



Appendix D

Ecological Assessment

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JAMES WARREN & Associates Pty Ltd

ECOLOGICAL CONSULTANTS



ECOLOGICAL ASSESSMENT

LOT 4 DP 1022342

**NEW ENTRANCE ROAD
SOUTH WEST ROCKS**

NOVEMBER 2010

**A REPORT PREPARED FOR
SHANNON PACIFIC PTY LTD**

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Ecological Assessment

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1 INTRODUCTION

1.1 Background

James Warren & Associates (JWA) have been engaged by Shannon Pacific Pty Ltd to complete an Ecological Assessment for the proposed development on land described as Lot 4 DP 1022342 New Entrance Road, South West Rocks (**FIGURE 1**).

A Project Application for a Tourist Facility has been lodged with the NSW Department of Planning and will be assessed as a Major Project in accordance with Part 3a of the Environmental Planning and Assessment Act 1979 (DA 09_0019). Director General Environmental Requirements (DGEAR's) were issued on the 6th March 2009.

The Ecological Assessment has 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);
- Searching for and recording Threatened (*TSC Act 1995*), ROTAP (Briggs & Leigh 1996) and regionally significant plant species (Sheringham & Westaway 1995), and assessing the occurrence of Endangered Ecological Communities (EECs);
- Determining the suite of Threatened fauna (*TSC Act 1995*) that occurs in the locality and assessing their potential occurrence in the Study area;
- Assessing habitat provided by the site in relation to adjacent habitat and making an assessment of the corridor value of the site; and
- Addressing statutory requirements including Part 3A of the *Environmental Planning & Assessment Act (1979)* (EPA Act), the *Commonwealth Environment Protection and Biodiversity Act 1999* (EPBC Act) and the *Fisheries Management and Amendment Act (1997)*.

1.2 Locality

1.2.1 Introduction

The Locality is defined as the area within a 10km radius of the subject site and extends from Rainbow Reach in the south to Stuarts Point in the north and from Clybucca in the west to the Pacific Ocean in the east (**FIGURE 1**).

Prominent features include the townships of South West Rocks, and the villages of Arakoon, and Jerseyville. Prominent water bodies in the locality include the Macleay River, South West Rocks Creek, and the Pacific Ocean.

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



1.2.2 The Subject site

The subject site covers approximately 23 hectares of low lying flat ground extending east from the south bank of the Macleay River, near its mouth. The site is separated from the edge of the river by a road reserve. The Riverside Tavern is located within the site adjacent to the Macleay River (**FIGURE 2**). A road is situated along the northern boundary of the site which effectively acts as a bund preventing the inflow of tidal water. A pipe with a tidal flap is situated at the eastern end of the road, allowing floodwater to flow out (**FIGURE 2**). The construction of the road initiated a change within the wetland from a saline to a semi-saline condition resulting in gradual changes to the vegetation (Sainty 2005). The tidal flap is broken and is allowing a limited amount of tidal flow into the wetland.

1.2.3 The Study area

The Study area is defined as the Subject site and any proximate areas potentially affected by the proposed development. For this assessment, the study area extends:

- over the road/bund that forms the north boundary of the site;
- to the strip of vegetation that separates the site from residential areas to south and east; and
- to the river bank/riparian area along the Macleay River.

1.2.4 Significant conservation areas

There are three significant environmental conservation areas in the locality:

- Hat Head Nation Park - 4kms to the south east;
- Arakoon State Conservation Area - 3kms east; and
- Yarrahapinni Wetlands National Park - 5kms west.

1.2.5 SEPP 14 Wetlands

State Environmental Planning Policy No. 14 - Coastal Wetlands (SEPP 14) protects wetlands of ecological significance. Several SEPP 14 Wetlands occur within 10km of the locality (**FIGURE 3**).

The southern portion of SEPP Wetland number 436 occurs within the subject site (**FIGURE 3**). The boundary of the SEPP 14 Wetland 436, within the subject site, has been ground-truthed and surveyed (**FIGURE 4**).

1.3 Landuse zones

The Subject site is currently zoned 7(d) Scenic Protection pursuant to the provisions of the Kempsey Local Environment Plan 1987 (**FIGURE 5**). The objective of a 7(d) zoning is to control development so that the environmental and scenic qualities of visually significant land are preserved.



1.4 The Proposed Development

The proposed development is a tourist facility, involving the construction of nine (9) self contained tourist cabins, internal roads and landscaping (**FIGURE 6**). The development also proposes to implement a Wetland Management Plan (WMP) to protect, enhance and manage the SEPP 14 Wetland within the Subject site. The plan includes providing:

- an extensive constructed freshwater wetland to act as a buffer between the cabin area and the SEPP 14 area; and
- weed management and rehabilitation measures where required or appropriate.

1.5 Reintroduction of tidal flows to the SEPP 14 Wetland

The proposed development will include the repair and/or replacement of the tidal flap on the pipe at the eastern end of the northern boundary road to allow a natural tidal flow into the wetland (**FIGURE 2**). The specifications of either the nature of the repair or a new device should be investigated by a suitably qualified person, in the context of the Wetland Management Plan.



2 STRUCTURE OF THIS ASSESSMENT

The Ecological Assessment and associated documents have been prepared in accordance with the accepted format for a Section 3A assessment report. The report format is as follows:

SECTION 1 - Introduction, background and relevant site information

SECTION 3 - Responses to accepted DGEARs

SECTION 4 - Summary of Impacts, Mitigation and Offsets

SECTION 5 - SEPP 44 Koala Habitat Assessment

SECTION 6 - EPBC Assessment

APPENDIX 1 - *Flora Assessment*

APPENDIX 2 - *Site Species List*

APPENDIX 3 - *Fauna Assessment*



3 DIRECTOR GENERAL'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

3.1 Background

Under Part 3A of the *Environmental Planning & Assessment Act 1979* (EPA Act 1979), a major projects application has been lodged with the Department of Planning. Director General's Environmental Assessment Requirements (DGEARs) have been issued dated 6th March 2010. The following relevant DGEAR's have been addressed in this report:

- 9.1 Assess the potential direct and indirect impacts of the development on flora and fauna taking into consideration impacts on any threatened species, populations, ecological communities and/or critical habitat and any relevant recovery plan in accordance with, DECC's Guidelines for Threatened Species Assessment (2005), having particular consideration for any known threatened species on the site. Provide measures for the conservation of flora and fauna, where relevant.
- 9.2 Outline measures for the conservation of existing wildlife corridor values and/or connective importance of any vegetation on the subject land.
- 9.3 Address measures to protect and manage the riparian corridor and adjacent aquatic habitats including measures that increase tidal flows into the site's *State Environmental Planning Policy No 14 - Coastal Wetlands* (SEPP 14) Wetland.
- 9.4 Survey the extent of the site's SEPP 14 wetland, area and show suitable buffers.
- 9.5 Consider the impacts of the project on vegetation in accordance with the Native Vegetation Act 2003.

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

An assessment has also been undertaken in accordance with the State Environmental Planning Policy Number 44 - Koala Protection (SEPP 44) and the Commonwealth Environmental Protection and Biodiversity Conservation Act (EPBC).

3.2 Compliance with Relevant Legislation

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.

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.



4 RESPONSES TO DGEAR'S

4.1 Impacts on flora and fauna

4.1.1 Introduction

DGEAR 9.1 - "Assess the potential direct and indirect impacts of the development on flora and fauna taking into consideration impacts on any threatened species, populations, ecological communities and/or critical habitat and any relevant recovery plan in accordance with, DECC's Guidelines for Threatened Species Assessment (2005), having particular consideration for any known threatened species on the site. Provide measures for the conservation of flora and fauna, where relevant."

This section will consider the impacts (direct and indirect) of the proposed development on the existing native flora and fauna. Impacts considered will pay particular attention to threatened species, populations, ecological communities (as listed under the *NSW Threatened Species Conservation Act 1995*) and their habitats. Impact assessment has been undertaken in accordance with *Guidelines for Threatened Species Assessment* (DECC 2005).

Assessment, under Part 3A, allows the use of avoidance and impact mitigation strategies as well as offsets, to achieve maintain-or-improve outcomes and reduce the impacts of a proposed development on threatened species and endangered ecological communities.

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

- Impacts
- Avoidance of Impacts
- Mitigation
- Offsets

A Key Thresholds Assessment has also been completed in accordance with Department of Environment and Conservation (DEC) and the Department of Primary Industries guidelines (DEC & DPI 2005).

4.1.2 Summary of existing flora and fauna values

Detailed Flora and Fauna assessments were undertaken on the Subject site (**APPENDICES 1 & 3**). A summary of existing Flora and Fauna values are as follows:

Flora

The Flora assessment recorded:

- Five (5) vegetation communities (**FIGURE 7**); and



Ecological Assessment

- Two (2) Endangered Ecological Communities (EECs), Coastal Saltmarsh and Swamp Oak Floodplain Forest.

Fauna

The Fauna assessment recorded:

- Sixty-eight (68) fauna species including six (6) amphibians, four (4) reptiles, forty-six (46) birds and twelve (12) mammal species;
- No threatened fauna species were recorded;
- Five (5) threatened fauna species were considered either likely to occur or a possible occurrence on the Subject site over time.

4.1.3 Impacts on Flora and Fauna

4.1.3.1 Vegetation

Impacts

There will be no significant loss of native vegetation on the subject site. Most of the development is situated within Community 5 (i.e. grassland with scattered trees), a highly degraded and disturbed area. There will be no loss of any quality vegetation communities for the construction of the cabins. A small area of Saltmarsh occurs in the area proposed for the Constructed wetland however this area is highly degraded and has been excluded from the mapped SEPP 14 Wetland.

Potential indirect impacts could arise from stormwater run-off into the SEPP 14 Wetland area or uncontrolled access by pedestrians and/or vehicles. These issues will be discussed further in the **Section 3.5** (i.e. DGEAR 9.3).

**TABLE 2
IMPACTS ON VEGETATION COMMUNITIES**

COMMUNITY	TOTAL AREA (ha)	LOSS (ha)	Loss (%)
Community 1 - Mid-high forest (<i>Casuarina glauca</i>)	3.9726	0.0000	0.00
Community 2 - Saltmarsh (<i>Sporobolus virginicus</i> , <i>Juncus kraussii</i>)	9.7375	0.0334	0.34
Community 3 - Sedgeland (<i>Eleocharis equisetina</i> +/- <i>Juncus usitatus</i> , <i>Persicaria hydropiper</i> , <i>Cyperus polystachyos</i>)	0.1116	0.0000	0.00
Community 4 - Rushland (<i>Typha domingensis</i>)	0.4564	0.0000	0.00
Community 5 - Grassland with scattered trees	2.9124	1.2222	41.97
Mudflats	3.7500	0.0000	0.00
Existing buildings	0.6218	0.0000	0.00
TOTAL	21.5623	1.2556	5.82



Avoidance of impacts

The layout of the proposed development (i.e. construction of cabins, internal road and landscaping) has been designed to avoid areas of significant vegetation. The development largely occurs within an area of 'grassland with scattered trees' and outside any areas of significant native vegetation (i.e. Coastal Saltmarsh and Swamp Oak Forest).

Mitigation

A Wetland Management Plan (WMP) has been completed detailing measures to protect, enhance and manage the SEPP 14 Wetland area. Protection will involve the construction a freshwater wetland environment to act as physical, biological and visual buffer, between the proposed development and the SEPP 14 area. The constructed wetland will also create new habitat for wetland species.

The SEPP 14 area will be further enhanced by rectifying the tidal flow into the area, returning the wetland to a saline condition, weed control and additional plantings. The WMP also includes a detailed monitoring and reporting program.

4.1.3.2 Fauna

Impacts

The layout of the proposed development (i.e. construction of cabins, internal road and landscaping) has been designed to avoid areas of significant habitat. There will be very little impact on native fauna in the area. The vegetation to be removed generally represents poor quality fauna habitat, with the exception of highly mobile species such as the Eastern grey kangaroo.

A population of Eastern grey kangaroos occurs in the area. Approximately 20-30 animals were sighted on a number of occasions during the fauna survey (**APPENDIX 3**). These kangaroos have become accustomed to humans and were also observed to move through the adjoining residential community.

The proposed development is unlikely to have a major impact on the survival of this population. Although the Eastern grey kangaroo is not a threatened species and considered to be relatively harmless, interaction between humans and the kangaroos should be discouraged. Educational signage should be erected providing information about the population and warnings not to interact or feed these animals. This information could be incorporated with other education signage provided for the Constructed Wetland (JWA 2010). Recommendations are further discussed within the Wetland Management Plan.

Avoidance of impacts

The layout of the proposed development (i.e. construction of cabins) largely occurs within an area of grassland with scattered trees which generally does not represent significant habitat for any native fauna species.

Mitigation

A Wetland Management Plan (WMP) has been completed detailing measures to protect, enhance and manage the remaining areas of vegetation. By improving the vegetation the values of the area as habitat for native fauna will also be improved. A Freshwater Wetland will also be constructed creating new quality habitat for wetland fauna species.



4.1.4 Impacts on Threatened Species

4.1.4.1 Flora

No threatened flora species were recorded on the Subject site.

4.1.4.2 Fauna

Details of the fauna survey completed are contained in **APPENDIX 3**.

Impacts

No threatened fauna species were recorded from the subject site. Five (5) threatened fauna species were considered likely or possible occurrences on the Subject site over time, including:

- | | |
|-------------------------------------|--------------------|
| • <i>Ixobrychus flavicollis</i> | Black bittern |
| • <i>Ephippiorhynchus asiaticus</i> | Black-necked stork |
| • <i>Sterna albifrons</i> | Little tern |
| • <i>Pandion haliaetus</i> | Osprey |
| • <i>Haematopus longirostris</i> | Pied oystercatcher |
| • <i>Lophoictinia isura</i> | Square-tailed kite |

Avoidance of impacts

The layout of the proposed development (i.e. construction of cabins) largely occurs within an area of grassland with scattered trees which does not represent significant habitat for any of the above threatened fauna species.

Potential indirect impacts may include:

- Increased light, noise and activity may cause reclusive species to move away from habitat edges;
- Alteration of hydrology;
- Contamination or reduction of water quality in drainage lines due to runoff from chemicals or debris (fertilisers, etc); and
- Introduction of weed species into core habitat areas.

Mitigation

A WMP has been completed detailing measures to protect, enhance and manage the remaining areas of vegetation and to minimise the impacts listed above. By improving the vegetation the values of the area as habitat for native fauna will also be improved. A Freshwater Wetland will also be constructed creating new quality habitat for wetland fauna species and to act as physical, biological and visual buffer, between the proposed development and the SEPP 14 area.



4.1.5 Impacts on Endangered Ecological Communities

Two (2) EECs are considered to occur on the site:

- Coastal Saltmarsh; and
- Swamp Oak Floodplain Forest (**FIGURE 7**).

These vegetation communities occur within the SEPP 14 Wetland.

Avoidance of impacts

The layout of the proposed development (i.e. construction of cabins) largely occurs within an area of grassland with scattered trees which does not contain any significant areas of vegetation, with the exception of a small patch of degraded Saltmarsh.

