STATEMENT OF EFFECT

ON THREATENED FLORA AND FAUNA

for a proposed

Abalone Farm

at

Lot 2 DP 1014683
Clarke Street
PINDIMAR
NSW

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EXECUTIVE SUMMARY

Flora, fauna and habitat studies have been undertaken at Lot 2 DP 1014683 Clarke Street, Pindimar NSW to assess the impact of a proposed Abalone Farm.

Investigations in accordance with the requirements of the Environmental Planning and Assessment Act 1979 (EPA Act), Threatened Species Conservation Act 1995 (TSC Act) have led to this report upon Threatened Flora and Fauna, which incorporates an assessment of the study area under SEPP 44 – Koala Habitat Protection, SEPP 14 – Coastal Wetlands and the Environmental Protection and Biodiversity Conservation Act 1999. An aquatic assessment of the proposal under the Fisheries Management Act has also been undertaken by Bio-analysis Pty Ltd (BIO-ANALYSIS, 2013). These studies have been undertaken to ascertain whether or not the proposed Abalone Farm would have a significant effect upon any populations, ecological communities, or habitats of threatened flora and fauna species.

The Proposal

The proposed development comprises a land-based marine aquaculture farm for the production of approximately 60 tonnes per year of live *Haliotis rubra* (Blacklip Abalone). The proposed farm will be located in the southern portion of Lot 2 DP 1014683 and positioned over a development area of approximately 5 hectares (total building footprint is approximately 1.13ha). The main building/structures will be situated on an area of open forest. However many of the building/structures are partly positioned on already disturbed areas. The construction of the building footprint will result in the removal of 1ha of open forest containing approximately 65 trees. A bushfire assessment completed for the proposal (Australian Bushfire Protection Planners Pty Limited, 2013) recommends a distance of 20m wide defendable space to the north, east and south of the building precinct. A 30m wide defendable space is recommended to the west and north-west of the building precinct. Approximately 1ha of Ironbark/Tallowwood Open Forest would be required to be modified to meet the required Bushfire Asset Protection Zone recommendations (APZ). The proposal will also include four intake and outtake and outlet pipes (500mm in internal diameter, approximately 630mm external pipe diameter), extending from the development envelope into the waters of Port Stephens (Crown Land in the LGA of Port Stephens). The 4 Intake/ Outlet Pipes will be raised on supports north of the pumping station to the access road. The pipes will go under the access road and lie on the surface within the building precinct. Below the pumping station the pipes will be buried until the low tide mark. The pipes will be manoeuvred to avoid the removal of any trees. However

there may be a chance of damage to the root zone of a small number of trees. It is recommended that an arborist be consulted during the construction of the pipelines to reduce the impact on nearby trees.

In order to address the requirement for an alternate emergency egress from the development precinct it is proposed that a boardwalk across Pig Station Creek to the western terminus of Cambage Street be constructed. The area the boardwalk will traverse is an area of saltmarsh and mangroves and will be situated just outside a SEPP 14 wetland (Wetland No. 757a). The remainder of the egress will link up with the formed Cambage Street which crosses through approximately 110 metres of Wetland No. 757a. This section of egress which would not require any additional modification as it consists of a vehicle track previously built up above the high water mark by outside fill.

Description of study area

The 60ha study area is located to the west of the village of Pindimar on the northern shoreline of the waters of Port Stephens. The study area was composed of the 51ha irregularly shaped subject site (Lot 2 DP 1014683) and an additional area to the south and south-east consisting of the aquatic and intertidal environment of Port Stephens and Pig Station Creek where the proposed pipeline route and emergency egress are proposed to be positioned. Topography within the study area consisted of a flat low lying area in the south which rose relatively gently to a knoll about 20m high in the centre of the site. A higher ridgeline reaching a height of approximately 40m asl was present in the far north.

Vegetation

The study area was predominantly undeveloped and covered in native vegetation consisting primarily of open forest. Several small areas have been cleared in the past for development, and include an orchard, mainly comprising Kaffir Lime trees and an associated building. The aquatic and intertidal environment along the proposed pipeline route was relatively undisturbed by anthropogenic activities. A total of 14 vegetation communities were delineated within the study area. Ten of these communities were mapped within Lot 2 with a further four delineated outside Lot 2 within the far south of the study area.

Vegetation communities present within Lot 2:

- Swamp Mahogany – Paperbark Forest (EEC);
- Smooth-barked Apple Heath;
- Coastal Sand Blackbutt Open Forest;
- Ironbark/Tallowwood Open Forest;
- Grey Gum/Tallowwood/Ironbark Open Forest;
- Spotted Gum/Ironbark Open Forest;
- Smooth-barked Apple/Stringybark Open Forest;
- Moist Riparian Forest;
- Aquatic Vegetation – Dam;
- Cleared Modified.

Vegetation communities present outside Lot 2 within the far south of the study area:

- Mangrove;
- Foreshore vegetation;
- Saltmarsh (EEC);
- Swamp Oak Forest (EEC).

Endangered Ecological Communities (EEC) TSC Act

The study area was found to contain three Endangered Ecological Communities (EEC's):

- Swamp Mahogany – Paperbark Forest (Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions):
- Saltmarsh (Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions):
- Swamp Oak Forest (Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions).

Two of these communities Swamp Sclerophyll Forest and Coastal Saltmarsh will be directly impacted by the proposal.

Swamp Sclerophyll Forest

Approximately 7.4ha of Swamp Mahogany – Paperbark Forest consistent with the EEC - Swamp Sclerophyll Forest was present on lower ground within the south of the study area. This area of Swamp Forest formed part of a larger area of adjoining Swamp Sclerophyll Forest to the east and west. The proposed building footprint will be located a short distance to the north of the Swamp Sclerophyll Forest boundary. The intake and outtake pipes connecting the proposed facility to the waters of Port Stephens will be required to cross the area of Swamp Sclerophyll Forest. The pipeline will run along a narrow corridor (approximately 4.5m) and manoeuvred to avoid the removal of any trees. To reduce the impact on this Endangered Ecological Community the pipelines will be raised on supports north from the pumphouse until they reach an access road. South of the pumphouse the pipelines will be buried underground resulting in possible root zone impacts to a small number of trees. Approximately 0.14ha of understorey vegetation within the area of Swamp Sclerophyll Forest will be disturbed during construction. Due to the close proximity of the proposed facility to the EEC there is the potential for secondary impacts such as stormwater runoff and increased weed infestation. Strict controls will have to be applied to the building precinct to prevent any future degradation to the area of Swamp Sclerophyll Forest.

Saltmarsh

Approximately 0.5ha of Saltmarsh was found to occupy the outer edges of Pig Station Creek within the study area. The proposed emergency egress across Pig Station Creek will pass through

approximately 20m of Saltmarsh along an unformed section of Cambage Street. This area of saltmarsh was found to be in generally good condition although was subject to some disturbance from illegal vehicle crossings of Pig Station Creek. The egress is proposed to consist of a wooden boardwalk approximately 2m wide that will provide only pedestrian access. The boardwalk will require only minimal removal of vegetation to allow for holes for the pylons. The boardwalk is to be raised so as to allow the vegetation to grow out from underneath and to allow continued movement through the area by terrestrial and aquatic fauna.

Swamp Oak Forest

Approximately 0.33ha of Swamp Oak Floodplain Forest was present within the vicinity of Pig Station Creek along the unformed Cambage Street. The proposal was considered unlikely to have any impact upon this EEC.

A summary of the impact of the proposal on individual vegetation communities is shown below.

- Swamp Mahogany Paperbark Forest – disturbance to approximately 0.14ha of understorey vegetation during pipeline construction.
- Ironbark/Tallowwood Open Forest – Approximately 0.7ha to be cleared for the Building/Structure Footprint. An additional 1.0ha is required to be underscrubbed and thinned to comply with Bushfire APZ requirements;
- Coastal Sand Apple Blackbutt Forest – Approximately 0.35ha to be cleared for the Building/Structure Footprint. Disturbance to approximately 0.10ha of understorey vegetation during the construction of the pipelines;
- Saltmarsh – Emergency Egress boardwalk will require a number of small auger holes to accommodate the pylons;
- Mangroves – No Mangroves are required to be removed for the boardwalk. A small amount of pneumatophores may be affected.

Threatened Flora

Despite targeted searches no threatened flora species were recorded during the survey. Suitable habitat of varying quality was found to be present for 18 of the 26 species addressed in this report.

- *Cryptostylis hunteriana* (Leafless Tongue Orchid)
- *Diuris arenaria* (Tomaree Doubletail)
- *Diuris praecox* (Newcastle Doubletail)
- *Corybas dowlingii* (Red Helmet Orchid)
- *Rhizanthella slateri* (Eastern Underground Orchid)
- *Asperula asthenes* (Trailing Woodruff)
- *Angophora inopina* (Charmhaven Apple)
- *Callistemon linearifolius* (Netted Bottlebrush)
- *Tetratheca juncea* (Black-eyed Susan)

- *Eucalyptus parramattensis* ssp. *decadens* (Drooping Red Gum)
- *Melaleuca biconvexa* (Biconvex Paperbark)
- *Melaleuca groveana* (Grove's Paperbark)
- *Syzygium paniculatum* (Magenta Lilly Pilly)
- *Maundia triglochinoides*
- *Persicaria elatior* (Tall Knotweed)
- *Cynanchum elegans* (White-flowered Wax Plant)
- *Chamaesyce psammogeton* (Sand Spurge)
- *Senecio spathulatus* (Coastal Fireweed)

Of these threatened flora species *T. juncea* is considered the most likely species to be present within the study area. Any occurrence of *T. juncea* within the study area would be largely confined to the area mapped as Smooth-barked Apple/Stringybark Forest which occurs to the north of the proposed development area. There is a paucity of local records on the northern shore of Port Stephens for the remainder of the addressed species considered to have suitable habitat within the study area. Taking into consideration the large amount of suitable habitat in the local area and the relatively small area of disturbance the proposal is unlikely to disrupt the life cycle the addressed threatened flora species such that local extinction would occur.

Threatened Fauna

Five threatened fauna species were recorded on within the study area during the survey:

- *Crinia tinnula* (Wallum Froglet)
- *Glossopsitta pusilla* (Little Lorikeet)
- *Pteropus poliocephalus* (Grey-headed Flying-fox)
- *Miniopterus australis* (Small Bentwing-bat)
- *Scoteanax rueppellii* (Greater Broad-nosed Bat)

As a result of secondary evidence, *Phascolarctos cinerea* (Koala) was also considered to utilise the study area.

Crinia tinnula (Wallum Froglet)

The Wallum Froglet was recorded within the wetter lower lying areas of Swamp Mahogany Paperbark Forest in the southern portion of the study area. Due to the close proximity of the proposed facility to suitable habitat there is the potential for secondary impacts such as stormwater runoff and increased weed infestation. As stated for the area of Swamp Sclerophyll Forest strict sediment and weed controls will need to be applied to prevent any future degradation of suitable habitat. The inlet and outlet pipes connecting the proposed facility to the waters of Port Stephens will cross the area of Swamp Mahogany Paperbark Forest Swamp Forest. To reduce the impact on *C. tinnula* the pipelines will be raised on supports north from the pumphouse until they reach an access road. The pipelines will be buried south of the pumphouse and the natural ground levels will be reinstated. Considering the recommendations the proposal is unlikely to cause extinction of *C. tinnula* in the local area.

Glossopsitta pusilla (Little Lorikeet)

The Little Lorikeet was recorded within a tree in the far south of the study area. Suitable foraging and nesting habitat was present across the forested areas of the study area. The proposal will result in the clearing of approximately 1ha of suitable foraging habitat including up to ten potential nesting trees resulting in a small incremental reduction in habitat in the local area for this species. To help reduce the impact on the Little Lorikeet it is recommended that suitable compensatory nesting habitat in the form of nestboxes be erected within the subject site. Taking the recommendation into consideration the proposal is considered unlikely to result in the extinction of any local population of this lorikeet species.

Pteropus poliocephalus (Grey-headed Flying-fox)

The Grey-headed Flying-fox was observed foraging within the canopy of a small number of flowering eucalypt species during the nocturnal survey. The majority of the study area contained suitable foraging habitat in the form of seasonally flowering myrtaceous species. Potential campsites were also considered to be present however, no roosting individuals were found to be present. Taking into account the relatively large amount of suitable surrounding habitat and high mobility of this species it is considered that the proposal is unlikely to cause extinction of the local population of Grey-headed Flying-fox.

Miniopterus australis (Small Bentwing-bat)

Miniopterus australis was recorded within the study area as a result of the bat call survey and harp trapping. The majority of the study area contains suitable hunting habitat for this microchiropteran bat species, although no preferred roosting habitat in the form of caves, culverts or other similar man-made structures was found to be present. The proposal is likely to result in a small incremental reduction in quality of hunting habitat in the local area however considering the absence of preferred roosting habitat the proposal is unlikely to disrupt the life cycle of this microchiropteran bat species such that local extinction would occur.

Scoteanax rueppellii (Greater Broad-nosed Bat)

Scoteanax rueppellii was also recorded within the study area as a result of the bat call survey and harp trapping. The majority of the study area was considered to contain suitable hunting habitat for this species. Roosting habitat in the form of tree hollows was also common throughout the study area. The proposal will result in a small incremental reduction in hunting habitat and the removal of up to ten suitable roosting trees. Taking into consideration the relatively large amount of suitable hunting and roosting habitat in the local area the proposal is considered unlikely to result in the extinction of any local population of this species. To help reduce the impact on this microchiropteran bat species it is recommended that suitable compensatory nesting habitat in the form of nestboxes be erected within the subject area.

Phascolarctos cinerea (Koala)

No Koalas were directly observed within the study area during fieldwork completed for this or other known reports under taken within the study area. However evidence of Koala activity in the form of characteristic scratches and scats were found to be present within the area of Swamp Forest in the southern portion of the study area. Two species of 'Koala Feed Tree', *Eucalyptus robusta* (Swamp Mahogany) and *Eucalyptus microcorys* (Tallowwood) were recorded and were largely confined to the southern portion of the study area. Koala activity was found to be associated with specimens of *E. robusta*. There was one past records of the Koala within the eastern portion of the study area dating back to 1995 (OEH, 2012). Previous reports of characteristic scats within the study area of swamp forest indicate the study area, in particular the area of Swamp Forest has been utilised periodically as part of a larger area by a small number of Koalas. Koala records documented by the Myall Koala & Environment Group Inc show a small number of more recent records from within the local area. The evidence suggests that the study area particularly the area of Swamp Forest has been periodically utilised by a small number of Koalas over a period of time. Given the lack of Koala sightings and low level of Koala activity it is not considered that the study area constitutes 'Core Koala Habitat'.

The proposal will result in the removal of approximately 24 specimens of *E. microcorys,* however, no specimens of *E. robusta* are required to be removed. To reduce the impact on Koalas it is recommended that as many specimens of *E. microcorys* are retained where possible within the scope of the development. It is also recommended that the proposal particularly the pipelines do not create any barriers to the safe movement of Koalas. The pipeline will be raised on supports north of the pumphouse with a gap of at least 200mm to allow the movement of Koalas underneath within the area of Swamp Sclerophyll Forest and parts of Coastal Sand Blackbutt Open Forest.

Taking the recommendations into consideration the action is unlikely to have an adverse effect on the life cycle of the Koala such that the local population of Koalas may be placed at risk of extinction.

No additional threatened species were recorded within the site. However it is considered that foraging/hunting/nesting resources of varying quality was available for 51 of the 83 remaining fauna species assessed.

- *Litoria aurea* (Green and Golden Bell Frog)
- *Litoria brevipalmata* (Green-thighed Frog)
- *Caretta caretta* (Loggerhead Turtle)
- *Chelonia mydas* (Green Turtle)
- *Hoplocephalus bitorquatus* (Pale-headed Snake)
- *Hoplocephalus stephensii* (Stephen's Banded Snake)
- *Limicola falcinellus* (Broad-billed Sandpiper)
- *Limosa limosa* (Black-tailed Godwit)
- *Xenus cinereus* (Terek Sandpiper)
- *Charadrius leschenaultii* (Greater Sand-plover)

- *Charadrius mongolus* (Lesser Sand-plover)
- *Haematopus fuliginosus* (Sooty Oystercatcher)
- *Haematopus longirostris* (Pied Oystercatcher)
- *Esacus neglectus* (Beach Stone-curlew)
- *Sterna albifrons* (Little Tern)
- *Rostratula benghalensis australis* (Australian Painted Snipe)
- *Botaurus poiciloptilus* (Australasian Bittern)
- *Ixobrychus flavicollis* (Black Bittern)
- *Ephippiorhynchus asiaticus* (Black-necked Stork)
- *Ptilinopus magnificus* (Wompoo Fruit-Dove)
- *Ptilinopus regina* (Rose-crowned Fruit-Dove)
- *Ptilinopus superbus* (Superb Fruit-Dove)
- *Callocephalon fimbriatum* (Gang-gang Cockatoo)
- *Calyptorhynchus lathami* (Glossy Black-Cockatoo)
- *Lathamus discolor* (Swift Parrot)
- *Neophema pulchella* (Turquoise Parrot)
- *Melithreptus gularis gularis* (Black-chinned Honeyeater)
- *Anthochaera phrygia* (Regent Honeyeater)
- *Daphoenositta chrysoptera* (Varied Sittella)
- *Pandion haliaetus* (Osprey)
- *Hieraaetus morphnoides* (Little Eagle)
- *Lophoictinia isura* (Square-tailed Kite)
- *Ninox connivens* (Barking Owl)
- *Ninox strenua* (Powerful Owl)
- *Tyto novaehollandiae* (Masked Owl)
- *Dasyurus maculatus maculatus* (Tiger Quoll)
- *Planigale maculata* (Common Planigale)
- *Potorous tridactylus tridactylus* (Long-nosed Potoroo - SE Mainland)
- *Aepyprymnus rufescens* (Rufus Bettong)
- *Cercartetus nanus* (Eastern Pygmy –possum)
- *Petaurus australis* (Yellow-bellied Glider)
- *Petaurus norfolcensis* (Squirrel Glider)
- *Phascogale tapoatafa* (Brush-tailed Phascogale)
- *Pseudomys gracilicaudatus* (Eastern Chestnut Mouse)
- *Falsistrellus tasmaniensis* (Eastern False Pipistrelle)
- *Saccolaimus flaviventris* (Yellow-bellied Sheathtail-bat)
- *Myotis macropus* (Large-footed Myotis)
- *Miniopterus schreibersii oceanensis* (Large Bentwing-bat)
- *Mormopterus norfolkensis* (Eastern Freetail Bat)
- *Vespadelus troughtoni* (Eastern Cave Bat)
- *Chalinolobus dwyeri* (Large-eared Pied Bat)

Taking the habitat present within the study area and local records into consideration the most likely of these species to utilise the study area would include *C. lathami, D. chrysoptera, N. strenua, P. haliaetus, D. maculatus maculatus, P. norfolcensis, P. tapoatafa, M. schreibersii oceanensis, M. norfolkensis* and a number of the addressed waders. The proposal will result in an incremental loss of potential habitat for these addressed threatened fauna species, however taking into consideration the relatively large amount of suitable habitat in the local area and the relatively small area of disturbance the proposal is unlikely to disrupt the life cycle the addressed threatened species such that local

extinction would occur.

Endangered Populations

Within the NSW North Coast Bioregion and Port Stephens LGA the population of the Emu has been listed as Endangered. The Emu was not recorded within the study area during the survey. Open Forest vegetation that covers the majority of the study area would provide some habitat for this species, which prefers more open habitat. Taking into consideration the large amount of suitable habitat in the locality and the relatively small area that will impacted the proposal is unlikely to result in the local extinction of a viable local population of the Emu.

