 14 Wetlands;
- Prevention of gross pollution entering the waterways;
- Management of the flow of stormwater to mimic the natural hydrological regime; and
- Protect water levels in the riparian areas and freshwater wetlands.

The internal layout of the proposed development will also impact on an area containing a single stem of the Rough-shelled bush nut (*Macadamia tertraphylla*). This single stem is proposed to be relocated to more suitable habitat within the proposed Conservation Area in accordance with the Revised VMRP (JWA 2013).

3.3.4 Broadwater Parkway

The SEPP 14 Wetland number 23 occurs immediately adjacent to the northern boundary of the subject site. Land zoned as Environmental Protection (7a) extends south into the subject site by approximately 100m (**FIGURE 6**). The proposed Broadwater Parkway has been located and designed to generally occur outside the Environmental Protection Zoned land (**FIGURE 11**). This area will be subject to the following (in accordance with the Revised VMRP - JWA 2013):

- Retention of native vegetation (i.e. Sclerophyll forest and Freshwater wetland);
- rehabilitation and enhancement of disturbed vegetation; and
- offset plantings for the removal of degraded Rainforest vegetation elsewhere on the site.



On the subject site, there is currently no buffer to the majority of the SEPP 14 Wetland (i.e. the vegetation has been cleared for agriculture). A vegetated buffer will be created with the implementation of the Revised VMRP. The proposed development will significantly enhance the buffering capabilities of the land adjacent to the wetlands resulting in a positive impact on the SEPP 14 Wetlands to the north of subject site.

3.4 Riparian Areas

3.4.1 Introduction

DGEAR 10.5 - "Identify all riparian areas on site including any creeks, wetlands, drainage lines etc., and outline the intended management, protection and restoration of these areas, including monitoring and mitigation measures. The protection and restoration; of riparian zones will maintain and the ecological functions of watercourses and forms a key part of ensuring appropriate water quality is achieved. If any works are, proposed within the riparian areas (such as bridges, culverts, stormwater outlets, walking tracks etc...) then this should be identified"

Riparian areas on the subject site can be categorised as follows:

- SEPP 14 Wetland No. 23 adjacent to the northern portion of the subject site;
- Degraded Freshwater wetland in the northern portion of the site;
- Constructed drainage lines (i.e. first order streams); and
- Constructed farm dams.

3.4.2 SEPP Wetland number 23

The SEPP 14 Wetland adjacent to the subject site will be protected as a result of the substantial vegetated buffer (i.e. 100m wide) to be established in accordance with the Revised VMRP (JWA 2013).

A stormwater detention bund (**FIGURE 8**) and Stormwater Management Plan (Gilbert & Sutherland 2013) will ensure that only water treated to a suitable level will enter the SEPP 14 Wetland.

3.4.3 Freshwater Wetland

The degraded Freshwater wetland will be retained within a proposed Conservation Area (**FIGURE 10**). There will be a minor loss (0.11ha) to this wetland for the construction of a stormwater detention bund (**FIGURE 8**) however this will be offset through 0.66ha of assisted Freshwater wetland regeneration. This Freshwater wetland will be protected and restored through the implementation of the Revised VMRP (JWA 2013). The proposed revegetation works will result in a minimum 12m vegetated buffer between the Broadwater Parkway and the Freshwater wetland area.

Gilbert & Sutherland (2013) have completed 1, 2, 5, 10, 20, 50 & 100 year ARI water surface level modelling simulations (24 hour) which provide the time taken for current and developed water levels to drain to existing levels across the entire bunded area of

the Freshwater wetland EEC. Results demonstrate that for all rain events plotted, the time taken for surface water levels to return to existing levels is approximately 9 hours for both the current and developed situation, although the water surface level would obviously be initially higher (i.e. during first 3 hours approx.) in the bunded condition. This is not considered to have a significant impact on the ecological functioning of the wetland. Casanova & Brock (2000) reported that water depth within a wetland is not a crucial factor in community development when water levels fluctuate (refer APPENDIX 2).

3.4.4 Constructed Drainage Lines

Drainage lines on the Subject site have been constructed to convey water away from areas previously utilised for crops. Very little native vegetation is associated with these drainage lines with the exception of some clumps of regrowth and scattered mature trees in the southern portion of the subject site.

3.4.5 Constructed farm dams

The constructed farm dams will be filled as these areas will be incorporated into the Stormwater Management System designed by Gilbert and Sutherland (G&S 2013).

3.5 Impacts on flora and fauna

3.5.1 Introduction

DGEAR 13.1 - "Provide an up-to-date assessment of any potential direct and indirect impacts of the development on flora and fauna, taking into consideration impacts on any threatened species, populations, ecological communities and/or critical habitat and any relevant recovery plan in accordance with the draft Guideline for Threatened Species Assessment (Part 3A) and Threatened Species Assessment Guideline: The Assessment of Significance. Describe the actions that will be taken to avoid or mitigate impacts or compensate unavoidable impacts, where relevant."

This section will consider the impacts (direct and indirect) of the proposed development on the existing native flora and fauna. Impacts considered will pay particular attention to Threatened species, populations, ecological communities (as listed under the *NSW Threatened Species Conservation Act 1995*) and their habitats.

Impact assessment has been undertaken in accordance with:

- *Guidelines for Threatened Species Assessment* (DEC & DPI 2005) - SECTION 3.9; and
- *Threatened species assessment guidelines. The assessment of significance* (DECC 2007) (i.e. 7 part tests) (APPENDIX 1).

Assessment under Part 3A allows the use of avoidance and impact mitigation strategies as well as offsets, to achieve maintain-or-improve outcomes and reduce the impacts of a proposed development on Threatened Species and Endangered Ecological Communities.

This section begins with a summary of the Flora and Fauna values on the subject site and discusses the impacts of the proposed development on Threatened species and EECs with an assessment of:

- Potential impacts
- Avoidance of Impacts
- Mitigation
- Offsets

3.5.2 Summary of existing flora and fauna values

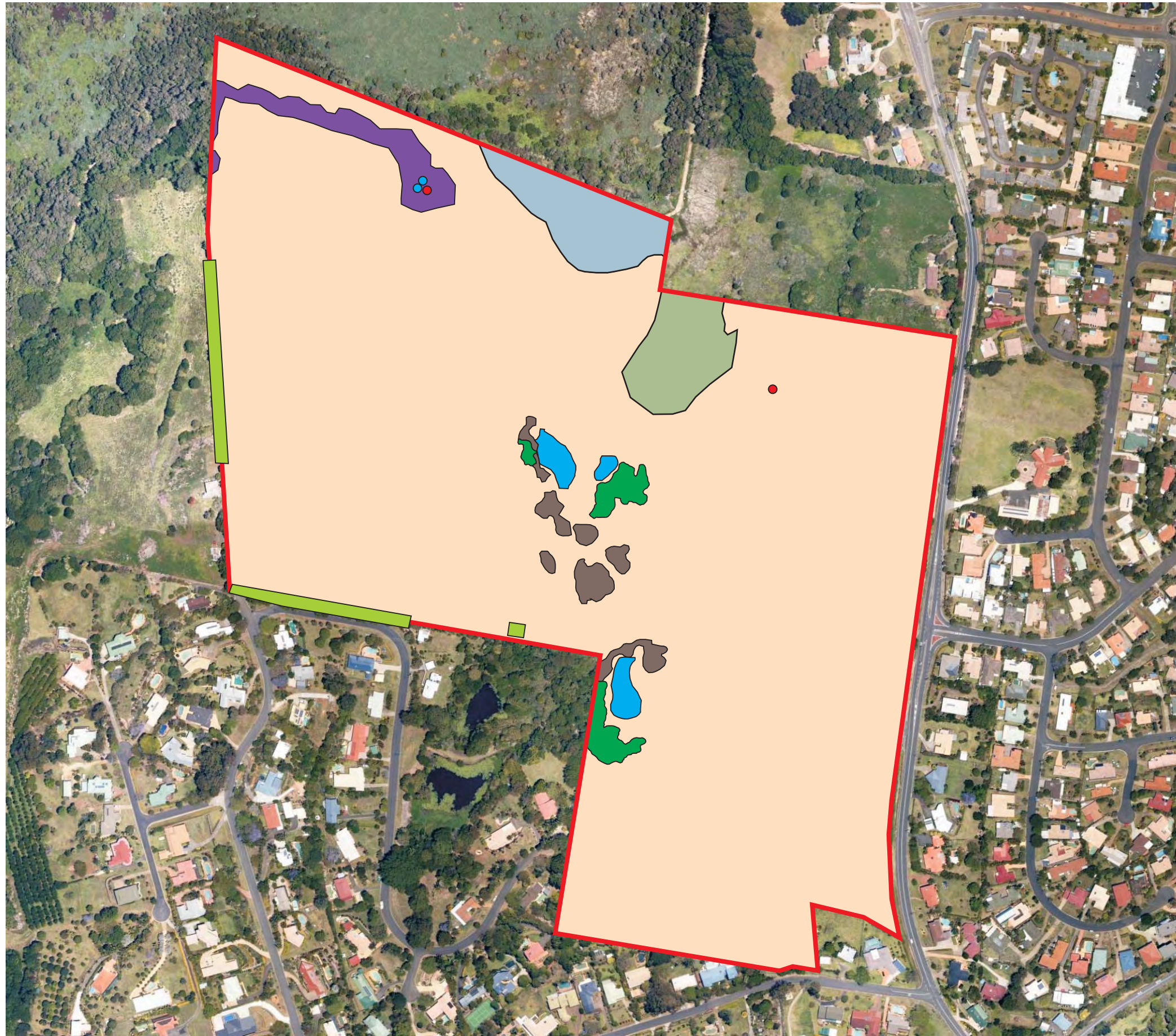
Details of the methodology and results of Flora and Fauna assessments undertaken on the subject site are contained in APPENDICES 2 - 4. A summary of existing Flora and Fauna values are as follows:

Flora

- Seven (7) vegetation communities (FIGURE 12);
- Two (2) heavily degraded EECs (FIGURE 9):
 - Lowland Rainforest (DECCW 2008); and
 - Freshwater wetlands (DECCW 2008b);
- One hundred and sixty-four (164) plant species (APPENDIX 3 & 4) including the following significant species (FIGURE 9):
 - One (1) Threatened flora species - Rough-shelled bush nut (*Macadamia tetraphylla*); and
 - One ROTAP species (Briggs & Leigh 1996) - Veiny lace flower (*Archidendron muellerianum*).

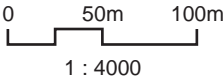
Fauna

- Forty eight (48) fauna species including:
 - Four (4) amphibians;
 - Four (4) reptiles;
 - Thirty-eight (38) birds; and
 - Two (2) mammals.
- No Threatened fauna species were recorded however, eight (8) threatened fauna species were considered a possible occurrence on the Subject site based on the availability of suitable habitat:
 - Pale-vented bush-hen (*Amaurornis moluccana*)
 - Collared kingfisher (*Todiramphus chloris*)
 - Eastern bent-wing bat (*Mormopterus schreibersii oceanensis*)
 - Eastern long-eared bat (*Nyctophilus bifax*)



LEGEND

- Community 1 - Mid-high Closed Forest / Regrowth (Mixed rainforest species)
- Community 2 - Mid-high Wet Grassland +/- Sedgeland / Rushland (Mixed species)
- Community 3 - Mid-high Wet Grassland (*Setaria sp.*)
- Community 4 - Grazing Land / Abandoned Crops
- Community 5 - Pond / Dam Communities
- Community 6 - Tall closed forest (*Cinnamomum camphora*)
- Community 7 - Tall open moist sclerophyll forest (*Lophostemon confertus* +/- *Corymbia intermedia*)
- Rough-shelled bush nut (*Macadamia tetraphylla*)
- Planted Macadamia (Hybrid Species)
- Veiny lace flower (*Archidendron muellerianum*) (ROTAP)
- Site Outline



SOURCE: JWA Site Investigations;
Near Map Nov 2011 Aerial Photograph
SCALE: 1 : 4000 @ A3
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FIGURE 12
PREPARED: BW
DATE: 13 April 2012
FILE: N09031_Veg.cdr

TITLE
VEGETATION COMMUNITIES

- Grey-headed flying fox (*Pteropus poliocephalus*)
- Little bent-wing bat (*Miniopterus australis*)
- Rose-crowned fruit dove (*Ptilinopus regina*)
- Yellow-bellied sheath-tail-bat (*Saccolaimus flaviventris*)

3.5.3 Impacts on Vegetation

Impacts

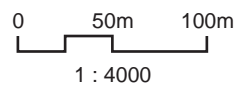
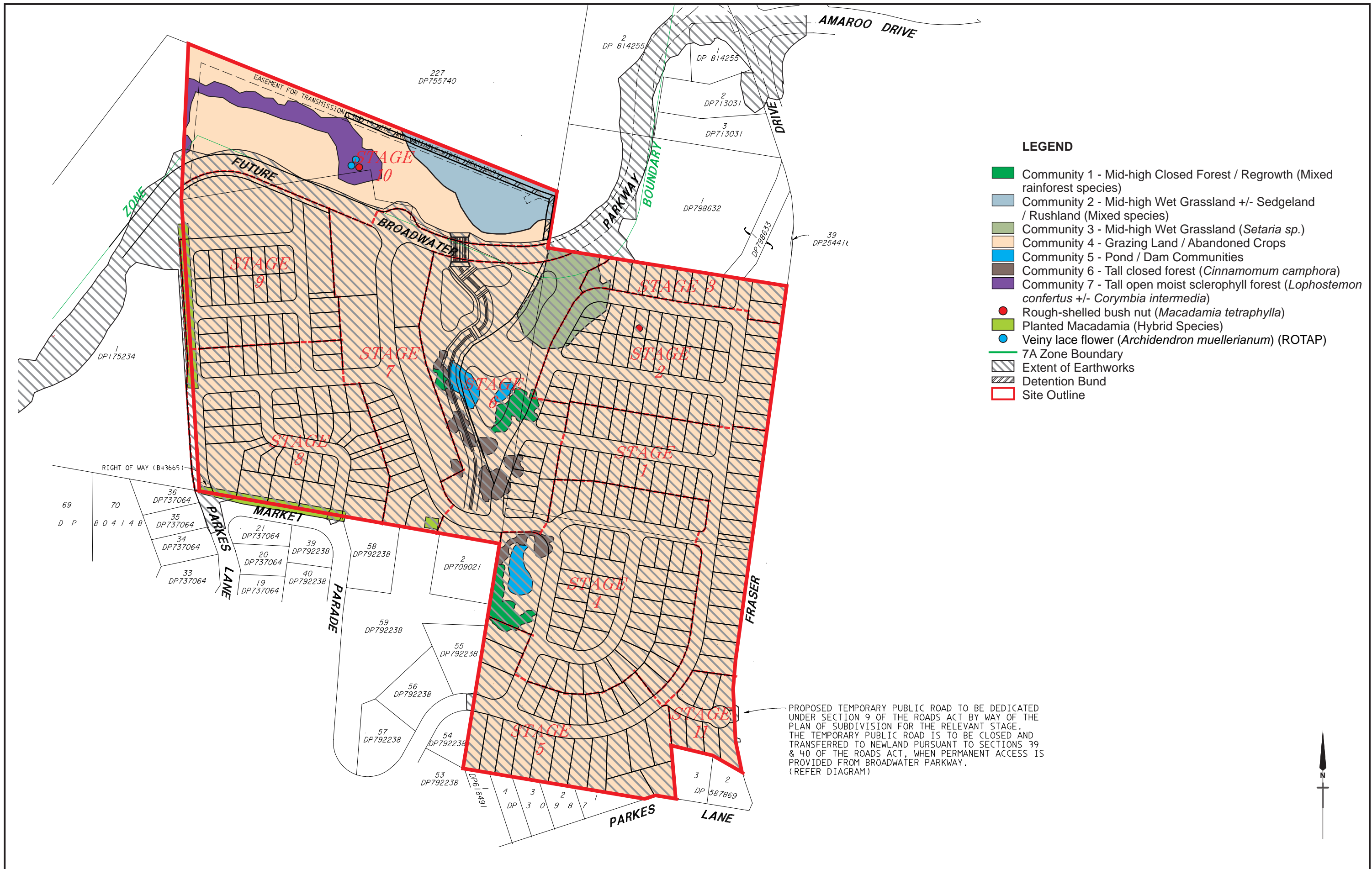
Some losses of native vegetation will occur, however over 94% of the vegetation losses will occur within the cleared agricultural land (TABLE 1). An overlay of the proposed development on vegetation communities is provided in FIGURE 13.

**TABLE 1
LOSS OF VEGETATION COMMUNITIES FROM THE PROPOSED DEVELOPMENT**

Community	Total (ha)	Loss (ha)	Loss (%)
<u>Community 1</u> - Mid-high closed forest/regrowth (Mixed rainforest species)	0.36	0.36	100%
<u>Community 2</u> - Mid-high wet grassland +/- sedgeland/rushland (Mixed species)	0.94	0.11	11.70%
<u>Community 3</u> - Mid-high wet grassland (<i>Setaria</i> sp.)	0.82	0.82	100%
<u>Community 4</u> - Grazing land/Abandoned crops	32.52	29.81	91.67%
<u>Community 5</u> - Pond/dam communities	0.27	0.27	100%
<u>Community 6</u> - Tall closed forest (<i>Cinnamomum camphora</i>)	0.42	0.42	100%
<u>Community 7</u> - Tall open moist sclerophyll forest (<i>Lophostemon confertus</i> +/- <i>Corymbia intermedia</i>)	0.63	0.00	0%
TOTAL	35.95	31.78	88.40%

Avoidance

The proposed development has been designed to generally utilise existing cleared and disturbed areas within the subject site. Over 94% of the vegetation to be removed has been mapped as grazing land/abandoned crops. The majority of the Freshwater wetland EEC and the entire stand of moist sclerophyll forest in the north-western corner of the site have been avoided.



SOURCE: JWA: B&P Surveys (Ref: 18779B-A.pdf); Bradlees (Ref: x-09-374-base-final.dwg); G&S (Ref: 10849_BundLocation_for_JWA_20130416.pdf)
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FIGURE 13
PREPARED: BW
DATE: 17 April 2013
FILE: N09031_Impacts.cdr

TITLE
IMPACTS OF PROPOSED DEVELOPMENT

Mitigation

Mitigation for the loss of native vegetation will be provided through the rehabilitation of existing habitat areas to be retained and the creation of additional habitat within proposed Conservation Areas throughout the subject site.

A Revised VMRP has been prepared outlining strategies to restore retained areas (i.e. through weed control and natural regeneration) and create further areas of native vegetation (i.e. through enhancement planting of indigenous species).

Offsets

Offsets for the removal of degraded Lowland rainforest EEC (i.e. Community 1) and Freshwater wetland EEC (i.e. Community 2) are discussed in **Section 3.5.4.3**.

3.5.4 Impacts on Threatened species and their habitats

3.5.4.1 Threatened flora

Impacts

One (1) Threatened flora species has been recorded from the subject site - two (2) stems of Rough-shelled bush nut (*Macadamia tetraphylla*). It was previously thought that several additional stems of the Rough-shelled bush nut occurred on the site. Further surveys have revealed that numerous other individuals occur immediately adjacent to the western and southern boundaries (**FIGURE 9**). However, these individuals occur in rows, and it is obvious they have been planted. Furthermore, it appears that these additional plants are orchard specimens, and are therefore not covered by the schedules of the *Threatened Species Conservation Act (1995)*.

An overlay of the proposed development showing the location of the two stems of Rough-shelled bush nut is provided in **FIGURE 10**. There will be no impacts on the plant in the north-western portion of the site within the proposed Conservation Area. The plant in the north-eastern portion of the subject site occurs in sub-optimal (weed infested) habitat surrounded by agricultural land. It is proposed to translocate this specimen to more suitable habitat within the Conservation Area.

Avoidance

The single stem of Rough-shelled bush nut in the north-western portion of the site will be retained in-situ. The stem in the north-eastern portion of the site occurs within the residentially zoned portion of the site, cannot be avoided by the proposed development and will be translocated to more suitable habitat in accordance with the Revised VMRP (2013).

Mitigation

A Revised VMRP has been prepared outlining strategies to restore retained areas (i.e. through weed control and natural regeneration) and create further areas of native vegetation (i.e. through enhancement planting of indigenous species). This will result in an increase in available habitat on the subject site for this species and the provision of a significant buffer. Specific protection measures are also included in the Revised VMRP to

ensure the continued survival of this species on the subject site, including the translocation of a single stem from the development footprint to more suitable habitat within the proposed Conservation Area.

Offsets

No offsets are required.

3.5.4.2 Threatened Fauna

Impacts

No Threatened fauna species have been recorded from the subject site. Some losses of native vegetation (i.e. fauna habitat) will occur, however over 94% of the vegetation losses will occur within the cleared agricultural land. A more thorough assessment of potential impacts on Threatened fauna species is included in **APPENDIX 1**.

Avoidance

No Threatened fauna species have been recorded from the subject site. Eight (8) Threatened fauna species are considered a possible occurrence on or adjacent to the subject site over time based on the availability of suitable habitat:

- Pale-vented bush hen (*Amaurornis moluccana*);
- Collared kingfisher (*Todiramphus chloris*)
- Eastern bent-wing bat (*Mormopterus schreibersii oceanensis*)
- Eastern long-eared bat (*Nyctophilus bifax*)
- Grey-headed flying fox (*Pteropus poliocephalus*)
- Little bent-wing bat (*Miniopterus australis*)
- Rose-crowned fruit dove (*Ptilinopus regina*)
- Yellow-bellied sheath-tail-bat (*Saccolaimus flaviventris*)

The proposed development has been designed to generally utilise existing cleared and disturbed areas.

Mitigation

Mitigation for the loss of native vegetation and fauna habitat will be provided through the rehabilitation of existing habitat areas and the creation of additional habitat within proposed Conservation Areas throughout the subject site. A Revised VMRP has been prepared outlining strategies to restore retained areas (i.e. through weed control and natural regeneration) and create further areas of native vegetation (i.e. through enhancement planting of indigenous species).

Offsets

No offsets are required.

3.5.4.3 Endangered Ecological Communities

Impacts

Some losses of native vegetation will occur. Over 94% of the vegetation losses will occur within the cleared agricultural land however, 1.1% of the vegetation loss will be from vegetation that represents the Lowland rainforest EEC (TABLE 2). In addition, approximately 0.35% of the vegetation loss will be from vegetation that represents the Freshwater wetland EEC (TABLE 2) due to the construction of a stormwater detention bund along the northern boundary (FIGURE 8). An overlay of the proposed development on identified EEC's on the subject site is provided in FIGURE 10.

**TABLE 2
LOSS OF ENDANGERED ECOLOGICAL COMMUNITIES FROM THE PROPOSED
DEVELOPMENT**

Vegetation Community	Endangered Ecological Community (EEC)	Total (ha)	Loss (ha)	Loss (%)
<u>Community 1</u> - Mid-high closed forest/regrowth (Mixed rainforest species)	Lowland Rainforest	0.36	0.36	100%
<u>Community 2</u> - Mid-high wet grassland +/- sedgeland/rushland (Mixed species)	Freshwater Wetland	0.94	0.11	11.70%

Avoidance

The proposed development has been designed to generally utilise existing cleared and disturbed areas within the subject site.

The alignment of the Broadwater Parkway has been redesigned to avoid areas of the Freshwater wetland EEC. The location and design of the Broadwater Parkway has been subject to significant assessment of alternative routes (including ecological assessment of the site and surrounding lands) and detailed consultation with Tweed Shire Council. There is no suitable alternative to the current proposed alignment which allows a 12m minimum buffer to the Freshwater wetland EEC.

Due to a combination of steep topography, compliance with TSC subdivision requirements in terms of landform, retaining wall heights etc., and the requirement to treat all stormwater within the central gully on the site to reduce impact on the adjacent SEPP 14 wetland, the entire development footprint will be subject to some form of earthworks.

There will be an unavoidable loss of the small, isolated and degraded patches of the Lowland rainforest EEC (0.36ha in total) and Freshwater wetland EEC (0.11ha in total).

Mitigation

Mitigation for the loss of native vegetation and fauna habitat will be provided through the rehabilitation of existing habitat areas and the creation of additional habitat within proposed Conservation Area in the north of the subject site. A Revised VMRP has been prepared outlining strategies to restore retained areas (i.e. through weed control and

natural regeneration) and create further areas of native vegetation (i.e. through enhancement planting of indigenous species). A minimum 12m vegetated buffer will be provided to the Freshwater wetland EEC.

Offsets

Offsets will be provided for the removal of 0.36ha of degraded Lowland rainforest EEC through the planting of 1.57ha within the identified Conservation area (i.e. a replacement ratio of >4:1). The removal of 0.11ha of degraded Freshwater wetland EEC, for the construction of a detention bund, will be offset through the assisted regeneration of 0.66ha to the south of the existing EEC. **FIGURE 14** shows the location of the proposed offset areas. Based on site observations the Lowland rainforest offset area appears to be characterised by the presence of ferosols and alluvium which are likely to be suitable for the regeneration of lowland rainforest. The proposed offset area for Freshwater wetland is adjacent to the existing EEC and is considered suitable for the assisted regeneration of this community.

3.6 Field Survey

3.6.1 Introduction

DGEAR 13.2 - "A field survey of the site should be conducted as part of this assessment in accordance with DECCW's Threatened Biodiversity Survey and Assessment Guidelines."

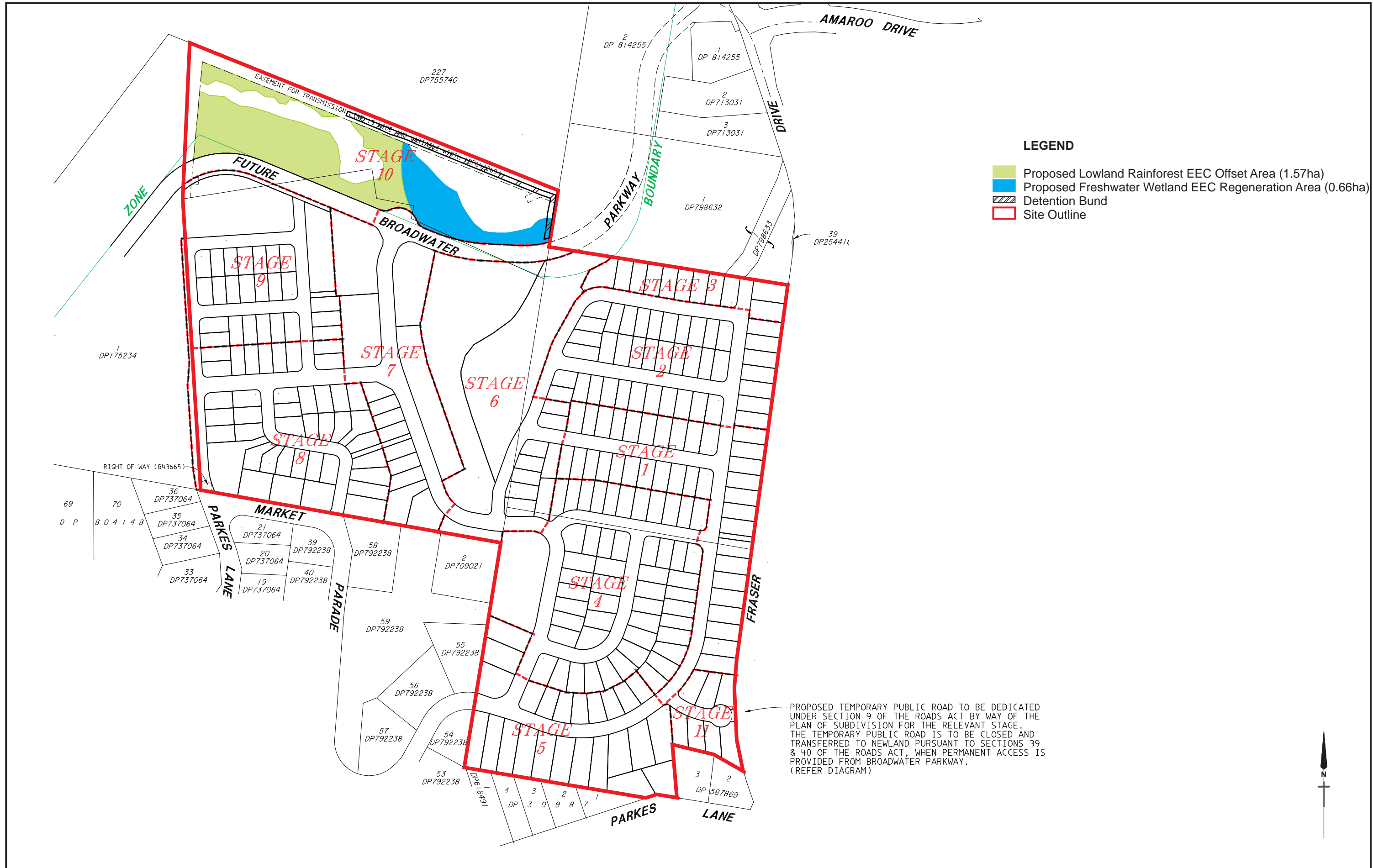
3.6.2 Compliance with Biodiversity Survey Guidelines (DEC 2004)

The NSW Department of Environment and Conservation (DEC) have prepared a set of guidelines for use by decision makers when considering a proposed development, activity or action pursuant to Parts 4 and 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act), and Part 6 of the *Threatened Species Conservation Act 1995* (TSC Act).

The Guidelines aim to facilitate informed decision-making at the local scale for individual development activities with particular regard to:

- preliminary animal and plant assessments;
- Section 5A Assessments of Significance under the EP&A Act;
- Species Impact Statements (SISs);
- licensing under Part 6 of the TSC Act;
- Local Environmental Studies (LESSs), Regional Environmental Studies (RESs) and spot re-zoning;
- Development Applications (DAs); and
- Clearing Applications (CAs) under the NVC Act.

The Guidelines aim to inform the process of survey and assessment of threatened biodiversity by describing and discussing:



SOURCE: JWA Site Investigations; B&P Surveys (Ref: 18779B-A.pdf); Gilbert & Sutherland (Ref: 10849_BundLocation_for_JWA_20130416.pdf)
SCALE: 1:4000 @ A3
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FIGURE 14
PREPARED: BW
DATE: 17 April 2013
FILE: N09031_EEC Offset.cdr

TITLE
**PROPOSED
EEC OFFSET &
REGENERATION
AREAS**

- the chronological steps within the threatened biodiversity assessment process;
- the strategies, policies and legislation relevant to threatened biodiversity;
- appropriate survey techniques for detecting threatened biodiversity;
- the information required for an Assessment of Significance; and
- reporting requirements and standards.

The Guidelines aim to provide a consistent and systematic approach to survey and assessment of threatened biodiversity. In particular, the guidance provided will assist in:

- setting appropriate aims for survey and assessment of threatened biodiversity;
- the planning of suitable survey techniques and the appropriate level of effort;
- the provision of adequate reporting;
- a justifiable interpretation of results; and
- making an informed and justifiable decision.

3.6.3 JWA Surveys

The flora and fauna surveys conducted by JWA (APPENDICES 3 & 5) generally follow the guidelines outlined above. However, as the majority of the subject site is comprised of agricultural land, a full fauna survey was not considered necessary.

Opportunistic sightings were recorded during the flora survey in accordance with Section 5.3.1 of the DECCW Guidelines and a habitat assessment was completed in accordance with Section 5.3.3 of the DECCW guidelines.

Whilst the assessment has relied on opportunistic sightings and a habitat assessment only on the subject site, these results are bolstered by detailed fauna assessments completed by JWA (2009) on adjoining sites during the Area E rezoning process (APPENDIX 6).

3.7 Threatened Species Impact Assessment

3.7.1 Introduction

DGEAR 13.3 - "Likely impacts on threatened species and their habitat need to be assessed, evaluated and reported on. The assessment should specifically report on the guiding principles for threatened species assessment at section 1.2 of the draft Guideline for Threatened Species Assessment (Part 3A). Identify measures to protect remaining native fauna and flora on the site where appropriate."

The impacts of the proposed development have been assessed in accordance with The Guidelines for Threatened Species Assessment (DEC & DPI, 2005). Section 1.2 outlines six guiding principles for threatened species assessment and Section 3 Step 4 provides guidelines for assessing impacts through assessing key thresholds with the response to a set of questions. These have been addressed in the following two sections.

3.7.2 Guiding principles for threatened species assessments

Each guideline will be addressed in the context of the proposed development.