Impacts

The reintroduction of tidal flow will impact on the distribution of both the Coastal Saltmarsh and the Swamp Oak Forest into the SEPP 14 Wetland. Historically, stormwater runoff, from areas around the Subject site, would have naturally fed into the SEPP 14 Wetland. The vegetation communities would have reflected a gradual transition from a freshwater to a saline condition (i.e. Swamp oak, Saltmarsh to Mangroves) (DECCW 2008a). The construction of the bund wall/road has restricted tidal flow and facilitated a condition with a greater freshwater influence. The current vegetation pattern reflects the restriction of tidal flow over the past three decades. *Casuarina glauca*, probably previously restricted to smaller patches, has expanded as a response to less saline conditions (Sainty 2004). Under the current water regime fully salt tolerant species face competition from less salt tolerant species. A return to a more natural tidal flow will result in the retreat of *C. glauca* and the expansion of salt tolerant species whose propagules are water dispersed.

There will be no direct loss of vegetation within the EECs for the construction of the proposed development. However, a very small area currently mapped as Saltmarsh is within the design layout of the constructed wetland. There will be no direct loss to this vegetation, however it may be modified over time and adapt to more freshwater and less saline conditions.

There may be some indirect impacts on EECs during both the construction and operational phases. These issues will be discussed in **Section 3.5** (i.e. DGEAR 9.3).

Mitigation

A WMP has been completed detailing measures to protect, enhance and manage the remaining areas of vegetation and to minimise the potential impacts of the proposed development. A Freshwater Wetland will be constructed creating a buffer between the cabin area and the SEPP 14 wetland.

4.1.6 Key Thresholds Assessment

The Department of Environment and Conservation (DEC) and the Department of Primary Industries provided guidelines for assessing impacts through assessing key thresholds with the response to a set of questions (DEC & DPI 2005).

Key Threshold Assessment Questions have been assessed for the following:



Endangered Ecological Communities (EECs)

- Two (2) EECs:
 - Swamp Oak Forest on Coastal Floodplains of the NSW North Coast.
 - Saltmarsh

Fauna

Five (5) threatened fauna species are predicted to occur on the Subject site over time:

- | | |
|-------------------------------------|--------------------|
| • <i>Ixobrychus flavicollis</i> | Black bittern |
| • <i>Ephippiorhynchus asiaticus</i> | Black-necked stork |
| • <i>Sterna albifrons</i> | Little tern |
| • <i>Pandion haliaetus</i> | Osprey |
| • <i>Haematopus longirostris</i> | Pied oystercatcher |
| • <i>Lophoictinia isura</i> | Square-tailed kite |

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

Biodiversity should be considered on three (3) levels:

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

The proposed development will maintain and improve biodiversity on all three levels. To avoid any direct impacts on the natural environment the development has been designed in an area devoid of quality vegetation (grassland and scattered trees) and outside the surveyed boundaries of the SEPP14 Wetland No. 436. A Wetland Management Plan (WMP) has been completed detailing measures to protect, enhance and manage the wetland area. Protection will involve the construction a freshwater wetland environment between the proposed development and the SEPP 14 area providing a buffer to physical, biological and visual disturbance. The constructed wetland will also create new quality habitat for wetland flora and fauna species. The SEPP 14 area will be further enhanced by re-establishing tidal exchange, returning the wetland to a saline condition, and weed control. The WMP also includes a detailed monitoring and reporting program.

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

The two (2) EECs (i.e. Swamp Oak Forest and Coastal Saltmarsh) occurring on the site will not be directly impacted by the proposed development. Measures to ensure their protection and enhancement are included in the WMP (JWA 2010). The WMP outlines a strategy for the re-establishment of a healthy saltmarsh ecosystem. This may facilitate the retreat of the Swamp oak forest but is highly unlikely to reduce the long viability of Swamp oak on the Subject site. Swamp oaks are likely to persist, either in patches or as scattered trees on the margins of the tidal extreme. The re-introduction of the tidal flow will halt the invasion of Swamp oaks over the entire site.



The proposed development and re-introduction of the tidal flow will have a negligible impact on the habitat of the threatened fauna consider likely or possible occurrences on the site. Habitat for these species will be improved through the implementation of the WMP (JWA 2010).

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

As there will be negligible impact on the local populations of threatened fauna and the 2 (two) EECs (see above), it is highly unlikely that the proposed development will accelerate the extinction of these species/EECs.

(d) Will the proposal adversely affect critical habitat?

Critical habitats are areas of land that are critical to the survival of a particular threatened species, population or ecological communities and are listed under the Threatened Species Conservation Act (1995). There is currently no habitat listed or recommend for any of the species or EECs found on the subject site.

4.2 Wildlife Corridor Values

4.2.1 Introduction

DGEAR 9.2 “Outline measures for the conservation of existing wildlife corridor values and/or connective importance of any vegetation on the subject land.”

The NPWS Key Habitats and Corridors project does not include any areas of the subject site as part of a corridor or as key habitat. However, there is regional corridor occurring adjacent to the northern boundary (**FIGURE 9**). The Southwest Rocks - Macleay Arm Corridor is contiguous with the northern section of the Subject site, an area that will remain undeveloped and the focus of a Wetland Management Plan.

4.2.2 Potential impacts

The proposed development will have no direct negative impact on the overall effectiveness of the site as a corridor. Positive impacts are more likely with the implementation of the Wetland Management Plan.

4.2.3 Avoidance of impacts

The proposed development has been designed to utilise existing highly disturbed areas and avoid the SEPP 14 Wetland, an area which is contiguous with the regional corridor on the northern boundary of the site.

4.2.4 Mitigation

Mitigation measures include the implementation of a WMP (JWA 2010). The aim of the WMP is to protect, enhance and manage the undeveloped areas of the Subject site resulting in an increased value as a habitat corridor.



4.3 Protection and management of riparian and aquatic habitats

4.3.1 Introduction

DGEAR 9.3 - “Address measures to protect and manage the riparian corridor and adjacent aquatic habitats including measures that increase tidal flows into the site’s State Environmental Planning Policy No 14 - Coastal Wetlands (SEPP 14) Wetland.”

This section will describe the measures to protect and enhance the southern portion of the SEPP 14 Wetland No 436.

4.3.2 Impacts on SEPP 14 Wetland No. 463

In response to the state-wide degradation of coastal wetlands, the Department of Planning enacted the State Environment Planning Policy (SEPP) - 14 Coastal Wetlands in 1985. The policy aims to “ensure that the coastal wetlands are preserved and protected in the environmental and economic interests of the State”.

Impacts

SEPP 14 Wetland No. 436 occurs on the subject site and encompasses the EECs Swamp Oak Forest and Coastal Saltmarsh (**FIGURE 3**). The development (i.e. construction of cabins) largely occurs on disturbed land (i.e. Grass \land and scattered trees) outside the SEPP14 Wetland Boundary. With the implementation of the WMP (JWA 2010), the proposed tourist development is unlikely to have any direct impacts on the ecology of the wetland area (**FIGURE 8**). However, there is the potential for indirect impacts resulting from the following:

1. Noise, light and activity may disturb fauna with the wetland;
2. Fuel reduction activities in the Asset Protection Zone (APZ);
3. Pollution as a result of uncontrolled stormwater runoff; and/or
4. Uncontrolled human access causing trampling.

Avoidance

The proposed development is situated in a highly disturbed area and outside the SEPP 14 boundaries.

Mitigation

1. *Noise, light and activity may disturb fauna with EEC*

Vegetation rehabilitation will be undertaken between the cabin area and SEPP 14 boundary (i.e. the EECs). A WMP has been prepared (JWA 2010) which outlines weed control measures, species selection, planting densities and a monitoring, maintenance and reporting program. The rehabilitation area will create a buffer to the SEPP 14 wetland.

2. *Fuel reduction activities in the Asset Protection Zone (APZ)*



There is approximately 40-50 metres between the edge of the cabins and the existing line of vegetation (**FIGURE 6**). This will be sufficient to act as an APZ. However, plantings are required in this area to form a vegetated buffer to the EECs and SEPP 14 wetland. Planting will be undertaken in such a way as to provide the adequate screening and buffering and also comply with any APZ requirements. The details of this strategy are outlined in a Wetland Management Plan (JWA 2010).

3. Pollution as a result of uncontrolled stormwater runoff

An extensive constructed wetland area is planned between the cabin area and the SEPP 14 boundary (**FIGURE X**). The area covers approximately 4000 m². This wetland will be designed incorporating the latest best practice strategies to ensure that water reaching the SEPP 14 Wetland is of the highest quality. A Stormwater Management Plan (SMP) and water monitoring regime should also be in place to monitor the success of the Constructed Wetland. The SMP should also incorporate measures to ensure the effective removal of gross pollutants from the stormwater runoff before they enter the constructed wetland.

4. Uncontrolled human access causing trampling

The Constructed Wetland will physically block access, by vehicles and pedestrians, to the SEPP 14 area. Access will be provided to the Constructed Wetland by a raised boardwalk (**FIGURE 6**).

Consideration should be given to the installation of bollards or a similar fauna friendly fencing design along the SEPP 14 boundary line as well as signage stating "Environmental Protection Area - Keep out".

Restoration

The southern portion of the SEPP 14 Wetland 463 has been denied full tidal inundation for approximately 3 decades. The conditions within the wetland have gradually changed from a saline to a semi-saline condition. Historical photographs show smaller areas of *Casuarina glauca* indicating that they have expanded since tidal inundation has been restricted.

The proposed development includes a WMP which will restore tidal flows to the SEPP 14 area allowing the former dominance of the salt tolerant species such *Sarcocornia quinqueflora*, *Sporobolus virginicus* and *Juncus kraussii* to be re-established. The re-introduction of tidal flows will assist in returning the wetland area to its former condition.

Coastal Saltmarsh in NSW has been in a gradual decline since European settlement. It was listed as a Threatened Ecological Community in 2004 (DECCW 2008). Large areas have been drained and used for agricultural activities, have become weed infested and used for vehicular recreation and as rubbish dumps. The mitigation measures proposed with this development (i.e. the implementation of a WMP) present an opportunity to restore and establish an area of this valuable ecological community.



4.4 SEPP 14 Wetland No. 463

DGEAR 9.4 - “Survey the extent of the site’s SEPP 14 wetland area and show suitable buffers.”

The boundary of the SEPP 14 Wetland has been surveyed and ground-truthed by the DoP (FIGURE 4). The proposed development includes the construction of a freshwater wetland system and associated revegetation works between the development and the SEPP 14 Wetland (FIGURE 4). This area is considered to provide a sufficient buffer to the SEPP 14 Wetland.

4.5 Native Vegetation Act (2003)

4.5.1 Introduction

DGEAR 9.5 - “Consider the impacts of the project on vegetation in accordance with the Native Vegetation Act 2003 (NVA)”.

This section provides a discussion of the objectives of the NVA in the context of the proposed development.

4.5.2 Objectives of the Act

The objectives of the Native Vegetation Act (2003) are:

- (a) to provide for, encourage and promote the management of native vegetation on a regional basis in the social, economic and environmental interests of the State,
- (b) to prevent broadscale clearing unless it improves or maintains environmental outcomes,
- (c) to protect native vegetation of high conservation value having regard to its contribution to such matters as water quality, biodiversity, or the prevention of salinity or land degradation,
- (d) to improve the condition of existing native vegetation, particularly where it has high conservation value, and
- (e) to encourage the revegetation of land, and the rehabilitation of land, with appropriate native vegetation,

in accordance with the principles of ecologically sustainable development.

4.5.3 Response to Objectives of the Act

- (a) The proposed development has measures included to manage the native vegetation on the site.
- (b) There will be no broadscale clearing for the proposed development.



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- (c) The proposed development will protect native vegetation of high conservation value having regard to its contribution to such matters as water quality, biodiversity, or the prevention of salinity or land degradation. All the vegetation representative of EECs and within the SEPP14 Wetland on the subject site will be retained.
- (d) All the retained vegetation on site will be the subject of a WMP. The objectives of the WMP will be to protect, enhance and manage the EECs and the SEPP14 Wetland on the subject site.
- (e) Areas included in the WMP will be revegetated and rehabilitated with appropriate native vegetation. However, natural regeneration will be encouraged as a priority.



5 SEPP 44 KOALA HABITAT ASSESSMENT

STATE ENVIRONMENTAL PLANNING POLICY No. 44 - KOALA HABITAT PROTECTION

In response to the statewide 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 area 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.

- ***Does the policy apply?***

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

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

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

Yes.

- ***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?

No.

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

The site does not support core Koala habitat.

- ***Is there a requirement for the preparation of a Plan of Management for identified core Koala habitat?***

No.



6 COMMONWEALTH ENVIRONMENTAL PROTECTION AND BIODIVERSITY CONSERVATION ACT (1999)

6.1 Introduction

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

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

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

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

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

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

Matters of NES in New South Wales are:

- (a) Declared World Heritage Areas;
- (b) Declared Ramsar Wetlands;
- (c) Listed Threatened Species;
- (d) Listed Ecological Communities in New South Wales; and
- (e) Listed migratory species (JAMBA and CAMBA).

6.2 Occurrence of Matter of NES on Subject Site

6.2.1 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.

6.2.2 Listed Threatened species

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

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

6.2.3 Listed Ecological Communities

No ecological community currently listed in the EPBC Act (1999) occurs in the study area.

6.2.4 Listed Migratory Species

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

No migratory species as listed within schedules of the EPBC Act (1999) were recorded on site, however the Little Tern *Sterna albifrons* is considered a possible occurrence on site (APPENDIX 3).

6.3 Assessment against EPBC Act Principal Significant Impact Guidelines

6.3.1 Background

The Commonwealth DEH has prepared EPBC Act Policy Statements, including the EPBC Act - Principal Significant Impact Guidelines 1.1 (2005) which outline a self-assessment process to assist in determining whether an action should be referred to the Department for a decision on whether assessment and approval is required under the Act. The following sections assess the proposed development (the action) against these guidelines.

6.3.2 Migratory Species

Significant Impact Criteria

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.

Assessment of Proposed Action

It is considered that although the Little tern is likely to occur occasionally in the Study area, no area of important habitat occurs in the Study area and thus there will be no negative impacts on this species.

6.3.3 Requirement for Commonwealth Referral

Based on the assessment provided above, Referral to the Commonwealth DEWHA is not required. The proposed action is unlikely to result in a significant impact on any matter of NES.



7 REFERENCES

Davies and Lane (1995) - Effective Buffers for Wetlands - Guidelines for Design of Effective Buffers for Wetlands on the Swan Coastal Plain. Report to ANCA.

DECCW (2008) Coastal saltmarsh in the NSW North Coast, Sydney Basin and South East Corner bioregions - endangered ecological community listing. NSW Scientific Committee - final determination. NSW Department of Climate Change and Water. Viewed at <http://www.environment.nsw.gov.au/determinations/CoastalSaltmarshEndSpListing.htm> (last updated 12 February 2008) on 19th April 2010.

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APPENDIX 1 - FLORA ASSESSMENT



1 FLORA ASSESSMENT

1.1 Introduction

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

1.2 Methods

1.2.1 Database searches

Searches of the NPWS and EPBC databases were conducted (23rd March 2010) to find records of State and Commonwealth Threatened species¹ within 10km of the Subject site.