State Environmental Planning Policy 44 – Koala Habitat Protection

Two species of 'Koala Feed Tree', *Eucalyptus robusta* (Swamp Mahogany) and *Eucalyptus microcorys* (Tallowwood) were recorded within the study area. The SEPP 44 assessment revealed that *E. robusta* and *E. microcorys* would comprise over 15% of the total trees present in some locations, particularly the southern half of the study area where the proposal is situated. Therefore the study area would be considered to constitute 'Potential Koala Habitat', and accordingly further provisions of this policy apply to the study area. No Koalas were directly observed within the study area during fieldwork completed for this report or previous reports. However as stated a small amount secondary evidence of Koala activity was noted. Given the lack of Koala sightings and low level of Koala activity it is not considered that the study area constitutes 'Core Koala Habitat'. Therefore an Individual Koala Plan of Management would not be required.

State Environmental Planning Policy 14 – Coastal Wetlands

The alternate evacuation egress from the development precinct is proposed to be constructed in close proximity to SEPP 14 Wetland No. 757a. Within this area the boardwalk will impact approximately 20m of Saltmarsh and 20m of Mangroves along a 2m wide strip. The boardwalk will require only minimal removal of vegetation to allow for holes for the pylons. Some disturbance from illegal vehicle crossings has created an opening enabling the boardwalk to be constructed without the removal of any mature Mangrove Trees. However a small number of branches may be required to be removed. The boardwalk is to be raised so as to allow the vegetation to grow out from underneath and to allow continued movement through the area by terrestrial and aquatic fauna. The site is likely to overlie Potential Acid Sulfate Soils. However considering the minimal amount of digging it would not be considered to be significant. It is recommended that auger holes only be the same diameter to the pylons to minimise the amount of sediment to be removed and the spoil from the holes is to be removed from the site. To avoid toxic ions leaching into the environment timber preservative treatments in the form of copper, chromium and arsenic should not be used.

A vegetation management plan recommended for the proposal will help ensure their long-term viability of this wetland during and post construction. The egress may also prevent illegal vehicle access to the site. Given the recommendations the proposal is unlikely to significantly impact this nearby SEPP 14 Wetland.

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

Consideration has been given to the Commonwealth Environment Protection and Biodiversity Conservation (EPBC) Act (1999). Two nationally listed species *Pteropus poliocephalus* (Grey-headed Flying-fox) and *Phascolarctos cinerea* (Koala) were recorded within the study area. Taking the recommendations given in the assessment under the TSC Act 1995 into consideration it was determined that the proposal is unlikely to have any significant impact on this species or other matters of National Environmental Significance.

No other nationally threatened species were recorded on site during the survey. Of the listed species those terrestrial species most likely to occur/utilise the site include *Tetratheca juncea, Dasyurus maculatus maculatus* and *Pseudomys novaehollandiae* (New Holland Mouse). The listed marine turtle species particularly *Chelonia mydas* (Green Turtle) would also utilise the waters of Port Stephens. Marginal habitat at best was considered to be available for a number of the listed Albatross and Petrel species, however these species would rarely occur within proximity to the study area.

Four listed migratory species, the White-bellied Sea-Eagle, Rufous Fantail, Eastern Curlew and Whimbrel were recorded within the study area during fieldwork. Considering the relative commonality of the four migratory species recorded within the local area and the relatively small impact of the inlet/outlet pipes on habitat in the locality it is unlikely that these species or any of the listed migratory species would be significantly impacted by the development.

Recommendations

To reduce the impact of the proposal on the surrounding environment a number of recommendations were given in this report:

- Consideration is to be given to retaining known Koala Feed Tree species within the scope of the development. It is also recommended that no barriers which would impact the safe movement of Koalas are put in place. Structures containing water will also need to be designed to avoid any unintended drowning of Koalas;
- Where possible it is recommended that hollow-bearing trees be retained. Hollow-bearing trees that are required to be removed are to be compensated by suitable nest boxes at a ratio of 2:1. Additionally any future removal of hollow-bearing trees from the site will be required to be supervised by a suitably qualified ecologist;
- All invasive weeds species, particularly *Lantana camara* (Lantana) and *Chrysanthemoides*

monilifera: (Bitou Bush) are to be controlled within proximity to the facility;

- Strict controls will need to be applied to the development to prevent any future degradation to surrounding native habitat in the from of stormwater runoff and sedimentation;
- In relation to the construction of the emergency egress boardwalk the auger holes are only to be the same size in diameter to the pylons to minimise the amount of sediment to be removed. The spoil from the holes is to be removed from the site. To avoid toxic ions leaching into the environment timber preservative treatments in the form of copper, chromium and arsenic should not be used:
- An arborist should be consulted during the construction of the pipelines to reduce the impact on the root zones of nearby trees;
- Artificial lighting used to operate at night or used for security may influence nocturnal fauna. It is recommended that lighting be minimised and confined wherever possible.

To help ensure these recommendations are carried out, particularly those pertaining to habitat that will surround the development, a vegetation management plan will need to be developed to address any likely impacts during construction and ensure the long-term viability of the nearby surrounding environment.

Conclusion

The development of an Abalone Farm will result in an incremental loss and/or disturbance of habitat for a number of the addressed threatened species. However taking into account the relatively large amount of surrounding habitat and given the recommendations it is believed that the proposal is unlikely to disrupt the life cycle of any addressed threatened species, endangered population or endangered ecological community such that local extinction would occur.

CONTENTS

1.0 INTRODUCTION

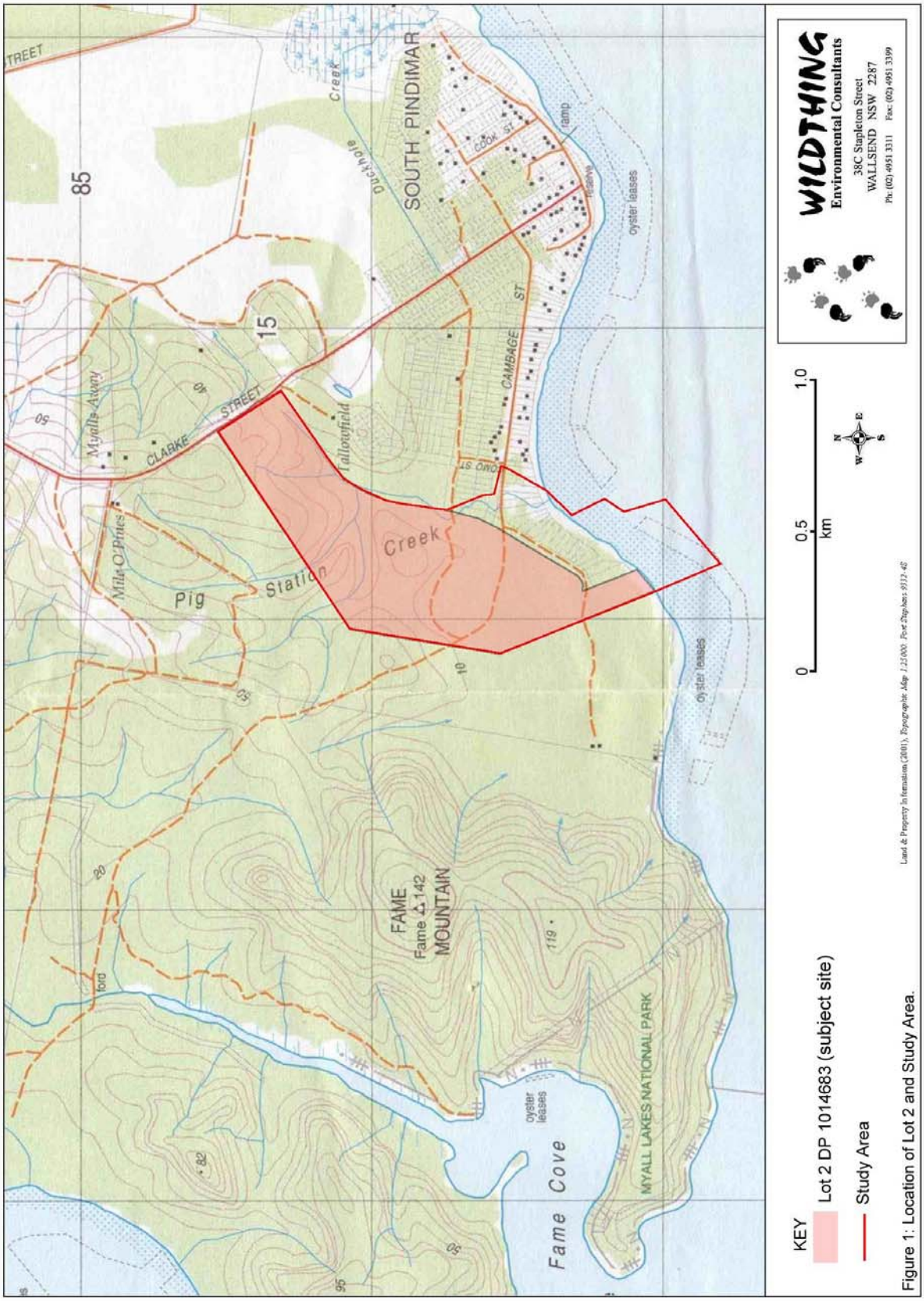
It is proposed that an Abalone Farm be constructed within Lot 2 DP 1014683 Clarke Street, Pindimar NSW. This report is intended to indicate the likelihood of the subsequent development having a significant effect on threatened species of flora, fauna, populations and ecological communities and to fulfil other requirements of the Environmental Planning and Assessment Act (EPA Act) 1979 and the Threatened Species Conservation Act (TSC Act) 1995. Considerations have also been given to SEPP 44 – 'Koala Habitat Protection', State Environmental Planning Policy 14 – Coastal Wetlands (SEPP 14) and the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). An aquatic report fulfilling the requirements of the Fisheries Management Act has been undertaken by Bio-analysis (BIO-ANALYSIS, 2013).

1.1 GENERAL DESCRIPTION OF THE SITE

The subject site (Lot 2 DP 1014683) is an irregularly shaped allotment with an area of approximately 51 hectares. The land is located to the west of the village of Pindimar with the waters of Port Stephens forming a 120m boundary in the south (Figure 1). Clarke Street is located on the north-eastern boundary with the unformed Carruthers Avenue running along the south-eastern boundary. The subject land consists of a flat low lying area in the south composed of well drained Pleistocene sand sheets and low dunes (Murphy, 1995). Areas of poorly drained sand sheets were also present within this area. To the north the ground rose relatively gently to a knoll about 20m high in the centre of the subject land. A higher ridgeline composed of Carboniferous mudstones and minor interbeds of lithic sandstones of the Wootton Beds reaching a height of approximately 40m asl was present in the north of the subject land (Murphy, 1995). Two main ephemeral drainage lines leading to Pig Station Creek were located between the knoll and higher ridgeline.

The subject site was predominantly undeveloped and covered in native vegetation consisting primarily of open forest. *Eucalyptus pilularis* (Blackbutt) was a common canopy species on the sandy soils in the southern portion of the subject site. *Eucalyptus robusta* (Swamp Mahogany) and *Melaleuca quinquenervia* (Broad-leaved Paperbark) were also found to be common within the lower lying poorly drained areas in the south. Vegetation communities within the higher ground in the north were characterised by the canopy species *Eucalyptus propinqua* (Small-fruited Grey Gum), *Eucalyptus siderophloia* (Northern Grey Ironbark), *Eucalyptus maculata* (Spotted Gum) and *Eucalyptus costata* (Smooth-barked Apple). Several small areas within the subject land had been cleared in the past for development, and include:

- An orchard, mainly comprising Kaffir Lime trees and an associated building near the sites south-western boundary;
- An out building near the southern boundary;
- Several small farm dams, including one near the site's Clarke Street frontage and one in the location of the proposed development;


SOUTH PINDIMAR
Duckhole Creek
Tallowfield
Myalls Aviary
CLARKE STREET
Mila O'Prues
Pig Station Creek
FAME MOUNTAIN
Fame 142
Fame Cove
MYALL LAKES NATIONAL PARK
COOK ST
CAMBAGE ST
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Lot 2 DP 1014683 (subject site)
Study Area
Figure 1: Location of Lot 2 and Study Area.

- A number of informal, dirt roads traversing the site;
- Electricity transmission lines along the site's south-eastern boundary and then underground in a westerly direction across the lot.

As a result of the proposed pipeline extending into the waters of Port Stephens and an emergency egress boardwalk across Pig Station Creek the adjoining estuarine, aquatic and intertidal environment was also considered as part of the study area (Figure 2). These areas appeared to be relatively undisturbed by anthropogenic activities although there was some evidence of past vehicular activity across Pig Station Creek. Vegetation communities occurring within these areas included mangroves, saltmarsh and intertidal sand/mud flats. More detailed ecological surveys pertaining to the impact of the proposal on the aquatic marine and intertidal environment has been completed by Bio-analysis Pty Ltd (BIO-ANALYSIS, 2013).

1.2 DESCRIPTION OF THE PROPOSAL

The proposed development comprises a land-based marine aquaculture farm for the production of approximately 60 tonnes per year of live *Haliotis rubra* (Blacklip Abalone). The proposed farm will be located in the southern portion of the subject site and positioned over a development area of approximately 5 hectares (total building footprint is approximately 1.13 hectare). The development will be partly situated on already disturbed ground however, it occurs largely over native open forest vegetation (Figure 2). Approximately 65 trees will be required to be removed for the footprint. A further 1ha of Open Forest will be required to be modified (underscrubbed and thinned) to meet the Bushfire Asset Protection Zone (APZ) requirements

Building Footprint

The development will incorporate the following land-based facilities (Figure 3):

- Cultivation and breeding facilities;
- Water circulation and treatment facilities;
- Water supply pumping and reticulation facilities;
- Settlement ponds;
- Outdoor cultivation tanks;
- Waste management facilities;
- Access roads and an internal road network including car parking areas and loading areas;
- Administration/staff amenity building;
- Maintenance and workshop facilities;
- Landscaping; and
- Storage facilities

Figure 2: Aerial Photo showing the proposed Abalone Aquaculture Development.

The farm will utilise and improve existing access tracks throughout the site to ensure suitability for commercial vehicles and rural fire service vehicles, as required.

Intake/Outtake Pipes

The proposal will include four intake and outtake pipes (500mm in internal diameter, approximately 630mm external pipe diameter), extending from the development envelope into the waters of Port Stephens (Crown Land in the LGA of Port Stephens). The 4 Intake/ Outtake Pipes will be buried in some locations and raised on supports in others. The pipelines will generally be constructed in-situ via the sequential connection of high-density polypropylene pipe 'spools' (segments). It is anticipated that a small rubber-tracked excavator will be used to move pipe spools around the site and into position. Pipes are relatively flexible and will be manoeuvred around trees and other obstacles. Spools will be stockpiled in appropriate locations (i.e. clear areas in close proximity to pipeline route) prior to the construction of each segment. For required excavations, the top layer (approximately 150mm) of vegetative groundcover and soil/ sediment will be removed.

No trees are anticipated to be removed for pipeline construction. However there is the potential for the root zones of a small number of trees to be damaged. Excavated topsoil/ sediment will be stockpiled adjacent to the pipes for later reinstatement, and any vegetative matter mulched for use within landscaped terrestrial areas. A single trench will be created to accommodate the 4 pipes, approximately 0.9m deep and approximately 2.5m wide, in terrestrial areas. In intertidal areas, the trench will be of a variable depth in order to maintain the consistent grade of the pipe. Excavated spoil will be stockpiled for regular backfilling into the trench upon the completion of each segment. Any excess fill will be utilised within the site where possible (e.g. filling in of road potholes) or disposed of at an appropriately licensed landfill. The width of the 'disturbance corridor' for buried pipes, including stockpile areas, will be approximately 4.5m. Disturbed areas will be revegetated with endemic species upon completion of works. Additional details on the construction of each segment are provided in Table 1.

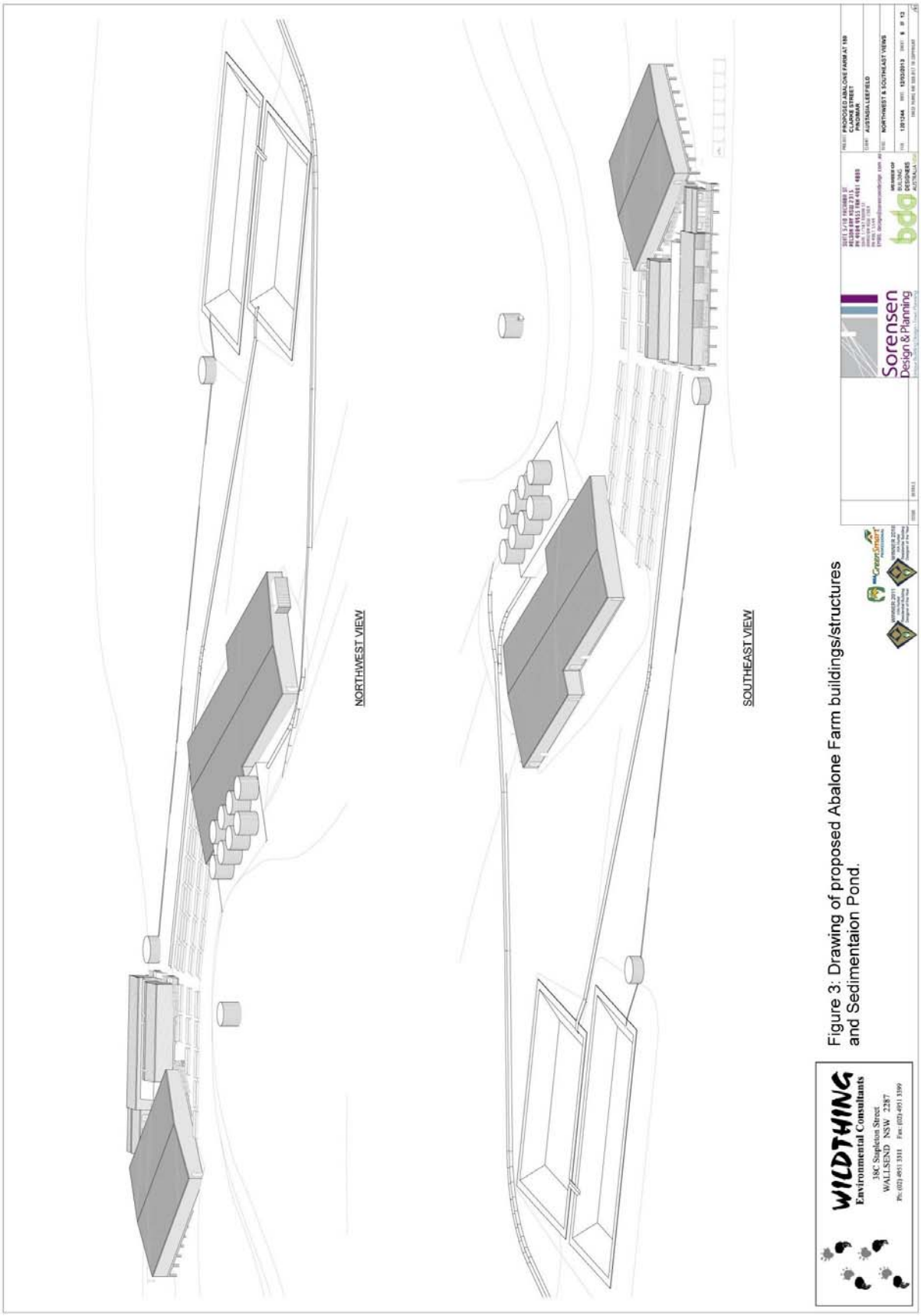


Figure 3: Drawing of proposed Abalone Farm buildings/structures and Sedimentaion Pond.

