APPENDIX B

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AMENDED
ECOLOGICAL ASSESSMENT

VOLUME 1

LOT 73 DP 851902
BAYSIDE WAY BRUNSWICK HEADS

A REPORT PREPARED FOR
CODLEA PTY LTD

DECEMBER 2012

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TABLE OF CONTENTS

1 INTRODUCTION

1.1 Background

James Warren and Associates were engaged by Codlea Pty Ltd to complete an Ecological Assessment (EA) for Lot 73 DP 851 902 Bayside Way, Brunswick Heads.

Under section 3A of the *Environmental Planning & Assessment Act 1979* (EPA Act 1979), a major projects application was lodged with the Department of Planning (DoP). Revised Director General's Environmental Assessment Requirements (DGEARs) were issued dated 14th October 2010 **(MP 05_0091).**

To address the relevant DGEARs the assessment involved the following:

- Mapping and ground truthing vegetation units and determining their conservation status 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), and with reference to the Byron Shire Flora and Fauna Study (1999);

- Searching for and recording species and communities listed under the NSW Threatened Species Conservation Act (*TSC Act 1995*);

- Searching for and recording flora listed as Rare or Threatened Australian Plant taxa (ROTAP; Briggs & Leigh 1996);

- Determining the suite of threatened fauna (*TSC Act 1995*) that occurs in the locality and assessing their potential occurrence on the Subject site;

- Assessing habitat provided by the site in relation to adjacent habitat and making an assessment of the corridor value of the site;

- Surveying and categorising significant trees on the site for their habitat value;

- Addressing statutory requirements as stated within the Director General's Environmental Assessment Requirements (DGEARs) (i.e. Commonwealth *Environment Protection and Biodiversity Act 1999* (EPBC Act) and NSW *Threatened Species Conservation Act* (TSC Act 1995); and

- Presenting the report in a format that address the Director General's Environmental Assessment Requirements (DGEARs).

Subsequent to the preparation of the EA (JWA 2010) DoP completed a 'test of adequacy'. Comments were outlined in a letter from the DoP dated 13th January 2011. Meetings were then held with the DoP in Sydney (i.e. 25th February & 10th March 2011) and negotiations resulted in an amendment to the residential layout.

The EA was then revised in July 2011 to address DoP issues and the amended residential layout. In particular, the development layout was amended to remove eleven lots from the south east corner of the site. This area is now proposed as Park 1 and will be dedicated to the Byron Shire Council as a conservation area on completion of revegetation works. Revegetation will include: Wallum vegetation **(SECTION 4.2.2),** Wallum froglet habitat

(SECTION 4.2.5.8), proposed EEC offsets **(SECTION 4.2.4)** and proposed significant tree offset area **(SECTION 4.2.3)** and is discussed further in the relevant sections.

After exhibition of the EA, Government department and public submissions were received. Subsequently, the development layout was amended and a further four lots (B147 – B150) were removed from the western portion of the site. These lots have been reconfigured to create a larger lot i.e. B146. This will allow for the retention of a number of significant trees in this area and provide for improved buffering to the Swamp sclerophyll on coastal floodplain EEC in this portion of the site.

1.2 Project Approval

The proposal was originally lodged with the Department as a concept plan application as, at the time, sewer was not available for the proposed lots to be connected to. Byron Shire Council had committed to building a new sewage treatment plant, however, as it was not operational the proponent could not seek project approval for the subdivision. As a concept plan does not approve the construction of a development, the concept plan progressed while Council built the STP that would service the site.

The environmental, planning and engineering investigations undertaken for the concept plan application to meet the Director General's requirements and the additional investigations undertaken to respond to submissions, results in sufficient detail being provided to enable the proposal to be assessed at project application level and consequently, project approval is sought.

1.3 Locality

1.3.1 Introduction

The locality is defined as the area within a 10 km radius of the subject site. The locality therefore extends from Byron Bay in the south, to Hastings Point in the north and the Coastal foreshore in the east to Main Arm and Nightcap National Park in the west (**FIGURE 1)**.

Prominent features in the locality include Brunswick Heads and township, Ocean Shores, Bangalow, Mullumbimby, Billinudgel, Middle Pocket, Goonengerry, Coolamon plateau, Mount Matheson, the north coast railway line, the Brunswick River, Simpson's Creek, Marshall's Creek, Mullumbimby Creek, Mount Chincogan, Belongil Creek, Tyagarah lagoon, Cumbebin Swamp and the coastal beaches and headlands.

Dominant habitat types are Coastal and Wallum heath, Scribbly gum forest, Wet and Dry sclerophyll forest, Mangrove, Coastal foreshore, Lowland rainforest, Fresh and Saline swamp, Paperbark wetland, Pasture and Camphor laurel dominated forest **(FIGURE 2).**

There are five (5) dedicated conservation reserves in the locality **(FIGURE 3).** These reserves are:

- Tyagarah NR
- Brunswick Heads NR

- Billinudgel NR
- Marshall's Creek NR
- Julian Rocks NR

State Wetlands numbers 61 -72 occur in the locality. SEPP 69 occurs to the east of the Subject site along Simpsons Creek. These wetlands are protected by State Environmental Planning Policy No. 14 – Coastal Wetlands (SEPP 14) **(FIGURE 4)**.

SEPP 26 Littoral Rainforests numbers 15, 16 and 18 also occur in the locality. These rainforests are protected by State Environmental Planning Policy No. 26 – Littoral Rainforest (SEPP 26) **(FIGURE 5)**.

Land uses within the locality include residential, tourism, retail, fishing, agriculture and conservation.

1.3.2 The Subject Site

The subject site is defined as the area subject to the proposed development. The subject site for the proposed development is formally described as Lot 73, DP 851902 Brunswick Heads. The site covers approximately 31.33 hectares and is bound by residential development to the north-east, Simpsons Creek (tidal) to the east and native regrowth heath and swamp sclerophyll vegetation to the south. The western boundary adjoins a partially forested rural property.

An aerial photograph of the subject site is provided as **FIGURE 6**.

The majority of the subject site is cleared and is currently subject to an approved slashing regime. Scattered Scribbly gums occur across the slashed area. An unsealed track traverses the eastern portion of the site, in a north-south direction, separating the slashed area with the forested Environmental Protection Zone adjacent to Simpsons Creek. This track also provides access to Simpsons Creek in the south west corner of the subject site.

1.3.3 Soils and Geology

The soils on the site are dominated by Tyagarah aeolian landscape, which is characterised by sediment basins of mixed estuarine and aeolian origin, forming level to gently undulating plains. Such environments contain deep (>150cm), sandy podsols and acid peats characteristic of back barrier dune systems of Pleistocene derivation. A layer of indurated sand (coffee rock) is present at varying depths, which separates a perched water table from the deep water table.

1.3.4 Landuse Zones

The Byron LEP 1988 Landuse zones (**FIGURE 7**) for this area include: sections zoned as 7(a) and 7(b) along Simpson's Creek and an area zoned as 2(a) residential. These zoned lands are listed by the Byron Shire LEP as:

- 2(a) (Residential zone)
- 7(a) (Wetlands zone)

- 7(b) (Coastal habitat zone).

The Draft Byron Local Environmental Plan 2012 is currently on exhibition. Subsequently, landuse zones will be amended when the Draft LEP becomes a legal document.

1.4 Literature Review

A number of reports and other sources were reviewed for the purpose of this assessment. These include:

- NPWS Wildlife Atlas and Database
- NRAC Report Vertebrates of Upper North Coast NSW
- NRAC Report Flora of Upper North Coast NSW
- Byron Flora and Fauna Study 1999
- Byron Shire Biodiversity Conservation Strategy (2004)
- JWA Reports for land in the Brunswick Heads area (2001-2003)
- Brunswick Estuary Management Plan (Issue No. 2 January 2009)
- Brunswick Heads Bypass proposal (RTA 2002)
- Byron Shire Coastline Management Strategy (2003)
- Fauna Impact Statement Mixed density Urban Residential Development, Brunswick Heads (Woodward-Clyde 1996)

1.5 The Proposed Development

The proposed development is for a residential subdivision of 163 lots including the following **(FIGURE 8)**:

- 162 single dwelling lots (i.e. ranging from 450 m^2 to 1136.6m^2);
- 1 lot comprising of 16 dual occupancy dwellings (i.e 4966.7m^2);
- Large areas for environmental restoration including;
  - 'Environmental lifestyle' lot B156 (0.74 ha);
  - 'Environmental lifestyle' lot B146 (1.24 ha);
  - Public Reserve (P1) (13.17 ha); and
  - Central stormwater management area (1.28 ha)

It should be noted that after restoration the land zoned 7(a) Wetlands and 7(b) Coastal Habitat will be dedicated to the Byron Shire Council for conservation.

1.5 Structure of this Assessment

The Ecological Assessment and associated documents have been prepared in response to the relevant DGEARs, and contain the following sections:

VOLUME 1

SECTION 1 – Introduction, background and relevant site information

SECTION 2 – DGEARs

SECTION 3 – Statutory considerations

SECTION 4 – Flora and fauna

SECTION 5 – Native vegetation and wildlife corridors

SECTION 6 – Impacts on the riparian zone of Simpson's creek

SECTION 7 – Ownership and management of the proposed conservation areas (riparian) and buffers

SECTION 8 – Summary of impacts, mitigation & offsets

VOLUME 2

APPENDIX 1 – Listed EPBC Fauna Assessment

APPENDIX 2 - Fauna Assessment

APPENDIX 3 – Grey-head Flying-fox Camps

APPENDIX 4 - Key Thresholds Assessment

APPENDIX 5 – Wallum Froglet Compensatory Habitat

APPENDIX 6 – Compensatory Habitat Plan Tugun Bypass

APPENDIX 7 - Flora Assessment

APPENDIX 8 – Tree Survey

APPENDIX 9 - Tree Table - Retained/Removed

APPENDIX 10 - Literature Review: Buffers

APPENDIX 11 – Literature Review: Corridors & Connectivity

APPENDIX 12 – Responses to Government Authority and Private Submissions

APPENDIX 13 – Attempts to Provide an Appropriate Offset Site

2 DIRECTOR GENERAL'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

2.1 Introduction

Under section 3A of the *Environmental Planning & Assessment Act 1979* (EPA Act 1979), a major projects application was lodged with the Department of Planning (DoP). Revised Director General's Environmental Assessment Requirements (DGEARs) were issued dated 14th October 2010 **(MP 09_0166).**

The following sections describe which DGEARs and legislation, Guidelines and Policies will be addressed in this report.

2.2 DGEARs to be addressed

The following DGEARs 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).

Flora and fauna

3.1 Assess the potential impacts of the development on flora and fauna taking into consideration impacts on any threatened species, populations, ecological communities and/or critical habitat and relevant recovery plan in accordance with DECC's Guidelines for Threatened Species Assessment (2005), having particular regard for the Wallum vegetation and the Wallum Froglet identified on the site. Provide measures for the conservation of the flora and fauna, where relevant.

3.2 Address any impacts on migratory species, RAMSAR wetlands and species listed under Section 18 and 18A of the EPBC Act.

3.3 Address impacts of clearing of native vegetation, and outline measures for the conservation of existing wildlife corridor values and/or connective importance of any vegetation on the Subject land. Particular consideration should be given to minimising impacts on the creek line running north/south on the western side of the lot, in consultation with council.

3.4 Address direct and indirect impacts on the riparian zone, and identify conservation (riparian) buffer zones between the development areas and the adjoining vegetation, having regard to a recommended 50m buffer width and findings, conclusions and recommendations of the Brunswick Estuary Management Study and Management Plan.

3.5 Address ownership of the proposed conservation areas (riparian) and buffer zones, and management regimes to be undertaken in these areas and zones.

The following DGEARs are not applicable as a footbridge is no longer included as part of the development application.

3.6 Address the preliminary design for the footbridge over Simpson's Creek and its potential impacts on the aquatic habitat, including any requirements of the Department of Primary Industries (Fisheries) regarding this habitat.

3.7 Address potential impacts of the proposed beach access through Tyagarah Nature Reserve and any requirements of the Department of Environment and Climate Change (DECC).

Each of the relevant requirements will be addressed in the following sections of this report.

3 STATUTORY CONSIDERATIONS

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

3.1.1 Introduction

This section provides a response to the following relevant DGEARs:

> *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)."*
>
> AND
>
> *DGEAR 3.2 – "Address any impacts on migratory species, RAMSAR wetlands and species listed under Section 18 and 18A of the 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.

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.

One Commonwealth listed threatened fauna species was recorded on the subject site – the Grey-headed flying-fox (*Pteropus poliocephalus*).

Ten (10) Commonwealth listed threatened fauna species were considered a possible occurrence on the site**.** An assessment of EPBC listed fauna considered a possible occurrence on the subject site is provided as **APPENDIX 1 (VOLUME 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).

One (1) migratory species, as listed within schedules of the EPBC Act (1999), was recorded on site (i.e. Cattle egret) and eighteen (18) are considered as possible occurrences over time. An assessment of EPBC listed migratory fauna considered a possible occurrence on the subject site is provided as **APPENDIX 1 (VOLUME 2).**

3.1.3 Assessment Against EPBC Act Significant Impact Guidelines

3.1.3.1 Background

The Assessment against the EPBC Act is made using the Matters of National Environmental Significance, Significant Impact Guidelines 1.1 (DEWHA 2009). These 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) (now the Department of Sustainability, Environment, Water, Population and Communities (DSEWPC)) 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 Critically Endangered and Endangered Species

Significant Impact Criteria

An action has, will have, or is likely to have a significant impact on a critically endangered or endangered species if it does, will, or is likely to:

- lead to a long-term decrease in the size of a population;
- reduce the area of occupancy of the species;
- fragment an existing population into two or more populations;
- adversely affect habitat critical to the survival of a species;
- disrupt the breeding cycle of a population;
- modify, destroy, remove, 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 critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;
- introduce disease that may cause the species to decline; or
- interfere with the recovery of the species.

Assessment of Proposed Action

Potential habitat for the following species occurs on the Subject site**:**

- Regent Honeyeater (*Anthochaera phrygia*); and
- Swift parrot (*Lathamus discolor)*.

Whilst potential habitat occurs on the subject site, the following surveys have not recorded their presence:

- Woodward Clyde site survey 1996;
- JWA site survey 2003 and 2004;
- JWA site survey 2008; and
- JWA site survey 2009.

Details of the above listed surveys are provided in **APPENDIX 2 (VOLUME 2).**

Therefore, it is considered that the proposed development will not result in any of the above significant impacts on populations of these species.

3.1.3.3 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 a population;
- reduce the area of occupancy of the species;
- fragment an existing population into two or more populations;
- adversely affect habitat critical to the survival of a species;
- disrupt the breeding cycle of a 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 (*Pteropus poliocephalus*) has been recorded on site. However, the latest recording was in 1996 (Woodward-Clyde 1996) and the species has not been recorded in more recent fauna surveys by JWA (e.g. JWA 2003 & 2004, JWA 2008, JWA 2009).

Grey-headed flying-foxes are found up to 200 kms inland of the east coast of Australia, from North Queensland to Victoria (DEC 2005). The location of Grey headed flying-fox camps in the region are listed in **APPENDIX 3 (VOLUME 2)** (B. Roberts *pers. comm.* August 2010). There are four (4) camps within 10 km of the subject site (i.e. Ewingsdale, Myocum, Ocean Shores and Marshalls Creek) and the NSW Parks and Wildlife database indicates two (2) records approximately 1 km north of the site.

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

1. Lead to a long-term decrease in the size of a population

The proposed development is unlikely to result in the local extinction or long-term decrease in the size of a population of this species. The loss of some forage habitat trees within the development footprint will be offset through revegetation in portions of the site outside of the development area.

2. Reduce the area of occupancy of the species

The majority of potential forage habitat will be retained on the subject site and is contained on land under Environmental Protection Zoning. This area will be dedicated to Byron Shire Council as a conservation area after the completion of revegetation works and

subject to a conservation agreement. Therefore, it is not considered that any area of occupancy will be reduced for this species.

3. Fragment an existing population into two or more populations

The Grey-headed flying fox is a highly mobile, migratory species. The proposed development will therefore not fragment an existing population into two or more populations.

4. Adversely affect habitat critical to the survival of a species

A Vegetation Management Plan (VMP) will be prepared for the site, which will outline appropriate management practices to ensure the integrity of retained forage habitat for this species is maintained. Tree removal within the proposed development area will be offset through revegetation in other areas of the site. While it is acknowledged that a small number of trees representing potential forage habitat for this species will be removed from the site, it is not considered that habitat critical to the survival of this species will be adversely affected.

5. Disrupt the breeding cycle of a population

Disruption to the breeding cycle of this species can occur as a result of direct or indirect impacts on roosting habitat. The subject site is not considered to contain roosting habitat for this species and the proposed development will not impact on any Grey-headed flying-fox camps as listed in **APPENDIX 3 (VOLUME 2).**

6. Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The removal of some forage habitat trees will be offset through revegetation on the subject site. While it is acknowledged that there will be some reduction in the availability of forage habitat while replacement plantings reach maturity, it is considered highly unlikely that this will lead to the decline of this species.

7. Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

It is not considered that the proposed development will result in an invasive species that is harmful to the Grey-headed flying-fox becoming established on the site. The keeping of cats within the proposed development will be prohibited by way of a Section 88B Instrument under the *Conveyancing Act 1919.*

8. Introduce disease that may cause the species to decline

Australian bat lyssavirus (ABL) can cause clinical disease and mortality in Grey-headed flying-foxes. The incidence of ABL in the species is low (<1%) and is generally in equilibrium with the population (DECCW 2009). However, significant ecological stress can increase the incidence of ABL to the point where the population is impacted. With the proposed mitigation measures including revegetation and the retention of potential forage habitat, it is not considered likely that disease will be introduced or increased as a result of the proposed development.

9. Interfere substantially with the recovery of the species

It is not considered likely that the proposed development will interfere substantially with the recovery of the Grey-headed flying-fox for the following reasons:

- The majority of potential forage habitat on the site for this species will be retained and dedicated to Byron Shire Council for conservation;
- Revegetation areas will offset the minor loss of isolated forage habitat trees; and
- This species is highly mobile, foraging over extensive areas, and its potential to utilise the site for sourcing food trees will not be reduced.

Therefore, it is considered that the proposed development is unlikely to result in any of the above significant impacts on populations of the Grey-headed flying-fox.

Whilst potential habitat for the following species occurs on the subject site**:**

- Australian Painted Snipe (*Rostratula australis*);
- Large-eared Pied Bat (*Chalinolobus dwyeri*);
- Long-nosed Potoroo (*Potorous tridactylus tridactylus*);
- New holland mouse *(Pseudomys novaehollandiae*); and
- Wallum sedge frog (*Litoria olongburensis*);

The following surveys have not recorded their presence:

- Woodward Clyde site survey 1996;
- JWA site survey 2003 and 2004;
- JWA site survey 2008; and
- JWA site survey 2009.

A habitat assessment for fauna considered a possible occurrence is provided in **APPENDIX 1 (VOLUME 2).** Details of the above listed surveys are provided in **APPENDIX 2 (VOLUME 2)**.

It is considered that the proposed development will not result in any of the above significant impacts on populations of these species.

3.1.3.4 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).

An action has, will have, or is likely to have a significant impact on a migratory species if it does, will, or is likely to:

- substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat of the migratory species; or

- result in invasive species that is harmful to the migratory species becoming established* in an area of important habitat of the migratory species; or
- seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of the species.

(* Introducing an invasive species into the habitat may result in that species becoming established. An invasive species may harm a migratory species by direct competition, modification of habitat, or predation.)

An area of important habitat is:

1. habitat utilised by a migratory species occasionally or periodically within a region that supports an *ecologically significant proportion* of the population of the species, or
2. habitat utilised by a migratory species which is at the limit of the species range, or
3. habitat within an area where the species is declining.

It is considered that a number of listed migratory species are known or likely to occur occasionally on the subject site as follows**:**

- Bar-tailed godwit (*Limosa lapponica*)
- Black-faced monarch *(Monarcha melanopsis)*
- Cattle egret (*Ardea ibis*)
- Fork-tailed swift (*Apus pacificus*)
- Latham's snipe *(Gallinago hardwickii)*
- Little curlew/Little whimbrel (*Numenius minutus)*
- Pacific golden plover (*Pluvialis fulva)*
- Painted snip (*Rostratula benghalensis)*
- Rainbow bee-eater (*Merops ornatus)*
- Regent Honeyeater (*Anthochaera phrygia*)
- Rufous fantail (*Rhipidura rufifrons)*
- Satin flycatcher (*Myiagra cyanoleuca)*
- Swift parrot (*Lathamus discolor)*
- Whimbrel *(Numenius phaeopus)*
- White bellied sea eagle (*Haliaeetus leucogaster)*
- White-throated Needletail (*Hirundapus caudacutus*)

However, no area of important habitat, as defined above, occurs on the subject site for listed migratory species.

3.1.4 Requirement for Commonwealth Referral

An assessment of the Commonwealth listed species, including migratory species, known to occur on the site or considered as possible occurrences has shown that populations of these species do not occur on the site. The proposed development will not cause a significant adverse impact on any of these species.

3.2 NSW Threatened Species Conservation Act 1995 (TSC Act)

3.2.1 Introduction

The NSW *Threatened Species Conservation Act 1995* (TSC Act 1995) requires that the planning and development approval process for development and other activities have regard to the potential for adverse impacts on Threatened flora and fauna species and their habitats. Assessments of significance (TSC Act) are not required as the project is being assessed under Part 3A of the Environmental Planning and Assessment Act 1979.

However, in July 2005 the NSW Department of Environment and Conservation (DEC) and NSW Department of Primary Industries (DPI) drafted *Guidelines for Threatened Species Assessment*. These guidelines identify factors that must be considered when assessing potential impacts on threatened species, populations, or ecological communities, or their habitats for development applications assessed under part 3A of the EPA Act 1979.

A Key Thresholds Assessment is provided in **APPENDIX 4 (VOLUME 2)**. This assessment has been completed in accordance with:

- Guidelines for Threatened Species Assessment (DEC & DPI, 2005);
- Threatened Species Assessment Guidelines: The Assessment of Significance (DECC 2007);
- All relevant approved recovery plans and threat abatement plans; and
- Principles for the use of biodiversity offsets in NSW (DECCW 2010). These principles provide a framework for considering environmental impacts and developing offset proposals, they do not represent a mandatory requirement.

3.3 SEPP 44 Koala Habitat Assessment

STATE ENVIRONMENTAL PLANNING POLICY No. 44 - KOALA HABITAT PROTECTION

In response to the state wide decline of Koala populations the Department of Planning has enacted SEPP - 44 Koala Habitat Protection. The Policy aims to "encourage the proper conservation and management of areas of natural vegetation that provide habitat for Koalas, to ensure permanent free-living populations over their present range and to reverse the current trend of population decline."

A number of criteria in the SEPP are to be addressed as follows:

1. Does the policy apply?

Does the subject land occur in an LGA identified in Schedule 1?

The Subject site occurs in the Byron LGA, which is listed under Schedule 1.

Is the landholding to which the DA applies greater than 1 hectare in area?

Yes.

2. Is the land potential Koala habitat?

Does the site contain areas of native vegetation where the trees of types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component?

Yes. The listed Koala feed tree Scribbly gum (*Eucalyptus signata*) occurs over much of the eastern portion of the site, and to a lesser degree in the western portion of the site. A small area of the Koala feed trees species Swamp mahogany (*Eucalyptus robusta*) also occurs (**FIGURE 9**).

3. Is there core Koala habitat on the subject land?

No. As defined in SEPP 44 'core koala habitat' is defined as an area of land with a resident population of koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a population.

Targeted Koala surveys and results are listed below:

- Woodward Clyde survey (1996) – low levels of Koala activity recorded (i.e. scratches on trees and small number of scats recorded - see **APPENDIX 2 (VOLUME 2);**
- JWA (2003 & 2004) – low levels of Koala activity recorded (i.e. scats recorded at the base of several Scribbly gums - see **APPENDIX 2 (VOLUME 2);**
- JWA (2008) – low levels of Koala activity recorded (i.e. scratches on trees and small number of scats recorded – see **APPENDIX 2 (VOLUME 2);** and
- JWA (2009) – low levels of Koala activity recorded on the site (i.e. small number of scats recorded. Higher levels of Koala activity were recorded in vegetated lands to the south - see **APPENDIX 2 (VOLUME 2).**

The presence of only a small number of scats, combined with a lack of historical observations of Koalas on the site suggests that the subject site does not comprise core Koala habitat.

4. Is there a requirement for the preparation of a Plan of Management for identified core Koala habitat?

No.

3.4 Water Management Act 2000

3.4.1 Introduction

The Water Management Act 2000 (WMA) requires that controlled activities carried out in or under waterfront land are now regulated. The document "Guidelines for riparian corridors on waterfront land" (NOW 2012) outlines appropriate widths for riparian corridors and how much riparian vegetation should be protected or re-established.

3.4.2 Assessment of Central Drainage Channel

The north-south central drainage channel has been modified from its natural state. Byron Shire Council has entered the site on a number of occasions over the last twenty (20) years to clean out the drain with heavy machinery. Council carry out these works to alleviate the backing up of stormwater into the Bayside residential area to the north of the drain. However, the drainage channel is a first order stream as classified under the Strahler System. A 10m Vegetated Riparian Zone (VRZ) on either side of the water course (comprising the bed and banks to the highest bank) is therefore required in accordance with the WMA. The recommended riparian corridor (RC) width for the channel is 20m in addition to the channel width (watercourse).

In compliance with the WMA:

- The RC/ VRZ should be maintained or rehabilitated with fully structured native vegetation;
- Stormwater run-off should be treated before discharging into the RC/VRZ;
- Stormwater outlet structures are permissible within the RC/ VRZ with consent; and
- Stream realignment is permissible with consent.

3.4.3 Proposed Re-grading of Central Drainage Channel

The proposed development will involve the regrading of the north- south central drainage channel in order to form a central stormwater management area. To allow adequate stormwater drainage from the site the channel will be cut (fill will be used on other parts of the site) and then re-contoured.

Waste Solutions Australia completed detailed investigations into the presence of an indurated sand layer at the site of the proposed drainage basin. They then modelled the likely extent of basin water infiltration in this environment (WSA 2012). Based on this data/modelling, CivilTech Consulting Engineers have advised that the construction of an unlined basin is the preferred solution. It is considered that the indurated sand present under the proposed basin floor will act as an impermeable layer and preclude the need for an artificial lining.

Occurrences of indurated sand layers have been identified within many unconsolidated profiles along the east coast of Australia and around the world. Indurated sand layers are often discontinuous resulting in localised aquifer heterogeneity, however, their regional significance is commonly underestimated (Armstrong 2006).

Groundwater can be divided into a shallow unconfined water table aquifer and basal confined aquifers in which upper and lower aquifers are characterised by different hydrological processes, physic-chemical properties, and water chemistry (Armstrong 2006). An elevated shallow water table results from the mounding of water above the indurated sand layer. The elevated unconfined groundwater is usually stained with organic matter ("black water"), whereas beneath the indurated sand layer groundwater is colourless ("white water"). The elevated groundwater is also distinguished by low pH, low bicarbonate concentrations, high concentrations of organic carbon and interaction with surface water (Armstrong 2006).

The proposed basin will require shallow excavation into the indurated sand layer. It is expected that the layer of indurated sand is of a thickness that will not be compromised in its function of separating the perched water table from the deep water table by the construction of the proposed basin. Basin construction should be carried out during dry periods when water tables are low. This will reduce or obviate the need for dewatering during construction of the basin.

It is unlikely that acid sulphate materials will be encountered for excavations up to 2 m below the existing surface levels according to the findings of the Acid Sulphate Soil Assessment (Border-Tech 2010). Most, if not all excavation for the basin and associated drains will be less than 2m. If deeper excavation should occur it is recommended to check for acid sulphate materials prior to proceeding and if required, implement mitigation measures in accordance with the acid sulphate management plan to be submitted with the construction certificate application.

Construction of the basin will be carried out using standard earthwork machinery such as excavators, dozers, graders and trucks as required to achieve the final earthwork levels. A layer of suitable topsoil will be spread in readiness to receive the proposed plantings and seeds required to complete the basin surface.