1. **Maintain or improve biodiversity values (i.e. there is no net impact on threatened species or native vegetation)**

Response

The current development will improve the biodiversity values of the site. The site consists of highly disturbed land with small patches of degraded native vegetation. The proposed development includes measures to mitigate any negative impacts on biodiversity during the construction and operational phases including:

1. Largely avoiding patches of good quality native vegetation;
2. Maintaining and creating new areas of quality habitat for flora and fauna with the implementation of a Vegetation Management & Rehabilitation Plan (JWA 2013), including offsets for the removal of degraded Lowland rainforest EEC patches at a ratio of 4.4:1 (i.e. 1.57ha for the 0.36ha removed) and offsets for the removal of degraded Freshwater wetland EEC at a ratio of 6:1 (i.e. 0.66ha for the removal of 0.11ha);
3. The removal of constructed dams (i.e. obstructions to the natural flow) and the construction of an efficient drainage line (and associated habitat) along the natural drainage line of the subject site (G&S 2013);
4. The construction of freshwater wetland systems (i.e. creating aquatic habitat) in the form of stormwater retention, filtration and sedimentation areas (G&S 2013);
5. Water quality assurance measures to improve the quality draining into the SEPP 14 Wetland, including a stormwater detention bund adjacent to the northern property boundary (FIGURE 8).

Collectively, these measures will improve the biodiversity values of the subject site by conserving, improving and creating quality habitat for native flora and fauna.

2. **Conserve biological diversity and promote ecologically sustainable development.**

Response

The current development will conserve in its entirety, the moist sclerophyll forest in the north western portion of the site. There will be unavoidable losses of Lowland rainforest and Freshwater wetland EECs however these will be offset at ratios of 4.4:1 and 6:1 respectively. The moist sclerophyll forest and Freshwater wetland will be buffered from the development through revegetation works. Therefore, there will be a net conservation of biological diversity on the site.

Whilst there is no universally accepted definition of ESD, in 1990 the Commonwealth Government suggested the following definition for ESD in Australia:

- 'using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased'.

Put more simply, ESD is development which aims to meet the needs of Australians today, while conserving our ecosystems for the benefit of future generations.

The development will conserve the existing ecosystems on the site by way of conservation, rehabilitation and buffering.

3. Protect areas of high conservation value (including areas of critical habitat).

Response

No areas mapped as critical habitat occur on the subject site.

The majority (88.3%) of the Freshwater wetland EEC will be retained, buffered and rehabilitated. Assisted regeneration will increase the size of this EEC on the subject site to 1.49ha. The adjoining SEPP 14 wetland will be protected by a stormwater detention bund and 100m vegetated buffer. Whilst there will be unavoidable losses of Lowland rainforest EEC, this will be offset at a ratio of 4.4:1.

4. Prevent the extinction of threatened species.

Response

The proposed development will not increase the likelihood of extinction of any threatened species or EECs on the subject site or in the local area. An Assessment of Significance (7-part test) has been completed for all Threatened species recorded or considered a possible occurrence on the subject site (APPENDIX 1).

5. Protect the long term viability of local populations of a species, population or ecological communities.

Response

Potential impacts on the long term viability of local populations of Threatened species, populations and ecological communities have been assessed in an Assessment of Significance (7-part test) (APPENDIX 1).

6. Protect aspects of the environment that are matters of national environmental significance.

Response

An assessment of the proposed development pursuant to the EPBC Act (1999) has been undertaken in SECTION 3.1. The Grey-headed flying fox, listed as vulnerable within schedules of the EPBC Act (1999), is considered a possible occurrence on the subject site. The subject site does not support an important population of this species and the

proposed development will not result in any impacts on the Grey-headed flying-fox such that it will cause the species to become locally extinct.

3.7.3 Key Thresholds Assessment

Key Threshold Assessment Questions have been assessed for the following:

Endangered Ecological Communities (EECs)

- Two (2) heavily degraded EECs:
 - Lowland Rainforest (DECCW 2008); and
 - Freshwater wetlands (DECCW 2008b);
- One (1) Threatened flora species - Rough-shelled bush nut (*Macadamia tetraphylla*).

(a) Will the proposal, including actions to avoid or mitigate impacts or compensate to prevent unavoidable impacts, maintain or improve biodiversity values?

Biodiversity should be considered on three (3) levels:

- Genetic diversity - the variation of the genes within a species.
- Species diversity - the number of different types of plants and animals.
- Ecosystem diversity - this is the variety habitats on earth.

The proposed development will maintain Biodiversity on all of these levels.

Avoid

The proposed development will utilise land that is degraded due to a significant disturbance history and is currently infested by many weed species. The layout has been planned in a manner which will maintain biodiversity on the site. Most areas comprised of native vegetation will be retained.

Mitigate

The majority (88.3%) of the Freshwater wetland EEC will be retained, buffered and rehabilitated. Assisted regeneration will increase the size of this EEC on the subject site to approximately 1.5ha. The adjoining SEPP 14 wetland will be protected by a stormwater detention bund and a 100m vegetated buffer. Whilst there will be unavoidable losses of Lowland rainforest EEC, this will be offset at a ratio of 4.4:1.

Compensation

In addition, strategies to further reduce environmental impacts will be undertaken (i.e. the implementation of a Revised VMRP - JWA 2013).

(b) Is the proposal likely to reduce the long-term viability of a local population of the species, population, or ecological community?

The proposed development will not reduce the long-term viability of any threatened flora, fauna or EECs recorded on the Subject site. Mitigation for the loss of areas of degraded EEC vegetation and potential threatened fauna habitat will be provided through the rehabilitation of retained habitat areas and associated buffers and the creation of additional habitat. Habitat for these species/EECs will be improved therefore increasing the viability of their long-term survival.

The single stem of Rough-shelled bush nut occurring on the site will be retained in-situ and habitat restoration measures implemented.

A Revised VMRP has been prepared outlining strategies to restore retained areas (i.e. through weed control and natural regeneration) and create further areas of native vegetation (i.e. through enhancement planting of indigenous species). Areas to be revegetated will include offsets for the removal of small isolated patches of EEC vegetation and will form a buffer to the SEPP 14 Wetland at the north of the site.

Potential impacts on the long term viability of local populations of Threatened species, populations and ecological communities have been further assessed in an Assessment of Significance (7-part test) (APPENDIX 1).

(c) Is the proposal likely to accelerate the extinction of the species, population or ecological community or place it at risk?

The proposed development is unlikely to accelerate the extinction or place at risk the Lowland rainforest EEC or Freshwater wetland EEC on the site. On the contrary, the proposal will result in larger, more consolidated patches of these EECs which will be less susceptible to edge effects and other impacts, and will be protected in a Conservation Area in perpetuity.

The proposed development is unlikely to accelerate the extinction or place at risk the single Rough-shelled bush nut on the site. On the contrary, the proposal will result in a significant increase in available habitat on the site.

(d) Will the proposal adversely affect critical habitat?

Critical habitats are areas of land that are critical to the survival of a particular threatened species, population or ecological communities and are listed under the *Threatened Species Conservation Act (1995)*. The proposed development will not impact on any of the listed critical habitats.

3.8 Areas of Ecological Significance

DGEAR 13.4 - Provide an assessment of the proposal that ensures (if possible) adverse impacts on identified areas of ecological significance are avoided or mitigated (including the adjacent SEPP 14 Wetland, Endangered Ecological Communities, threatened species habitat etc...)

An assessment, including avoidance and/or mitigation measures, of ecological significant areas has been undertaken in the following sections:

- SEPP 14 Wetland number 23 - SECTION 3.3
- Threatened species and EECs - SECTION 3.7
- Endangered Ecological Communities - SECTION 3.5.4.3
- Threatened Fauna - SECTION 3.5.4.2
- Threatened Flora - SECTION 3.5.4.1

3.9 Conservation of existing wildlife corridor values

DGREAR 13.5 - Outline measures for the conservation of existing wildlife corridor values and/or connective importance of any vegetation on the subject land. Address measures to protect and manage the riparian corridor and adjacent aquatic habitats.

3.9.1 Introduction

The Tweed Regional Corridor passes across the north-west corner of the subject site. This Regional Corridor links Stott's Island Nature Reserve to Ukerabagh Island. The Terranora Sub-regional Corridor occurs off site and to the south (FIGURE 15).

3.9.2 Potential impacts

The proposed development will result in vegetation losses in the north-west portion of the subject site (i.e. the area of the mapped Tweed Regional Corridor). The vegetation to be lost is highly disturbed being previously used for agriculture and now used as grazing land. Areas of the corridor that are currently vegetated will be retained. A 100m wide strip along the northern boundary of the subject site, buffering the SEPP 14 Wetland, will be retained (SECTION 3.3.3). There will be no impacts on the effectiveness of the Terranora Sub-regional Corridor.

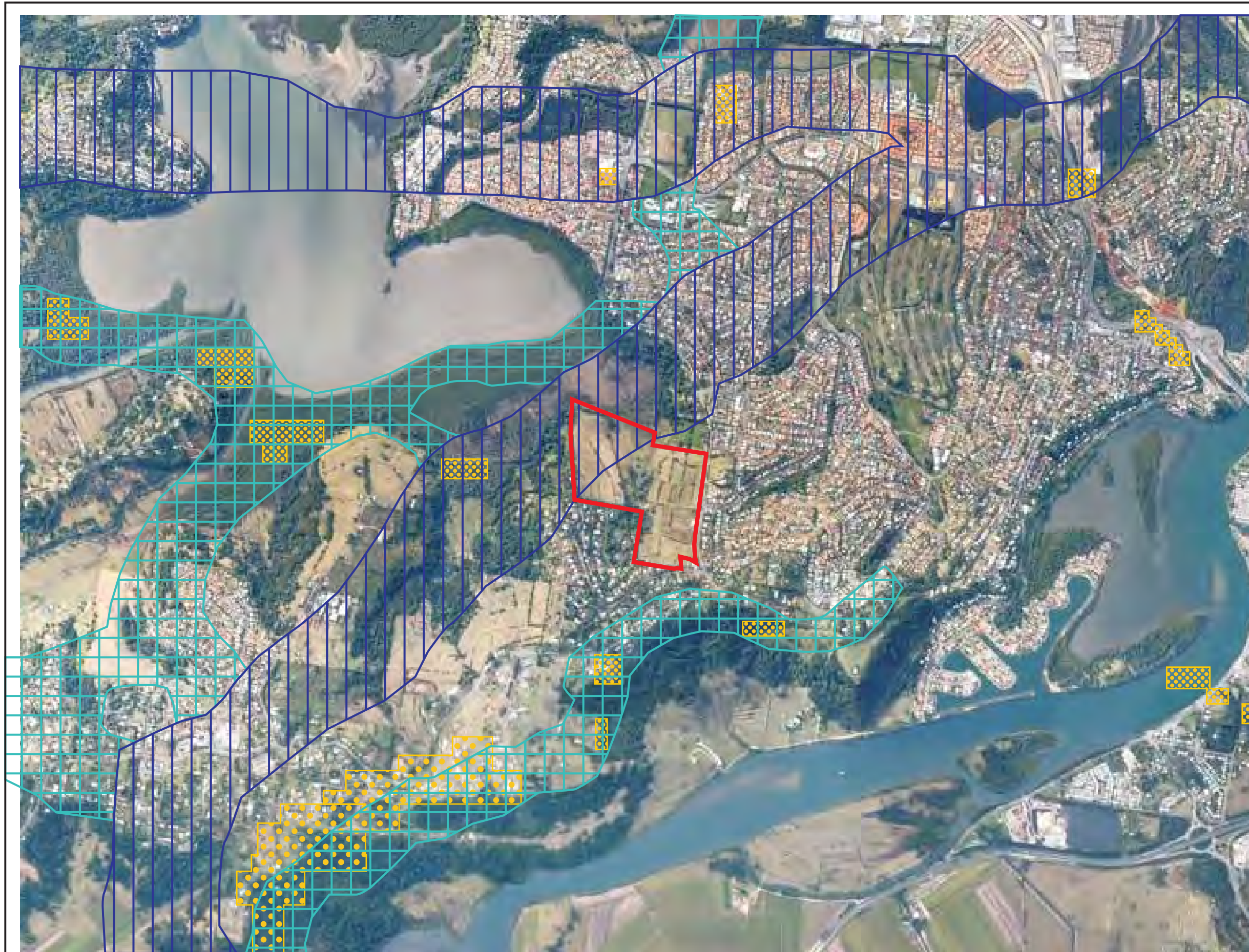
3.9.3 Avoidance of impacts





The proposed development has been designed to generally utilise existing cleared and disturbed areas on the subject site.

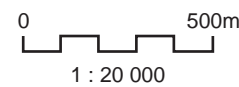
3.9.4 Mitigation

The following measures will mitigate the minor loss of vegetation within the Tweed Regional Corridor:

1. The retained 100m wide strip of land along the northern boundary of the subject site, forming the buffer to the SEPP 14 Wetland, will be enhanced and protected. With the implementation of a Revised VMRP (JWA 2013) which includes the complete revegetation/regeneration of this 100m buffer, the effectiveness of this part of the Tweed Regional Corridor will be significantly improved.



- LEGEND**
-  Regional Corridor
 -  Subregional Corridor
 -  Key Habitat
 -  Subject Site



SOURCE: NSW NPWS Key Habitats & Corridors in Northern NSW (website accessed 07.04.10); Near Map July 2010 Aerial Photograph
SCALE: 1 : 20 000 @ A3
JAMES WARREN & ASSOCIATES PTY LIMITED
Environmental Consultants

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Newland Developers Pty Ltd
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Ecological Assessment
Altitude Aspire
Fraser Drive, South Terranora, NSW
Shire of Tweed

FIGURE 15

PREPARED: BW
DATE: 13 April 2012
FILE: N09031_Corridor.cdr

TITLE
**NPWS
KEY HABITATS
& CORRIDORS**

2. The area of Freshwater wetland EEC occurring within the mapped corridor will be retained and fully rehabilitated.
3. A major drainage line, running from south to north, will be constructed through the middle of the subject site (G&S 2013). The riparian areas of the drainage line will be revegetated (Form Landscape Architects 2013, JWA 2013), aquatic habitat provided in treatment wetlands, and a faunal underpass constructed to facilitate fauna movement under the Broadwater Parkway.

The amount of native vegetation within the corridor will be significantly increased.

3.10 Buffer to SEPP 14 Wetland # 23

DGEAR 13.6 - Provide appropriate buffers and habitat protection measures for known significant ecological habitats as identified in the constraints map contained in Figure 3.4 of the Tweed Area E Local Environment Study (Parsons Brinckerhoff, 2004).

Tweed Area E Local Environment Study identifies the SEPP 14 Wetland number 23 immediately north of the Subject site as "Significant ecological areas not suitable for development" (Parsons Brinckerhoff, 2004, p47) (**FIGURE 16**). Parsons Brinckerhoff (2004) also indicates that a 50m buffer is required to this area.

The proposed development will provide a stormwater detention bund and a 100m revegetated/regenerated buffer to the SEPP 14 Wetland.

The LES also labels the area of brushbox forest in the north-western corner of the site as significant and to be retained where possible. This stand of vegetation is proposed to be retained and buffered from the development.

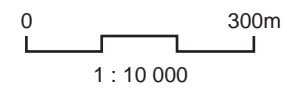
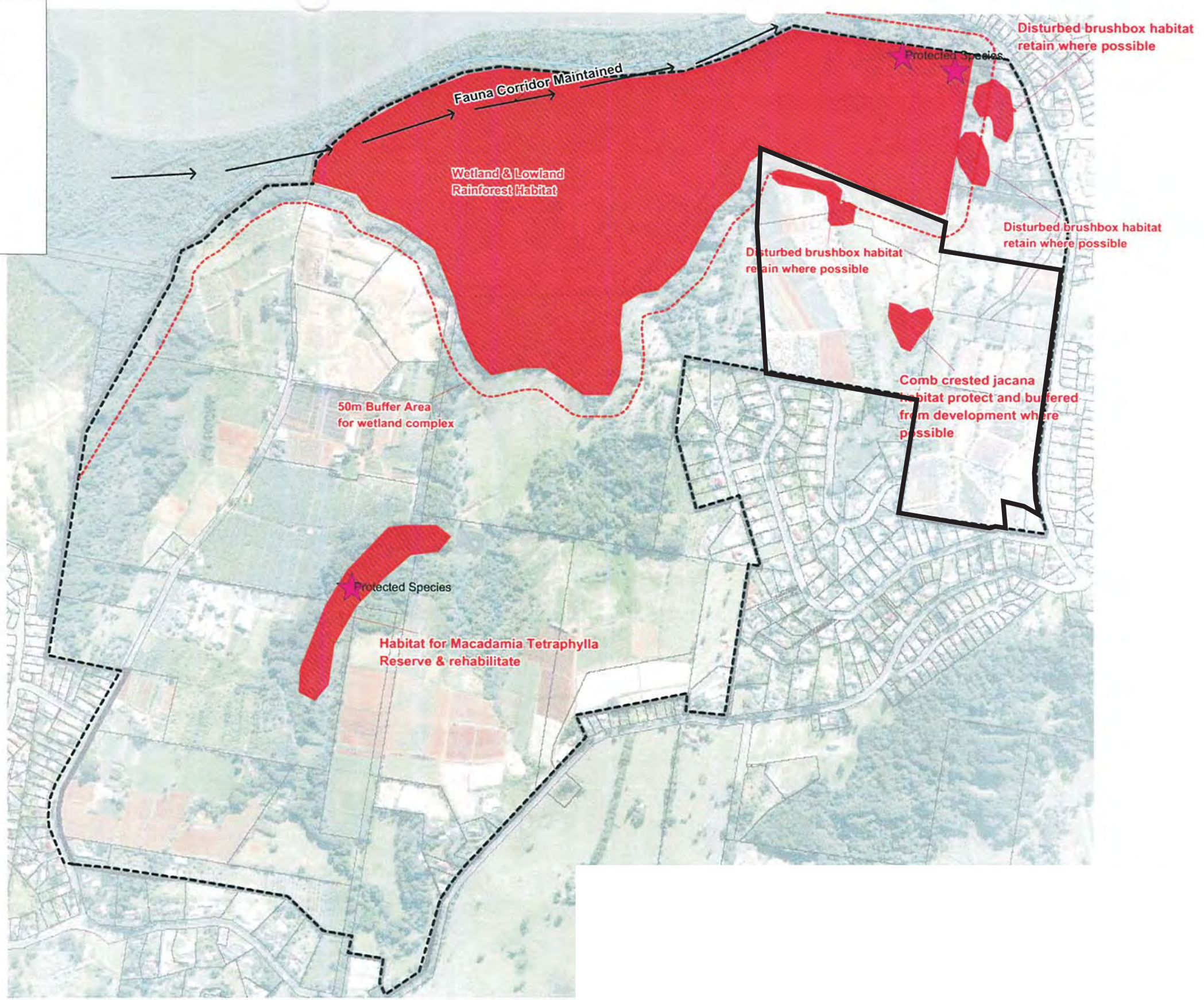
Thirdly, the LES identifies two farm dams on the subject site as Comb-crested jacana habitat to be retained where possible. A detailed assessment of the habitat suitability of these dams for the Comb-crested jacana has been completed on the site (**Section 4.2.3**). Based on habitat assessments completed on the site it is considered highly unlikely that the dams on the subject site provide suitable habitat for the Comb-crested jacana. The habitat mapping in the LES is considered to be incorrect.

3.11 Vegetation Management Plan

DGEAR 13.8 - "Provide a detailed Vegetation Management Plan (VMP) for that area of the site zoned 7(a) Environmental Protection (Wetlands and Littoral Rainforests) and for future dedication to the Tweed Shire Council. As a minimum the VMP should incorporate scoped and appropriate performance requirements for any habitat/wetland rehabilitation works (e.g. in relation to the diversity and density of plantings, seedling survival and growth rates, cumulative crown coverage, and the abundance and diversity of weed species) referenced to appropriate benchmarks (such as comparable, undisturbed vegetation communities)."

Legend

- ★ Significant Flora species
 - Macadamia tetraphylla
 - Cordyline congesta
 - Lepiderema pulachella
 - Syzgium moorei
- - - 50m Buffer Area
- Fauna Corridor
- Significant ecological areas not suitable for development
- - - Area E
- Site Outline



<p>SOURCE: Parsons Brinckerhoff - Local Environmental Study Figure 3.4 Constraints Map for Environmental Values</p> <p>SCALE: 1 : 10 000 @ A3</p> <p>JAMES WARREN & ASSOCIATES PTY LIMITED Environmental Consultants</p>	<p>CLIENT Newland Developers Pty Ltd</p> <p>PROJECT Ecological Assessment Altitude Aspire Fraser Drive, South Terranora, NSW Shire of Tweed</p>	<p>FIGURE 16</p> <p>PREPARED: BW DATE: 13 April 2012 FILE: N09031_LES.cdr</p>	<p>TITLE</p> <p>LOCAL ENVIRONMENTAL STUDY CONSTRAINTS MAP</p>
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A Revised Vegetation Management & Rehabilitation Plan (VMRP) has been prepared for the subject site (JWA 2013). The aim of this VMRP is to direct the rehabilitation and management of proposed Open Space and Conservation areas.

Areas of the site subject to rehabilitation and management can be separated into four (4) distinct categories (**FIGURE 17**):

1. Casual Open Space (Neighbourhood Park, Pocket Parks);
2. Stormwater treatment areas;
3. Passive Open Space; and
4. Conservation Areas (i.e. land zoned 7a).

The specific objectives of this VMRP are to:

- Identify areas of retained vegetation that will be maintained through weed control and general maintenance;
- Identify areas that will be rehabilitated using natural regeneration or revegetation plantings, including offsets for the removal of degraded EECs from the site;
- Provide management guidelines for the revegetation, natural regeneration and weed control of retained areas;
- Provide guidelines for the translocation of a *Macadamia tetraphylla* plant;
- Outline a maintenance and monitoring program for the site; and
- Provide management guidelines for the on-going conservation of vegetation on the site.

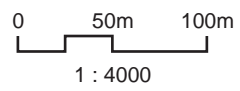
The Revised VMRP will be implemented over 5 years and monitoring will be undertaken to ensure the following performance targets are met:

- Survival and continued growth of seedlings;
- Establishment of a 70% native ground cover after 2-3 years;
- 90% native ground cover after 5th year;
- Establishment of a 70% native canopy cover after 2-3 years;
- 90% native canopy cover after 5th year;
- Height of planted trees to be minimum of 1.5m at year 3 & 2.5m after year 5;
- Natural recruitment of native seedlings throughout rehabilitation areas;
- Establishment of a healthy SEPP 14 Buffer Zone after year 5;
- Environmental weeds to be less than <1%; and
- Infrastructure functional and well-maintained in a state suitable for hand over to Tweed Shire Council.



- LEGEND**
- Casual Passive Open Space
 - Stormwater Treatment
 - Conservation Area
 - Detention Bund
 - Site Outline

PROPOSED TEMPORARY PUBLIC ROAD TO BE DEDICATED UNDER SECTION 9 OF THE ROADS ACT BY WAY OF THE PLAN OF SUBDIVISION FOR THE RELEVANT STAGE. THE TEMPORARY PUBLIC ROAD IS TO BE CLOSED AND TRANSFERRED TO NEWLAND PURSUANT TO SECTIONS 39 & 40 OF THE ROADS ACT, WHEN PERMANENT ACCESS IS PROVIDED FROM BROADWATER PARKWAY. (REFER DIAGRAM)



SOURCE: JWA: B&P Surveys (Ref: 18779B-A.pdf); Bradlees (Ref: x-09-374-base-final.dwg); G&S (Ref: 10849_BundLocation_for_JWA_20130416.pdf)
 SCALE: 1: 4000 @ A3
JAMES WARREN & ASSOCIATES PTY LIMITED
 Environmental Consultants

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 Newland Developers Pty Ltd
 PROJECT
 Ecological Assessment
 Altitude Aspire
 Fraser Drive, South Terranora, NSW
 Shire of Tweed

FIGURE 17
 PREPARED: BW
 DATE: 17 April 2013
 FILE: N09031_Rehab.cdr

TITLE
REHABILITATION STRATEGY

3.12 Mosquitoes

DGEAR 14.2 - "Provide evidence of consultation with Tweed Shire Council regarding a recently, submitted project entitled 'Fish Move In, Mosquitoes Move Out' and discuss the implications for this project for the development within the assessment."

Information was requested, via email, from the Tweed Shire Council on the "Fish in Mosquitoes Out" project. The following reply was received from Clive Easton, Tweed Shire Council's Entomologist.

"The project has only officially just got going. Hence, there is no report on the project as yet; however, I do have information on the grant applications outlining this project and some background that I can send you later."

The project is being carried out in a mature Avicennia Mangrove wetland below the Terranora Hills adjacent to the proposed "Area E" rezoning.

Basically, we are hoping to evaluate the potential for increased tidal flushing in the mangroves which have become bunded by natural and man-made levees. It is hoped this flushing will increase the fisheries productivity of the site and reduce the mosquito productivity. Research to date has focused on mosquito larval abundance & distribution, mosquito egg shell counts in the substrate, LIDAR micro elevation data, monitoring water flow with loggers, fish observations and deep core sampling.

The site is a prolific mosquito breeding area following major rain and spring tides."

4 RESPONSES TO SUBMISSIONS

4.1 Introduction

The exhibition of the Environmental Assessment Report for the Altitude Aspire development ended on the 4th April 2011. In accordance with Section 75H of the Environmental Planning & Assessment Act 1979, the Director-General of the NSW Department of Planning requires responses to the issues raised in the submissions.

The following sections provide responses to the relevant submissions as follows:

- NSW Department of Planning;
- Office of Environment & Heritage;
- Tweed Shire Council
- NSW Industry & Investment (Fisheries); and
- The public.

4.2 NSW Department of Planning

4.2.1 Flora & Fauna

Issue

The Department refers to the submissions of the DECCW, Council and other agencies on these issues. The Department notes areas of EEC (or potential EEC) are proposed to be destroyed within the central gully and adjacent to the SEPP 14 wetland boundary with the construction of stormwater infrastructure, roads, the proposed alignment of Broadwater Parkway, the community facility and residential lots. The Department is generally not supportive of this approach where there is sufficient space to avoid these areas with a more suitable subdivision design and layout.

JWA Response

The layout and design of the Broadwater Parkway has been amended to avoid all significant vegetation. A number of small, isolated and degraded patches of Lowland rainforest EEC occur within the central gully on the subject site (i.e. fringing farm dams). These patches of EEC are shown on **FIGURE 9** and detailed as follows:

- Patch 1 = 251m²;
- Patch 2 = 1,593m²; and
- Patch 3 = 1,746m².

Due to a combination of steep topography, compliance with TSC subdivision requirements in terms of landform, retaining wall heights etc., and the requirement to treat all stormwater within the central gully on the site to reduce impact on the adjacent SEPP 14 wetland, the entire development footprint will be subject to some form of earthworks.

There will be an unavoidable loss of the small, isolated and degraded patches of the Lowland rainforest EEC (0.36ha in total) and a loss of 0.11ha of Freshwater wetland EEC for the construction of a stormwater detention bund.

The removal of this vegetation will be offset through revegetation works in the Conservation Areas of the site at a rate of >4:1 (i.e. 1.57ha for the 0.36ha removed) and 6:1 (i.e. 0.66ha for the removal of 0.11ha) respectively. This will result in more consolidated areas of these EECs and significantly improve the likelihood of the survival of the EECs on the subject site in the long-term.

4.2.2 EEC removal

Issue

It appears construction of the Broadwater Parkway will necessarily require the destruction of some environmentally sensitive areas. However the proposed removal of 60% of Lowland Rainforest EEC and 45% of Freshwater Wetland EEC on-site appears to be excessive when alternative Parkway alignments and subdivision layouts are considered. The proponent should give consideration to redesigning the subdivision layout to avoid these areas as a first preference. As a second preference the proponent should liaise with the DECCW to determine suitable offsets and/or mitigation measures for any unavoidable impacts on these areas of biodiversity value. The VMP shall be updated to reflect these outcomes and any proposed actions included in the Statement of Commitments.

JWA Response

As discussed above the layout and design of the Broadwater Parkway has been amended to avoid all significant vegetation. However, the removal of small, isolated and degraded patches of Lowland rainforest EEC in the central gully of the subject site and an area of degraded Freshwater wetland EEC adjacent to the northern boundary is unavoidable.

OEH (formally DECCW) in their submission has also requested further consideration of the retention of this EEC. However, they note that:

"In the event that the removal of any EEC is permitted, DECC recommends that an appropriate offset (for example of 1:10 ratio) be required either within the site or in close proximity to the site."

It is proposed to offset the unavoidable loss of 0.36ha of Lowland rainforest vegetation and 0.11ha of Freshwater wetland from the subject site by revegetating/regenerating 1.57ha (i.e. 1:4.4 ratio) and 0.66ha (i.e. 1:6 ratio) respectively within the identified Conservation Area in the northern portion of the site. The location and extent of the proposed EEC offsets are shown in **FIGURE 14**.

The Revised VMRP (JWA 2013) has been updated to reflect these outcomes.

4.2.3 Comb-crested jacana

Issue

Comb-crested jacana have been recorded on the site in previous ecological studies and the LES for Area E. The current ecological assessment by James Warren should refer to those studies and assess the impacts of the proposal on this species and provide mitigation measures (if necessary).

JWA Response

It is understood that the LES for Area E did not record this species on the subject site but identified farm dams as potentially providing suitable habitat.

The original Fauna Assessment completed by JWA (2010) (**APPENDIX 5** of the Ecological Assessment) noted the Comb-crested jacana as being recorded within 10km of the subject site (i.e. based on the results of a search of the NPWS online database). The results of the on-site habitat assessment however, revealed that the dams on the subject site did not represent suitable habitat for the species due to poor vegetation cover.

A further habitat assessment was completed by JWA (May 2011). The Comb crested jacana (*Irediparra gallinacea*), also known as the Lotusbird or Lilytrotter, is adapted to the floating vegetation of tropical freshwater wetlands. It occurs in northern and eastern Australia, mainly in coastal and subcoastal regions, from the north-eastern Kimberley Division of Western Australia to Cape York Peninsula then south along the east coast to the Hunter region of NSW, with stragglers recorded in south-eastern NSW (possibly in response to unfavorable conditions further north).

The Comb-crested jacana requires a good surface cover of floating vegetation, especially water-lilies, on which it forages primarily for insects and other invertebrates, as well as some seeds and other vegetation.

The habitat assessment included the two dams identified as habitat in the LES and considered the following:

1. size of the dams;
2. availability of floating vegetation, particularly water-lilies; and
3. distance to other areas of potential habitat.

Dam 1 and Dam 2 identified in the LES as habitat for the Comb-crested jacana cover an area of approximately 0.12ha (1,225m²) and 0.04ha (378m²) respectively.

The dams have little to no suitable floating vegetation as depicted in **PLATES 1 & 2**. Whilst Dam 1 has a small fringe of water-lilies (**PLATE 3**) it is considered unlikely that this small area of floating vegetation would provide suitable forage or breeding habitat for the Comb-crested jacana. Similarly, the Duckweed (*Azolla* spp.) covering the entire surface of Dam 2 does not represent suitable habitat for the Comb-crested jacana.



PLATE 1: Dam 1 viewed from north.



PLATE 2: Dam 2 viewed from north.



PLATE 3: Thin fringe of Water-lilies on Dam 1

The nearest record of the Comb-crested jacana to the subject site occurs approximately 2km to the north of the subject site (**FIGURE 18**).

Based on the above details, it is considered highly unlikely that the dams on the subject site provide suitable habitat for the Comb-crested jacana. The habitat mapping in the LES is considered to be incorrect.

The proposed development is not considered likely to significantly impacts this species, or its habitat, and no mitigation measures are considered necessary.

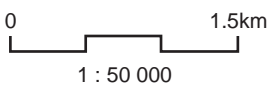
4.2.4 SEPP 14 buffer

Issue

SEPP 14 buffer currently includes the proposed Broadwater Parkway road reserve and embankment, stormwater treatment ponds, and a transmission line easement and lies at the bottom of a steep slope. Alternative road designs have been put forward by Council that avoid environmentally sensitive areas and environmental protection zones. For a greenfield site, there is no justifiable reason for not considering alternative road locations outside these sensitive areas. The Department would prefer to see land reserved for Broadwater Parkway removed from these areas.



LEGEND
 ● Comb-crested jacana records
 □ Subject Site



SOURCE: NSW Office of Environment & Heritage
 - Atlas of NSW Wildlife: Near Map Jan 2011 Aerial
 SCALE: 1 : 50 000 @ A3
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 Environmental Consultants

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FIGURE 18
 PREPARED: BW
 DATE: 13 April 2012
 FILE: N09031_Jacana.cdr

TITLE
**COMB-CRESTED
 JACANA
 RECORDS**

JWA Response

The location and design of the Broadwater Parkway has been amended after significant assessment of alternative routes (including ecological assessment of the site and surrounding lands) and detailed consultation with Tweed Shire Council.