Table 1: General Construction Methodology – Placement of Intake/Outtake Pipes.

Pipe Location/Segment	Proposed Pipe Treatment	General Placement Methodology
Within farm precinct.	Laid on ground surface	Pipes will be positioned directly on the ground, adjacent to each other, except where they will be partially buried between the settlement Ponds and the lower access road.
Intersection with internal access roads.	Buried under roads, placed within culverts.	A trench leading to and beneath the roads will be excavated (generally as outlined above this Table), and a culvert put in position. This includes the area between the settlement ponds and the lower access road. Pipe spools will be connected through the culverts.
Lower access road to Pumphouse.	Raised above ground on low supports (to avoid impacts on terrestrial fauna mobility).	Pipes will be placed directly on raised concrete supports (at least 200mm high), positioned at regular intervals. Pipes will be positioned around trees and other obstacles. A shallow trench will be excavated adjacent to the Pumphouse to allow a partially-below ground connection to the Pumphouse.
Pumphouse to Indian Spring Low Tide mark.	Buried underground (to avoid visual amenity and access impacts).	Excavations within terrestrial areas will be generally as outlined above this Table. Pipes will be positioned directly adjacent to each other within the trench. Excavations within intertidal areas will begin at the low tide mark and progress towards the shoreline. Concrete weights will be attached to the bottom of each pipe spool (for ballast) via 'Band-It' straps and buckles. Pipe spools will be prepared prior to the commencement of trenching in order to minimise trenching time. All works will occur at low tide. As the placement of pipes within the intertidal area is likely to take more than 1 tide cycle, emplaced pipe spools will be sealed and fitted with inlets to allow the pipes to fill with water as the tide rises (to avoid the floatation of the pipes). Highly visible hardwood marker posts would be driven into the sediment to temporarily mark the position of the next excavation. Note that appropriate Acid Sulphate Soil management procedures will be implemented, as well as the transplantation of mangrove seedlings and appropriate seagrasses.
Indian Spring Low Tide mark to pipe terminus (intake/ outtake)	Raised above seabed on low supports (to avoid seagrass impacts).	All required pipe spools would be joined by butt fusion (on land) before placement. Each end of the pipeline will be capped to create a floating pontoon, allowing the floating of pipes into position with the aid of a work boat. Once in position, low concrete supports will be attached sequentially to each spool via Band-It straps. The pipes would then be strategically flooded and allowed to gently sink to the seabed, maintaining anchorage at both ends. SCUBA divers will be in position to ensure pipe footings are positioned without undue impacts on seagrasses adjacent to the pipeline route. Once pipelines are fixed in position, underwater technicians will fix appropriate inlet structures with screens to the Intake.

Bushfire Asset Protection Zones

A Bushfire Assessment has been completed for the proposal (Australian Bushfire Protection Planners Pty Limited, 2013) giving a number of protection measures that are required to be implemented to mitigate the potential of bushfire threat. The report recommends the provision of a suitable "defendable space" between the bushfire hazard and the proposed buildings. A distance of 20m wide

defendable space is recommended to the north, east and south of the building precinct. A 30m wide defendable space is recommended to the west and north-west of the building precinct. Approximately 1ha of open forest would be required to be modified to fulfil the recommendations.

Management of the Defendable Space within the development shall comply with the following minimum standards:

- Maintain a clear area of low cut lawn or pavement adjacent to the buildings; utilise non-flammable materials such as Scoria, pebbles and recycled crushed bricks as ground cover to landscaped areas in close proximity to buildings;
- Keep areas under shrubs and trees raked and clear of combustible fuels;
- Trees and shrubs should be maintained in such a manner that tree canopies are separated by 2 metres and understorey vegetation is not continuous [retained as clumps];
- Tree crowns shall not over-hang buildings and shall be maintained to provide a minimum clearance of 5 metres between the buildings and
- Trees are under-pruned to provide a minimum 2 metre clearance between the ground and the lower limbs of the tree;
- Accumulated ground fuels (grasses, leaves & twigs) shall be regularly managed to maintain a maximum fuel loading of 3 – 5 tonnes/hectare.

The existing tracks to the proposed Abalone Farm shall be upgraded to provide a minimum formed width of 4m, within a cleared corridor of 6m wide x 4m high. The road surface and bridge across Pig Station Creek shall be designed and constructed to carry a heavy rigid heavy of 15 tonne GVM. Existing fire trails within the development site shall be maintained to a width of 4m within a 6m width x 4m high corridor kept clear of grasses and shrubs. Passing bays shall be provided at 200m intervals or at strategic locations which permit fire appliances to pass safely [i.e. blind corners]. Access gates shall be minimum 3.6 metre clear width.

Alternate Emergency Egress

In order to address the requirement for an alternate emergency egress from the development precinct it is proposed that a boardwalk across Pig Station Creek to the western terminus of Cambage Street be constructed. The boardwalk will traverse saltmarsh and mangrove vegetation a short distance to the west of an area identified as SEPP 14 wetlands under State Environmental Planning Policy No. 14 – Coastal Wetlands (Wetland No. 757a)(Figure 2). The boardwalk is to be positioned roughly in line with the existing electricity wire and will not be required to be positioned within the area of SEPP 14 Wetland. This route had been previously disturbed with evidence of past vehicular activity and would not require the removal of any mature mangroves. The structure would be 2m in width and similar to the boardwalk that connects the villages of North and South Pindimar that was completed in 2004. The remainder of the egress which links up with the formed Cambage Street will cross through

approximately 110 metres of Wetland No. 757a. This section of egress which would not require any additional modification consists of a vehicle track previously built up above the high water mark by outside fill.

2.0 SCOPE OF THE STUDY

This study was designed to address any likely flora and fauna issues of significance occurring upon the study area. This was achieved by appraisal of the vegetation assemblage and structural formation, and identification of representative plant species of the various structural layers. Potential habitat offered by the vegetation present was also assessed. The possibility of this site being significant for any Schedule 1 and 2 (endangered and vulnerable) flora, fauna and ecological communities was paramount in the assessment process. Appraisal has been confined to the site and its immediate surroundings in the Section 5A assessment.

2.1 LEGISLATIVE REQUIREMENTS

This Statement of Effect on Threatened Flora and Fauna report has been structured upon the guidelines laid down in Section 5A of the Environmental Planning and Assessment Act (1979), and the Threatened Species Conservation Act (1995), which requires consideration of the impact of the proposed development upon any Schedule 1 and 2 (endangered or vulnerable) species and ecological communities expected or found on the site. Endangered and vulnerable species are collectively referred to as 'threatened' species in this report.

Also considered in this report was the Commonwealth Environment Protection and Biodiversity Conservation Act (1999), and SEPP 44 – 'Koala Habitat Protection'. An assessment of the proposal under the Fisheries Management Act has been undertaken by Bio-analysis Pty Ltd (BIO-ANALYSIS 2013).

Fieldwork undertaken by Wildthing Environmental Consultants was carried out under the following NPWS Scientific Investigation Licence SL100345 and under Animal Care and Ethics Approval: Animal Research Authority Issue by the Director General of NSW Agriculture (File No. 08 – 361) for the Fauna Survey for Biodiversity and Impact Assessment.

3.0 INITIAL ASSESSMENT

The flora and fauna within the study area and adjacent land has been subject to a number of previous ecological investigations (Table 2). These past studies are considered to be the initial assessment.

Table 2: Previous Environmental Studies undertaken within site and adjacent lands.

Environmental Consultant	Area Surveyed	Survey/Study Type
Wildthing Environmental Consultants (2008a)	Updated vegetation mapping Lot 2 DP 1014683	Vegetation mapping including flora survey plots.
Wildthing Environmental Consultants (2008b)	Small area on the boundary of both Lot 1 & 2 DP 1014683	Targeted Flora & Fauna Survey. Targeted Flora searches
Wildthing Environmental Consultants (2002).	Approximately 5ha of the southern portion of Lot 2 DP 1014683	Targeted Flora & Fauna Survey Targeted Flora & Fauna searches including fauna trapping.
Wildthing Environmental Consultants (2001).	Environmental Impact Statement for a proposed pedestrian boardwalk across Duckhole Creek Pindimar NSW. Pindimar Bundabah Community Association.	EIS
National Parks and Wildlife Service (2011).	Lot 3 DP 528723 Neighbouring property to east of study area.	Survey for Conservation Agreement between the Minister Administering the New South Wales National Parks and Wildlife Act (1974) for Tallowfield.

4.0 METHODOLOGY

4.1 VEGETATION APPRAISAL METHODOLOGY

General Flora Survey

The initial determination of the basic vegetation community boundaries was undertaken through the review of an orthophoto covering the site. Following this, a detailed ground survey was conducted, in accord with the Department of Environment and Conservation's (NSW) Threatened Biodiversity Survey and Assessment Guidelines – Working Draft (Department of Environment and Conservation, 2004). This involved 12 vegetation transects of 100m and 13 vegetation quadrats 20×20m in area. During the transect-based surveys all species observed within 2m either side of the centre line were recorded as well as the physical attributes of the surrounding area. Within the survey plot the height of each primary structural layer and relative cover abundance of the species within was recorded, along with location, elevation, slope, aspect and general soil type.

In addition to the above, flora searches for threatened species were undertaken across the site in the manner described by Cropper (1993) as the 'Random Meander Technique'. This involved walking in a random manner throughout the entire study site, visiting the full range of potential habitats and checking every plant species seen. A list of all flora species identified on site has been provided in Appendix B and the results of transect and plot surveys can be seen in Appendix C.

Targeted Flora Surveys

Seasonal surveys during known flowering periods were undertaken to maximise detection of targeted threatened cryptic plant species such as *Tetratheca juncea* (Black-eyed Susan), *Cryptostylis hunteriana* (Leafless Tongue-orchid), *Rhizanthella slateri* (Easter Underground Orchid), *Corybas dowlingii* (Red Helmet Orchid), *Diuris arenaria* (Tomaree Doubletail) and *Diuris praecox* (Newcastle Doubletail). The flowering periods for each of these cryptic species are shown in Table 3.

Table 3: Flowering periods of targeted threatened cryptic flora species.

SPECIES	Flowering Period months of the year											
	J	F	M	A	M	J	J	A	S	O	N	D
Corybas dowlingii												
Cryptostylis hunteriana												
Diuris arenaria												
Diuris praecox												
Rhizanthella slateri												
Tetratheca juncea												

Remaining threatened flora species were also surveyed opportunistically during incidental and targeted and surveys within the study area.

4.2 HABITAT APPRAISAL METHODOLOGY

Habitat may be defined as the physical and biological environment required for the survival of a specific population of a species. In modern usage habitat has also come to be regarded as an association of landform and plant life, which provides sustenance and shelter for a particular fauna assemblage.

The methodology of the habitat appraisal used the vegetation community data combined, where relevant, with geomorphological features and the occurrence of particular plant species or forms (i.e. tree hollows) to provide a basis for a subjective habitat assessment aimed at placing the ecological status of the site within a local perspective.

4.2.1 GENERAL HABITAT FOR NATIVE SPECIES

From the vegetation appraisal and a general inspection of the study area and surrounds, a subjective assessment of the general habitat value of this site was made. Considered in this assessment were:

- occurrence of that habitat type in the general vicinity;
- degree of disturbance and degradation;
- area occupied by that habitat on site;
- continuity with similar habitat adjacent to the site, or connection with similar habitat off site by way of corridors; and
- structural and floral diversity.

4.2.2 HABITAT FOR SIGNIFICANT SPECIES

This study area was evaluated as potential habitat for each of the threatened species reported on the Office of Environment and Heritage (OEH), the Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) and Sydney Botanic Gardens databases from within 10km of the site. This evaluation was based on home-range, feeding, roosting, breeding, movement patterns and corridor requirements for fauna and hydrology, soil types, aspect and structural formation for flora species.

4.3 FAUNA APPRAISAL METHODOLOGY

The fauna survey was initiated with the production of an Expected Fauna Species List and an assessment of the potential use of the study area by any threatened species identified in the OEH and SEWPaC database searches. Subsequently, the confirmation and supplementation of the Expected Fauna Species List, by way of on-site observation, trapping and recording, was carried out as described below. The survey was carried out using the Department of Environment and Conservation's (NSW) Threatened Biodiversity Survey and Assessment Guidelines – Working Draft (Department of Environment and Conservation, 2004).

4.3.1 SMALL TERRESTRIAL MAMMAL TRAPPING

Terrestrial mammal trapping was undertaken using 50 Elliott Type A traps (8x10x33cm) within the study area. The traps were left in place for four consecutive nights giving a total of 200 small terrestrial trap nights. The traps were hidden in thick grass, under shrubs or and around trees and were camouflaged with vegetation where the ground cover was sparse. The baits used for the traps were a mixture of rolled oats and honey, Good-O's (dry dog food) and peanut butter. The traps were checked early each morning and, where necessary, reset and rebaited. The location of the small terrestrial traps is shown in Figure 4.

4.3.2 MEDIUM TERRESTRIAL MAMMAL TRAPPING

Medium terrestrial mammal trapping was undertaken using 25 cage traps (60×35×40cm) within the study area. The traps were left in place for four consecutive nights giving a total of 100 terrestrial trap nights. The traps were hidden in thick grass, under shrubs or near fallen logs and were camouflaged with vegetation where the ground cover was sparse. The bait used for the traps were raw chicken wings. The traps were checked early each morning and where necessary, reset and rebaited. The location of the Medium Terrestrial Mammal trap survey is shown in Figure 4.

Figure 4: Fauna trap locations.

4.3.3 ARBOREAL TERRESTRIAL MAMMAL TRAPPING

Arboreal mammal trapping was undertaken using 25 Elliott Type B traps (15 × 15 × 46cm) within the study area to determine the presence of arboreal mammals, particularly *Phascogale tapoatafa* (Brush-tailed Phascogale), *Petaurus australis* (Yellow-bellied Glider) and *Petaurus norfolcensis* (Squirrel Glider) which are known to occur in similar habitats in the local area (OEH, 2012). The traps were left in place for four consecutive nights giving a total of 100 terrestrial trap nights.

The traps were placed around 3 - 4 metres above the ground on platforms mounted on tree trunks. Trees, which were targeted, contained hollows, were flowering or had scratches present on the boles. The baits used consisted of a rolled oats and honey mixture, peanut butter and an aniseed ring (sugar coated sweet). The traps were sprayed with honey mixed in water before being placed in the trees to attract fauna and mask the smell of humans. The tree trunks were also sprayed with this mixture each day. In all cases the traps were checked early each morning and, where necessary, reset and rebaited. The position of the arboreal traps within the study area can be seen in Figure 4.

4.3.4 HARP TRAPPING

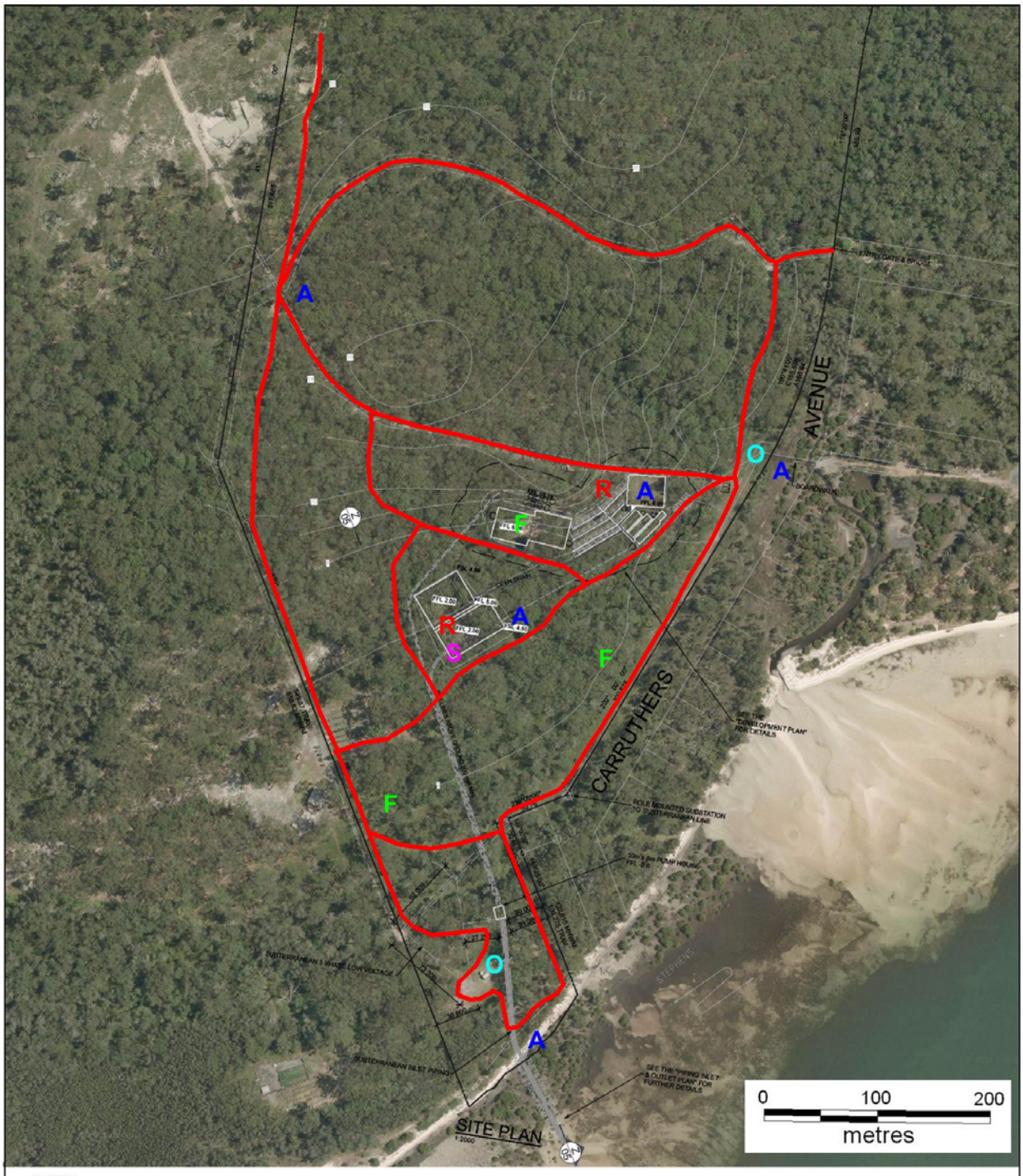
Two monofilament harp traps were set for four consecutive nights giving a total of 8 harp trap nights within the study area. The harp trapping was undertaken in order to sample the use of the site by sub-canopy microchiropteran bat species, such as *Mormopterus norfolkensis* (East Coast Freetail Bat) and *Miniopterus australis* (Little Bentwing-bat). The traps were positioned in a potential flyway and were checked early each morning. The location of the harp trap is shown in Figure 4.

4.3.5 MICROCHIROPTERAN BAT CALL SURVEY

Bat echo-location calls were taped using an Anabat detector in areas which were considered likely to be used by bats. These positions were selected to sample potential hunting sites for bats, including flyways, clearings and ecotones. Echolocation surveys used a combination of set point and hand held mobile surveys over the entire site. Surveys were conducted for 120 minutes over three nights giving a total of 6 hours of bat call surveys. The transformed calls were analysed using an Anabat V Zero Crossing Analysis Interface feeding into a computer and identified by comparison with sample bat calls. The bat calls recorded by Wildthing Environmental Consultants were analysed in-house by Mungo Worth. The location of the bat call survey is shown in Figure 5.