1.2.2 Site survey

A site survey was completed in March 2010 by one (1) scientist (A. Macarthur, APPENDIX 4) during which all areas of vegetation were traversed and previous vegetation mapping (i.e. JWA 2006 & 2007) verified. The species list was also checked and amended. Threatened flora species were targeted during the site survey. A total of over fifteen (15) hours flora survey was undertaken.

1.3 Results

1.3.1 Database searches

The EPBC Protected Matter Search Tool indicates that four (4) Commonwealth threatened flora species, or their habitat, are likely to occur in the locality. A search of the NPWS Database revealed five (5) threatened flora species within 10km of the Subject site.

These species are shown in TABLE 1. Status is in accordance with the Commonwealth EPBC Act and the *Threatened Species Conservation Act 1995* (TSC Act).

TABLE 1
DATABASE RECORDS OF THREATENED FLORA SPECIES
WITHIN 10 KM OF THE SUBJECT SITE

Common name	Specific Name	Status	
		EPBC	TSC
Juncaginaceae	<i>Maundia triglochinoides</i>	Not listed	V
Milky Silkpod	<i>Parsonsia dorrigensis</i>	E	V 1
Dwarf Heath Casuarina	<i>Allocasuarina defungens</i>	E	E1 1
Brown Fairy-chain Orchid	<i>Peristeranthus hillii</i>	Not listed	V 1
Scented Acronychia	<i>Acronychia littoralis</i>	E	E1 2
Austral Toadflax	<i>Thesium australe</i>	V	V 1

V = Vulnerable; E = Endangered

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



1.3.2 Site survey

Five (5) vegetation communities (**FIGURE 7**) and one hundred and sixteen (116) plant species were recorded (**APPENDIX 2**). No threatened species were recorded.

1.3.3 Community descriptions

Introduction

Five (5) vegetation communities were identified (**TABLE 2**). The conservation status of these communities is discussed with reference to the Comprehensive Regional Assessment completed for NSW Forest and Non-forest ecosystems as part of the Regional Forestry Agreement (RFA) process (CRA Unit 1999). The RFA establishes the framework for the management of the forests of upper north-east and lower north-east regions. The RFA document sets out percentage reservation status of forest and non-forest Ecosystems in the CAR Reserve System based on vegetation modelling to establish the pre-1750 extent of forest ecosystems in the region.

TABLE 2
VEGETATION COMMUNITIES PRESENT ON THE SUBJECT SITE

1	Mid-high forest (<i>Casuarina glauca</i>)
2	Saltmarsh (<i>Sporobolus virginicus</i> , <i>Juncus kraussii</i>)
3	Sedgeland (<i>Eleocharis equisetina</i> +/- <i>Juncus usitatus</i> , <i>Persicaria hydropiper</i> , <i>Cyperus polystachyos</i>)
4	Rushland (<i>Typha domingensis</i>)
5	Grassland with scattered trees

Community 1 - Mid-high forest (*Casuarina glauca*)

Location and area

This vegetation community occupies several patches throughout the site (**FIGURE 7**). Photographic evidence indicates the extent of Swamp she-oak (*C. glauca*) has increased over the years, probably due to the reduction in saline conditions as tidal flow has been restricted.

Description

The canopy of this community is comprised entirely of Swamp she-oak to an average height of approximately 10m.

The midstorey is generally absent with the exception of scattered Cheese tree (*Glochidion ferdinandi*) and some infestations of the weed species Groundsel bush (*Baccharis halimifolia*) and Lantana (*Lantana camara*). Coastal morning glory (*Ipomoea cairica*) occurs as a common scrambler in some areas.

The groundcover is variable with dense stands of Swamp she-oak generally shading out any native groundcovers. In these areas the ground is generally covered with fallen phyllodes. In more open areas native groundcovers include Bordered panic (*Entolasia marginata*), Salt couch (*Sporobolus virginicus*), Salt rush (*Juncus kraussii*) and Common spike-rush (*Eleocharis equisetina*). Weeds are prevalent in some areas and include Blue



billy goat weed (*Ageratum houstonianum*), Carpet grass (*Axonopus affinis*) and Farmer's friend (*Bidens pilosa*).

Conservation Status

Swamp she-oak forest is analogous to forest ecosystem 143 (Swamp oak) (NPWS 1999). The Regional Forestry Agreement document provides the following data on this ecosystem:

- Pre 1750 there was 11165 hectares of this ecosystem type in the upper northeast Section of the NSW North Coast Bioregion. 2883 hectares (25.8 %) remains.
- The ecosystem is considered to be Rare.
- 8.3% of the ecosystem type is present within the Comprehensive, Adequate and Representative (CAR) reserve system, including 7.6% in dedicated reserves and 0.2% in informal reserves. A further 0.5% is protected by tabulated prescriptions.
- Swamp oak communities have been identified as a priority for conservation on private land.

The Swamp oak community on the site is representative of the EEC Swamp Oak Forest on Coastal Floodplain (DECCW 2008a). Endangered Ecological Communities are, by definition, of State significance.

This vegetation community is considered to have a high conservation value on the subject site.

Community 2 - Saltmarsh (*Sporobolus virginicus*, *Juncus kraussii*)

Location and area

This community occurs over a large portion of the site (**FIGURE 7**).

Description

This community is dominated by a mixture of salt marsh species that vary with location. Dominant species are Saltwater couch and Salt rush. Other common species include Samphire (*Sarcocornia quinqueflora*), Streaked arrow-grass (*Triglochin striata*), Fringe rush (*Fimbristylis ferruginea*), Club-rush (*Bulboschoenus caldwellii*) and Nodding club-rush (*Isolepis cernua*).

Large areas of this community are infested with the weeds Wild aster (*Aster subulatus*) and Groundsel bush.

Conservation status

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

- The pre-1750 extent of this ecosystem type is unknown. Approximately 24,118 hectares remains.
- The ecosystem is considered **Endangered**.
- The extent of this ecosystem type contained within the Comprehensive, Adequate & Representative (CAR) reserve system has not been calculated.



This vegetation community is representative of the EEC Coastal Salt marsh in the North Coast Bio-region (DECCW 2008). Endangered Ecological Communities are, by definition, of State significance.

This vegetation community is considered to have a high conservation value on the subject site.

Community 3 - Sedgeland (*Eleocharis equisetina* +/- *Juncus usitatus*, *Persicaria hydropiper*, *Cyperus polystachyos*)

Location and area

This community occurs as a small area in the eastern portion of the site (FIGURE 7).

Description

This community occurs as a small depression in the eastern portion of the site which receives treated stormwater from the existing Tavern. The depression is dominated by Common spike-rush with other common species including Common rush (*Juncus usitatus*), Water pepper (*Persicaria hydropiper*) and Bunchy sedge (*Cyperus polystachyos*). Coastal morning glory also occurs as a common weed in the western portion of this community.

Conservation status

This community is best described by Forest Ecosystem 141 - Swamp (CRA Unit 1999) as described for Community 2.

Whilst this vegetation community contains some species considered to be representative of the EEC Freshwater wetlands on coastal floodplain, this community on the subject site is small in area and is isolated from any similar vegetation. This depression on the subject site receives treated stormwater from the existing Tavern and is not considered to represent a natural wetland ecosystem.

This vegetation community is considered to have a moderate conservation value on the subject site.

Community 4 - Rushland (*Typha domingensis*)

Location and area

This community occurs in small pockets along the southern boundary of the subject site (FIGURE 7).

Description

This community occurs as dense stands of Narrow-leaved cumbungi (*Typha domingensis*). All other native species are generally absent. Coastal morning glory occurs as a common weed. It is likely that the Narrow-leaved cumbungi has encroached onto the site from three (3) stormwater treatment ponds within the adjoining residential development.

Conservation status

This community is best described by Forest Ecosystem 141 - Swamp (CRA Unit 1999) as described for Community 2.



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This vegetation community is not considered to be representative of the EEC Freshwater wetlands on coastal floodplain. This vegetation community is considered to have a low-moderate conservation value on the subject site.

Community 5 - Grassland with scattered trees

Location and area

This community occurs in the western portion of the subject site (**FIGURE 7**).

Description

This community is generally dominated by a mixture of exotic grasses and common agricultural weeds. Species commonly occurring include Kikuyu (*Pennisetum clandestinum*), Couch grass (*Cynodon dactylon*), Farmer's friends, Blue billy goat weed, Carpet grass, Rhodes grass (*Chloris gayana*), Fleabane (*Conyza albida*), Crowsfoot grass (*Eleusine indica*), Lovegrass (*Eragrostis* sp.) and Flatweed (*Hypochaeris radicata*).

Scattered, isolated occurrences of regenerating Swamp she-oak, Sydney golden wattle (*Acacia longifolia*) and Cheese tree occur.

Conservation status

This vegetation community is considered to have a low conservation value on the subject site.



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APPENDIX 2 - PLANT SPECIES LIST



PLANT SPECIES LIST

FAMILY	SPECIES NAME	COMMON NAME
Acanthaceae	<i>Avicennia marina</i> subsp. <i>australasica</i>	Grey Mangrove
Aizoaceae	<i>Tetragonia tetragonoides</i>	New Zealand Spinach
Amaranthaceae	<i>Alternanthera nana</i>	Hairy Joyweed
Apiaceae	<i>Centella asiatica</i>	Indian Pennywort
	<i>Hydrocotyle bonariensis</i> *	Beach pennywort
Apocynaceae	<i>Gomphocarpus physocarpus</i> *	Balloon Cotton Bush
	<i>Parsonsia straminea</i>	Common Silkpod
Araliaceae	<i>Polyscias sambucifolia</i>	Elderberry Panax
	<i>Schefflera actinophylla</i> *	Umbrella Tree
Asparagaceae	<i>Asparagus aethiopicus</i> *	Asparagus fern
Aspleniaceae	<i>Asplenium bulbiferum</i> subsp. <i>gracillimum</i>	Mother Spleenwort
Asteliaceae	<i>Cordyline stricta</i>	Narrow-leaved Palm Lily
Asteraceae	<i>Aster subulatus</i> *	Wild aster
	<i>Ageratum houstonianum</i> *	Blue billygoat weed
	<i>Baccharis halimifolia</i> *	Groundsel Bush
	<i>Conyza albida</i> *	Fleabane
	<i>Bidens pilosa</i> *	Cobbler's Pegs
	<i>Enydra fluctuans</i>	
	<i>Hypochaeris radicata</i> *	Flatweed
	<i>Senecio madagascariensis</i> *	Fireweed
	<i>Tagetes minuta</i> *	Stinking roger
	<i>Taraxacum officinale</i> *	Dandelion
	<i>Xanthium orientale</i> *	Californian burr
Aizoaceae	<i>Tetragonia tetragonoides</i>	New Zealand spinach
Blechnaceae	<i>Blechnum indicum</i>	Swamp Water Fern
Brassicaceae	<i>Lepidium africanum</i>	Peppercress
Caryophyllaceae	<i>Spergularia marina</i>	Lesser Sea-spurrey
Casuarinaceae	<i>Casuarina glauca</i>	Swamp Oak
Chenopodiaceae	<i>Atriplex semibaccata</i>	Creeping saltbush
	<i>Einadia hastata</i>	Berry Saltbush
	<i>Einadia trigonos</i>	Fishweed
	<i>Sarcocornia quinqueflora</i>	Samphire
	<i>Suaeda australis</i>	
Commelinaceae	<i>Tradescantia albiflora</i> *	Wandering jew
Convolvulaceae	<i>Calystegia marginata</i>	
	<i>Dichondra repens</i>	Kidney Weed
	<i>Ipomoea cairica</i> *	Coastal morning glory
Cyperaceae	<i>Bolboschoenus caldwellii</i>	Club-rush
	<i>Carex appressa</i>	Tall Sedge
	<i>Cyperus polystachyos</i>	
	<i>Cyperus rotundus</i> *	Nutgrass
	<i>Eleocharis equisetina</i>	Common spike-rush
	<i>Isolepis cernua</i>	Nodding club-rush
	<i>Isolepis nodosa</i>	Knobby Club-rush
	<i>Fimbristylis ferruginea</i>	Fringe-rush
	<i>Schoenus brevifolius</i>	
Dennstaedtiaceae	<i>Hypolepis muelleri</i>	Harsh ground fern



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FAMILY	SPECIES NAME	COMMON NAME
	<i>Pteridium esculentum</i>	Bracken
Elaeocarpaceae	<i>Elaeocarpus reticulatus</i>	Blueberry Ash
Euphorbiaceae	<i>Breynia oblongifolia</i>	Coffee Bush
	<i>Glochidion ferdinandi</i>	Cheese Tree
Fabaceae (Caesalpinioideae)	<i>Senna pendula</i> var. <i>glabrata</i> *	Winter senna
Fabaceae (Faboideae)	<i>Glycine clandestina</i>	Twining glycine
	<i>Hardenbergia violacea</i>	False Sarsaparilla
Fabaceae (Mimosoideae)	<i>Acacia longifolia</i>	
Flagellariaceae	<i>Flagellaria indica</i>	Whip Vine
Gentianaceae	<i>Centaurium erythraea</i>	Common centaury
Juncaceae	<i>Juncus kraussii</i>	Salt Rush
	<i>Juncus pallidus</i>	
	<i>Juncus usitatus</i>	
Juncaginaceae	<i>Maundia triglochinoides</i>	
	<i>Triglochin striatum</i>	
Plantaginaceae	<i>Plantago coronopus</i> *	Plantain
Lauraceae	<i>Cinnamomum camphora</i> *	Camphor Laurel
Lomandraceae	<i>Lomandra longifolia</i>	Spiny-headed Mat-rush
Luzuriagaceae	<i>Geitonoplesium cymosum</i>	Scrambling Lily
Malvaceae	<i>Sida rhombifolia</i> *	Paddy's Lucerne
Moraceae	<i>Ficus coronata</i>	Creek Sandpaper Fig
	<i>Ficus watkinsiana</i>	Strangling Fig
Myrtaceae	<i>Acmena smithii</i>	Lilly Pilly
	<i>Melaleuca quinquenervia</i>	Broad-leaved paperbark
	<i>Melaleuca styphelioides</i>	Prickly-leaved Tea Tree
	<i>Tristaniopsis laurina</i>	Kanooka
Onagraceae	<i>Ludwigia peploides</i>	Water primrose
	<i>Oenothera stricta</i> *	
Passifloraceae	<i>Passiflora subpeltata</i> *	White Passionflower
Philydraceae	<i>Philydrum lanuginosum</i>	Frogsmouth
Phormiaceae	<i>Dianella caerulea</i>	Blue Flax-lily
Phytolaccaceae	<i>Phytolacca octandra</i> *	Inkweed
Poaceae	<i>Andropogon virginicus</i> *	Whisky Grass
	<i>Axonopus affinis</i> *	Carpet grass
	<i>Axonopus fissifolius</i> *	Narrow-leaved Carpet Grass
	<i>Bromus sp.</i> *	
	<i>Chloris gayana</i> *	Rhodes grass
	<i>Cynodon dactylon</i>	Couch grass
	<i>Ehrharta erecta</i>	Panic veldtgrass
	<i>Eleusine indica</i> *	Crowsfoot grass
	<i>Entolasia marginata</i>	Bordered panic
	<i>Entolasia stricta</i>	Wiry Panic
	<i>Eragrostis sp.</i> *	Lovegrass
	<i>Imperata cylindrica</i>	Blady Grass
	<i>Paspalum dilatatum</i> *	Paspalum
	<i>Paspalum distichum</i>	Water Couch
	<i>Pennisetum clandestinum</i> *	Kikuyu Grass
	<i>Phragmites australis</i>	Common reed
	<i>Polypogon monspeliensis</i> *	Annual beardgrass



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FAMILY	SPECIES NAME	COMMON NAME
	<i>Setaria sphacelata</i> *	South African Pigeon Grass
	<i>Sporobolus virginicus</i>	Salt couch
Polygonaceae	<i>Persicaria decipiens</i>	Slender knotweed
	<i>Persicaria hydropiper</i>	Water pepper
Proteaceae	<i>Lomatia silaifolia</i>	Crinkle Bush
	<i>Persoonia linearis</i>	Narrow-leaved Geebung
Ranunculaceae	<i>Ranunculus inundatus</i>	River buttercup
Rhamnaceae	<i>Alphitonia excelsa</i>	Red Ash
Rosaceae	<i>Rubus anglocandicans</i> *	Blackberry
Rubiaceae	<i>Pomax umbellata</i>	Pomax
Rutaceae	<i>Acronychia imperforata</i>	Beach Acronychia
	<i>Zieria southwellii</i>	
Sapindaceae	<i>Dodonaea triquetra</i>	Large-leaf Hop-bush
	<i>Alectryon subdentatus</i>	Hard alectryon
Solanaceae	<i>Duboisia myoporoides</i>	Corkwood
	<i>Solanum mauritianum</i> *	Wild Tobacco Bush
Theophrastaceae	<i>Samolus repens</i>	Creeping brookweed
Typhaceae	<i>Typha domingensis</i>	Narrow-leaved cumbungi
Verbenaceae	<i>Lantana camara</i> *	Lantana
	<i>Verbena bonariensis</i> *	Purpletop
* Introduced Species		



APPENDIX 3 - FAUNA ASSESSMENT



1 FAUNA ASSESSMENT

1.1 Introduction

This section includes a description of the methods used in determining which fauna species use the Study area and a discussion of the results of the Fauna assessment. The fauna assessment involved detailed fauna surveys (i.e. specialised bird, bat and amphibian survey, spotlighting, hair sampling and trapping).