The alignment now avoids environmentally sensitive areas (FIGURE 10) and, for the most part, the environmental protection zone (FIGURE 11).

4.2.5 VMP

Issue

The Statement of Commitments (SoC) must clearly state how long the proponent is intending to undertake the actions specified in the VMP, and completion criteria for when it is proposed to be handed over to Council. Funding for these works is the sole responsibility of the proponent. It is not satisfactory to leave VMP actions to Council to fund out of general rates (until the land is dedicated). These works (and all ongoing works outlined in any management plans) should be included in the CIV estimate. Ensure the landscape plan is consistent with VMP in terms of species planted, objectives, area covered and bushfire requirements etc.

JWA Response

The Statement of Commitments, sources of funding, and CIV estimates are outside the scope of this response document.

The Amended Landscape Master Plan (Form Landscape Architects 2013) has been reviewed to ensure consistency with the Revised VMRP (JWA 2013).

4.2.6 Watercourses/waterbodies & groundwater dependant ecosystems

Issue

Provide an assessment of the ecological values of the watercourses/waterbodies and groundwater dependent ecosystems likely to be impacted by the proposed development. Significant environmental impacts are likely to be realised in these areas with excess filling, removal of existing dams and associated ponds, and downstream impacts on Freshwater Wetland EEC areas and the SEPP 14 wetland.

JWA Response

Riparian areas on the subject site can be categorised as follows:

- SEPP 14 Wetland No. 23 adjacent to the northern portion of the subject site;
- Degraded Freshwater wetland in the northern portion of the site;
- Constructed drainage lines; and
- Constructed farm dams.

SEPP Wetland number 23

The Ecological values of SEPP 14 Wetland No. 23 can be summarised as follows:

- Generally comprised of four (4) vegetation types:
 - Tall grassland (*Phragmites australis*)
 - Tall open swamp sclerophyll forest (*Casuarina glauca*)
 - Tall open swamp sclerophyll forest (*Melaleuca quinquenervia/Archontophoenix cunninghamiana*)
 - Low to mid-high open mangrove forest (*Avicennia marina* var. *australasica/Aegiceras corniculatum*)
- Contains vegetation representative of three (3) Endangered Ecological Communities:
 - Swamp sclerophyll forest on coastal floodplain
 - Swamp oak floodplain forest
 - Freshwater wetland on coastal floodplain
- Weed density and diversity in the wetland is generally low, with some small areas of moderate and high density around the edges.
- No Threatened flora species have been recorded from the wetland.
- The wetland is considered likely to provide suitable habitat for a number of Threatened fauna species.

The SEPP 14 Wetland adjacent to the subject site will be protected as a result of the substantial vegetated buffer (i.e. 100m wide) to be established in accordance with the Revised VMRP (JWA 2013).

The proposed stormwater detention bund and the Stormwater Management Plan (Gilbert & Sutherland 2013) will ensure that only water treated to a suitable level will enter the SEPP 14 Wetland.

Freshwater Wetlands

The Ecological values of the degraded Freshwater wetland on the subject site are discussed in **APPENDIX 3**.

The degraded Freshwater wetland will be retained within a proposed Conservation Area (**FIGURE 10**). A small area (0.11ha) will be removed for the construction of a stormwater detention bund (**FIGURE 8**), however this will be offset by the regeneration of approximately 0.66ha of Freshwater wetland to the south of the existing wetland. This Freshwater wetland will be protected and restored through the implementation of the Revised VMRP (JWA 2013).

Constructed Drainage Lines

Drainage lines on the Subject site have been constructed to convey water away from areas previously utilised for crops. Very little native vegetation is associated with these drainage lines with the exception of some clumps of regrowth and scattered mature trees in the southern portion of the subject site.

Constructed farm dams

The farm dams were constructed in the 1950's and served to provide water for irrigating the crops being grown on the site.

The constructed farm dams will be filled and designed to fulfil roles as parkland and drainage reserve. The Stormwater Management System has been designed by Gilbert and Sutherland (G&S 2013).

Section 4.2.3 contains Plates 1, 2, and 3 which provide a pictorial description of the farm dams.

An assessment of the Farm Dams has been completed in compliance with the Aquatic Ecology in Environmental Impact Assessment (2003) Guidelines. This assessment is contained in **APPENDIX 7**.

It should be noted that the small size of the dams, their isolation from surrounding native habitats and their lack of emergent vegetation indicates that these dams have a low value for native fauna.

4.2.7 Wetland Restoration

Issue

The proposal does not have sufficient regard to wetland restoration and providing better hydraulic connections between the site and the SEPP 14 wetland and saltmarsh breeding areas. Refer to Council's submission for further information in this regard. This was a key feature of the LES for Area E and has been specifically allowed for by Clause 53D of the Tweed LEP.

JWA Response

The majority (88.3%) of Freshwater wetland on the subject site will be retained and fully restored in accordance with the Revised VMRP (2013). This will include the regeneration of 0.66ha of Freshwater wetland vegetation to the south of the existing wetland.

Existing hydraulic connections between the subject site and the adjacent SEPP 14 Wetland have been considered in the redesign of the site stormwater treatment facilities and the subsequent amendments to the Stormwater Management Plan (Gilbert & Sutherland 2013), specifically all stormwater management facilities, apart from a stormwater detention bund, have been removed from the Freshwater wetland area and associated buffer.

4.2.8 Public access

Issue

Please identify designated access points to the Crown Reserve 1012191 and outline any proposed access structures to ensure public access to the foreshore is appropriately controlled (pp. 3 of the Ecological Assessment).

JWA Response

It is no longer proposed to provide designated access points to the Crown Reserve adjacent to the subject site. A 100m vegetated buffer is proposed to the SEPP 14 Wetland adjacent to the northern boundary of the site (i.e. between the site and the Crown Reserve). This densely vegetated area will be fenced to prevent unauthorized access and will in turn restrict access to the SEPP 14 wetland and the Crown Reserve.

4.3 Office of Environment & Heritage (formerly DECCW)

4.3.1 SEPP 14 Wetland

Issue

It is standard mitigation practice for developments that potentially impact on identified biodiversity values of an area to include a vegetated buffer. DECCW has previously recommended a vegetated buffer of 50 metres in such circumstances. For this particular proposal, the primary role of the vegetated buffer would be to adequately protect the SEPP14 Wetland, Freshwater Wetland and Floodplain Rainforest EEC from modification and stormwater runoff. It is noted that a 100 metre buffer is proposed, however, it is clear that this buffer incorporates WSUD strategies, the Broadwater Parkway road easement and a transmission line easement. For this reason DECCW maintains its recommendation for a 50 metre vegetated buffer free of all infrastructure. The proponent should be required to demonstrate that the proposed width of the buffer is adequate for this purpose.

JWA Response

All infrastructure (WSUD) has now been removed from the proposed 100m SEPP14 buffer, with the exception of a very small section of the Broadwater Parkway and a stormwater detention bund. The location of the Broadwater Parkway has been subject to detailed studies by the project consultants, in consultation with Tweed Shire Council, and there is no suitable alternative to the revised location presented in this PPR.

The 100m buffer will be subject to assisted regeneration measures where appropriate, with the remainder being fully revegetated with 1.57ha of locally endemic Lowland rainforest species and 0.66ha of Freshwater wetland regeneration to offset the unavoidable removal of degraded EEC patches from the development footprint.

Issue

Predation by domestic animals within the SEPP 14 Wetland is likely to occur without mitigation strategies. The inclusion of an appropriate vegetated buffer as an ecological mitigation boundary is the best means available to limit access and protect endemic flora and fauna urban impacts.

JWA Response

As discussed above, the SEPP 14 Wetland will be provided with a 100m fully vegetated buffer in accordance with the Revised VMRP (JWA 2013).

Issue

Stormwater runoff and associated urban pollutants have the potential to impact on the quality and quantity of water within the SEPP 14 Wetland.

JWA Response

A detailed Stormwater Management Plan has been prepared for the subject site (Gilbert & Sutherland 2013) to ensure that stormwater runoff and urban pollutants do not impact on the adjacent SEPP 14 Wetland.

4.3.2 Threatened species

Issue

DECCW records and research indicate a number of threatened species inhabit the surrounding area, specifically Comb-crested Jacana, Mitchell Rainforest Snail, Swamp fox glove, Acacia bakeri, Osprey, Koala, Black-necked Stork, Grey Headed Flying Fox and potentially the Grass Owl. These species could be indirectly affected by the proposal.

These impacts largely pertain to remnant vegetation clearing, wandering domestic pets and stormwater discharges to the adjoining SEPP 14 Wetland. Retaining remnant vegetation and placing a covenant on the estate in regards to cats is the best practice to protect endemic native species and associated habitat.

JWA Response

There will be no direct impact on any of the listed species. The removal of small, isolated patches of vegetation from within disused agricultural land is not considered to significantly impact any of the above species. Regardless, an Assessment of Significance (7-part test) has been completed from the above listed species (APPENDIX 1).

A detailed Stormwater Management Plan has been prepared for the subject site (Gilbert & Sutherland 2013) to ensure that stormwater runoff and urban pollutants do not impact on the adjacent SEPP 14 Wetland.

It is considered that the requirements and enforcement measures of the NSW *Companion Animals Act (1998)* are sufficient to allow for the control of cats.

4.3.3 Endangered Ecological Communities

Issue

It is standard mitigation practice for developments that potentially impact on identified biodiversity values of an area to include a vegetated buffer. DECCW has previously recommended a vegetated buffer of 50 metres in such circumstances. For this particular proposal the primary role of the vegetated buffer would be to adequately protect the Freshwater Wetland and Lowland Rainforest EEC from modification and stormwater runoff. For this reason DECCW maintains its recommendation for a 50 metre vegetated buffer free of all infrastructure. The proponent should be required to demonstrate that the proposed width of the buffer is adequate for this purpose.

JWA Response

The location of the Broadwater Parkway has been subject to detailed studies by the project consultants, in consultation with Tweed Shire Council, and there is no suitable alternative to the revised location presented in this PPR. For this reason, a 50m buffer to the existing Freshwater wetland is not feasible. The degraded Freshwater wetland will be retained within a proposed Conservation Area and will be protected and restored through 0.66ha of assisted regeneration and the implementation of the Revised VMRP (JWA 2013).

Due to a combination of steep topography, compliance with TSC subdivision requirements in terms of landform, retaining wall heights etc., and the requirement to treat all stormwater within the central gully on the site to reduce impact on the adjacent SEPP 14 wetland, the entire development footprint will be subject to some form of earthworks. There will therefore be an unavoidable loss of the small, isolated and degraded patches of the Lowland rainforest EEC (0.36ha in total) and a 50m buffer to these areas is not feasible.

The width of the proposed buffer to the Freshwater wetland EEC is restricted by the final agreed alignment of the Broadwater Parkway. A minimum 12m wide fully vegetated buffer will be established to the Freshwater wetland area. It is considered that the proposed buffer is sufficient to protect the ecological values of the Freshwater wetland. A buffer is required to protect the Freshwater wetland area from the potential adverse impacts from the construction of the Broadwater Parkway i.e.:

- Polluted stormwater run-off;
- Weed incursion;
- Erosion and/or sedimentation during construction; and
- Changes to hydrology of the wetland.

A wide buffer zone would be required if no construction or operational measures were implemented to mitigate these potential impacts. The following measures will be implemented to protect the values of the Freshwater wetland:

- Stormwater control in accordance with the Stormwater Management Plan (Gilbert & Sutherland 2013) will ensure no untreated stormwater enters the Freshwater wetland EEC;
- Approximately 0.66ha of assisted Freshwater wetland regeneration will be implemented adjacent to the existing Freshwater wetland EEC;
- Weed control will occur throughout the Freshwater wetland and surrounding areas in accordance with the Revised VMRP (JWA 2013);
- Erosion and/or sedimentation will be controlled during the construction of the road in accordance with an approved Sediment & Erosion Control Plan.
- The Stormwater management on the site has been designed to ensure no changes to the hydrology of the Freshwater wetland area on the site.

The above ameliorative measures will ensure that the proposed buffer is sufficient.

Issue

DECCW's preference is to maximise the protection of identified EECs regardless of condition. It is noted that the proposal intends to remove 59.51% of the Lowland

Rainforest and 44.91% of the Freshwater Wetland occurring on the site. DECCW does not support this approach given the biodiversity value of these ecosystems and that these areas can be avoided with allotment redesign. In the event that the removal of any EEC is permitted, DECC recommends that an appropriate offset (for example of 1:10 ratio) be required either within the site or in close proximity to the site.

JWA Response

There will be an unavoidable loss of the small, isolated and degraded patches of the Lowland rainforest EEC (0.36ha in total) and 0.11ha of Freshwater wetland EEC for the construction of a stormwater detention bund (FIGURE 8).

Offsets will be provided for the removal of 0.36ha of degraded Lowland rainforest EEC through the planting of 1.57ha within an identified Conservation area (i.e. a replacement ratio of 4.4:1). Offsets for the removal of 0.11ha of Freshwater wetland EEC will be provided through the assisted regeneration of 0.66ha of Freshwater wetland (i.e a replacement ratio of 6:1).

Issue

DECCW does not support the inclusion of WSUD measures within the mapped area of the Freshwater EEC given its status and value. It is also inconsistent with DECCW stormwater guidelines. An allotment modification around the central drainage line would alleviate the impact on the Freshwater and Lowland Rainforest EECs, allow for better drainage, provide more recreational access and avoid rubbish dumping over fences.

JWA Response

All infrastructure has now been removed from the area of Freshwater wetland EEC.

Due to a combination of steep topography, compliance with TSC subdivision requirements in terms of landform, retaining wall heights etc., and the requirement to treat all stormwater within the central gully on the site to reduce impact on the adjacent SEPP 14 wetland, the entire development footprint will be subject to some form of earthworks. An allotment modification around the central drainage line has been investigated and is not feasible.

4.3.4 Regional Corridor for native fauna

Issue

It is understood that the proposed Broadwater Parkway is to be created solely for the purpose of providing access to the development. However, DECCW believes the impacts for nature conservation within the development site and more widely in the region with the extension of this road are potentially significant. DECCW recommends that other options for access should be explored to avoid the impact on the identified Regional Corridor.

JWA Response

Numerous other options for site access have been examined. The location of the Broadwater Parkway has been subject to detailed studies by the project consultants, in consultation with Tweed Shire Council. Due to a combination of steep topography,

compliance with TSC subdivision requirements in terms of landform, retaining wall heights etc., and the requirement to treat all stormwater within the central gully on the site to reduce impact on the adjacent SEPP 14 wetland, there is no suitable alternative to the revised location presented in this PPR.

4.4 Tweed Shire Council

4.4.1 Impacts on Environmental Protection Zone

Issue

The alignment traverses the Environmental Protection Zone for approximately 1,108 metres.

JWA Response

The alignment proposed as part of the Part 3A application resulted from discussions with TSC and DECCW officers. It was agreed that the proposed 100m buffer to adjacent SEPP 14 wetlands (i.e. 7(a) zoned land) could be made up of a 50m vegetated zone and 50m of other non-vegetated land, which could include infrastructure such as roads.

The results of these discussions were acknowledged in Council's Resolution No. P82 from Council's meeting on 16th November 2005 adopting the Draft Local Environmental Plan, and page 169 of the accompanying report. The report also noted that DECCW expressed support for the Draft LEP in a letter to council on the 29th October 2004.

Regardless of both Council's and DECCW's previous endorsement of the Part 3A alignment, Newland Developers Pty Ltd. have now agreed to modify the proposed route of the Broadwater Parkway through the subject site. Whilst this will ultimately result in a reduced yield on the site, the amended route will prevent the clearing of any identified EEC's on the site.

FIGURE 11 shows the proposed development (including the location of the modified Part 3A alignment) overlaid on the Environmental Protection Zone.

4.4.2 Impacts on EEC's

Issue

Within this length, two EEC's are intersected on five occasions. The EEC's identified include Lowland rainforest and Freshwater wetland. Figure 2 shows the Section 2 alignment over these EEC's, the mapping for which was prepared by James Warren & Associates, and previously submitted to Council by Metricon.

JWA Response

The figure provided by TSC shows the Broadwater Parkway alignment overlaid on JWA vegetation mapping which accompanied a Wetland Restoration Plan prepared for Area E in 2008. The focus of the vegetation surveys in 2008 was the Freshwater wetland area, with cursory vegetation inspections completed in surrounding areas.

Subsequent to the preliminary site vegetation surveys completed in 2008, more detailed site assessment was completed in 2010, resulting in revised vegetation and

EEC mapping for the subject site. Further detailed site investigations were then completed (May 2011) in accordance with the BioBanking Assessment Methodology (BAM) (DECCW 2008) and the results of the assessment are provided in **APPENDIX 8**. This assessment confirmed the amended 2010 vegetation and EEC mapping within the Part 3A alignment, and further revised EEC mapping in other areas of the site.

Regardless of perceived impacts on EEC's, Newland Developers Pty Ltd. have now agreed to modify the proposed route of the Broadwater Parkway through the subject site. Whilst this will ultimately result in a reduced yield on the site, the amended route will prevent the clearing of any identified EEC's on the site.

FIGURE 10 shows the proposed development (including the location of the modified Part 3A alignment) overlaid on the confirmed locations of EEC's.

4.4.3 Comb-crested jacana

Issue

Within the area subject to the current proposal, Figure 3.4 of the LES has identified an area of Comb-crested jacana habitat (listed as Vulnerable under the TSC Act) that should be protected and buffered from development where possible.

JWA Response

A detailed response to this issue is provided in **Section 4.2.3**.

Based on habitat assessments completed on the site it is considered highly unlikely that the dams on the subject site provide suitable habitat for the Comb-crested jacana. The habitat mapping in the LES is considered to be incorrect.

The proposed development is not considered likely to significantly impacts this species, or its habitat, and no mitigation measures are considered necessary.

4.4.4 Rough-shelled bush nut

Issue

Five individuals of this species were recorded on the subject site (refer Figure 11 of JWA Ecological Assessment November 2010). One of these occurs within a proposed residential allotment with translocation of this individual proposed. Whilst the LES did not pick up occurrences of Rough-shelled bush nut that occur on the development site, it is noted that occurrences of this species elsewhere within Area E were significant and states that buffering and habitat rehabilitation should be undertaken to protect occurrences of this species on site.

JWA Response

The figure referred to within the JWA Ecological Assessment (2010) in fact only mapped three (3) occurrences of this species on the subject site, with a further two (2) occurrences mapped within a road reserve to Market Parade adjacent to the south-western boundary of the site.

During a further site assessment (May 2011) searches were completed to verify the locations of previously mapped Rough-shelled bush nut. An additional ten (10) mature *Macadamia* sp. were identified within the road reserve to Market Parade (i.e. adjacent to the subject site) and fourteen (14) mature *Macadamia* sp. were identified in a strip of vegetation along the western site boundary. These trees were overlooked in the original vegetation surveys due to the substantial level of weed infestation in these patches of vegetation. Not surprisingly the LES did not pick up any occurrences of *Macadamia* on the subject site, likely due to the degraded nature of vegetation on the site combined with the difficult terrain.

The assessment revealed that all *Macadamia* sp. in these road reserves are in fact orchard specimens and are evenly spaced at 2.5 - 3m intervals in a single row. This suggests that these trees have been planted and are perhaps remnants of a past *Macadamia* plantation.

The single Rough-shelled bush nut mapped as occurring within the north-eastern portion of the subject site occurs in a highly degraded small vegetation patch and is proposed to be translocated to more suitable habitat in accordance with the Revised VMRP (JWA 2013).

A revised map of Threatened plant species currently occurring on the subject site is provided in **FIGURE 9**. The Revised Vegetation Management & Rehabilitation Plan (JWA 2013) prepared for the site has been amended to reflect the revised Threatened species mapping.

4.4.5 Lowland Rainforest EEC

Issue

Two EEC's were recorded by JWA on the proposal site being Freshwater Wetlands and Lowland Rainforest. This is relatively consistent with EEC mapping also provided by JWA (March 2008) in the proposed Wetland Restoration Plan Area E Terranora (submitted to Council with the Draft DCP for Area E). However, an additional area of Lowland Rainforest EEC was identified on the proposal site by JWA in 2008, located at the eastern extent of an area of Eucalypt forest (refer Figure 7). Further investigation and clarification is sought in this regard.

JWA Response

Subsequent to the JWA March 2008 site assessment, a more detailed vegetation assessment was completed at the subject site (JWA 2010). The detailed vegetation assessment suggested that whilst some rainforest species were present in the vegetation patch in question, the canopy was in fact comprised entirely of *Eucalypt* species (**PLATE 4**), and therefore did not represent the EEC Lowland rainforest, and hence the vegetation mapping was revised.

Further detailed site investigations were then completed (May 2011) in accordance with the BioBanking Assessment Methodology (BAM) (DECCW 2008) and the results of the assessment are provided in **APPENDIX 8**. This assessment confirmed the amended 2010 vegetation and EEC mapping in this area, and further amended the EEC mapping in other areas of the site.



PLATE 4: Vegetation dominated by *Eucalypt* species.

Issue

The proposal notes a large portion of the Lowland Rainforest EEC will be cleared for residential allotments, internal roads and also the central stormwater drain.

JWA Response

The Ecological Assessment (JWA 2010) concluded that **0.42ha (60%)** of highly degraded Lowland rainforest EEC would be removed from the subject site.

Further detailed site investigations were then completed (May 2011) in accordance with the BioBanking Assessment Methodology (BAM) (DECCW 2008) and the results of the assessment are provided in **APPENDIX 8**. The results of the assessment have resulted in revisions to EEC mapping on the subject site. The more detailed field investigations have revealed that some areas previously mapped as Lowland rainforest EEC fall well below relevant benchmarks and in some instances contained very few native species at all. It is also worth noting that the LES did not identify any areas of Lowland rainforest EEC on the subject site.

The proposed development layout has now been revised as a result of the DoP Test of Adequacy, State agency submissions and detailed negotiations with Tweed Shire Council. Revised EEC mapping for the subject site overlaid on the revised development layout is provided in **FIGURE 10**.

The revised layout will result in the removal of **0.36ha (100%)** of the Lowland rainforest EEC on the subject site. Offsets will be provided in the Conservation Area on the site. 1.57ha is proposed to be revegetated (i.e. Replacement ratio of 4.4:1).

The Revised Vegetation Management & Rehabilitation Plan (JWA 2013) prepared for the site has been amended to reflect the revised EEC mapping as well as the revised development layout.

Issue

Whilst it is noted in the Ecological Assessment that occurrences of this EEC are regrowth and disturbed, and it is also acknowledged that this area is quite fragmented, the species list of this community indicates high diversity including less common plant species and species that typically occur in more intact stands of rainforest.

JWA Response

No species list was provided specifically for the Lowland rainforest EEC on the subject site in the Ecological Assessment (JWA 2010). Commonly occurring species in this community were included in the "Community descriptions" section of the Ecological Assessment (**APPENDIX 1**, Section 1.3.3) and none of these are considered to represent "*less common plant species and species that typically occur in more intact stands of rainforest*".

It is likely that TSC are referring to the plant species prepared for the entire site (i.e. **APPENDIX 3**) however it is worth noting that the study area included adjacent vegetated lands, particularly Lot 2 DP709021 adjacent to the southern boundary, which included intact rainforest vegetation.

Species lists for the EEC patches are contained within the BAM Assessment (**APPENDIX 8**). The assessments have revealed that these vegetation patches do not have a high diversity of species.

Issue

The species list also notes the occurrence of five Rare or Threatened Australian Plants (as per Briggs & Leigh 1996) including the Silver leaf (*Argophyllum nullemense*), Black walnut (*Endiandra globosa*), Veiny lace flower (*Archidendron muellerianum*), Ardisia (*Ardisia bakeri*) and Long-leaved tuckeroo (*Cupaniopsis newmanii*). No assessment has been undertaken on whether the development will impact on these ROTAP's.

JWA Response

Only one (1) of the ROTAP species occurs on the subject site - Veiny lace flower (*Archidendron muellerianum*) - with the remainder recorded in vegetation adjacent to the subject site. The location of the Veiny lace flower has been included in FIGURE 9. It is proposed to retain the two (2) stems of this species in-situ on the subject site within a proposed Conservation Area (FIGURE 10).

It should be noted that there is no legislative requirement to assess development impacts on ROTAP species.

4.4.6 Freshwater Wetland EEC

Issue

The proposal notes that a portion of the Freshwater Wetlands on Coastal Floodplains will be removed in order to create stormwater detention/treatment basins and a stormwater drain (refer to Figure 2).

JWA Response

The proposed development layout has been revised to avoid all areas of Freshwater Wetland EEC on the subject site (FIGURE 10). This EEC will be protected within a Conservation Zone and significant revegetation works will be completed to provide a buffer to this area.

A biometric analysis of the freshwater wetland has been completed in accordance with the Biobanking Assessment Methodology (BAM). This assessment is contained in APPENDIX 9. The assessment indicates that the wetland has a value of 58/100. An area of 0.66 hectares surrounding the wetland is proposed for the regeneration of freshwater wetland. The area is currently comprised of freshwater wetland species and a small range of grazing grasses. The conversion of this area to a high quality freshwater wetland community is described in detail in the Vegetation Management & Rehabilitation Plan.

4.5 NSW Industry & Investment (Fisheries)

4.5.1 Buffer to SEPP 14 Coastal wetland

Issue

To achieve protection of the subject SEPP 14 Coastal Wetland and associated key fish habitats, the DPI "Policy and Guidelines for Aquatic Habitat Management and Fish Conservation, 1999" requires buffers to ecologically sensitive areas be 50 metres wide, be rehabilitated with native endemic vegetation and be appropriately managed in the

long term to maintain their functionality and habitat values. In this instance, DPI requests that the Department of Planning and Infrastructure and the proponent consider improving the protection of the 50 metre habitat buffer zone and relocate infrastructure outside this area to ensure that the SEPP 14 Coastal Wetland is adequately protected in the long-term from off-site impacts and edge effects of the development.

JWA Response

The proposed development layout has been revised to remove all infrastructure from the SEPP 14 buffer area (FIGURE 10). A more detailed response is provided in SECTION 4.3.1.

4.6 Public submissions

4.6.1 Mike Allen - 10 Bione Avenue, Banora Point NSW 2486

Issue

In summary it is my view that a location for Broadwater Parkway based solely on the avoidance of EIS preparation cannot be supported. A number of routes should be examined, including one as mandated in Tweed LEP 2000, and a full and transparent EIS prepared. A final layout should be based on public amenity issues, traffic safety, environmental issues and cost. Routes through and adjacent the wetland have been examined!!

JWA response

The location of the Broadwater Parkway has been subject to detailed studies by the project consultants, in consultation with Tweed Shire Council. Due to a combination of steep topography, compliance with TSC subdivision requirements in terms of landform, retaining wall heights etc., and the requirement to treat all stormwater within the central gully on the site to reduce impact on the adjacent SEPP 14 wetland, there is no suitable alternative to the revised location presented in this PPR.

4.6.2 Helen Wilson - 1-5 Market Parade, Terranora NSW 2486

Issue

The ecological predictive assessment seriously understates the fauna diversity on the site. Over 100 species of birds have been recorded by neighboring residents as using both the subject site and adjoining reserves. Only 38 species were recorded through the time-limited assessment by the proponent's consultant. Indeed the predictive assessment indicated that the Comb-crested Jacana, Magpie Goose and the Wompoo fruit dove are unlikely to occur in the study area. On the contrary all these species have been observed on numerous occasions as using water bodies (farm dams) and pockets of existing vegetation remaining on the site. A population of Comb-crested Jacana have been recorded inhabiting artificial waterways opposite the South Tweed Rugby League Club on Fraser Drive. It's highly probable the Jacanas use the network of farm dams on the subject site as part of their local migratory corridor. The report does not record the wallaby population on the site, which are regular visitors to adjoining

properties. Much photographic material records their presence. The removal of grassland corridors by restricting the width of the drainage swale and planting it out to subtropical species, combined with impact of feral cats and dogs will in all probability quickly decimate the remnant population of the larger marsupials on this site, as it has done in. No provision has been made for their accommodation in terms of vegetation or connecting grassland corridors. A family of wedge tailed eagles have used this property for generations as part of their range. A reduction of open grasslands will incrementally diminish their habitat.

JWA response

The removal of small, isolated and heavily degraded patches of vegetation from a disused agricultural parcel of land is considered highly unlikely to significantly impact on native fauna species, including Threatened species. Rehabilitation works proposed as part of the development (in accordance with the Revised VMRP 2013) will result in a significant increase in endemic native habitat on the subject site, and will also significantly improve the corridor values of the central drainage line.

A detailed assessment of potential habitat for the Comb-crested jacana has revealed that no suitable habitat occurs on the site.

Magpie geese generally inhabit deep freshwater wetland and lagoons with foraging habitat nearby. Farm dams on the site are highly unlikely to provide suitable habitat for this species.

Wompoo fruit-doves generally inhabit large, intact patches of Subtropical rainforest and/or Wet sclerophyll forest with ample supply of mature fruiting rainforest trees. Scattered patches of degraded rainforest on the subject site are highly unlikely to represent suitable habitat for this species. The patch of Tall moist sclerophyll forest in the northern low-lying portion of the site is considered to represent marginal forage habitat at best, and may occasionally be utilised by this species as it moves through the locality. This area will be retained, rehabilitated and buffered from the development.

The disused agricultural land on the site, and neighboring backyards, do not represent good quality habitat for wallabies. Whilst some areas of forage habitat may be removed from the subject site, this is not natural forage habitat, it is retired farmland and extensively weed infested. The removal of this habitat is not considered likely to result in the local extinction of macropod species.

Wedge-tailed eagles occupy a home-range of up to 100km². The subject site would form a very small portion of a home range. The subject site is not a natural open grassland area, and therefore does not provide quality forage habitat. The proposed development is considered highly unlikely to significantly impact on the local population.

5 COMPLIANCE WITH AREA E DCP

5.1 Background

On the 13th December 2011 Tweed Shire Council resolved to amend the Tweed Shire Development Control Plan (Tweed DCP) to include a new section: Section B24 - Area E Urban Release Development Code. Section B24 of the Tweed DCP identifies design principles for high quality urban and sustainable development of the site as well as the need to provide critical infrastructure within Area E, including:

- internal roads such as Broadwater Parkway;
- structured and casual open space; and
- land for stormwater drainage.

The Plan will not formally take effect until an appropriate framework has been approved by Council, and which is anticipated to take upward of 10 months. Accordingly, the Code has been set to formerly take effect under the Environmental Planning and Assessment Act 1979 on the 1st October 2012.

Should a contributions framework be/not be endorsed by this date Council may resolve to bring forward / delay the Code's taking effect.

Section B24 applies to the Area E Urban Release Area as shown in Figure 1.1 of the Code document. The purpose of the Code is to establish a detailed planning framework for Area E and to provide the community with the appropriate planning tools for managing the area's growth and development over the next 25-30 years.

5.2 Design Principle 1 - Environment

5.2.1 Introduction

Part 2 (Subdivision), Section 2.3 (Design Principle 1 - Environment) of the Area E Urban Release Area Development Code contains the following list of objectives:

- The environmental lands, natural watercourses and other natural systems are protected and retained;
- To preserve and protect land of high ecological significance from urban development;
- To encourage the enhancement of land with high environmental qualities;
- To provide for the rehabilitation and enhancement of degraded habitat and ensure that comprehensive rehabilitation plans form part of any future development applications or master plans;
- To provide for the protection and improvement of existing hydrological conditions in Terranora Broadwater;
- To provide a natural growth boundary to residential development and visual relief for the proposed urban environment;
- To integrate localised 'green belts' into the urban footprint;

- To create additional wildlife corridors; and
- To embody urban development within a park-like setting.

The following section addresses compliance with the development control section of Design Principle 1 - Environment.

5.2.2 Development control

To achieve the stated objectives above, the following information is to be submitted with any Development Application for subdivision:

- *Flora and Fauna assessments will be required to identify the presence of land of high environmental quality, suitable buffering and ongoing management.*
- *A Wetland Restoration Plan and Habitat Restoration Plan must be prepared to Council's satisfaction for all land zoned for Environmental Protection.*

This Ecological Assessment report identifies all ecologically significant areas of the site. Proposed ecological buffers are also identified and a Revised Vegetation Management & Rehabilitation Plan (VMRP) has been prepared (JWA 2013) which details ongoing management procedures.

The Revised VMRP (JWA 2013) has been prepared for the land zoned for Environmental Protection.