The central drainage channel provides habitat for the Wallum froglet (*Crinia tinnula*) which is listed as 'Vulnerable' under schedules of the *Threatened Species Conservation Act* (1995). Following regrading, the channel will be revegetated with the objective to re-instate the vegetation and habitat conditions which occurred prior to re-grading. These pre-regrading conditions were providing Wallum froglet core breeding and forage habitat. The revegetation methodology will be based on the compensatory habitat design utilised as a condition of the Tugun Bypass development. However, unlike the design of the Tugun Bypass compensatory habitat, proposed 'core breeding' habitat will be located away from first-flush stormwater with potential high nutrient loads (i.e. outside of the low-flow channel).

The entire central drainage area, including the low flow channel (forage habitat for Wallum froglets) and the created 'core breeding' habitat for Wallum froglets, will be revegetated with scattered Broad-leaved paperbarks (i.e. 12m centres) and Wet heath species.

The Wallum froglet compensatory habitat plan is outlined in **APPENDIX 5** – Volume 2 and the Tugun Bypass compensatory habitat plan is discussed in **APPENDIX 6** – Volume 2. A typical section and plan view of the proposed stormwater treatment and frog habitat swale is provided in **FIGURE 1 – Volume 2.**

4 FLORA AND FAUNA

4.1 Introduction

This section provides a response to the following relevant DGEAR:

> *DGEAR 3.1 - Assess the potential impacts of the development on flora and fauna taking into consideration impacts on any threatened species, populations, ecological communities and/or critical habitat and relevant recovery plan in accordance with DECC's Guidelines for Threatened Species Assessment (2005), having particular regard for the Wallum vegetation and the Wallum Froglet identified on the site. Provide measures for the conservation of the flora and fauna, where relevant.*

This section examines the potential impacts of the development on the significant environmental values of the site as outlined above in DGEAR 3.1. The impact assessment has been completed in accordance with Steps 3 and 4 of the "*Guidelines for Threatened Species Assessment"* (DEC & DPI 2005) as follows:

- Step 3 – Evaluation of impacts; and
- Step 4 – Avoid, mitigate and then offset.

The following assessment includes consideration of the measures to avoid or minimise the impacts, potential impacts, mitigation and where appropriate offset strategies.

In accordance with the Guidelines (DEC & DPI 2005) impacts on the threatened species and the endangered ecological communities, as listed under the Threatened Species Conservation Act (1995), are assessed with the response to a set of questions. The impact assessment is completed in accordance with Step 5 of the Guidelines (DEC & DPI 2005) as follows:

- Step 5 – Key Thresholds

This assessment is provided in **APPENDIX 4 (VOLUME 2).**

A vegetation assessment is provided in **APPENDIX 7 (VOLUME 2).**

4.2 Impact Assessment

4.2.1 Introduction

As required by DGEAR 3.1, this section discusses the potential impacts of the proposed development, both direct and indirect, on the significant ecological values of the site. These values include:

- Wallum vegetation;
- Significant trees;
- Endangered Ecological Communities;
- Threatened fauna species recorded on the site; and

- Threatened fauna species that may possibly occur on the site.

In accordance with the "*Guidelines for Threatened Species Assessment"* (DEC & DPI 2005), measures to avoid, mitigate and then offset potential impacts have been considered.

4.2.2 Wallum Vegetation

4.2.2.1 Background

Wallum vegetation is defined by Keith (2004) as "Wallum Sand Heaths" and is found on the nutrient poor ancient sand deposits along the east coast of Australia. Wallum vegetation can also be described as vegetation, across the full range of structural formations, occurring on dunefields, beach ridge plains and sandy backbarrier flats in southern Queensland and northern NSW (Griffith *et al* 2003). Wallum communities are often found in a mosaic pattern with Swamp forest communities, as occurs on the Subject site (Keith 2004).

Wallum vegetation is represented by seven vegetation communities on the subject site as follows **(FIGURE 9**):

- Tall closed forest (*E. robusta* and *M. quinquenervia*) (1e)
- Mid closed forest (*E. robusta* and *M. quinquenervia*) (1f)
- Tall closed sclerophyll forest (*E. signata* and *Endiandra sieberi*) (2a)
- Tall open forest (*Eucalyptus signata*, *Allocasuarina littoralis* and *Banksia aemula*) (2b)
- Tall closed heath – (*B. aemula* and *A. littoralis*) (3a)
- Low closed dry heath (3b)
- Low closed wet heath (3c)

4.2.2.2 Avoidance of Impacts

The development footprint avoids wallum vegetation communities as much as possible by utilising land that is zoned 2(a) residential and has been previously disturbed through an approved and sustained slashing program.

Approximately, 7.02ha of intact Wallum vegetation occurs on the subject site. 6.63ha (94%) of this intact vegetation exists within the land zoned 7(a) & 7(b) and has been avoided.

Approximately 14.99ha of highly disturbed wallum vegetation (i.e. subject to regular slashing) occurs on the subject site. The majority of this disturbed vegetation occurs within the 2(a) residential land. Therefore only 2.93ha (19.5%) of this vegetation has been avoided. It is worth noting that despite the proposed removal of this vegetation as result of the development, the alternative outcome of continued slashing of this vegetation would likely lead to increased weed incursions and decreased native species diversity in the long-term.

4.2.2.3 Impacts

As discussed above, development of the site will result in the loss of some wallum vegetation. An overlay of the development footprint on the wallum vegetation is shown in **FIGURE 10** and a summary of different wallum vegetation communities to be lost is shown in **TABLE 1**.

As discussed above, the majority of Wallum vegetation to be removed (i.e. 12.06 ha or 98.13%) has been previously disturbed (i.e. cleared) and is currently subject to an approved slashing regime.

TABLE 1
POTENTIAL LOSS OF WALLUM VEGETATION

Wallum vegetation community		Total Area (ha)	Loss (ha)	Loss (%)
1e[1]	Tall closed forest (*E. robusta*, *M. quinquenervia* and *Leptospermum polygalifolium*)	1.82	0.00	0.00
1f[5]	Mid closed forest (*L. polygalifolium*, *M. quinquenervia* and *E. robusta*)	0.17	0.00	1.37
2a	Tall closed forest (*E. racemosa* and *Endiandra sieberi*)	0.89	0.00	0.00
2b	Tall open forest (*E. racemosa*, *Allocasuarina littoralis* and *Banksia aemula*)	2.99	0.21	6.88
3a	Tall closed heath (*B. aemula* and *A. littoralis*)	1.15	0.02	2.03
3b	Low closed dry heath	9.76	7.48	76.70
3c	Low closed wet heath	5.23	4.58	87.44
	TOTAL	**22.01**	**12.29**	**55.84**

4.2.2.4 Mitigation

A Vegetation Management Plan (VMP) will outline appropriate management practices which will ensure the integrity of the remaining Wallum vegetation is maintained.

The VMP will provide the following:

- A clear aim and set of objectives;

[1] Vegetation community considered to be representative of the EEC Swamp Sclerophyll Forest

- A set of measurable performance criteria;
- A strategy to rehabilitate/revegetate areas;
- Guidelines for the establishment and maintenance of protective vegetated buffers to the retained Swamp sclerophyll EEC;
- A strategy to control and manage weeds in the retained areas of vegetation (i.e. utilising best practice methods);
- A strategy to encourage natural regeneration after weed control;
- A species list to be used in landscaped areas;
- A species list to be used in rehabilitation/revegetation areas (i.e. providing details of what species will be planted in specific areas and/or vegetation communities e.g. Wallum vegetation);
- A species list that will outline replacement species for significant trees lost including Koala food trees (i.e. replacement numbers will also be provided); and
- A monitoring and maintenance and reporting schedule.

4.2.2.5 Offsets

A Wallum Froglet Compensatory Habitat Plan (WFCHP) will be completed which will provide strategies for the creation of artificial "wallum" wetland habitat. A draft WFCHP is included as **APPENDIX 5 (VOLUME 2).**

Approximately 4.08ha of revegetation work will be completed in accordance with the VMP and the WFCHP (**FIGURE 11**). All revegetation works will utilise Wallum species. Whilst the loss of disturbed/slashed wallum vegetation communities is unavoidable, revegetation works on the subject site will result in a long term net gain of intact Wallum vegetation on the site **(TABLE 2).**

TABLE 2
POTENTIAL NET GAIN OF INTACT WALLUM VEGETATION

Wallum Vegetation	Existing area (ha)	Impacts (ha)	Rehabilitation (ha)	Net Gain (ha)
Intact wallum vegetation	7.02	0.23	4.08	3.85
Slashed/disturbed wallum vegetation	14.97	13.23	n/a	n/a

4.2.3 Significant Trees

4.2.3.1 Background

A tree location survey was completed by LandPartners in May 2010. In accordance with the Byron Shire Council Tree Preservation Order, all trees above 10cm dbh[2] and/or 3m in height on the subject site were located by survey **(FIGURE 12).**

JWA subsequently assigned a significance value to all trees over 20cm dbh **(FIGURE 12).** Details of the tree survey are provided in **APPENDIX 8 (VOLUME 2).** The environmental attributes used to determine the ranking are provided in **TABLE 3.**

TABLE 3
ENVIRONMENTAL ATTRIBUTES USED TO DETERMINE SIGNIFICANCE RANKING

Conservation Significance Category	Significance Ranking	Environmental attributes
Very high	1	• Old growth trees (i.e. >900mm dbh[3]) • Trees forming part of an Endangered ecological community
High	2	• Habitat trees (i.e. trees with obvious hollows, fissures, nests etc.) • Preferred Koala food trees showing evidence of activity (i.e. scats) • Preferred Glossy black-cockatoo food trees showing evidence of activity (i.e. chewed cones)
Moderate-High	3	• Mature preferred Koala food tree species (i.e. >300mm dbh) – no evidence of activity • Mature preferred Glossy black-cockatoo food trees (i.e. >300mm dbh) – no evidence of activity
Moderate	4	• Immature/sub-mature preferred Koala food tree species (i.e. <300mm dbh) – no evidence of activity • Immature/sub-mature preferred Glossy black-cockatoo food trees (i.e. <300mm dbh) – no evidence of activity
Low-Moderate	5	• Mature native tree species (i.e. >300mm dbh) not fulfilling any of the above criteria
Low	6	• Immature/sub-mature native tree species (i.e. <300mm dbh) not fulfilling any of the above criteria

4.2.3.2 Avoidance

The development footprint avoids significant trees as much as possible by utilising land that is zoned 2(a) residential and has been previously disturbed through an approved and sustained slashing program.

[2] Diameter at breast height
[3] Diameter at breast height

The proposed development layout was originally designed to retain as many trees, assigned a significance value, as possible.

DoP's 'test of adequacy' letter dated 13th January 2011 raised the following issue in relation to surveyed significant trees within the development area:

> *"Further discussion is required on the impact of proposed cut and fill on long-term health of trees to be retained, particularly in the west of the site and north-east."*

It is now considered inappropriate to retain mature eucalypts within the smaller residential lots on the site for safety reasons. Therefore, significant trees will only be retained within the larger 'environmental lifestyle' lots and other areas of the site that will not be impacted by bulk earthworks. The Australian Standard 4970-2009 Protection of Trees will be the guideline used to determine whether a tree is to be removed or retained. **APPENDIX 9 (VOLUME 2)** details the trees (that have been assigned a significance value) that will be removed/retained on the site.

4.2.3.3 Impacts

A total of 573 trees of significance have been identified within and immediately adjacent to the development footprint at the Bayside Brunswick site. Of these trees, 253 occur within proposed earthworks areas and will be removed. The remaining 320 will be retained (**TABLE 4**). Trees to be removed and retained are shown in **FIGURES 13 - 18.**

TABLE 4
SIGNIFICANT TREES TO BE RETAINED

Tree Category	Existing No.	No. to be retained	% Retained
Significance 1	149	120	80%
Significance 2	45	23	51%
Significance 3	101	42	42%
Significance 4	4	2	50%
Significance 5	261	127	49%
Significance 6	13	6	46%
TOTAL	**573**	**320**	**55.85%**

In addition to the 253 conservation significant trees that will be removed as a result of the proposed development, a further 332 trees mapped as 'No Conservation Significance' will also be removed. This amounts to a total tree loss of 585 trees as a result of the proposed development.

4.2.3.4 Mitigation

Conservation significant trees to be retained within larger lots, particularly the 'Environmental lifestyle' lots B146 and B156, will be protected in perpetuity with a Section 88b instrument that will prohibit any clearing of protected trees within these lots.

A Vegetation Management Plan (VMP) will outline appropriate management practices as described in **SECTION 4.2.2.4** which will ensure the integrity of retained significant trees is maintained.

4.2.3.5 Offsets

The removal of 585 trees will be offset through revegetation works on the subject site at a rate of 2:1. A minimum total of 1170 trees will therefore be planted to offset the loss of trees from within the development footprint. In addition, hollows from trees to be removed will be placed within revegetation/conservation areas and will serve to function as potential habitat for ground-dwelling fauna. Nest boxes will also be strategically placed in retained trees to replace removed hollows at a 2:1 ratio.

Areas identified for offset planting are identified in **FIGURE 11.** Approximately 2.92 ha of the proposed revegetation areas will be planted with *Eucalyptus signata* and *Allocasuarina littoralis* (in elevated portions of the site) and *E. robusta* and *Melaleuca quinquenervia* (in low-lying portions of the site) at 5m centres (i.e. 400 trees/ha). In the central drainage reserve, approximately 0.98 ha will be revegetated with *Melaleuca quinquenervia* at 12m centres (i.e. 80 plants/ha). In total, approximately 1246 trees will be planted in revegetation areas. Offset planting will also include locally native shrubs and groundcovers. The VMP will outline the species to be replaced and the location of replacement plantings.

The APZ within lot B146 may also allow for the revegetation of approximately 0.18ha with appropriate species planted at 12m centres (**FIGURE 11**). It should also be noted that APZ requirements may limit the planting density in areas immediately adjacent to road reserves.

4.2.4 Endangered Ecological Communities (EECs)

4.2.4.1 Background

Three (3) Endangered Ecological Communities (EEC's) were recorded on the site**:**

- Swamp Sclerophyll Forest;
- Swamp Oak Floodplain Forest; and
- Coastal Saltmarsh.

4.2.4.2 Avoidance of Impacts

The development layout has generally avoided areas of vegetation considered to be representative of EECs. The footprint utilises land that is zoned 2(a) residential, has been previously disturbed and is currently subject to an approved slashing regime.

4.2.4.3 Impacts

No areas of Swamp oak floodplain forest or Coastal saltmarsh EEC will be affected by the proposed development. Furthermore, no development will occur within 243 m and 145 m of the Swamp Oak forest and the Coastal Saltmarsh respectively **(FIGURE 19).**

Some small losses of the Swamp sclerophyll forest EEC are considered to be unavoidable.

TABLE 5 provides a summary of the existing EEC areas and the potential impacts of the proposed development. Impacts on the EECs are also depicted in **FIGURE 19.**

TABLE 5
IMPACTS ON EECs

EEC's	Existing area (ha)	Impacts (ha)	Loss (%)
Swamp Sclerophyll Forest	5.41	0.08	1.53
Swamp Oak Forest	0.23	Nil	0
Coastal Saltmarsh	0.24	Nil	0

4.2.4.4 Mitigation

DoP's 'test of adequacy' letter dated 13th January 2011 raised the following issue in relation to the Endangered Ecological Communities on the site:

> *"Discussion is required on appropriate buffers to swamp EECs on the site."*

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

A buffer may take any of a number of forms, depending upon the nature of the environmental value to be protected, the impacts associated with nearby land use and the interaction between these factors. A detailed literature review of the types and purposes of buffers is provided in **APPENDIX 10 (VOLUME 2).**

Buffering retained areas of EEC will be achieved through a combination of vegetation retention and rehabilitation/revegetation works. **FIGURE 20** shows the location of EECs on

the subject site and identifies associated buffers to these areas. It also identifies the buffer width provided to Simpson's Creek and the central drainage channel. A description of buffers to each of the EECs is provided below:

Swamp oak floodplain forest

- A small area of this EEC occurs in the north-eastern portion of the subject site adjoining Simpson's Creek.
- This area will be buffered from the development through retention and rehabilitation of existing vegetation.
- The buffer of retained vegetation will be a minimum width of approximately 243m **(FIGURE 20).**

Coastal saltmarsh

- Two (2) small areas of this EEC occur in the north-eastern portion of the subject site adjoining Simpson's Creek.
- These areas will be buffered from the development through retention and rehabilitation of existing vegetation.
- The buffer of retained vegetation to these two (2) areas will be a minimum width of approximately 145m & 230m **(FIGURE 20).**

Swamp sclerophyll forest

- A large area of this EEC occurs in the eastern portion of the site in association with other vegetation communities. An area of this EEC occurs in the north-western corner of the site and forms part of a larger EEC which extends onto adjoining lands. A number of smaller patches occur in the western portion of the site.
- The large area of this EEC in the eastern portion of the site will be buffered from the development through a combination of retention/rehabilitation of existing vegetation and revegetation works. The buffer will be a minimum width of approximately 15 m, but will generally exceed 30m **(FIGURE 20).**
- The area of this EEC in the north-western portion of the site will be buffered from the development through retention/rehabilitation of existing vegetation. The buffer will be a minimum width of approximately 19m **(FIGURE 20).** A bio-retention treatment swale will be utilised within this buffer area to ensure adequate treatment of stormwater prior to release into this EEC. Bio-retention swales will be designed to promote the removal of particulate and soluble contaminants by passing through a filter medium, thus reducing concentrations of TSS, TP and TN (Landpartners 2010).

The smaller areas of this EEC on the site generally occur as small, isolated stands of vegetation surrounded by cleared areas. These stands of trees will be buffered from the development through revegetation works. These small stands of trees occur within an allotment designated for "Park Living". A single building entitlement will occur on this land, with the balance of the land to be rehabilitated as EEC/Compensatory habitat (**FIGURE 11**).

4.2.4.5 Offsets

The location and extent of proposed EEC offsets are depicted in **FIGURE 11**. With the implementation of the VMP (see **SECTION 4.2.2.4**) there will be a long-term net gain of 1.33 ha of Swamp sclerophyll forest. **TABLE 6** provides a summary of the existing EEC areas, the potential impacts of the proposed development and the proposed offsets.

TABLE 6
PROPOSED OFFSETS FOR EECs

EEC's	Existing area (ha)	Impacts (ha)	Offsets (ha)	Net loss/ gain (ha)
Swamp Sclerophyll Forest	5.41	0.08	1.41	1.33 gain
Swamp Oak Forest	0.23	Nil	n/a	n/a
Coastal Saltmarsh	0.24	Nil	n/a	n/a

The WFCHP (see **APPENDIX 5 – VOLUME 2**) will guide the construction of the frog habitat and will also include details of the Swamp sclerophyll forest EEC offset plantings in this portion of the site. The VMP will guide the rehabilitation and management of Swamp sclerophyll forest EEC offsets elsewhere on the subject site.

4.2.5 Threatened Fauna Recorded on the Site

4.2.5.1 Background

Details of the fauna surveys completed on the Bayside Brunswick site are contained in **APPENDIX 2 (VOLUME 2)**. Seven (7) threatened fauna species have been recorded on or adjacent to the subject site. These species are listed below:

- Common planigale (*Planigale maculata*);
- Glossy black cockatoo (*Calyptorhynchus lathami*);
- Grey headed flying fox (*Pteropus poliocephalus)*;
- Koala (*Phascolarctos cinereus*);
- Little bentwing bat (*Miniopterus australis)*;
- Osprey (*Pandion haliaetus);* and
- Wallum froglet (*Crinia tinnula*).

Threatened fauna sightings on the subject site and within regenerating heathlands to the south are shown in **FIGURES 21 - 24.**

4.2.5.2 Common planigale

Location & Area

The Common planigale has been recorded from intact vegetation in the eastern portion of the subject site as well as in a number of locations on adjoining lands to the south of the site (**FIGURE 22**).

Potential habitat is contained within all intact vegetation communities in the 7(a) & 7(b) zoned land adjacent to Simpsons Creek**.** This area covers approximately 10.37 ha. Large areas of habitat also occur to the south of the subject site where the species has also been recorded.

Avoidance of impacts

In order to avoid and minimise environmental impacts, the footprint utilises land that is zoned 2(a) residential, has been previously disturbed (i.e. agriculture) and is currently subject to an approved slashing regime. Vegetation considered as habitat for the Common planigale (i.e. intact Rainforest, Sclerophyll forest, Grasslands and marshlands) will be unaffected by the proposed development.

Direct/Indirect Impacts

The proposed development will not result in any direct impacts on this habitat however, potential indirect impacts may include:

- Predation by domestic cats and dogs, and the invasive cane toad; and
- An increase is disturbance due to the increase in local population.

Mitigation

A VMP will be completed for the areas of retained vegetation. This will provide protection for retained areas of Common planigale habitat and enhance the site as a quality habitat. The VMP will also include details on measures to exclude domestic animals, pest animals and human traffic from retained habitat areas (i.e. fencing, signage etc.).

Offsets

No offset is required.

4.2.5.3 Glossy black cockatoo

Location & Area

The Glossy black cockatoo has been recorded in a number of locations on adjoining lands to the south of the site (**FIGURE 23**). This species has not been recorded from the subject site despite numerous surveys, however, potential habitat is considered to be contained within vegetation communities 2b and 3a (i.e. vegetation containing *Allocasuarina littoralis*) (**FIGURE 23**) and covers approximately 4.14 ha on the subject site. Large areas of habitat also occur to the south of the subject site where the species has been recorded.

Avoidance of impacts

The majority of vegetation containing food trees for the Glossy black cockatoo (i.e. 3.91ha – 94.4%) will be unaffected by the proposed development (**FIGURE 25**).

Direct/Indirect Impacts

The proposed development will result in minor impacts on potential Glossy black cockatoo habitat i.e. 0.23ha (5.6%) will be removed. Potential indirect impacts may include:

- Predation/disturbance by domestic cats and dogs;
- Loss of tree hollows;
- Increase risk of fire which may reduce the abundance and recovery of she-oaks; and
- Illegal bird smuggling and egg-collecting.

Mitigation

A VMP (see **SECTION 4.2.2.4**) will be completed for the areas of retained vegetation (i.e. Environmental Protection Zones and SEPP 14 Wetlands). This will provide protection for retained areas which contain a food source for the Glossy black cockatoo. The VMP will also include details on measures to exclude domestic animals, pest animals and human traffic from retained habitat areas (i.e. fencing, signage etc.).

Offsets

Areas identified for offset planting are identified in **FIGURE 11.**

Offset planting will also include local and native shrubs, groundcovers and food tree for the Glossy black cockatoo (i.e. *Allocasuarina littoralis)*. The VMP will outline the species to be replaced and the location of replacement plantings.

4.2.5.4 Grey headed flying-fox

Location & Area

Potential habitat for the Grey headed flying fox is contained within all intact vegetation communities in the 7(a) & 7(b) zoned land, between the Crown Road Reserve and Simpsons Creek (**FIGURE 9**).

Avoidance of impacts

In order to avoid and minimise environmental impacts, the development footprint utilises land that is zoned 2(a) residential, has been previously disturbed (i.e. agriculture) and is currently subject to an approved slashing regime. The majority of vegetation containing habitat for the Grey headed flying fox will be unaffected by the proposed development**.**

Direct/Indirect Impacts

Potential habitat for this species covers a total area of 10.37 ha on the subject site. The proposed development will not result in any direct impacts on this habitat. However, a small number of potential forage trees (mostly Heath-leaved banksia) will be lost within the development footprint. No potential roost habitat will be lost. Potential indirect impacts may include:

- electrocution on powerlines; and

- general disturbance and/or disturbance to roosting sites due to the increase in local human population.

Mitigation

A VMP (see **SECTION 4.2.2.4**) will be completed for the areas of retained vegetation. This will provide protection for retained areas which contain habitat for the Grey headed flying fox.

Offsets

No offset is required.

4.2.5.5 Koala

Location & Area

Habitat for the Koala is found within both the wet and dry Sclerophyll communities on the Subject site (i.e. a total area of approximately 8 ha) (**FIGURE 24**)**.**

Avoidance of impacts

In order to avoid and minimise environmental impacts, the footprint utilises land that is zoned 2(a) residential, has been previously disturbed (i.e. agriculture) and is currently subject to an approved slashing regime. However, this area does contain scattered Koala food trees.

Direct/Indirect Impacts

Primary and secondary Koala Habitat occurs on the Subject site and extensively to the south of the site (**FIGURE 24**)**.** Potential habitat was determined by the presence of preferred Koala food trees as outlined by the Byron Shire Council fact sheet, "Why trees are important?" (BSC undated). Although surveys have not identified a resident population, the presence of scats indicates that Koalas utilise the subject site and areas to the south. Impacts on primary and secondary Koala habitat are shown in **FIGURE 26,** and detailed in **TABLE 7.**

TABLE 7
POTENTIAL LOSS OF KOALA HABITAT

	Total Habitat (ha)	**Habitat lost in Development Area (ha)**
Primary Koala Habitat	2.79	0.08 (2.89%)
Secondary Koala Habitat	5.27	1.26 (23.90%)

Potential indirect impacts of the proposed development on Koalas include:

- Fire.
    - Fire regimes could be altered due to the proposed development. This has the potential to result in direct impact to Koalas (injury or death) or indirect impacts including the loss of habitat.
- Injury/death from vehicle strike.
    - The construction of roads in the vicinity of Koala habitat will lead to more frequent exposure to vehicles and a higher possibility of injury or death during both the construction and operational phases of the development.
- Domestic Dog attack.
    - The introduction of domestic dogs on the site could lead to the injury or death of Koalas as a result of dog attacks.
- Drowning in swimming pools.
    - Koalas entering residential areas may come into contact with swimming pools. Pools without a gently sloping side or a rope/ladder as a means for a koala to climb out, can cause a Koala to become trapped and drown.
- Disease.
    - Elevated incidence of disease such as chlamydiosis can result from increased levels of stress from habitat loss, reduced food availability, dog attack and motor vehicle strike.

Mitigation

Mitigation measures for this species include actions for both the construction and operational phase of the proposed development.

Construction Phase

An experienced ecologist/ fauna handler will be on site during all clearing activities. All workers will be made aware of the potential presence of Koalas on the site and the manner in which they should be treated. Accordingly, a construction personnel induction program shall be developed by the Proponent and approved by a suitably qualified person prior to construction commencing. It shall subsequently be applied in the general induction of all construction personnel, aimed at ensuring their awareness of Koala-related issues and of responsibilities and procedures in relation thereto, covering such matters as:

- Areas of the site in which Koalas are most likely to be encountered;
- Threats to Koalas associated with construction activities;

- Requirement to report *any* Koala sightings or incidents on or near the site, and actions required;
- Requirements of the VMP, particularly protocols for vegetation clearing and measures to protect all other native vegetation;
- Prohibition of construction personnel bringing dogs onto the site;
- Temporary fencing and signage to be erected along the margins of the Environmental protection areas stating that the area is Koala habitat; and
- During the construction phase, vehicles shall be restricted to a maximum speed of 50kph and shall operate only in daylight hours.

Operational Phase

Fire management

Any Bush Fire Management Plan covering Koala habitat on or adjacent to the site will aim to reduce the risk of high intensity fires within Koala habitat areas through controlled low intensity burns or mechanical means if and where appropriate.

Roads in the vicinity of Koala habitat

A 50kph speed limit will apply to all roads within the proposed development area. Appropriate lighting (capped) and signage will also be installed where appropriate.

Dogs

Dog confinement and control measures will be mandatory in order to minimise potential harmful encounters between domestic dogs and fauna species. The fencing of lots will be required wherever dogs are to be kept. In addition, dogs will be confined or movements restricted within the lot between peak fauna activity periods i.e. 6pm and 6am. Signage will be used in public spaces to advise of the potential presence of fauna species and the need to restrain dogs, particularly within peak fauna activity periods.

Swimming pools

Construction standards will be imposed in relation swimming pools to ensure a gently sloping side or a rope/ladder as a means for a koala to climb out if necessary.

Landscape plantings

No Primary or Secondary Koala food trees will be utilised for landscape planting within the proposed development.

Offsets

Koala food trees will be planted to offset any losses as a result of clearing for the proposed development. Trees will be planted at an approximate replacement ratio of 2:1. Specific details of Koala food tree planting will be outlined in the VMP. Fifty seven (57) primary Koala food trees (i.e. *E. robusta*) > 0.2 m will be lost and 114 will be planted. This will result in a net gain of 57 primary Koala food trees.