4.3.6 AMPHIBIAN SURVEY

The amphibian survey included a combination of diurnal and nocturnal census methods. Diurnal searches were undertaken for two half-person hour periods. Systematic searches involved searches within appropriate habitat for basking or sheltering individuals. Any appropriate cover such as logs were turned over for resting individuals. Nocturnal surveys were undertaken for a two person hours period. The surveys were undertaken in suitable habitat and involved listening for the characteristic



KEY

Diurnal Surveys

- A Avifauna Survey
- R Reptile Survey
- F Amphibian Survey

Nocturnal Surveys

- Spotlighting/Bat Call Survey Route
- F Amphibian Survey
- S Stag Watching Survey
- O Owl/Mammal Call Playback

Aerial Photo - Land and Property Information 2013.

WILDTHING
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Figure 5: Location of targeted fauna surveys.

call of male frogs. Playback of frog calls was undertaken in an attempt to elicit a response from threatened amphibian species in particular *Litoria aurea* (Green and Golden Bell Frog) and *Crinia tinnula* (Wallum Froglet). The location of the frog census conducted is shown in Figure 5. Frog searches were also augmented by recording any frog calls heard within the site. Recorded calls were identified by auditory comparison with commercially available frog call recordings.

4.3.7 REPTILE SURVEY

Searches for reptiles involved a combination of diurnal and nocturnal searches. Diurnal searches for reptiles involved searching in likely habitat (i.e. leaf litter, dead logs and long grass) during the morning and afternoon survey period. Nocturnal searches were conducted for reptile species active at night such as geckos and some species of snakes and involved searching in likely habitats with the aid of a spotlight. The location of the reptile surveys is shown in Figure 5.

4.3.8 DIURNAL AVIFAUNA SURVEY

The diurnal avifauna survey involved transects targeting potential habitat within the site for species such as *Daphoenositta chrysoptera* (Varied Sittella). Surveys were conducted at peak activity periods (i.e. dawn and dusk) for three periods for half an hour. A total of 3.0 hours of targeted diurnal bird surveys were undertaken. Incidental observations and secondary indications (i.e. distinctive feathers and nests) of avifauna were also recorded. The location of the diurnal avifauna surveys is shown in Figure 5.

4.3.9 NOCTURNAL AVIFAUNA AND MAMMAL CALLPLAYBACK SURVEY

During the nocturnal avifauna and mammal survey pre-recorded calls of *Ninox connivens* (Barking Owl), *Ninox strenua* (Powerful Owl), *Tyto novaehollandiae* (Masked Owl), *Tyto tenebricosa* (Sooty Owl), *Tyto capensis* (Grass Owl), *Petaurus australis* (Yellow-bellied Glider), *Petaurus norfolcensis* (Squirrel Glider) and *Phascolarctos cinereus* (Koala) were broadcast through an amplification system designed to project the sound for at least 1km under still night conditions. An initial listening period of 10 minutes was undertaken, followed by 5 minutes of calls (repeated in four different directions). A period of two minutes of quiet listening was then employed after each 5-minute bracket of calls. At the conclusion of the call playback survey, spotlighting was carried out in the vicinity of the call playback site. The locations of the call playback are shown in Figure 5.

4.3.10 SPOTLIGHTING SURVEY

Spotlighting was undertaken on foot using 100watt hand-held spotlights. The spotlighting undertaken was completed by two persons and involved walking at a slow pace around the study area and stopping every 2 minutes, allowing the observer to hear movements of animals. A total of 8 person hours of spotlighting was conducted during the survey. The spotlight routes are shown in Figure 5.

4.3.11 STAG WATCHING

The Stag watching involved watching significant hollow-bearing trees, 20 minutes prior to sunset and continuing until 20 minutes after sunset. The required listening period and stag watching were undertaken concurrently. The location of the stag watching survey is shown in Figure 4.

4.4 DATE, TIMES, ACTIVITIES & WEATHER CONDITIONS

A summary of the time spent on site during fieldwork and the prevailing weather conditions at the time is contained below in Table 4.

Table 4: Survey effort, dates, times and weather conditions

DATE	TIME (24HR)	SURVEY EFFORT (EXPRESSED IN PERSON HOURS)	ACTIVITY	WEATHER
Monday 18/10/10	1000 - 1030 1030 – 1430	0.5 5.0	General Site inspection Trap deployment Incidental observations	0/8 cloud, calm, 21°C.
Tuesday 19/10/10	0600 – 0730 0700 – 0730 0730 - 0800	1.5 1.0 (Two persons) 1.0 (Two persons)	Checking traps. Incidental observations. Avifauna survey Diurnal Reptile Survey	0/8 cloud, calm, 14°C.
Wednesday 20/10/10	0600 – 0730	1.5	Checking traps. Incidental observations.	1/8 cloud, calm, 19°C.
Thursday 21/10/10	0600 – 0800 0730 – 0800 0800 - 0830	2.0 1.0 (Two persons) 1.0 (Two persons)	Checking traps. Incidental observations. Avifauna survey Diurnal Reptile Survey	0/8 very calm, 14°C.
Friday 22/10/10	0600 – 0930	3.5	Checking Traps, Trap retrieval & Incidental observations.	0/8 cloud, calm, 13°C.

DATE	TIME (24HR)	SURVEY EFFORT (EXPRESSED IN PERSON HOURS)	ACTIVITY	WEATHER
Thursday 11/11/10	1430 - 1700	2.5	Vegetation surveys	0/8 Cloud, calm, humid, 28°C.
	1730 - 1830	1.0 (Two persons)	Diurnal Amphibian Survey	
	1830 - 1930	2.0 (Two persons)	Avifauna survey	
	1945 - 2130		Bat Call Survey	
	1945 – 2130	2.75	Spotlighting	
	2030 – 2100	1.0	Amphibian Survey & Call Playback	0/8 cloud, calm, humid, 25°C, Moon 3/8
	2100 - 2130	0.5	Owl, Bush Stone-curlew & Mammal Call Playback	
Thursday 18/11/10	1500 – 1800	3.0	Habitat and Koala tree survey	8/8 cloud, calm, 24°C.
	1830 - 1900	0.5	Avifauna survey	
	1945 - 2145	2.0	Bat Call Survey	4/8 cloud, calm, 21°C, 6/8 Moon behind thin layer of cloud.
	1945 – 2145	2.0	Spotlighting	
	2030 – 2100	1.0 (Two persons)	Amphibian Survey & Call Playback	
	2100 - 2130	0.5	Owl, Bush Stone-curlew & Mammal Call Playback	
Wednesday 24/11/10	0900 – 1600	7.0 two persons	Habitat, Orchid, Koala tree survey & incidental observations. Searches for *Cryptostylis hunteriana*.	0/8 cloud, NE breeze, 27°C.
Thursday 25/02/10	0900 – 1600	7.0 two persons	Habitat, Koala tree survey & incidental observations Additional vegetation transects and plots.	2/8 cloud, calm, 27°C.

DATE	TIME (24HR)	SURVEY EFFORT (EXPRESSED IN PERSON HOURS)	ACTIVITY	WEATHER
Tuesday 15/03/11	0830 - 1200	3.5	Additional habitat tree survey. Survey of Mangrove and Saltmarsh within secondary egress.	7/8 cloud, 28°C.
Wednesday 03/08/11	0900 - 1230	3.0 two persons	Meeting on site. Walked through proposal. Searches for *Corybas dowlingii.* Incidental observations.	3/8 cloud, calm, 18°C.
23/08/11 Tuesday	0930 - 1330	4.0 two persons	Targeted searches for: • *Corybas dowlingii* • *Diuris praecox* • *Diuris arenaria* • *Tetratheca juncea* Incidental observations.	2/8 cloud, calm, 18°C. Some showers overnight.
Thursday 22/03/12	0900 - 1530	5.5 one person	Meeting on site. Marking trees that are required to be removed within development area and Asset Protection Zone's. Incidental observations.	6/8 cloud, calm, 22°C 82% humidity.
Tuesday 03/07/12	1230 - 1300	1.0 one person	General inspection of where pump house is to be located and incidental observations. Incidental observations.	3/8 cloud, calm, 15°C 63% humidity.

4.5 SIGNIFICANT SPECIES, POPULATIONS AND ECOLOGICAL COMMUNITIES

The following threatened species listed in Table 5 have been recorded on the Atlas of NSW Wildlife (OEH, 2012), SEWPaC and Sydney Botanic Gardens Databases within 10km of the study area. The results of the SEWPaC data search is shown in Appendix F.

Table 5: Threatened species, endangered populations and ecological communities considered.

Scientific Name	Common Name	TSC Act 1995	EPBC Act 1999
Flora			
Corybas dowlingii	Red Helmet Orchid	E	
Cryptostylis hunteriana	Leafless Tongue Orchid	V	V
Diuris arenaria	Sand Doubletail	V	
Diuris praecox	Newcastle Doubletail	V	V
Genoplesium baueri	Bauer's Midge Orchid	V	
Phaius australis	Lesser Swamp Orchid	E	E
Rhizanthella slateri	Eastern Underground Orchid	E	E
Grevillea parviflora ssp. *parviflora*	Small-flowered Grevillea	V	V
Allocasuarina defungens	Dwarf Heath Casuarina	E	E
Angophora inopina	Charmhaven Apple	V	V
Callistemon linearifolius	Netted Bottle Brush	V	
Eucalyptus parramattensis ssp. *decadens*	Drooping Red Gum	V	V
Melaleuca biconvexa	Biconvex Paperbark	V	
Melaleuca groveana	Grove's Paperbark	V	
Syzygium paniculatum	Magenta Lillypilly	E	V
Tetratheca juncea	Black-eyed Susan	V	V
Prostanthera densa	Villous Mintbush	V	
Asperula asthenes	Trailing Woodruff	V	
Galium australe	Tangled Bedstraw	E	
Lindernia alsinoides	Noah's False Chickweed	E	
Chamaesyce psammogeton	Sand Spurge	E	
Senecio spathulatus	Coastal Fireweed	E	
Streblus pendulinus	Siah's Backbone		E
Maundia triglochinoides		V	
Cynanchum elegans	White-flowered Wax Plant	E	E
Persicaria elatior	Tall Knot-weed	V	V
Invertebrates			
Petalura gigantea	Giant Dragonfly	E	
Amphibians			
Crinia tinnula	Wallum Froglet	V	
Litoria aurea	Green and Golden Bell Frog	E	V
Litoria brevipalmata	Green-thighed Frog	V	
Mixophyes balbus	Stuttering Frog	V	V
Mixophyes iteratus	Giant Barred Frog	E	E
Reptiles			
Caretta caretta	Loggerhead Turtle	V	M
Chelonia mydas	Green Turtle	V	M
Dermochelys coriacea	Leatherback Turtle	E	E
Eretmochelys imbricata	Hawksbill Turtle		V
Natator depressus	Flatback Turtle		V
Hoplocephalus bitorquatus	Pale-headed Snake	V	
Hoplocephalus stephensii	Stephen's Banded Snake	V	
Birds			
Macronectes giganteus	Southern Giant Petrel	E	E & M
Macronectes halli	Northern Giant Petrel	E	M
Pterodroma leucoptera leucoptera	Gould's Petrel	E	
Pterodroma neglecta	Kermadec Petrel	V	

Scientific Name	Common Name	TSC Act 1995	EPBC Act 1999
Fregetta grallaria grallaria	White-bellied Storm Petrel	V	V
Pterodroma nigripennis	Black-winged Petrel	V	
Pterodroma solandri	Providence Petrel	V	
Calonectris leucomelas	Streaked Shearwater		M
Puffinus carneipes	Flesh-footed Shearwater	V	
Puffinus tenuirostris	Short-tailed Shearwater		M
Limicola falcinellus	Broad-billed Sandpiper	V	
Limosa lapponica	Bar-tailed Godwit		M
Limosa limosa	Black-tailed Godwit	V	M
Arenaria interpres	Ruddy Turnstone		M
Xenus cinereus	Terek Sandpiper	V	M
Heteroscelus brevipes	Grey-tailed Tattler		M
Sterna albifrons	Little Tern	E	M
Onychopriom fuscata	Sooty Tern	V	
Actitis hypoleucos	Common Sandpiper		M
Calidris acuminata	Sharp-tailed Sandpiper		M
Calidris canutus	Red Knot		M
Calidris ferruginea	Curlew Sandpiper	E	M
Calidris ruficollis	Red-necked Stint		M
Calidris tenuirostris	Great Knot	V	M
Tringa stagnatilis	Marsh Sandpiper		M
Numenius madagascariensis	Eastern Curlew		M
Numenius minutus	Little Curlew		M
Numenius phaeopus	Whimbrel		M
Charadrius bicinctus	Double-banded Plover		M
Charadrius leschenaultii	Greater Sand-plover	V	
Charadrius mongolus	Lesser Sand-plover	V	M
Pluvialis fulva	Pacific Golden Plover		M
Pluvialis squatarola	Grey Plover		M
Diomedea antipodensis	Antipodeam Albatross	V	V & M
Diomedea gibsoni	Gibson's Albatross	V	V & M
Thalassarche bulleri	Buller's Albatross		V & M
Thalassarche cauta cauta	Shy Albatross	V	V & M
Thalassarche cauta salvini	Salvin's Albatross		V & M
Thalassarche cauta steadi	White-capped Albatross	V	V & M
Thalassarche melanophris impavida	Campbell Albatross		V & M
Haematopus fuliginosus	Sooty Oystercatcher	V	
Haematopus longirostris	Pied Oystercatcher	E	
Esacus neglectus	Beach Stone-curlew	E4A	
Gallinago hardwickii	Latham's Snipe		M
Rostratula benghalensis australis	Australian Painted Snipe	E	V & M
Botaurus poiciloptilus	Australian Bittern	E	E
Ixobrychus flavicollis	Black Bittern	V	
Ardea alba	Great Egret		M
Ardea ibis	Cattle Egret		M
Ephippiorhynchus asiaticus	Black-necked Stork	E	
Irediparra gallinacea	Comb-crested Jacana	V	
Turnix maculosa	Red-backed Button-quail	V	
Burhinus grallarius	Bush Stone-curlew	E	
Ptilinopus magnificus	Wompoo Fruit-Dove	V	
Ptilinopus regina	Rose-crowned Fruit-Dove	V	
Ptilinopus superbus	Superb Fruit-Dove	V	
Lathamus discolor	Swift Parrot	E	E
Neophema pulchella	Turquoise Parrot	V	
Glossopsitta pusilla	Little Lorikeet	V	
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	

Scientific Name	Common Name	TSC Act 1995	EPBC Act 1999
Callocephalon fimbriatum	Gang Gang Cockatoo	V	
Apus pacificus	Fork-tailed Swift		M
Hirundapus caudacutus	White-throated Needletail		M
Monarcha melanopsis	Black-faced Monarch		M
Monarcha trivirgatus	Spectacled Monarch		M
Merops ornatus	Rainbow Bee-eater		M
Rhipidura rufifrons	Rufous Fantail		M
Epthianura albifrons	White-fronted Chat	V	
Petroica boodang	Scarlet Robin	V	
Petroica phoenicea	Flame Robin	V	
Climacteris picumnus victoriae	Brown Treecreeper	V	
Anthochaera phrygia	Regent Honeyeater	E4A	E & M
Daphoenositta chrysoptera	Varied Sittella	V	
Melithreptus gularis gularis	Black-chinned Honeyeater	V	
Pomatostomus temporalis temporalis	Grey-crowned Babbler	V	
Dasyornis brachypterus	Eastern Bristlebird	E1	E
Circus assimilis	Spotted Harrier	V	
Pandion cristatus	Eastern Osprey	V	
Lophoictinia isura	Square-tailed Kite	V	
Erythrotriorchis radiatus	Red Goshawk	E4A	V
Hieraaetus morphnoides	Little Eagle	V	
Haliaeetus leucogaster	White-bellied Sea Eagle		M
Ninox connivens	Barking Owl	V	
Ninox strenua	Powerful Owl	V	
Tyto longimembris	Eastern Grass Owl	V	
Tyto novaehollandiae	Masked Owl	V	
Tyto tenebricosa	Sooty Owl	V	
Mammals			
Planigale maculata	Common Planigale	V	
Dasyurus maculatus maculatus	Tiger Quoll	V	V
Phascogale tapoatafa	Brush-tailed Phascogale	V	
Phascolarctos cinereus	Koala	V	
Macropus parma	Parma Wallaby	V	
Petrogale penicillata	Brush-tailed Rock-wallaby	E1	V
Potorous tridactylus tridactylus SE Mainland	Long-nosed Potoroo	V	V
Aepyprymnus rufescens	Rufous Bettong	E1	
Cercartetus nanus	Eastern Pygmy-possum	V	
Petaurus australis	Yellow-bellied Glider	V	
Petaurus norfolcensis	Squirrel Glider	V	
Pseudomys gracilicaudatus	Eastern Chestnut Mouse	V	
Psuedomys novaehollandiae	New Holland Mouse		V
Pteropus poliocephalus	Grey-headed Flying-fox	V	V
Syconycteris australis	Common Blossom-bat	V	
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	
Mormopterus norfolkensis	Eastern Freetail-bat	V	
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	
Miniopterus australis	Little Bentwing-bat	V	
Miniopterus schreibersii oceanensis	Large Bentwing-bat	V	
Kerivoula papuensis	Golden-tipped Bat	V	
Myotis macropus	Southern Myotis	V	
Scoteanax rueppellii	Greater Broad-nosed Bat	V	
Chalinolobus dwyeri	Large Pied Bat	V	V
Vespadelus troughtoni	Eastern Cave Bat	V	
Endangered Populations			
Dromaius novaehollandiae (Emu) – population in the NSW North Coast Bioregion and Port Stephens LGA.			
Hawks Nest and Tea Gardens Endangered Koala (*Phascolarctos cinereus*) Population			

Scientific Name	Common Name	TSC Act 1995	EPBC Act 1999
Endangered Ecological Communities			
Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions.			
Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner Bioregions.			
River Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions.			
Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions.			
Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions.			

E=Endangered Species **V=Vulnerable Species** **E4A=Critically Endangered** **M=Migratory Species**

5.0 RESULTS

5.1 FLORA ASSEMBLAGES

The study area was predominantly undeveloped and was covered in native vegetation comprising 14 community types. The delineation of these vegetation communities was based on structure and flora species composition. Ten of these communities were mapped within the subject site (Lot 2) with a further four delineated outside the subject site within the far south of the study area.

Vegetation communities present within Lot 2:

- Swamp Mahogany – Paperbark Forest (EEC)(1)
- Smooth-barked Apple Heath (2)
- Coastal Sand Blackbutt Open Forest (3)
- Ironbark/Tallowwood Open Forest (4)
- Grey Gum/Tallowwood/Ironbark Open Forest (5)
- Spotted Gum/Ironbark Forest (6)
- Smooth-barked Apple/Stringybark Open Forest (7)
- Moist Riparian Forest (8)
- Cleared Modified Vegetation (9)
- Aquatic Vegetation – Dam (10)

Vegetation communities present outside Lot 2 within the far south and west of the study area:

- Mangrove (11)
- Sandy Foreshore vegetation (12)
- Saltmarsh (EEC)(13)
- Swamp Oak Forest (EEC)(14)

A description of the 14 vegetation communities is shown below. The vegetation within the study area is shown in Figure 6. The results and locations of the quadrat and transect based surveys can be seen in Appendix C.