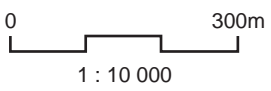
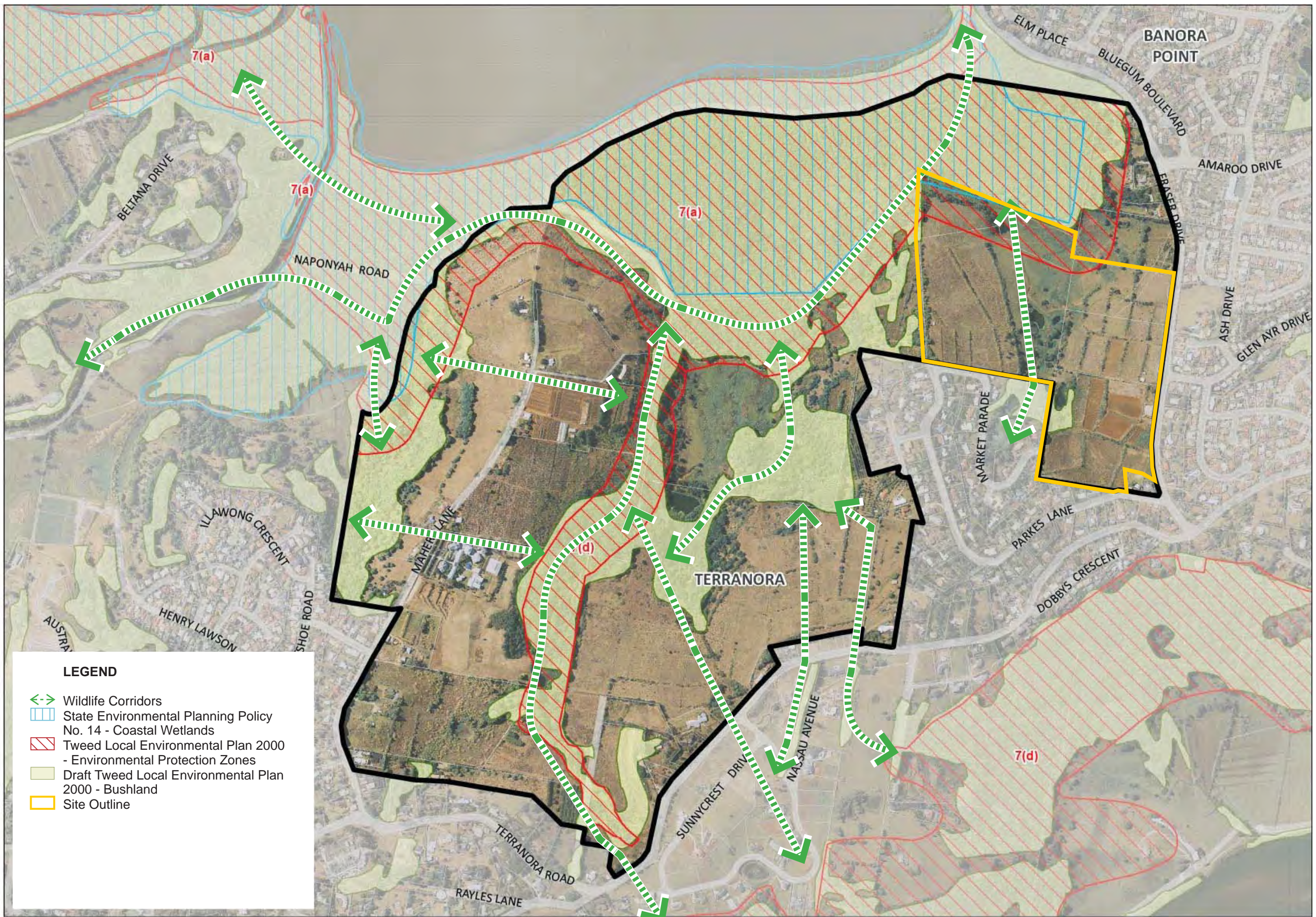
The following requirements are also listed (a response is provided for each point):

- 1. *Demonstrate that the environmental protection areas are retained and protected, that existing wildlife corridors and vegetative links have been maintained, and links identified within Figure 2.3 established. These links could be continuous tracts of vegetation, or where they traverse urban areas, a strong linking canopy of native street trees;***

FIGURE 11 shows the proposed development (including the location of the modified Broadwater Parkway alignment) overlaid on the Environmental Protection Zone.

The Tweed Regional Corridor passes across the north-west corner of the subject site. This Regional Corridor links Stott's Island Nature Reserve to Ukerabagh Island. The Terranora Sub-regional Corridor occurs off site and to the south (**FIGURE 15**). A 100m wide strip along the northern of the subject site, buffering the SEPP 14 Wetland, will be retained and revegetated to ensure no impacts occur on the effectiveness of the Terranora Sub-regional Corridor.

A major drainage line, running from south to north, will be constructed through the middle of the subject site (G&S 2013). This area has been identified as a wildlife corridor within Section B24 of the Tweed DCP (**FIGURE 19**). The riparian areas of the drainage line will be revegetated (Form Landscape Architects 2013, JWA 2013), aquatic habitat provided in treatment wetlands, and a faunal underpass constructed to facilitate fauna movement under the Broadwater



SOURCE: Area E Urban Release Development Code - Figure 2.3 Environmental Attributes
 SCALE: 1 : 10 000 @ A3
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FIGURE 19
 PREPARED: BW
 DATE: 13 April 2012
 FILE: N09031_Area E DCP links.cdr

TITLE
AREA E DCP LINKAGES

Parkway. These measures will effectively create a link between the Tweed Regional Corridor to the north and the Terranora Sub-regional Corridor to the south.

2. Demonstrate suitable buffering and ongoing management of land possessing high environmental quality;

The significant ecological values on and adjacent to the subject site, and the buffers proposed are as follows:

SEPP 14 Wetland

SEPP 14 Wetland no. 23 occurs adjacent to the northern boundary of the subject site. A 100m vegetated buffer will be provided to this wetland.

Freshwater wetland EEC

A small area of this EEC occurs in the northern portion of the subject site. This EEC will be buffered by a minimum 12m vegetated buffer through 0.66ha of assisted Freshwater wetland regeneration. The final location of the Broadwater Parkway has been subject to numerous and detailed studies, as well as significant negotiations and discussions with Tweed Shire Council.

Lowland rainforest EEC

Due to a combination of steep topography, compliance with TSC subdivision requirements in terms of landform, retaining wall heights etc., and the requirement to treat all stormwater within the central gully on the site to reduce impact on the adjacent SEPP 14 wetland, the entire development footprint will be subject to some form of earthworks.

There will be an unavoidable loss of the small, isolated and degraded patches of the Lowland rainforest EEC (0.36ha in total). However, offsets will be provided for the removal of 0.36ha of degraded Lowland rainforest EEC through the planting of 1.57ha within an identified Conservation area (i.e. a replacement ratio of 4.4:1).

Rough-shelled bush nut

Two (2) stems of the Threatened species Rough-shelled bush nut (*Macadamia tetraphylla*) occur on the subject site. One (1) plant will be retained in-situ within the Conservation area and provided with a minimum 40m vegetated buffer. The second stem occurs within sub-optimal habitat (weed infested) surrounded by agricultural land and within the development footprint. This plant is proposed to be translocated to more suitable habitat within the Conservation Area in accordance with the Revised VMRP (JWA 2013).

3. Demonstrate that an adequate buffer of at least 20m (which may include the road reserve) is retained around the edge of the environmental protection area;

A minimum buffer of 20m (which includes the Broadwater Parkway and associated road reserve) is provided around the environmental protection area in the north of the subject site.

4. *Demonstrate the works identified within the Council approved Wetland Restoration Plan and Habitat Restoration Plan that the development will be responsible for and the intended method of addressing the works required;*

The Revised VMRP (JWA 2013) is yet to be approved by Council.

5. *Demonstrate that any wetland on the land will be restored and managed to the consent authority's satisfaction to restore freshwater wetland values and minimise breeding habitat for saltwater mosquitoes and biting midges.*

The Revised VMRP (JWA 2013) includes measures to restore and manage the values of the freshwater wetland on the subject site.

Management of saltwater mosquitoes and biting midges is dealt with in the Biting Insect Management Plan (HMC Environmental Consulting 2012).

5.3 Conclusion

Section B24 of the Tweed DCP identifies design principles for high quality urban and sustainable development of the site. Part 2 (Subdivision), Section 2.3 (Design Principle 1 - Environment) of the Area E Urban Release Area Development Code contains a list of objectives.

The discussions provided above demonstrate that the proposed development complies with the requirements of Design Principle 1 - Environment of the Area E DCP.

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APPENDIX 1 - THREATENED SPECIES ASSESSMENTS (7 PART TESTS)

1 THREATENED SPECIES ASSESSMENTS

1.1 Background

An Assessment of Significance (7-part test equivalence) has been undertaken for all listed species/EECs recorded on the site, including threatened fauna predicted to occur over time (SECTION 2). Potential impacts on threatened species, populations, or ecological communities, and their habitats were assessed using the *Threatened Species Assessment Guidelines: The Assessment of Significance* (DECC 2007).

The Assessment of Significance should not be considered a "pass or fail" test as such, but a system allowing proponents to undertake a qualitative analysis of the likely impacts and ultimately whether further assessment needs to be undertaken via a Species Impact Statement. All factors must be considered and an overall conclusion must be drawn from all factors in combination.

1.2 Flora

1.2.1 Background

One (1) Threatened flora species was recorded from the subject site - the Rough-shelled bush nut.

In response to a submission from the NSW Office of Environment & Heritage, the following additional species have also been considered:

- Swamp fox glove; and
- Marblewood

1.2.2 Factors for consideration

(a) *In the case of a Threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.*

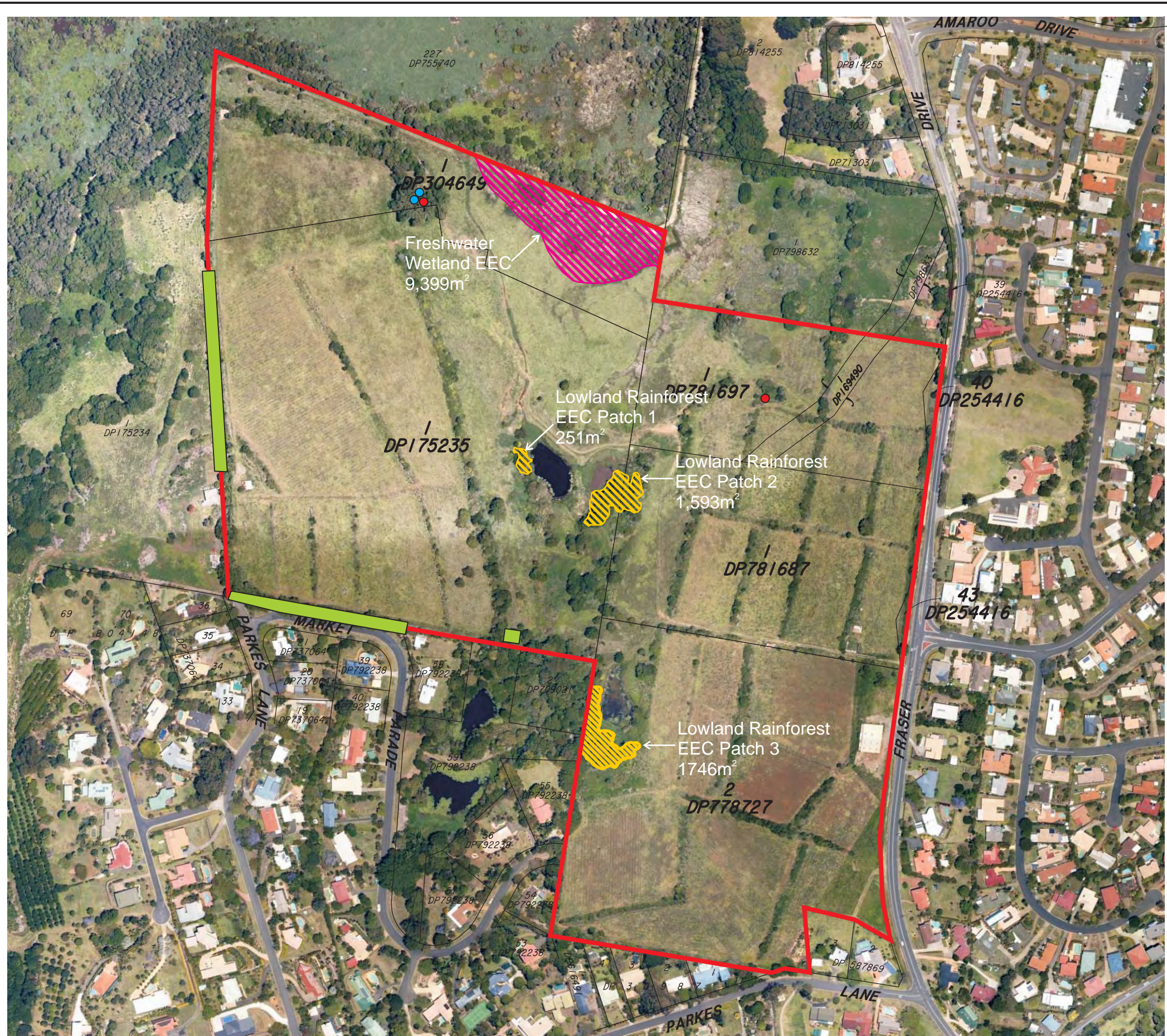
1.2.2.1 Rough-shelled bush nut (*Macadamia tetraphylla*)

Extent of the local population

The NPWS database contains sixty-five (65) records of this species within 10 km of the subject site. 170 records occur within the Tweed LGA and two (2) stems have been recorded on the subject site (FIGURE 1).

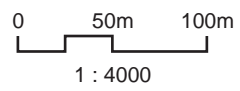
Stages of the life-cycle affected by the proposed development

The Rough-shelled bush nut occurs in Subtropical rainforest, usually near the coast (Floyd 1989) and is confined mainly to the Richmond and Tweed Rivers in north-east NSW, extending over the border into Queensland (NPWS 2002). It is also found in notophyll vine forest (Quinn *et al.* 1995). Neither Floyd (1989), Barry & Thomas (1994) nor Quinn *et al.* (1995) discuss the pollination or dispersal vectors for this species. Bees have been observed on the flowers of this species on a number of



LEGEND

- Lowland Rainforest Endangered Ecological Community (EEC)
- Freshwater Wetland Endangered Ecological Community (EEC)
- Rough-shelled bush nut (*Macadamia tetraphylla*)
- Planted Macadamia (Hybrid Species)
- Veiny lace flower (*Archidendron muellerianum*) (ROTAP)
- Site Outline



SOURCE: JWA Site Investigations;
Near Map Nov 2011 Aerial Photograph;
SCALE: 1 : 4000 @ A3
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APPENDIX 1
FIGURE 1
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DATE: 13 April 2012
FILE: N09031_EECs.cdr

TITLE
**ENDANGERED
ECOLOGICAL
COMMUNITIES &
SIGNIFICANT PLANTS**

occasions and may be responsible for pollination. Rodents are known to take fruits of the similarly sized *M. integrifolia* from plantations. It is likely that rodents are also involved in the dispersal of Rough-shelled bush nut in natural situations. Gravity and water may also play a role in dispersal.

NPWS have identified the following threats to the species:

- Clearing and fragmentation of habitat for coastal development, agriculture and roadwork;
- Low numbers increasing the risk of local extinction;
- Grazing and trampling by domestic stock;
- Fire;
- Invasion of habitat by introduced weeds; and
- Loss of local genetic strains through hybridisation with commercial varieties.

Likelihood of local extinction

The Proposed development will not result in any direct impacts on the single stem in the north-western portion of the subject site (**FIGURE 2**). This plant will be retained in-situ within a proposed Conservation Area. The single stem in the north-eastern portion of the subject site occurs in sub-optimal habitat (weed infested) surrounded by agricultural land. It is proposed to translocate this stem to more suitable habitat within the Conservation Area.

The entire Conservation Area will be rehabilitated including the creation of an additional 1.57ha of potential habitat for this species.

It is highly unlikely that the proposed development will result in the local extinction of this species.

1.2.2.2 Swamp fox glove (*Centranthera cochinchinensis*)

Extent of the local population

The NSW BioNet database contains one (1) record of this species within 10km of the subject site. The record occurs immediately adjacent to the eastern boundary of the subject site and is the only record within the Tweed LGA. It is likely this is an error in the database as in NSW, this species is known from only six (6) locations near Wooli, east of Grafton on the NSW North Coast.

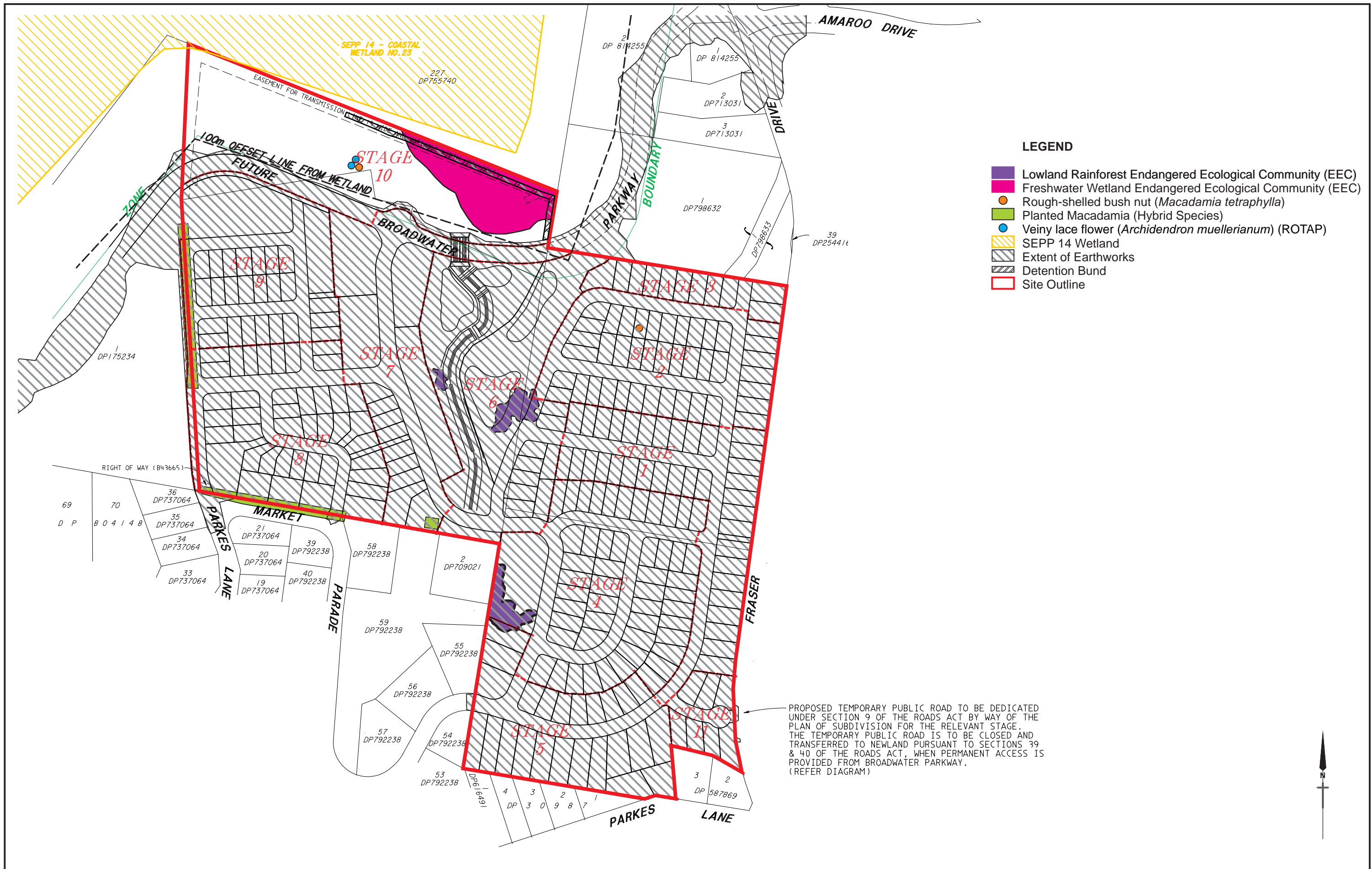
Stages of the life-cycle affected by the proposed development

This species is not known to occur within the Tweed LGA. No stages of the lifecycle of this species will be affected by the proposed development.

Likelihood of local extinction

The Proposed development will not result in any direct impacts on this species.

It is highly unlikely that the proposed development will result in the local extinction of this species.



SOURCE: JWA: B&P Surveys (Ref: 18779B-A.pdf); Bradlees (Ref: x-09-374-base-final.dwg); G&S (Ref: 10849_BundLocation_for_JWA_20130416.pdf)
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**APPENDIX 1
FIGURE 2**
PREPARED: BW
DATE: 17 April 2013
FILE: N09031_Impacts EECs.cdr

TITLE
**IMPACTS ON
EEC, SIGNIFICANT
PLANTS &
SEPP 14 WETLANDS**

1.2.2.3 Marblewood (*Acacia bakeri*)

Extent of the local population

The NSW BioNet database contains twenty-five (25) records of this species within 10 km of the Subject site. There are 127 records within the Tweed LGA. This species has not been recorded from the subject site and the nearest record occurs approximately 750m to the south-west.

Stages of the life-cycle affected by the proposed development

Marblewood has a restricted distribution from coastal south-east Queensland to north-east NSW (Mullumbimby). Suitable habitat consists of subtropical rainforest and adjacent eucalypt forest.

NPWS have identified the following threats to the species:

- Loss of habitat from development and agriculture
- Invasion by weeds, particularly Lantana
- Fire
- Visitor impacts in high-use areas

Likelihood of local extinction

The Proposed development will not result in the removal of any Marblewood from the site. The Proposed development is highly unlikely to result in the local extinction of this species.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) In the case of an endangered ecological community or critically endangered ecological community whether the action proposed:

- (i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or***

Not applicable.

- (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.***

Not applicable.

(d) In relation to the habitat of a threatened species, population or ecological community:

- (i) the extent to which habitat is likely to be removed or modified as a result of the action proposed;*

Ideal habitat for the *Macadamia tetraphylla* and *Acacia bakeri* is considered to be Subtropical Rainforest. There is 0.32ha of degraded Sub-tropical rainforest on the subject site and this vegetation will be lost for the proposed development.

- (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action;*

No areas of habitat are likely to become fragmented or isolated from other areas of habitat as a result of the proposed development.

- (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.*

A small amount of vegetation (~0.32ha) considered to be suitable habitat for the *M. tetraphylla* and *A. bakeri* will be lost for the proposed development. This area is degraded by weeds. A Lowland Rainforest community will be rehabilitated within a designated Conservation Area on the site. This will create 1.57ha of quality habitat and opportunities for this species to regenerate.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

There will be no adverse effects on any of the critical habitats listed under the *Threatened Species Conservation Act (1995)* from the action proposed.

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

No approved recovery plan exists for this species.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

A "threatening process" means a process that threatens, or may have the capability to threaten, the survival or evolutionary development of a species, population or ecological community. A "threatening process" means a process that threatens, or may have the capability to threaten, the survival or evolutionary development of a species, population or ecological community. Key Threatening Processes have been listed in Schedule 3 of the *TSC Act (1995)*.
Key Threatening Processes (Schedule 3):

- Invasion and establishment of exotic vines and scramblers
- Invasion of native plant communities by Bitou bush & boneseed
- Invasion of native plant communities by exotic perennial grasses
- Invasion, establishment and spread of *Lantana camara*
- Competition and grazing by the feral European rabbit
- Competition and habitat degradation by feral goats
- Competition from feral honeybees
- Herbivory and environmental degradation caused by feral deer
- Importation of red imported fire ants into NSW
- Introduction of the large earth bumblebee (*Bombus terrestris*)
- Invasion and establishment of the Cane Toad
- Invasion of the yellow crazy ant (*Anoplolepis gracilipes*)
- Predation by feral cats
- Predation by the European Red Fox
- Predation by the Plague Minnow (*Gambusia holbrooki*)
- Predation by the ship rat (*Rattus rattus*) on Lord Howe Island
- Predation, habitat degradation, competition and disease transmission by Feral Pigs (*Sus scrofa*)
- Alteration to the natural flow regimes of rivers, streams, floodplains & wetlands
- Bushrock Removal
- Clearing of native vegetation
- Alteration of habitat following subsidence due to longwall mining
- Ecological consequences of high frequency fires
- Human-caused Climate Change
- Loss and/or degradation of sites used for hill-topping by butterflies
- Loss of Hollow-bearing Trees
- Removal of dead wood and dead trees
- Infection by Psittacine circoviral (beak & feather) disease affecting endangered psittacine species
- Infection of frogs by amphibian chytrid fungus causing the disease chytridiomycosis
- Infection of native plants by *Phytophthora cinnamomi*
- Death or injury to marine species following capture in shark control programs on ocean beaches
- Entanglement in, or ingestion of anthropogenic debris in marine and estuarine environments

The Proposed development will contribute towards the clearing of native vegetation, a key threatening process listed on Schedule 3 of the *TSC Act (2002)*. The final determination of the NSW Scientific Committee notes that clearing of native vegetation is recognised as a major factor contributing to loss of biological diversity, with impacts such as: destruction of habitat; fragmentation of habitat; riparian zone degradation; increased greenhouse gas emissions; increased habitat for invasive species; loss of leaf litter layer; loss or disruption of ecological function (e.g. loss of populations of pollinators or seed dispersers) and changes to soil biota.

Habitat loss is the main threatening process affecting all Subject species. The Proposed development will make a minor contribution towards the loss of habitat in the region.

1.2.3 Results of Assessment of Significance

On the basis of this assessment, it is considered that the proposed development will not result in any significant impacts on any threatened flora species recorded on the Altitude 1 site.

1.3 Endangered Ecological Communities (EEC's)

1.3.1 Background

Two (2) EECs occur on the subject site (FIGURE 1):

- Lowland Rainforest (DECCW 2008); and
- Freshwater Wetlands (DECCW 2008b);

1.3.2 Factors for consideration

(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.*

Not applicable for EEC's.

(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 for EEC's.

(c) *In the case of an endangered ecological community or critically endangered ecological community whether the action proposed:*

(i) *is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or*

The local occurrence of EEC's includes adjacent contiguous areas which facilitates the dispersal of propagules/pollen/fruits/seeds (i.e. the exchange of genetic material).

Impacts of the proposed development on EEC's are depicted in FIGURE 2. A summary of impacts on EEC's is provided in TABLE 1.

**TABLE 1
LOSS OF ENDANGERED ECOLOGICAL COMMUNITIES FROM THE PROPOSED
DEVELOPMENT**

Vegetation Community	Endangered Ecological Community (EEC)	Total (ha)	Loss (ha)	Loss (%)
<u>Community 1</u> - Mid-high closed forest/regrowth (Mixed rainforest species)	Lowland Rainforest	0.36	0.36	100%
<u>Community 2</u> - Mid-high wet grassland +/- sedgeland/rushland (Mixed species)	Freshwater Wetland	0.94	0.11	11.70%

The risk of extinction of an EEC relates to the likelihood that the local occurrence of EEC will become extinct either in the short term or the long term as a result of direct or indirect impacts.

The removal of a small area of EEC will not represent a significant impact in relation to local occurrence of the above EECs. With the adoption of recommended management practices, the proposed development is highly unlikely to result in the local extinction of any of the EEC's identified on the Subject site.

Furthermore, offsets are proposed for the removal of small, isolated and degraded patches of Lowland rainforest EEC from the development footprint at a rate of 4.4:1 and 6:1 for Freshwater wetland offsets (FIGURE 3).

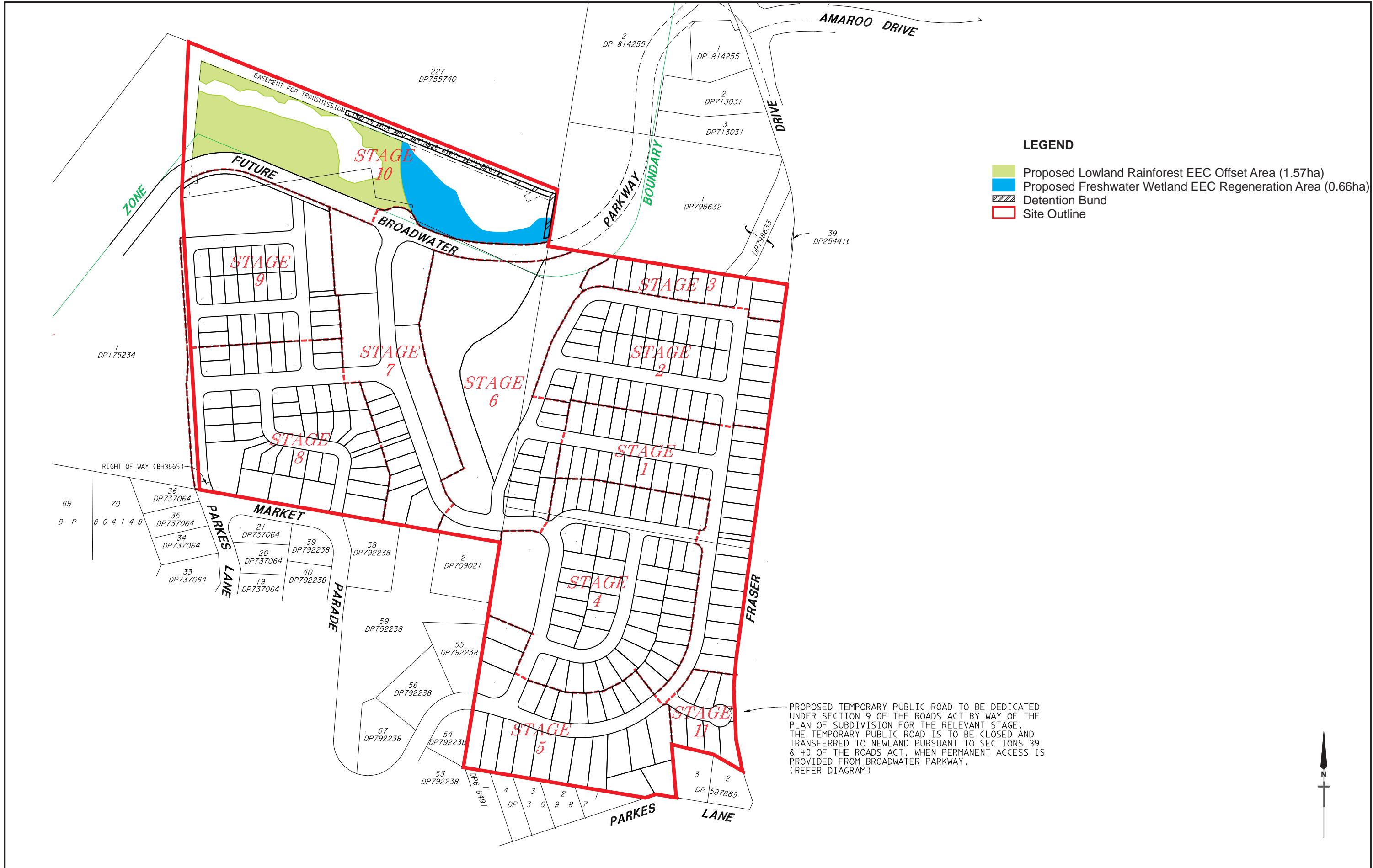
- (ii) *is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.*

The composition of an EEC refers to both the plant and animal species present, and the physical structure of the EEC. The Revised VMRP (JWA 2013) includes measures to ensure that the composition and ecological function of EECs on the subject site is not significantly impacted by development. Implementation of the Revised VMRP will improve the composition of the EECs by removing weeds, encouraging natural regeneration and enhancement planting.

- (d) *In relation to the habitat of a threatened species, population or ecological community:*

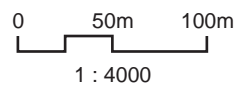
- (i) *the extent to which habitat is likely to be removed or modified as a result of the action proposed, and*

Development of disused farm land over the site is not considered likely to significantly reduce habitat for either the Lowland rainforest or the Freshwater wetland EEC's. The Revised VMRP (JWA 2013) includes measures to increase available habitat for these communities through weed control, rehabilitation and revegetation/regeneration measures.