1.2 Methods

1.2.1 Database searches

Searches of the NPWS and the EPBC (Protected Matters) databases were completed (12th February 2010) to find records of State and Commonwealth threatened species² within 5km of the Subject site.

1.2.2 Fauna surveys

Background

A detailed fauna survey was carried out between the 1st and the 5th march 2010. The weather was generally warm during the survey period with a number of heavy showers on the 2nd & 3rd.

Survey Techniques

Detailed fauna surveys were designed to target identified threatened species. Targeted fauna survey focussed on the area surrounding the proposed development. The following survey techniques were utilised in this assessment. **FIGURE 10** shows the location of trap sites. A summary of trapping effort is shown in **TABLE 1**.

Opportunistic Sightings

Fauna species were opportunistically sighted while walking or checking trap lines or generally traversing the site. Fauna observed during all survey work were recorded.

Terrestrial Elliott Traps

Elliott traps sample locally significant species such as the Grassland melomys and provide an insight into the prey availability of predatory nocturnal birds such as the Eastern grass owl and the Masked owl. This sampling technique also indicates the extent of invasion by exotic species such as the Black rat and the House mouse which allows an assessment of the 'naturalness' of the area to be made.

Ten (10) Type A Elliott traps were set in five (5) transects totalling fifty (50) Type A Elliot traps. The traps were baited with a mixture of rolled oats, honey, peanut butter and pistachio essence and left in place for four (4) nights. A total of two hundred (200) trap nights were achieved in this component of the Study.

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



Five (5) Type B Elliott traps were also set, one (1) on each Type A transect. These traps were also baited with a mixture of rolled oats, honey, peanut butter and pistachio essence and left in place for four (4) nights. A total of twenty (20) trap nights were achieved in this component of the Study.

Cage Trapping

Five (5) cage traps (30x40x60cm) were baited with a mix of rolled oats, peanut butter, honey, Pistachio essence, chicken necks and fruit in an attempt to capture medium sized marsupials such as the Long-nosed potoroo, Bandicoots, the Spotted tail quoll and Possums. The cage traps were set and left in place for four (4) nights. A total of twenty (20) traps nights were achieved in this component of the Study.

Pitfall Trapping

Three (3) pitfall lines of five (5) buckets spaced five (5) metres apart (incorporating drift fencing) were set for a period of four nights. A total of sixty (60) trap nights were achieved during this component of the Study.

Targeted avian survey

Diurnal birds, including waders, were surveyed visually and aurally by habitat search for an hour at dusk on the 1st, and hour at dawn and dusk on the 2nd, an hour at dawn and dusk on the 3rd, an hour at dawn and dusk on the 4th, and an hour at dawn on the 5th, for a total of 8 hours. More time was spent in the SEPP 14 section of the site than in the disturbed grassland areas. Searches included mangroves of the estuary adjoining the SEPP 14 wetland section of the subject site.

Nocturnal birds were surveyed by means of listening, call-playback and spotlighting as described below.

Nocturnal bird and Mammal playback

Call playback was undertaken at two (2) selected sites over four (4) nights. Species targeted included:

- Koala
- Masked owl
- Powerful owl
- Squirrel glider
- Yellow-bellied glider

A half hour listening period was followed by 2 minutes of call playback for each species with 1 minute of stationary spotlighting after each species.

Ultrasonic call recording

An Anabat II sonar detector (Titley Electronics, Ballina) was used to down-load the ultrasonic calls of Microchiropteran bats.



Recording was undertaken for twelve (12) hours per night over four (4) nights. A total of forty-eight (48) hours of recording was undertaken. Recording times commenced from slightly before dusk and concluded slightly before dawn. Stationary recording was undertaken in positions along the edges of vegetation or where possible flyways were located.

Spotlighting

Approximately one and a half (1.5) hours of spotlighting was carried out on the Subject site on four (4) consecutive nights. The edges of the SEPP 14 Wetland were traversed on foot. Spotlighting was carried out using a 50W spotlight powered by 12V batteries and walking at approximately 1km/h allowing intensive listening as an adjunct to visual detection. A total of six (6) hours of spotlighting was completed on the subject site.

Scat, tracks and den/nest survey

Scat, track and den/nest searches were regularly undertaken during trap servicing and general site work, targeting the bases of trees, any fallen timber and along tracks. At least ten (10) hours were spent in this activity during the survey.

During the survey period, searches were completed for:

- Possible nest and roost sites of large forest owls;
- Pellets of large forest owls;
- Nests and dens of threatened hollow dependent fauna;
- Distinctive scats (e.g. Koala);
- Distinctive, readily identifiable tracks; and
- Accessible basal tree hollows in likely bat roost trees (> 100cm dbh dead stags or large trees with accessible base hollows).

**TABLE 1
SUMMARY OF TRAPPING EFFORT**

Survey technique	Survey effort
Elliott trapping	Type A: 200 trap nights Type B: 20 trap nights
Cage traps	20 trap nights
Pitfall traps	60 trap nights
Diurnal bird survey	8 hours
Call playback	4 consecutive nights
Anabat (bat calls)	48 hours
Spotlighting	6 hours
Track, scat & den search	10 hours

1.2.3 Habitat Suitability Assessment for Significant Fauna

Site habitats were assessed to determine their value for native fauna species. This assessment was completed in conjunction with the flora survey. The assessment focused on identifying habitat features typically associated with threatened species as well as other native fauna groups. Particular attention was paid to habitat features such as:

- The presence of mature trees with hollows, fissures and/or other suitable roosting/nesting places;



- The presence of Koala food trees;
- The presence of preferred Glossy black cockatoo feed trees (Forest oak and/or Black she-oak);
- The presence of characteristic signs of foraging (e.g. Yellow-bellied glider feeding scars);
- Condition, flow and water quality of drainage lines and bodies of water;
- Areas of dense vegetation;
- Presence of hollow logs/debris and areas of dense leaf litter;
- Presence of fruiting flora species;
- Presence of blossoming flora species, particularly winter-flowering species;
- Vegetation connectivity and proximity to neighbouring areas of intact vegetation; and
- Presence of caves and man-made structures suitable as microchiropteran bat roost sites.

Each threatened species known from the locality was regarded as *Likely*, *Possible* or *Unlikely* to occur on the Subject site based on the occurrence of suitable habitat characteristics (Section 3.3.4). A rating of *Likely* was given for those species where breeding or high quality habitat is present on the site; a rating of *Possible* was given for those species where suitable foraging or roosting habitat is present on the site; and a rating of *Unlikely* was given for species where no suitable habitat occurs on the site.

1.3 Results and Discussion

1.3.1 Database searches

A search of the NPWS and DEWHA databases revealed records of thirty-two (32) threatened fauna species within 10km of the Subject site. Six of these species are listed under EPBC Act (TABLE 2).

TABLE 2
DATABASE RECORDS OF THREATENED FAUNA SPECIES
WITHIN 10 KM OF THE SUBJECT SITE

Scientific Name	Common Name	STATUS	
		EPBC	TSC
<i>Coracina lineata</i>	Barred cuckoo-shrike		V
<i>Ixobrychus flavicollis</i>	Black bittern	-	V
<i>Ephippiorhynchus asiaticus</i>	Black-necked stork	-	E
<i>Irediparra gallinacea</i>	Comb-crested jacana	-	V
<i>Miniopterus schreibersii</i>	Eastern bentwing-bat	-	V
<i>Oceanensis</i>			
<i>Mormopterus norfolkensis</i>	Eastern freetail-bat	-	V
<i>Calyptorhynchus lathami</i>	Glossy black-cockatoo	-	V
<i>Kerivoula papuensis</i>	Golden-tipped bat	-	V
<i>Scoteanax ruepellii</i>	Greater broad-nosed bat	-	V
<i>Litoria aurea</i>	Green and golden bell frog	V	E



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Scientific Name	Common Name	STATUS	
		EPBC	TSC
<i>Chelonia mydas</i>	Green turtle	V	V
<i>Litoria brevipalmata</i>	Green-thighed frog	-	V
<i>Pteropus poliocephalus</i>	Grey-headed flying-fox	V	V
<i>Chalinolobus nigrogriseus</i>	Hoary wattled bat	-	
<i>Phascolarctos cinereus</i>	Koala	-	V
<i>Dermochelys coriacea</i>	Leathery turtle	V	V
<i>Miniopterus australis</i>	Little bent-wing bat	-	V
<i>Sterna albifrons</i>	Little tern	-	E
<i>Tyto novaehollandiae</i>	Masked owl	-	V
<i>Pandion haliaetus</i>	Osprey	-	V
<i>Haematopus longirostris</i>	Pied oystercatcher	-	V
<i>Ninox strenua</i>	Powerful owl	-	
<i>Ptilinopus regina</i>	Rose-crowned fruit-dove	-	V
<i>Tyto tenebricosa</i>	Sooty owl	-	V
<i>Haematopus fuliginosus</i>	Sooty oystercatcher	-	V
<i>Macronectes giganteus</i>	Southern giant petrel	E	E
<i>Lophoictinia isura</i>	Square-tailed kite	-	V
<i>Petaurus norfolcensis</i>	Squirrel glider	-	V
<i>Lathamus discolor</i>	Swift parrot	E	E
<i>Ptilinopus magnificus</i>	Wompoo fruit-dove	-	V
<i>Petaurus australis</i>	Yellow-bellied glider	-	V
<i>Saccolaimus flaviventris</i>	Yellow-bellied sheath-tail bat	-	V

CE = Endangered; E = Endangered and V = Vulnerable

1.3.2 Habitat assessment

Amphibians

Amphibians occurring in the region are poikilothermic, predominantly insectivorous and generally require free water for reproduction, with the exception of two highland genera (*Assa darlingtoni* and *Philoria* spp.) The habitat requirements of most species are unlikely to be determined by forest cover or floristics, but are more strongly influenced by factors such as climate, distance to water bodies, riparian vegetation, hydrological and morphological characteristics of water bodies and the availability of suitable micro-habitat for aestivation and shelter.

The majority of species that occur within the region lay eggs in or near temporary or permanent water bodies and rely on free water for larval development and metamorphosis. Of these species, only a few are dependent on forested habitats beyond the riparian zone or beyond areas of temporary inundation. These species include the Red-eyed tree frog (*Litoria chloris*), Leseuer's frog (*Litoria leseueri*), Fletchers frog (*Lechriodus fletcheri*) and the Barred frogs of the *Mixophyes* genus.

The SEPP 14 Wetland occurring on the Subject site is likely to provide good quality habitat for a range of frogs. Additionally, the small area of sedgeland provides a dense groundcover and an ephemeral water source for shelter.



Grasslands provide suitable habitat for a range of Amphibian species, particularly along drainage depressions and soaks. Species commonly encountered in grassland communities include the Common eastern froglet, Eastern sign bearing froglet, Striped marsh frog, Spotted grass frog, Eastern dwarf tree frog, Rocket frog, Whistling tree frog and Cane toad.

Species typically encountered in or adjacent to Closed Forests include the Eastern dwarf tree frog, Red-eyed tree frog, Striped marsh frog, Cane toad and Dainty green tree frog. Relatively few species occur in conjunction with Closed Forest types when permanent water is absent. Species which typically occur in low elevation Rainforest and permanent streams such as the Giant barred frog (*Mixophyes iteratus*) are unlikely to occur at the study site due to the disturbed nature.

Reptiles

As reptiles are poikilothermic, and predominantly insectivorous or carnivorous, their habitat requirements are less directly determined by vegetation species composition than other taxa which feed directly on plants. Reptile distributions are strongly influenced by structural characteristics of the vegetation, climate and other factors affecting thermoregulation such as shade and availability of shelter and basking sites (Smith *et al* 1994).

In a survey of the moist forest herpetofauna of North-eastern NSW, Smith *et al* (1989) found that few species discriminated between rainforest and wet sclerophyll forest, however, most species exhibited a response to differences in elevation and the availability of microhabitat components and other substrates.

The availability of microhabitats, of varying thermal properties is particularly important for most reptile species, as behavioural thermoregulation (regulation of body heat) is important in controlling critical body functions such as digestion, foraging activity and reproduction.

Reptile diversity and abundance is often (but not always) significantly higher in drier habitat types, particularly those with a wide variety of ground substrate microhabitats. This contrasts markedly with the distribution patterns of birds, and most mammals.

The single limiting factor in terms of species diversity in coastal vegetation is the lack of shelter sites (e.g. logs, tree hollows and decorticated bark). Such habitat components characterise eucalypt forests and woodlands, where species diversity may be much higher, depending on disturbance factors.

The SEPP 14 Wetland occurring on the Subject site is considered to provide good quality habitat for reptiles due to the presence of: the combination of shelter and basking sites; forest areas with good canopy and leaf litter development; areas of dense groundcover; availability of water and reliable sources of prey.

The cleared areas of the site may provide good quality 'temporary' habitat for some common species of reptile.



Birds

The significance of near coastal environments of the N.S.W. Far North Coast and South-East Queensland as over-wintering habitat for migratory birds has been established by many observers and bird banders including Keast (1968), Robertson (1973), Gravatt (1974), Porter (1982) and Robertson and Woodall (1983). These patterns may be attributable to the relatively high winter temperatures and long growing season of this region compared with the rest of south-eastern Australia (Fitzpatrick and Nix 1973; Edwards 1979; Nix 1982; Specht *et al* 1981).