*Note on Vegetation Community Distribution Map. A map of vegetation of any area seeks to describe the distribution of the plant species in that area by defining a number of vegetation units (assemblages or communities), which are relatively internally homogenous. Whilst such mapping is a convenient tool, it greatly oversimplifies the real situation. Plants rarely occur in defined communities with distinct boundaries. Accordingly vegetation units used for the accompanying map should be viewed as indicative of their extent rather than being precise edges of communities.

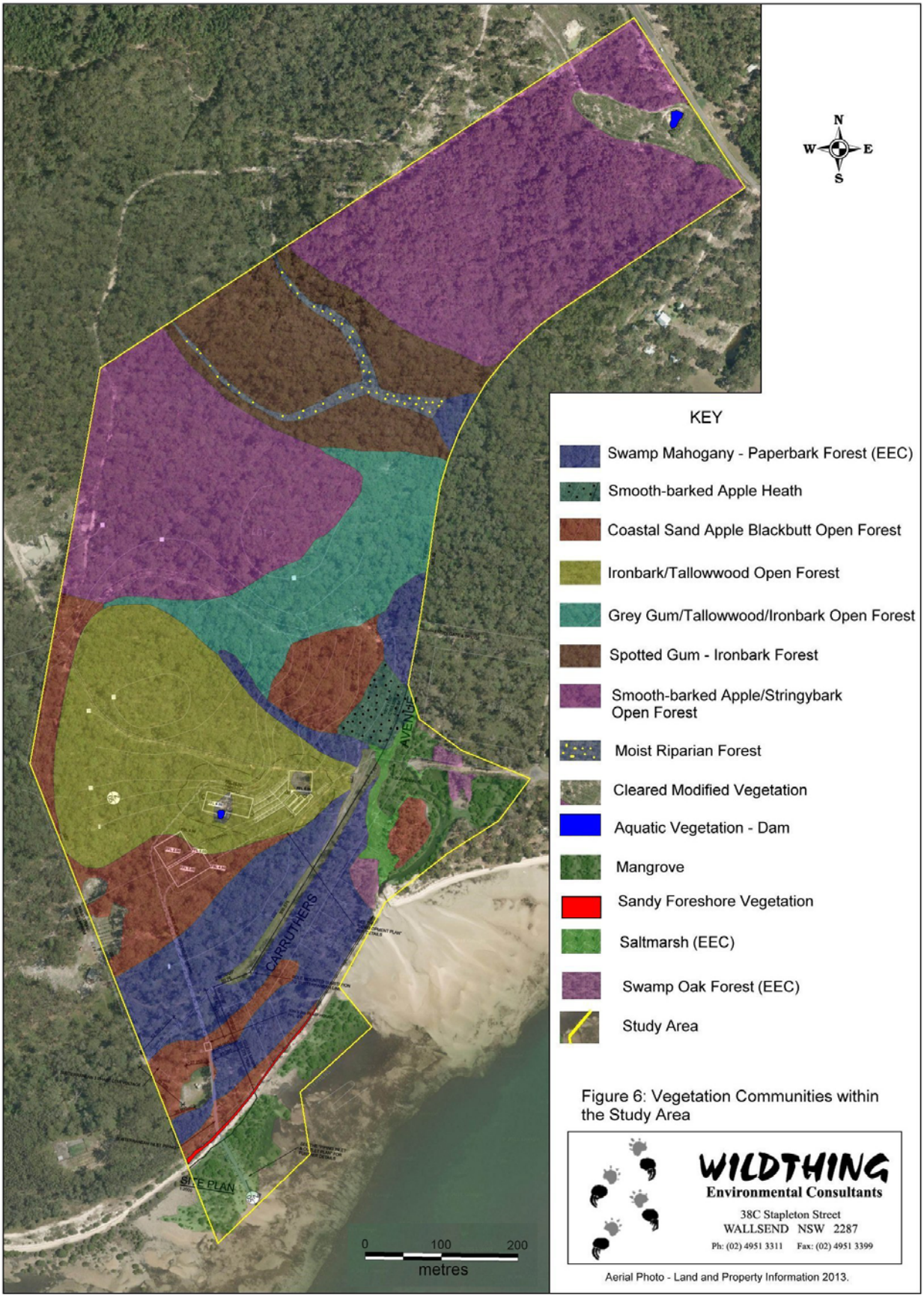

Figure 6: Vegetation Communities within the Study Area

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Aerial Photo - Land and Property Information 2013.

1. Swamp Mahogany – Paperbark Forest

This community occupied approximately 7ha in the south of the study area and was located on the lower lying poorly drained Pleistocene sand sheets and low dunes (Figures 7 & 8). Smaller areas were also found to be present along Pig Station Creek. This community was generally characterised by a canopy of *Eucalyptus robusta* (Swamp Mahogany) and *Melaleuca quinquenervia* (Broad-leaved Paperbark). The shrub and ground layer were generally dominated by fern and sedge species.

Similar Vegetation Types

Biometric ID and Vegetation Type	(405) Swamp Mahogany swamp forest on coastal Lowlands of the North Coast and Northern Sydney Basin.
Great Lakes Council (2003)	Swamp Mahogany/Paperbark (30/31)
NPWS, (2000)	Map Unit 37 Swamp Mahogany – Paperbark Forest

Endangered Ecological Community:

The Swamp Mahogany Paperbark Forest Community was consistent with the Endangered Ecological Community Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions (NPWS, 2001). This Endangered Ecological Community has been further assessed within Section 6 and Appendix A of this report.

Figure 7: Swamp Mahogany - Paperbark Forest within vicinity of proposed inlet/outlet pipes.

Figure 8: Swamp Mahogany - Paperbark Forest eastern portion of assemblage.

Structure

Stratum	**Height Range**	**Canopy Cover**
Canopy	15 - 25m	15-45%
Small Tree	10 - 15m	40-85%
Shrub	1.5 – 4m	5-20%
Ground	<1m	5 – 40%

Species Composition

Canopy

Eucalyptus robusta (Swamp Mahogany), *Melaleuca quinquenervia* (Broad-leaved Paperbark), *Livistona australis* (Cabbage Tree Palm), *Casuarina glauca* (Swamp Oak).

Small Tree Layer

Glochidion ferdinandi (Cheese Tree), *Livistona australis* (Cabbage Tree Palm).

Shrub Layer

Acacia longifolia (Sydney Golden Wattle). *Leptospermum polygalifolium* (Tea Tree), *Viminaria juncea* (Sea Spray).

Ground Layer

Pteridium esculentum (Bracken Fern), *Gahnia clarkei* (Sword Grass), *Viola hederacea* (Native Violet), *Baloskion tetraphyllum* ssp. *meiostachyum, Phragmites australis* (Australian Reed).

Climbers

Parsonsia straminea (Common Silkpod), *Geitonoplesium cymosum* (Scrambling Lily).

2. Smooth-barked Apple Heath

This community occupied approximately 0.7ha of the site and was located on the Pleistocene sand sheets in the south-east of the study area (Figures 9 & 10). This community was generally characterised by the canopy species *Angophora costata* (Smooth-barked Apple). *Banksia serrata* (Old Man Banksia) was a common small tree species. The understorey was composed of a mixture of heathy species and those adapted to inundation particularly *Baloskion tetraphyllum* ssp. *meiostachyum*.

Similar Vegetation Types
Great Lakes Council (2003) Smooth-barked Apple (105)

Structure

Stratum	**Height Range**	**Canopy Cover**
Canopy	15 – 20m	15-35%
Small Tree	10 - 15m	5-20%
Shrub	1.5 – 4m	5-20%
Ground	<1m	30 – 70%

Figure 9: Smooth-barked Apple Heath Forest in east of study area.

Figure 10: Smooth-barked Apple Heath Forest in east of study area.

Species Composition

Canopy

Angophora costata (Smooth-barked Apple), *Eucalyptus pilularis* (Blackbutt), *Eucalyptus robusta* (Swamp Mahogany)*, Melaleuca quinquenervia* (Broad-leaved Paperbark).

Small Tree Layer

Banksia serrata (Old Man Banksia). *Endiandra sieberi* (Corkwood).

Shrub Layer

Correa reflexa (Correa), *Acacia longifolia*, *Acacia suaveolens* (Sweet-scented Wattle), *Dodonaea triquetra* (Hop Bush), *Platylobium formosum* (Handsome Flat-pea).

Ground Layer

Baloskion tetraphyllum ssp. *meiostachyum, Lomandra longifolia* (Spiny Mat Rush), *Dianella caerulea* var. *producta* (Blue Flax Lily), *Pomax umbulata* (Pomax), *Gonocarpus tetragynus* (Raspwort), *Glycine clandestina* (Glycine), *Platylobium formosum* (Handsome Flat-pea).

3. Coastal Sand Blackbutt Open Forest

This community occupied approximately 5.8ha of the study area and was located on the well-drained Pleistocene sand sheets and low dunes in the south (Figures 11 & 12). This community was characterised by large specimens of *Eucalyptus pilularis* (Blackbutt).

Similar Vegetation Types

NPWS, (2000)	Map Unit 33 – Coastal Sand Apple – Blackbutt Forest
Biometric ID & Type	(402) Blackbutt – Smooth-barked Apple shrubby open forest on coastal sands of the southern North Coast.

Structure

Stratum	**Height Range**	**Canopy Cover**
Canopy	20 - 35m	20-45%
Small Tree	10 - 20m	5-40%
Shrub	1.5 – 4m	10-30%
Ground	<1m	5 – 40%

Species Composition

Canopy

Eucalyptus pilularis (Blackbutt), *Corymbia gummifera* (Red Bloodwood), *Angophora costata* (Smooth-barked Apple), *Eucalyptus microcorys* (Tallowwood).

Small Tree Layer

Banksia serrata (Old Man Banksia), *Endiandra sieberi* (Corkwood), *Allocasuarina torulosa* (Forest Oak).

Shrub Layer

Leucopogon margarodes, Acacia longifolia (Sydney Golden Wattle), *Breynia oblongifolia* (Breynia), *Dodonaea triquetra* (Common Hop Bush)*, Indigofera australis* (Indigofera), *Monotoca elliptica* (Tree Broom-heath).

Ground Layer

Pteridium esculentum (Bracken Fern), *Themeda triandra* (Kangaroo Grass), *Imperata cylindrica* var. *major* (Blady Grass), *Themeda triandra* (Kangaroo Grass), *Lomandra longifolia* (Spiny Mat Rush), *Calochlaena dubia* (Soft Bracken Fern).

Climbers

Parsonsia straminea (Common Silkpod), *Geitonoplesium cymosum* (Scrambling Lily), *Kennedia rubicunda* (Kennedia).

Figure 11: Coastal Sand Blackbutt Open Forest within study area.

Figure 12: Coastal Sand Blackbutt Open Forest within study area.

4. Ironbark/Tallowwood Open Forest

This community occupied approximately 8.1ha of the study area and was situated on a low hill in the south of the study area. This community was generally characterised by the dominance of *Eucalyptus siderophloia* (Northern Grey Ironbark) and *Eucalyptus microcorys* (Tallowwood)(Figure 13 & 14).

Similar Vegetation Types

Great Lakes Council (2003)	Ironbark (84)
Biometric No. & Type	(417) - Small-fruited Grey Gum - Tallowwood shrubby open forest on coastal foothills of the southern North Coast

Structure

Stratum	**Height Range**	**Canopy Cover**
Canopy	20 - 30m	20-50%
Small Tree	10 - 20m	10-20%
Shrub	1.5 – 4m	5-20%
Ground	<1m	30 – 60%

Figure 13: Ironbark/Tallowwood Open Forest

Figure 14: Ironbark/Tallowwood Open Forest

Species Composition
Canopy
Eucalyptus siderophloia (Northern Grey Ironbark), *Eucalyptus microcorys* (Tallowwood), *Eucalyptus acmenoides* (White Mahogany).

Small Tree Layer
Allocasuarina torulosa (Forest Oak).

Shrub Layer
Persoonia linearis (Narrow-leaved Geebung), *Pittosporum undulatum* (Sweet Pittosporum), *Breynia oblongifolia* (Breynia), *Lantana camara* (Lantana).

Ground Layer
Lomandra longifolia (Spiny Mat Rush), *Dichondra repens* (Kidney Weed), *Goodenia heterophylla, Dianella caerulea* var. *producta* (Blue Flax Lily), *Gahnia aspera*.

5. Grey Gum/Tallowwood/Ironbark Open Forest

This community occupied approximately 4.5ha of the study area and was generally located on sloping ground in the central area of the study area (Figure 15).

Similar Vegetation Types

Biometric No. & Type	(417) Small-fruited Grey Gum - Tallowwood shrubby open forest on coastal foothills of the southern North Coast
Great Lakes Council (2003)	Tallowwood/Grey Gum (45/60)

Structure

Stratum	**Height Range**	**Canopy Cover**
Canopy	20 - 30m	20-45%
Small Tree	10 - 20m	5-40%
Shrub	1.5 – 4m	10-30%
Ground	<1m	5 – 40%

Species Composition

Canopy
Eucalyptus propinqua (Small-fruited Grey Gum), *Eucalyptus microcorys* (Tallowwood), *Eucalyptus siderophloia* (Northern Grey Ironbark).

Small Tree Layer
Allocasuarina torulosa (Forest Oak).

Shrub Layer
Persoonia linearis (Narrow-leaved Geebung), *Dodonaea triquetra* (Common Hop Bush), *Pultenaea villosa* (Hairy Bush Pea).

Ground Layer
Lomandra longifolia (Spiny Mat Rush), *Dianella caerulea* var. *producta* (Blue Flax Lily).

6. Spotted Gum/Ironbark Open Forest

This community occupied approximately 5.5ha of the study area and was generally located in the central area on steeper slopes alongside drainage lines. The community was generally characterised by *Corymbia maculata* (Spotted Gum) and *Eucalyptus siderophloia* (Northern Grey Ironbark)(Figure 16).

Similar Vegetation Types

Great Lakes Council (2003)	Spotted Gum (70), Spotted Gum – Ironbark/Grey Gum (74)
NPWS, (2000)	Map Unit 15 – Coastal Foothills Spotted Gum – Ironbark Forest

Structure

Stratum	**Height Range**	**Canopy Cover**
Canopy	15 - 25m	20-50%
Small Tree	10 - 15m	5-15%
Shrub	1.5 – 4m	5-25%
Ground	<1m	30 – 70%

Figure 15: Grey Gum/Tallowwood/Ironbark Open Forest

Figure 16: Spotted Gum/Ironbark Open Forest

Species Composition
Canopy
Eucalyptus maculata (Spotted Gum), *Eucalyptus siderophloia* (Ironbark), *Eucalyptus propinqua* (Small-fruited Grey Gum).

Small Tree Layer
Allocasuarina torulosa (Forest Oak), Juvenile canopy species.

Shrub Layer
Persoonia linearis (Narrow-leaved Geebung), *Dodonaea triquetra* (Common Hop Bush), *Pultenaea villosa.*

Ground Layer
Lomandra longifolia (Spiny Mat Rush), *Dianella caerulea* var. *producta* (Blue Flax Lily), *Imperata cylindrica* var. *major* (Blady Grass).

7. Smooth-barked Apple/Stringybark Forest

This community occupied approximately 20.5ha of the site and was located within the central and northern areas of the study area. This community was generally characterised by the canopy species *Angophora costata* (Smooth-barked Apple) and *Eucalyptus globoidea* (White Stringybark)(Figures 17 & 18).

Similar Vegetation Types
Great Lakes Council (2003) Smooth-barked Apple-Sydney Peppermint, (106)

Structure

Stratum	**Height Range**	**Canopy Cover**
Canopy	15 - 20m	20-40%
Small Tree	10 - 15m	5-25%
Shrub	1.0 – 4m	5-20%
Ground	<1m	40 – 75%

Species Composition
Canopy
Angophora costata (Smooth-barked Apple), *Eucalyptus globoidea* (White Stringybark).

Shrub Layer
Dodonaea triquetra (Common Hop Bush), *Comesperma ericinum* (Matchheads), *Pultenaea villosa, Pultenaea palacea* var. *palacea, Pultenaea daphnoides* (Large-leaf Bush-pea).

Ground Layer
Joycea pallida (Joycea), *Goodenia heterophylla, Pomax umbellata, Dianella caerulea* var. *producta, Phyllanthus hirtellus* (Thyme Spurge), *Patersonia sericea* (Purple Flag), *Hardenbergia violacea* (Hardenbergia).

Figure 17: Smooth-barked Apple/Stringybark Forest.

Figure 18: Smooth-barked Apple/Stringybark Forest

8. Moist Riparian Forest

This community occupied approximately 0.75ha of the drainage lines in the central area of the study area. This community was characterised by the paperbark species *Melaleuca lineariifolia* (Snow in Summer) and *Melaleuca styphelioides* (Prickly-leaved Paperbark)(Figure 19).

Similar Vegetation Types

Great Lakes Council (2003)	Paperbark (31)
NPWS, (2000)	Map Unit 42 – Riparian Melaleuca Swamp Woodland

Structure

Stratum	**Height Range**	**Canopy Cover**
Canopy	15 - 25m	20-35%
Small Tree	10 - 25m	40-85%
Shrub	1.5 – 4m	10-30%
Ground	<1m	5 – 40%

Figure 19: Moist Riparian Forest.

Species Composition

Canopy

Eucalyptus propinqua (Small-fruited Grey Gum), *Eucalyptus microcorys* (Tallowwood).

Small Tree Layer

Melaleuca styphelioides (Prickly-leaved Paperbark), *Melaleuca lineariifolia* (Snow in Summer).

Shrub Layer

Callistemon salignus (Weeping Bottlebrush).

Ground Layer
Lomandra longifolia (Spiny Mat Rush), *Lepidosperma elatius, Pteridium esculentum* (Bracken Fern), *Gahnia clarkei* (Sword Grass).

9. Cleared Modified Land

Six areas of cleared modified land (approximately 2.3ha) were found to be present within the study area. The largest area bordered Clarke Street in the north and was composed of low regenerating native plants (Figure 20). Four smaller cleared areas were present in the south of the site and included areas were buildings and a Citrus orchard were located. The remaining two areas were found in the south-east and consisted of small clearings within the Ironbark/Tallowwood Open Forest assemblage. These two areas were largely composed of native groundcovers common to the Ironbark/Tallowwood Open Forest

Figure 20: Cleared area of land bordering Clarke Street in the far north of the study area.

10. Aquatic Dam Vegetation

Two relatively small constructed dams were present within the study area (combined area 0.04ha)(Figures 21 & 22). One dam was located within the proposed development area and the other within cleared modified land near the site's Clarke Street frontage and one. *Gahnia clarkei* (Sword Grass) was a common aquatic flora species around the perimeter of the southern dam. Common species noted within the northern dam included aquatic *Philydrum lanuginosum* (Woolly Frogmouth), *Juncus usitatus* (Common Rush) and *Juncus prismatocarpus*.

Figure 21: Aquatic vegetation around small constructed dam within development area.

Figure 22: Aquatic Vegetation within small constructed dam in north-west of study area.

Vegetation Assemblages occurring within the study area outside Lot 2

11. Mangrove

This community dominated by *Avicennia marina* ssp. *australasica* (Grey Mangrove) occupied areas of the intertidal mud/sandflat in the far south of the study area (Figure 23). It was also mapped within intertidal areas of Pig Station Creek (Figure 24). Approximately 3ha of Mangroves were present within the study area.