- LEGEND**
- Proposed Lowland Rainforest EEC Offset Area (1.57ha)
 - Proposed Freshwater Wetland EEC Regeneration Area (0.66ha)
 - Detention Bund
 - Site Outline

PROPOSED TEMPORARY PUBLIC ROAD TO BE DEDICATED UNDER SECTION 9 OF THE ROADS ACT BY WAY OF THE PLAN OF SUBDIVISION FOR THE RELEVANT STAGE. THE TEMPORARY PUBLIC ROAD IS TO BE CLOSED AND TRANSFERRED TO NEWLAND PURSUANT TO SECTIONS 39 & 40 OF THE ROADS ACT, WHEN PERMANENT ACCESS IS PROVIDED FROM BROADWATER PARKWAY. (REFER DIAGRAM)



SOURCE: JWA Site Investigations; B&P Surveys (Ref: 18779B-A.pdf); Gilbert & Sutherland (Ref: 10849_BundLocation_for_JWA_20130416.pdf)
 SCALE: 1:4000 @ A3
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APPENDIX 1
FIGURE 3
 PREPARED: BW
 DATE: 17 April 2013
 FILE: N09031_EEC Offset.cdr

TITLE
PROPOSED
LOWLAND
RAINFOREST EEC
OFFSET AREA

- (ii) *whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and*

Areas of EEC on the subject site are already highly fragmented as the site has a long history of disturbance. The proposed development has been designed to utilise disturbed areas and will not further fragment these communities. Proposed revegetation/regeneration works in accordance with the Amended Landscape Master Plan (Form Landscape Architects 2013) within Passive Open Space areas and the proposed EEC offsets within the Conservation Area (i.e. SEPP 14 Wetland buffer) (FIGURE 3) will effectively link areas of native vegetation to the north and south of the Subject site.

- (iii) *the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.*

Most of the vegetation to be removed consists of highly disturbed vegetation. The importance of this vegetation is minor when compared to the areas of suitable habitat proposed to be retained, protected and rehabilitated. The assessment of the importance of the habitat to be removed has taken into consideration the stages of relevant flora and fauna life cycles and how reproductive success may be affected. It is considered that, with the implementation of the Revised VMRP (JWA 2013) the proposed development will significantly improve the chances of the long-term survival of the EECs found on the subject site.

- (e) *Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).*

Critical habitat areas listed under the *Threatened Species Conservation Act (1995)* currently consist of habitat for Mitchell's rainforest snail in Stott's Island Nature Reserve, and habitat for the Little penguin population in Sydney's North Harbour.

There will be no adverse effects on any critical habitat listed, in the Register of critical habitat in NSW, from the action proposed.

- (f) *Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.*

No Recovery plans or relevant Threat Abatement Plans has been prepared for the EEC's occurring on the subject site.

- (g) *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

A "threatening process" means a process that threatens, or may have the capability to threaten, the survival or evolutionary development of a species, population or ecological community. Key Threatening Processes have been listed in Schedule 3 of the *TSC Act (1995)*.

Key Threatening Processes (Schedule 3):

- Invasion and establishment of exotic vines and scramblers
- Invasion of native plant communities by Bitou bush & boneseed
- Invasion of native plant communities by exotic perennial grasses
- Invasion, establishment and spread of *Lantana camara*
- Competition and grazing by the feral European rabbit
- Competition and habitat degradation by feral goats
- Competition from feral honeybees
- Herbivory and environmental degradation caused by feral deer
- Importation of red imported fire ants into NSW
- Introduction of the large earth bumblebee (*Bombus terrestris*)
- Invasion and establishment of the Cane Toad
- Invasion of the yellow crazy ant (*Anoplolepis gracilipes*)
- Predation by feral cats
- Predation by the European Red Fox
- Predation by the Plague Minnow (*Gambusia holbrooki*)
- Predation by the ship rat (*Rattus rattus*) on Lord Howe Island
- Predation, habitat degradation, competition and disease transmission by Feral Pigs (*Sus scrofa*)
- Alteration to the natural flow regimes of rivers, streams, floodplains & wetlands
- Bushrock Removal
- Clearing of native vegetation
- Alteration of habitat following subsidence due to longwall mining
- Ecological consequences of high frequency fires
- Human-caused Climate Change
- Loss and/or degradation of sites used for hill-topping by butterflies
- Loss of Hollow-bearing Trees
- Removal of dead wood and dead trees
- Infection by Psittacine circoviral (beak & feather) disease affecting endangered psittacine species
- Infection of frogs by amphibian chytrid fungus causing the disease chytridiomycosis
- Infection of native plants by *Phytophthora cinnamomi*
- Death or injury to marine species following capture in shark control programs on ocean beaches
- Entanglement in, or ingestion of anthropogenic debris in marine and estuarine environments

The proposed development has the potential to impact on several 'Key Threatening Processes' as listed above. Mitigation for these is as follows:

- **Invasion and establishment of exotic vines and scramblers;**
- **Invasion of native plant communities by exotic perennial grasses; and**
- **Invasion, establishment and spread of *Lantana camara*.**

The Revised VMRP includes measures that will ensure that these key threatening processes will not be exacerbated.

- **Invasion and establishment of the Cane Toad;**
- **Predation by feral cats; and**

- **Predation by the European Red Fox.**

The Revised VMRP includes measures that will ensure that these key threatening processes will not be exacerbated.

- **Alteration to the natural flow regimes of rivers, streams, floodplains & wetlands.**

A Stormwater Management Plan has been prepared for the proposed development (G & S 2013) which will ensure that this key threatening processes is not exacerbated.

- **Clearing of native vegetation**

The proposed development will result in the clearing of some native vegetation. However, mitigation for this action has been proposed by the implementation of the Revised VMRP (JWA 2013). Significant areas will be restored (e.g. weed control), improved (e.g. enhancement plantings/ assisted regeneration) and protected.

- **Loss of Hollow-bearing trees; and**
- **Removal of dead wood and dead trees.**

To prevent the exacerbation of these processes the Revised VMRP (JWA 2013) includes the following measures:

- Hollow-bearing trees within the restoration areas will be retained where appropriate;
- Woody debris (i.e. habitat) should be placed within the restoration areas where appropriate; and
- Wildlife boxes for bats, birds & other mammals should be installed where appropriate.

1.3.3 Results of Assessment of Significance

On the basis of this assessment, it is considered that the proposed development will not result in any significant impacts on EEC's recorded on the Altitude 1 site.

1.4 Fauna

1.4.1 Background

An Assessment of significance has been completed for the following Threatened fauna species considered a possible occurrence on the subject site based on the availability of suitable habitat:

- Pale-vented bush-hen;
- Collared kingfisher;
- Eastern bent-wing bat;
- Eastern long-eared bat;
- Grey-headed flying-fox;
- Little bent-wing bat;
- Rose-crowned fruit-dove; and
- Yellow-bellied sheath-tail bat.

In response to a submission from the NSW Office of Environment & Heritage, the following additional species have also been considered:

- Comb-crested jacana;
- Mitchell's rainforest snail;
- Osprey;
- Koala;
- Black-necked stork; and
- Eastern grass owl.

1.4.2 *Factors for consideration*

(a) *In the case of a Threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.*

1.4.2.1 Pale-vented bush hen (*Amaurornis moluccana*)

Extent of the local population

The NSW BioNet database contained three (3) records of this species within 10 kilometres of the subject site and there are twenty-seven (27) sightings within the Tweed LGA. The nearest record occurs approximately 2.5km to the north of the subject site. This species has not been recorded from the subject site, however suitable habitat is considered to occur on and adjacent to the subject site.

It is difficult to estimate the number of birds within the local population. No Pale-vented bush-hens have been recorded on the subject site and no records exist within areas of contiguous vegetation.

Stages of the life-cycle affected by the proposed development

The Pale-vented bush hen generally inhabits tall dense understorey or ground-layer vegetation on the margins of freshwater streams and natural or artificial wetlands, usually within or bordering rainforest, rainforest remnants or forests. It has also been recorded from secondary forest growth, rank grass or reeds, thickets of weeds, such as Lantana (*Lantana camara*), and pastures, crops or other farmland, such as crops of sugar cane, and grassy or weedy fields, or urban gardens where they border forest and streams or wetlands, such as farm dams.

Key elements of their habitat are dense undergrowth 2-4 m tall and within 300 m of water. The diet of the species consists of seeds, plant matter, earthworms, insects and some frogs, taken from ground cover or by wading at edges of streams or wetlands.

The breeding season is from spring to early autumn, October to April. The nest is a shallow bowl or cup of grass stems, often partly hooded, built close to water in thick ground vegetation such as dense Blady grass (*Imperata cylindrica*) or mat rush (*Lomandra* sp.) or reeds, often under or growing through shrubs or vine or beneath a tree. Birds lay 4-7 eggs in a clutch and will re-lay after a successful breeding attempt and make multiple attempts after nesting failures. The incubation period is about 3 weeks. The hatchlings are precocial and can run soon after hatching. They are probably dependent on their parents for 4-5 weeks after hatching.

The DEC online species profile lists the following direct and indirect impacts as threats to the survival of the Pale-vented bush hen:

- Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands;
- Loss of dense and rank understorey vegetation near streams and wetlands with clearing associated with urban and semi-rural developments;
- Clearing, filling and draining of wetlands for agricultural, residential and industrial development;
- Pollution of wetlands from agricultural, urban and industrial run-off, including herbicides and pesticides;
- Changes to wetlands caused by weed invasion, often associated with sedimentation or grazing;
- Predation by introduced, feral and domestic predators, particularly Red Foxes (*Vulpes vulpes*) and Cats; and
- Destruction of habitat and predation by feral Pigs (*Sus scrofa*).

The proposed development is not considered likely to result in any alteration to the natural flow regimes of rivers, streams, floodplains or wetlands. In fact, particular consideration has been given to potential impacts of the proposed development on the local hydrology and proposed stormwater management of the site deigned accordingly.

The proposed development will not result in the loss of any significant potential wetland habitat (i.e. roosting and feeding areas) for this species.

The proposed development is considered unlikely to result in any significant pollution of wetlands.

Implementation of proposed rehabilitation practises outlined in the Revised VMRP (JWA 2013) will ensure that weeds within and surrounding wetland areas are controlled.

The proposed development is not considered likely to significantly increase the pressures of predation on this species.

The proposed development is considered unlikely to lead to an increase in feral pig numbers.

Likelihood of local extinction

The proposed development is not considered to represent a significant impact in relation to the distribution of habitat, in the locality, for the local population of this species. Therefore, it is considered that the proposed development is unlikely to result in the extinction, either in the short- or long-term, of the local population of this species.

1.4.2.2 Collared kingfisher (*Todiramphus chloris*)

Extent of the local population

The NPWS database contains forty-eight (48) records of this species within 10 km of the Subject site and a total of fifty-eight (58) records within the Tweed LGA. This species has not been recorded from the subject site, however suitable habitat is considered to occur adjacent to the subject site

The local population for this species is considered to be comprised of all individuals that may occur on the Subject site as well as any individuals within adjoining areas (contiguous or otherwise) that are known or likely to use habitat in the study area.

Stages of the life-cycle affected by the proposed development

The NPWS Threatened Species Unit records the following information on the distribution and ecology of the Collared kingfisher.

The Collared kingfisher is virtually restricted to mangroves and other estuarine habitats and mainly occurs about the mouths of the larger coastal rivers. It is frequently observed perched on rock walls, jetties, piles and tidal flats and sometimes occurs in parks and gardens along foreshores. Nests are usually in a hollow in a mangrove tree or drilled into termite nests in a large eucalypt or paperbark adjacent to mangroves.

The NPWS Threatened Species Unit discusses the following threats for the Collared kingfisher:

- Destruction of old mangrove stands for tourist, residential and infrastructure development;
- Loss of large coastal trees containing hollows or termite nests;
- Pollution of estuaries and accumulation of agricultural herbicide and pesticide residues; and
- Use of pesticides to protect tourist and residential developments.

The proposed development will not result in the destruction of any mangrove stands.

The proposed development will result in the loss of any hollow bearing trees or large trees containing termite nests.

The proposed development will not result in the pollution of estuaries or accumulation of agricultural herbicide or pesticide residues.

It is not proposed to use pesticides as part of the residential development of the site.

Likelihood of local extinction

The proposed development is not considered to represent a significant impact in relation to the distribution of habitat, in the locality, for the local population of this species. Therefore, it is considered that the proposed development is unlikely to result in the extinction, either in the short- or long-term, of the local population of this species.

1.4.2.3 Eastern bent-wing bat (*Miniopterus schreibersii oceanensis*)

Extent of the local population

The NPWS database contains five (5) records of this species within 10 km of the Subject site and a total of eleven (11) records within the Tweed LGA.

The local population for this species is considered to be comprised of all individuals that may occur on the Subject site as well as any individuals within adjoining areas (contiguous or otherwise) that are known or likely to use habitat in the study area.

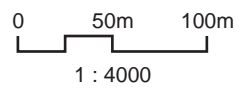
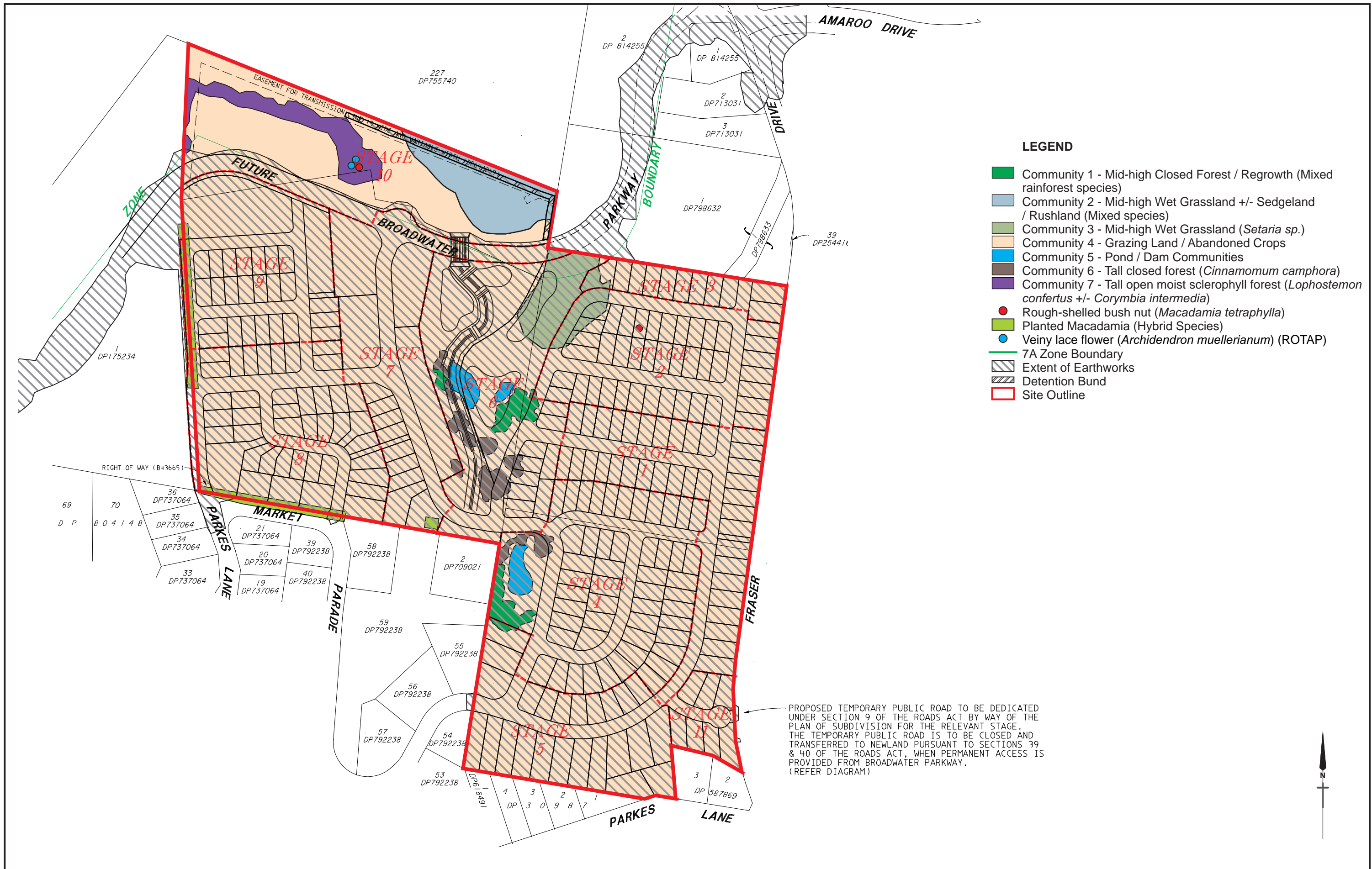
Stages of the life-cycle affected by the proposed development

As part of the RFA process, Environment Australia (1999) conducted an analysis of the responses of forest fauna to various forms of land cover disturbance in the North-east region. The analysis was based on local expert knowledge and identified breeding sites for Eastern bent-wing bat as consisting of limestone caves, where it usually occurs in association with the Common bent-wing bat. It congregates in high numbers in maternity roost (in 1000's). It also shelters in a range of artificial structures including culverts, drains, mines etc. The Eastern bent-wing bat forages on flying insects in forested areas, predominantly swamp forest, moist eucalypt forest, rainforest and some dry forests.

The RFA analysis (Environment Australia 1999) ranked the significance of various forms of disturbance for the Eastern bent-wing bat, with the following results:

1 st order disturbances	Clearing - habitat loss
2 nd order disturbances	Disturbance to camps/caves by limestone mining (cave collapse, altered air flow, noise, dust etc.) and recreational activities.
3 rd order disturbances	Clearing - fragmentation Logging - loss of foraging habitat Frequent burning Altered hydrology/microclimate - old growth-regrowth
4 th order disturbances	Grazing Wildfire Pesticides
5 th order disturbances	Introduced predators

The Eastern bent-wing bat is likely to forage widely over the locality. The most likely impacts to bats from the proposed development would be from urban disturbance (light spill, noise, vehicle movements) adjacent to potential foraging areas and the loss of foraging areas themselves in urban-zoned land. Small and isolated patches of vegetation will be removed from the development footprint (**FIGURE 4**). However, it is expected these impacts would be relatively low as some species of micro-bat are known to adapt to urban environments where street lighting provides greater opportunities for the capture of prey. Micro-bats will have areas of foraging habitat retained within Buffer to the SEPP 14 Wetland and along central constructed and revegetated drainage line.



SOURCE: JWA: B&P Surveys (Ref: 18779B-A.pdf); Bradlees (Ref: x-09-374-base-final.dwg); G&S (Ref: 10849_BundLocation_for_JWA_20130416.pdf)
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JAMES WARREN & ASSOCIATES PTY LIMITED
 Environmental Consultants

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 Newland Developers Pty Ltd
 PROJECT
 Ecological Assessment
 Altitude Aspire
 Fraser Drive, South Terranora, NSW
 Shire of Tweed

APPENDIX 1
FIGURE 4
 PREPARED: BW
 DATE: 17 April 2013
 FILE: N09031_Impacts.cdr

TITLE
IMPACTS OF PROPOSED DEVELOPMENT

Furthermore, regeneration and revegetation measures proposed in accordance with the Revised VMRP (2013) (FIGURE 5) will increase the availability of good quality forage habitat on the subject site.

Likelihood of local extinction

Impacts on micro-bat species are likely to be relatively low. Any hollow-bearing trees within the restoration areas should be retained where possible or if trees require removal, bat boxes should be installed. The removal of a small area of potential habitat from the subject site is not considered to represent a significant impact in relation to the distribution of habitat for the local population of this species. This species is likely to continue to forage over all areas of the site therefore it is unlikely that the proposed development will result in the local extinction of this species.

1.4.2.4 Eastern long-eared bat (*Nyctophilus bifax*)

Extent of local population

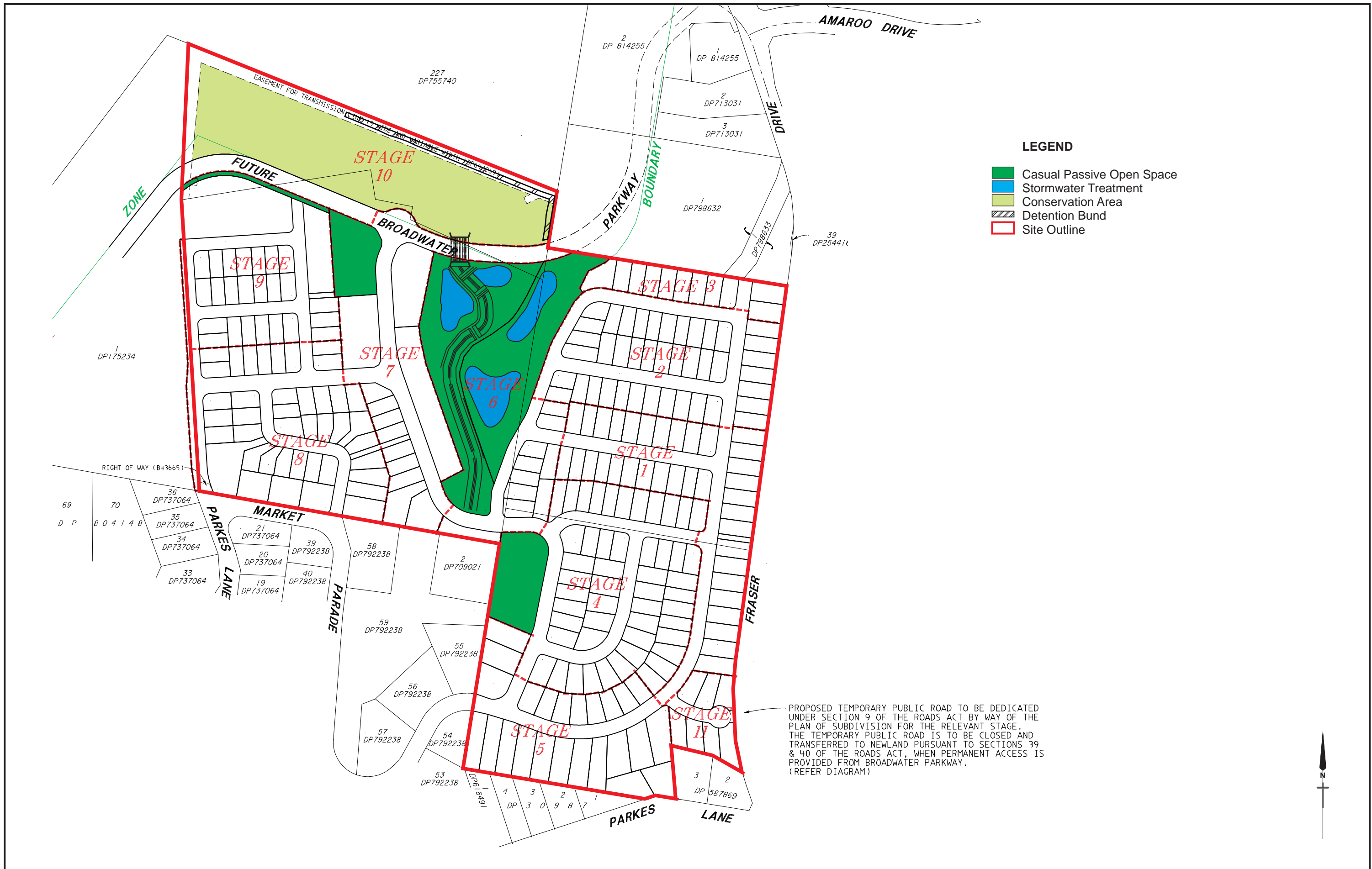
The NPWS database contains six (6) records of this species within 10 km of the Subject site and a total of twenty-nine (29) records within the Tweed LGA. The local population for this species is considered to be comprised of all individuals that may occur on the Subject site as well as any individuals within adjoining areas (contiguous or otherwise) that are known or likely to use habitat in the study area.

Stages of the life-cycle affected by the proposed development

As part of the RFA process, Environment Australia (1999) conducted an analysis of the responses of forest fauna to various forms of land cover disturbance in the North-east region. The analysis was based on local expert knowledge and identified breeding sites for the Eastern long-eared bat as consisting of hollows in littoral and subtropical rainforest and other associated moist and coastal swamp forest. This species will roost communally in foliage. The Eastern long-eared bat forages on flying insects and gleans insects from leaves and bark. It prefers structurally complex forests.

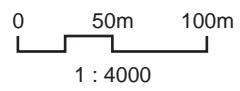
The RFA analysis (Environment Australia 1999) ranked the significance of various forms of disturbance for the Eastern long-eared bat, with the following results:

1 st order disturbances	Clearing - habitat loss
2 nd order disturbances	Clearing - fragmentation
3 rd order disturbances	Logging - loss of understorey Frequent burning Grazing Mining - sand
4 th order disturbances	Logging - loss of hollows Weed invasion Weed spraying
5 th order disturbances	Dams



- LEGEND**
- Casual Passive Open Space
 - Stormwater Treatment
 - Conservation Area
 - Detention Bund
 - Site Outline

PROPOSED TEMPORARY PUBLIC ROAD TO BE DEDICATED UNDER SECTION 9 OF THE ROADS ACT BY WAY OF THE PLAN OF SUBDIVISION FOR THE RELEVANT STAGE. THE TEMPORARY PUBLIC ROAD IS TO BE CLOSED AND TRANSFERRED TO NEWLAND PURSUANT TO SECTIONS 39 & 40 OF THE ROADS ACT, WHEN PERMANENT ACCESS IS PROVIDED FROM BROADWATER PARKWAY. (REFER DIAGRAM)



SOURCE: JWA: B&P Surveys (Ref: 18779B-A.pdf); Bradlees (Ref: x-09-374-base-final.dwg); G&S (Ref: 10849_BundLocation_for_JWA_20130416.pdf)
 SCALE: 1: 4000 @ A3
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CLIENT
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 Shire of Tweed

APPENDIX 1
FIGURE 5
 PREPARED: BW
 DATE: 17 April 2013
 FILE: N09031_Rehab.cdr

TITLE
REHABILITATION STRATEGY

	Wildfire Road kills
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The Eastern long-eared bat is likely to forage widely over the locality. The most likely impacts to bats from the proposed development would be from urban disturbance (light spill, noise, vehicle movements) adjacent to potential foraging areas and the loss of foraging areas themselves in urban-zoned land. Small and isolated patches of vegetation will be removed from the development footprint (FIGURE 4). However, it is expected these impacts would be relatively low as some species of micro-bat are known to adapt to urban environments where street lighting provides greater opportunities for the capture of prey. Micro-bats will have areas of foraging habitat retained within Buffer to the SEPP 14 Wetland and along central constructed and revegetated drainage line.

Furthermore, regeneration and revegetation measures proposed in accordance with the Revised VMRP (2013) (FIGURE 5) will increase the availability of good quality forage habitat on the subject site.

Likelihood of local extinction

Impacts on micro-bat species are likely to be relatively low. Any hollow-bearing trees within the restoration areas should be retained where possible or if trees require removal, bat boxes should be installed. The removal of a small area of potential habitat from the subject site is not considered to represent a significant impact in relation to the distribution of habitat for the local population of this species. This species is likely to continue to forage over all areas of the site therefore it is unlikely that the proposed development will result in the local extinction of this species.

1.4.2.5 Grey-headed flying fox (*Pteropus poliocephalus*)

Extent of the local population

The NPWS database contains forty-seven (47) records of this species within 10 km of the Subject site and a total of one-hundred and ninety (190) records within the Tweed LGA.

The local population for this species is considered to be comprised of all individuals that may occur on the Subject site as well as any individuals within adjoining areas (contiguous or otherwise) that are known or likely to use habitat in the study area.

Stages of the life-cycle affected by the proposed development

As part of the RFA process, Environment Australia (1999) conducted an analysis of the responses of forest fauna to various forms of land cover disturbance in the North-east region. The analysis was based on local expert knowledge and identified breeding and sheltering sites for the Grey-headed flying fox as consisting of mainly rainforest and moist riparian forest with a complex mosaic of rainforest, swamp and sclerophyll forest resources less than 40-50km from roost. There is high site fidelity with roosts often in riverine rainforest. The Grey-headed flying fox forages in subtropical rainforest with a mosaic of resources - rainforest fruit, nectar and

pollen. The Grey-headed flying fox is less restricted to rainforest remnants than the Black flying fox.

The RFA analysis (Environment Australia 1999) ranked the significance of various forms of disturbance for the Grey-headed flying fox, with the following results:

- Clearing - resulting in fragmentation and habitat loss
- Direct disturbance to camps
- Drainage of swamps
- Powerlines
- Logging of Sclerophyll
- Wildfire and Management burns
- Shooting
- Disease - lyssavirus
- Apiary
- Barbed wire fences
- Weed invasion
- Climate change

Grey-headed flying-foxes may utilise the site on a seasonal basis when feed trees are flowering (Swamp Mahogany, Swamp Box, Scribbly Gum, Broad-leaved Paperbark, Figs etc.). Small and isolated patches of vegetation will be removed from the development footprint (FIGURE 4), however this is a highly mobile species and forage resources will be available within the restored and protected areas of the subject site (JWA 2013).

There are approximately 22 camps within 50 km of the subject site (TABLE 2). None of these camps will be affected by the proposed development.

**TABLE 2
GREY-HEADED FLYING FOX CAMPS WITHIN 50 KM OF THE SUBJECT SITE**

COLONY NAME	LONG.	LAT.	OCCUPATION	NOTES
Big Island	153.51046991	-28.20700499	annual	
Brooks Rd	153.36003824	-28.30182291		
Caddy's Island	153.51562226	-28.19136931	annual	
Chinderah	153.55697696	-28.25421390		
Dallis Park 1	153.38540954	-28.35731310		destroyed
Dallis Park 2	153.38765808	-28.35549236	annual	destroyed
Daveys Island	153.51262113	-28.19657100		
Dulguigan	153.39191553	-28.29215774		destroyed
Ewingsdale	153.56882600	-28.64225643	occasional	
Marshall's Creek	153.54229873	-28.51132163	rare	
Mt. Warning	153.22971766	-28.41222173		
Myocum	153.52836957	-28.59514080	occasional	
Ocean Shores	153.54181915	-28.53145232	continuous	
Oxley Cove	153.54478683	-28.23259890	annual	
Pottsville	153.56435675	-28.38732598	occasional	
Stotts Island	153.49451901	-28.27250760		
Terania Creek	153.30588938	-28.58151815	annual	
Uki	153.33296557	-28.41485185	annual	
Canungra	153.18140995	-28.04106165	annual	

COLONY NAME	LONG.	LAT.	OCCUPATION	NOTES
Cascade Gardens	153.42640843	-28.02046144	continuous	
Currumbin Valley	153.41712409	-28.18706508	occasional	
Helensvale	153.33381210	-27.90238861	continuous	
Mudgeeraba	153.36232828	-28.10712475	occasional	
Southport	153.41246259	-27.98051380	continuous	
Tallebudgera	153.44354369	-28.11586799	annual	

The removal of 0.36ha of small, isolated and degraded patches of habitat from the development footprint will be offset at a rate of 4.4:1. This will result in a significant net gain of habitat on the subject site for this species.

Likelihood of local extinction

Impacts on this bat species are likely to be relatively low. The removal of a small area of potential habitat from the subject site is not considered to represent a significant impact in relation to the distribution of habitat for the local population of this species. This species is likely to continue to forage over the restored and conserved areas of the site therefore it is unlikely that the proposed development will result in the local extinction of this species.

1.4.2.6 Little bent-wing bat (*Miniopterus australis*)

Extent of the local population

The NPWS database contains fourteen (14) records of this species within 10 km of the Subject site. This species is likely to forage widely throughout the locality including within urban and rural areas, however better quality forage habitat is likely to be within and adjacent to intact vegetation. The local population for this species is considered to be comprised of all individuals that may occur on the Subject site as well as any individuals within adjoining areas (contiguous or otherwise) that are known or likely to use habitat in the study area.

Stages of the life-cycle affected by the proposed development

As part of the RFA process, Environment Australia (1999) conducted an analysis of the responses of forest fauna to various forms of land cover disturbance in the North-east region. The analysis was based on local expert knowledge and identified breeding sites for Little bent-wing bat as consisting of limestone caves, where it usually occurs in association with the Common bent-wing bat. It congregates in high numbers in maternity roost (in 1000's). It also shelters in a range of artificial structures including culverts, drains, mines etc. The Little bent-wing bat forages on flying insects in forested areas, predominantly swamp forest, moist eucalypt forest, rainforest and some dry forests.

The RFA analysis (Environment Australia 1999) ranked the significance of various forms of disturbance for the Little bent-wing bat, with the following results:

- Clearing - habitat loss and fragmentation
- Disturbance to camps/caves by limestone mining (cave collapse, altered air flow, noise, dust etc.) and recreational activities.
- Logging - loss of foraging habitat
- Wildfire and Frequent burning

- Altered hydrology/microclimate - old growth-regrowth
- Grazing
- Pesticides
- Introduced predators

The Little bent-wing bat is likely to forage widely over the locality. The most likely impacts to bats from the proposed development would be from urban disturbance (light spill, noise, vehicle movements) adjacent to potential foraging areas and the loss of foraging areas themselves in urban-zoned land.