Many insectivorous birds from higher latitudes and elevation over-winter in the locality. These include species such as the Fantail cuckoo, Sacred kingfisher, Rainbow bee-eater, Noisy pitta, Tree martin, Black-faced cuckoo-shrike, Cicada bird, Golden whistler, Rufous whistler, Rose robin, Grey fantail, White-throated gerygone, Silvereye, Olive-backed oriole and Spangled drongo.

Birds such as honeyeaters and lorikeets are Blossom nomads (*ibid.*). These birds move locally in response to variation in the availability of nectar and or pollen, important components in their diet. Porter (1982) highlights the importance of Forest red gum, Broad-leaved paperbark and Coast banksia for Scaly-breasted and Rainbow lorikeets as these species flower during the lorikeet's winter breeding period. A sequence of important nectar bearing plants in the genera Eucalyptus, Banksia, Melaleuca and Callistemon provide a continuity of food for nectarivorous birds.

Studies of bird usage in rainforest remnants by Holmes (1987), Connelly and Specht (1988) and Lott & Duigan (1993) indicate that the diversity and abundance of birds is related to the size of the Rainforest patches and their degree of isolation from major areas of native forest. Lott & Duigan (1993) and Howe *et al* (1981) also note that sites with a higher diversity of vegetation and those which are closer to water generally support a greater diversity of birds. Locally nomadic and migratory rainforest species such as the Wompoo, Rose-crowned and Superb fruit-doves, Common koel and Black-faced cuckoo-shrike are known to use scattered areas of habitat as "stepping-stones" between more intact areas of forest (Date *et al* 1992; Lott & Duigan 1993).

The variety of habitats present in the Study area is likely to result in a high diversity of resident and nomadic birds occurring on the site over the year. The SEPP 14 wetland on the subject site and associated saltmarsh and mudflat areas are considered to provide good habitat for migratory waders.

Mammals

Small terrestrial mammals generally occur in highest densities in association with a complex vegetation structure. A dense groundcover layer, which provides shelter from predators and provides nesting opportunities, is particularly important.

In general medium-large terrestrial mammals such as macropods select habitats which provide a dense cover for shelter and refuge and open areas for feeding. The larger species tend to occupy drier more open habitats: the smaller species, moister and more densely vegetated habitats.

All Arboreal mammals that occur in the region (with the exception of the Koala) utilise tree hollows for nesting and shelter (although the Common ringtail possum is not dependent on hollows). Smith & Lindenmeyer (1988) consider that shortage of nest



hollows is likely to limit arboreal mammal populations where density of hollow bearing trees is less than 2 to 8 trees per hectare.

Arboreal folivores (e.g. Common ringtail possum, Greater glider) are widespread and abundant but exhibit local variation in response to such factors as tree species composition, foliage protein and fibre levels, leaf toughness, toxins, forest structure and the availability of shelter sites. Arboreal folivores are expected to be most abundant in areas of high productivity, high soil fertility and moderate climate, in conjunction with adequate shelter and suitable foraging substrate.

Arboreal nectarivore/insectivores feed on a wide variety of plant and insect exudates including the nectar of flowering eucalypts, and shrubs such as Banksia and Acacia sp. These species also feed extensively on insects, particularly under the shedding bark of eucalypts. The distribution of nectarivore/insectivores is considered to be related to the abundance of nectar and pollen producing plants, the abundance of bark shedding eucalypts which harbour insect prey, and the occurrence of sap and gum exudate producing trees (Sap feed trees) and shrubs (e.g. Acacia sp.). Arboreal nectarivores and insectivores are generally hollow dependent species.

There is a lack of trees with hollows necessary for hollow-dependent mammals. No primary Koala feed trees were recorded on the Subject site. The structural complexity and habitat diversity of the SEPP 14 Wetland on the Subject site may support a moderate diversity and abundance of ground dwelling mammals.

Insectivorous bats like insectivorous birds overlap considerably in diet and broad vegetation preferences (Hall 1981), but specialise in foraging in specific layers or substrates within the forest (Crome and Richards 1988). The Study area is not likely to provide significant forage habitat for insectivorous bats, due to the isolation of the site from any significant areas of mature forest that would provide roosting opportunities. The site provides a relatively low diversity and abundance of flowering species and is considered to represent poor quality foraging habitat for nectarivorous bats.

1.3.3 Results of fauna surveys

Amphibians

Six (6) amphibians were recorded during site surveys. These are shown in TABLE 3 below. No threatened amphibians were recorded.

**TABLE 3
AMPHIBIAN SPECIES RECORDED ON THE SUBJECT SITE**

Common name	Scientific name	Method*
Dainty tree frog	<i>Litoria gracilentia</i>	C, S
Striped marsh frog	<i>Limnodynastes peronii</i>	Pf, S, C
Common eastern froglet	<i>Crinia signifera</i>	C
Red-backed toadlet	<i>Pseudophryne coriacea</i>	C
Dwarf tree frog	<i>Litoria fallax</i>	C
Common green tree frog	<i>Litoria caerulea</i>	C, S

* Pf = Pitfall trap
S = Spotlighting
C = Call recognition.



Reptiles

Four (4) reptile species were recorded during the fauna survey. These are shown in TABLE 4 below. No threatened reptiles were recorded.

TABLE 4
REPTILE SPECIES RECORDED ON THE SUBJECT SITE

Common name	Scientific name	Method*
Common garden skink	<i>Lampropholis delicata</i>	Pf, Obs.
Friendly sun-skink	<i>Lampropholis amicula</i>	Pf.
Carpet python	<i>Morelia spilota</i>	Obs.
Blue-tongue lizard	<i>Tiliqua scincoides</i>	Cg.

* Pf = Pitfall trap

Obs = Incidental observation

Cg = Cage trap

Birds

Forty-six (46) bird species were recorded from the subject site. No threatened species were recorded. TABLE 5 lists the bird species recorded at the Subject site.

TABLE 5
BIRD SPECIES RECORDED AT THE SUBJECT SITE

Common name	Scientific name
Eastern Spinebill	<i>Acanthorhynchus tenuirostris</i>
Chestnut teal	<i>Anas castanea</i>
Pacific black duck	<i>Anas superciliosa</i>
Little wattlebird	<i>Anthochaera chrysoptera</i>
Great egret	<i>Ardea alba</i>
White-breasted wood swallow	<i>Artamus leucorhynchus</i>
Galah	<i>Cacatua roseicapilla</i>
Yellow-tailed black cockatoo	<i>Calyptorhynchus funereus</i>
Pheasant coucal	<i>Centropus phasianinus</i>
Shining bronze cuckoo	<i>Chalcites lucidus</i>
Grey shrike-thrush	<i>Colluricincla harmonica</i>
Black-faced cuckoo-shrike	<i>Coracina novaehollandiae</i>
Torresian crow	<i>Corvus orru</i>
Pied butcherbird	<i>Cracticus nigrogularis</i>
Laughing kookaburra	<i>Dacelo novaeguineae</i>
Mistletoebird	<i>Dicaeum hirundinaceum</i>
Spangled drongo	<i>Dicrurus bracteatus</i>
White-faced heron	<i>Egretta novaehollandiae</i>
Latham's snipe	<i>Gallinago hardwickii</i>
Bar-shouldered dove	<i>Geopelia humeralis</i>
White-throated gerygone	<i>Gerygone olivacea</i>
Magpie-lark	<i>Grallina cyanoleuca</i>
Australian magpie	<i>Gymnorhina tibicen</i>
Brahminy kite	<i>Haliastur indus</i>
Black-winged stilt	<i>Himantopus himantopus</i>
Welcome swallow	<i>Hirundo neoxena</i>
Brown honeyeater	<i>Lichmera indistincta</i>
Superb fairy-wren	<i>Malurus cyaneus</i>



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Common name	Scientific name
Red-backed fairy-wren	<i>Malurus melanocephalus</i>
Noisy Miner	<i>Manorina melanocephala</i>
Lewin's Honeyeater	<i>Meliphaga lewinii</i>
Crested pigeon	<i>Ocyphaps lophotes</i>
Olive-backed oriole	<i>Oriolus sagittatus</i>
Striated pardalote	<i>Pardalotus striatus</i>
Little pied cormorant	<i>Phalacrocorax melanoleucos</i>
Noisy friarbird	<i>Philemon corniculatus</i>
Eastern rosella	<i>Platycercus eximius</i>
Striped honeyeater	<i>Plectorhyncha lanceolata</i>
Grey fantail	<i>Rhipidura fuliginosa</i>
Willie wagtail	<i>Rhipidura leucophrys</i>
White-browed scrub-wren	<i>Sericornis frontalis</i>
*Spotted Turtle-Dove	<i>Streptopelia chinensis</i>
Australian white ibis	<i>Threskiornis molucca</i>
Rainbow lorikeet	<i>Trichoglossus haematodus</i>
Marsh sandpiper	<i>Tringa stagnatilis</i>
Masked lap-wing	<i>Vanellus miles</i>

* Denotes an introduced species.

Threatened species are shown in bold.

Mammals

Twenty four (24) mammal species were recorded during the site survey. No threatened species were recorded. TABLE 6 shows the mammal species recorded at the Subject site.

TABLE 6
MAMMALS RECORDED DURING THE FIELD SURVEY

Common Name	Scientific name	Method of Identification
*Dog	<i>Canis sp.</i>	Observation
*Cat	<i>Felis catus</i>	Observation
Northern brown bandicoot	<i>Isodon macrourus</i>	Cage trap, Observation
Eastern grey kangaroo	<i>Macropus giganteus</i>	Observation
*House mouse	<i>Mus musculus</i>	Elliott trap
White-striped free-tail bat	<i>Tadarida australis</i>	ANABAT
Swamp rat	<i>Rattus luteolus</i>	Elliott trap
Black rat	<i>Rattus rattus</i>	Elliott trap
Eastern broad-nosed bat	<i>Scotorepens orion</i>	ANABAT
Common brushtail possum	<i>Trichosurus vulpecular</i>	Spotlight, Cage trap
Eastern forest bat	<i>Vespadelus pumilus</i>	ANABAT
Swamp wallaby	<i>Wallabia bicolor</i>	Observation

* Denotes introduced species

1.3.4 Threatened species considered possible occurrences in the Study area

Based on the assessment of habitats on the Subject site, threatened fauna species known from the locality were assessed for the likelihood of their occurrence on the Subject site (TABLE 7). A rating of *Likely* was given for those species where breeding or high quality habitat is present on the site; a rating of *Possible* was given for those



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species where suitable foraging or roosting habitat is present on the site; and a rating of *Unlikely* was given for species where no suitable habitat occurs on the site.

TABLE 7
LIKELIHOOD OF OCCURRENCE OF THREATENED FAUNA SPECIES IN THE STUDY AREA

Species	Likelihood of occurrence in the Study area	Notes
Barred cuckoo-shrike	Unlikely	This species occurs in rainforest, eucalypt forest and woodlands, clearings in secondary growth, swamp woodlands and timber along watercourses. This species is generally uncommon, and is rare in NSW. The general lack of fruiting species on the Subject site is likely to preclude the occurrence of this species.
Black bittern	Possible	This species is usually found in dense vegetation fringing streams, swamps, tidal creeks and mudflats. Vegetation on site and within the SEPP 14 Wetland may provide suitable forage habitat.
Black-necked stork	Possible	The Black-necked stork occurs in swamps, mangroves, mudflats, dry floodplains and irrigated land.
Comb-crested jacana	Unlikely	The Comb-crested jacana occurs throughout coastal Australia and well inland in the north from the Kimberley to Sydney. Vagrants occasionally appear further south, possibly in response to unfavourable conditions further north in NSW. The inhabit permanent wetlands with a good surface cover of floating vegetation, especially water-lilies. Pairs and family groups forage across floating vegetation, walking with a characteristic bob and flick, or flying low with toes dangling behind. They feed primarily on insects and other invertebrates, as well as some seeds and other vegetation. Breeds in spring and summer in NSW, in a nest of floating vegetation. The male builds the nest, incubates the eggs and broods the young. Females defend up to four mated males and their territories (the floating vegetation around their nest) from other females.
Eastern bent-wing bat	Unlikely	Caves are the primary roosting habitat for this species, but it will also use derelict mines, storm-water tunnels, buildings and other man-made structures. The Eastern bent-wing bat forages in forested areas, catching moths and other flying insects above the tree tops.
Eastern free-tail bat	Unlikely	The Eastern free-tail bat generally roosts in eucalypt hollows, but has also been found under loose bark on trees and in buildings. It is a solitary species and probably forages on insects.
Glossy black cockatoo	Unlikely	Found in coastal forests and open inland woodland in eastern Australia. The Glossy black-cockatoos distribution is limited to habitat which contains sufficient seed reserves of their three favoured species of food trees: <i>Allocasuarina littoralis</i> , <i>A. torulosa</i> and <i>A. verticillata</i> and suitable large hollow bearing trees for nesting.



Ecological Assessment

Species	Likelihood of occurrence in the Study area	Notes
Golden-tipped bat	Unlikely	The Golden-tipped Bat is distributed along the east coast of Australia in scattered locations from Cape York Peninsula in Queensland to Bega in southern NSW. They are found in rainforest and adjacent sclerophyll forest and roost in abandoned hanging Yellow-throated Scrubwren and Brown Gerygone nests located in rainforest gullies on small first- and second-order streams. They will fly up to 2 km from roosts to forage in rainforest and sclerophyll forest on upper-slopes. Specialist feeder on small web-building spiders.
Greater broad-nosed bat	Unlikely	This species utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. Although this species usually roosts in tree hollows, it has also been found in buildings. It forages after sunset, flying slowly and directly along creek and river corridors at an altitude of 3 - 6 m. Open woodland habitat and dry open forest suits the direct flight of this species as it searches for beetles and other large, slow-flying insects.
Green and golden bell frog	Unlikely	This species is found amongst vegetation in and around permanent swamps, lagoons and farm dams and on flood-prone river flats, particularly where there are bulrushes and spikerushes.
Green turtle	Unlikely	The Green turtle is widely distributed in tropical and sub-tropical seas. They are usually found in tropical waters around Australia but also occur in coastal waters of NSW, where it is generally seen on the north or central coast, with occasional records from the south coast. This ocean-dwelling species spends most of its life at sea. Carnivorous when young but as adults they feed only on marine plant material. Eggs laid in holes dug in beaches throughout their range. There are scattered nesting records along the NSW coast.
Green-thighed frog	Unlikely	Isolated localities along the coast and ranges from the NSW central coast to south-east Queensland. Green-thighed Frogs occur in a range of habitats from rainforest and moist eucalypt forest to dry eucalypt forest and heath, typically in areas where surface water gathers after rain. Breeding occurs following heavy rainfall in late spring and summer, with frogs aggregating around grassy semi-permanent ponds and flood-prone grassy areas. The frogs are thought to forage in leaf-litter.