Similar Vegetation Types

Biometric ID and Type	(13005) -Mangrove forest in estuaries of the Sydney Basin and South East Corner
Great Lakes Council (2003)	Mangrove (33)
NPWS, (2000)	Map Unit 47 – Mangrove Estuarine Complex

Structure

Stratum	**Height Range**	**Canopy Cover**
Canopy	1 - 5m	10-35%
Ground	<1m	5 – 50%

Species Composition

Canopy

Avicennia marina ssp. australasica (Grey Mangrove). Within the mud/sandflats some patches of *Zostera capriconi* (Zostera) were present within deeper areas of water

Ground (within Pig Station Creek)

Sporobolus virginicus (Sand Couch)

12. Sandy Foreshore Vegetation

A narrow band of mostly sand (0.2ha) was located between the intertidal area and Coastal Sand Blackbutt Community along the edge of Port Stephens (Figure 25). This area was located within the erosion zone and was largely void of vegetation. A few clumped species such as *Carpobrotus glaucescens* (Pigface), *Tetragonia tetragonioides* (New Zealand Spinach), *Atriplex cinerea* (Grey Saltbush) and the invasive *Chysanthemoides monilifera* ssp. *rotunda* (Bitou Bush) were found to be present on the higher terrestrial side of this area. Sandy Foreshore Vegetation occupied approximately 0.2ha of the study area.

13. Saltmarsh

Saltmarsh was located within the tidal area of Pig Station Creek. This community was dominated by the ground covers *Juncus kraussii* (Sea Rush) and *Baumea juncea* (Figure 26). This area was largely void of trees and shrubs. Saltmarsh occupied approximately 0.5ha of the study area.

Figure 23: Mangroves and associated mudflats within the vicinity of the outlet/inlet pipes.

Figure 24: Mangroves within Pig Station Creek where the secondary egress is proposed to be located.

Figure 25: Foreshore vegetation within study area.

Figure 26: Saltmarsh within Pig Station Creek where the secondary egress is proposed to be located.

Similar Vegetation Types

Biometric ID and Type	(13059) –Saltmarsh in estuaries of the Sydney Basin and South-East Corner.
NPWS, (2000)	Map Unit 47a – Saltmarsh

Endangered Ecological Community:

The Saltmarsh Community was consistent with the Endangered Ecological Community Coastal saltmarsh in the NSW North Coast, Sydney Basin and South East Corner bioregions (DECC, 2004). This Endangered Ecological Community has been further assessed within Section 6 and Appendix A of this report.

Structure

Stratum	**Height Range**	**Canopy Cover**
Canopy	1 - 5m	<5%
Ground	<1m	80%

Species Composition

Canopy
Casuarina glauca (Swamp Oak)

Shrub
Melaleuca ericifolia (Swamp Paperbark)

Ground (within Pig Station Creek)

Juncus kraussii (Sea Rush), *Baumea juncea, Phragmites australis* (Australian Reed), *Sarcocornia quinqueflora* ssp. *quinqueflora* (Samphire), *Sporobolus virginicus* (Sand Couch).

14. Swamp Oak Forest

Swamp Oak Forest was found to be associated with Pig Station Creek (approximately 0.32ha). This community was dominated by the canopy *Casuarina glauca* (Swamp Oak).

Similar Vegetation Types

NPWS, (2000)	Map Unit 40 – Swamp Oak Rushland Forest
Biometric ID & Type	(520) - Swamp Oak swamp forest fringing estuaries, Sydney Basin and South-east Corner.

Endangered Ecological Community:

Swamp Oak Forest was consistent with the Endangered Ecological Community Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (NSW Scientific Committee, 2004).

Structure

Stratum	**Height Range**	**Canopy Cover**
Canopy	10 - 20m	<5%
Ground	<1m	20%

Species Composition

Canopy
Casuarina glauca (Swamp Oak)

Ground (within Pig Station Creek)

Juncus kraussii (Sea Rush), *Baumea juncea, Phragmites australis* (Australian Reed).

5.1.1 ENDANGERED ECOLOGICAL COMMUNITIES

Five Endangered Ecological Communities are known to occur within the local area:

- Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions;
- Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner Bioregions;
- River Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions;
- Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions;
- Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions.

Three Endangered Ecological Communities comprising Swamp Sclerophyll Forest on Coastal Floodplains, Coastal Saltmarsh and Swamp Oak Floodplain Forest were found to be present within the study area.

Approximately 7ha of Swamp Mahogany – Paperbark Forest present within the study area was found to contain floristic components consistent with the Endangered Ecological Community - Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions. This area occupied the lower lying poorly drained sand sheets in the south of the study area. Smaller areas were also found to be present along Pig Station Creek. Swamp Sclerophyll Forest occupying the lower ground in the south formed part of a larger area of adjoining Swamp Sclerophyll Forest to the east and west.
Saltmarsh was located within the intertidal area of Pig Station Creek where the emergency egress is proposed to be located.

Areas of Swamp Oak Forest occupied lower parts of Pig Station Creek within the vicinity of the emergency egress.

The proposed pipeline will travel through the area of Swamp Sclerophyll Forest to the south of the development footprint. Although the development footprint containing the Abalone Farm occurs outside areas of Swamp Sclerophyll Forest there is the potential for additional impacts such as sedimentation and increased weed infestation. The emergency egress will also cross an area of Saltmarsh. No areas of Swamp Oak Forest will be impacted as a result of the proposal.

The impact of the proposal on these Endangered Ecological Communities has been detailed in Section 6 and Appendix A of this report.

5.1.2 THREATENED AND RARE FLORA SPECIES

Field surveys identified 290 plant species occurring within the Study Area. Twenty-eight threatened and rare plant species were recorded within 10km of the site on the OEH Wildlife Atlas, SEWPaC and Sydney Botanic Gardens databases (Table 6).

Table 6: Threatened and Rare Flora species recorded within the locality.

FLORA SPECIES	TSC	EPBC	ROTAP
Corybas dowlingii (Red Helmet Orchid)	E		
**Cryptostylis hunteriana* (Leafless Tongue Orchid)	E	V	
Diuris arenaria (Sand Doubletail)	E		
Diuris praecox (Rough Doubletail)	V	V	2VC-
Genoplesium baueri (Bauer's Midge Orchid)	V		
Rhizanthella slateri (Eastern Underground Orchid)	E	E	
**Persicaria elatior* (Knotweed)		V	
Grevillea parviflora ssp. *parviflora* (Small-flowered Grevillea)	V	V	
Allocasuarina defungens (Dwarf Heath Casuarina)	E	E	
Angophora inopina (Charmhaven Apple)	V	V	
Callistemon linearifolius (Netted Bottle Brush)	V		2RCi
Eucalyptus fergusonii ssp. *fergusonii* (Ferguson's Ironbark)			3KC
Eucalyptus glauca (Slaty Red Gum)	V		
Eucalyptus parramattensis ssp. *decadens* (Drooping Red Gum)	V	V	2V
Eucalyptus rudderi (Rudder's Box)			3RC
Melaleuca biconvexa (Biconvex Paperbark)	V		
Melaleuca groveana (Grove's Paperbark)	V		
Syzygium paniculatum (Magenta Lillypilly)	E	V	
**Tetratheca juncea* (Black-eyed Susan)	V	V	3VCa
Prostanthera densa (Cliff Mintbush)	V	V	3VC-
Cynanchum elegans (White-flowered Wax Plant)	V	V	3ECi
Asperula asthenes (Trailing Woodruff)		V	
Galium australe (Tangled Bedstraw)	E		
Lindernia alsinoides (Noah's False Chickweed)	E		
Maundia triglochinoides		V	
Chamaesyce psammogeton (Sand Spurge)	E		
Senecio spathulatus (Coastal Fireweed)	E		
Macrozamia flexuosa			2K

None of the abovementioned threatened flora species were found within the study area during fieldwork. The study area was considered to contain suitable habitat for all of the addressed threatened flora species with the exception of *G. australe*, *A. defungens* and *G. bauera. Tetratheca juncea* has been recorded within the adjoining property to the east (NPWS, 2011).

A species-specific habitat assessment for the addressed threatened flora species has been provided in Section 5.2.4 of this report.

No additional ROTAP species were recorded within the study area. The study area contained suitable habitat for *E. fergusonii* ssp. *fergusonii, M. flexuosa* and *E. rudderi*. Records of these flora species are known from the local area. At least one specimen of *E. rudderi* and several specimens of *E. fergusonii* ssp. *fergusonii* are known to occur within the adjoining lot to the east of the study area (NPWS, 2011).

5.1.3 NOXIOUS WEEDS AND WEEDS OF STATE AND NATIONAL SIGNIFICANCE

A number noxious weed species were found to be present within the site and are listed below in Table 7. The site lies within the Great Lakes Council Noxious Plants Advisory Area.

Table 7: Noxious Weed species found on site.

WEED SPECIES	WEED CLASS GREAT LAKES LGA	ADDITIONAL SIGNIFICANCE
Lantana camara (Lantana)	Class 4	N & T
Rubus fruticosa (Blackberry)	Class 4	
Chrysanthemoides monilifera ssp. *monilifera* (Bitou Bush)	Class 4	N & T

N – Weed of National Significance (Listed in the Commonwealth Government's National Weeds Strategy 1997)

T – Listed as a Threatening Process under the NSW TSC Act 1995.

***Control Classes under the Noxious Weeds Act 1993.**

Class 1 & 2 This plant must be eradicated from the land and the land must be kept free of this plant.

Class 3 This plant must be fully and continuously suppressed and destroyed.

Class 4 The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the Local Control Authority (LCA). Must also, 'not be sold, propagated or knowingly distributed'.

Class 5 The requirements of the Noxious Weeds Act 1993 for a notifiable weed must be complied with.

Weed control is to be included within the Vegetation Management Plan recommended for the proposal.

5.2 HABITAT APPRAISAL

5.2.1 HABITAT DESCRIPTION AND DISTRIBUTION IN THE VICINITY

The vegetation and landforms present within the study area offered habitat for a variety of native species. The main habitat types within the study area were Eucalypt Forest, Cleared open areas and Coastal Marine. Areas of aquatic freshwater habitat were also present within the lower lying areas of Swamp Forest in the south of the study area and within the two constructed dams.

Eucalypt Forest within the study area provided suitable habitat opportunities for a variety of species. Frugivorous, nectivorous, granivorous and insectivorous birds and microchiropteran bat species would all find potential foraging resources within this complex. Hollow-bearing trees would provide some potential nesting and roosting sites for a variety of avifauna and other hollow dependant species such as arboreal marsupials and tree-roosting bats. Hunting opportunities exist for birds of prey, given that the variable tree coverage and understorey vegetation has created a myriad of ecotones and habitat densities. Such habitat is suitable for terrestrial species including small and medium sized mammals, macropods, reptiles and potentially for some frog species adapted to such areas. Recognised species of Koala feed trees *Eucalyptus microcorys* (Tallowwood) and *Eucalyptus robusta* (Swamp Mahogany) listed under State Environmental Planning Policy 44 (SEPP 44) were present. Another species *Eucalyptus propinqua* (Small-fruited Grey Gum) which is not listed under SEPP 44 is also known to be utilised by Koalas in the local area.

The cleared open areas of habitat provide opportunity for a variety of avifauna, including predominantly terrestrial species preferring open spaces, seed eating birds and several birds of prey, which may hunt over this area in search of potential prey species. Macropods may also frequent such areas whilst grazing. Some species of bats may also forage over this cleared area for insects. However, the lack of vegetative cover often limits the value of such areas as this for many species, particularly reptiles and small mammals which are vulnerable to predation in open spaces.

Low lying areas of Swamp Forest and to a lesser extent the two small constructed dams were found to provide suitable aquatic habitat for a range of waterbirds, frogs and other herpetofauna. Water within the low lying areas of swamp forest was found to be ephemeral in nature and dried out during extended periods of low rainfall. This area contained preferred habitat for the threatened *Crinia tinnula* (Wallum Froglet). The two constructed dams would also provide habitat for herpetofauna and limited habitat for waterbird species. The low lying areas of swamp forest and two dams would also act as a water source for other native animals such as macropods and offer potential habitat for bats that prefer to hunt above or around water bodies.

The intake/outtake pipeline will extend out from the shore of Port Stephens through tidal sand/mudflats and the waters of Port Stephens. This area would provide habitat for a variety of wading birds and aquatic marine species which occupy the waters of the port. Suitable hunting habitat would be available for birds such as the threatened *Pandion haliaetus* (Osprey).

In general, the habitats within the study area offer a wide range of habitat opportunities for a range of native species. The habitats proposed to be affected by the proposal range from less ecologically significant areas such as open cleared areas to areas of Eucalypt Forest that would appear capable of offering suitable resources to both resident and transitory species.

5.2.2 HABITAT CORRIDORS

According to the National Parks and Wildlife Service Key Habitats and Corridors for Forest Fauna-Occasional Paper 32 – Figure 7.20 (Scott, D. 2003) the study area is located on an area of Key Habitat and forms part of a sub-regional corridor that links habitat to the north, west and east (Figure 27). The proposal may result in a small incremental disturbance to this corridor however it is unlikely to have a significant impact.

5.2.3 SIGNIFICANT TREE SURVEY

A total of 191 habitat (hollow-bearing) trees were identified as a result of a significant tree survey within the southern portion of the study area where the Abalone Farm is proposed to be situated. Many of these trees where considered to be significant as a result of their very large size and variety and number of hollows they contained.

It is recommended that trees, particularly those containing hollows be left in-situ where possible within the scope of the development. Up to 13 habitat trees are likely to be required to be removed to make way for the proposal. For those habitat trees that are required to be removed compensatory fauna nestboxes are to be installed within adjoining habitat at a ratio of two nest boxes per removed hollow. The removal of any habitat tree is to be supervised by a suitably qualified person to help protect any fauna that may be present. The details of each tree within the southern portion of the study area including height, diameter at breast height (dbh), canopy spread, coordinates and fauna habitat attributes such as hollows were recorded. The presence of Koala activity in the form of scats and scratches on the trunks of trees were also noted. The results of the significant tree survey is shown in Appendix E and the location of the trees are shown in Figure E1.

5.2.4 HABITAT FOR SIGNIFICANT SPECIES

An assessment of habitat attributes on site has been undertaken for the threatened species listed in Section 3.5. The results of the assessment are displayed in Table 8. Those species identified in this assessment as having potential habitat available on site have been considered further under Section 5A of the EPA Act in Section 6.0 of this report. The description of the ecology of each species is contained in Appendix A.

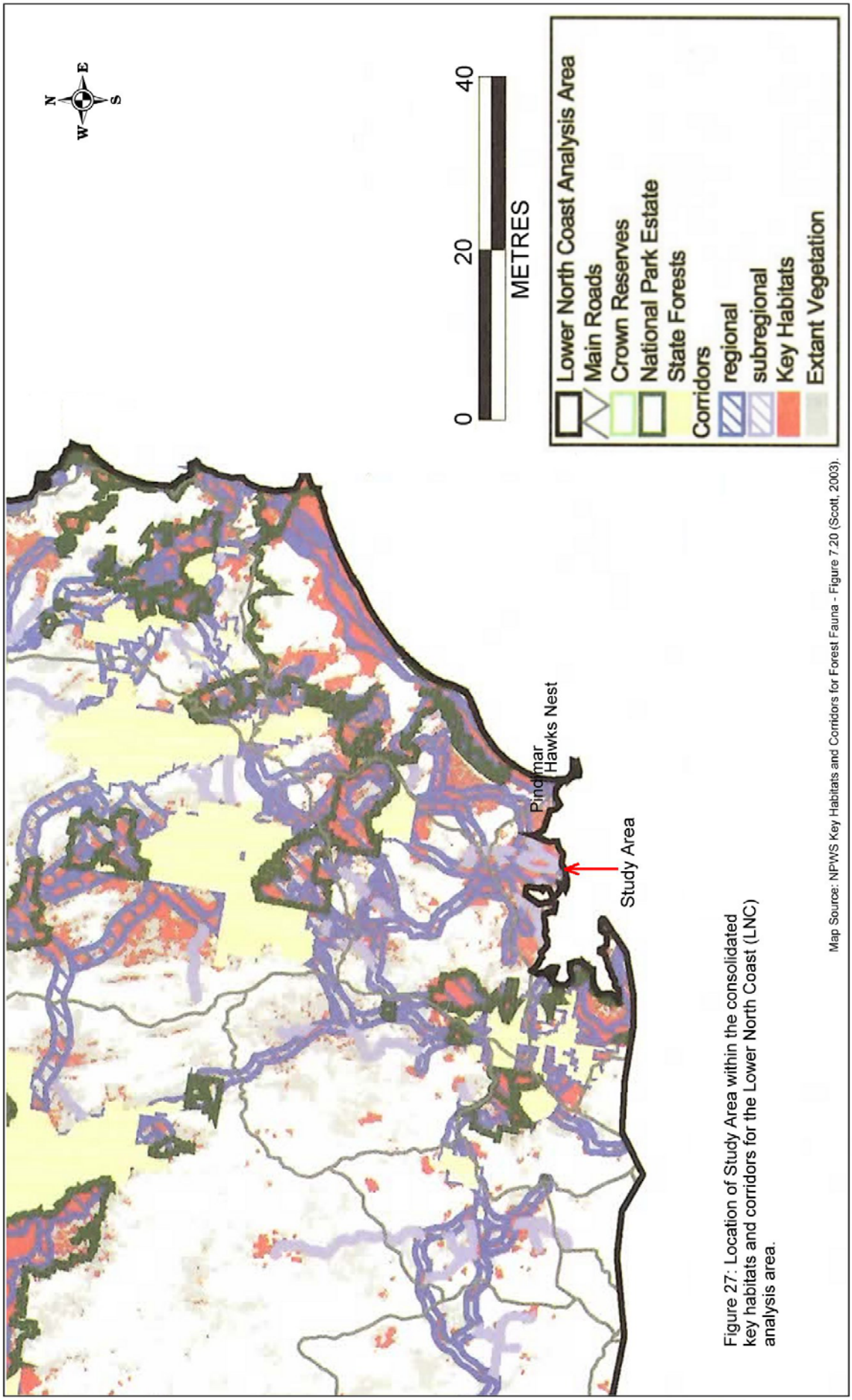

Figure 27: Location of Study Area within the consolidated key habitats and corridors for the Lower North Coast (LNC) analysis area.