Small and isolated patches of vegetation will be removed from the development footprint (FIGURE 4). However, it is expected these impacts would be relatively low as some species of micro-bat are known to adapt to urban environments where street lighting provides greater opportunities for the capture of prey.

Furthermore, regeneration and revegetation measures proposed in accordance with the Revised VMRP (2013) (FIGURE 5) will increase the availability of good quality forage habitat on the subject site.

Likelihood of local extinction

Impacts on micro-bat species are likely to be relatively low. Any hollow-bearing trees within the restoration areas should be retained where possible or if trees require removal, bat boxes should be installed. The removal of a small area of potential habitat from the subject site is not considered to represent a significant impact in relation to the distribution of habitat for the local population of this species. This species is likely to continue to forage over all areas of the site therefore it is unlikely that the proposed development will result in the local extinction of this species.

1.4.2.7 Rose-crowned fruit dove (*Ptilinopus regina*)

Extent of the local population

The NPWS database contains six (6) records of this species within 10 km of the Subject site. Twenty-six (26) records occur within the Tweed LGA.

This species has not been recorded from the subject site however was recorded during surveys of adjacent properties (JWA 2009). Suitable habitat is considered to occur within mature vegetation in the north-western portion of the subject site, and adjacent to the site.

Stages of the life-cycle affected by the proposed development

The Rose-crowned fruit-dove forages in lowland subtropical rainforest including remnants dominated by Camphor laurel, Littoral rainforest and wet sclerophyll forests. The Camphor laurel has become very important in replacing lowland species previously used but now cleared (Environment Australia 1999). Other habitats occupied are gallery forests or sclerophyll woodlands (often dominated by Melaleuca or Eucalyptus species), with abundant fruiting trees, near or next to rainforest (Marchant & Higgins 1993). The Rose-crowned fruit-dove appears to be tolerant of disturbance, having been recorded in patches of rainforest as small as two (2) hectares (Frith 1952).

Breeding and sheltering sites for the Rose-crowned fruit-dove consist of scattered patches of habitat in lowland subtropical rainforest including remnants dominated by Camphor laurel and wet sclerophyll forests (Environment Australia 1999). The Rose-crowned fruit-dove erects nests usually within 6m of the ground, thus rainforest of any age and structure is suitable (Recher & Date 1988).

As part of the RFA process, Environment Australia (1999) conducted an analysis of the responses of forest fauna to various forms of land cover disturbance in the North-east region. The analysis was based on local expert knowledge and ranked the significance of various forms of disturbance for the Rose-crowned fruit-dove, with the following results:

1 st order disturbances	Clearance for agriculture Urban development Weed invasion Loss of habitat Intensive horticulture
2 nd order disturbances	Logging that reduces age classes of mesomorphic midstorey

Likelihood of local extinction

The Rose-crowned fruit dove has been recorded on adjacent properties. Mature vegetation in the north-western portion of the subject site provides suitable forage habitat for this species and will be retained and buffered.

This species will also benefit in the long term from the proposed rainforest revegetation works on the subject site. The Proposed development is unlikely to result in the local extinction of this species.

1.4.2.8 Yellow-bellied sheath-tail bat (*Saccolaimus flaviventris*)

Extent of the local population

The NPWS database contains four (4) records of this species within 10 km of the Subject site and a total of five (5) records within the Tweed LGA. This species is likely to forage widely throughout the locality including within urban and rural areas, however better quality forage habitat is likely to be within and adjacent to intact vegetation. The local population for this species is considered to be comprised of all individuals that may occur on the Subject site as well as any individuals within adjoining areas (contiguous or otherwise) that are known or likely to use habitat in the study area.

Stages of the life-cycle affected by the proposed development

As part of the RFA process, Environment Australia (1999) conducted an analysis of the responses of forest fauna to various forms of land cover disturbance in the North-east region. The analysis identified a lack of knowledge on this species. The Yellow-bellied sheath-tailed bat breeds and shelters in hollows. It feeds on flying insects. The Yellow-bellied sheath-tail bat forages in most habitats across its very wide range, with and without trees.

The RFA analysis (Environment Australia 1999) ranked the significance of various forms of disturbance for the Yellow-tailed sheath-tail bat, with the following results:

1 st order disturbances	Logging - loss of hollows & old growth
2 nd order disturbances	Clearing - habitat loss
3 rd order disturbances	Grazing Frequent burning
4 th order disturbances	Pesticides
5 th order disturbances	Barbed wire Disease - lyssavirus

The Yellow-bellied sheath-tail bat is likely to forage widely over the locality. The most likely impacts to bats from the proposed development would be from urban disturbance (light spill, noise, vehicle movements) adjacent to potential foraging areas and the loss of foraging areas themselves in urban-zoned land.

Small and isolated patches of vegetation will be removed from the development footprint (FIGURE 4). However, it is expected these impacts would be relatively low as some species of micro-bat are known to adapt to urban environments where street lighting provides greater opportunities for the capture of prey.

Furthermore, regeneration and revegetation measures proposed in accordance with the Revised VMRP (2013) (FIGURE 5) will increase the availability of good quality forage habitat on the subject site.

Likelihood of local extinction

Impacts on micro-bat species are likely to be relatively low. Any hollow-bearing trees within the restoration areas should be retained where possible or if trees require removal, bat boxes should be installed. The removal of a small area of potential habitat from the subject site is not considered to represent a significant impact in relation to the distribution of habitat for the local population of this species. This species is likely to continue to forage over all areas of the site therefore it is unlikely that the proposed development will result in the local extinction of this species.

1.4.2.9 Comb-crested jacana

Extent of the local population

The NPWS database contains seventeen (17) records of this species within 10 km of the Subject site and twenty seven (27) records within the Tweed LGA.

There are no records of this species from the subject site. The Area E LES noted that potential habitat occurred on the subject site in the form of two farm dams. However a detailed habitat assessment on the subject site has revealed that these farm dams do not constitute suitable habitat in their current form.

Stages of the life-cycle affected by the proposed development

The NPWS Threatened Species Unit records the following information on the distribution and ecology of the Comb-crested jacana:

The Comb-crested jacana lives amongst vegetation floating on the surface of slow-moving rivers and permanent lagoons, swamps, lakes and dams. They are usually seen walking on floating plants such as lily pads, as they forage for aquatic insects. The nest is a low heap of wet floating vegetation.

The NPWS Threatened Species Unit discusses the following threats for the Comb-crested jacana:

- Drainage of swamps, ponds, dams and other wetland areas;
- Removal of surface aquatic vegetation from swamps, ponds and dams;
- Reduced water quality affecting food availability;
- Use of herbicides, insecticides and other chemicals near wetlands; and
- Introduced water weeds choking out native water plants.

The proposed development will not result in the draining of swamps or wetland areas. Farm dams will be removed from the subject site however these areas do not constitute suitable habitat.

No suitable surface aquatic vegetation will be removed as part of the proposed development.

The proposed development will not result in reduced water quality.

The proposed development will not involve the use of pesticides or insecticides near wetlands. Any herbicides used during rehabilitation works within the Conservation Area on the site will be biodegradable in accordance with the Revised VMRP (JWA 2013).

The Revised VMRP (JWA 2013) will ensure that weeds are controlled in wetland areas.

Likelihood of local extinction

The proposed development is not considered to represent a significant impact in relation to the distribution of habitat, in the locality, for the local population of this species. Therefore, it is considered that the proposed development is unlikely to result in the extinction, either in the short- or long-term, of the local population of this species.

1.4.2.10 Mitchell's rainforest snail

Extent of the local population

The NPWS database contains three (3) records of this species within 10 km of the Subject site and seventy-four (74) records within the Tweed LGA. There are no records of this species from the subject site. Suitable habitat is considered to occur on adjoining land (i.e. palm forest adjoining the north-western boundary) however extensive targeted surveys completed in this vegetation (JWA 2009) failed to record this species.

Stages of the life-cycle affected by the proposed development

The NPWS Threatened Species Unit records the following information on the distribution and ecology of the Mitchell's rainforest snail.

Primary habitat for the Mitchell's rainforest snail is remnant areas of lowland subtropical rainforest and swamp forest on alluvial soils. Slightly higher ground with palms and fig trees around the edges of wetlands are particularly favoured habitat. Typically found amongst leaf-litter on the forest floor, and occasionally under the bark on trees. This species is active at night when it feeds on leaf-litter, fungi and lichen.

The NPWS Threatened Species Unit discusses the following threats for the Mitchell's rainforest snail:

- Clearing of lowland rainforest, swamp forest and wetland margins for urban development and agriculture;
- Damage to remnant areas of habitat by fire, weed invasion and grazing by stock;
- Predation of snails by introduced rats; and
- Use of herbicides and pesticides in and near areas of habitat.

The proposed development will not result in the clearing of any suitable habitat for this species.

The proposed development is considered unlikely to result in the introduction of fire to suitable habitat. Weeds will be controlled on the subject site in accordance with the Revised VMRP (JWA 2013). Stock will be removed from the subject site.

The proposed development is considered unlikely to significantly increase predation pressures on the species.

The proposed development will not result in the use of pesticides near habitat areas. Any herbicides used during rehabilitation works within the Conservation Area on the site will be biodegradable in accordance with the Revised VMRP (JWA 2013).

Likelihood of local extinction

The proposed development is not considered to represent a significant impact in relation to the distribution of habitat, in the locality, for the local population of this species. Therefore, it is considered that the proposed development is unlikely to result in the extinction, either in the short- or long-term, of the local population of this species.

1.4.2.11 Osprey

Extent of the local population

The NPWS database contains two hundred and ninety four (294) records of this species within 10 km of the Subject site. Four hundred (400) records occur within the Tweed LGA. This species has not been recorded on the subject site and suitable habitat is not considered to occur.

Stages of the life-cycle affected by the proposed development

Ospreys forage for fish in fresh, brackish or saline waters of rivers, lakes, estuaries and inshore coastal waters (NPWS 2002; Marchant and Higgins 1993). A breeding pair requires a suitable foraging area with nesting sites nearby. The nest is a large bulky structure of dead sticks, often located in a tall dead tree or on artificial structures such as power transmission poles or towers. It is used year after year for as long as it lasts (NPWS 2002).

As part of the RFA process, Environment Australia (1999) conducted an analysis of the responses of forest fauna to various forms of land cover disturbance in the North-east region. The RFA analysis was based on local expert knowledge and ranked the significance of various forms of disturbance for the Osprey, with the following results:

1 st order disturbances	Drainage of wetlands Chemical pollutants Urban development Loss of nest sites Commercial fishing (removal of prey, especially mullet)
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Likelihood of local extinction

Suitable habitat is not considered to occur on the subject site.

The proposed development is not considered to represent a significant impact in relation to the distribution of habitat, in the locality, for the local population of this species. Therefore, it is considered that the proposed development is unlikely to result in the extinction, either in the short- or long-term, of the local population of this species.

1.4.2.12 Koala

Extent of the local population

The NPWS database contains fifty three (53) records of this species within 10 km of the Subject site. Four hundred and ninety five (495) records occur within the Tweed LGA. This species has not been recorded from the subject site and suitable habitat is not considered to occur.

Stages of the life-cycle affected by the proposed development

As part of the RFA process, Environment Australia (1999) conducted an analysis of the responses of forest fauna to various forms of land cover disturbance in the North-east region. The analysis was based on local expert knowledge and identified feeding sites for Koalas in coastal forested environments (not woodland) as areas with stands with a high diversity of known food trees (three or more) including Tallowwood, Grey gum, Forest oak, Sydney blue gum, Swamp mahogany and Red gums. The Koala shelters in larger trees with big lateral branches (not necessarily food trees). The Koala disperses over any open habitat (including pasture and grassland) as long as scattered trees are present.

The RFA analysis (Environment Australia 1999) ranked the significance of various forms of disturbance for the Koala, with the following results:

1 st order disturbances	Habitat clearing
2 nd order disturbances	Introduced predators - foxes and dogs
3 rd order disturbances	Intensive logging that removes the critical tree size classes from the stand (may be frequent or single and intensive) Logging that fails to retain stems in the 30-80 DBH size class.
4 th order disturbances	Wildfire
5 th order disturbances	Road kills
6 th order disturbances	Disease

Likelihood of local extinction

The site offers relatively poor Koala habitat due to the lack of feed trees available, combined with the relative isolation of the site, and lack of any connectivity with good quality Koala habitat. Any extensive use of the site, save for the very occasional straying individual is considered highly unlikely.

The proposed development is considered unlikely to result in the local extinction of this species.

1.4.2.13 Black-necked stork

Extent of local population

The NPWS database contains twenty-seven (27) records of this species within 10 km of the subject site and a total of eighty-six (86) records within the Tweed LGA. No records exist from the subject site however the Freshwater wetland on the subject site is considered to provide marginal habitat.

Stages of the life-cycle affected by the proposed development

The Black-necked stork inhabits swamps, mangroves, mudflats, dry floodplains, and irrigated land. It occasionally forages in open grassy woodland (Environment Australia 1999). An abundant supply of frogs and fish is required, together with suitable roost and nest trees, usually overhanging rivers and swamps (SFNSW 1995). It strides through the water probing for prey with its bill and may chase fish. The nest is a large flat pile of sticks, grass and rushes in a tree, usually near water (NPWS 2002).

As part of the RFA process, Environment Australia (1999) conducted an analysis of the responses of forest fauna to various forms of land cover disturbance in the North-east region. This analysis was based on local expert knowledge and ranked the significance of various forms of disturbance for the Black-necked stork, with the following results:

1 st order disturbances	Drainage of wetlands Dams
2 nd order disturbances	Power lines

	Intensive horticulture (tea trees)
3 rd order disturbances	Pesticide contamination of wetlands Urban development Loss of nest trees
4 th order disturbances	Shooting

The Freshwater wetland on the subject site is considered to provide marginal habitat for this species. Although there will be a minor loss (0.11ha) to this wetland for the construction of a stormwater detention bund (**FIGURE 8**), this area will be fully rehabilitated/regenerated and retained within a proposed Conservation Area.

Likelihood of local extinction

The proposed development is not considered to represent a significant impact in relation to the distribution of habitat, in the locality, for the local population of this species. Therefore, it is considered that the proposed development is unlikely to result in the extinction, either in the short- or long-term, of the local population of this species.

1.4.2.14 Eastern grass owl

Extent of the local population

The NPWS database contains three (3) records of this species within 10 km of the Subject site and twenty four (24) records within the Tweed LGA. There are no records of this species from the subject site. Dense vegetation within the SEPP 14 wetland to the north of the site may represent suitable habitat.

Stages of the life-cycle affected by the proposed development

Eastern grass owls are found in areas of tall grass, including grass tussocks, in swampy areas, grassy plains, swampy heath, and in cane grass or sedges on flood plains. They rest by day in a 'form' (i.e. a trampled platform in a large tussock or other heavy vegetative growth). If disturbed they burst out of cover and fly low and slowly, before dropping straight down again into cover.

Numerous species of rodent have been recorded as prey. Eastern grass owls, even more so than Barn owls, are specialist hunters of small rodents and rarely take any other prey. Even though they weigh much the same as Barn owls, their wings are considerably longer, reflecting their method of hunting which is done entirely in flight and never from perches. Hunting is by low, quartering flight followed by a quick plunge into the grass when prey is detected.

Eastern grass owls probably breed at any time of year if conditions are favourable however, laying usually occurs between March and June. The nest is on the ground in dense tussocks of grass or sedges, particularly Blady grass, usually well away from trees. The nest is a flimsy platform of grasses which soon becomes trampled. It is enveloped in grasses and is approached by a series of tunnels, usually at least three, which the owls make by pushing their way through on foot. One of these is normally the main tunnel and the grass at its entrance becomes flattened from repeated landing and departures. In the nest, 3-8 dull white eggs are laid. Incubation is thought to be around 42 days (assumed to be similar to the African grass owls). The

young have a first down of white and second of warm golden brown. Fledging is at about 2 months. Long before this, the female stops brooding them and they walk away from the nest to hide in the grass, returning at night when the adults bring in food. All young appear to fledge in dark plumage, indistinguishable from adult females.

The DEC online species profile lists the following direct and indirect impacts as threats to the survival of the Grass owl:

- Loss of suitable habitat due to grazing, agriculture and development.
- Habitat disturbance and degradation by stock.
- Use of pesticides in agriculture to control rodent populations thereby limiting seasonal food sources for owls, reducing reproductive potential, and potentially poisoning owls.
- Frequent burning, which reduces ground cover needed for safe roosting and nesting, and can reduce prey abundance.

The proposed development will not result in the loss of potential habitat (i.e. roosting and feeding areas) for this species.

The introduction of cattle to the subject site is not proposed as part of the development application.

The proposed development is not likely to result in a significant increase in pesticide use in the study area.

The proposed development will not result in frequent burning of potential habitat areas.

Likelihood of local extinction

The proposed development is not considered to represent a significant impact in relation to the distribution of habitat, in the locality, for the local population of this species. Therefore, it is considered that the proposed development is unlikely to result in the extinction, either in the short- or long-term, of the local population of this species.

- (b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.***

Thirty-five (35) endangered populations have been identified under the *TSC Act*. The following five (5) endangered populations occur in north-eastern NSW:

- Long-nosed potoroo population, Cobaki Lakes and Tweed Heads West;
- Emu population in the NSW North Coast Bioregion and Port Stephens LGA;
- Low growing form of *Zieria smithii*, Diggers Head;
- Narrow-leaved red gum in the Greater Taree LGA;
- *Glycine clandestina* (Broad-leaf form) in the Nambucca LGA.

The proposed action will not have an adverse effect on any of these endangered populations.

- (c) *In the case of an endangered ecological community or critically endangered ecological community whether the action proposed:*
- (i) *is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or*
 - (ii) *is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.*

Not applicable for Threatened fauna

- (d) *In relation to the habitat of a threatened species, population or ecological community:*
- (i) *the extent to which habitat is likely to be removed or modified as a result of the action proposed*

Development of disused farm land over the site is not considered likely to significantly reduce habitat for any Threatened fauna species recorded, or considered a possible occurrence in the study area. The Revised VMRP (JWA 2013) includes measures to increase available habitat for native fauna (including Threatened species) through weed control, rehabilitation and revegetation measures.

- (ii) *whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action*

The proposed development has been designed to utilise disturbed areas and will not further fragment these communities. Proposed revegetation works within Passive Open Space areas and the Conservation Area (i.e. SEPP 14 Wetland buffer) will effectively link areas of native vegetation to the north and south of the Subject site.

- (iii) *the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.*

Most of the vegetation to be removed consists of highly disturbed vegetation. The importance of this vegetation is minor when compared to the areas of suitable habitat proposed to be retained, protected and rehabilitated. The assessment of the importance of the habitat to be removed has taken into consideration the stages of relevant flora and fauna life cycles and how reproductive success may be affected. It is considered that, with the implementation of the Revised VMRP (JWA 2013) the proposed development will improve the chances of the long-term survival of

Threatened fauna species recorded or considered a possible occurrence in the study area.

(e) *Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).*

Critical habitat areas listed under the *Threatened Species Conservation Act (1995)* currently consist of habitat for Mitchell's rainforest snail in Stott's Island Nature Reserve, and habitat for the Little penguin population in Sydney's North Harbour.

There will be no adverse effects on any critical habitat listed, in the Register of critical habitat in NSW, from the action proposed.

(f) *Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.*

No Recovery plans or relevant Threat Abatement Plans has been prepared for the Threatened fauna species discussed above.

(g) *Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

A "threatening process" means a process that threatens, or may have the capability to threaten, the survival or evolutionary development of a species, population or ecological community. Key Threatening Processes have been listed in Schedule 3 of the *TSC Act (1995)*.

Key Threatening Processes (Schedule 3):

- Invasion and establishment of exotic vines and scramblers
- Invasion of native plant communities by Bitou bush & boneseed
- Invasion of native plant communities by exotic perennial grasses
- Invasion, establishment and spread of *Lantana camara*
- Competition and grazing by the feral European rabbit
- Competition and habitat degradation by feral goats
- Competition from feral honeybees
- Herbivory and environmental degradation caused by feral deer
- Importation of red imported fire ants into NSW
- Introduction of the large earth bumblebee (*Bombus terrestris*)
- Invasion and establishment of the Cane Toad
- Invasion of the yellow crazy ant (*Anoplolepis gracilipes*)
- Predation by feral cats
- Predation by the European Red Fox
- Predation by the Plague Minnow (*Gambusia holbrooki*)
- Predation by the ship rat (*Rattus rattus*) on Lord Howe Island
- Predation, habitat degradation, competition and disease transmission by Feral Pigs (*Sus scrofa*)
- Alteration to the natural flow regimes of rivers, streams, floodplains & wetlands
- Bushrock Removal

- Clearing of native vegetation
- Alteration of habitat following subsidence due to longwall mining
- Ecological consequences of high frequency fires
- Human-caused Climate Change
- Loss and/or degradation of sites used for hill-topping by butterflies
- Loss of Hollow-bearing Trees
- Removal of dead wood and dead trees
- Infection by Psittacine circoviral (beak & feather) disease affecting endangered psittacine species
- Infection of frogs by amphibian chytrid fungus causing the disease chytridiomycosis
- Infection of native plants by *Phytophthora cinnamomi*
- Death or injury to marine species following capture in shark control programs on ocean beaches
- Entanglement in, or ingestion of anthropogenic debris in marine and estuarine environments

The proposed development has the potential to impact on several 'Key Threatening Processes' as listed above. Mitigation for these is as follows:

- **Invasion and establishment of exotic vines and scramblers;**
- **Invasion of native plant communities by exotic perennial grasses; and**
- **Invasion, establishment and spread of *Lantana camara*.**

The Revised VMRP includes measures that will ensure that these key threatening processes will not be exacerbated.

- **Invasion and establishment of the Cane Toad;**
- **Predation by feral cats; and**
- **Predation by the European Red Fox.**

The Revised VMRP includes measures that will ensure that these key threatening processes will not be exacerbated.

- **Alteration to the natural flow regimes of rivers, streams, floodplains & wetlands.**

A Stormwater Management Plan has been prepared for the proposed development (G&S 2013) which will ensure that this key threatening processes is not exacerbated.

- **Clearing of native vegetation**

The proposed development will result in the clearing of some native vegetation (SECTION 3.5.3). However, mitigation for this action has been proposed by the implementation of the Revised VMRP (JWA 2013). Significant areas will be restored (e.g. weed control) and improved (e.g. enhancement plantings/ assisted regeneration) and protected.

- **Loss of Hollow-bearing trees; and**
- **Removal of dead wood and dead trees.**

To prevent the exacerbation of these processes the Revised VMRP (JWA 2013) includes the following measures:

- Hollow-bearing trees within the restoration areas will be retained where appropriate;
- Woody debris (i.e. habitat) should be placed within the restoration areas where appropriate; and
- Wildlife boxes for bats, birds & other mammals should be installed where appropriate.

1.4.3 Results of Assessment of Significance

On the basis of this assessment, it is considered that the proposed development will not result in any significant impacts on threatened fauna on the Subject site.

APPENDIX 2- WETLAND PLANT COMMUNITIES RESPONSE TO DEPTH, DURATION AND FREQUENCY OF FLOODING

1.1 Introduction

This section discusses the work of Cassanova & Brock (1997 & 2000) which demonstrates the effects of varying water regimes (i.e. depth, duration and/or frequency of flooding) on wetland development and community composition.

1.2 Literature Review

Seedbank material was collected from two (2) shallow freshwater wetlands on the Northern Tablelands of New South Wales. Cassanova & Brock (2000) state that the two wetlands selected represent two extremes of natural water regime and both possess diverse, species rich seed banks. The Species occurrence (x) in the seed bank of each wetland type (the intermittent wetland and the near-permanent wetland) and classification into groups is defined in TABLE 1 (Brock & Casanova 1997).

TABLE 1
SPECIES OCCURRENCE

Species name	Near-permanent	Intermittent	Classification
<i>Cyperus eragrostis</i>	-	X	ATe
<i>Cyperus sanguinolentus</i>	X	X	ATe
<i>Cyperus sp</i>	-	X	ATe
<i>Eleocharis acuta</i>	-	X	ATe
<i>Eleocharis deitrichiana</i>	-	X	ATe
<i>Eleocharis pusilla</i>	X	X	ATe
<i>Juncus articulatus</i>	X	X	ATe
<i>Juncus bufonius</i>	X	X	Tda
<i>Juncus pin</i>	X	X	Tda
<i>Pericaria decipiens</i>	-	X	ATe
<i>Pericaria hydropiper</i>	-	X	ATe
<i>Pericaria prostrata</i>	-	X	Tda

Classification of species that occurred in field surveys and established under experimental conditions into seven species groups after Brock & Casanova (1997).

Two (2) of these groups are noted in TABLE 2 below.

TABLE 2
SPECIES CLASSIFICATION

Primary category	Secondary category	Description
Terrestrial	Damp species: Tda	Species which germinate, grow and reproduce on saturated soil
Amphibious fluctuation-tolerators	Emergent species: ATe	Species which germinate in damp or flooded conditions, which tolerate variation in water-level, and which grow with their basal portions under water and reproduce out of the water

Invasion of exotic terrestrial species may be a consequence of the longer dry periods that are part of the natural water regime of this wetland. Exotic species were found to be more sensitive to changes in hydrology than native species in Europe (Tabacchi 1995).

Of the three factors examined, depth alone was the least important in determining plant community development when water levels fluctuate.

It is clear from the literature that different species can be expected to have different depth tolerances under stable water regimes (e.g. Spence 1967; Seabloom et al. 1998). However, in this experiment when water levels fluctuated, absolute depth was less important than frequency of fluctuations and duration of flooding.

Results demonstrated that there was gradual decline in species richness under longer durations of flooding for the intermittent wetland seed bank. However, short frequent flooding promoted high species richness.

With shorter durations of flooding there was time for Amphibious species to germinate and establish between flooding events, and shorter durations of anoxia during the flooding events for terrestrial species to tolerate. Survival at the intermediate durations requires tolerance of both emersion and immersion. Only the Amphibious groups of species have adaptations for both these conditions.

The Amphibious fluctuation-tolerator species were largely species of *Eleocharis* and *Cyperus* for these two wetland seed banks, and while those species apparently prefer to grow under damp conditions, their emergent morphology allowed them to tolerate short periods of submergence.

Wetland reproductive dynamics is strongly influenced by depth, duration and season of inundation. A range of flooding patterns is important in wetlands to establish not only a diversity of plant species but also to allow a diversity of plant species to reproduce (Warwick & Brock 2003).

The results from Warwick & Brock (2003) indicate that should a particular regime be imposed on this diverse seed bank material selection will take place for a particular suite of species. Permanent flooding or long periods of inundation will result in a submergent-dominated wetlands, whereas, long periods of damp will lead to an amphibious-dominated community.

1.3 Implications for the Altitude Aspire site

The Freshwater wetland EEC will be bunded and as such subjected to short periods, up to 3 hours based on hydrograph analysis (G&S 2013), of increased depth of inundation. As demonstrated in the literature review above this is not considered to represent a significant impact on the ecological functioning of the Freshwater wetland EEC occurring on the subject site, but may promote high species richness. However, there may be some variation in plant species zonation and community composition over time.

The growth habit and preferred habitat of wetland species occurring within the Freshwater wetland EEC on the subject site is provided below.

Stephens & Dowling (2002):

- *Baumea articulata*: Occurs in swampy areas along the eastern coastal plains. Leaves of this perennial sedge are borne in tufts arising from the rhizomes and are from 1 to 2m tall.
- *Eleocharis equisetina*: Stoloniferous sedge with tufted, slender, cylindrical, sharply pointed stems that are up to 1m tall and have internal discs of tissue at regular intervals similar to bamboo, to help keep them erect. Grows in swampy coastal and subcoastal areas.
- *Leersia hexandra*: Rhizomatous, perennial, aquatic or semi-aquatic grass with decumbent stems. Occurs in and beside shallow swamps and creeks in the eastern parts of QLD and NSW.
- *Ranunculus inundatus*: Emergent perennial herb with finely dissected leaves growing to about 30cm in height. Occurs on riverbanks, wet mud and in shallow water along creek lines.

Sainty & Jacobs (1981):

- *Paspalum paspalodes*: Rhizomatous and stoloniferous perennial to 50cm high, forming dense mats or turf. Grows in wet or damp areas in shallow water, or if slowly flowing water, floating across the surface.

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APPENDIX 3 - FLORA ASSESSMENT

2 FLORA ASSESSMENT

2.1 Introduction

This section discusses the methods used in the vegetation assessment and presents the results of the assessment.

2.2 Methods

2.2.1 Database search

A search of the relevant wildlife database (NPWS wildlife atlas) was completed (23rd March 2010) to find records of State and Commonwealth Threatened species¹ within 10km of the Subject site.

These searches have recently been completed again (6th March 2012) to ensure the most up-to-date information is provided in the Preferred Project Report.

2.2.2 Site surveys

JWA 2008

Vegetation surveys were completed on the subject site in 2008 during the preparation of a Wetland Restoration Plan for Area E (JWA 2008). The focus of the assessment was the Freshwater wetland area, with cursory vegetation inspections completed in surrounding areas.

JWA 2010

A survey was completed at the Subject site on the 9th March 2010. Two scientists were present on the site for 1/2 day between approximately 11am and 4pm. Weather conditions were fine and hot.

All vegetated areas of the subject site were traversed in a random fashion and a plant species list was compiled. Plant communities were mapped with the aid of an aerial photograph and hand held G.P.S.

Targeted searches were completed for all Threatened flora species known from the locality (as recorded in the NPWS database search and literature review) and considered potential occurrences on the site.

JWA 2011

Further detailed site investigations were completed on the site in May 2011. This assessment was completed in accordance with the BioBanking Assessment Methodology (BAM) (DECCW 2008). The methodology and the results of the assessment are provided separately in **APPENDIX 6**.

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

2.3 Results

2.3.1 Database search

A search of the NSW BioNet database has revealed records of forty six (46) Threatened Flora species within 10km of the subject site (TABLE 1).

TABLE 1
THREATENED FLORA RECORDED WITHIN 10 KM OF THE SUBJECT SITE

SPECIES	COMMON NAME	TSC Act	EPBC Act
<i>Ochrosia moorei</i>	Southern ochrosia	E1	
<i>Davidsonia johnsonii</i>	Smooth Davidson's plum	E1	
<i>Eleocharis tetraquetra</i>	Square-stemmed spike-rush	E1	
<i>Diospyros mabacea</i>	Red-fruited ebony	E1	
<i>Diospyros major var. ebenus</i>	Shiny-leaved ebony	E1	
<i>Corokia whiteana</i>	Corokia	V	
<i>Acalypha eremorum</i>	Acalypha	E1	
<i>Chamaesyce psammogeton</i>	Sand spurge	E1	
<i>Phyllanthus microcladus</i>	Brush sauropus	E1	
<i>Cassia brewsteri var. marksiana</i>	Brush cassia	E1	
<i>Desmodium acanthocladum</i>	Thorny pea	V	
<i>Sophora tomentosa</i>	Silverbush	E1	
<i>Acacia bakeri</i>	Marblewood	V	
<i>Archidendron hendersonii</i>	White lace flower	V	
<i>Xylosma terrae-reginae</i>	Queensland xylosma	E1	
<i>Grammitis stenophylla</i>	Narrow-leaf finger fern	E1	
<i>Cryptocarya foetida</i>	Stinking cryptocarya	V	
<i>Endiandra hayesii</i>	Rusty rose walnut	V	
<i>Endiandra muelleri subsp. bracteata</i>	Green-leaved rose walnut	E1	
<i>Lindsaea brachypoda</i>	Short-footed screw fern	E1	
<i>Lindsaea fraseri</i>	Fraser's screw fern	E1	
<i>Angiopteris evecta</i>	Giant fern	E1	
<i>Tinospora tinosporoides</i>	Arrow-head vine	V	
<i>Gossia fragrantissima</i>	Sweet myrtle	E1	
<i>Syzygium hodgkinsoniae</i>	Red lilly pillly	V	
<i>Syzygium moorei</i>	Durobby	V	
<i>Geodorum densiflorum</i>	Pink nodding orchid	E1	
<i>Oberonia titania</i>	Red-flowered king of the fairies	V	
<i>Peristeranthus hillii</i>	Brown fairy-chain orchid	V	
<i>Phaius australis</i>	Southern swamp orchid	E1	
<i>Sarcochilus fitzgeraldii</i>	Ravine orchid	V	
<i>Floydia praealta</i>	Ball nut	V	

SPECIES	COMMON NAME	TSC Act	EPBC Act
<i>Grevillea hilliana</i>	Yiel yiel	E1	
<i>Hicksbeachia pinnatifolia</i>	Red boppel nut	V	
<i>Macadamia tetraphylla</i>	Rough-shelled bush nut	V	
<i>Oldenlandia galioides</i>		E1	
<i>Randia moorei</i>	Spiny gardenia	E1	
<i>Acronychia littoralis</i>	Scented acronychia	E1	
<i>Bosistoa transversa</i>	Yellow satinheart	V	
<i>Geijera paniculata</i>	Axe-breaker	E1	
<i>Cupaniopsis serrata</i>	Smooth tuckeroo	E1	
<i>Diploglottis campbellii</i>	Small-leaved tamarind	E1	
<i>Lepiderema pulchella</i>	Fine-leaved tuckeroo	V	
<i>Niemeyera whitei</i>	Rusty plum	V	
<i>Centranthera cochinchinensis</i>	Swamp foxglove	E1	
<i>Symplocos baeuerlenii</i>	Small-leaved hazelwood	V	

2.3.2 Site surveys

Seven (7) vegetation communities have been identified on the subject site and their locations and extent are shown in (FIGURE 1). One hundred and sixty-four (164) plant species have been recorded and are listed in APPENDIX 3.