It should be noted that, although Scribbly gum (*Eucalyptus signata*) is recognised as a primary Koala food tree within the SEPP–44 Koala Habitat Protection (refer **SECTION 3.3**),

the value of this species as a preferred koala food tree on the Bayside Brunswick site has been discounted for the following reasons:

- Scribbly gum is not listed as a Primary, Secondary or Supplementary food tree species for the North Coast of NSW as defined by the Approved Recovery Plan for the Koala (DECC 2008); and
- Scribbly gum has not been recognised as a preferred food tree species in either the cuticle scale analysis work completed by JWA (2000), or other site-specific assessments (Phillips and Callaghan 1996; Phillips 2004; Phillips *et al*. 2011) completed for sites located on the Tweed Coast.

4.2.5.6 Little bentwing bat

Location & Area

Potential habitat for the Little bentwing bat is contained within all intact vegetation communities in the 7(a) & 7(b) zoned land, between the Crown Road Reserve and Simpsons Creek **(FIGURE 9).**

Avoidance of Impacts

In order to avoid and minimise environmental impacts, the development footprint utilises land that is zoned 2(a) residential, has been previously disturbed (i.e. agriculture) and is currently subject to an approved slashing regime. Vegetation containing habitat for the Little bentwing bat will be unaffected by the proposed development **(FIGURE 25).**

Direct/Indirect Impacts

Potential habitat for this species covers a total area of 10.37 ha on the subject site. The development will not result in the loss of any potential habitat for this species as mapped within the 7(a) & 7(b) zoned land. However, some isolated potential forage trees will be removed from within the proposed development area. Potential indirect impacts may include:

- death and/or injury from predation/disturbance by domestic dogs and cats; and
- death and/or disease from the use of domestic pesticides.

Mitigation

A VMP **(see SECTION 4.2.2.4)** will be completed for the areas of retained vegetation (i.e. Environmental Protection Zones and SEPP 14 Wetlands). This will provide protection for retained areas of Little bentwing bat.

Offsets

Revegetation will offset the loss of trees within the proposed development area which represent potential forage habitat.

4.2.5.7 Osprey

Location & Area

The Osprey hunts over coastal rivers, estuaries and streams. Forage area for this species occurs over Simpsons Creek. In addition, there are potential nest trees within the intact vegetation communities in the 7(a) & 7(b) zoned land, between the Crown Road Reserve and Simpsons Creek **(FIGURE 9).**

Avoidance of Impacts

The proposed development was designed to utilise existing cleared and disturbed areas. Large areas, within the environmental Protection zone, in the east of the site will remain unaffected. These areas will remain available as potential nest sites for the Osprey.

Direct/Indirect Impacts

Simpsons Creek will not be affected by the proposed development. However, potential indirect impacts may include:

- loss of potential nest trees on the Subject site within the residential footprint;
- disturbances and degradation to water quality from the disposal of treated effluent or stormwater runoff (e.g. increases in turbidity);
- disturbance from human activity to areas of any potential nest sites; and
- disturbance from straying domestic pets and death and/or disease from the ingestion of fish containing discarded fishing tackle.

Mitigation

A VMP (see **SECTION 4.2.2.4**) will be completed for the areas of retained vegetation (i.e. Environmental Protection Zones and SEPP 14 Wetlands). This will provide protection for retained areas containing potential Osprey nest sites. Revegetation areas will provide many more potential nest trees.

Water will be treated to a high standard prior to release to land to the south of the site. Stormwater will not be released directly to Simpsons Creek.

Offsets

No offset is required.

4.2.5.8 Wallum froglet

Background

DoP's 'test of adequacy' letter dated 13th January 2011 raised the following issues in relation the Wallum froglet:

> *"It appears that there is consistent evidence (numerous sitings over a 10 year period in some areas of the site) of Wallum froglet usage in areas not mapped as core habitat, this requires further explanation."*
>
> *"A draft of the Wallum Froglet Compensatory Habitat Plan must be included in the EA for exhibition. This is a significant part of the impact offset for this species and there is a high amount of uncertainty as to*

> *whether this approach will be successful, adequate details of the proposal will need to be available for review by government agencies, Council and the public."*
>
> *"The National recovery plan for the wallum sedgefrog and other wallum-dependent frog species (2006), Report to Department of Environment and Water Resources, Canberra should be referred to."*

The Wallum froglet (*Crinia tinnula*) is listed as Vulnerable within schedules of the Threatened Species Conservation Act (1995). Wallum froglets inhabit acid paperbark swamps and sedge swamps of the coastal 'wallum' country. Habitat for these frogs can be described as core and forage habitat. Core habitat consists of Pleistocene sandy areas of Wallum country where acid, tannin stained water remains as ponds for up to 3-4 months. This allows the full metamorphosis of the frogs from eggs to tadpoles to adults. Core habitat for this species on the subject site is considered to occur within the drainage lines where sedges have proliferated and water sits for prolonged periods. Land near the drains (i.e. adjoining areas of grassland and slashed areas) is considered to provide forage habitat when inundated during wet periods.

Based on the success of the compensatory habitat created during the construction of the Tugun Bypass (**APPENDIX 6 – VOLUME 2**), as demonstrated by the recording of Wallum froglets during numerous monitoring events, it is not considered that there is "*a high amount of uncertainty as to whether this approach will be successful".*

Location & Area

Wallum froglet habitat is found throughout the subject site including 'wallum vegetation' and drainage lines communities and associated slashed grass/sedge lands **(FIGURE 21)** (i.e. core habitat) **(FIGURE 21).** Records of this species also occur within regeneration heathlands to the south of the subject site **(FIGURE 21).** This species appears to disperse into adjoining slashed areas during suitable conditions (i.e. localised flooding after heavy rain).

Whilst numerous records have occurred over a 10 year period in some areas of the site not mapped as core habitat, records of this species do not necessarily equate with breeding habitat. Breeding habitat must retain water for extended periods of time.

Furthermore, the Wallum froglet is known to move into adjacent habitats during rainfall events. During a study of the habitat and movements of the Wallum froglet by White & Pike (2006), froglets were often located away from breeding ponds in nearby heath and woodland and could be found up to 100m from a pond. Froglet movement between ponds and foraging sites nearby appeared to be directed by the occurrence of rainfall events.

Avoidance of impacts

The proposed development was designed to utilise existing cleared and disturbed areas and avoid likely Wallum froglet core habitat. Large areas, within the Environmental Protection Zone, in the east of the site, will remain unaffected. Additionally, likely core habitat in the drainage line running into the Environmental Protection Zone has been avoided.

Direct/Indirect Impacts

To provide adequate stormwater conveyance from the site to existing drainage lines to the south, the proposed development will result in unavoidable impacts on some core habitat areas (i.e. within the existing site drain).

The direct impact of the proposed development on core Wallum froglet habitat is depicted in **FIGURE 27.** The proposed development will result in the removal of 0.50 ha (9.09%) of the available core habitat (i.e. 5.49 ha) on the subject site.

Potential indirect impacts include:

- Impact of pest vertebrate species;
- Reduction of water quality and modification to acidity allowing other native species to colonise Wallum froglet habitat; and
- Introduction of Chytrid fungus during construction activities.

Mitigation

An Erosion and Sediment Control Plan and Stormwater Management Plan will also ensure that storm water runoff into core habitat areas will be of a high quality **(FIGURES 28 & 29).** All houses will have rainwater storage tanks to comply with BASIX requirements. Lots B146 & B151-B156 will utilise lot specific infiltration swales. There will also be larger infiltration swales located within lot B156 and P1 Public Reserve. It is proposed that all headwall outlets have an Ecosol Net Tech Solid Pollutant Filter to remove and retain gross pollutants from stormwater flows. Temporary dry sediment basins and straw bale filters will be utilised for erosion and sediment control.

The activities of construction contractors within and adjacent to the drainage channel will be strictly controlled by way of compliance with the provisions of a Wallum Froglet Compensatory Habitat Plan.

Offsets

The loss of Wallum froglet habitat will be offset through the creation of compensatory habitat areas **(FIGURE 30).** These areas will be designed to provide additional core habitat areas on the subject site and will be created in accordance with a Wallum Froglet Compensatory Habitat Plan (see **APPENDIX 5 – VOLUME 2**).

TABLE 8 summarises the net gain of potential Wallum froglet habitat after these proposed rehabilitation measures.

TABLE 8
NET GAIN OF POTENTIAL WALLUM FROGLET HABITAT AFTER REHABILITATION

Total Habitat (ha)	Habitat Retained (ha)	Total Habitat Lost (ha)	Constructed Wallum Frog Habitat (ha)	Net gain (ha)
5.49 **(FIGURE 21)**	4.99 **(FIGURE 27)**	0.50	1.20	+0.70

4.2.6 Threatened Fauna species that may possibly occur on the Site

In addition to the Threatened fauna species recorded on or adjacent to the subject site, a further fourteen (14) threatened fauna species were considered either likely to occur or a possible occurrence on the Subject site based on the availability of suitable habitat (**APPENDIX 2 – VOLUME 2**)**.** An impact assessment for these species is provided in the following table **(TABLE 9):**

- Australasian bittern;
- Black bittern;
- Black-necked stork;
- Collared kingfisher;
- Common blossom bat;
- Eastern long-eared bat;
- Grass owl;
- Greater broad-nosed bat;
- Large-footed myotis;
- Long-nosed potoroo;
- Mangrove honeyeater;
- Swift parrot;
- Wallum sedge-frog; and
- White-eared monarch.

TABLE 9
POTENTIAL IMPACTS, MITIGATION AND OFFSETS for THREATENED FAUNA PREDICTED TO OCCUR ON THE SITE

Species/EECs/ Significant Vegetation	Habitat	Vegetation Communities	Impacts	Mitigation	Offsets
Australasian bittern	Freshwater habitats, dense Saltmarsh vegetation in estuaries and flooded grasslands	4a, 4b and 4c	Nil	na	No offset is required.
Black bittern	Riparian habitats	Intact[4] communities along Simpsons Creek	Nil	na	No offset is required.
Black-necked stork	Swamp, mangroves, mudflats, dry floodplains and irrigated land	4a, 4b and 4c Intact communities along Simpsons Creek	Nil	na	No offset is required.
Collared kingfisher	Mangroves	4a	Nil	na	No offset is required.

[4] Intact vegetation communities are contained with the 7(a) & 7(b) zoned land, between the Crown Road Reserve and Simpsons Creek, and will be retained.

Species/EECs/ Significant Vegetation	Habitat	Vegetation Communities	Impacts	Mitigation	Offsets
Common blossom bat	Vegetation containing plants with nectar producing flowers	All communities except 3b and 3c.	5.68 ha (29.7%) will be affected	A VMP will be completed for the areas of retained vegetation; This will provide protection for retained areas containing potential habitat/food resources for the Common blossom bat.	Suitable forage species will be included in the planting list for both landscaping and rehabilitation areas.
Eastern long-eared bat	Vegetation containing old growth trees with hollows	All communities except 3b and 3c.	5.68 ha (29.7%) will be affected	A VMP will be completed for the areas of retained vegetation; This will provide protection for retained areas containing habitat/food resources for the Eastern long-eared bat.	Suitable forage species will be included in the planting list for both landscaping and rehabilitation areas.
Grass owl	Intact coastal heath	3a	0.02 ha (2%) will be affected	A VMP will be completed for the areas of retained vegetation; This will provide protection for retained areas containing habitat/food resources for the Grass owl.	Suitable forage species will be included in the planting list for both landscaping and rehabilitation areas.
Greater broad-nosed bat	Rainforest and moist forests	All Intact vegetation communities	Nil	na	No offset is required.

Species/EECs/ Significant Vegetation	Habitat	Vegetation Communities	Impacts	Mitigation	Offsets
Large-footed myotis	Habitats containing water creeks, rivers, estuaries and dams	All Intact vegetation communities	Nil	na	No offset is required.
Long-nosed potoroo	Dense coastal heath	3a	0.02 ha (2%) will be affected	na	Suitable forage species will be included in the planting list for both landscaping and rehabilitation areas.
Mangrove honeyeater	Mangroves	4a	Nil	na	No offset is required.
Swift parrot	Winter flowering eucalyptus species	Community 7 (scattered trees)	75% of the scattered trees	A VMP will be completed for the areas of retained vegetation; This will provide protection for retained areas containing habitat/food resources for the Swift parrot.	Suitable forage species will be included in the planting list for both landscaping and rehabilitation areas.

Species/EECs/ Significant Vegetation	Habitat	Vegetation Communities	Impacts	Mitigation	Offsets
Wallum sedge-frog	The Wallum sedge-frog utilises similar habitat to the Wallum froglet i.e. 'wallum vegetation' and drainage lines **(FIGURE 9)**	As for Wallum froglet	Removal of 0.50 ha (9.1%) of habitat**.**	The mitigation and offsets proposed for the Wallum froglet will benefit the Wallum sedge frog **(see SECTION 4.2.5.8).**	
White-eared monarch	Coastal rainforest, swamp forest and wet eucalypt forest.	All Intact vegetation communities	Nil	na	No offset is required.

5 NATIVE VEGETATION AND WILDLIFE CORRIDORS

5.1 Introduction

This section provides a response to the following relevant DGEAR:

> *DGEAR 3.8 – "Address impacts of clearing of native vegetation, and outline measures for the conservation of existing wildlife corridor values and/or connective importance of any vegetation on the Subject land. Particular consideration should be given to minimising impacts on the creek line running north/south on the western side of the lot, in consultation with council."*

This section details the extent of native vegetation clearing that will result from the proposed development. Measures for the conservation of the existing wildlife corridor values and connective importance of the vegetated land on the subject site are considered. The possible direct and indirect impacts of the proposal are outlined, along with proposed offset strategies to ensure that there is no net loss of native vegetation values. The potential impacts on significant vegetation (i.e. remnant bushland, threatened flora species, EEC's etc.) has been discussed in previous sections of this report.

DGEAR 3.8 states that "*particular consideration should be given to minimising impacts on the creek line running north/south on the western side of the lot*". Surveys of this area indicate that there is a small depression in this area but no obvious Creek line. Swamp Sclerophyll vegetation is present in this area but will be unaffected by the development. The area will become part of the buffer to the Pacific Highway.

5.2 Native Vegetation

5.2.1 Avoidance of Impacts

In order to avoid and minimise environmental impacts, the footprint utilises land that is zoned 2(a) residential, has been previously disturbed and is currently subject to an approved slashing regime.

5.2.2 Direct/Indirect Impacts

Development of the site will result in the loss of vegetation for the construction of buildings, access roads, driveways and associated infrastructure. An overlay of the development footprint on the vegetation is shown in **FIGURE 25**.

A summary of vegetation types that will be lost is shown in **TABLE 10**.

TABLE 10
POTENTIAL LOSS OF NATIVE VEGETATION

	Description	Total Area (ha)	Loss (ha)	Loss (%)
Swamp sclerophyll communities				
1a	Tall closed forest (*Eucalyptus robusta*)[5]	0.14	0.00	0.00
1b	Tall closed woodland (*Eucalyptus robusta*) [4]	0.14	0.08	59.69
1c	Tall closed forest (*Melaleuca quinquenervia*) [4]	2.52	0.00	0.00
1d	Tall closed forest (*Eucalyptus signata*, *Eucalyptus robusta*) [4]	0.61	0.00	0.00
1e	Tall closed forest (*Eucalyptus robusta*, *Melaleuca quinquenervia*, *Leptospermum polygalifolium*) [4]	1.82	0.00	0.00
1f	Mid closed forest (*E. robusta* and *M. quinquenervia*)[4]	0.17	0.00	1.37
Dry sclerophyll communities				
2a	Tall closed forest (*Eucalyptus signata, Endiandra sieberi*)	0.89	0.00	0.00
2b	Tall open forest (*Eucalyptus signata*, *Allocasuarina littoralis, Banksia aemula*)	2.99	0.21	6.88
Heath communities				
3a	Tall closed heath (*Banksia aemula, Allocasuarina littoralis*)	1.15	0.02	2.03
3b	Low closed dry heath (*B. aemula* and *A. littoralis*)	9.76	7.48	76.70
3c	Low closed wet heath (*Lepyrodia interrupta* and *Xanthorrhoea fulva)*	5.23	4.58	87.44
Estuarine communities				
4a	Mid-high mid-dense forest (*Avicennia marina*, *Aegiceras corniculatum*)	0.93	0.00	0.00
4b	Mid-high forest (*Casuarina glauca*, *Melaleuca quinquenervia)*[6]	0.23	0.00	0.00
4c	Closed rushland/fernland (*Juncus kraussii*, *Acrostichum speciosum*)[7]	0.24	0.00	0.00
Other communities				
5	Tall closed grassland (*Andropogon virginicus*)	3.61	3.31	91.59
6	Drainage lines	0.52	0.49	95.29
7	Scattered trees (*Eucalyptus signata*)	1.39	1.05	75.25

[5] Denotes vegetation communities considered to be representative of the EEC Swamp Sclerophyll Forest
[6] Vegetation community representative of the EEC Swamp Oak Forest
[7] Vegetation community representative of the EEC Coastal Saltmarsh

In total, 17.22 hectares (55%) of the site will be subject to development. However, most development will occur in areas of already cleared and disturbed land (70%).

Additional impacts on vegetation communities may include:

- Clearance of areas of the Subject site represents a loss of habitat available for dispersal for plants and will reduce visits by pollination and dispersal vectors;
- Disturbance to the Subject site creates opportunities for weeds to colonise. Weeds may be introduced to the site in construction materials or by vehicles. Occupation of the Subject site creates opportunities for weeds to become established. Landscape species may escape to retained areas of vegetation;
- The removal of vegetation from the Subject site represents the loss of organic material from the site;
- Residents may create walking tracks through bushland areas. This may result in direct loss of vegetation, change in vegetation structure and increased opportunities for weeds and disturbance-adapted animal species; and
- Occupation of the site may increase the risk of fire release into the surrounding bushland.

5.2.3 Mitigation/Offsets

Approximately 14ha of vegetation will remain unaffected by the proposed development. A large portion of this is intact native vegetation communities with very few weeds. The VMP will outline appropriate management practices which will ensure the integrity of the remaining native vegetation is maintained.

In addition, the WFCHP **(APPENDIX 5 - VOLUME 2)** will provide strategies for the creation of artificial "wallum" wetland habitat which will be suitable as core Wallum froglet habitat. This will include regeneration/revegetation works utilising suitable 'aquatic' and 'wallum' native plant species.

Approximately, 4.08 ha of revegetation work will be completed in accordance with the VMP and the WFCHP (**FIGURE 11)**. This will include the revegetation of approximately 1.41ha of Swamp sclerophyll on coastal floodplain EEC and 1.51ha of Tall open dry sclerophyll forest. The areas of revegetation indicated within the Crown Road Reserve (**FIGURE 11)** and further potential for rehabilitation are possible subject to the resolution of the future of this Road Reserve with Crown Lands.

5.3 Wildlife corridors

5.3.1 Introduction

The following sections provide a discussion of the background to the site corridor issues, and an assessment of the corridor values of existing vegetation within and to the immediate west of Stage 4a of the proposed development. An assessment of additional corridors within and adjacent to the subject site is also provided for comparison purposes.

5.3.2 Background

Wildlife corridor mapping, for the locality, is provided by the NPWS Key Habitats and Corridors project (NPWS undated) and the Byron Shire Local Environment Study (BSC undated) (**FIGURES 31 & 32**)**.** The majority of the central portion of the subject site is mapped by NPWS as Key Habitat, with a Regional Corridor passing through the eastern portion of the site (**FIGURE 32**). Ground truthing (JWA 2010) has shown that the Key Habitat marked is largely comprised of cleared and disturbed land. The BSC Wildlife Corridors Plan maps a large part of the eastern portion of the site as Vegetated Corridor (**FIGURE 31**). This area corresponds with land zoned for environmental protection by the BSC. There is a smaller portion of land within the site that is mapped as part of a Non-vegetated Corridor.

During meetings with DoP (25th February & 10th March 2011) it was requested that an assessment of the corridor values of existing vegetation within and surrounding Stage 4a of the proposed development be completed. In particular, the assessment was to provide details on how the existing corridor values of this area could be maintained if the Stage 4a development proceeded in its current form.

5.3.3 Literature Review

Based largely on the patch-matrix-corridor model of landscape ecology, wildlife corridors are a frequently discussed landscape feature and are a recommended management tool to enhance landscape connectivity.

Connectivity is a measurement of the relationships within and between areas of vegetation. These relationships exist in a continuum from high to isolated (also referred to as 'degree of connectedness'). Connectivity relates to physical features of the landscape and the behaviour of species dependant on that landscape.

The fundamental question that must be asked in the discussion of corridors is whether the particular corridor is capable of facilitating sufficient delivery of the target species to the recipient habitat patch(es). A detailed literature review of the principles of corridors and connectivity is provided in **APPENDIX 11 (VOLUME 2).**

5.3.4 Bayside Corridor Descriptions

5.3.4.1 Stage 4a Corridor

The corridor of existing vegetation in the western portion of the Stage 4a area will be retained and rehabilitated (**FIGURE 33**). Approximately 60% of this corridor is covered by isolated pockets of vegetation (**PLATES 1 & 2**). These pockets of vegetation contain Swamp sclerophyll and regrowth wet heath species (i.e. Broad-leaved paperbark, Swamp mahogany and *Leptospermum* spp.) and are interspersed with cleared areas (approximately 40% of the corridor) that are maintained via a periodic slashing regime.

The corridor, running along the western boundary of Stage 4a and extending onto adjoining land to the west, ranges in width from 30 m to 80 m.

It should be noted that the Stage 4a area is not identified by either the NPWS corridor mapping or by the BSC corridor mapping.

5.3.4.2 Western Corridor

The western corridor (**FIGURE 33**) includes Lot B156 (to the west of the Bayside Brunswick site) and the vegetated land to the north and south, extending to the Pacific Highway to the west. Collectively, this forms an extensive vegetated corridor ranging in width from approximately 100m to 250m.

The corridor is generally comprised of Swamp sclerophyll forest (approximately 90% of corridor) (**PLATE 3**) and Dry sclerophyll forest (approximately 10% of corridor) (**PLATE 4**).

PLATE 1: Taken from centre of Stage 4a corridor looking south (see **FIGURE 34** for photo orientation).

PLATE 2: taken from centre of Stage 4a corridor looking north (see **FIGURE 34** for photo orientation).

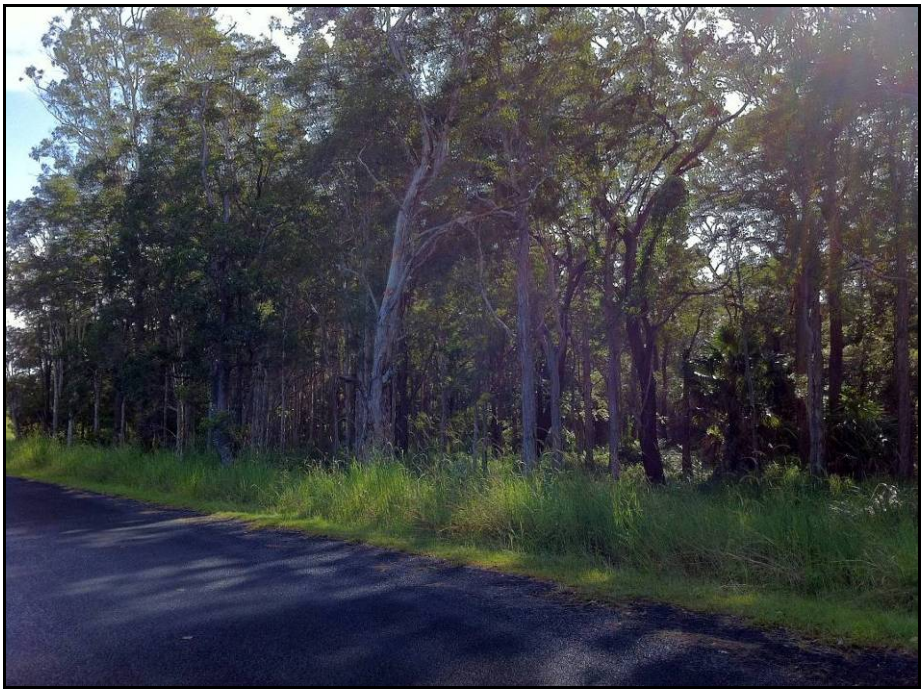

PLATE 3: taken from the western edge of the Western Corridor looking east towards the Bayside Brunswick site (see **FIGURE 34** for photo orientation).

PLATE 4: taken from the eastern edge of the Western Corridor (see **FIGURE 34** for photo orientation).

5.3.5 Bayside Corridor Fauna Analysis

5.3.5.1 Introduction

Criteria have been developed by JWA to assess the importance of site habitats for fauna movement/dispersal. Six (6) categories have been developed based on an analysis of the following criteria:

- corridor dimension;
- continuity;
- habitat diversity and quality;
- extent of internal and external disturbance; and
- importance of the corridor for linking significant habitats.

5.3.5.2 Fauna Movement Objectives

TABLE 12 describes the criteria utilised to define the six (6) fauna movement categories.

TABLE 12
FAUNA MOVEMENT CORRIDOR CATEGORIES

CATEGORY	CRITERIA
Category 1 Corridors	• The corridor is of sufficient dimension to support many of the ecological processes functioning in the habitats that it is linking; • Facilitates gene flow by providing a continuum of breeding territories rather than runways which allows only physical movement of individuals; • Contain a wide diversity of habitats; • Contain core habitats free from edge effects and with minimal internal disturbance; • Connect habitats of at least Sub-regional importance (i.e. significant in far north-eastern NSW);
Category 2 Corridors	• The corridor is of sufficient dimension to support many of the ecological processes functioning in the habitats that it is linking; • Facilitates gene flow by providing a continuum of breeding territories rather than runways which allows only the physical movement of individuals; • Contain a limited diversity of habitat; • Contain core habitats free from edge effects and with minimal internal disturbance; • Connect habitats of at least local to sub-regional importance.
Category 3 Corridors	• Fragmented habitat likely to provide a linkage with high quality ecological areas; • Facilitate gene flow by allowing physical movement of individuals but does not generally contain breeding habitat; • Contain a low diversity of habitats; • Edge effects and internal disturbance are significant; • Connect habitats of local to sub-regional importance;
Category 4 Corridors	• Detached remnants that may contain populations of small terrestrial species largely isolated from other populations. • Small pockets of habitat that provide stepping stones for larger scansorial species such as Koalas and locally nomadic and migratory fauna following blossom or fruiting cycles. • Contain a low diversity of habitats; • Edge effects and internal disturbance are significant; • Provides stepping stones between habitats of local - regional importance.
Category 5 Corridors	• Drains, creeks, forest roads etc, that provide open flyways for Microchiropteran bats; • Creeks and rivers that are used as a navigation aid by Flying foxes; • Contain a low diversity of habitats: • Edge effects and internal disturbance are significant; • Connect habitats of local to regional importance;

CATEGORY	CRITERIA
Category 6 Corridors	• Cleared or isolated non-native habitats that have a low value as dispersal habitat. • Do not generally link habitats of importance.

Vegetation within and adjacent to Stage 4a were assessed according to the above criteria. Fauna movement corridors identified on and adjacent to Stage 4a are shown in **FIGURE 33** and are described below.

5.3.5.3 Corridor Values for Fauna Groups

The values for fauna groups of each of the Stage 4 and western corridors on and adjacent to the Subject site respectively, were assessed according to habitats provided. A summary is shown in **TABLE 13.**

TABLE 13
CORRIDOR VALUES FOR FAUNA GROUPS

Corridor	**Fauna Group For Which Corridor Has Value**									
	Amphibians	Reptiles	Cryptic Wetland Birds	Forest Interior Birds	Local & Regional Migrants	Small terrestrial mammals	Koalas	Other arboreal mammals	Microchiropteran bats	Megachiropteran bats
Stage 4a Corridor	Mod.	Low	Low	Low	Low	Low	Low	Low	Mod.	Mod.
Western Corridor	High	High	Mod.	Mod.	Mod.	High	High	High	High	High

5.3.5.4 Results of Fauna Corridor Analysis

The broad band of habitat extending along Simpsons Creek is the most important corridor in the study area. It is of sufficient width to allow the movement of a wide range of species, is free of significant internal disturbance and edge effects, and connects habitats of sub-regional significance.

The Western Corridor supports a diversity of vegetation types and is likely to facilitate the free movement of amphibians, reptiles, birds and mammals. The Western Corridor is considered to be a Category 2 corridor (**TABLE 3**) as it is considered to:

- Be of sufficient dimension to support many of the ecological processes functioning in the habitats that it is linking;
- Facilitate gene flow by providing a continuum of breeding territories rather than runways which allows only the physical movement of individuals;
- Contain a moderate diversity of habitat;
- Contain core habitats free from edge effects
- Internal disturbance is minimal;
- Connect habitats of at least local to sub-regional importance (i.e. key habitat and non-vegetated corridors as mapped by the NPWS [**FIGURE 31**] and BSC **[FIGURE 32]** respectively).