Table 8: Habitat Assessment for Significant Species

SPECIES	STATUS	HABITAT DESCRIPTION AND LOCALLY KNOWN POPULATIONS	LIKELYHOOD OF OCCURRENCE WITHIN THE STUDY AREA	7-PART TEST REQUIRED
Corybas dowlingii Red Helmet Orchid	TSC Act-E	Forms colonies and typically grows in gullies in tall open forest on well-drained gravelly soil at elevations of 10-200m. Is restricted to New South Wales where it is currently known from 4 localities including Port Stephens (2 localities), Bulahdelah and Freemans Waterhole south of Newcastle. A population is known from Stoney Ridge Reserve on Soldiers Point on the southern shore of Port Stephens.	**Moderate** Suitable habitat was considered to be present within the study area.	**Yes**
Cryptostylis hunteriana Leafless Tongue Orchid	TSC Act-E EPBC Act-E	This species is a saprophyte, which grows in small, localised colonies on flat plains close to the coast. This species has also been recorded in mountainous areas growing in moist depressions as well as in swampy habitats.	**Moderate** Suitable habitat was considered to be present within the study area.	**Yes**
Diuris arenaria Tomaree Doubletail	TSC Act - E	Coastal heath, Dry Sclerophyll Forest with patches of *Themeda triandra* (Kangaroo Grass) on sandy flats (Bishop, 1996). This species is only known from the Tomaree Peninsula on the southern side of Port Stephens.	**Low** Suitable habitat was considered to be present within the southern portion of the study area. This orchid species has not been recorded on the northern side of Port Stephens.	**Yes**
Diuris praecox Newcastle Doubletail	TSC Act - V EPBC Act – V ROTAP – 2VC-	Found in eucalypt forests on hilltops or slopes, and is widespread in grassy habitats. Large populations have been recorded within power line easements at Anna Bay (ERM, 2003).	**Low** Suitable habitat was considered to be present within the study area. There is a lack of records of this species on the northern side of Port Stephens.	**Yes**
Genoplesium baueri Bauer's Midge Orchid	TSC Act - V	Grows in sparse sclerophyll forest and moss gardens over sandstone.	**Unlikely** No suitable habitat was considered to be present for this orchid species. No local records exist for this species.	**No**
Phaius australis Southern Swamp Orchid	TSC Act - E EPBC Act - E	Swampy grassland or swampy forest including rainforest, eucalypt or paperbark forest, mostly in coastal areas. Occurs in Queensland and north-east NSW as far south as Coffs Harbour. Historically, it extended farther south, to Port Macquarie.	**Unlikely** Suitable habitat present. Study area occurs well south of known distribution of the orchid species.	**No**

SPECIES	STATUS	HABITAT DESCRIPTION AND LOCALLY KNOWN POPULATIONS	LIKELYHOOD OF OCCURRENCE WITHIN THE STUDY AREA	7-PART TEST REQUIRED
Rhizanthella slateri Eastern Underground Orchid	TSC Act - E EPBC Act – E	Habitat requirements are poorly understood and no particular vegetation type has been associated with this species, although it is known to occur in sclerophyll forest. This species is highly cryptic as it grows almost completely below the soil. It flowers from October to November. The nearest known local record of this species is Buladelah (Jones, 2006).	**Low** Suitable habitat was considered to be present within the study area. There is a paucity of local records of this species in the local area.	**Yes**
Grevillea parviflora ssp. *parviflora*	TSC Act-V EPBC Act-V	This species of Grevillea occurs in light clayey soils in woodlands. This species grows chiefly in south-western Sydney. Disjunct populations occur near Cessnock, Putty and Cooranbong (Fairley, 2004). A record from the north-west of Port Stephens was present on the OEH database.	**Low** Suitable habitat was considered to be present within the northern half of the study area.	**Yes**
Allocasuarina defungens Dwarf Heath Casuarina	TSC Act-E EPBC Act-E ROTAP – 2E	A small erect shrub occurring on sand in the Nabiac area and farther north in the NSW North Coast Region.	**Unlikely** The study area lacks suitable habitat.	**No**
Angophora inopina Charmhaven Apple	TSC Act-V EPBC Act-V	Found in shallow sandy soils within open woodland/forest assemblages in co-dominant distribution with *Eucalyptus haemastoma* (Scribbly Gum), *Corymbia gummifera* (Red Bloodwood) and *Eucalyptus capitellata* (Brown Stringybark), as well as within wet-dry heath, and swamp forest communities. The main occurrences of this species are in the Wyong and Lake Macquarie LGA. Disjunct populations have also been found south of Karuah in the Port Stephens LGA and north of Karuah in the Great Lakes LGA.	**Low** Suitable habitat was considered to be present within the northern portion of the study area.	**Yes**
Callistemon linearifolius Netted Bottle Brush	TSC Act-V ROTAP – 2RCi	Grows in dry sclerophyll forest on the coast and adjacent ranges from the Georges River to the Hawkesbury River in the Sydney area, and north to Nelson Bay.	**Moderate** Suitable habitat was found to be present over a large portion of the study area containing Dry Sclerophyll Forest.	**Yes**
Eucalyptus parramattensis spp. *decadens* Drooping Red Gum	TSC Act - V EPBC Act – V ROTAP – 2V_	Occurs in woodland on sandy soils in wet sites. In the Port Stephens area, the Drooping Red Gum occurs in open wet sclerophyll woodland on heavy, often waterlogged, inter-barrier depression soils. This species is present within Mambo Swamp on the southern shore of Port Stephens..	**Low** Marginal habitat was considered to be present on lower areas of ground in the far south of the study area.	**Yes**
Melaleuca biconvexa Biconvex Paperbark	TSC Act - V	May occur in dense stands adjacent to watercourses, in association with other *Melaleuca* species or as an understorey species in wet	**Low** Limited habitat was considered	**Yes**

SPECIES	STATUS	HABITAT DESCRIPTION AND LOCALLY KNOWN POPULATIONS	LIKELYHOOD OF OCCURRENCE WITHIN THE STUDY AREA	7-PART TEST REQUIRED
		forest.	to be present within the narrow areas of riparian vegetation. There are few local records of this species in the local area.	
Melaleuca groveana Grove's Paperbark	TSC Act-V	This species is generally found in north eastern NSW and south east Queensland in heath, often in exposed sites and mainly at higher altitude. In Tomaree National Park, *Melaleuca groveana* occurs in closed heath communities on rhyodacite volcanic rock. This species has been recorded on the top of a hill to the west of the site at Fame Cove (Wildthing Environmental Consultants, 2004).	**Low** Suitable habitat was considered to be present in the northern higher areas of the study area. However according to the Soil Map (Murphy, 1995) no associated volcanic rock is likely to occur within the study area	**Yes**
Syzygium paniculatum Magenta Lillypilly	TSC-E EPBC-V	Occurs in coastal rainforests on sandy soils or stabilised coastal dunes from Jervis Bay to Bulahdelah in NSW.	**Low** Suitable habitat was considered to be present in the wetter areas of open forest in the southern portion of the study area.	**Yes**
Tetratheca juncea Black-eyed Susan	TSC Act-V EPBC Act-V 3VCa	Heath and Dry Sclerophyll Forests on low nutrient soil with a dense understorey of grasses. Is most commonly found associated with species including, *Angophora costata* (Smooth-barked Apple), *Eucalyptus globoidea* (White Stringybark), *Corymbia gummifera* (Red Bloodwood) and *Acacia myrtifolia* (Myrtle Wattle).	**High** Suitable habitat was considered to be present within the drier areas of sclerophyll forest within the northern portion of the study area. Has been recorded within the adjoining property (Lot 3) to the east in similar habitat (NPWS, 2011).	**Yes**
Prostanthera densa Villous Mintbush	TSC Act - V EPBC Act – V ROTAP – 3VC-	This species is known to occur on clay soils on volcanic hills and on sandy soils occurring as a shallow mantle over volcanic hills. It has been reported generally from sclerophyll forest and shrubland on coastal headlands and near-coastal ranges, chiefly on sandstone.	**Low** Suitable habitat was considered to be present within the higher northern portion of the study area. Habitat was limited by the lack of volcanic rock and absence of records north of Port Stephens.	**Yes**

SPECIES	STATUS	HABITAT DESCRIPTION AND LOCALLY KNOWN POPULATIONS	LIKELYHOOD OF OCCURRENCE WITHIN THE STUDY AREA	7-PART TEST REQUIRED
Asperula asthenes Trailing Woodruff	TSC Act - V	Damp Sites, often along riverbanks (DEC, 2006). The major portion of the distribution of this species occurs in the Great Lakes LGA. Populations are known from North Karuah and The Branch areas (Great Lakes Council, 2003).	**Low** Limited habitat was considered to be present within wetter gullies within the study area.	**Yes**
Galium australe Tangled Bedstraw	TSC Act-E	Found in moist gullies of tall forest, *Eucalyptus tereticornis* (Forest Red Gum) forest, coastal Banksia shrubland, and *Allocasuarina nana* heathland.	**Unlikely** This species is unlikely to be present due to the lack of local records.	**No**
Lindernia alsinoides Noah's False Chickweed	TSC Act-E	Grows in swampy sites in sclerophyll forests and coastal heath.	**Low** Suitable habitat was considered to be present in the south of the study area on the edges of the Swamp Mahogany/Paperbark Forest assemblage. The study area would be considered south of the known distribution of this species.	**Yes**
Chamaesyce psammogeton Sand Spurge	TSC Act-E	This prostrate perennial herb grows on foredunes and exposed sites on headlands.	**Low** – Suitable habitat was considered to occur along the narrow sandy foreshore of the study area.	**Yes**
Senecio spathulatus Coastal Fireweed	TSC Act-E	Confined to areas of unstabilised sand on coastal dunes. This species is usually recorded in southern Victoria and Tasmania.	**Low** – Suitable habitat was considered to occur along the narrow sandy foreshore of the study area.	**Yes**
Streblus pendulinus Siah's Backbone	EPBC Act - E	Siah's Backbone is found in warmer rainforests, chiefly along watercourses. The altitudinal range is from near sea level to 800 m above sea level. The species grows in well-developed rainforest, gallery forest and drier, more seasonal rainforest.	**Unlikely –** No suitable habitat was present.	**No**
Maundia triglochinoides	TSC Act - V	Grows in swamps, creeks or shallow freshwater 30-60cm deep on heavy clay with low nutrients.	**Low** Wetter areas of Swamp Sclerophyll Forest and the two constructed dams offer limited habitat for this species.	**Yes**

SPECIES	STATUS	HABITAT DESCRIPTION AND LOCALLY KNOWN POPULATIONS	LIKELYHOOD OF OCCURRENCE WITHIN THE STUDY AREA	7-PART TEST REQUIRED
Cynanchum elegans White-flowered Wax Plant	TSC Act – E1 EPBC Act – E ROTAP 3ECi	This species occurs in scattered coastal localities from the QLD-NSW border south to Wollongong. Found in dry, littoral or subtropical rainforest, and occasionally in scrub and woodland from sea level to about 600m ASL.	**Low** The study area lacked preferred habitat attributes. Marginal habitat present within the wetter areas of sclerophyll forest.	**Yes**
Persicaria elatior Tall Knotweed	TSC Act - V EPBC Act – V	Occurs in damp places such as swamps and margins of dams.	**Low** Habitat was considered to be present within the lower lying areas of swamp forest in the south of the study area. The occurrence of this species is marginalised by the lack of local records.	**Yes**
Petalura gigantea Giant Dragonfly	TSC Act-E	Permanent wetlands both coastal and upland. Larvae occupy permanent long chambered burrows built under swamps. According to the OEH database this Dragonfly has been recorded within Mambo Swamp on the southern side of Port Stephens in 2006.	**Moderate** – Swamps within the lower lying areas of ground in the southern portion of the study area contain suitable habitat for this Dragonfly species.	**Yes**
Crinia tinnula Wallum Froglet	TSC Act-V	Shallow acid swamps (temporary / semi-permanent) and associated connecting channels and deeper water holes (permanent) consisting of hard-leafed heaths, shrubs and woodland on coastal plains and dunes and associated sedgelands and swamps in low lying areas collectively known as wallum.	**High – Present in study area** Suitable habitat was found to occur within the lower lying areas of swamp forest within the southern portion of the study area.	**Yes**
Litoria aurea Green and Golden Bell Frog	TSC Act-E EPBC Act-E	This frog species inhabits swamps, lagoons, streams and ponds as well as dams, drains and storm water basins.	**Low** Suitable habitat was considered to be present with the lower lying areas of swamp forest and two constructed dams.	**Yes**
Litoria brevipalmata Green-thighed Frog	TSC Act-V	Open Forest, rainforest bordering cleared areas.	**Low** The study area was considered to contain only marginal habitat for this frog species.	**Yes**
Mixophyes balbus Stuttering Frog	TSC Act-V EPBC Act-V	Occurs in wet forest regions of south-eastern Queensland, Eastern NSW and Victoria. In late spring, eggs are deposited among leaf	**Unlikely** No suitable habitat was	**No**

SPECIES	STATUS	HABITAT DESCRIPTION AND LOCALLY KNOWN POPULATIONS	LIKELYHOOD OF OCCURRENCE WITHIN THE STUDY AREA	7-PART TEST REQUIRED
		litter on the banks of streams and subsequently are washed into the water during heavy rain.	considered to be present within the study area for this frog species.	
Mixophyes iteratus Great Barred Frog	TSC Act-E EPBC Act-E	Occurs on forest slopes of the Great Dividing Range, generally between 20-800m A.S.L. It appears to prefer riparian vegetation or other moist vegetation communities, generally on rich organic soils. Deep leaf litter and/or thick cover is necessary for this species. Water quality must be of a high standard, and the species occurs in 1st to 3rd order streams (i.e. 'young' streams), and is absent from ponds and ephemeral pools. Graded banks with undercuts and steep edges are favourable haunts of this frog.	**Unlikely** No suitable habitat was considered to be present within the study area for this frog species.	**No**
Caretta caretta Loggerhead Turtle	TSC Act-E EPBC Act-E	Ocean dwellers foraging in deeper water for fish, jellyfish and bottom dwelling animals. The female comes ashore to layer her eggs in a hole dug on the beach in tropical regions during the warmer months.	**Low-moderate** The waters of Port Stephens which form part of the southern boundary of the study area contain suitable habitat for this turtle species.	**Yes**
Chelonia mydas Green Turtle	TSC Act-V EPBC Act-V	Occurs in shallow seas where there is sufficient light to ensure an abundant growth of marine grasses. When resting this species searches out an appropriate rest area i.e. rock overhang, rocky pothole, which gives some protection from predators.	**Moderate - High** The waters of Port Stephens which form part of the southern boundary of the study area contain suitable habitat for this turtle species.	**Yes**
Dermochelys coriacea Leatherback Turtle	TSC Act-V EPBC Act-E	The Leatherback Turtle is a pelagic feeder, found in tropical, subtropical and temperate waters throughout the world. It has been recorded feeding in the coastal waters of all Australian States. Three, or possibly four, Leatherback Turtle clutches were laid on beaches near Ballina, NSW (Tarvey 1993). One clutch was laid in Bootie National Park, south of Forster, NSW (Hamann et al 2006).	**Low** The waters of Port Stephens which form part of the southern boundary of the study area contain suitable habitat for this turtle species.	**Yes**
Eretmochelys imbricata Hawksbill Turtle	EPBC Act-V	Hawksbill turtles typically occur in tidal and sub-tidal coral and rocky reef habitats throughout tropical waters, extending into warm temperate areas as far south as northern New South Wales.	**Low** The waters of Port Stephens which form part of the southern boundary of the study area	Assessed in Aquatic Report (Bio-analysis 2013).

SPECIES	STATUS	HABITAT DESCRIPTION AND LOCALLY KNOWN POPULATIONS	LIKELYHOOD OF OCCURRENCE WITHIN THE STUDY AREA	7-PART TEST REQUIRED
			contain suitable habitat for this turtle species. The waters of Port Stephens would be considered to be below the normal distribution for this species.	
Natator depressus Flatback Turtle	EPBC Act-V	Although found in open seas, they prefer inshore waters and bays where their feeding ground is the shallow, soft-bottomed seabed.	**Low** The waters of Port Stephens which form part of the southern boundary of the study area contain suitable habitat for this turtle species. The waters of Port Stephens would be considered to be well below the normal distribution for this species.	Assessed in Aquatic Report (Bio-analysis 2013).
Hoplocephalus bitorquatus Pale-headed Snake	TSC Act-V	Rainforest to the drier sclerophyll forests.	**Low-moderate** Suitable habitat was considered to be present within the study area. There was a lack of local records for this species.	**Yes**
Hoplocephalus stephensii Stephen's Banded Snake	TSC Act-V	Partly arboreal found in wet sclerophyll forest or rainforest.	**Low-moderate** Suitable habitat was considered to be present within the study area. There was a lack of local records for this species.	**Yes**
Macronectes giganteus Southern Giant Petrel	TSC Act – E EPBC Act-E	The Southern Giant Petrel ranges from deep circumpolar waters from Antarctica across the entire length of the New South Wales coast.	**Marginal** This bird species is usually found in the open ocean.	**Yes**
Macronectes halli Northern Giant Petrel	TSC Act - E	Inhabits subtropical waters in winter and early spring. Potential foraging resources in N.S.W. are regarded as significant during the winter months although representing a small proportion of the total foraging area for this species.	**Marginal** This bird species is usually found in the open ocean.	**Yes**
Pterodroma leucoptera leucoptera Gould's Petrel	TSC Act - E	Lives pelagic life, nests on Cabbage Tree Island.	**Marginal** This bird species is usually found in the open ocean.	**Yes**

SPECIES	STATUS	HABITAT DESCRIPTION AND LOCALLY KNOWN POPULATIONS	LIKELYHOOD OF OCCURRENCE WITHIN THE STUDY AREA	7-PART TEST REQUIRED
Pterodroma neglecta Kermadec Petrel	TSC Act-V	It is a pelagic species inhabiting the subtropical and tropical waters of the Pacific Ocean, rarely reaching mainland.	**Marginal** This bird species is usually found in the open ocean.	**Yes**
Pterodroma nigripennis Black-winged Petrel	TSC Act-V	Pelagic species	**Marginal** This bird species is usually found in the open ocean.	**Yes**
Pterodroma solandri Providence Petrel	TSC Act-V	Pelagic species	**Marginal** This bird species is usually found in the open ocean.	**Yes**
Calonectris leucomelas Streaked Shearwater	**EPBC-Migratory**	Pelagic species	**Marginal** This bird species is usually found in the open ocean.	**Not required.**
Ardenna carneipes Flesh-footed Shearwater	TSC Act-V	Lives pelagic life, nests on Lord Howe Island.	**No habitat present** – No habitat was present for this pelagic species.	**Yes**
Puffinus tenuirostris Short-tailed Shearwater	EPBC-Migratory	Pelagic species	**Marginal** This bird species is usually found in the open ocean.	Yes
Limicola falcinellus Broad-billed Sandpiper	TSC Act-V	Habitat utilised by this species includes tidal mudflats, reefs, salt marshes, freshwater wetlands and sewage farms. Favours muddy ooze.	**Moderate-High** The tidal mudflats to the south contain suitable foraging habitat for this species.	**Yes**
Limosa lapponica Bar-tailed Godwit	EPBC-Migratory	Tidal mudflats, estuaries, sewerage ponds, shallow river margins, brackish or saline inland lakes and flooded pastures (Pizzey & Knight, 2001).	**Moderate-High** The tidal mudflats to the south contain suitable foraging habitat for this species.	**Yes**
Limosa limosa Black-tailed Godwit	TSC Act-V	Habitat utilised by this species includes tidal mudflats, river edges, sandy beaches, brackish swamps as well as the shallows of lakes, reservoirs and sewage farms.	**Moderate-High** The tidal mudflats to the south contain suitable foraging habitat for this species.	**Yes**
Arenaria interpres Ruddy Turnstone	EPBC-Migratory	Tidal reefs and pools; weed-covered rocks; pebbly, shelly and sandy shores with stranded seaweed; mudflats; occasionally inland shallow waters; sewage ponds and open or ploughed ground.	**Moderate** The tidal mudflats to the south contain suitable foraging habitat for this species.	**Yes**