Ecological Assessment

Species	Likelihood of occurrence in the Study area	Notes
Grey-headed flying fox	Unlikely	Grey-headed Flying-foxes are found within 200 km of the eastern coast of Australia, from Bundaberg in QLD to Melbourne in Victoria. Occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Travel up to 50 km to forage. Feed on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines. Also forage in cultivated gardens and fruit crops and can inflict severe crop damage.
Hoary wattled bat	Unlikely	The Hoary wattled bat is widely distributed across northern Australia but absent from the arid centre. In north east NSW it reaches the lower Clarence and Richmond River areas, extending from near Murwillumbah in the north, south to between Grafton and Coffs Harbour. In NSW the Hoary Wattled Bat occurs in dry open eucalypt forests, favouring forests dominated by Spotted Gum, boxes and ironbarks, and heathy coastal forests where Red Bloodwood and Scribbly Gum are common. Because it flies fast below the canopy level, forests with naturally sparse understorey layers may provide the best habitat.
Koala	Unlikely	There are no preferred Koala feed trees on the Subject site.
Leathery turtle	Unlikely	The Leathery turtle occurs throughout the world's tropical and temperate seas and in all coastal waters of Australia. Most sightings are in temperate waters. Large numbers of Leathery Turtles feed in coastal waters from southern Queensland to the central coast of NSW. They occur in inshore and offshore marine waters. Rarely breeds in Australia, with the nearest regular nesting sites being the Solomon Islands and Malayan Archipelago. Occasional breeding records from NSW coast, including between Ballina and Lennox Head in northern NSW. A number of sightings in southern waters suggest species actively seeks temperate feeding grounds, rather than occurring only as stray vagrants. Feed on jellyfish.
Little bent-wing bat	Unlikely	This species inhabits moist eucalypt forest, rainforest or dense coastal banksia scrub and roosts in caves, tunnels and sometimes tree hollows during the day. At night is forages for small insects beneath the canopy of densely vegetated habitats.



Ecological Assessment

Species	Likelihood of occurrence in the Study area	Notes
Little tern	Possible (migratory)	The Little tern migrates from east Asia and is found on the north, east and south- east Australian coasts, from Shark Bay in Western Australia to the Gulf of St Vincent in South Australia. In NSW, it arrives from September to November, occurring mainly north of Sydney, with smaller numbers found south to Victoria. It breeds in spring and summer along the entire east coast from Tasmania to northern Queensland, and is seen until May, with only occasional birds seen in winter months. Almost exclusively coastal, preferring sheltered environments; however may occur several kilometres from the sea in harbours, inlets and rivers. Nests in small, scattered colonies in low dunes or on sandy beaches just above high tide mark near estuary mouths or adjacent to coastal lakes and islands. Often seen feeding in flocks, foraging for small fish, crustaceans, insects, annelids and molluscs by plunging in the shallow water of channels and estuaries, and in the surf on beaches, or skipping over the water surface with a swallow-like flight.
Masked owl	Unlikely	This species occurs in dry eucalypt forest and woodland and often hunts along forest edges. Its typical diet consists of tree-dwelling and ground mammals, especially rats. It has a large home range covering forested and partly open country.
Osprey	Possible	This raptor is thinly distributed in coastal Australia. It nests in singularly overtopping, generally dead trees. The Osprey hunts in coastal rivers, estuaries and streams and may gather nesting material from nearby forests.
Pied oyster catcher	Possible	The Pied oyster catcher is distributed around the entire Australian coastline, although it is most common in coastal Tasmania and parts of Victoria. In NSW the species is thinly scattered along the entire coast. They favours intertidal flats of inlets and bays, open beaches and sandbanks and forages on exposed sand, mud and rock at low tide, for molluscs, worms, crabs and small fish. The chisel-like bill is used to pry open or break into shells of oysters and other shellfish. Nests are mostly found on coastal or estuarine beaches although occasionally they use saltmarsh or grassy areas.
Powerful owl	Unlikely	This species has a large home range and occupies a variety of habitat types, from woodland and open forest to tall moist forest and rainforest. They roost by day in dense vegetation, commonly along drainage lines, and nest in large tree hollows.



Ecological Assessment

Species	Likelihood of occurrence in the Study area	Notes
Rose crowned fruit dove	Unlikely	The Rose crowned fruit dove is found on the coast and ranges of eastern NSW and Queensland, from Newcastle to Cape York. Vagrants are occasionally found further south to Victoria. Rose-crowned Fruit-doves occur mainly in sub-tropical and dry rainforest and occasionally in moist eucalypt forest and swamp forest, where fruit is plentiful. They are shy pigeons, not easy to see amongst the foliage, and are more often heard than seen. They feed entirely on fruit from vines, shrubs, large trees and palms, and are thought to be locally nomadic as they follow the ripening of fruits. Some populations are migratory in response to food availability - numbers in north-east NSW increase during spring and summer then decline in April or May.
Sooty owl	Unlikely	Occupies the eastern most one-eighth of NSW, occurring on the coast, coastal escarpment and eastern tablelands. There is no seasonal variation in its distribution. Occurs in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests. Roosts by day in the hollow of a tall forest tree or in heavy vegetation; hunts by night for small ground mammals or tree-dwelling mammals such as the Common Ringtail Possum (<i>Pseudocheirus peregrinus</i>) or Sugar Glider (<i>Petaurus breviceps</i>). Nests in very large tree-hollows.
Sooty oystercatcher	Unlikely	Sooty Oystercatchers are found around the entire Australian coast, including offshore islands, being most common in Bass Strait. Small numbers of the species are evenly distributed along the NSW coast. The availability of suitable nesting sites may limit populations. They favour rocky headlands, rocky shelves, exposed reefs with rock pools, beaches and muddy estuaries and forage on exposed rock or coral at low tide for foods such as limpets and mussels.
Southern giant petrel	Unlikely	The Southern Giant Petrel has a circumpolar pelagic range from Antarctica to approximately 20° S and is a common visitor off the coast of NSW. Over summer, the species nests in small colonies amongst open vegetation on Antarctic and subantarctic islands, including Macquarie and Heard Islands and in Australian Antarctic territory. A single chick is raised and although breeding occurs annually, approximately 30% of the potential breeding population does not nest. It is an opportunistic scavenger and predator, and scavenges from fishing vessels and animal carcasses on land. It is also an active predator of cephalopods and euphausiids, as well as smaller birds (particularly penguins) both at land and at sea. Birds will desert their nests if disturbed at the breeding colony.



Ecological Assessment

Species	Likelihood of occurrence in the Study area	Notes
Square-tailed kite	Possible	The Square-tailed Kite ranges along coastal and sub-coastal areas from south-western to northern Australia, Queensland, NSW and Victoria. In NSW, scattered records of the species throughout the state indicate that the species is a regular resident in the north, north-east and along the major west-flowing river systems. It is a summer breeding migrant to the south-east, including the NSW south coast, arriving in September and leaving by March. Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses. In arid north-western NSW, has been observed in stony country with a ground cover of chenopods and grasses, open acacia scrub and patches of low open eucalypt woodland. Appears to occupy large hunting ranges of more than 100km ² . Breeding is from July to February, with nest sites generally located along or near watercourses, in a fork or on large horizontal limbs.
Squirrel glider	Unlikely	The Sugar glider is found widely though sparsely distributed in eastern Australia, from northern Queensland to western Victoria. It inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. It prefers mixed species stands with a shrub or Acacia midstorey, requiring abundant tree hollows for refuge and nest sites. Diet varies seasonally and consists of Acacia gum, eucalypt sap, nectar, honeydew and manna, with invertebrates and pollen providing protein.
Swift parrot	Unlikely	This species migrates to the Australian south-east mainland from Tasmania between March and October. On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany <i>Eucalyptus robusta</i> , Spotted Gum <i>Corymbia maculata</i> , Red Bloodwood <i>C. gummifera</i> , Mugga Ironbark <i>E. sideroxylon</i> , and White Box <i>E. albens</i> . Whilst Swamp mahogany and Red Bloodwood occur on the subject site, no records of this species exist for the Nambucca LGA.
Wompoo fruit dove	Unlikely	This species is primarily associated with large undisturbed patches of tropical or subtropical evergreen rainforest. They feed on fruits from a diverse range of trees and vines and move locally following ripening of fruits. As with the Superb fruit-dove the general lack of fruiting species on the Subject site is likely to preclude the occurrence of this species.



Ecological Assessment

Species	Likelihood of occurrence in the Study area	Notes
Yellow-bellied glider	Unlikely	This species occurs in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. They feed primarily on plant and insect exudates, including nectar, sap, honeydew and manna with pollen and insects providing protein. They den, often in family groups, in hollows of large trees. Yellow-bellied gliders are very mobile and occupy large home ranges between 20 and 85 ha to encompass dispersed and seasonally variable food resources. This species has been recorded within the adjacent Nambucca State Forest, however due to past disturbance and open structure of site vegetation, is considered unlikely to utilise the site.
Yellow-bellied sheath-tail bat	Unlikely	The Yellow-bellied Sheath-tail-bat is a wide-ranging species found across northern and eastern Australia. In the most southerly part of its range - most of Victoria, south-western NSW and adjacent South Australia - it is a rare visitor in late summer and autumn. There are scattered records of this species across the New England Tablelands and North West Slopes. They roost singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. When foraging for insects, flies high and fast over the forest canopy, but lower in more open country. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory.

APPENDIX 4
CV - ADAM MCARTHUR

Curriculum Vitae

Adam McArthur Senior Environmental Scientist

Adam McArthur
Senior Environmental Scientist - *B.App.Sc.*

Personal details

- Current address - 100 Fischer Street, Goonellabah NSW 2480
- Mobile - 0400 392 039
- D.O.B - 28th October 2008
- Marital status - Married, no children
- Drivers License - C Class

Expertise

- Ecological Assessment Reporting/Impact Assessment
- Wildlife Ecology and Management
- Flora Survey, Vegetation Mapping and Conservation Assessment
- Threatened Species Survey and Management
- Licensing and Approvals (State and Federal)
- Environmental Monitoring
- Supervision of staff

Education

- 2002 Bachelor of Applied Science (Environmental Resource Management), Southern Cross University, Lismore NSW.
- 1998 Higher School Certificate, Grafton High School, Grafton NSW.

Short Courses/Training

- 2007 - QLD Blue Card (General Safety Induction - Construction Industry)
- 2005 - Guidelines for the Translocation of Threatened Plants in Australia
- 2004 - Occupational Health and Safety
- 2004 - 4WD Operations training
- 2002 - Animal Rescue and Rehabilitation
- 2002 - Chainsaw Operations (Level 1)

Professional Experience

- September 2007 - Current Senior Environmental Scientist, James Warren and Associates
- July 2004 - August 2007 Environmental Scientist, James Warren and Associates
- Feb 2004 - June 2004 Demonstrator - Biology, Southern Cross University, Lismore
- Jan 2004 - June 2004 Bush Regenerator, Environmental Training & Employment, (ENVITE)
- Feb 2002 - June 2002 Assistant to the Program Officer (Flora & Fauna Division), Brisbane City Council

Community service/Charity

- 2003 - Current Monthly donations to The Heart Research Institute of Australia
- July 2002 - April 2003 Volunteer Wildlife Officer, Wildlife Information and Rescue Service (WIRES)
- 1999 - 2002 Volunteer Rainforest Regenerator, Scrub Club, Southern Cross University, Lismore NSW.

Biography

I have been employed as an Environmental Scientist with James Warren and Associates for almost five and a half (5½) years. I began consulting in the Alstonville office (northern NSW), completed a 12 month period in the Brisbane office, an 18 month period in the Caloundra Office (Sunshine Coast), and am now based in the Ballina office (northern NSW). Since September 2007, I have fulfilled the role of Senior Environmental Scientist within the company which has included the following responsibilities:

- Staff management (within the Brisbane, Caloundra and now Ballina offices);
- Conducting weekly project meetings;
- Client liaison;
- Creation of new projects;
- Reporting weekly to the Managing Director;
- Review and sign off of all staff reports, letters and other correspondence;
- Ensuring staff are adequately resourced;
- Close scrutiny of invoices relating to QLD & NSW projects; and
- Ensuring all company equipment (including motor vehicles) is being maintained in a serviceable and clean condition.

In addition to an aptitude in a broad environmental management role, I possess expertise in Wildlife Biology and am also proficient in Flora Survey and Vegetation Mapping. I have prepared baseline ecological surveys, impact assessments, rehabilitation plans and Threatened species management plans, and have completed environmental monitoring programs for numerous urban development, resource extraction and linear infrastructure projects both in NSW and in

Queensland. I have completed flora and fauna surveys and impact assessment reports in the following ecosystems and regions:

- Coastal heath communities in northern NSW and southern Qld;
- Mangrove woodlands in the subtropics;
- Littoral rainforest in the subtropics;
- Coastal and sub-coastal Eucalypt woodlands and forests in NSW and Qld;
- Woodlands and heathlands of the Qld coastal sand islands;
- Coastal Melaleuca woodlands and open forests in NSW and Qld;
- Subtropical rainforest of the NSW/Qld Border region; and
- Salt/estuarine plains in the subtropics.

I am proficient in the assessment of local government Planning Schemes, State and Commonwealth legislation and the preparation of Court evidence. I have assisted many clients in meeting reporting and monitoring requirements associated with large-scale residential development, and have project experience with resource extraction and infrastructure development. I have worked on major road projects such as the Tugun Bypass (northern NSW) as well as minor infrastructure projects. Major residential projects include Peregrine Springs, Pelican Links, The Edge Noosa, Kings Forest, Casuarina Beach and Minnippi Parklands.

Areas of Practice

- Baseline flora and fauna assessment, constraint analysis and technical reporting (ecological assessment reports).
- Development assessment and rezoning advice under the NSW Environmental Planning and Assessment Act 1979, State Planning Policies and Local Planning Instruments.
- Preparation of impact assessment reports in accordance with Commonwealth, State and Local Government nature conservation Legislation and Policy.
- Vegetation Management, including assessment of and applications under the Vegetation Management Act (1999)(as amended), preparation of PVMP's, PMAV's, map amendment requests and clearing applications.
- Development assessment advice and approval planning under Queensland Integrated Planning Act 1997, State Planning Policies, EP Act and Local Authority Planning Schemes.
- Preparation of referrals and submissions to the DEH under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999.
- Preparation of Species Impact Statements and Environmental Impact Statements.
- Preparation of Fire Management Plans and Mosquito Management Plans.
- License applications to state government authorities.
- Pre-clearing fauna survey and fauna rescue programs (registered spottercatcher with QPWS).

Major Projects

Mining and Infrastructure

- Chinderah Sand Quarry - ecological surveys and preparation of SIS.
- Ballina Sand Quarry - ecological surveys and EIA reports.
- Tugun bypass - ecological surveys and Threatened Species Monitoring.
- Kunghur Creek Road bridge replacement - ecological surveys and EIA reports.
- Proposed Shannon Creek Dam - ecological surveys and EIS preparation.
- Moonee Beach Shopping Centre & Highway re-alignment - ecological surveys and EIS preparation.
- Peregrine Springs Shopping Centre - ecological surveys and EIS preparation.
- Lady Loretta Mining Project, Mt Isa - ecological surveys and EIS preparation.