Vegetation within Stage 4a on the site may be used by fauna as habitat (including threatened species), but offers limited opportunities for movement. Disturbance adapted species (particularly Koalas) may utilise patches of scattered vegetation within Stage 4a as 'stepping stone' habitat when dispersing. This area is not identified as a corridor by NPWS or BSC and is considered to represent a Category 4 corridor **(TABLE 3)** on the subject site as it consists of:

- Detached remnants that may contain populations of small terrestrial species largely isolated from other populations.
- Small pockets of habitat that provide stepping stones for larger scansorial species such as Koalas;
- Stepping stones for locally nomadic and migratory fauna following blossom or fruiting cycles;
- A low diversity of habitats;
- Edge and internal disturbance which are considered significant; and
- Provide stepping stones between habitats of local - regional importance.

5.3.5.5 Impacts of development on existing corridors

In summary, it is considered that the Western Corridor (Category 2) provides an important movement and dispersal conduit for fauna (including threatened fauna) in the locality. Movement of fauna north-south on either side of the development footprint will be

maintained and improved with the completion of the VMP. There will be no impacts on the Western Corridor as a result of the proposed development.

The existing corridor in the proposed Stage 4a of the development will also be retained. As part of the proposal, the cleared areas within this corridor, and on the subject site, will be rehabilitated and will provide further habitat for the Wallum froglet. The proposed rehabilitation works will widen this corridor to a range of 50 m to 150 m.

It is considered that given the excellent movement opportunities provided by the Western corridor, as well as vegetation along Simpsons Creek and on lands to the south of the subject site, there are no further requirements for the provision of corridors within the subject site.

6 IMPACTS ON THE RIPARIAN ZONE OF SIMPSON'S CREEK

6.1 Introduction

This section provides a response to the following relevant DGEAR:

> *DGEAR 3.4 – "Address direct and indirect impacts on the riparian zone, and identify conservation (riparian) buffer zones between the development areas and the adjoining vegetation, having regard to a recommended 50m buffer width and findings, conclusions and recommendations of the Brunswick Estuary management Study and Management Plan."*

This section details the direct and indirect impacts on the riparian zone of Simpson's Creek.

6.2 Site Assessment

A large area of land, between the Crown Road Reserve and Simpsons Creek, will be set aside as a Conservation area. A Vegetation Management Plan (VMP) will be completed for this area which includes land under Environmental Protection Zoning 7(a) & 7(b) and SEPP 14 Wetlands. The VMP will include measures to reduce the potential indirect impacts of the development such as weeds, humans, feral and domestic animals. The proposed development will have minor effects on the riparian Zone of Simpsons Creek. **FIGURE 20** illustrates the distances of the proposed development from riparian zone (i.e. EECs) along Simpsons Creek.

6.3 Brunswick Estuary Management Study and Management Plan

The Brunswick Estuary Management Plan (BEMP) covers the tidal reaches of the Brunswick River, Kings Creek, Marshals Creek and Simpson's Creek. The estuary is within the Cape Byron Marine Park, which was declared in November 2002. The report documents the findings of a combined Estuary Management Study and Plan for the Brunswick Estuary.

The report (BEMP 2009) recommends the incorporation of a 50-metre wide undeveloped conservation zone alongside all new development and subdivisions adjacent to waterways within the new Bryon LEP and/or DCP, in accordance with the Mullumbimby and Brunswick Heads Settlement Strategies and the NSW Planning Reforms LEP standard template.

6.4 Mitigation of Impacts on the Riparian Zone of Simpson's Creek

Land under Environmental Protection Zoning 7(a) & 7(b) and SEPP 14 Wetlands occurs adjacent to Simpsons Creek, forming a buffer between the Creek and the development footprint. At the widest point, the buffer will be approximately 300m and at the narrowest 70m. Only low impact public access will be provided to the Simpson's Creek area. This will include pedestrian only access to Simpsons Creek along with advisory/ regulatory signage and a small car parking facility adjacent to the proposed perimeter road (i.e. situated at a suitable distance from Simpson's Creek to minimise disturbance).

Proposed stormwater management strategies, including erosion control, will ensure that runoff, from the proposed development, into Simpsons Creek is treated and will be of a high quality. All houses will have rainwater storage tanks to comply with BASIX requirements. Temporary dry sediment basins and straw bale filters will be utilised for erosion and sediment control (**FIGURE 28**). Lots B146 & B151-B156 will utilise lot specific infiltration swales. There will also be larger infiltration swales located within lot B156 and P1 Public Reserve (**FIGURE 29**). It is proposed that all headwall outlets have an Ecosol Net Tech Solid Pollutant Filter to remove and retain gross pollutants from stormwater flows.

7 OWNERSHIP AND MANAGEMENT OF THE PROPOSED CONSERVATION AREAS (RIPARIAN) AND BUFFER ZONES

7.1 Introduction

This section provides a response to the following relevant DGEAR:

> *DGEAR 3.5 – "Address ownership of the proposed conservation areas (riparian) and buffer zones, and management regimes to be undertaken in these areas and zones"*

This section will discuss the location of proposed Environmental Protection Areas on the subject site and address the management and maintenance of these Protected Areas.

7.2 Development Constraints

The Development Layout has been designed in accordance with the following constraints i.e. the layout is situated within land that:

- is zoned as residential;
- has a continual clearing history (i.e approved slashing);
- is outside existing areas of intact native vegetation;
- is outside SEPP 14 Wetlands;
- avoids significant trees (i.e. high significance score); and
- is above highest predicted flood levels including the level modelled with the effect of Global warming.

7.3 Description of Environmental Protection Areas

The remaining areas outside the development layout will be the subject of a VMP. Key ecological values of the Environmental Protection Areas will be retained through the following measures:

- No development except for tracks for pedestrian access or for essential environmental management purposes.
- Pedestrian access is to be limited to designated tracks.
- Vehicular access, apart from for essential environmental management purposes, will be precluded.
- Low impact, pedestrian only access will be provided from the proposed development to Simpsons Creek in the south-eastern corner of the Subject site. A small car parking facility will be provided adjacent to the proposed perimeter road

at the head of the access track. Parking will be restricted to 8 spaces/ lots and will be designed in accordance with low impact design guidelines in order to minimise disturbance to Simpson's Creek.

- Advisory and regulatory signage will be provided e.g. advising of environmental protection/revegetation areas, nature reserve/marine park, requirement to keep dogs on leashes and keep to designated tracks etc.

7.4 Management of Environmental Protection Areas

A VMP will be completed for the 7(a) & 7(b) zoned area which includes areas of SEPP 14 Wetlands. The plan will include the following:

- A description of the existing features;
- An outline of the rehabilitation or revegetation to be completed, including a detailed description of which species are to be planted;
- A detailed maintenance and monitoring program, including performance indicators, deadlines for completion, reporting and reviewing and any corrective action that may be required.

7.5 Maintenance

The maintenance of the Environmental Protection Areas will be described in detail in the VMP. The Plan will detail a 5 year maintenance program with the aim that maintenance becomes public responsibility in the long term.

7.6 Ownership

Codlea Pty Ltd will retain responsibility of the 7(a) & 7(b) Protected Land during the implementation of the VMP. After this period the area will be dedicated to Byron Shire Council, who will resume ownership and responsibility subject to a conservation agreement.

8 SUMMARY OF IMPACTS, MITIGATION & OFFSETS

The proposed development comprises a residential subdivision of approximately 163 Lots. The provision of 2 parks (P1 and P2) is also proposed. The P1 Public Reserve covers an area of approximately 13.17ha (excluding the Crown Road Reserve) and will be dedicated to Byron Shire Council as a conservation area after the completion of revegetation works. The P2 Drainage Reserve covers an area of approximately 1.28ha and will be utilised for stormwater treatment purposes and the creation of Wallum froglet habitat.

In order to avoid and minimise environmental impacts, the development footprint utilises disturbed land that is zoned 2(a) residential. This land consists of Low closed wet and dry heath communities and is currently subject to an approved slashing regime. In total, 17.22 hectares (55%) of the site will be subject to development. However, most development will occur in areas of already cleared and disturbed land. There will also be a loss of 585 trees of varying ecological significance.

A Vegetation Management Plan will be prepared for the Subject site. The plan will outline both mitigation and compensatory strategies. The plan will set out a strategy for the rehabilitation and management of the Environmental Protection Zone on the Subject site (i.e. the areas covering approximately 10.37ha between the development footprint and Simpson's creek), outline a compensatory replacement planting strategy to offset the loss of the ecologically significant trees and the treatment of the ecological buffers to the Endangered ecological ecosystems found on the site. All Koala and Glossy black cockatoo food trees impacted by the development will be replaced at a ratio of 2:1 in accordance with the VMP.

The proposed development is likely to impact on native fauna in a number of ways. However, impacts are likely to be minor due to the disturbed nature of the slashed heath areas of the development footprint. To mitigate the loss of habitat for the Wallum froglet, an area of constructed Wallum froglet habitat is proposed within Reserves P1 and P2. These areas will result in the net gain of approximately 0.7ha of Wallum froglet habitat. A Wallum Froglet Compensatory Management Plan will guide the construction and management of this habitat.

The eastern part of the site is mapped as a regional movement corridor. The movement corridor passes through the intact forested areas on the site and will not be affected by the proposed development.

Description and justification of measures to mitigate any adverse effects to fauna have been provided in accordance with relevant Threatened Species Assessment Guidelines. Consideration has been given to measures to avoid or minimise the impacts. Where measures to avoid and mitigate are not possible, then offset strategies have been considered.

Predation by domestic cats and dogs was listed as a threatening process for a number of threatened fauna species that are known to occur or are likely to occur on the subject site. In order to minimise the risk of predation or injury to fauna, the keeping of cats within the proposed development will be prohibited in perpetuity by way of a Section 88B Instrument under the *Conveyancing Act 1919*, or a covenant (as part of a condition of approval).

While dogs will be permitted, dog confinement and control measures will be mandatory in order to minimise potential harmful encounters between domestic dogs and fauna species. The fencing of lots will be required wherever dogs are to be kept. In addition, dogs will be confined or movements restricted within the lot between peak fauna activity periods i.e. 6pm and 6am. Signage will be used in public spaces to advise of the potential presence of fauna species and the need to restrain dogs, particularly within peak fauna activity periods.

An assessment of impacts through assessing key thresholds has been completed in accordance with OEH & DPI guidelines. It is considered that the proposed development will not reduce the long term viability of the EEC's or threatened fauna species on the subject site will not be reduced by the proposed development. The Proposal is unlikely to accelerate the extinction or place at risk the EEC's or threatened fauna species on the subject site.

An assessment of the Commonwealth listed species (including migratory species) known to occur or considered a possible occurrence on the site, has shown that populations of these species do not occur on the site. The proposed development will not cause a significant adverse impact on any of these species.

Through retention of intact habitat areas and the majority of habitat trees, and the provision of additional habitat areas (i.e. core habitat for the Wallum froglet and additional food trees for the Koala and Glossy black cockatoo), it is considered that the proposal represents an ecologically sustainable development.

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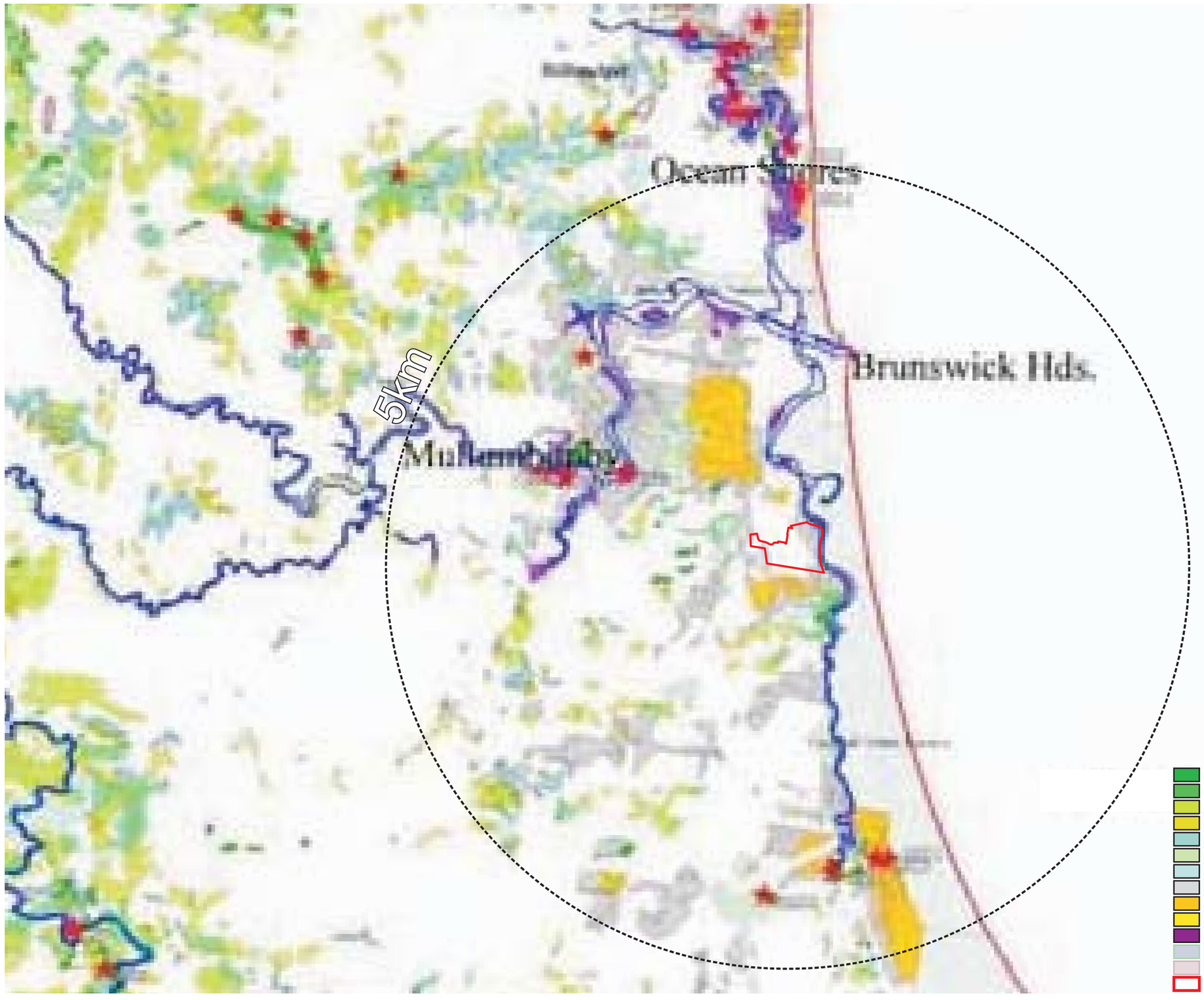
SOURCE: Department of Lands 2008 SCALE: 1 : 25 000 @ A4 JWA PTY LTD Ecological Consultants	CLIENT Codlea Pty Ltd PROJECT Ecological Assessment Bayside Brunswick Lot 73 on DP851902; Brunswick Heads, NSW Shire of Byron	**FIGURE 1** PREPARED: BW DATE: 02 November 2012 FILE: N97066_Locality.cdr	TITLE **LOCALITY PLAN**



N

LEGEND

- Rainforest (minimal Camphor laurel presence)
- Rainforest (low to moderate Camphor laurel presence)
- Camphor laurel +/- naturalised exotic tree species
- Brushbox forest
- Wet to moist sclerophyll forest
- Moist to dry sclerophyll forest
- Wattle/mixed regrowth forest & shrubland
- Swamp sclerophyll forest
- Heathland/shrubland
- Sedgeland/fernland/grassland
- Mangrove forest
- Unassessed (U)
- Plantation (P)
- Subject Site

0 1.5km

1 : 50 000

SOURCE: Byron Flora and Fauna Study 1999

SCALE: 1 : 50 000 @ A3

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Ecological Consultants

CLIENT
Codlea Pty Ltd

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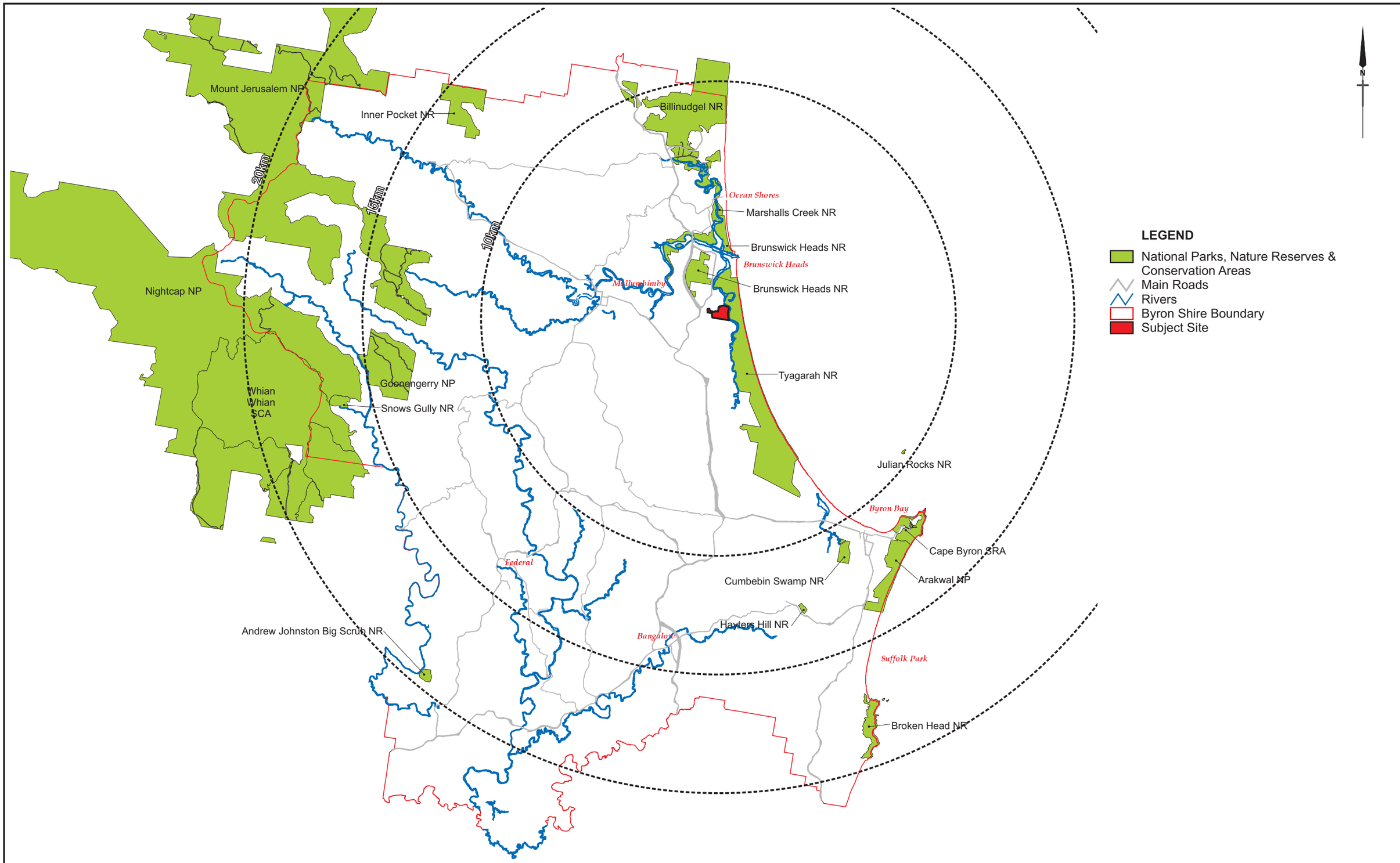
Ecological Assessment
Bayside Brunswick
Lot 73 on DP851902; Brunswick Heads, NSW
Shire of Byron

FIGURE 2

PREPARED: BW
DATE: 02 November 2012
FILE: N97066_Byron Veg.cdr

TITLE

VEGETATION OF BYRON SHIRE



SOURCE: NSW DECCW; Byron Shire Council

SCALE: 1 : 150 000 @ A3

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Codlea Pty Ltd

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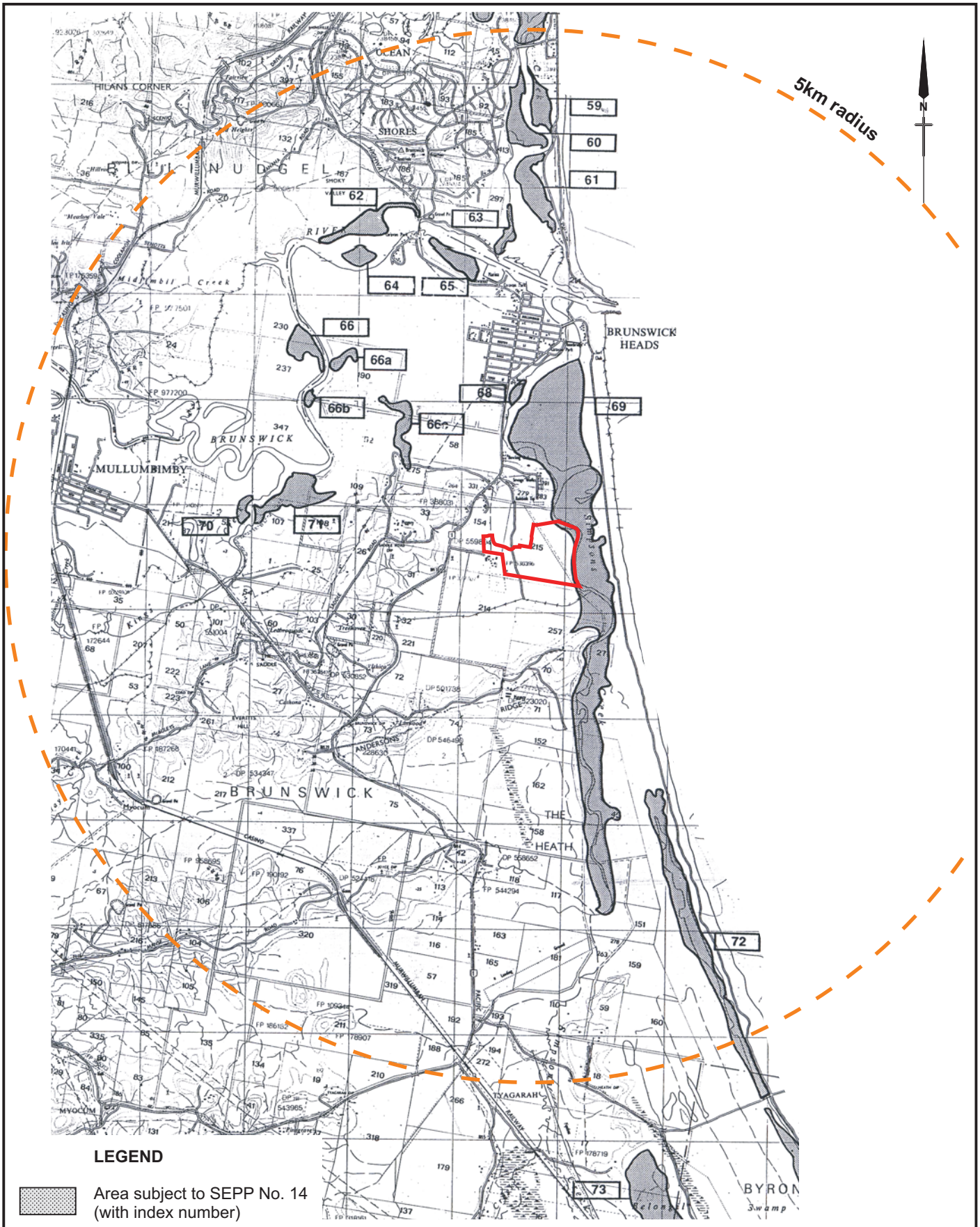
Ecological Assessment
Bayside Brunswick
Lot 73 on DP851902; Brunswick Heads, NSW
Shire of Byron

FIGURE 3

PREPARED: BW
DATE: 02 November 2012
FILE: N97066_Reserves.cdr

TITLE

NATIONAL PARKS & NATURE RESERVES



LEGEND

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

Subject site

0 1.5km

SOURCE: State Env. Planning Policy No. 14 Coastal Wetlands Map 4 Amend. No 11

SCALE: 1 : 50 000 @ A4

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Bayside Brunswick
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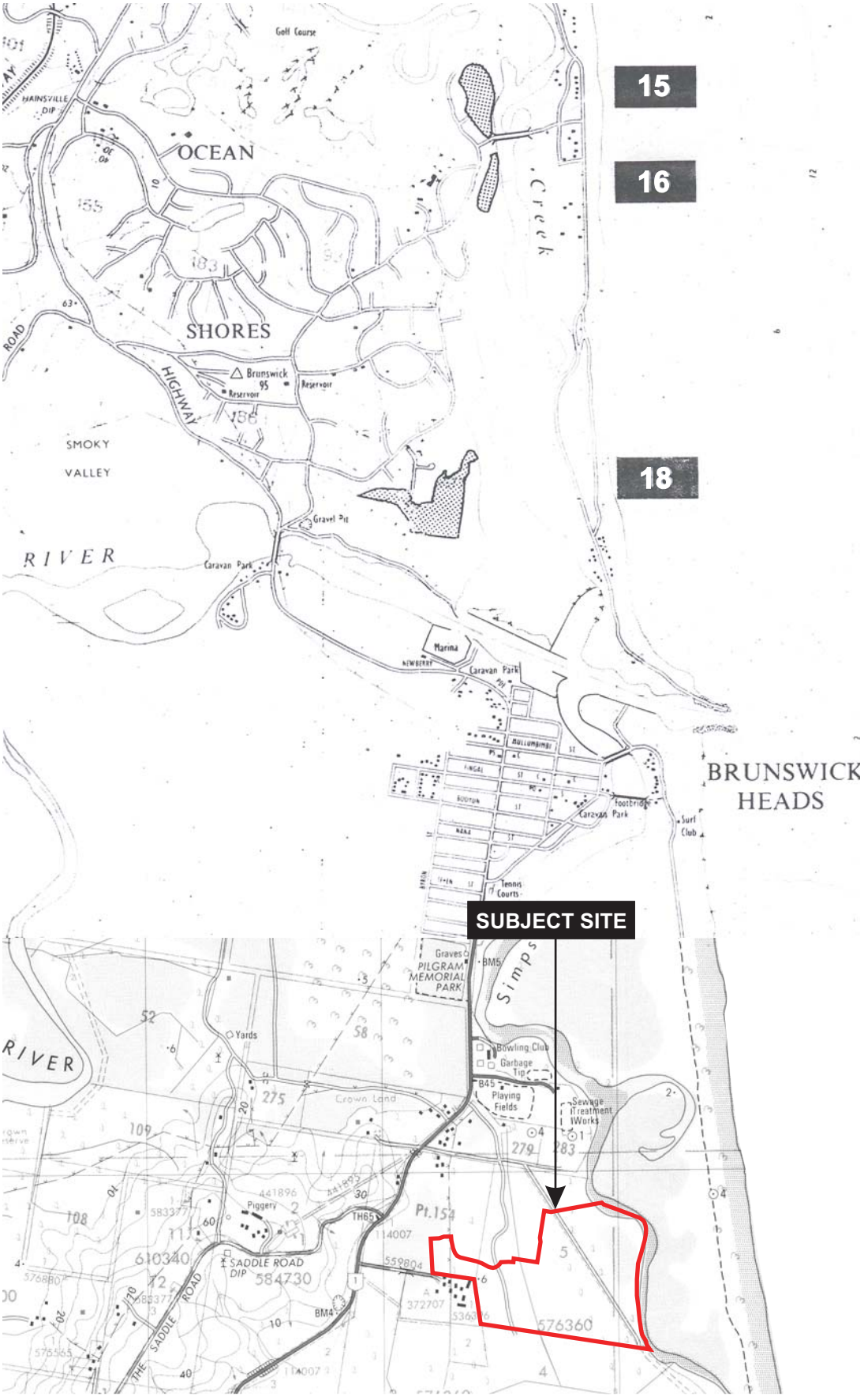
Shire of Byron