Plant species recorded on the subject site include one (1) Threatened species - Rough-shelled bush nut (*Macadamia tetraphylla*), and one ROTAP species (Briggs & Leigh 1996) - Veiny lace flower (*Archidendron muellerianum*). The locations of these species are shown in FIGURE 2.

Two (2) Endangered Ecological Communities (EECs) are considered to occur (FIGURE 2):

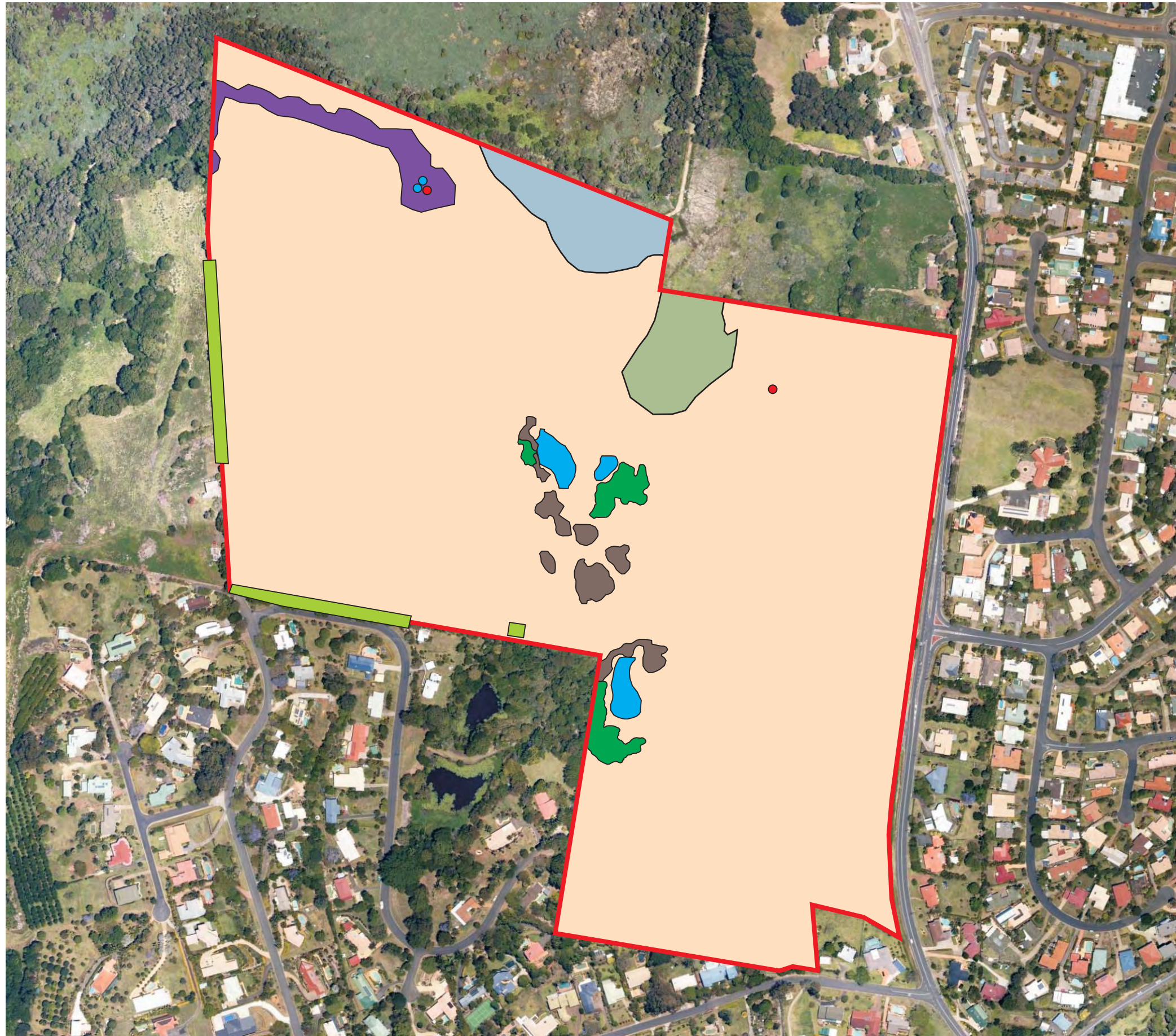
- Freshwater wetland;
- Lowland rainforest

2.3.3 Community descriptions

2.3.3.1 Introduction

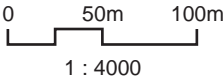
Seven (7) broad vegetation community types were recorded. Brief community descriptions are provided in TABLE 2 and detailed descriptions are provided in the following sections.

The conservation status of these communities is discussed with reference to the Comprehensive Regional Assessment completed for NSW Forest and Non-forest ecosystems as part of the Regional Forestry Agreement (RFA) process (CRA Unit 1999). The RFA establishes the framework for the management of the forests of upper north-east and lower north-east regions. The RFA document sets out percentage reservation status of forest and non-forest Ecosystems in the CAR



LEGEND

- Community 1 - Mid-high Closed Forest / Regrowth (Mixed rainforest species)
- Community 2 - Mid-high Wet Grassland +/- Sedgeland / Rushland (Mixed species)
- Community 3 - Mid-high Wet Grassland (*Setaria sp.*)
- Community 4 - Grazing Land / Abandoned Crops
- Community 5 - Pond / Dam Communities
- Community 6 - Tall closed forest (*Cinnamomum camphora*)
- Community 7 - Tall open moist sclerophyll forest (*Lophostemon confertus* +/- *Corymbia intermedia*)
- Rough-shelled bush nut (*Macadamia tetraphylla*)
- Planted Macadamia (Hybrid Species)
- Veiny lace flower (*Archidendron muellerianum*) (ROTAP)
- Site Outline



SOURCE: JWA Site Investigations;
Near Map Nov 2011 Aerial Photograph
SCALE: 1 : 4000 @ A3
JAMES WARREN & ASSOCIATES PTY LIMITED
Environmental Consultants

CLIENT
Newland Developers Pty Ltd
PROJECT
Ecological Assessment
Altitude Aspire
Fraser Drive, South Terranora, NSW
Shire of Tweed

APPENDIX 3
FIGURE 1
PREPARED: BW
DATE: 17 April 2013
FILE: N09031_Veg.cdr

TITLE
VEGETATION COMMUNITIES

Reserve System based on vegetation modelling to establish the pre-1750 extent of forest ecosystems in the region.

The conservation status is also discussed with regard to the Tweed Regional Vegetation Management Plan (Kingston *et al* 1999) and Tweed Vegetation Management Strategy (Ecograph 2004).

**TABLE 2
VEGETATION COMMUNITIES PRESENT ON THE SUBJECT SITE**

Community No.	Brief description
1	Mid-high closed forest/regrowth (Mixed rainforest species)
2	Mid-high wet grassland +/- sedgeland/rushland (Mixed species)
3	Mid-high wet grassland (<i>Setaria sp.</i>)
4	Grazing land/Abandoned crops
5	Pond/dam communities
6	Tall closed forest (<i>Cinnamomum camphora</i>)
7	Tall open moist sclerophyll forest (<i>Lophostemon confertus</i> +/- <i>Corymbia intermedia</i>)

2.3.3.2 Community 1 - Mid-high closed forest/regrowth (Mixed rainforest species)

Location and area

This community occurs in three (3) discrete patches in association with farm dams within the central gully on the subject site (**FIGURE 1**):

- Patch 1 = 251m²;
- Patch 2 = 1,593m²; and
- Patch 3 = 1,746m².

Description

Patch 1 - The canopy of this small patch is comprised of Bangalow palm, Red kamala and Guioa. The midstorey is comprised of a combination of Creek sandpaper fig, Foambark, Macaranga, Cheese tree and Lantana.

The groundcover in this small patch is comprised of a mixture of Soft bracken, Native raspberry and common agricultural grasses and weeds.

The vine species Scrambling lilly and Blood vine also occur.

Patch 2 - The canopy of this small patch is comprised of White fig, Bangalow palm, Red bean, Guioa and Red kamala. The midstorey is comprised of a combination of Creek sandpaper fig, Umbrella cheese tree, Macaranga, Cockspur, Wing-leaved tulip, Whalebone tree, Foambark and Lantana.

The groundcover in this small patch is comprised of a mixture of Batswing fern, Cunjevoi and common agricultural grasses and weeds.
The vine species Wombat berry also occurs.

Patch 3 - The canopy of this small patch is comprised of Bangalow palm, Cheese tree, Guioa and Red kamala. The midstorey is comprised of a combination of Creek sandpaper fig, Macaranga, Foambark, Straw tree fern and Lantana.

The groundcover in this small patch is comprised of a mixture of Batswing fern, Binung fern and common agricultural grasses and weeds.

The vine species Wombat berry also occurs.

Conservation Status

Under the CRA classification, this community type is best described by Forest Ecosystem 168 (Rainforest) (NPWS 1999). It must be noted that CRA (1999) does not provide for more detailed categorisation of rainforest, e.g. Littoral rainforest or Subtropical rainforest. The Regional Forestry Agreement document provides the following data on this ecosystem:

- 159211 hectares of this ecosystem type remains within the upper north east section of the NSW North Coast Bioregion. The original extent (ie. Pre 1750) has not been calculated.
- The extent present in the Comprehensive, Adequate and Representative (CAR) reserve system has not been determined.
- The ecosystem is considered to be Endangered.
- Rainforest communities have been identified as a priority for conservation on private land.

Under the Tweed Vegetation Management Strategy (Ecograph 2004) this ecosystem is classified Rainforest and Riparian - 102 Sub-tropical/ Warm Temperate Rainforest. The Tweed Vegetation Management Strategy (Ecograph 2004) provides the following data on this ecosystem:

- This ecosystem covers an area of approximately 9819 hectares (vegetated land), which represents approximately 12.99 % of the vegetated land in the shire, and 6.77 % of the shire;
- Adequately conserved.

This vegetation community is considered to represent the EEC Lowland Rainforest in NSW North Coast and Sydney Basin Bioregion (DECCW 2008).

2.3.3.3 Community 2 - Mid-high wet grassland +/- sedgeland/rushland (Mixed species)

Location and area

This community occurs in the low-lying northern portion of the subject site, adjacent to the SEPP 14 wetland, and covers a total area of 0.94ha (FIGURE 1).

Description

Species which commonly occur include Water couch, Tall flat sedge, Swamp rice grass, Common rush, Sag, Smart weed, Bushy starwort, Jointed twig rush, River buttercup, Frogsmouth, Swamp water fern and Umbrella sedge.

Conservation status

Under the CRA classification, this community is best described by Non-Forest Ecosystem 141 (Swamp) (NPWS 1999). The Regional Forestry Agreement document provides the following data on this ecosystem:

- 24118 hectares of this ecosystem type remains within the upper north east section of the NSW North Coast Bioregion. The original extent (i.e. Pre 1750) has not been calculated.
- The extent present in the Comprehensive, Adequate and Representative (CAR) reserve system has not been determined.
- The ecosystem is considered to be Endangered.

Under the Tweed Vegetation Management Strategy (Ecograph 2004) this ecosystem is classified as Sedgeland and related communities - 701 Sedgeland/Rushland. The Tweed Vegetation Management Strategy (Ecograph 2004) provides the following data on this ecosystem:

- This ecosystem covers an area of approximately 262 hectares (vegetated land), which represents approximately 0.38 % of the vegetated land in the shire and 0.20 % of the shire;
- Inadequately conserved over a major part of its range.

The conservation value of this community is reduced due to small size of the community, fragmentation and degradation caused by cattle grazing. The conservation value of this community is considered to be moderate.

This vegetation community is considered to represent the EEC Freshwater wetlands on coastal floodplains of the North Coast bio-region (DECCW 2008b).

2.3.3.4 Community 3 - Mid-high wet grassland (*Setaria sp.*)

Location and area

This community occurs as one (1) patch located in the east of the Subject site (FIGURE 1) and covers a total area of 0.82ha

Description

The patch of this community which occurs on the subject site is dominated by *Setaria* (*Setaria sphacelata*). Broad leaved paspalum and Giant parramatta grass (*Sporobolus indicus* var. *major*) are also prevalent. Various wetland species also occur including Common rush (*Juncus usitatus*) and Common spikerush (*Eleocharis acuta*). Some common agricultural grass and weed species also occur including Cotton bush, Fireweed and Purple top. Very few native species occur within this community.

Conservation status

Due to the almost exclusive presence of exotic species, along with cleared land and disturbed vegetation, conservation status is considered low.

2.3.3.5 Community 4 - Grazing land/abandoned crops

Location and area

This community occurs over the majority of the subject site and covers a total area of 32.52ha (FIGURE 1).

Description

Areas of land cultivated for Bananas and other crops occur throughout the subject site. Many of these areas are now abandoned however cattle are still using the area for grazing.

Conservation status

As this vegetation community is purely agricultural, conservation status does not apply.

2.3.3.6 Community 5 - Pond/dam communities

Location

Three (3) dams occur on the subject site (FIGURE 1) and cover a total area of 0.27ha.

Description

A few constructed dams/ponds occur on the subject site and contain common aquatic species such as Water lily (*Nymphaea* sp.) and Smartweed (*Persicaria* spp.). Fringing aquatic species include sedges and grasses e.g. *Juncus* spp., *Cyperus* spp, *Typha* sp.

Conservation status

Areas of vegetation within dams and ponds on the subject site have little conservation value. These environments are man-made, and contain weed species in addition to native vegetation. There is no appropriate CRA or TVMS classification for this community. The highly modified nature of the dams and associated drain lines lowers the conservation values.

No Significant plant species were found in this community. The conservation status of this community on the subject site is considered to be low.

2.3.3.7 Community 6 - Tall closed forest (*Cinnamomum camphora*)

Location and area

This community occurs in scattered patches within the central gully on the subject site (FIGURE 1) and covers a total area of 0.42ha.

Description

This community is generally dominated by Camphor laurel (*Cinnamomum camphora*). Few native species occur.

Conservation Status

There is no appropriate CRA or TVMS classification for this community. No Significant plant species were found in this community. The conservation status of this community on the subject site is considered to be low.

2.3.3.8 Community 7 - Tall open moist sclerophyll forest (*Lophostemon confertus* +/- *Corymbia intermedia*)

Location and area

This community occurs as one (1) patch in the north of the site (FIGURE 1) and covers an area of 0.63ha.

Description

The canopy is generally comprised of Brushbox (*Lophostemon confertus*) with emergent Pink bloodwood (*Corymbia intermedia*) to a height of 20m.

The mid-storey is comprised of a mixture of Foambark, Scentless rosewood, Red bean, Macaranga, Tuckeroo, Sweet pittosporum, Brown kurrajong, Umbrella cheese tree, Plum myrtle, Cudgerie, White bolly gum, Red kamala, Bennett's ash and Rough leaved elm. Smooth clerodendrum, Scrub turpentine and Birds nest ferns also occur sporadically. Various weed species also occur including Camphor laurel, Lantana, Winter senna, Cocos palms, Large-leaved privet, Passionfruit and Mickey mouse plant.

The understorey of this community is comprised of Gristle fern and decaying leaf. The climbers Asparagus fern (introduced) and Cockspur (*Maclura cochinchinensis*) also occur.

Common climbers and ground covers include the native species Common silkpod (*Parsonia straminea*), Scrambling lily, Cockspur, Prickly smilax, Corky prickly vine, Burney vine, Gristle fern, Rough maidenhair fern, Blue flax lily litter and the occasional Mat rush (*Lomandra hystrix*, *L. longifolia*). Weed species occurring as ground covers include Asparagus fern.

Conservation status

The most appropriate CRA classification for this community is of Forest Ecosystem 103 (Northern wet brushbox). The regional Forestry Agreement provides the following data on FE 103:

- 16,379 hectares of this ecosystem type remains within the upper north east section of the NSW North Coast Bioregion. The original extent (ie. Pre 1750) was approximately 25,433 hectares;
- The ecosystem is not considered to be Vulnerable or Rare.

Under the Tweed Vegetation Management Strategy (Ecograph 2004) this ecosystem is classified as Sclerophyll open forest on bedrock substrates - 207 Brushbox open forest complex. The Tweed Vegetation Management Strategy (Ecograph 2004) provides the following data on this ecosystem:

- This ecosystem covers an area of approximately 10,211 hectares (vegetated land), which represents approximately 14.88 % of the vegetated land in the shire, and 7.75 % of the shire;
- Adequately conserved.

The conservation status of this community is considered to be low to moderate.

2.3.4 Threatened & significant species

One (1) Threatened species was recorded (FIGURE 2):

- Two (2) stems of the Rough-shelled bush nut (*Macadamia tetraphylla*) [Threatened] Schedule 2 - Vulnerable TSC Act (1995) were recorded.

One (1) ROTAP species (Briggs & Leigh 1996) was recorded (FIGURE 2):

- Veiny lace flower (*Archidendron muellerianum*)

Two (2) of the broad vegetation communities, whilst heavily degraded, are representative of the Endangered Ecological Communities (EEC's) (FIGURE 2):

- Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions; and
- Lowland Rainforest in NSW North Coast and Sydney Basin Bioregion.

APPENDIX 4 - FLORA SPECIES LIST

Grouping	Family	Botanical Name	Common Name
Dicotyledons	Acanthaceae	<i>Pseuderanthemum variabile</i>	Pastel flower
Dicotyledons	Amaryllidaceae	<i>Crinum pedunculatum</i>	Crinum lily
Dicotyledons	Anacardiaceae	<i>Euroschinus falcata</i>	Ribbonwood
Dicotyledons	Anacardiaceae	<i>Mangifera indica*</i>	Mango
Dicotyledons	Annonaceae	<i>Meiogyne stenopetala</i>	
Dicotyledons	Apiaceae	<i>Centella asiatica</i>	Pennywort
Dicotyledons	Apiaceae	<i>Hydrocotyle peduncularis</i>	Hydrocotyle
Dicotyledons	Apocynaceae	<i>Alyxia ruscifolia</i>	Prickly alyxia
Dicotyledons	Apocynaceae	<i>Carissa ovata</i>	Currant bush
Dicotyledons	Apocynaceae	<i>Melodinus australis</i>	Southern melodinus
Dicotyledons	Apocynaceae	<i>Parsonsia straminea</i>	Common silkpod
Dicotyledons	Apocynaceae	<i>Tabernaemontana pandacaqui</i>	Banana bush
Dicotyledons	Araliaceae	<i>Astrotricha latifolia</i>	Broad-leaf flannel bush
Dicotyledons	Araliaceae	<i>Polyscias elegans</i>	Celerywood
Dicotyledons	Araliaceae	<i>Schefflera actinophylla</i>	Umbrella tree
Dicotyledons	Arecaceae	<i>Archontophoenix cunninghamiana</i>	Bangalow palm
Dicotyledons	Asclepiadaceae	<i>Gomphocarpus physocarpus*</i>	Balloon cotton bush
Dicotyledons	Asclepiadaceae	<i>Hoya australis</i>	Native hoyo
Dicotyledons	Asteraceae	<i>Ageratina adenophora*</i>	Crofton weed
Dicotyledons	Asteraceae	<i>Ageratina riparia*</i>	Mistflower
Dicotyledons	Asteraceae	<i>Ageratum houstonianum*</i>	Blue billygoat weed
Dicotyledons	Asteraceae	<i>Baccharis halimifolia*</i>	Groundsel bush
Dicotyledons	Asteraceae	<i>Bidens pilosa*</i>	Cobblers pegs
Dicotyledons	Asteraceae	<i>Carduus sp.*</i>	Milk thistle
Dicotyledons	Asteraceae	<i>Cirsium vulgare*</i>	Black thistle
Dicotyledons	Asteraceae	<i>Conyza albida*</i>	Fleabane
Dicotyledons	Asteraceae	<i>Crassocephalum crepidioides*</i>	Thickhead
Dicotyledons	Asteraceae	<i>Eclipta prostrata</i>	White eclipta
Dicotyledons	Asteraceae	<i>Enydra fluctuans</i>	
Dicotyledons	Asteraceae	<i>Hypochoeris radicata*</i>	Flatweed
Dicotyledons	Asteraceae	<i>Senecio madagascariensis*</i>	Fireweed
Dicotyledons	Asteraceae	<i>Soliva pterosperma*</i>	Bindii
Dicotyledons	Asteraceae	<i>Tagetes minuta*</i>	Stinking roger
Dicotyledons	Asteraceae	<i>Taraxacum officinale*</i>	Dandelion
Dicotyledons	Asteraceae	<i>Vernonia cinerea</i>	
Dicotyledons	Asteraceae	<i>Wedelia trilobata*</i>	Singapore daisy
Dicotyledons	Asteraceae	<i>Xanthium occidentale*</i>	Noogoora burr
Dicotyledons	Basellaceae	<i>Anredera cordifolia*</i>	Madeira vine
Dicotyledons	Bignoniaceae	<i>Pandorea jasminoides</i>	Bower vine
Dicotyledons	Boraginaceae	<i>Ehretia acuminata</i>	Koda
Dicotyledons	Caesalpiniaceae	<i>Senna pendula var. glabrata*</i>	Winter senna
Dicotyledons	Caesalpinoideae	<i>Caesalpinia subtropica</i>	Corky prickly vine
Dicotyledons	Capparaceae	<i>Capparis arborea</i>	Brush caper berry
Dicotyledons	Caryophyllaceae	<i>Stellaria media*</i>	Chick weed
Dicotyledons	Casuarinaceae	<i>Allocasuarina littoralis</i>	Black she-oak
Dicotyledons	Casuarinaceae	<i>Casuarina glauca</i>	Swamp she-oak

Grouping	Family	Botanical Name	Common Name
Dicotyledons	Celastraceae	<i>Denhamia celastroides</i>	Denhamia
Dicotyledons	Celastraceae	<i>Hedraianthera porphyropetala</i> ^{RS}	Hedraianthera
Dicotyledons	Convolvulaceae	<i>Ipomoea cairica</i> *	Coastal morning glory
Dicotyledons	Convolvulaceae	<i>Ipomoea indica</i> *	Morning glory
Dicotyledons	Cunoniaceae	<i>Caldcluvia paniculosa</i>	Soft corkwood
Dicotyledons	Cunoniaceae	<i>Pseudoweinmannia lachnocarpa</i>	Rose Marara
Dicotyledons	Dilleniaceae	<i>Hibbertia scandens</i>	Climbing guinea flower
Dicotyledons	Dioscoreaceae	<i>Dioscorea transversa</i>	Native yam
Dicotyledons	Ebenaceae	<i>Diospyros pentamera</i>	Myrtle ebony
Dicotyledons	Elaeocarpaceae	<i>Elaeocarpus grandis</i>	Blue quandong
Dicotyledons	Elaeocarpaceae	<i>Elaeocarpus obovatus</i>	Hard quandong
Dicotyledons	Elaeocarpaceae	<i>Elaeocarpus reticulatus</i>	Blueberry ash
Dicotyledons	Elaeocarpaceae	<i>Sloanea woollsii</i>	Yellow carabeen
Dicotyledons	Escalloniaceae	<i>Argophyllum nullemense</i> ^{RT}	Silver leaf
Dicotyledons	Euphorbiaceae	<i>Baloghia inophylla</i>	Brush bloodwood
Dicotyledons	Euphorbiaceae	<i>Breynia oblongifolia</i>	Coffee bush
Dicotyledons	Euphorbiaceae	<i>Glochidion ferdinandi</i> var. <i>ferdinandi</i>	Cheese tree
Dicotyledons	Euphorbiaceae	<i>Glochidion sumatranum</i> ^{RS}	Umbrella cheese tree
Dicotyledons	Euphorbiaceae	<i>Homalanthus populifolius</i>	Native bleeding heart
Dicotyledons	Euphorbiaceae	<i>Macaranga tanarius</i>	Macaranga
Dicotyledons	Euphorbiaceae	<i>Mallotus claoxyloides</i>	Green Kamala
Dicotyledons	Euphorbiaceae	<i>Mallotus phillippensis</i>	Red kamala
Dicotyledons	Eupomatiaceae	<i>Eupomatia laurina</i>	Bolwarra
Dicotyledons	Fabaceae	<i>Callerya megasperma</i>	Native wistaria
Dicotyledons	Fabaceae	<i>Desmodium uncinatum</i> *	Silver-leaved desmodium
Dicotyledons	Faboideae	<i>Castanospermum australe</i>	Black bean
Dicotyledons	Faboideae	<i>Kennedia rubicundra</i>	Purple running pea
Dicotyledons	Lauraceae	<i>Cinnamomum camphora</i> *	Camphor laurel
Dicotyledons	Lauraceae	<i>Cryptocarya laevigata</i> ^{RS}	Glossy laurel
Dicotyledons	Lauraceae	<i>Cryptocarya microneura</i>	Murrogun
Dicotyledons	Lauraceae	<i>Cryptocarya obovata</i>	Pepperberry tree
Dicotyledons	Lauraceae	<i>Cryptocarya triplinervis</i> var. <i>pubens</i>	Three-veined laurel (hairy form)
Dicotyledons	Lauraceae	<i>Endiandra globosa</i> ^{RT}	Black walnut
Dicotyledons	Lauraceae	<i>Endiandra pubens</i>	Hairy walnut
Dicotyledons	Lauraceae	<i>Endiandra sieberi</i>	Hard corkwood
Dicotyledons	Lauraceae	<i>Neolitsea dealbata</i>	White bolly gum
Dicotyledons	Lauraceae	<i>Pratia purpurascens</i>	White root
Dicotyledons	Melastomataceae	<i>Melastoma affine</i>	Native lasiandra
Dicotyledons	Meliaceae	<i>Dysoxylum fraserianum</i>	Rosewood
Dicotyledons	Meliaceae	<i>Synoum glandulosum</i>	Scentless rosewood
Dicotyledons	Menispermaceae	<i>Stephania japonica</i>	Snake vine
Dicotyledons	Mimosaceae	<i>Acacia melanoxylon</i>	Blackwood wattle
Dicotyledons	Mimosaceae	<i>Archidendron muellerianum</i> ^{RT}	Veiny lace flower
Dicotyledons	Monimiaceae	<i>Wilkiea austroqueenslandica</i> ^{RS}	Smooth wilkiea
Dicotyledons	Monimiaceae	<i>Wilkiea huegeliana</i>	Veiny wilkiea
Dicotyledons	Moraceae	<i>Ficus coronata</i>	Creek sandpaper fig
Dicotyledons	Moraceae	<i>Ficus macrophylla</i>	Moreton bay fig

Grouping	Family	Botanical Name	Common Name
Dicotyledons	Moraceae	<i>Ficus virens</i> ^{RS}	White fig
Dicotyledons	Moraceae	<i>Ficus watkinsiana</i>	Strangler fig
Dicotyledons	Moraceae	<i>Maclura cochinchinensis</i>	Cockspur
Dicotyledons	Moraceae	<i>Streblus brunonianus</i>	Whalebone tree
Dicotyledons	Moraceae	<i>Trophis scandens</i>	Burny vine
Dicotyledons	Musaceae	<i>Musa paradisiaca</i> *	Banana
Dicotyledons	Myrsinaceae	<i>Ardisia bakeri</i> ^{RT}	Ardisia
Dicotyledons	Myrtaceae	<i>Acmena hemilampra</i> ^{RS}	Broad leaved lilly-pilly
Dicotyledons	Myrtaceae	<i>Acmena smithii</i>	Common lilly pilly
Dicotyledons	Myrtaceae	<i>Corymbia intermedia</i>	Pink bloodwood
Dicotyledons	Myrtaceae	<i>Lophostemon suaveolens</i>	Swamp box
Dicotyledons	Myrtaceae	<i>Lophostemon confertus</i>	Brushbox
Dicotyledons	Myrtaceae	<i>Melaleuca quinquenervia</i>	Broad-leaved paperbark
Dicotyledons	Myrtaceae	<i>Ptilidostigma glabrum</i>	Plum myrtle
Dicotyledons	Myrtaceae	<i>Syzygium oleosum</i>	Blue lilly pilly
Dicotyledons	Ochnaceae	<i>Ochna serrulata</i> *	Mickey mouse plant
Dicotyledons	Oleaceae	<i>Ligustrum lucidum</i> *	Large-leaved privet
Dicotyledons	Oleaceae	<i>Ligustrum sinense</i> *	Small-leaved privet
Dicotyledons	Oleaceae	<i>Notelaea longifolia</i>	Large mock olive
Dicotyledons	Oleaceae	<i>Olea paniculata</i>	Native Olive
Dicotyledons	Passifloraceae	<i>Passiflora edulis</i> *	Passionfruit
Dicotyledons	Passifloraceae	<i>Passiflora suberosa</i> var. <i>suberosa</i> *	Corky passionfruit
Dicotyledons	Passifloraceae	<i>Passiflora subpeltata</i> *	White passionflower
Dicotyledons	Phytolaccaceae	<i>Rivina humilis</i> *	Coral berry
Dicotyledons	Pittosporaceae	<i>Pittosporum multiflorum</i>	Orange thorn
Dicotyledons	Pittosporaceae	<i>Pittosporum revolutum</i>	Hairy pittosporum
Dicotyledons	Pittosporaceae	<i>Pittosporum undulatum</i>	Sweet pittosporum
Dicotyledons	Polygonaceae	<i>Persicaria strigosa</i> *	Smartweed
Dicotyledons	Proteaceae	<i>Macadamia tetraphylla</i>	Rough-shelled bush nut
Dicotyledons	Ranunculaceae	<i>Ranunculus inundatus</i>	River buttercup
Dicotyledons	Rhamnaceae	<i>Alphitonia excelsa</i>	Red ash
Dicotyledons	Rubiaceae	<i>Atractocarpus benthamiana</i>	Native gardenia
Dicotyledons	Rubiaceae	<i>Morinda jasminoides</i>	Morinda
Dicotyledons	Rubiaceae	<i>Pomax umbellata</i>	Pomax
Dicotyledons	Rubiaceae	<i>Psychotria loniceroides</i>	Hairy psychotria
Dicotyledons	Rutaceae	<i>Melicope elleryana</i> ^{RS}	Pink-flowered doughwood
Dicotyledons	Rutaceae	<i>Zieria smithii</i>	Sandfly ziera
Dicotyledons	Sapindaceae	<i>Arytera distylis</i> ^{RS}	Twin-leaved coogera
Dicotyledons	Sapindaceae	<i>Cupaniopsis newmanii</i> ^{RT}	Long-leaved tuckeroo
Dicotyledons	Sapindaceae	<i>Elattostachys nervosa</i>	Green tamarind
Dicotyledons	Sapindaceae	<i>Guioa semiglauc</i>	Guioa
Dicotyledons	Sapindaceae	<i>Jagera pseudorhus</i>	Foambark
Dicotyledons	Sapindaceae	<i>Mischocarpus pyriformis</i>	Yellow pear fruit
Dicotyledons	Sapotaceae	<i>Pouteria chartacea</i>	Thin-leaved condoo
Dicotyledons	Solanaceae	<i>Solanum mauritianum</i> *	Wild tobacco tree
Dicotyledons	Solanaceae	<i>Solanum nigrum</i> *	Black-berry nightshade
Dicotyledons	Solanaceae	<i>Solanum seafortianum</i> *	Brazilian nightshade
Dicotyledons	Sterculiaceae	<i>Commersonia bartramia</i>	Brown kurrajong