Urban Residential

- Peregrine Springs - ecological surveys and EIA reports.
- Coolum Ridges Residential Development - ecological surveys, EIA reports and Threatened species management plans.
- Kings Forest Residential Development - ecological surveys and EIA reports.
- Cobaki Lakes residential development - ecological surveys, Threatened species management plans, EIA reports and Environmental monitoring programs.
- Seabreeze residential development - ecological surveys, EIA reports and Environmental monitoring programs.
- Mudgeerabah Forest residential development - ecological surveys and EIA reports.
- Scotts Head Tourist Resort - ecological surveys, EIA reports and Threatened species management plans.
- Redevelopment of Terranora Country Club - ecological surveys and EIA reports.
- Pacific Pines Estate - ecological surveys and EIA reports.
- Pebble Beach Estate - EIA reports.
- Pacific Bay Resort, Coffs Harbour - ecological surveys and EIA reports.
- Mt Cotton residential development - ecological surveys and EIA reports.
- The Edge residential development, Noosa - Threatened species management plans.

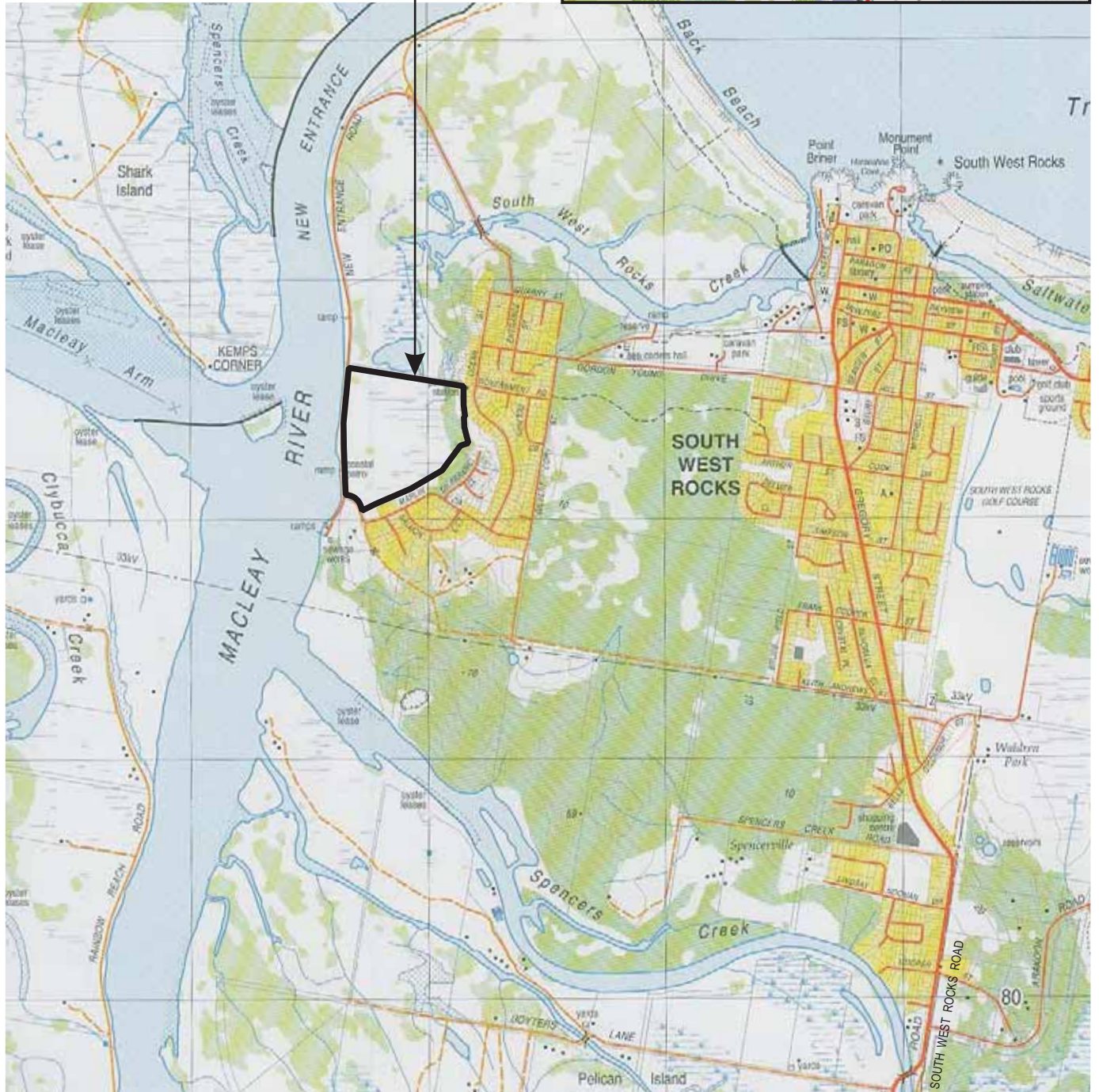
Other experience

- June 2003 - Oct 2003 Yardman Nitro Marine, Southport QLD.
- April 2003 - Oct 2003 Glassy/Barman Trocadero Entertainment Centre, Surfers Paradise QLD.
- July 2002 & Feb 2003 Stock-take assistant Big W, Grafton NSW.

- Nov 2002 - Jan 2003 Nursery Hand Junction Hill Nursery, Grafton NSW.
2002 Labourer Tony O'Keefe - Builder, Grafton NSW.
- 2002 Casual Concrete Labourer Rocla, Grafton NSW



SUBJECT SITE



0 1000m

DRAFT 20.04.10

SOURCE: Topographic map "South West Rocks"

SCALE: 1 : 25 000 @ A4

JAMES WARREN & ASSOCIATES PTY LIMITED
Environmental Consultants

CLIENT
Shannon Pty Ltd
PROJECT
Ecological Assessment
Lot 4 on DP1022342
New Entrance Road, South West Rocks, NSW
Shire of Kempsey

FIGURE 1

PREPARED: BW
DATE: 20 April 2010
FILE: 05084_EA_locality.cdr

TITLE

LOCALITY PLAN



Legend
 Subject Site



0 50m

DRAFT 20.04.10

SOURCE: NSW LPI Aerial Photograph
 (taken 26/08/03)

SCALE: 1 : 2000 @ A3

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FIGURE 2

PREPARED: BW
 DATE: 20 April 2010
 FILE: 05084_EA_Aerial.cdr

TITLE

**AERIAL
 PHOTOGRAPH**



M.G.A. COORDINATES

	EASTING	NORTHING
PEG 1	501756.682	6582084.301
PEG 2	501766.129	6582116.049
PEG 3	501738.538	6582157.238
PEG 4	501746.722	6582196.996
PEG 5	501706.602	6582198.102
PEG 6	501702.242	6582222.125
PEG 6A	501732.726	6582230.951
PEG 7	501752.680	6582252.877
PEG 8	501774.482	6582249.590
PEG 9	501745.795	6582336.156
PEG 10	501725.438	6582359.213
PM 74276	501633.670	6582152.296
SSM 61122	501721.549	6581960.601

Legend

- Proposed SEPP 14 Boundary as located on site (25/06/09)
- Subject Site

0 50m

SOURCE: Amos & McDonald Surveyors
(Ref: Proposed SEPP 14.pdf)

SCALE: 1 : 2000 @ A3

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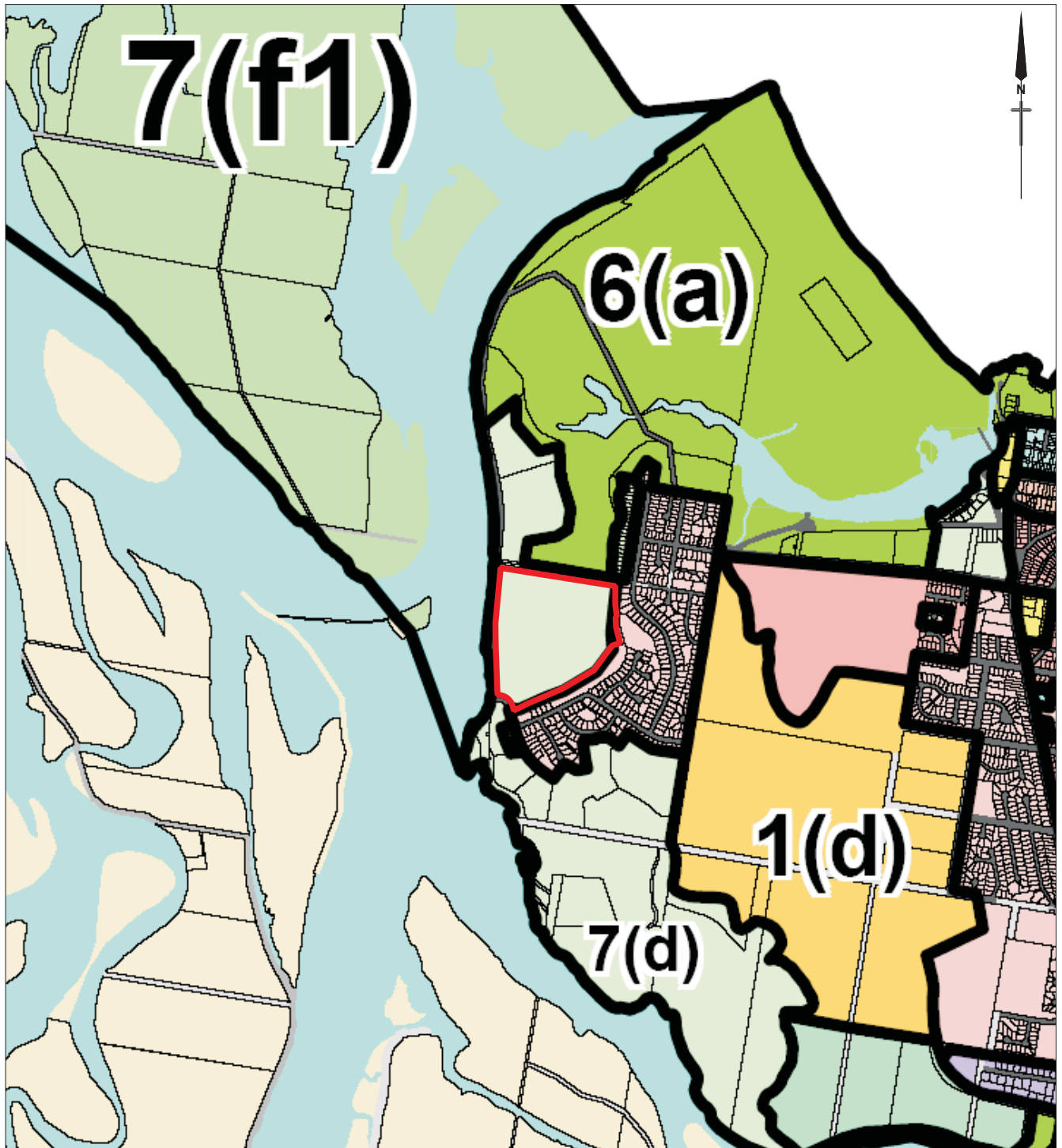
FIGURE 4

PREPARED: BW
DATE: 20 April 2010
FILE: 05084_EA_Sepp Boundary.cdr

DRAFT 20.04.10

TITLE

**PROPOSED
SEPP 14
BOUNDARY**



Legend

- 1(a1) Rural A1
- 2(a) Residential A
- 1(d) Rural (Investigations) D
- 6(a) Open Space A
- 7(d) Scenic Protection
- 7(f1) Coastal Land Protection
- Subject Site