FIGURE 4

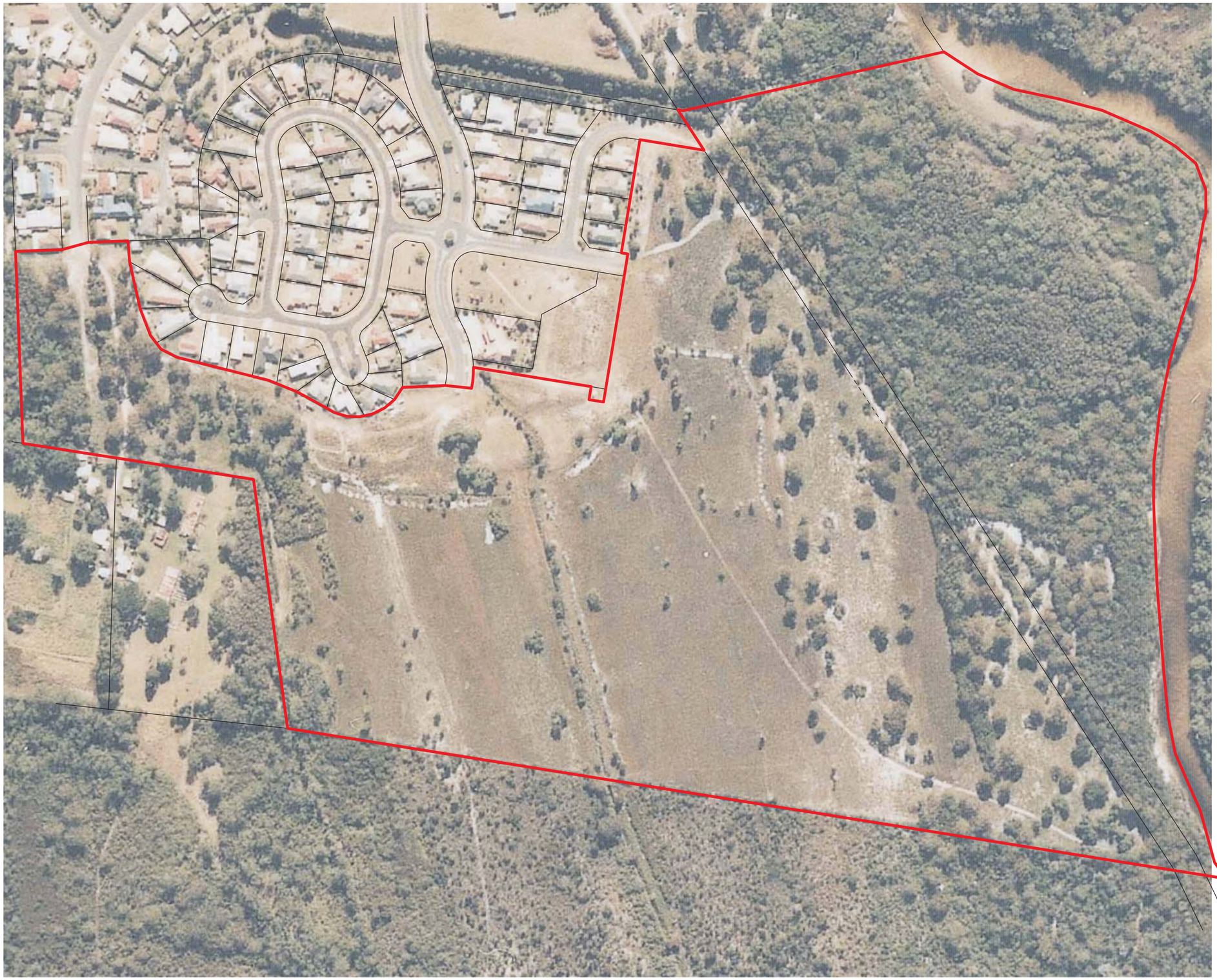
PREPARED: BW
DATE: 02 November 2012
FILE: N97066_SEPP14.cdr

TITLE

SEPP No. 14 COASTAL WETLANDS



SOURCE: State Env. Planning Policy No.26 Littoral Rainforest Map 1 Amend.No.1 SCALE: 1 : 25 000 @ A4 JWA PTY LTD Ecological Consultants	CLIENT Codlea Pty Ltd PROJECT Ecological Assessment Bayside Brunswick Lot 73 on DP851902; Brunswick Heads, NSW Shire of Byron	**FIGURE 5** PREPARED: VJA/BW DATE: 02 November 2012 FILE: N97066_SEPP26.cdr	TITLE **SEPP No. 26 LITTORAL RAINFOREST**



LEGEND

Subject Site

0 100m

1 : 3000

SOURCE: Department of Lands 2004 Aerial; Landpartners (Ref: LM080082_EV4A.pdf)

SCALE: 1 : 3000 @ A3

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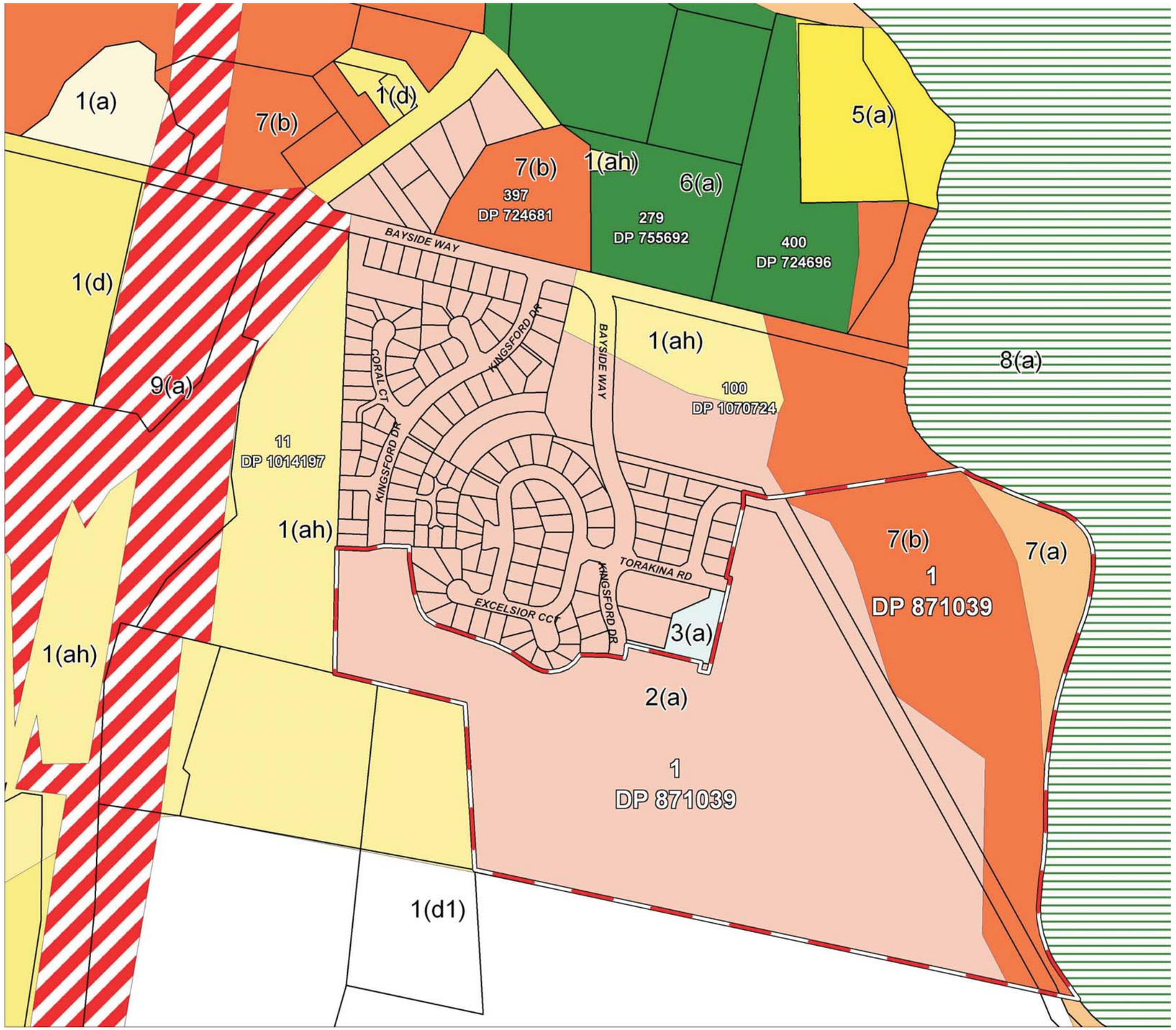
Lot 73 on DP851902; Brunswick Heads, NSW
Shire of Byron

FIGURE 6

PREPARED: BW
DATE: 02 November 2012
FILE: N97066_Aerial.cdr

TITLE

AERIAL PHOTOGRAPH



N

LEGEND

- 1(a) General Rural Zone
- 1(ah) General Rural Zone - hatched
- 1(d) Investigation Zone
- 1(d1) Investigation Zone
- 2(a) Residential Zone
- 3(a) Business Zone
- 5(a) Special Uses Zone
- 6(a) Open Space Zone
- 7(a) Wetlands Zone
- 7(b) Coastal Habitat Zone
- 8(a) National Parks & Nature Reserves
- 9(a) Proposed Road Zone
- Subject Site

0 150m

1 : 5000

SOURCE: Landpartners
(Ref: LM080082_EV3A.pdf)

SCALE: 1 : 5000 @ A3

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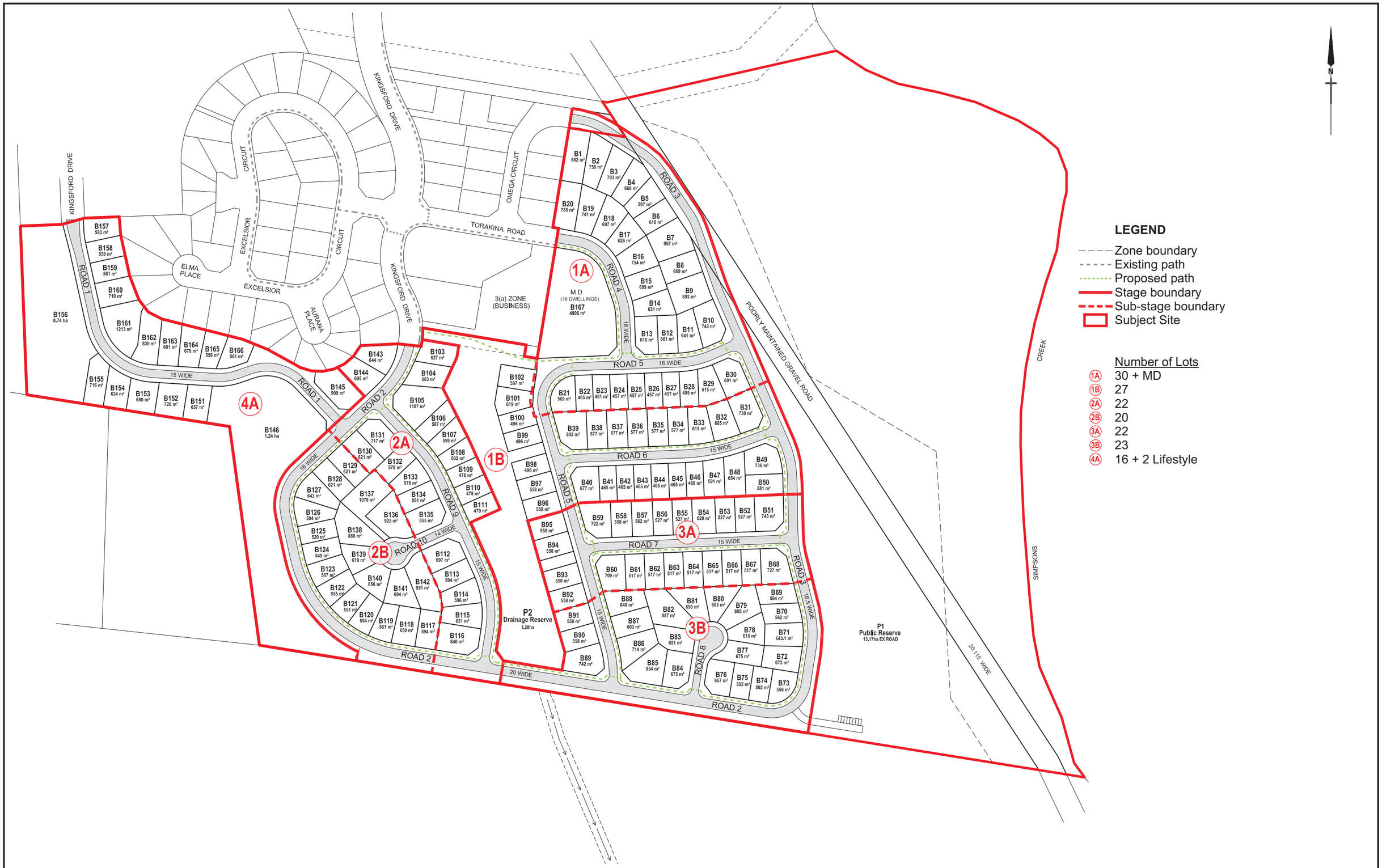
Shire of Byron

FIGURE 7

PREPARED: BW
DATE: 02 November 2012
FILE: N97066_Zoning.cdr

TITLE

BYRON LEP ZONING PLAN



SOURCE: Landpartners (Ref: LM080082-DR30D.pdf)

SCALE: 1 : 3000 @ A3

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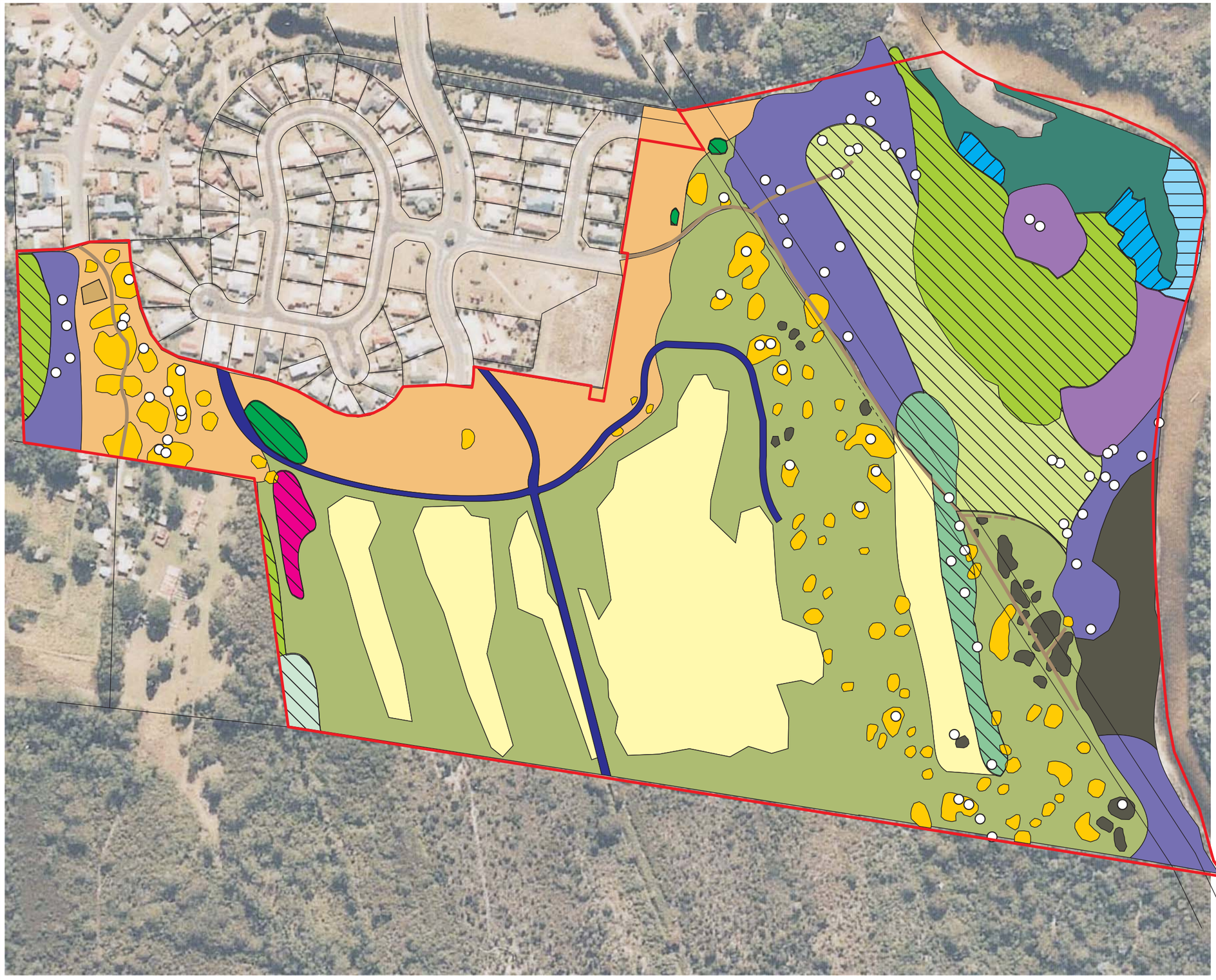
Bayside Brunswick
Lot 73 on DP851902; Brunswick Heads, NSW
Shire of Byron

FIGURE 8

PREPARED: BW
DATE: 02 November 2012
FILE: N97066_Layout.cdr

TITLE

AMENDED DEVELOPMENT LAYOUT



N

LEGEND

Swamp sclerophyll communities
- Community 1a - Tall closed swamp sclerophyll forest *(Eucalyptus robusta)*
- Community 1b - Tall closed swamp sclerophyll woodland *(Eucalyptus robusta)*
- Community 1c - Tall closed swamp sclerophyll forest *(Melaleuca quinquenervia)*
- Community 1d - Tall closed swamp sclerophyll forest *(Eucalyptus racemosa, Eucalyptus robusta)*
- Community 1e - Tall closed swamp sclerophyll forest *(Eucalyptus robusta +/- Melaleuca quinquenervia / Leptospermum polygalifolium)*
- Community 1f - Regenerating swamp sclerophyll forest (*Leptospermum polygalifolium +/- Melaleuca quinquenervia / Eucalyptus robusta)*

Dry sclerophyll communities
- Community 2a - Tall closed sclerophyll forest (*Eucalyptus racemosa, Endiandra sieberi*)
- Community 2b - Tall open dry sclerophyll forest (*Eucalyptus racemosa, Allocasuarina littoralis, Banksia aemula*)

Heath communities
- Community 3a - Tall closed heath (*Banksia aemula* & *Allocasuarina littoralis*)
- Community 3b - Low closed slashed dry heath
- Community 3c - Low closed slashed wet heath

Estuarine communities
- Community 4a - Mid-high mid-dense mangrove forest *(Avicennia marina, Aegiceras corniculatum)*
- Community 4b - Mid-high forest (*Casuarina glauca +/- Melaleuca quinquenervia*)
- Community 4c - Brackish swamp (*Juncus kraussii / Acrostichum speciosum*)

Other communities
- Community 5 - Tall closed grassland (*Andropogon virginicus*)
- Community 6 - Drainage lines
- Community 7 - Scattered trees (*Eucalyptus racemosa*)
- Garden weeds
- Habitat Trees
- Track
- Swamp sclerophyll forest on coastal floodplain EEC
- Swamp oak forest floodplain forest EEC
- Coastal saltmarsh EEC
- Subject Site

0 100m

1 : 3000

SOURCE: JWA Site Investigations; Dept of Lands 2004 Aerial; Landpartners (LM080082_EV4A.pdf)

SCALE: 1 : 3000 @ A3

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Bayside Brunswick
Lot 73 on DP851902; Brunswick Heads, NSW
Shire of Byron

FIGURE 9

PREPARED: BW
DATE: 02 November 2012
FILE: N97066_Veg.cdr

TITLE

EXISTING VEGETATION COMMUNITIES

0 100m

1 : 3000

LEGEND

- Wallum vegetation (communities 1e, 1f, 2b, 3a, 3b & 3c)
- Proposed Stormwater Network
- Typical Drainage Flow Direction
- Stormwater Catchment Boundary (total development catchment 19.03ha)
- Proposed Dry Rock Retaining Wall
- Design Surface Level
- Bio-retention Treatment
- Proposed Gravity Sewer (maintenance hole & junction)
- Proposed Low Pressure Sewer (size & layout to be confirmed)
- Proposed Water Reticulation (100Ø typical with house connection)
- Temporary Dry Sediment Basin SD6-3 Type 'C' Soils (with overflow weir filtered by straw bales See SD6-7)
- Sediment Fence (See SD6-8)
- Stabilised Site Access (See SD 5-7)
- Straw Bale Filter (See SD6-7)
- Sandbag Barrier (Pit Inlet Filter) (to be installed at each inlet pit) (See (SD6-11)
- Dirty Water Catch Drain (300 Deep) (SEE SD5-5)
- Bulk Fill Area (conceptual only)
- Bulk Cut Area (conceptual only)
- Subject Site

SOURCE	CLIENT / PROJECT	FIGURE	TITLE
SOURCE: JWA Site Investigations; Landpartners (Ref: LM080082-DR22F.pdf; LM080082-DR23H.pdf; LM080082-DR25F.pdf & LM080082-DR26F.pdf) SCALE: 1 : 3000 @ A3 *JWA PTY LTD Ecological Consultants*	CLIENT Codlea Pty Ltd PROJECT Ecological Assessment Bayside Brunswick Lot 73 on DP851902; Brunswick Heads, NSW Shire of Byron	**FIGURE 10** PREPARED: BW DATE: 13 November 2012 FILE:N97066_Impact wallum veg.cdr	TITLE **IMPACT ON WALLUM VEGETATION**

SOURCE: Landpartners (Ref: LM080082-DR30D.pdf)

SCALE: 1 : 3000 @ A3

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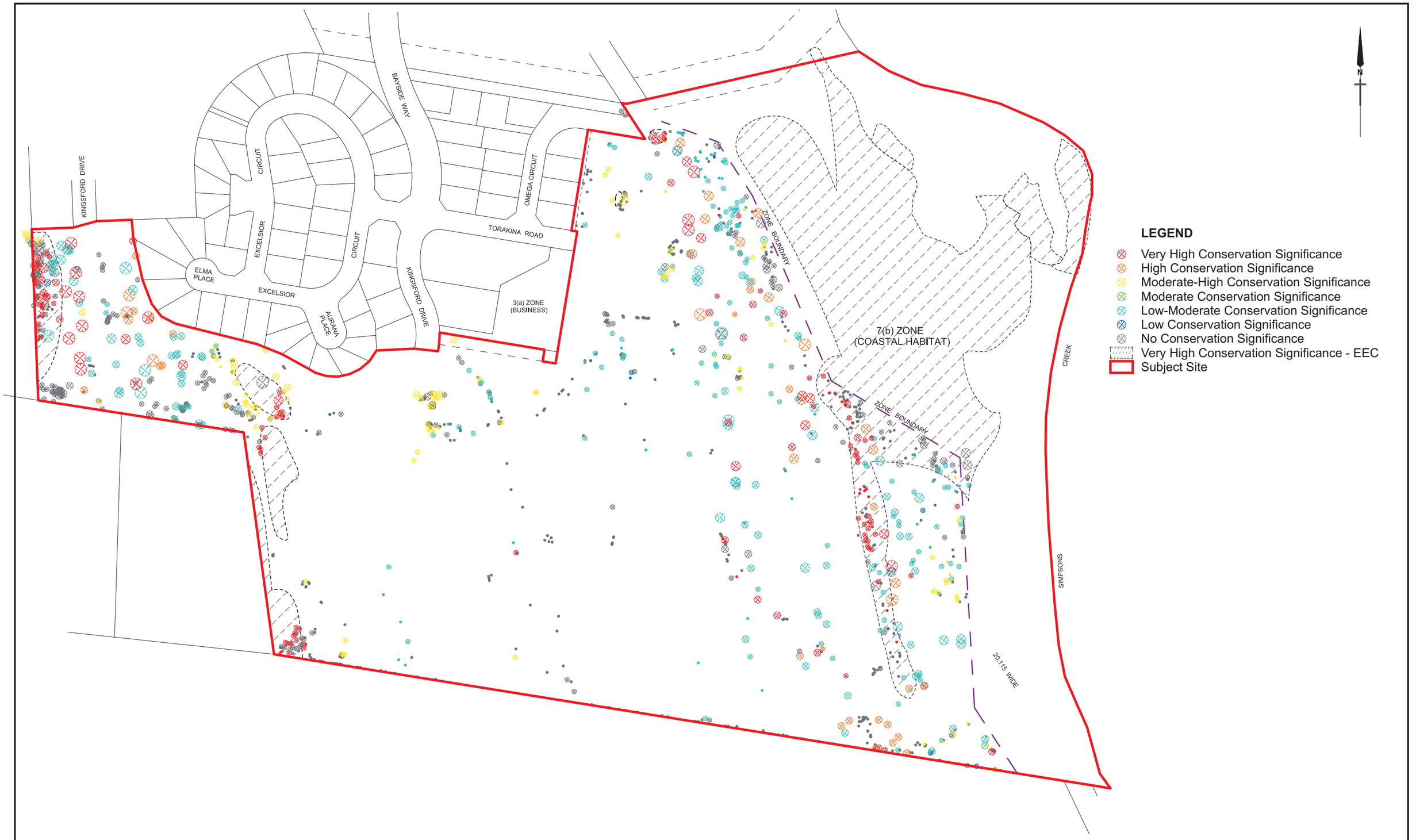
Bayside Brunswick
Lot 73 on DP851902; Brunswick Heads, NSW
Shire of Byron

FIGURE 11

PREPARED: BW
DATE: 02 November 2012
FILE: N97066_EEC Offsets.cdr

TITLE

PROPOSED EEC OFFSETS



SOURCE: JWA Site Investigations; Landpartners (LM080082-DR11A.pdf)

SCALE: 1 : 3000 @ A3

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Bayside Brunswick
Lot 73 on DP851902; Brunswick Heads, NSW
Shire of Byron

FIGURE 12

PREPARED: BW
DATE: 05 November 2012
FILE: N97066_Significant Trees.cdr

TITLE
ECOLOGICALLY SIGNIFICANT TREES

LEGEND

- Zoning Boundary
- Existing Path
- Proposed Path
- Proposed Boundary
- W — Proposed Watermain
- SW — Proposed Stormwater Pipe
- LPS — Proposed Lower Pressure Sewer
- S — Proposed Gravity Sewer
- Biofiltration Treatment
- APZ Boundary
- Very High Conservation Significance - EEC

TREES PROPOSED TO BE RETAINED

- Very High Conservation Significance
- High Conservation Significance
- Moderate - High Conservation Significance
- Moderate Conservation Significance
- Low - Moderate Conservation Significance
- Low Conservation Significance

TREES PROPOSED TO BE REMOVED

- Conservation Significant Trees
- No Conservation Significance Trees (remove or retain as required)

0 100m

1 : 3000

SOURCE: JWA Site Investigations; Landpartners (Ref: LM080082-DR20G.pdf)