Grouping	Family	Botanical Name	Common Name
Dicotyledons	Thymelaeaceae	<i>Wikstroemia indica</i>	Wikstromeia
Dicotyledons	Ulmaceae	<i>Aphananthe philippinensis</i>	Rough-leaved elm
Dicotyledons	Verbenaceae	<i>Lantana camara</i> *	Lantana
Dicotyledons	Vitaceae	<i>Cissus antarctica</i>	Water vine
Dicotyledons	Vitaceae	<i>Cissus hypoglauca</i>	Five-leaf water vine
Ferns and Fern Allies	Adiantaceae	<i>Adiantum hispidulum</i>	Rough maidenhair
Ferns and Fern Allies	Adiantaceae	<i>Pellaea falcata</i>	Sickle fern
Ferns and Fern Allies	Aspleniaceae	<i>Asplenium australasicum</i>	Bird's nest fern
Ferns and Fern Allies	Athyriaceae	<i>Diplazium dilatatum</i>	Lady fern
Ferns and Fern Allies	Blechnaceae	<i>Blechnum cartilagineum</i>	Gristle fern
Ferns and Fern Allies	Blechnaceae	<i>Blechnum indicum</i>	Swamp water fern
Ferns and Fern Allies	Blechnaceae	<i>Doodia aspera</i>	Rasp fern
Ferns and Fern Allies	Cyatheaceae	<i>Cyathea leichhardtiana</i>	Prickly tree fern
Ferns and Fern Allies	Davalliaceae	<i>Nephrolepis cordifolia</i> *	Fishbone fern
Ferns and Fern Allies	Dennstaedtiaceae	<i>Pteridium esculentum</i>	Bracken
Ferns and Fern Allies	Dryopteridaceae	<i>Lastreopsis munita</i>	Naked shield fern
Ferns and Fern Allies	Glecheniaceae	<i>Histiopteris incisa</i>	Batswing fern
Ferns and Fern Allies	Nephrolepidaceae	<i>Arthropteris tenella</i>	A climbing fern
Ferns and Fern Allies	Pteridaceae	<i>Acrostichum speciosum</i>	Mangrove fern
Ferns and Fern Allies	Schizaeaceae	<i>Lygodium microphyllum</i>	Climbing snake fern
Monocotyledons	Araceae	<i>Alocasia brisbanensis</i>	Cunjevoi
Monocotyledons	Araceae	<i>Pothos longipes</i>	Pothos vine
Monocotyledons	Arecaceae	<i>Calamus muelleri</i>	Lawyer vine
Monocotyledons	Arecaceae	<i>Livistona australis</i>	Cabbage palm
Monocotyledons	Asparagaceae	<i>Asparagus aethiopicus</i> *	Asparagus fern
Monocotyledons	Asparagaceae	<i>Asparagus plumosus</i> *	Climbing asparagus fern
Monocotyledons	Asteliaceae	<i>Cordyline petiolaris</i>	Broad-leaved palm lily
Monocotyledons	Asteliaceae	<i>Cordyline rubra</i>	Red-fruited palm lily
Monocotyledons	Commelinaceae	<i>Commelina cyanea</i>	Native wandering jew
Monocotyledons	Cyperaceae	<i>Baumea articulata</i>	Jointed twig-rush
Monocotyledons	Cyperaceae	<i>Baumea juncea</i>	Bare twig-rush
Monocotyledons	Cyperaceae	<i>Baumea rubiginosa</i>	Soft twig-rush
Monocotyledons	Cyperaceae	<i>Carex appressa</i>	Tall sedge
Monocotyledons	Cyperaceae	<i>Cyperus eragrostis</i> *	Tussock sedge
Monocotyledons	Cyperaceae	<i>Cyperus exaltatus</i>	Tall flat-sedge
Monocotyledons	Cyperaceae	<i>Cyperus polystachyos</i> var <i>polystachyos</i>	Bunchy sedge
Monocotyledons	Cyperaceae	<i>Cyperus rotundus</i>	Nutgrass

Grouping	Family	Botanical Name	Common Name
Monocotyledons	Cyperaceae	<i>Cyperus stradbokensis</i>	Sedge
Monocotyledons	Cyperaceae	<i>Eleocharis equisetina</i>	Common spike-rush
Monocotyledons	Cyperaceae	<i>Eleocharis sphacelata</i>	Tall spikerush
Monocotyledons	Cyperaceae	<i>Fimbristylis ferruginea</i>	Rusty finger-rush
Monocotyledons	Cyperaceae	<i>Gahnia sieberiana</i>	Red-fruited saw-sedge
Monocotyledons	Cyperaceae	<i>Lepidosperma laterale</i>	Variable sword-sedge
Monocotyledons	Cyperaceae	<i>Lepironia articulata</i>	Giant sedge
Monocotyledons	Cyperaceae	<i>Schoenus brevifolius</i>	Zig-zag bog rush
Monocotyledons	Flagellariaceae	<i>Flagellaria indica</i>	Whip vine
Monocotyledons	Juncaceae	<i>Juncus usitatus</i>	Common rush
Monocotyledons	Lomandraceae	<i>Lomandra longifolia</i>	Long-leaved matrush
Monocotyledons	Luzuriagaceae	<i>Eustrephus latifolius</i>	Wombat berry
Monocotyledons	Luzuriagaceae	<i>Geitonoplesium cymosum</i>	Scrambling lily
Monocotyledons	Philydraceae	<i>Philydrum lanuginosum</i>	Frogsmouth
Monocotyledons	Phormiaceae	<i>Dianella caerulea</i>	Blue flax lily
Monocotyledons	Poaceae	<i>Andropogon virginicus</i> *	Whiskey grass
Monocotyledons	Poaceae	<i>Axonopus fissifolius</i> *	Narrow-leaf carpet grass
Monocotyledons	Poaceae	<i>Chloris gayana</i> *	Rhodes grass
Monocotyledons	Poaceae	<i>Cynodon dactylon</i> *	Couch grass
Monocotyledons	Poaceae	<i>Digitaria didactyla</i> *	Queensland blue couch
Monocotyledons	Poaceae	<i>Digitaria parviflora</i>	Small-flowered finger grass
Monocotyledons	Poaceae	<i>Entolasia stricta</i>	Wiry panic
Monocotyledons	Poaceae	<i>Eragrostis</i> sp.	Lovegrass
Monocotyledons	Poaceae	<i>Hemarthria uncinata</i>	Matgrass
Monocotyledons	Poaceae	<i>Imperata cylindrica</i>	Blady grass
Monocotyledons	Poaceae	<i>Ischaemum australe</i>	Swamp grass
Monocotyledons	Poaceae	<i>Leersia hexandra</i>	Swamp ricegrass
Monocotyledons	Poaceae	<i>Melinis minutiflora</i> *	Molasses grass
Monocotyledons	Poaceae	<i>Melinis repens</i> *	Red natal grass
Monocotyledons	Poaceae	<i>Paspalum conjugatum</i> *	Sour grass
Monocotyledons	Poaceae	<i>Paspalum dilatatum</i> *	Paspalum
Monocotyledons	Poaceae	<i>Paspalum paspalodes</i>	Water couch
Monocotyledons	Poaceae	<i>Paspalum wettsteinii</i> *	Broad-leaved paspalum
Monocotyledons	Poaceae	<i>Phragmites australis</i>	Common reed
Monocotyledons	Poaceae	<i>Setaria</i> sp.*	Pigeon grass
Monocotyledons	Poaceae	<i>Urochloa mutica</i> *	Para grass
Monocotyledons	Ripogonaceae	<i>Ripogonum album</i>	White supplejack
Monocotyledons	Smilacaceae	<i>Smilax australis</i>	Prickly smilax
Monocotyledons	Smilacaceae	<i>Smilax glyciphylla</i>	Smooth smilax
Monocotyledons	Zingiberaceae	<i>Alpinia caerulea</i>	Native ginger

*Introduced Species

Threatened species are shown in bold

^{RS} Non- ROTAP regionally common taxa that reach their southern limit in NSW (Sheringham & Westway 1995)

^{RT} ROTAP Flora of NSW - Briggs & Leigh 1996

APPENDIX 5 - FAUNA ASSESSMENT

1 FAUNA ASSESSMENT

1.1 Introduction

The methods used in determining which fauna species use, or are likely to use, the Study area and a discussion of the results of fauna surveys are provided in this section.

1.2 Methods

1.2.1 Database Search

A search of the relevant wildlife database (NPWS wildlife atlas) was completed (23rd March 2010) to find records of State and Commonwealth Threatened species² within 10km of the Subject site.

These searches have recently been completed again (6th March 2012) to ensure the most up-to-date information is provided in the Preferred Project Report.

1.2.2 Habitat Assessment

Site habitats were assessed to determine their value for native fauna species. The assessment focused on identifying habitat features associated with Threatened species as well as other native fauna groups. Particular attention was paid to habitat features such as:

- The presence of mature trees with hollows, fissures and/or other suitable roosting/nesting places.
- The presence of Koala food trees.
- The presence of preferred Glossy black cockatoo feed trees (Forest oak and/or Black she-oak).
- The presence of Yellow-bellied glider feeding scars.
- Condition, flow and water quality of drainage lines and bodies of water.
- Areas of dense vegetation.
- Presence of hollow logs/debris and areas of dense leaf litter.
- Presence of fruiting flora species.
- Presence of blossoming flora species, particularly winter-flowering species.
- Vegetation connectivity and proximity to neighbouring areas of intact vegetation.
- Presence of caves and man-made structures suitable as microchiropteran bat roost sites.

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

Each Threatened species known from the locality was regarded as *Likely*, *Possible* or *Unlikely* to occur on the Subject site based on the occurrence of suitable habitat characteristics. A rating of *Likely* was given for those species where breeding or high quality habitat is present on the site; a rating of *Possible* was given for those species where suitable foraging or roosting habitat is present on the site; and a rating of *Unlikely* was given for species where no suitable habitat occurs on the site.

1.2.3 Fauna Surveys

JWA 2008

An opportunistic fauna survey was completed on the subject site in 2008 in association with the vegetation survey. The focus of the assessment was the Freshwater wetland area, with cursory inspections completed in surrounding areas.

JWA 2010

An opportunistic fauna survey was completed at the Subject site on the 9th March 2010 in conjunction with the vegetation survey. Two scientists were present on the site for 1/2 day between approximately 11am and 4pm. Weather conditions were fine and hot.

Logs, sheets of tin, cardboard, bark and leaves were overturned in search of reptiles and amphibians while incidentally traversing the site. Diggings were searched for signs of droppings. The site was actively searched for scats and bones. Active observation of bird activity was undertaken.

JWA 2011

A further opportunistic fauna survey was completed on the site in May 2011 in association with the vegetation survey.

Logs, sheets of tin, cardboard, bark and leaves were overturned in search of reptiles and amphibians while incidentally traversing the site. Diggings were searched for signs of droppings. The site was actively searched for scats and bones. Active observation of bird activity was undertaken.

1.3 Results and Discussion

1.3.1 Results of Database Search

A search of the NSW BioNet database revealed records of thirty-three (33) significant fauna species, and one (1) significant fauna population, within 10km of the subject site (TABLE 1). Oceanic and coastal species (i.e. Humpback whale, Flesh-footed shearwater etc.) have been omitted from the results as they will not occur on the subject site.

TABLE 1
RECORDS OF SIGNIFICANT FAUNA WITHIN 10 KM OF THE SUBJECT SITE

Common Name	Scientific Name	Status	
		TSC Act (1995)*	EPBC Act (1999)#
INVERTEBRATES			
Mitchell's rainforest snail	<i>Thersites mitchellae</i>	E ¹	CE
BIRDS			
Barking owl	<i>Ninox connivens</i>	V	-
Barred cuckoo-shrike	<i>Coracina lineata</i>	V	-
Black-necked stork	<i>Ephippiorhynchus asiaticus</i>	E ¹	-
Bush-hen	<i>Amaurornis olivaceus</i>	V	-
Bush stone-curlew	<i>Burhinus grallarius</i>		
Collared kingfisher	<i>Todiramphus chloris</i>	V	-
Comb-crested jacana	<i>Irediparra gallinacea</i>	V	-
Grass owl	<i>Tyto capensis</i>	V	-
Magpie goose	<i>Anseranas semipalmata</i>		
Mangrove honeyeater	<i>Lichenostomus fasciocularis</i>	V	-
Rose-crowned fruit-dove	<i>Ptilinopus regina</i>	V	-
White-eared monarch	<i>Monarcha leucotis</i>	V	-
Wompoo fruit-dove	<i>Ptilinopus magnificus</i>	V	-
MAMMALS			
Beccari's freetail-bat	<i>Mormopterus beccarii</i>	V	-
Eastern bentwing bat	<i>Miniopterus schreibersii oceanensis</i>	V	-
Eastern long-eared Bat	<i>Nyctophilus bifax</i>	V	-
Grey-headed flying-fox	<i>Pteropus poliocephalus</i>	V	V
Koala	<i>Phascolarctos cinereus</i>	V	-
Little bentwing bat	<i>Miniopterus australis</i>	V	-
Spotted-tail quoll	<i>Dasyurus maculatus maculatus</i>	V	E
Yellow-bellied sheath-tail bat	<i>Saccolaimus flaviventris</i>		

* V, E¹ & E² is Vulnerable, Endangered or an Endangered Population under the TSC Act 1995;

CE, E, V & M is Critically Endangered, Endangered, Vulnerable & Migratory under the EPBC Act 1999.

1.3.2 Habitat Assessment

1.3.2.1 Amphibians

Amphibians occurring in the region are poikilothermic, predominantly insectivorous and generally require free water for reproduction, with the exception of two highland genera (*Assa darlingtoni* and *Philoria* spp.) The habitat requirements of most species are unlikely to be determined by forest cover or floristics, but are more strongly influenced by factors such as climate, distance to water bodies, riparian vegetation, hydrological and morphological characteristics of water bodies and the availability of suitable micro-habitat for aestivation and shelter.

The degraded wetlands and farm dams that occur on the subject site are likely to provide habitat for commonly occurring amphibian species such as the Green tree frog (*Litoria caerulea*), Eastern dwarf tree frog (*Litoria fallax*) and Common eastern froglet (*Crinia signifera*).

Grasslands provide suitable habitat for a range of Amphibian species, particularly along drainage depressions and soaks. Species commonly encountered in grassland communities include the Common eastern froglet, Eastern sign-bearing froglet (*Crinia parinsignifera*), Striped marsh frog (*Limnodynastes peronii*), Spotted grass frog (*Limnodynastes tasmaniensis*), Eastern dwarf tree frog, Rocket frog (*Litoria nasuta*), Whistling tree frog (*Litoria verreauxii*) and the introduced Cane toad (*Bufo marinus*).

The Paperbark communities on and adjacent would suggest that habitat may occur for the Threatened Acid frog species - Wallum froglet (*Crinia tinnula*) however this SEPP 14 Wetland appears to be tidally influenced to some extent (evidenced by scattered mangroves) which may preclude this species. Furthermore, no evidence of this species was recorded on the subject site. This species, if it does occur, may extend into the adjacent forest and grassland communities during suitable periods (i.e. localised flooding after heavy rain).

Species which typically occur in low elevation Rainforest and permanent streams such as the Giant barred frog (*Mixophyes iteratus*) are unlikely to occur at the subject site.

1.3.2.2 Reptiles

As reptiles are poikilothermic, and predominantly insectivorous or carnivorous, their habitat requirements are less directly determined by vegetation species composition than other taxa which feed directly on plants. Reptile distributions are strongly influenced by structural characteristics of the vegetation, climate and other factors affecting thermoregulation such as shade and availability of shelter and basking sites (Smith *et al* 1994).

The subject site is likely to represent suitable habitat for commonly occurring reptile species such as Common garden skink (*Lampropholis delicata*), Friendly sun skink (*Lampropholis amicula*) and Carpet python (*Morelia spilota*).

Adjacent residential and agricultural uses may have resulted in a proliferation of introduced small mammals such as the House mouse (*Mus musculus*) and Black rat (*Rattus rattus*) which in turn provide prey for snakes such as the Red-bellied black snake (*Pseudechis porphyriacus*), Carpet python, Swamp snake (*Hemiaspis signata*) and Eastern brown snake (*Pseudonaja textilis*).

1.3.2.3 Birds

The subject site provides suitable habitat for a range of disturbance adapted open country birds such as the Magpie (*Gymnorhina tibicen*), Lewin's honeyeater (*Meliphaga lewinii*), Torresian crow (*Corvus orru*), Magpie-lark (*Grallina cyanoleuca*) and Noisy miner (*Manorina melanocephala*).

Degraded wetlands and farm dams on the subject site are likely to generate a substantial food source for insectivorous birds such as the Willie wagtail (*Rhipidura*

leucophrys), Grey fantail (*Rhipidura fuliginosa*), Spangled drongo (*Dicrurus bracteatus*), Welcome swallow (*Hirundo neoxena*) etc.

As previously discussed, residential and agricultural use of adjacent land may have resulted in a proliferation of introduced small mammals. These small mammals, as well as reptile species on the subject site, are likely to provide a food resource for various species of diurnal raptors, such as the Black-shouldered kite (*Elanus axillaris*), Brown falcon (*Falco berigora*) and Whistling kite (*Haliastur sphenurus*), as well as for nocturnal raptors such as the Barn owl (*Tyto alba*).

The degraded wetlands occurring on the subject site may provide habitat for crepuscular species such as Rails and Crakes however disturbance by cattle grazing is considered likely to preclude any migratory waders.

Paperbark communities in the northern portion of the subject site, as well as the adjoining SEPP 14 Wetland, are likely to provide a forage resource for nectarivorous birds such as the Rainbow lorikeet (*Trichoglossus haematodus*), Scaly-breasted lorikeet (*Trichoglossus chlorolepidotus*), Scarlet honeyeater (*Myzomela sanguinolenta*), Eastern spinebill (*Acanthorhynchus tenuirostris*) and White-eared Honeyeater (*Lichenostomus leucotis*).

Patches of regrowth rainforest vegetation and scattered mature trees on and adjacent to the subject site may provide forage resources for frugivorous birds, particularly scattered mature Figs.

1.3.2.4 Mammals

Small terrestrial mammals generally occur in highest densities in association with a complex vegetation structure. A dense understorey layer, which provides shelter from predators and provides nesting opportunities, is particularly important. As previously discussed, residential and commercial use of adjacent land may have been likely to result in a proliferation of introduced small mammals.

In general medium-large terrestrial mammals such as macropods select habitats which provide a dense cover for shelter and refuge and open areas for feeding. The larger species tend to occupy drier more open habitats: the smaller species, moister and more densely vegetated habitats.

All Arboreal mammals that occur in the region (with the exception of the Koala) utilise tree hollows for nesting and shelter (although the Common ringtail possum is not dependent on hollows). Smith & Lindenmeyer (1988) consider that shortage of nest hollows is likely to limit arboreal mammal populations where density of hollow bearing trees is less than 2 to 8 trees per hectare. Hollow-bearing trees are generally absent from the subject site. However, common species that also utilise constructed dreys (i.e. Common ringtail possum) may occur.

Insectivorous bats like insectivorous birds overlap considerably in diet and broad vegetation preferences (Hall 1981), but specialise in foraging in specific layers or substrates within the forest (Crome and Richards 1988). The Study area is likely to provide forage habitat for a relatively high diversity and abundance of insectivorous bats, due to the combination of open, forested and denser areas of vegetation. The site provides a number of flowering species and mature fig trees and represents

potential foraging habitat for the Commonwealth Threatened species Grey-headed flying-fox (*Pteropus poliocephalus*).

1.3.3 Fauna Survey

1.3.3.1 Introduction

This section provides the results of all records and observations of fauna for the duration of the survey.

1.3.3.2 Amphibians

Four (4) amphibian species were recorded during site surveys, and are shown in TABLE 3. No Threatened amphibians were recorded.

**TABLE 3
AMPHIBIAN SPECIES RECORDED ON THE SUBJECT SITE**

Common name	Scientific name	Method of identification
Common eastern froglet	<i>Crinia signifera</i>	Call
Eastern dwarf tree frog	<i>Litoria fallax</i>	Call
Striped marsh frog	<i>Limnodynastes peronii</i>	Call, Capture (Active searches)
Cane toad	<i>Bufo marinus</i>	Capture (Active searches)

1.3.3.3 Reptiles

Four (4) reptile species were recorded during the fauna survey and are shown in TABLE 4. No Threatened reptiles were recorded.

**TABLE 4
REPTILE SPECIES RECORDED ON THE SUBJECT SITE**

Common name	Scientific name	Method of identification
Dark flecked sun skink	<i>Lampropholis guichenoti</i>	Capture (Active searches)
Common garden skink	<i>Lampropholis delicata</i>	Capture (Active searches)
Eastern water dragon	<i>Physignathus lesueurii</i>	Observed
Red-bellied black snake	<i>Pseudechis porphyriacus</i>	Observed

1.3.3.4 Birds

Thirty-eight (38) bird species were recorded on the subject site. No Threatened species were recorded. Birds recorded during the survey are shown in TABLE 5.

**TABLE 5
BIRD SPECIES RECORDED DURING THE SURVEY**

Common Name	Scientific Name
Black duck	<i>Anas superciliosa</i>
Brown thornbill	<i>Acanthiza pusilla</i>
Crested pigeon	<i>Ocyphaps lophotes</i>
Eastern rosella	<i>Platycercus eximius</i>
Eastern spinebill	<i>Acanthorhynchus tenuirostris</i>
Eastern yellow robin	<i>Eopsaltria australis</i>
Fan-tailed cuckoo	<i>Cacomantis flabelliformis</i>

Common Name	Scientific Name
Galah	<i>Eolophus roseicapillus</i>
Grey fantail	<i>Rhipidura fuliginosa</i>
Grey shrike thrush	<i>Colluricincla harmonica</i>
Kookaburra	<i>Dacelo novaeguineae</i>
Lewin's honeyeater	<i>Meliphaga lewinii</i>
Magpie	<i>Gymnorhina tibicen</i>
Magpie-lark	<i>Grallina cyanoleuca</i>
Masked lapwing	<i>Vanellus miles</i>
Mistletoe bird	<i>Dicaeum hirundinaceum</i>
Noisy minor	<i>Manorina melanocephala</i>
Pied butcherbird	<i>Cracticus nigrogularis</i>
Pied currawong	<i>Strepera graculina</i>
Rainbow lorikeet	<i>Trichoglossus haematodus</i>
Red-backed wren	<i>Malurus melanocephalus</i>
Scaly breasted lorikeet	<i>Trichoglossus chlorolepidotus</i>
Scarlet honeyeater	<i>Myzomela sanguinolenta</i>
Silvereye	<i>Zosterops lateralis</i>
Spotted pardalote	<i>Pardalotus punctatus</i>
Superb fairy wren	<i>Malurus cyaneus</i>
Tawny frogmouth	<i>Podargus strigoides</i>
Torresian crow	<i>Corvus orru</i>
Welcome swallow	<i>Hirundo neoxena</i>
Whistling kite	<i>Haliastur sphenurus</i>
White cheeked honeyeater	<i>Phylidonyris nigra</i>
White faced heron	<i>Egretta novaehollandiae</i>
White ibis	<i>Threskiornis molucca</i>
White-breasted woodswallow	<i>Artamus leucorhynchus</i>
White-throated treecreeper	<i>Cormobates leucophaeus</i>
Willie wagtail	<i>Rhipidura leucophrys</i>
Wood duck	<i>Chenonetta jubata</i>
Yellow faced honeyeater	<i>Lichenostomus chrysops</i>

1.3.3.5 Mammals

Two (2) introduced mammal species were recorded on the subject site - Cow and Hare. No Threatened species were recorded.

1.3.4 *Threatened species considered possible occurrences in the Study area*

Based on the assessment of habitats in the Study area, Threatened fauna species known from the locality were assessed for the likelihood of their occurrence. Potential occurrences are discussed as either *possible* or *likely* occurrences. Possible occurrences are species, which may occur sporadically or are provided with small areas of potentially suitable habitat. Likely occurrences are provided with habitat of high quality on the subject site.

**TABLE 7
SIGNIFICANT FAUNA CONSIDERED POSSIBLE OCCURRENCES ON THE SITE**

Species	Likelihood of occurrence in the Study area	Notes
Bush-hen (<i>Amaurornis olivaceus</i>)	Possible	The Bush-hen occurs in coastal northern Australia and through eastern Qld to the NSW north coast. It inhabits a variety of coastal wetlands from mangroves, lagoons and swamps, to river margins and creeks running through rainforest. Suitable habitat is considered to occur within SEPP 14 Wetland No. 23 on and adjacent to the subject site.
Collared kingfisher (<i>Todiramphus chloris</i>)	Possible	The Collared kingfisher is most commonly observed in the Tweed River estuary in NSW. It is virtually restricted to mangroves and other estuarine habitats in Australia, mainly about the mouths of the larger coastal rivers. Suitable habitat is considered to occur within SEPP 14 Wetland No. 23 on and adjacent to the subject site.
Comb-crested jacana (<i>Irediparra gallinacea</i>)	Unlikely	This species is found in coastal and sub-coastal northern and eastern Australia. In NSW populations are localised and scattered. It lives amongst vegetation floating on the surface of slow-moving rivers and permanent lagoons, swamps, lakes and dams. Suitable habitat does not occur on the site. Dams generally have poor vegetation cover.
Eastern bent-wing bat (<i>Mormopterus schreibersii oceanensis</i>)	Possible	Caves are the primary roosting habitat for this species, but it will also use derelict mines, stormwater tunnels, buildings and other man-made structures. It hunts in forested areas, catching moths and other flying insects above the tree tops. This species may occasionally forage over the subject site however no significant roosting opportunities are present.

Species	Likelihood of occurrence in the Study area	Notes
Eastern long-eared bat (<i>Nyctophilus bifax</i>)	Possible	<p>This species occurs from Cape York through eastern Qld to the far north-east corner of NSW. It inhabits lowland subtropical rainforest and wet and swamp eucalypt forest, extending into adjacent moist eucalypt forest.</p> <p>This species may occasionally forage over the subject site however no significant roosting opportunities are present.</p>
Grass owl (<i>Tyto capensis</i>)	Unlikely	<p>The Grass owl occupies coastal heath and grassland across northern Australia (Reader's Digest 1993). In NSW they are more likely to be found in the north-east.</p> <p>Areas of tall grass occur on the subject site however these abandoned croplands are not considered to provide suitable habitat for this species.</p>
Grey-headed flying fox (<i>Pteropus poliocephalus</i>)	Possible	<p>This species occurs from central eastern Qld south to Vic. In NSW they mainly occur in coastal areas and along river valleys. They typically roost in conspicuous camps in lowland rainforest and swamp forest, often in isolated remnants or on islands in rivers. They forage on fruit, nectar and pollen in rainforests and eucalypt forests. Numerous figs on the site provide an excellent food resource for this species.</p>
Koala (<i>Phascolarctos cinereus</i>)	Unlikely	<p>The Koala occurs in eucalypt woodlands and forests throughout eastern Australia. They inhabit areas where there are appropriate food trees.</p> <p>No suitable habitat occurs on the subject site for this species.</p>
Little bent-wing bat (<i>Miniopterus australis</i>)	Possible	<p>This species occurs in coastal north-east NSW and eastern Qld. It inhabits moist eucalypt forest, rainforest and dense coastal scrub. It generally occupies caves and tunnels during the day, and may occasionally roost singularly or in small collectives under the bark of mature paperbark trees.</p> <p>This species may occasionally forage over the subject site however no significant roosting opportunities are present.</p>

Species	Likelihood of occurrence in the Study area	Notes
Magpie goose (<i>Anseranas semipalmata</i>)	Unlikely	<p>The Magpie goose occurs mainly in coastal and sub-coastal areas of northern Australia. The species is now a rare vagrant in NSW. It generally inhabits open lakes, swamps and permanent wetlands which are dominated by rush and sedge vegetation, with grasslands nearby.</p> <p>Suitable habitat does not occur on the site.</p>
Mangrove honeyeater (<i>Lichenostomus fasciogularis</i>)	Unlikely	<p>The Mangrove honeyeater is common in Qld but rare in NSW, where it is known from a few scattered localities, including the Tweed, Richmond and Clarence River estuaries. It primarily inhabits mangroves but also occurs in other near-coastal forests and woodlands, including casuarinas and paperbark swamp forests.</p> <p>Suitable habitat does not occur on the site.</p>
Mitchell's rainforest snail (<i>Thersites mitchellae</i>)	Unlikely	<p>This snail is restricted to remnant areas of lowland subtropical rainforest and swamp sclerophyll forest with a rainforest understorey on alluvial soils with a basaltic influence on the coastal plain between the Richmond and Tweed Rivers (NPWS 2000).</p> <p>Suitable habitat does not occur on the site.</p>
Osprey (<i>Pandion haliaetus</i>)	Unlikely	<p>This raptor is thinly distributed in coastal Australia. It nests in singularly overtopping, generally dead trees. The Osprey hunts in coastal rivers, estuaries and streams and may gather nesting material from nearby forests.</p> <p>Suitable habitat is not considered to occur on the subject site.</p>
Rose-crowned fruit-dove (<i>Ptilinopus regina</i>)	Possible	<p>The Rose-crowned fruit-dove occurs along the coast and the ranges of Qld and eastern NSW. It occurs mainly in subtropical and dry rainforest and occasionally in moist eucalypt forest and swamp forest, where fruit is plentiful.</p> <p>This species has been recorded from adjacent to the subject site in previous surveys (JWA 2009). The patchy nature of vegetation on the subject site and relative scarcity of mature rainforest trees suggests marginal habitat occurs at best.</p>

Species	Likelihood of occurrence in the Study area	Notes
Spotted-tail quoll	Unlikely	The Spotted-tail quoll forages in a broad range of habitats but is more abundant in larger, less disturbed forests. A history of clearing and disturbance by cattle has precluded the occurrence of suitable habitat for this species.
White-eared monarch (<i>Monarcha leucotis</i>)	Unlikely	This species is restricted to eastern Qld and the NSW north coast. It occurs primarily in coastal rainforest, swamp forest and wet eucalypt forest and appears to prefer forest edges. The patchy nature of vegetation on the subject site is likely to preclude the occurrence of this species.
Wompoo fruit dove (<i>Ptilinopus magnificus</i>)	Unlikely	This species is found along the coast and coastal ranges from Cape York to the Hunter River in NSW. It occurs in rainforests, low-elevation moist eucalypt forest and brushbox forests. They most often occur in mature forests, but are also found in remnant and regenerating forest. The patchy nature of vegetation on the subject site and relative scarcity of mature rainforest trees is likely to preclude the occurrence of this species.
Yellow-bellied sheath-tail-bat (<i>Saccolaimus flaviventris</i>)	Possible	The Yellow-bellied Sheath-tail-bat is a wide-ranging species found across northern and eastern Australia. Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. When foraging for insects, flies high and fast over the forest canopy, but lower in more open country. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory. This species may occasionally forage over the subject site however no significant roosting opportunities are present.

APPENDIX 6 - AREA E FAUNA ASSESSMENT

1.1 Introduction

A detailed fauna assessment was conducted over three lots within Area E:

- Lot 1 DP 175234, 93 Parkes Lane, Terranora - Creeksound;
- Lot 3 DP 622318 Mahers Lane, Terranora - Neusam; and
- Lot 7 DP 740104 Mahers Lane, Terranora - Southberry.

The methods used in determining which fauna species use, or are likely to use, the Study area and a discussion of the results of fauna surveys are provided in this section.

1.2 Methods

1.2.1 Fauna Survey

1.2.1.1 Background

A detailed fauna survey was carried out over five (5) days and four (4) nights between the 1st & 5th December 2008. The weather was generally fine and warm during the survey period.

1.2.1.2 Survey Techniques

Detailed fauna surveys were designed to target identified threatened species. The following survey techniques were utilised in this assessment. **FIGURE 1** shows the location of trap and survey sites.

Active Searching

Logs, sheets of tin, cardboard, bark and leaves were overturned in search of reptiles and amphibians while incidentally traversing the site. Diggings were searched for signs of droppings. The site was actively searched for scats and bones. Active observation of bird activity was undertaken during all site visits.

A search for Koala scats (approximately 2 minutes per tree) was undertaken under primary Koala feed trees known to be extensively utilised within the Tweed LGA, primarily Tallowwood (*Eucalyptus microcorys*), Swamp mahogany (*E. robusta*) and Red mahogany (*E. resinifera*).

Additionally, a ground search was undertaken where the feed tree species *Allocasuarina littoralis* occur on the site to look for the presence of chewed cones, a sign of feeding activity of the Glossy black cockatoo.

Searches were also completed for the Mitchell's rainforest snail within suitable habitat.

A total of twelve (12) hours of active searching was completed on the subject site.