0 1000m

DRAFT 20.04.10

SOURCE: Kempsey Local Environmental Plan
1987 Map C Land Use Zones

SCALE: 1 : 25 000 @ A4

JAMES WARREN & ASSOCIATES PTY LIMITED
Environmental Consultants

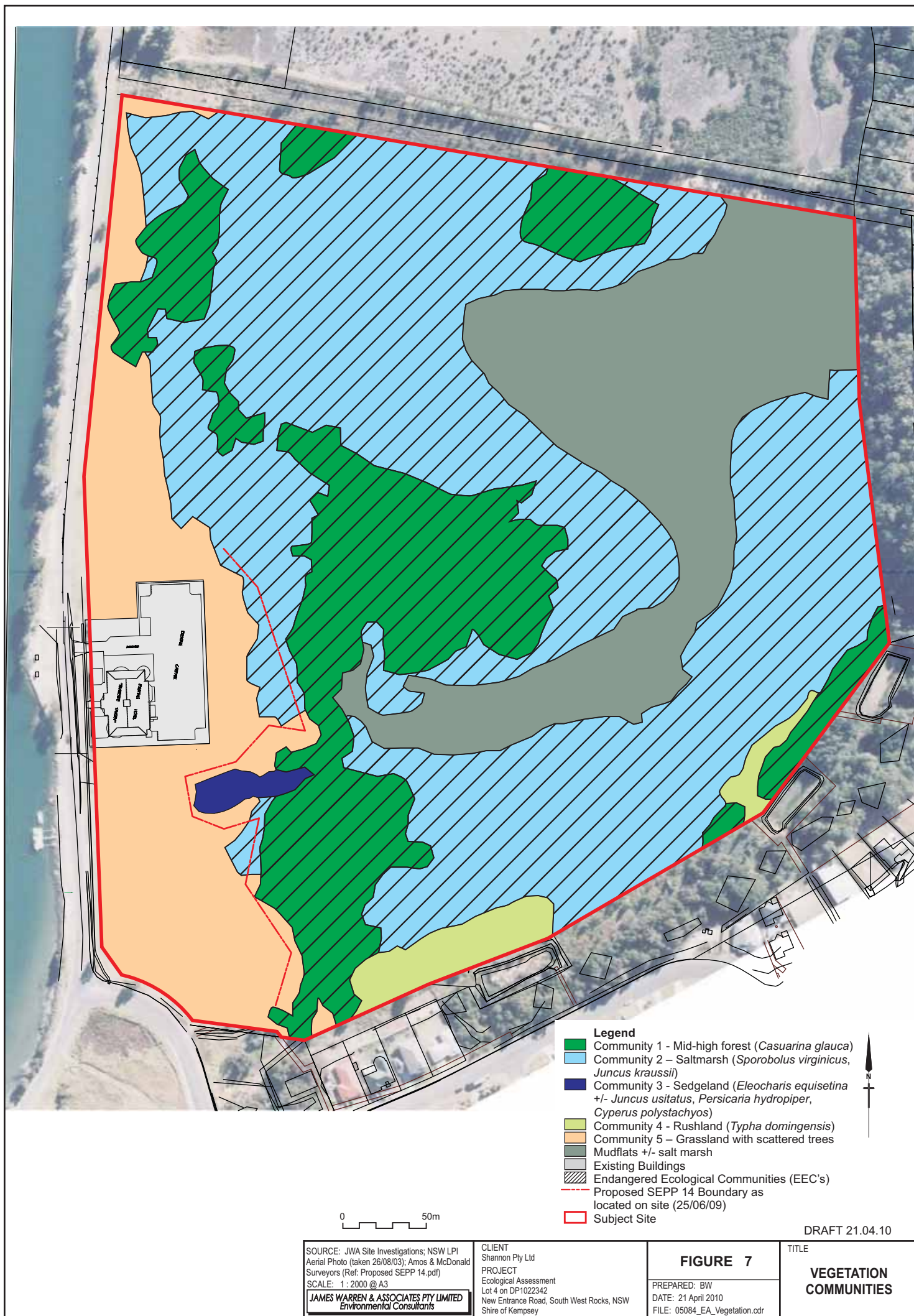
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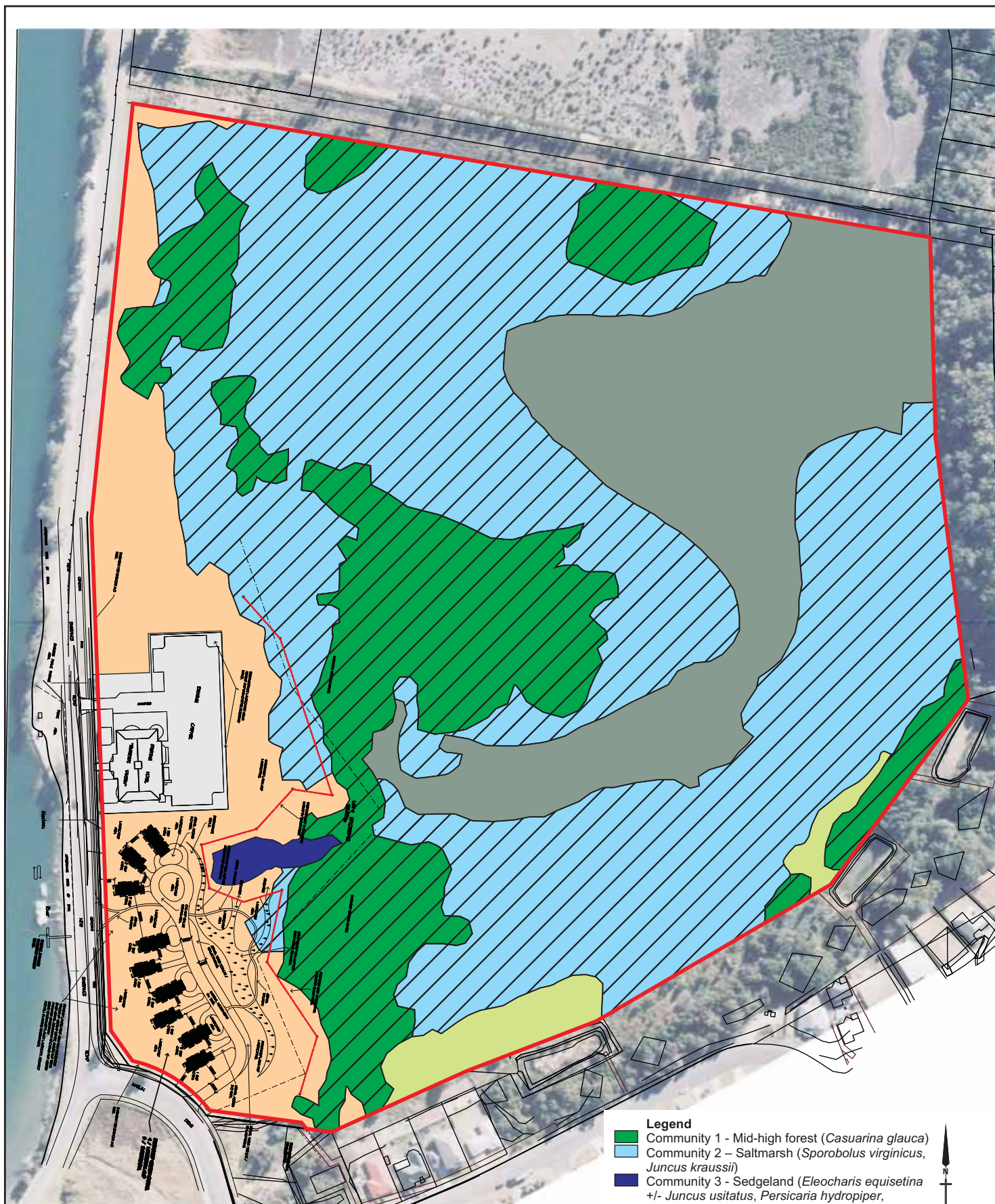
FIGURE 5

PREPARED: BW
DATE: 20 April 2010
FILE: 05084_EA_Zoning.cdr

TITLE

**LAND USE
ZONES**





Legend

- Community 1 - Mid-high forest (*Casuarina glauca*)
- Community 2 – Saltmarsh (*Sporobolus virginicus*, *Juncus kraussii*)
- Community 3 - Sedgeland (*Eleocharis equisetina* +/- *Juncus usitatus*, *Persicaria hydropiper*, *Cyperus polystachyos*)
- Community 4 - Rushland (*Typha domingensis*)
- Community 5 – Grassland with scattered trees
- Mudflats +/- salt marsh
- Existing Buildings
- Endangered Ecological Communities (EEC's)
- Proposed SEPP 14 Boundary as located on site (25/06/09)
- Subject Site

0 50m

SOURCE: JWA Site Investigations; Paul Smith Building Design (Ref: 08 129 MCEVOY CABINS AMEND PLAN D-A1 SITE PLAN OCTOBER 2009.pdf)
SCALE: 1 : 2000 @ A3
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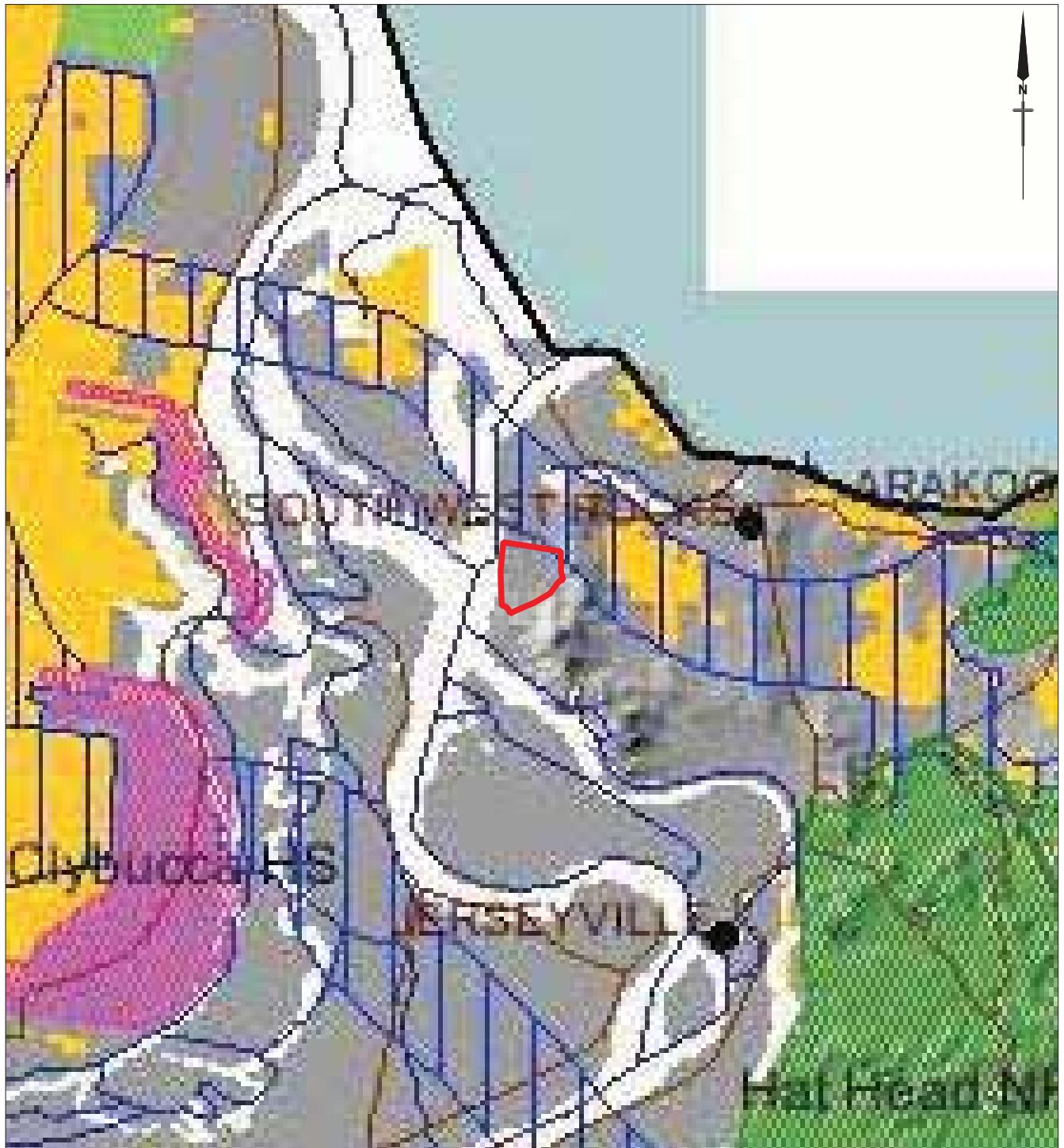
FIGURE 8

PREPARED: BW
DATE: 21 April 2010
FILE: 05084_EA_Impacts.cdr

DRAFT 21.04.10

TITLE

**IMPACT OF
PROPOSED
DEVELOPMENT**



Legend

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

0 1.5km

DRAFT 20.04.10

SOURCE: NSW NPWS Key Habitats & Corridors
in Northern NSW (website accessed 21.04.10)

SCALE: 1 : 50 000 @ A4

JAMES WARREN & ASSOCIATES PTY LIMITED
Environmental Consultants

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Lot 4 on DP1022342
New Entrance Road, South West Rocks, NSW
Shire of Kempsey

FIGURE 9

PREPARED: BW
DATE: 20 April 2010
FILE: 05084_EA_Corridors.cdr

TITLE

**NPWS
KEY HABITATS
& CORRIDORS**



- Legend**
- Type A Elliott traps
 - Type B Elliott traps
 - Cage traps
 - Pitfall traps
 - + Call playback location
 - ANABAT location
 - Proposed SEPP 14 Boundary as located on site (25/06/09)
 - Subject Site

0 50m

DRAFT 21.04.10

SOURCE: JWA Site Investigations; NSW LPI
Aerial Photo (taken 26/08/03); Amos & McDonald
Surveyors (Ref: Proposed SEPP 14.pdf)
SCALE: 1 : 2000 @ A3
JAMES WARREN & ASSOCIATES PTY LIMITED
Environmental Consultants

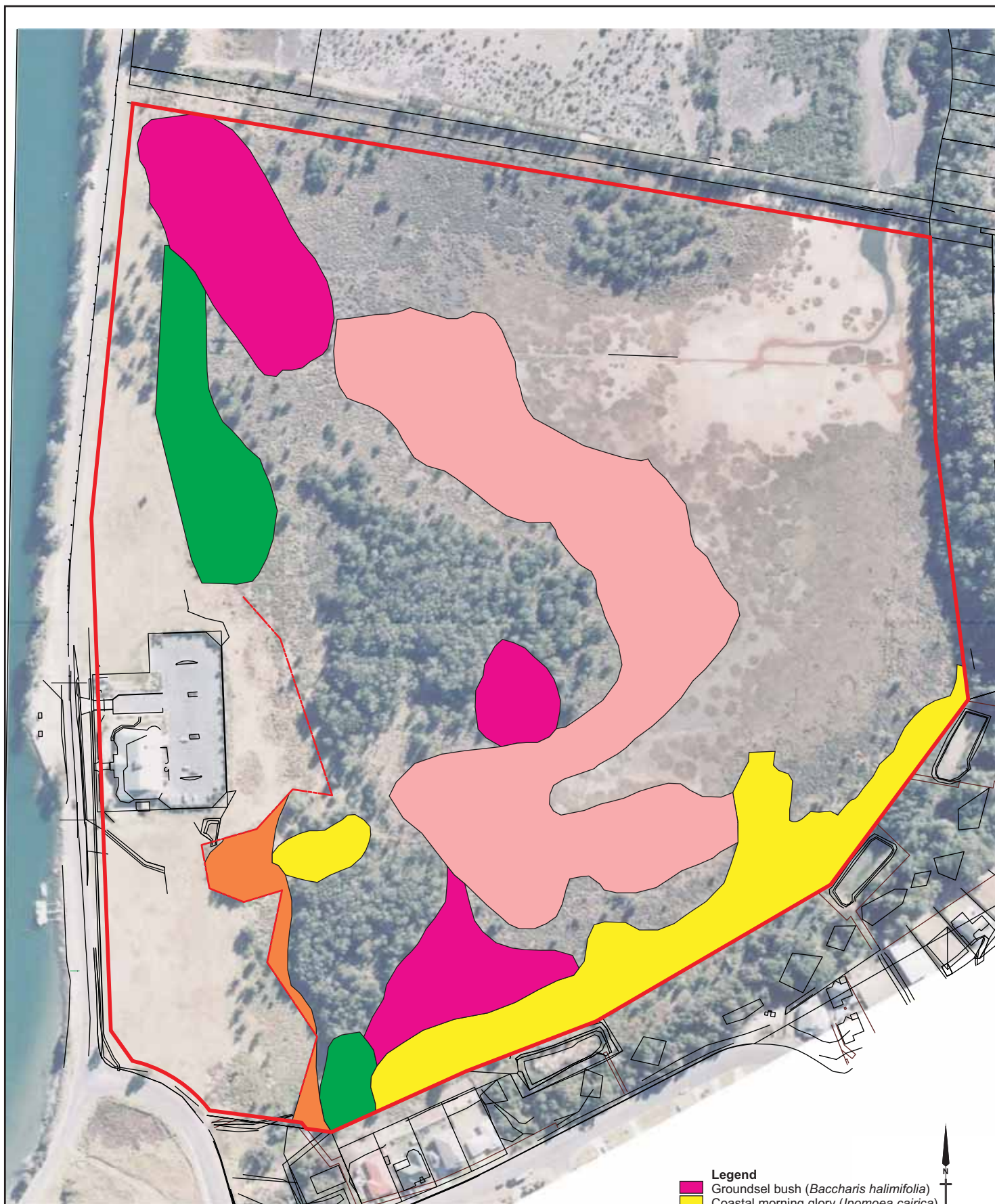
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New Entrance Road, South West Rocks, NSW
Shire of Kempsey

FIGURE 10

PREPARED: BW
DATE: 21 April 2010
FILE: 05084_EA_Survey.cdr

TITLE

**FAUNA
SURVEY
LOCATIONS**



Legend

- Groundsel bush (*Baccharis halimifolia*)
- Coastal morning glory (*Ipomoea cairica*)
- Groundsel bush (*Baccharis halimifolia*) + Coastal morning glory (*Ipomoea cairica*)
- Wild aster (*Aster subulatus*)
- Farmer's friends (*Bidens pilosa*)
- Surveyed SEPP14 Boundary
- Subject Site

0 50m

DRAFT 22.04.10

SOURCE: JWA Site Investigations; NSW LPI
Aerial Photo (taken 26/08/03); Amos & McDonald
Surveyors (Ref: Proposed SEPP 14.pdf)
SCALE: 1 : 2000 @ A3
JAMES WARREN & ASSOCIATES PTY LIMITED
Environmental Consultants

CLIENT
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Lot 4 on DP1022342
New Entrance Road, South West Rocks, NSW
Shire of Kempsey

FIGURE 11

PREPARED: BW
DATE: 22 April 2010
FILE: 05084_EA_Weeds.cdr

TITLE

**WEED
MAPPING**

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