SCALE: 1 : 3000 @ A3

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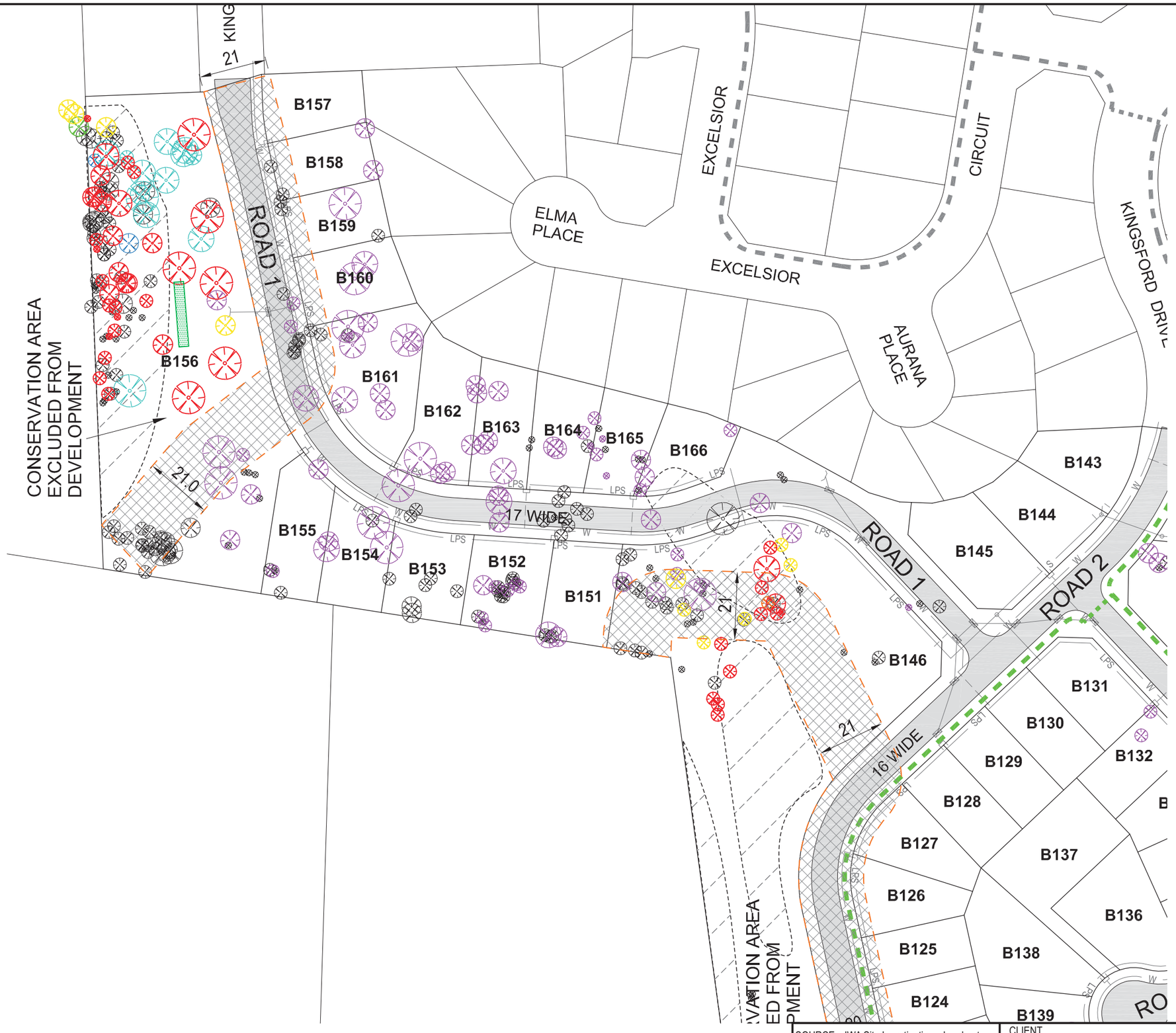
Lot 73 on DP851902; Brunswick Heads, NSW
Shire of Byron

FIGURE 13

PREPARED: BW
DATE: 13 November 2012
FILE: N97066_TRP.cdr

TITLE

TREE RETENTION PLAN



LEGEND

- Zoning Boundary
- Existing Path
- Proposed Path
- Proposed Boundary
- Proposed Watermain
- Proposed Stormwater Pipe
- Proposed Lower Pressure Sewer
- Proposed Gravity Sewer
- Biofiltration Treatment
- APZ Boundary
- Very High Conservation Significance - EEC

TREES PROPOSED TO BE RETAINED

- Very High Conservation Significance
- High Conservation Significance
- Moderate - High Conservation Significance
- Moderate Conservation Significance
- Low - Moderate Conservation Significance
- Low Conservation Significance

TREES PROPOSED TO BE REMOVED

- Conservation Significant Trees
- No Conservation Significance Trees (remove or retain as required)

SOURCE: JWA Site Investigations; Landpartners (Ref: LM080082-DR20G.pdf)

SCALE: 1 : 1250 @ A3

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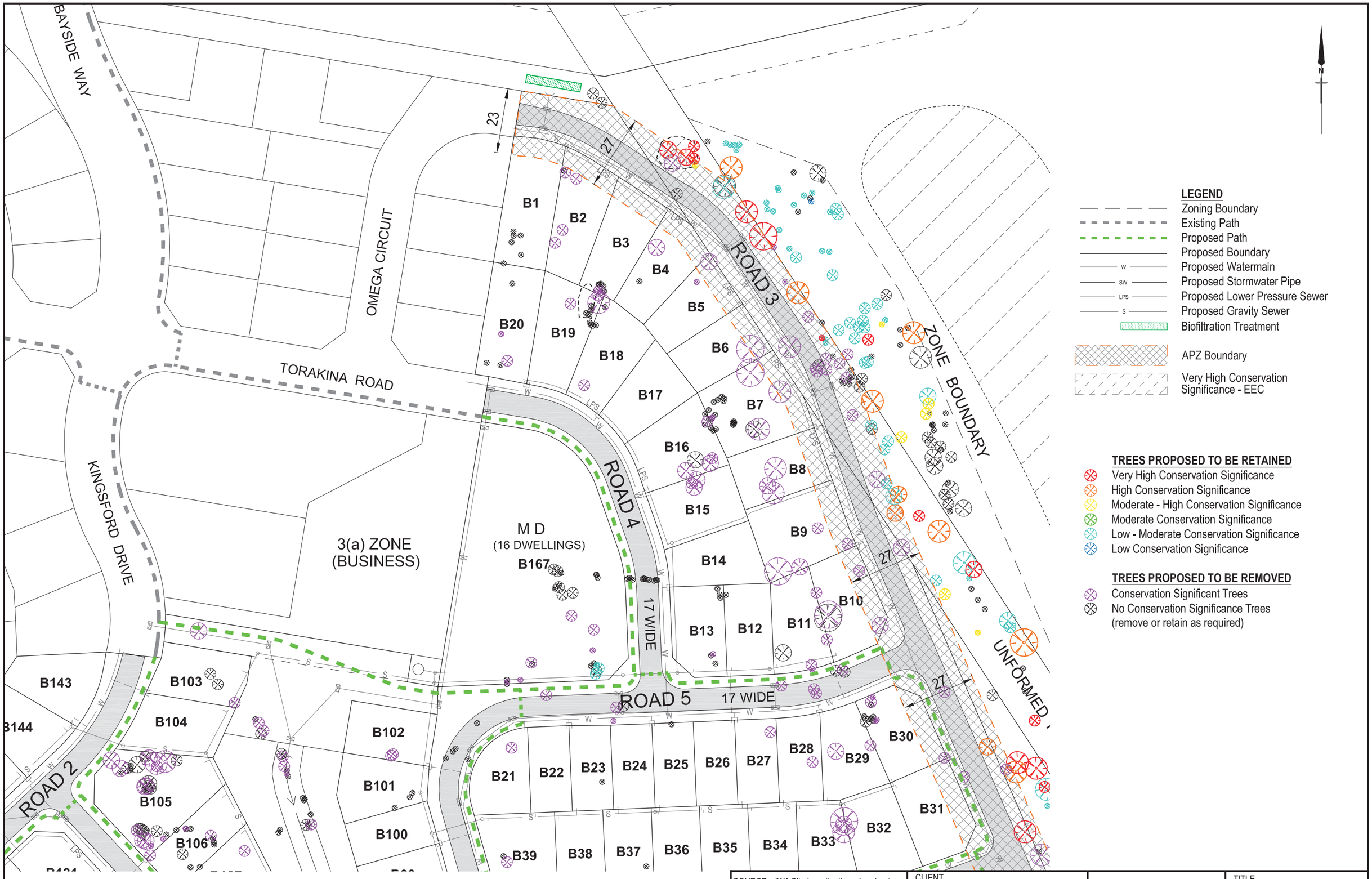
Lot 73 on DP851902; Brunswick Heads, NSW
Shire of Byron

FIGURE 14

PREPARED: BW
DATE: 13 November 2012
FILE: N97066_TRP(A).cdr

TITLE

TREE RETENTION PLAN



SOURCE: JWA Site Investigations; Landpartners (Ref: LM080082-DR20G.pdf)

SCALE: 1 : 1250 @ A3

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Bayside Brunswick
Lot 73 on DP851902; Brunswick Heads, NSW
Shire of Byron

FIGURE 15

PREPARED: BW
DATE: 13 November 2012
FILE: N97066_TRP(B).cdr

TITLE

TREE RETENTION PLAN

LEGEND

- Zoning Boundary
- Existing Path
- Proposed Path
- Proposed Boundary
- Proposed Watermain
- Proposed Stormwater Pipe
- Proposed Lower Pressure Sewer
- Proposed Gravity Sewer
- Biofiltration Treatment
- APZ Boundary
- Very High Conservation Significance - EEC

TREES PROPOSED TO BE RETAINED

- Very High Conservation Significance
- High Conservation Significance
- Moderate - High Conservation Significance
- Moderate Conservation Significance
- Low - Moderate Conservation Significance
- Low Conservation Significance

TREES PROPOSED TO BE REMOVED

- Conservation Significant Trees
- No Conservation Significance Trees (remove or retain as required)

0 25m

1 : 1 250

SOURCE: JWA Site Investigations; Landpartners (Ref: LM080082-DR20G.pdf)

SCALE: 1 : 1250 @ A3

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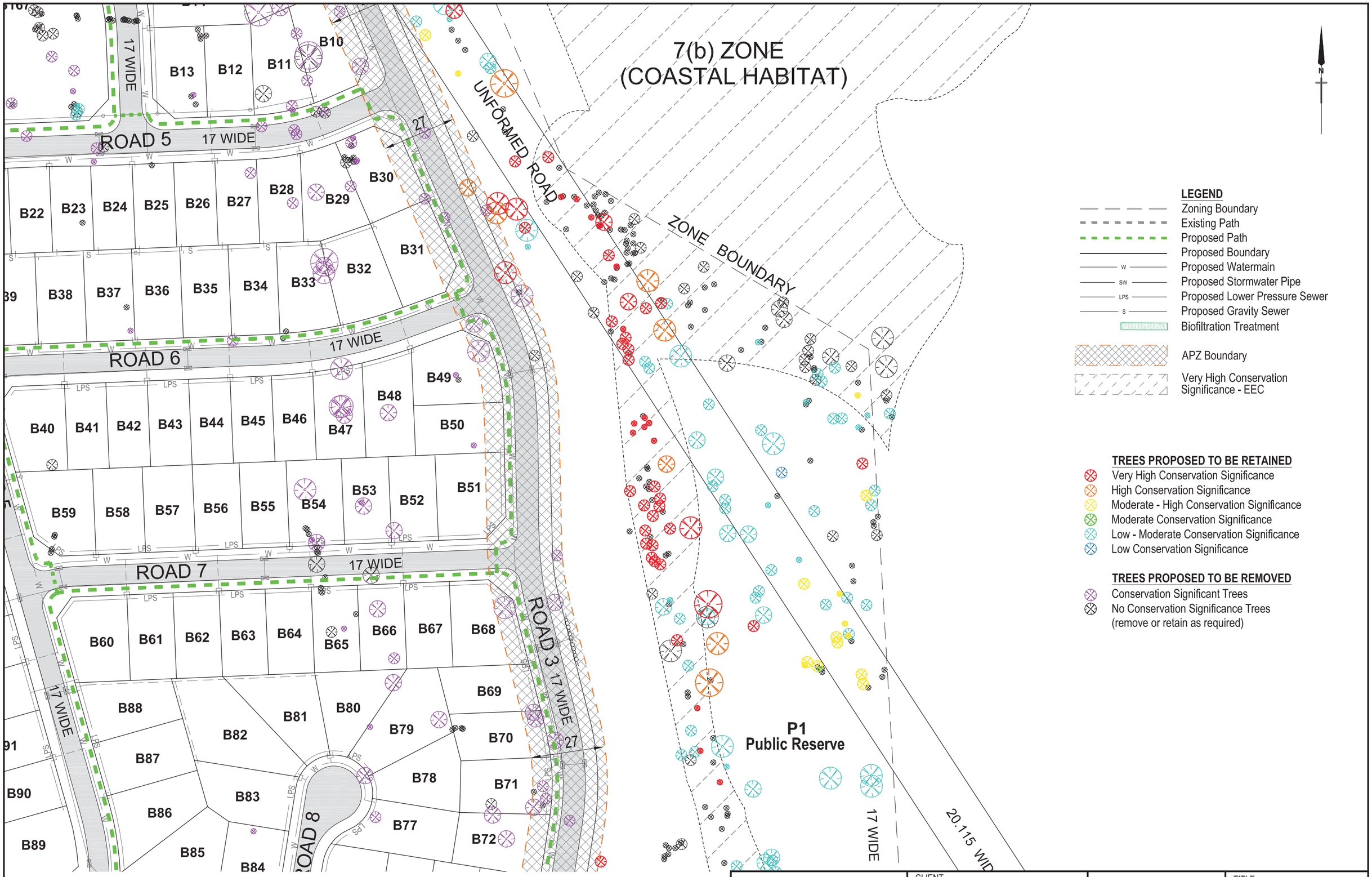
Bayside Brunswick
Lot 73 on DP851902; Brunswick Heads, NSW
Shire of Byron

FIGURE 16

PREPARED: BW
DATE: 13 November 2012
FILE: N97066_TRP(C).cdr

TITLE

TREE RETENTION PLAN



LEGEND

- Zoning Boundary
- Existing Path
- Proposed Path
- Proposed Boundary
- Proposed Watermain
- Proposed Stormwater Pipe
- Proposed Lower Pressure Sewer
- Proposed Gravity Sewer
- Biofiltration Treatment
- APZ Boundary
- Very High Conservation Significance - EEC

TREES PROPOSED TO BE RETAINED

- Very High Conservation Significance
- High Conservation Significance
- Moderate - High Conservation Significance
- Moderate Conservation Significance
- Low - Moderate Conservation Significance
- Low Conservation Significance

TREES PROPOSED TO BE REMOVED

- Conservation Significant Trees
- No Conservation Significance Trees (remove or retain as required)

SOURCE: JWA Site Investigations; Landpartners (Ref: LM080082-DR20G.pdf)

SCALE: 1 : 1250 @ A3

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Bayside Brunswick
Lot 73 on DP851902; Brunswick Heads, NSW
Shire of Byron

FIGURE 17

PREPARED: BW
DATE: 13 November 2012
FILE: N97066_TRP(D).cdr

TITLE

TREE RETENTION PLAN

LEGEND

- Zoning Boundary
- Existing Path
- Proposed Path
- Proposed Boundary
- W — Proposed Watermain
- SW — Proposed Stormwater Pipe
- LPS — Proposed Lower Pressure Sewer
- S — Proposed Gravity Sewer
- Biofiltration Treatment
- APZ Boundary
- Very High Conservation Significance - EEC

TREES PROPOSED TO BE RETAINED

- Very High Conservation Significance
- High Conservation Significance
- Moderate - High Conservation Significance
- Moderate Conservation Significance
- Low - Moderate Conservation Significance
- Low Conservation Significance

TREES PROPOSED TO BE REMOVED

- Conservation Significant Trees
- No Conservation Significance Trees (remove or retain as required)

0 25m

1 : 1 250

SOURCE: JWA Site Investigations; Landpartners (Ref: LM080082-DR20G.pdf)

SCALE: 1 : 1250 @ A3

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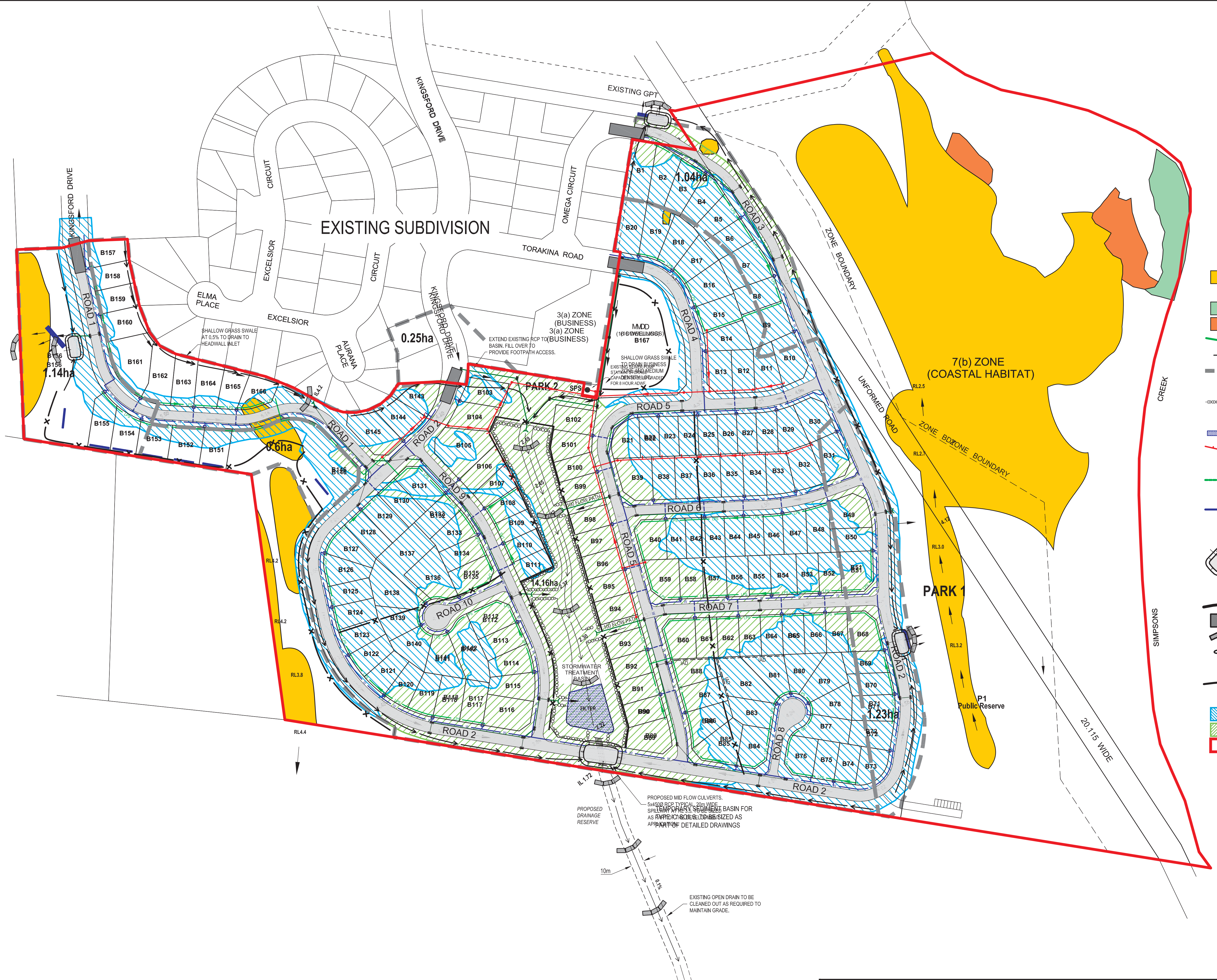
Bayside Brunswick
Lot 73 on DP851902; Brunswick Heads, NSW
Shire of Byron

FIGURE 18

PREPARED: BW
DATE: 13 November 2012
FILE: N97066_TRP(E).cdr

TITLE

TREE RETENTION PLAN



0 100m
1 : 3000

LEGEND

- Swamp sclerophyll forest on coastal floodplain EEC
- Swamp oak forest floodplain forest EEC
- Coastal saltmarsh EEC
- Proposed Stormwater Network
- Typical Drainage Flow Direction
- Stormwater Catchment Boundary (total development catchment 19.03ha)
- Proposed Dry Rock Retaining Wall
- Design Surface Level
- Bio-retention Treatment
- Proposed Gravity Sewer (maintenance hole & junction)
- Proposed Low Pressure Sewer (size & layout to be confirmed)
- Proposed Water Reticulation (100Ø typical with house connection)
- Temporary Dry Sediment Basin SD6-3 Type 'C' Soils (with overflow weir filtered by straw bales See SD6-7)
- Sediment Fence (See SD6-8)
- Stabilised Site Access (See SD 5-7)
- Straw Bale Filter (See SD6-7)
- Sandbag Barrier (Pit Inlet Filter) (to be installed at each inlet pit) (See (SD6-11)
- Dirty Water Catch Drain (300 Deep) (SEE SD5-5)
- Bulk Fill Area (conceptual only)
- Bulk Cut Area (conceptual only)
- Subject Site

SOURCE: JWA Site Investigations; Landpartners (Ref: LM080082-DR22F.pdf; LM080082-DR23H.pdf; LM080082-DR25F.pdf & LM080082-DR26F.pdf)
SCALE: 1 : 3000 @ A3

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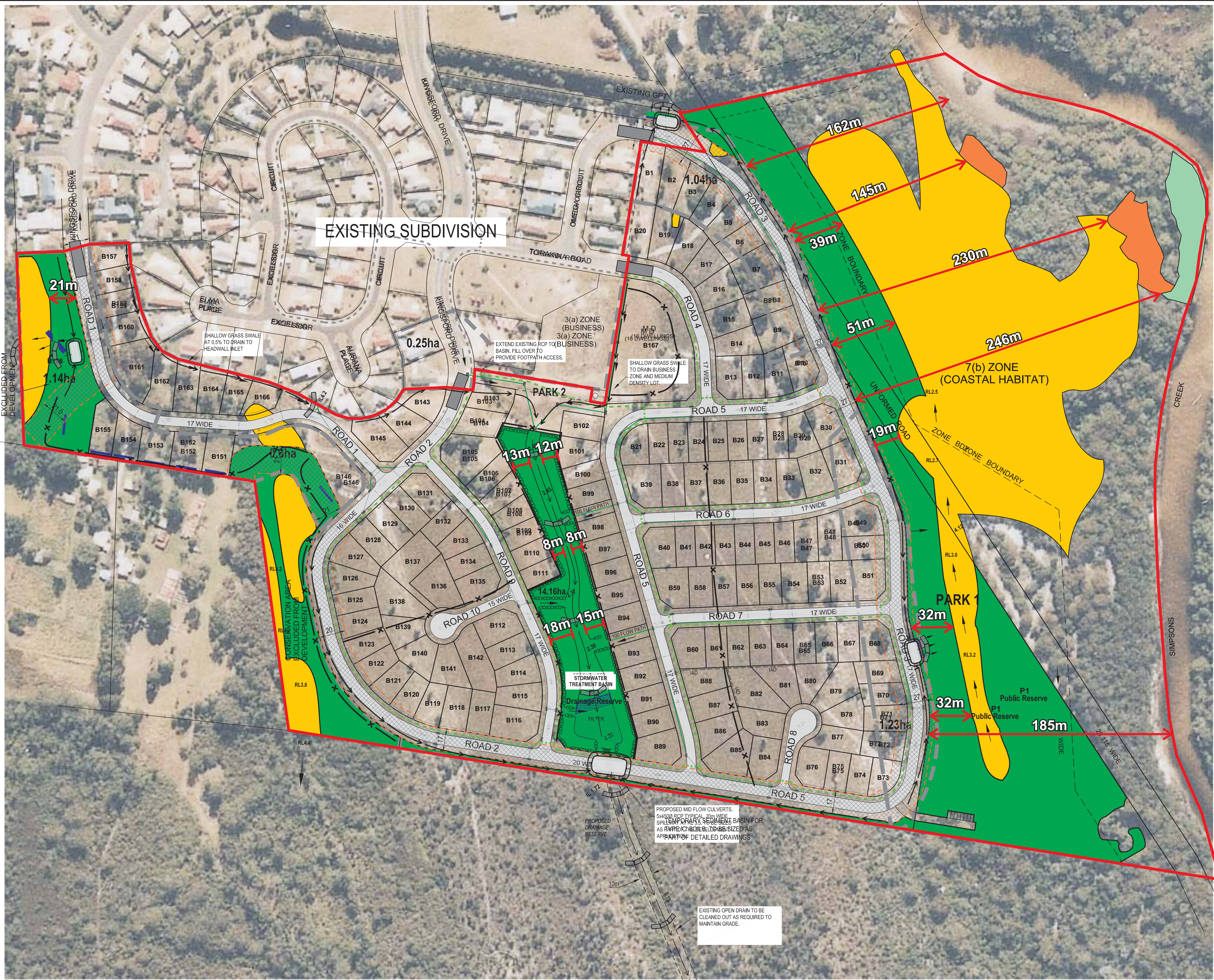
Ecological Assessment
Bayside Brunswick
Lot 73 on DP851902; Brunswick Heads, NSW
Shire of Byron

FIGURE 19

PREPARED: BW
DATE: 13 November 2012
FILE: N97066_Impact EEC.cdr

TITLE
IMPACT ON EEC'S



LEGEND

- Swamp sclerophyll forest on coastal floodplain EEC
- Swamp oak forest floodplain forest EEC
- Coastal saltmarsh EEC
- Retained/Rehabilitated/Revegetated Buffer
- Proposed Stormwater Network
- Typical Drainage Flow Direction
- Stormwater Catchment Boundary (total development catchment 19.03ha)
- Proposed Dry Rock Retaining Wall
- Design Surface Level
- Bio-retention Treatment
- Temporary Dry Sediment Basin SD6-3 Type 'C' Soils (with overflow weir filtered by straw bales See SD6-7)
- Sediment Fence (See SD6-8)
- Stabilised Site Access (See SD 5-7)
- Straw Bale Filter (See SD6-7)
- Sandbag Barrier (Pit Inlet Filter) (to be installed at each inlet pit) (See (SD6-11)
- Dirty Water Catch Drain (300 Deep) (SEE SD5-5)
- Subject Site

0 100m

1 : 3000

SOURCE: JWA Site Investigations; Landpartners (Ref: LM080082-DR22F.pdf; LM080082-DR23H.pdf; LM080082-DR25F.pdf & LM080082-DR26F.pdf)

SCALE: 1 : 3000 @ A3

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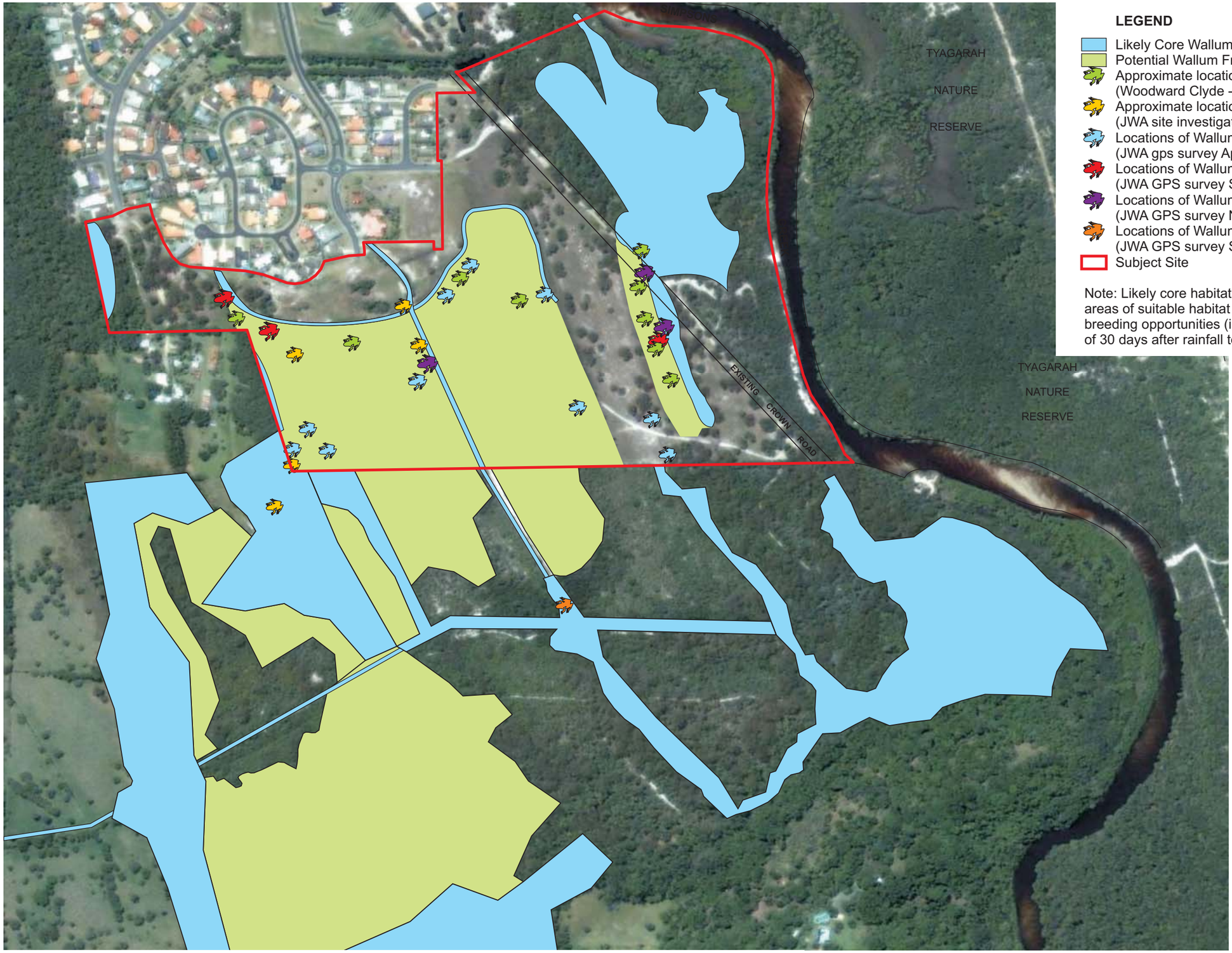
Ecological Assessment
Bayside Brunswick
Lot 73 on DP851902; Brunswick Heads, NSW
Shire of Byron

FIGURE 20

PREPARED: BW
DATE: 13 November 2012
FILE: N97066_Buffers.cdr

TITLE

PROPOSED BUFFERS



LEGEND

- Likely Core Wallum Froglet Habitat
- Potential Wallum Froglet Forage Habitat
- Approximate locations of Wallum froglet records (Woodward Clyde - Fauna Impact Statement, Oct. 1996)
- Approximate locations of Wallum froglet records (JWA site investigations 2005)
- Locations of Wallum froglet records (JWA gps survey April 2006)
- Locations of Wallum froglet records (JWA GPS survey September 2006)
- Locations of Wallum froglet records (JWA GPS survey November 2008)
- Locations of Wallum froglet records (JWA GPS survey September 2009)
- Subject Site

Note: Likely core habitat has been determined based on areas of suitable habitat that are likely to provide adequate breeding opportunities (i.e. hold standing water for a minimum of 30 days after rainfall to allow a full breeding cycle).

N

0 150m

1 : 5000

SOURCE: JWA Site Investigations; Google Earth 2006 Aerial Photograph

SCALE: 1 : 5000 @ A3

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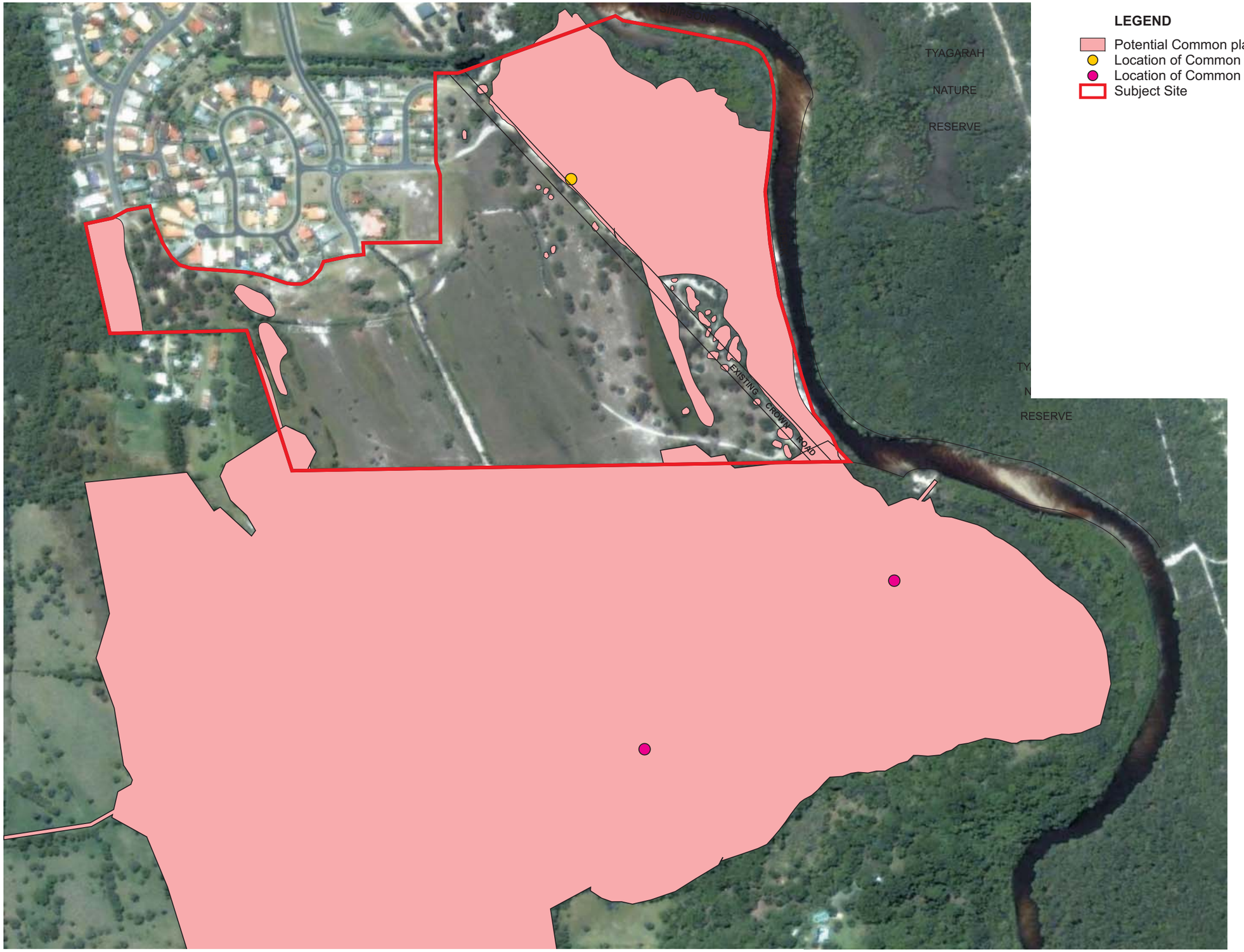
Bayside Brunswick
Lot 73 on DP851902; Brunswick Heads, NSW
Shire of Byron

FIGURE 21

PREPARED: BW
DATE: 08 November 2012
FILE: N97066_Frogs.cdr

TITLE
WALLUM FROGLET RECORDS & HABITAT



LEGEND

- Potential Common planigale Habitat
- Location of Common planigale (November 2008)
- Location of Common planigale (September 2009)
- Subject Site

N

0 150m

1 : 5000

SOURCE: JWA Site Investigations; Google Earth 2006 Aerial Photograph

SCALE: 1 : 5000 @ A3

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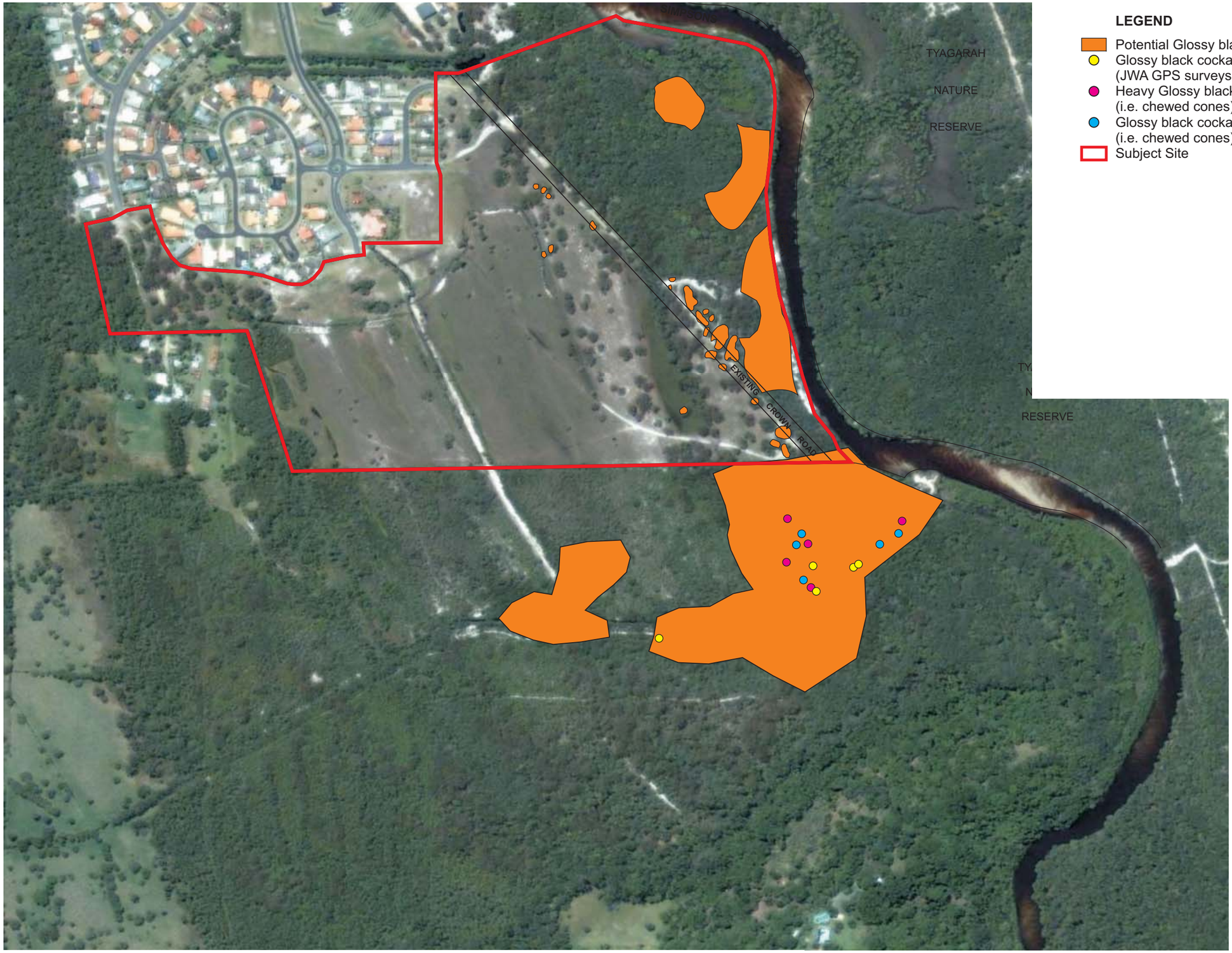
Bayside Brunswick
Lot 73 on DP851902; Brunswick Heads, NSW
Shire of Byron

FIGURE 22

PREPARED: BW
DATE: 02 November 2012
FILE: N97066_Planigale.cdr

TITLE

COMMON PLANIGALE HABITAT



SOURCE: JWA Site Investigations; Google Earth 2006 Aerial Photograph

SCALE: 1 : 5000 @ A3

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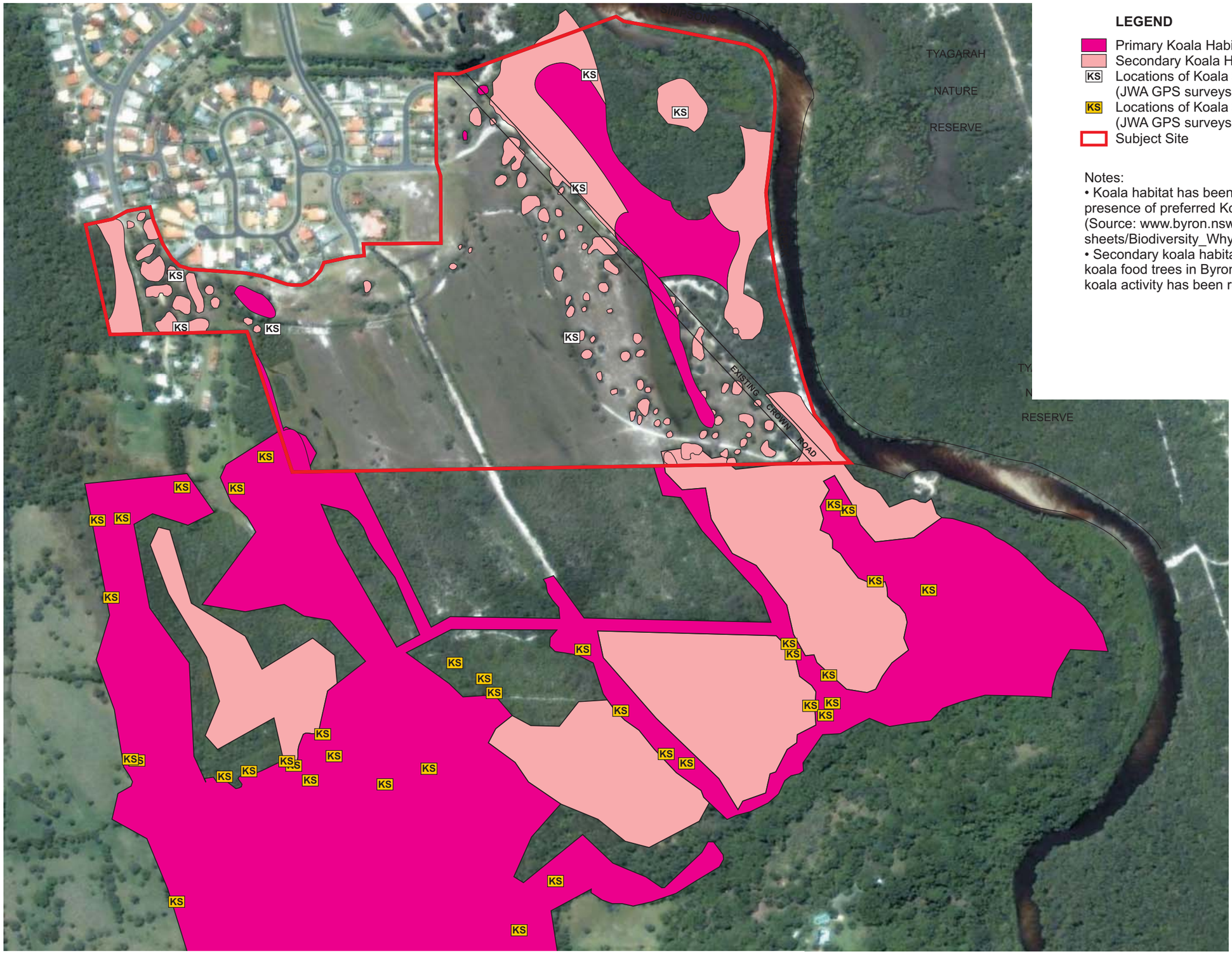
Shire of Byron

FIGURE 23

PREPARED: BW
DATE: 02 November 2012
FILE: N97066_GBC.cdr

TITLE

GLOSSY BLACK COCKATOO HABITAT



LEGEND

- Primary Koala Habitat
- Secondary Koala Habitat
- KS Locations of Koala Scat (JWA GPS surveys April 2006 - Nov2008 & May 2009)
- KS Locations of Koala Scat (JWA GPS surveys September 2009)
- Subject Site

N

Notes:
• Koala habitat has been determined based on the presence of preferred Koala food trees in Byron Shire (Source: www.byron.nsw.gov.au/files/publications/fact-sheets/Biodiversity_Why_Are_Trees_Important.pdf)
• Secondary koala habitat does not contain preferred koala food trees in Byron Shire however, evidence of koala activity has been recorded.

0 150m
1 : 5000

SOURCE: JWA Site Investigations; Google Earth 2006 Aerial Photograph
SCALE: 1 : 5000 @ A3

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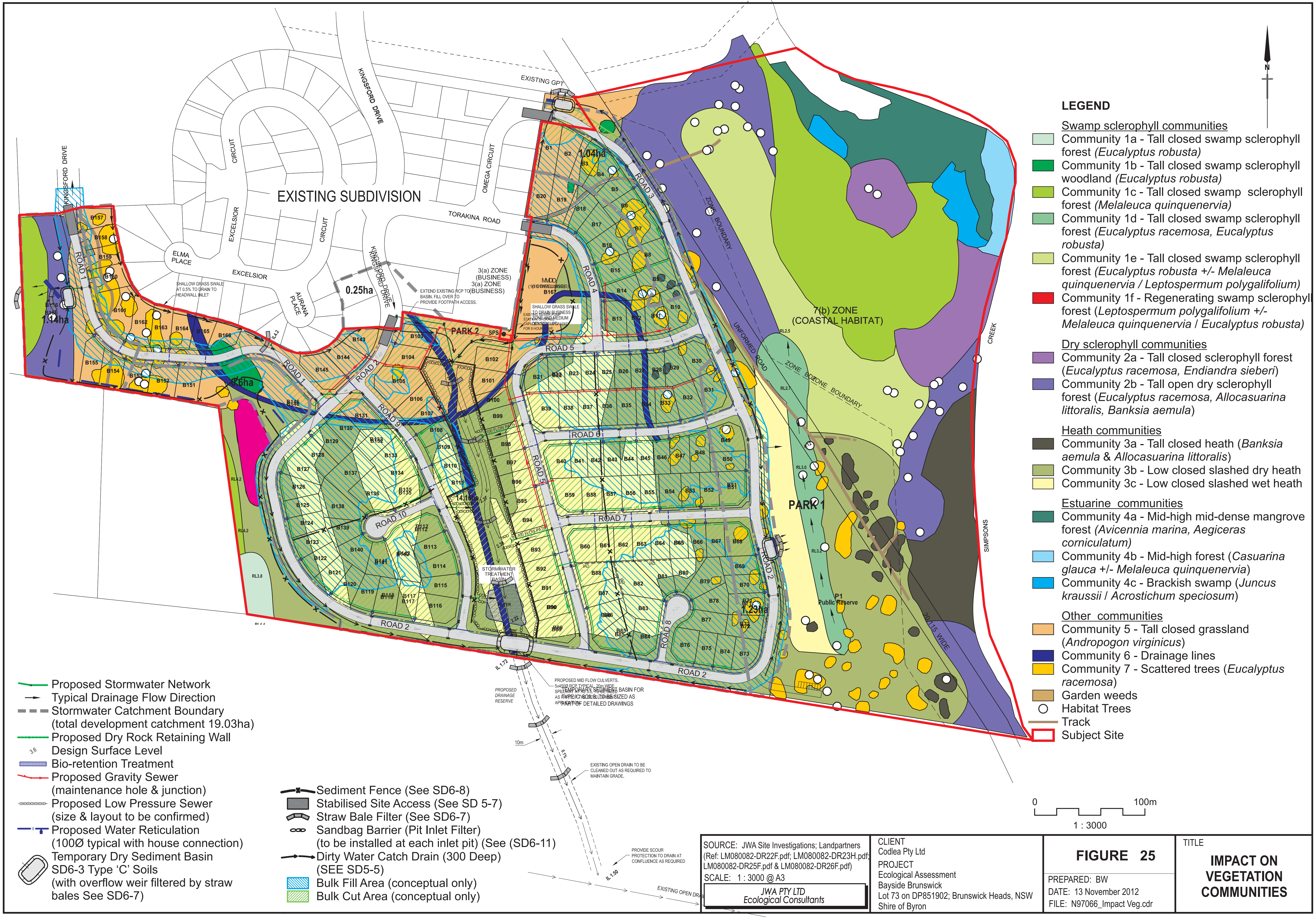
Bayside Brunswick
Lot 73 on DP851902; Brunswick Heads, NSW
Shire of Byron

FIGURE 24

PREPARED: BW
DATE: 02 November 2012
FILE: N97066_Koala.cdr

TITLE
KOALA HABITAT


EXISTING SUBDIVISION
7(b) ZONE (COASTAL HABITAT)
PARK 1
PARK 2
LEGEND
Swamp sclerophyll communities
Community 1a - Tall closed swamp sclerophyll forest (Eucalyptus robusta)
Community 1b - Tall closed swamp sclerophyll woodland (Eucalyptus robusta)
Community 1c - Tall closed swamp sclerophyll forest (Melaleuca quinquenervia)
Community 1d - Tall closed swamp sclerophyll forest (Eucalyptus racemosa, Eucalyptus robusta)
Community 1e - Tall closed swamp sclerophyll forest (Eucalyptus robusta +/- Melaleuca quinquenervia / Leptospermum polygalifolium)
Community 1f - Regenerating swamp sclerophyll forest (Leptospermum polygalifolium +/- Melaleuca quinquenervia / Eucalyptus robusta)
Dry sclerophyll communities
Community 2a - Tall closed sclerophyll forest (Eucalyptus racemosa, Endiandra sieberi)
Community 2b - Tall open dry sclerophyll forest (Eucalyptus racemosa, Allocasuarina littoralis, Banksia aemula)
Heath communities
Community 3a - Tall closed heath (Banksia aemula & Allocasuarina littoralis)
Community 3b - Low closed slashed dry heath
Community 3c - Low closed slashed wet heath
Estuarine communities
Community 4a - Mid-high mid-dense mangrove forest (Avicennia marina, Aegiceras corniculatum)
Community 4b - Mid-high forest (Casuarina glauca +/- Melaleuca quinquenervia)
Community 4c - Brackish swamp (Juncus kraussii / Acrostichum speciosum)
Other communities
Community 5 - Tall closed grassland (Andropogon virginicus)
Community 6 - Drainage lines
Community 7 - Scattered trees (Eucalyptus racemosa)
Garden weeds
Habitat Trees
Track
Subject Site
Proposed Stormwater Network
Typical Drainage Flow Direction
Stormwater Catchment Boundary (total development catchment 19.03ha)
Proposed Dry Rock Retaining Wall
Design Surface Level
Bio-retention Treatment
Proposed Gravity Sewer (maintenance hole & junction)
Proposed Low Pressure Sewer (size & layout to be confirmed)
Proposed Water Reticulation (100Ø typical with house connection)
Temporary Dry Sediment Basin SD6-3 Type 'C' Soils (with overflow weir filtered by straw bales See SD6-7)
Sediment Fence (See SD6-8)
Stabilised Site Access (See SD 5-7)
Straw Bale Filter (See SD6-7)
Sandbag Barrier (Pit Inlet Filter) (to be installed at each inlet pit) (See (SD6-11)
Dirty Water Catch Drain (300 Deep) (SEE SD5-5)
Bulk Fill Area (conceptual only)
Bulk Cut Area (conceptual only)
0 100m
1 : 3000
SOURCE: JWA Site Investigations; Landpartners (Ref: LM080082-DR22F.pdf; LM080082-DR23H.pdf; LM080082-DR25F.pdf & LM080082-DR26F.pdf)
SCALE: 1 : 3000 @ A3
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CLIENT Codlea Pty Ltd
PROJECT Ecological Assessment Bayside Brunswick Lot 73 on DP851902; Brunswick Heads, NSW Shire of Byron
FIGURE 25
PREPARED: BW
DATE: 13 November 2012
FILE: N97066_Impact Veg.cdr
TITLE
IMPACT ON VEGETATION COMMUNITIES

EXISTING SUBDIVISION

KINGSFORD DRIVE

CIRCUIT

EXCELSIOR

ELMA PLACE

AURANA PLACE

OMEGA CIRCUIT

TORAKINA ROAD

EXISTING GPT

ROAD 1

ROAD 2

ROAD 3

ROAD 4

ROAD 5

ROAD 6

ROAD 7

ROAD 8

ROAD 9

ROAD 10

PARK 1

PARK 2

SPS

1.04ha

1.14ha

0.16ha

0.25ha

4.16ha

1.23ha

3(a) ZONE (BUSINESS)

7(b) ZONE (COASTAL HABITAT)

ZONE BOUNDARY

UNFORMED ROAD

CREEK

SIMPSONS

P1 Public Reserve

20.115 WIDE

KS

SHALLOW GRASS SWALE AT 0.5% TO DRAIN TO HEADWALL INLET

EXTEND EXISTING RCP TO BASIN, FILL OVER TO PROVIDE FOOTPATH ACCESS.

SHALLOW GRASS SWALE TO DRAIN BUSINESS

STORMWATER TREATMENT BASIN

PROPOSED DRAINAGE RESERVE

PROPOSED MID FLOW CULVERTS, 5x450 RCP TYPICAL, 20m WIDE SPILLWAY APRON, TO BE SIZED AS APPROPRIATE AT TIME OF DETAILED DRAWINGS

TEMPORARY SEDIMENT BASIN FOR FARM DAM, TO BE SIZED AS APPROPRIATE AT TIME OF DETAILED DRAWINGS

EXISTING OPEN DRAIN TO BE CLEANED OUT AS REQUIRED TO MAINTAIN GRADE.

PROVIDE SCOUR PROTECTION TO DRAIN AT CONFLUENCE AS REQUIRED

EXISTING OPEN DRAIN

LEGEND

- Primary Koala Habitat
- Secondary Koala Habitat
- KS Locations of Koala Scat (JWA GPS surveys April 2006 - Nov 2008 & May 2009)
- Proposed Stormwater Network
- Typical Drainage Flow Direction
- Stormwater Catchment Boundary (total development catchment 19.03ha)
- Proposed Dry Rock Retaining Wall
- 3.6 Design Surface Level
- Bio-retention Treatment
- Proposed Gravity Sewer (maintenance hole & junction)
- Proposed Low Pressure Sewer (size & layout to be confirmed)
- Proposed Water Reticulation (100Ø typical with house connection)
- Temporary Dry Sediment Basin SD6-3 Type 'C' Soils (with overflow weir filtered by straw bales See SD6-7)
- Sediment Fence (See SD6-8)
- Stabilised Site Access (See SD 5-7)
- Straw Bale Filter (See SD6-7)
- Sandbag Barrier (Pit Inlet Filter) (to be installed at each inlet pit) (See (SD6-11)
- Dirty Water Catch Drain (300 Deep) (SEE SD5-5)
- Bulk Fill Area (conceptual only)
- Bulk Cut Area (conceptual only)
- Subject Site

Notes:

• Koala habitat has been determined based on the presence of preferred Koala food trees in Byron Shire (Source: www.byron.nsw.gov.au/files/publications/fact-sheets/Biodiversity_Why_Are_Trees_Important.pdf)

• Secondary koala habitat does not contain preferred koala food trees in Byron Shire however, evidence of koala activity has been recorded.

0 100m

1 : 3000

SOURCE: JWA Site Investigations; Landpartners (Ref: LM080082-DR22F.pdf; LM080082-DR23H.pdf; LM080082-DR25F.pdf & LM080082-DR26F.pdf)

SCALE: 1 : 3000 @ A3

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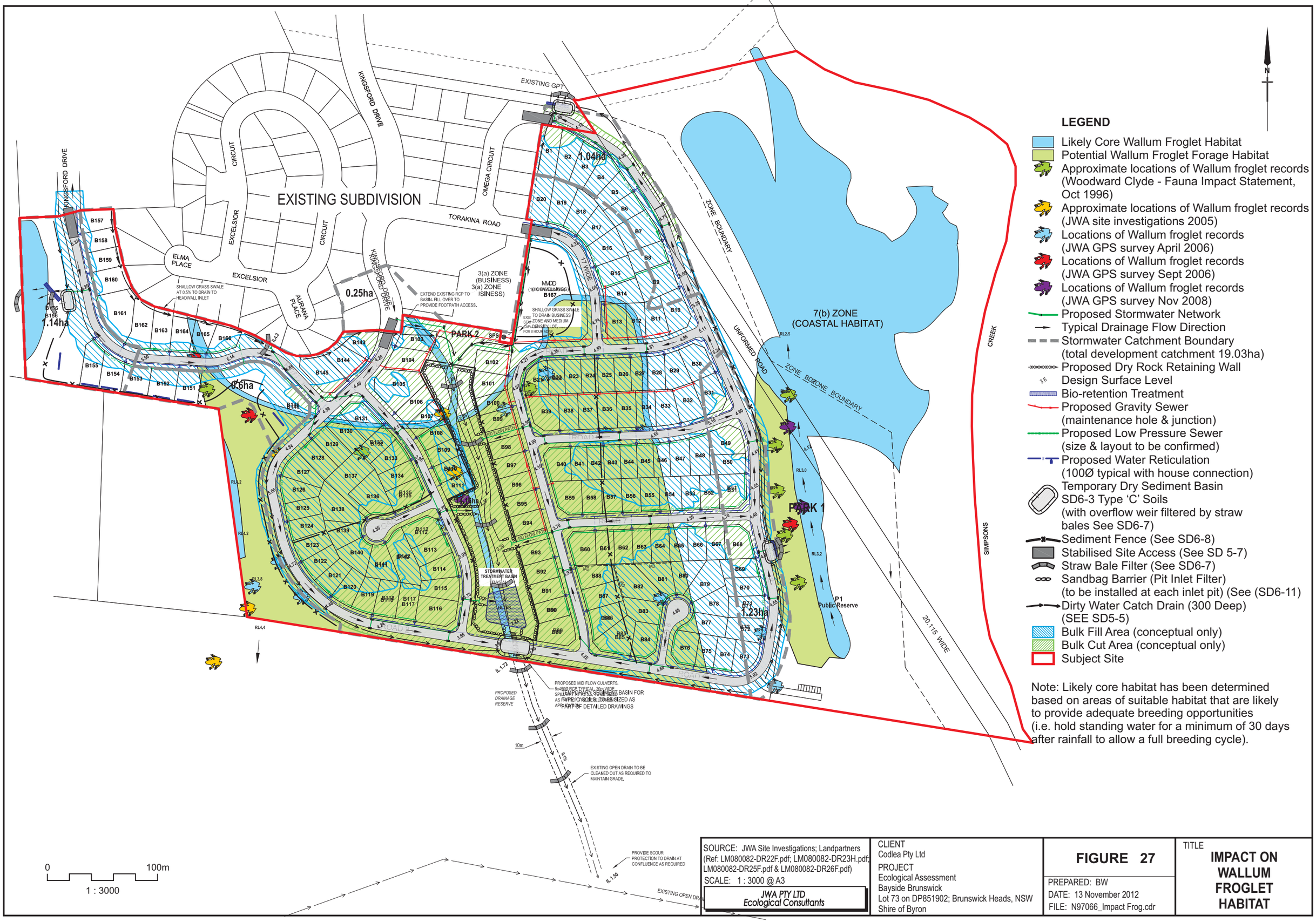
Ecological Assessment
Bayside Brunswick
Lot 73 on DP851902; Brunswick Heads, NSW
Shire of Byron

FIGURE 26

PREPARED: BW
DATE: 13 November 2012
FILE: N97066_Impact Koala.cdr

TITLE

IMPACT ON KOALA HABITAT



LEGEND

- Likely Core Wallum Froglet Habitat
- Potential Wallum Froglet Forage Habitat
- Approximate locations of Wallum froglet records (Woodward Clyde - Fauna Impact Statement, Oct 1996)
- Approximate locations of Wallum froglet records (JWA site investigations 2005)
- Locations of Wallum froglet records (JWA GPS survey April 2006)
- Locations of Wallum froglet records (JWA GPS survey Sept 2006)
- Locations of Wallum froglet records (JWA GPS survey Nov 2008)
- Proposed Stormwater Network
- Typical Drainage Flow Direction
- Stormwater Catchment Boundary (total development catchment 19.03ha)
- Proposed Dry Rock Retaining Wall
- Design Surface Level
- Bio-retention Treatment
- Proposed Gravity Sewer (maintenance hole & junction)
- Proposed Low Pressure Sewer (size & layout to be confirmed)
- Proposed Water Reticulation (100Ø typical with house connection)
- Temporary Dry Sediment Basin SD6-3 Type 'C' Soils (with overflow weir filtered by straw bales See SD6-7)
- Sediment Fence (See SD6-8)
- Stabilised Site Access (See SD 5-7)
- Straw Bale Filter (See SD6-7)
- Sandbag Barrier (Pit Inlet Filter) (to be installed at each inlet pit) (See (SD6-11)
- Dirty Water Catch Drain (300 Deep) (SEE SD5-5)
- Bulk Fill Area (conceptual only)
- Bulk Cut Area (conceptual only)
- Subject Site

Note: Likely core habitat has been determined based on areas of suitable habitat that are likely to provide adequate breeding opportunities (i.e. hold standing water for a minimum of 30 days after rainfall to allow a full breeding cycle).

SOURCE: JWA Site Investigations; Landpartners (Ref: LM080082-DR22F.pdf; LM080082-DR23H.pdf; LM080082-DR25F.pdf & LM080082-DR26F.pdf)
SCALE: 1 : 3000 @ A3

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PROJECT
Ecological Assessment
Bayside Brunswick
Lot 73 on DP851902; Brunswick Heads, NSW
Shire of Byron

FIGURE 27

PREPARED: BW
DATE: 13 November 2012
FILE: N97066_Impact Frog.cdr

TITLE
IMPACT ON WALLUM FROGLET HABITAT

LEGEND

- Temporary Dry Sediment Basin SD6-3 Type 'C' Soils (with overflow weir filtered by straw bales See SD6-7)
- Sediment Fence (See SD6-8)
- Stabilised Site Access (See SD 5-7)
- Straw Bale Filter (See SD6-7)
- Sandbag Barrier (Pit Inlet Filter) (to be installed at each inlet pit) (See (SD6-11)
- Dirty Water Catch Drain (300 Deep) (SEE SD5-5)
- Subject Site

See Soil & Construction Manual for SD Details

SOURCE: Landpartners
(Ref: LM080082-DR26F.pdf)

SCALE: 1 : 3000 @ A3

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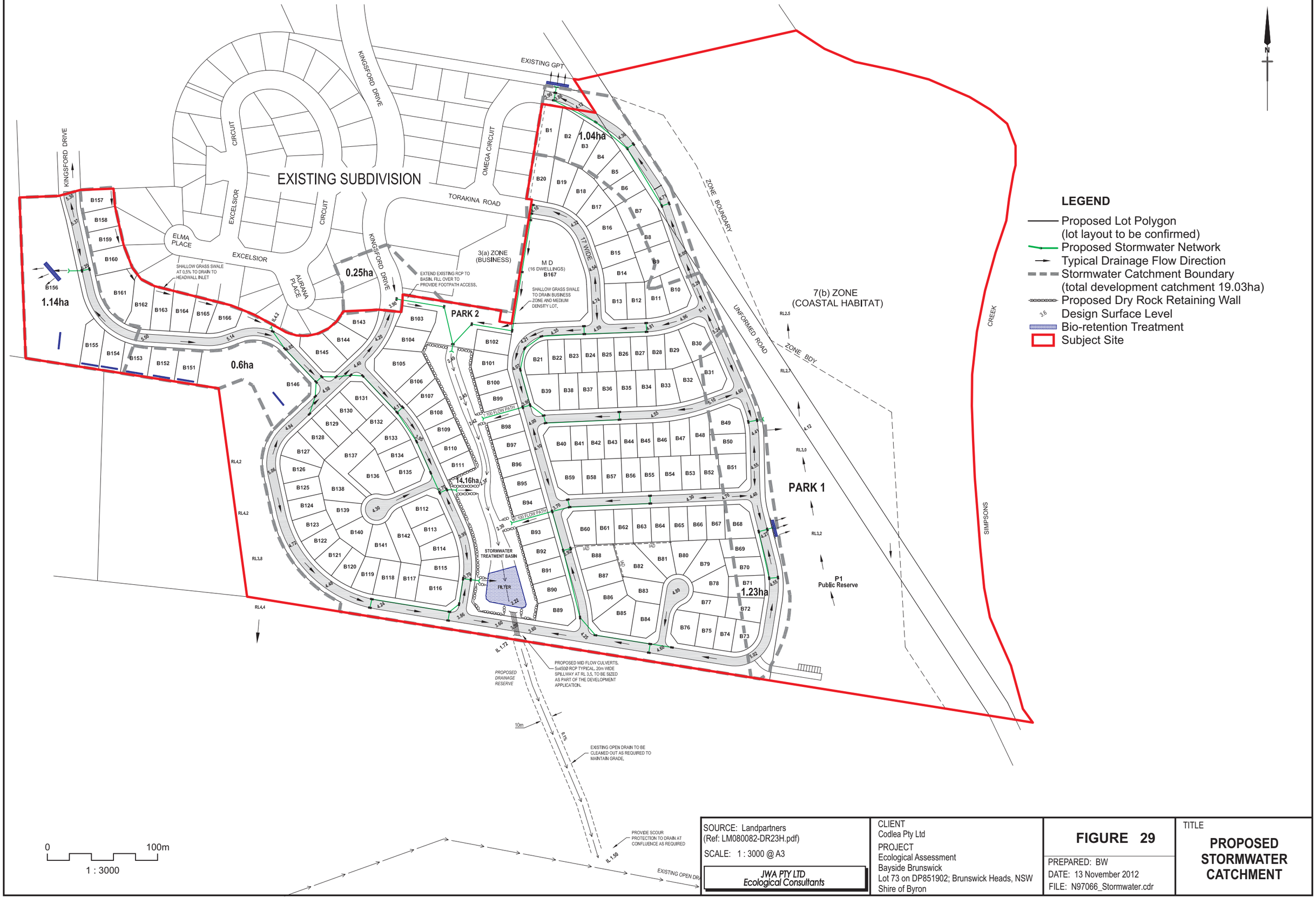
Bayside Brunswick
Lot 73 on DP851902; Brunswick Heads, NSW
Shire of Byron

FIGURE 28

PREPARED: BW
DATE: 02 November 2012
FILE: N97066_Erosion.cdr

TITLE
PROPOSED EROSION & SEDIMENT CONTROL



SOURCE: Landpartners
(Ref: LM080082-DR23H.pdf)

SCALE: 1 : 3000 @ A3

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Ecological Assessment
Bayside Brunswick
Lot 73 on DP851902; Brunswick Heads, NSW
Shire of Byron

FIGURE 29

PREPARED: BW
DATE: 13 November 2012
FILE: N97066_Stormwater.cdr

TITLE
PROPOSED STORMWATER CATCHMENT

EXISTING SUBDIVISION

KINGSFORD DRIVE

CIRCUIT

EXCELSIOR

ELMA PLACE

AURANA PLACE

TORAKINA ROAD

OMEGA CIRCUIT

17 WIDE

3(a) ZONE (BUSINESS)

M D (16 DWELLINGS) B167

7(b) ZONE (COASTAL HABITAT)

ZONE BOUNDARY

UNFORMED ROAD

ZONE BDY

CREEK

SIMPSONS

PARK 1

PARK 2

B1 B2 B3 B4 B5 B6 B7 B8 B9 B10 B11 B12 B13 B14 B15 B16 B17 B18 B19 B20

B21 B22 B23 B24 B25 B26 B27 B28 B29 B30 B31 B32 B33 B34 B35 B36 B37 B38 B39

B40 B41 B42 B43 B44 B45 B46 B47 B48 B49 B50 B51 B52 B53 B54 B55 B56 B57 B58 B59

B60 B61 B62 B63 B64 B65 B66 B67 B68 B69 B70 B71 B72 B73 B74 B75 B76 B77 B78 B79 B80 B81 B82 B83 B84 B85 B86 B87 B88

B89 B90 B91 B92 B93 B94 B95 B96 B97 B98 B99 B100 B101 B102 B103 B104 B105 B106 B107 B108 B109 B110 B111

B112 B113 B114 B115 B116 B117 B118 B119 B120 B121 B122 B123 B124 B125 B126 B127 B128 B129 B130 B131 B132 B133 B134 B135 B136 B137 B138 B139 B140 B141 B142

B143 B144 B145 B146 B151 B152 B153 B154 B155 B156 B157 B158 B159 B160 B161 B162 B163 B164 B165 B166

0.5ha

0.5ha

0.4ha

0.3ha

0.3ha

PROPOSED DRAINAGE RESERVE

EXISTING CREEK

N

LEGEND

- Existing Wallum froglet habitat - 0.8ha (combination of core breeding and forage areas)
- Proposed Wallum froglet core breeding area - 0.8ha (melon holes surrounded by saw sedge with broad leaf paperbark trees)
- Proposed Wallum froglet forage area - 0.4ha (broad leaf paperbark trees)
- Subject Site

0 100m

1 : 3000

SOURCE: Landpartners (Ref: LM080082-DR28E.pdf)

SCALE: 1 : 3000 @ A3

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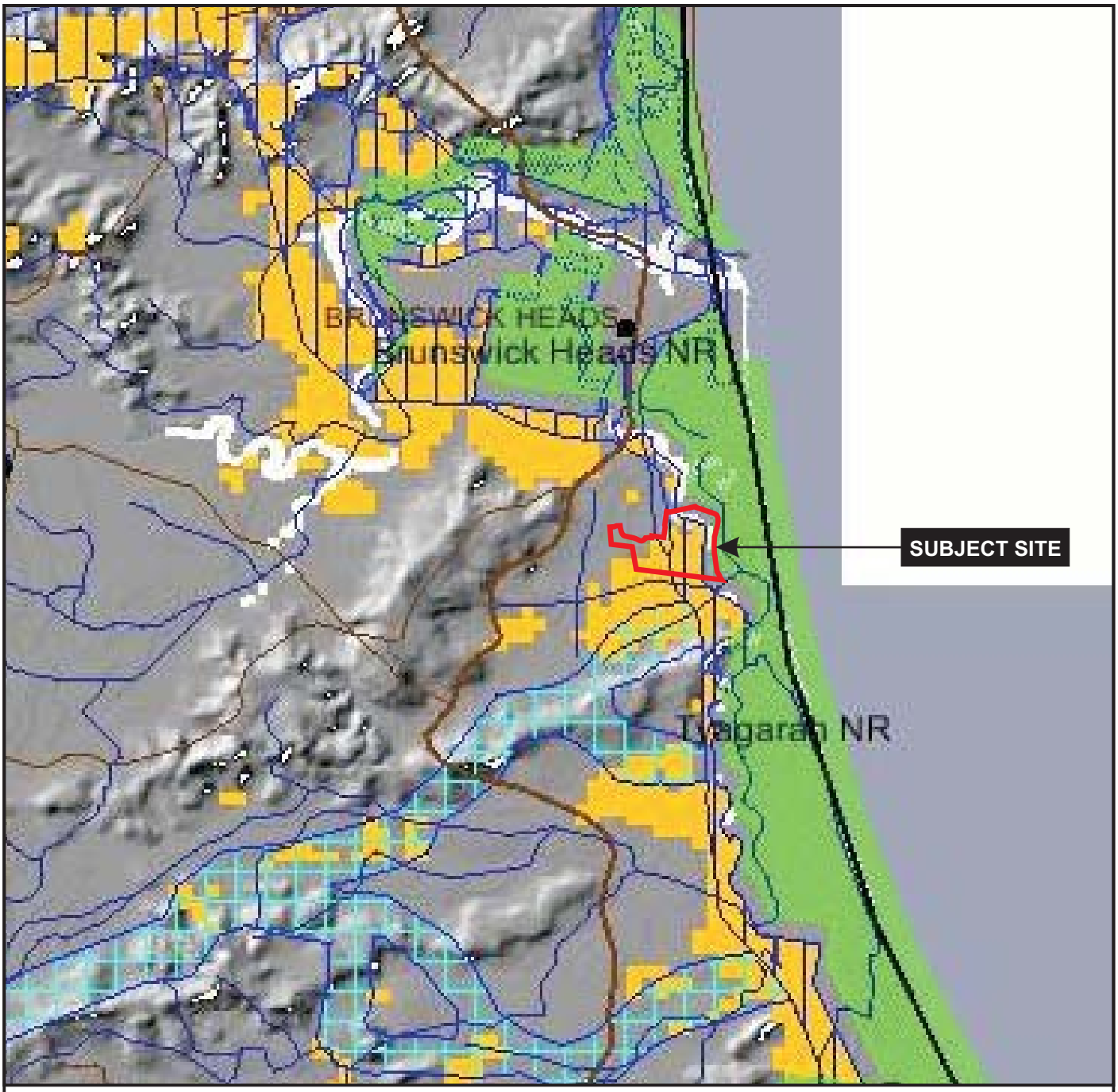
Ecological Assessment
Bayside Brunswick
Lot 73 on DP851902; Brunswick Heads, NSW
Shire of Byron

FIGURE 30

PREPARED: BW
DATE: 02 November 2012
FILE: N97066_Frog Offsets.cdr

TITLE
PROPOSED WALLUM FROGLET OFFSETS



LEGEND

- Regional Corridor
- Subregional Corridor
- Key Habitat
- Nature Reserve
- Regional Park
- State Forest
- Rivers
- Main Roads
- Minor Roads
- Wooded Vegetation
- Subject Site

N

0 1.5km

SOURCE: NPWS Key Habitats & Corridors (website accessed 09.04.09)

SCALE: 1 : 50 000 @ A4

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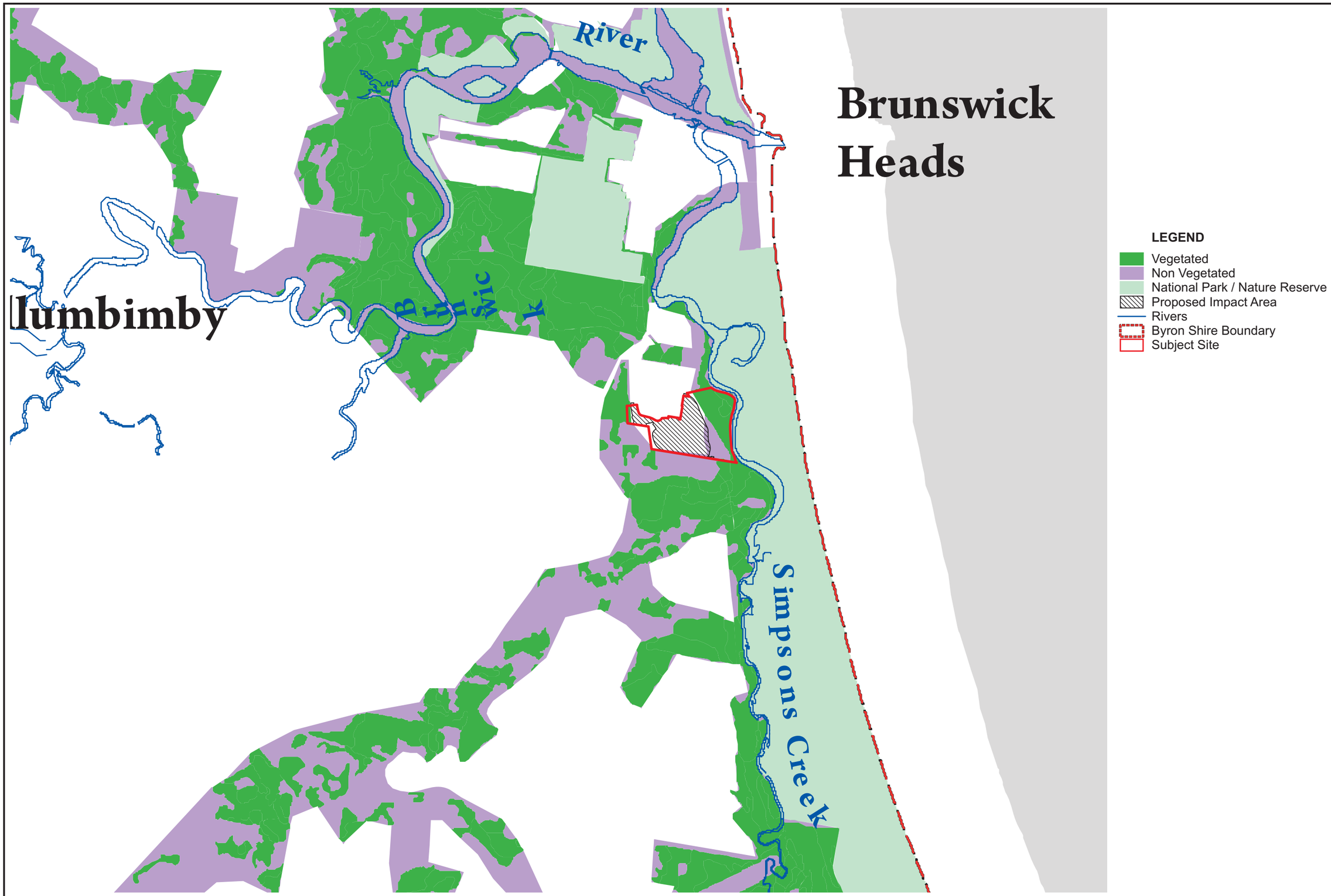
Ecological Assessment
Bayside Brunswick
Lot 73 on DP851902; Brunswick Heads, NSW
Shire of Byron

FIGURE 31

PREPARED: BW
DATE: 02 November 2012
FILE: N97066_Corridors.cdr

TITLE

NPWS KEY HABITATS & CORRIDORS



SOURCE: Byron Shire Council
Local Environmental Study - Wildlife Corridors; Landpartners (Ref: LM080082-DR30D.pdf)
SCALE: 1 : 30 000 @ A3

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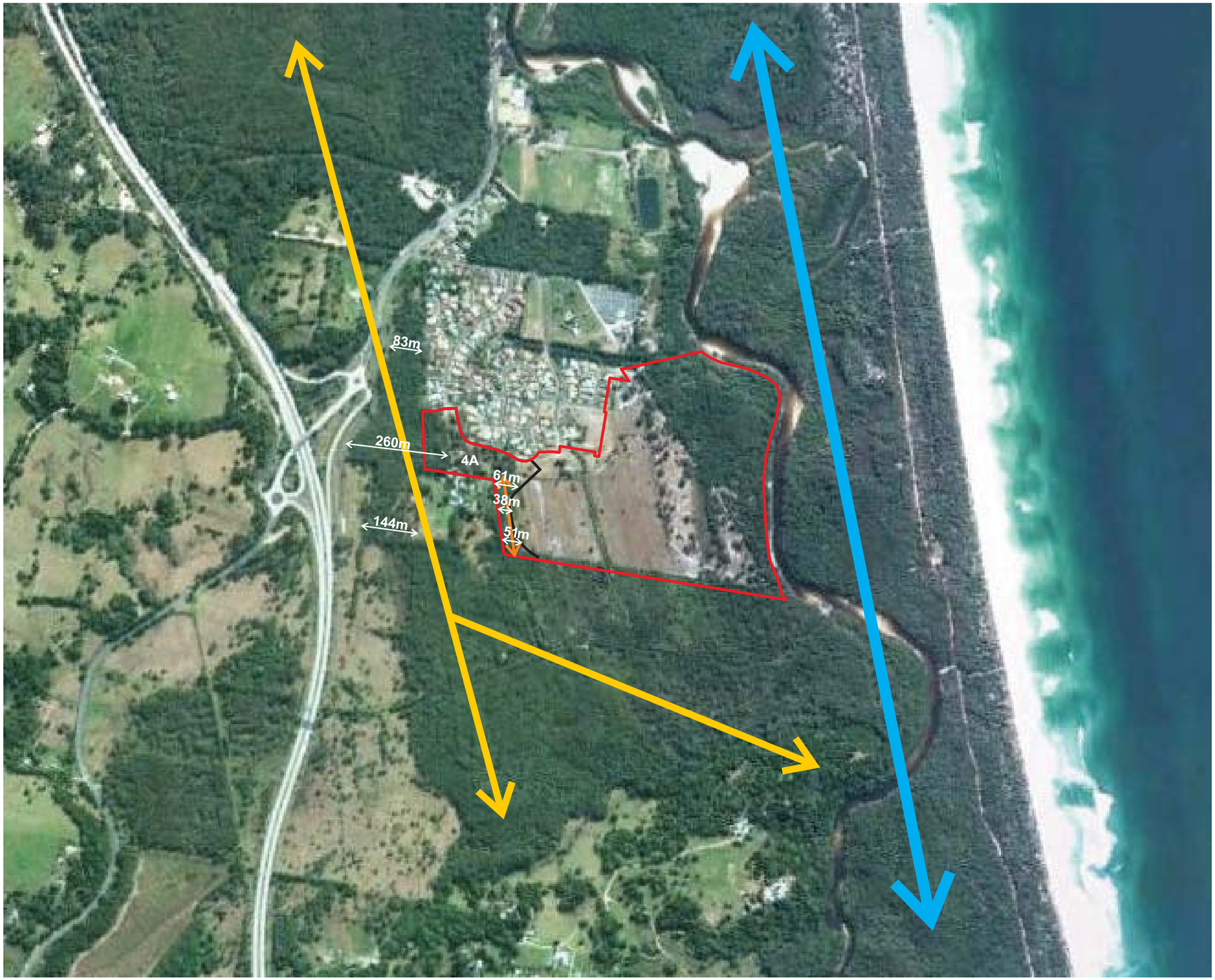
Ecological Assessment
Bayside Brunswick
Lot 73 on DP851902; Brunswick Heads, NSW
Shire of Byron

FIGURE 32

PREPARED: BW
DATE: 02 November 2012
FILE: N97066_BSC Corridors.cdr

TITLE
BYRON SHIRE COUNCIL WILDLIFE CORRIDORS



N

LEGEND

- Simpson's Creek Corridor
- Western Corridor
- Stage 4A Corridor
- Stage 4A Boundary
- Subject Site

0 300m

1 : 10 000

SOURCE: JWA Site Investigations; Google Earth 2010 Aerial Photograph

SCALE: 1 : 10 000 @ A3

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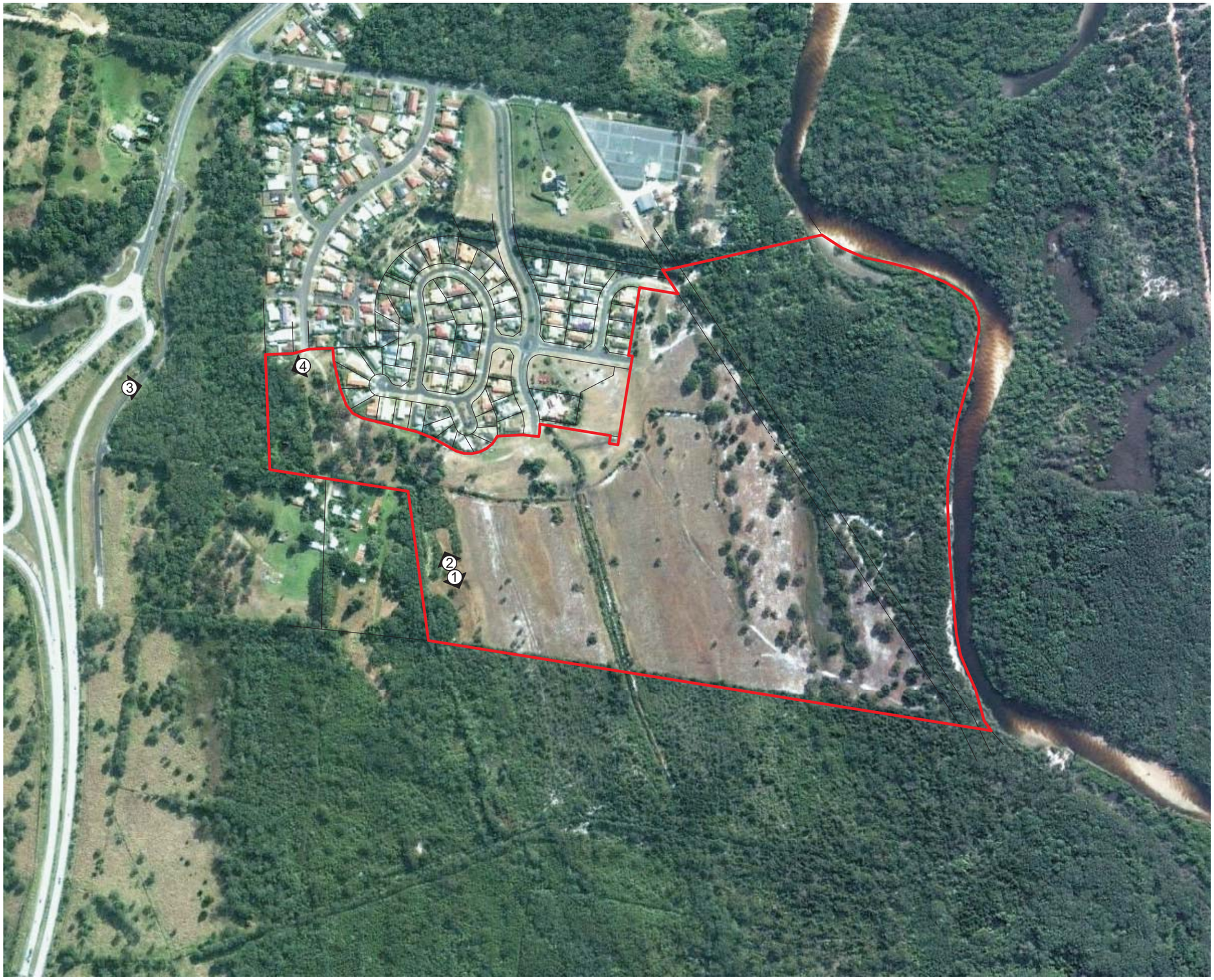
PROJECT
Ecological Assessment
Bayside Brunswick
Lot 73 on DP851902; Brunswick Heads, NSW
Shire of Byron

FIGURE 33

PREPARED: BW
DATE: 02 November 2012
FILE: N97066_Corridor Assess.cdr

TITLE

CORRIDOR ASSESSMENT



N

LEGEND

Location & direction of photo points

Subject Site

0 150m

1 : 5000

SOURCE: JWA Site Investigations; Google Earth 2009 Aerial

SCALE: 1 : 5000 @ A3

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Bayside Brunswick
Lot 73 on DP851902; Brunswick Heads, NSW
Shire of Byron

FIGURE 34

PREPARED: BW
DATE: 02 November 2012
FILE: N97066_Photo Points.cdr

TITLE

PHOTO POINTS