SPECIES	STATUS	HABITAT DESCRIPTION AND LOCALLY KNOWN POPULATIONS	LIKELYHOOD OF OCCURRENCE WITHIN THE STUDY AREA	7-PART TEST REQUIRED
Xenus cinereus Terek Sandpiper	TSC Act-V	Tidal Mudflats, estuaries, shores, reefs and coastal swamps.	**Moderate-High** The tidal mudflats to the south contain suitable foraging habitat for this species.	**Yes**
Heteroscelus brevipes Grey-tailed Tattler	EPBC-Migratory	Estuaries, tidal mudflats, mangroves, wave-washed rocks, and reefs; shallow river margins, coastal and inland.	**Moderate** The tidal mudflats to the south contain suitable foraging habitat for this species.	**Yes**
Sterna albifrons Little Tern	TSC Act - E	Little Terns nest only on or near the coast in N.S.W. The typical features of the nesting area are a sandy substrate, flat or gently sloping topography, abundant shells and pebbles and little vegetation.	**Low** Suitable hunting habitat present within the Waters of Port Stephens. Nesting habitat was considered to be absent.	**Yes**
Sterna fuscata Sooty Tern	TSC Act-V	A pelagic species, does not nest in the area.	**Unlikely** This bird species is usually found in the open ocean.	**No**
Actitis hypoleucos Common Sandpiper	EPBC-Migratory	Shallow pebbly, muddy or sandy edges of rivers and streams, coastal and inland; dams, lakes, sewage ponds, margins of tidal rivers, waterways in mangroves or saltmarsh; mudflats; rocky or sandy beaches.	**Moderate** The tidal mudflats, mangroves and saltmarsh within the southern portion of the study area contain suitable foraging habitat for this species.	**No**
Calidris acuminata Sharp-tailed Sandpiper	EPBC-Migratory	Tidal mudflats, saltmarshes, mangroves; shallow fresh, brackish or saline inland wetlands; sewage ponds and irrigated pastures.	**Moderate** The tidal mudflats, mangroves and saltmarsh within the southern portion of the study area contain suitable foraging habitat for this species.	**No**
Calidris canutus Red Knot	EPBC-Migratory	Tidal mudflats, sandflats, beaches, saltmarshes, flooded pastures, ploughed lands.	**Moderate** The tidal mudflats, mangroves and saltmarsh within the southern portion of the study area contain suitable foraging habitat for this species.	**No**

SPECIES	STATUS	HABITAT DESCRIPTION AND LOCALLY KNOWN POPULATIONS	LIKELYHOOD OF OCCURRENCE WITHIN THE STUDY AREA	7-PART TEST REQUIRED
Calidris ferruginea Curlew Sandpiper	TSC Act-E EPBC-Migratory	Tidal mudflats; saltmarsh; fresh, brackish or saline wetlands; sewage ponds.	**Moderate** The tidal mudflats, mangroves and saltmarsh within the southern portion of the study area contain suitable foraging habitat for this species.	**Yes**
Calidris ruficollis Red-necked Stint	EPBC-Migratory	Tidal mudflats; saltmarsh; fresh, brackish or saline wetlands; sewage ponds.	**Moderate** The tidal mudflats, mangroves and saltmarsh within the southern portion of the study area contain suitable foraging habitat for this species.	**No**
Calidris tenuirostris Great Knot	TSC Act-V	Inhabits beaches, coastal mudflats, bay shores, estuarine environments; sometimes freshwater wetlands.	**Moderate-High** The tidal mudflats to the south contain suitable foraging habitat for this species.	**Yes**
Tringa stagnatilis Marsh Sandpiper	EPBC-Migratory	Salt; fresh, brackish or saline wetlands; sewage ponds, mangroves, tidal flats and estuaries.	**Moderate** The tidal mudflats, mangroves and saltmarsh within the southern portion of the study area contain suitable foraging habitat for this species.	**No**
Numenius madagascariensis Eastern Curlew	EPBC-Migratory	Estuaries, tidal mudflats, sandspits, saltmarshes, mangroves; occasionally fresh or brackish lakes.	**High – Recorded with study area.** The tidal mudflats to the south contain suitable foraging habitat for this species.	**No**
Numenius minutus Little Curlew	EPBC-Migratory	Dry grasslands, floodplains, margins of drying swamps; tidal mudflats, crops and sewage ponds.	**Moderate-High** The tidal mudflats to the south contain suitable foraging habitat for this species.	**No**
Numenius phaeopus Whimbrel	EPBC-Migratory	Estuaries, tidal flats, coral cays, exposed reefs, flooded paddocks, sewage ponds and lawns.	**High – Recorded with study area.** The tidal mudflats to the south contain suitable foraging habitat	**No**

SPECIES	STATUS	HABITAT DESCRIPTION AND LOCALLY KNOWN POPULATIONS	LIKELYHOOD OF OCCURRENCE WITHIN THE STUDY AREA	7-PART TEST REQUIRED
			for this species.	
Charadrius bicinctus Double-banded Plover	EPBC-Migratory	Wide beaches, tidal mudflats, saltmarsh, sparsely vegetated margins of shallow saline and freshwater.	**Moderate** The tidal mudflats, mangroves and saltmarsh within the southern portion of the study area contain suitable foraging habitat for this species.	**No**
Charadrius leschenaultii Greater Sand-plover	TSC Act-V	Inhabits sheltered bays, harbours and estuaries with large intertidal sandflats mudflats or bare paddocks.	**Moderate** The tidal mudflats, mangroves and saltmarsh within the southern portion of the study area contain suitable foraging habitat for this species.	**Yes**
Charadrius mongolus Lesser Sand-plover	TSC Act-V	Inhabits sheltered bays, harbours and estuaries with large intertidal sandflats or mudflats.	**Moderate-High** The tidal mudflats to the south contain suitable foraging habitat for this species.	**Yes**
Pluvialis fulva Pacific Golden Plover	EPBC-Migratory	Estuaries, tidal mudflats, saltmarshes, mangroves; rocky reefs, margins of shallow open inland swamps, sewage ponds.	**Moderate** The tidal mudflats, mangroves and saltmarsh within the southern portion of the study area contain suitable foraging habitat for this species.	**No**
Pluvialis squatarola Grey Plover	EPBC-Migratory	Mudflats, saltmarsh, tidal reefs and estuaries.	**Moderate** The tidal mudflats, mangroves and saltmarsh within the southern portion of the study area contain suitable foraging habitat for this species.	**No**
Diomedea antipodensis Antipodeam Albatross	TSC Act-V EPBC Act-V & M	Lives a pelagic life.	**Unlikely** This bird species is usually found in the open ocean.	**No**
Diomedea gibsoni Gibson's Albatross	TSC Act-V EPBC Act-V & M	Lives a pelagic life.	**Unlikely** This bird species is usually found in the open ocean.	**No**

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Thalassarche bulleri Buller's Albatross	EPBC Act-V EPBC Act-V & M	Lives a pelagic life.	**Unlikely** This bird species is usually found in the open ocean.	**No**
Thalassarche cauta cauta Shy Albatross	TSC Act-V EPBC Act-V & M	Lives a pelagic life.	**Unlikely** This bird species is usually found in the open ocean.	**No**
*Thalassarche cauta **salvini*** Salvin's Albatross	EPBC Act-V & M	Lives a pelagic life.	**Unlikely** This bird species is usually found in the open ocean and would be a rare visitor to within Port Stephens..	**No**
Thalassarche cauta steadi White-capped Albatross	TSC Act-V EPBC Act-V & M	Lives a pelagic life.	**Unlikely** This bird species is usually found in the open ocean and would be a rare visitor to within Port Stephens..	**No**
Thalassarche melanophris impavida Campbell Albatross	EPBC Act-V & M	Lives a pelagic life.	**Unlikely** This bird species is usually found in the open ocean and would be a rare visitor to within Port Stephens..	**No**
Haematopus fuliginosus Sooty Oystercatcher	TSC Act-V	Prefer rocky intertidal shorelines and sandy beaches.	**Moderate-High** The tidal mudflats to the south contain suitable foraging habitat for this species.	**Yes**
Haematopus longirostris Pied Oystercatcher	TSC Act-E	Prefer rocky intertidal shorelines and sandy beaches.	**Moderate-High** The tidal mudflats to the south contain suitable foraging habitat for this species.	**Yes**
Esacus neglectus Beach Stone-Curlew	TSC Act–E4A	Inhabits undisturbed sandy beaches, especially those with extensive mangrove-backed sandflats, mudflats or reefs exposed at low tide. It has also been recorded utilising cane fields that are located in proximity to tidal areas.	**Moderate - High** The tidal mudflats to the south contain suitable foraging habitat for this species.	**Yes**
Gallinago hardwickii Latham's Snipe	EPBC Act-M	Utilises a variety of habitats, such as soft wet ground or shallow water with tussock and other green and dead vegetation, and scrub	**Low** Suitable habitat was present	**No**

SPECIES	STATUS	HABITAT DESCRIPTION AND LOCALLY KNOWN POPULATIONS	LIKELYHOOD OF OCCURRENCE WITHIN THE STUDY AREA	7-PART TEST REQUIRED
		or open wetland from sea-level to alpine bogs (Pizzey & Knight, 2001).	within areas of freshwater wetlands in the south of the study area.	
Rostratula benghalensis australis Australian Painted Snipe	TSC Act-E EPBC Act-V & M	Margins of swamps and streams, chiefly those covered with low and stunted vegetation.	**Low-Moderate** Suitable habitat was present for this species within the swamps in the south of the study area.	**Yes**
Botaurus poiciloptilus Australasian Bittern	TSC Act-E EPBC Act-E	Favours permanent fresh-waters dominated by sedges, rushes, reeds or cutting grasses (eg. Phragmites, Scirpus, Eleocharis, Juncus, Typha, Baumea and Gahnia).	**Low-Moderate** Suitable habitat was present for this species within the swamps in the south of the study area.	**Yes**
Ixobrychus flavicollis Black Bittern	TSC Act-V	Near water in mangroves and other trees, often forming only a narrow fringe of cover.	**Moderate** Suitable habitat was present for this species within the swamps and mangroves in the south of the study area.	**Yes**
Ardea alba Great Egret	EPBC Act-M	Inhabits shallows of rivers, larger dams, freshwater wetlands and irrigation areas.	**Moderate** Suitable habitat was present for this species within the swamps in the south of the study area.	**No**
Ardea ibis Cattle Egret	EPBC Act-M	Inhabits stock paddocks, pastures, croplands, wetlands and drains.	**Low** Only marginal habitat was available for this species.	**No**
Ephippiorhynchus asiaticus Black-necked Stork	TSC Act-E	Inhabits swamps associated with river systems and large permanent pools but sometimes appears on the coast or in estuaries. It has also been recorded on farm dams and sewage treatment ponds.	**Low** Suitable habitat within the study area would be confined to the area of tidal mudflats.	**Yes**
Irediparra gallinacea Comb-crested Jacana	TSC Act-V	Inhabits mostly deep permanent freshwater wetlands, which are abundant with floating aquatic vegetation that forms dense mats or rafts on the surface of the water (eg. *Nymphaeaceae, Myriophyllum lacifolium, Marsilea* and *Riccia*).	**Unlikely** No habitat was considered to be present due to the lack of deep freshwater and floating aquatic vegetation.	**No**
Turnix maculosa Red-backed Button-quail	TSC Act-V	Grasses, sedges near water, grassy woodlands, rainforest edges; black soil plains, spinifex, cereal crops and gardens.	**Unlikely** Study area occurs below the known distribution of this	**No**

SPECIES	STATUS	HABITAT DESCRIPTION AND LOCALLY KNOWN POPULATIONS	LIKELYHOOD OF OCCURRENCE WITHIN THE STUDY AREA	7-PART TEST REQUIRED
			species.	
Burhinus grallarius Bush Stone-curlew	TSC Act-E	This species inhabits dry open forest and woodland with an open grassy understorey that has not been overgrazed. It prefers woodland with many fallen branches where it roosts during the day. It has also been known to utilise coastal scrub, mangrove fringes, golf courses and plantations. This species has been recorded within the adjoining property (Lot 3) to the east (NPWS, 2011).	**Low-moderate** Suitable habitat was present for this species.	**Yes**
Ptilinopus magnificus Wompoo Fruit-Dove	TSC Act-V	This frugivorous Rainforest specialist inhabits the canopy of Sub-tropical, Warm-temperate and Littoral Rainforests. Favoured feed trees include Figs, Laurels, Myrtles and native Tamarind. The females lay one egg on a flimsy platform of vine tendrils on a slender horizontal branch.	**Marginal** Areas of secondary habitat were present within the study area.	**Yes**
Ptilinopus regina Rose Crowned Fruit-dove	TSC Act-V	Inhabits rainforest, though it also frequents nearby drier forests as well as mangroves. It usually feeds on Figs or other fruit and berry-bearing trees.	**Low** Areas of secondary habitat were present within the study area.	**Yes**
Ptilinopus superbus Superb Fruit Dove	TSC Act-V	Lives mainly in Rainforest but will feed in adjacent Mangroves or Eucalypt forest, venturing into coastal habitats. The nest is a platform built in a small tree on a horizontal fork situated in Open Forest at the edge of scrub.	**Low** Areas of secondary habitat were present within the study area.	**Yes**
Lathamus discolor Swift Parrot	TSC Act-E TSC Act-E	Open Forest to Woodland, also street trees and in parks and gardens, winter flowering eucalypts for feeding. This species nests in Tasmania during the summer months.	**Moderate –** Suitable foraging habitat was present in the form of winter flowering species particularly *Eucalyptus robusta* (Swamp Mahogany).	**Yes**
Neophema pulchella Turquoise Parrot	TSC Act-V	Lives on the edges of Eucalypt woodland adjoining clearings and on timbered ridges and creeks in farmland. It has also been recorded utilising roadside verges and orchards. Nests in small hollow branches of Eucalypts.	**Low** No preferred habitat was considered to be present within the study area. This parrot would be an infrequent visitor to the local area.	**Yes**
Glossopsitta pusilla Little Lorikeet	TSC Act-V	Tall Open Forests, woodlands, orchards, parks and street trees.	**High – recorded on site.** Suitable foraging and nesting habitat was considered to be present over the site.	**Yes**

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Calyptorhynchus lathami Glossy Black-Cockatoo	TSC Act-V	Lowland coastal forests, dense mountain forests, semi-arid woodland and trees bordering watercourses, with (Allo)Casuarina trees for foraging.	**High** Suitable foraging habitat in the form of *Allocasuarina torulosa* (Forest Oak), *Allocasuarina littoralis* (Black Sheoak) and to a lesser extent *Casuarina glauca* (Swamp Oak) were present. Suitable large nesting hollows were also observed.	**Yes**
Callocephalon fimbriatum Gang-gang Cockatoo	TSC Act-V	Tall montane forests and woodlands in mature wet sclerophyll forests. Requires hollows in which to breed between October and January. This Cockatoo species would be an infrequent visitor to the local area.	**Low – Moderate** Suitable foraging habitat was present. This species is unlikely to nest within the local area.	**Yes**
Apus pacificus Fork-tailed Swift	EPBC Act-M	Inhabits the airspace over open country from semi deserts to coasts.	**Low** Marginal habitat was present within airspace above the study area.	**No**
Hirundapus caudacutus White-throated Needletail	EPBC Act-M	Inhabits the airspace above forests, woodlands, farmlands, plains, lakes, coasts and towns.	**Moderate - High** Marginal habitat was present within airspace above the study area.	**No**
Monarcha melanopsis Black-faced Monarch	EPBC Act-M	Utilises a range of habitats including rainforests, eucalypt woodlands, coastal scrubs (Pizzey & Knight, 2001).	**Moderate** Suitable habitat was present over the majority of the study area.	**No**
Monarcha trivirgatus Spectacled Monarch	EPBC Act-M	Wet forests, thickly wooded gullies, waterside vegetation and mangroves.	**Moderate** Suitable habitat present within more thickly wooded parts of the study area.	**No**
Merops ornatus Rainbow Bee-eater	EPBC Act-M	Inhabits areas such as open woodlands with sandy soils, sandridges, riverbanks, beaches, dunes, cliffs and rainforests.	**Moderate** Suitable foraging habitat was present over the majority of the study area. No preferred nesting habitat was present.	**No**

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Rhipidura rufifrons Rufous Fantail	EPBC Act-M	Utilises a range of habitats including rainforests, wet sclerophyll forests, monsoon forests, scrubs, mangroves, watercourses, parks and gardens. During migration this species also utilises farms, street trees and buildings (Pizzey & Knight, 2001).	**High – recorded on site.** Suitable foraging and nesting habitat was considered to be present over a large portion of the study area.	**No**
Epthianura albifrons White-fronted Chat	TSC Act-V	Occurs mostly in the southern half of NSW, occurring in damp open habitats along the coast, and near waterways in the western part of the state	**Low – Moderate** – Suitable foraging habitat was present within the site. No nesting habitat was present.	**Yes**
Petroica boodang *Scarlet Robin*	TSC Act-V	The Scarlet Robin breeds in drier eucalypt forests and temperate woodlands, often on ridges and slopes, within an open understorey of shrubs and grasses and sometimes in open areas. Abundant logs and coarse woody debris are important structural components of its habitat. In autumn and winter it migrates to more open habitats such as grassy open woodland or paddocks with scattered trees.	**Low –** Only marginal habitat was considered to be present within areas of open forest. This species is more commonly found inland from the coast.	**Yes**
Petroica phoenicea *Flame Robin*	TSC Act-V	Breeds in upland tall moist eucalypt forests and woodlands, often on ridges and slopes and prefers clearings or areas with open understoreys. In winter, birds migrate to drier more open habitats in the lowlands including dry forests, open woodlands and in pastures and native grasslands, with or without scattered trees.	**Low –** Only marginal habitat was considered to be present within areas of open forest. This species is more commonly found inland from the coast.	**Yes**
Climacteris picumnus victoriae Brown Treecreeper	TSC Act-V	Occupies Eucalypt woodlands, particularly open woodlands lacking a dense understorey, River Red Gums on watercourses and around lakeshores. It is sedentary and nests in tree hollows within permanent territories.	**Unlikely** This Treecreeper species is more commonly found inland from the coast and would be unlikely to be present within the study area.	**No**
Anthochaera phrygia Regent Honeyeater	TSC Act-Crit-E EPBC Act-E & M	Temperate woodlands and open forest, including forest edges, preferring to forage on large-flowered Eucalypts.	**Moderate** – Suitable foraging habitat was present in the form of flowering myrtaceous species particularly the winter flowering *Eucalyptus robusta* (Swamp Mahogany).	**Yes**
Daphoenositta chrysoptera Varied Sittella	TSC Act-V	Open eucalypt woodland/forest, mallee, inland acacia, coastal tea-tree scrubs, golf courses, orchards and parks.	**Moderate-High** Suitable foraging habitat and nesting habitat was present.	**Yes**

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Melithreptus gularis gularis Black-chinned Honeyeater	TSC Act-V	Usually found on the western side of the Great Dividing Range in dry sclerophyll forests and woodlands containing box-ironbark associations and River Red Gum. In the Hunter Valley this species is known to utilise drier coastal woodlands. Usually found in open woodlands.	**Low** Only marginal habitat was considered to be present for this woodland bird.	**Yes**
Pomatostomus temporalis ssp. *temporalis* Grey-crowned Babbler	TSC Act-V	Open forest, woodland, scrubland, farmland and outer suburbs. Prefers woodlands with regenerating trees, tall shrubs, and an intact ground cover of grass and forbs.	**Unlikely** No suitable habitat was present for the Grey-crowned Babbler.	**No**
Dasyornis brachypterus Eastern Bristlebird	TSC Act-E EPBC Act-E	Habitat is characterised by dense, low vegetation including heath and open woodland with a heathy understorey; in northern NSW occurs in open forest with tussocky grass understorey.	**Unlikely** No known local records.	**No**
Circus assimilis *Spotted Harrier*	TSC Act-V	Occurs throughout the Australian mainland, except in densely forested or wooded habitats of the coast, escarpment and ranges. Occurs in grassy open woodland including acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands.	**Unlikely** This species is not usually associated with forested habitat of the coast.	**No**
Pandion cristatus Eastern Osprey	TSC Act-V	Open and swamp forest adjacent to the coast or estuaries, fishing mainly in brackish or salt water. This species is known to inhabit the Port Stephens area.	**High** Hunting habitat was present within the waters of Port Stephens. Suitable nesting habitat was present over a large portion of the forested area.	**Yes**
Lophoictinia isura Square-tailed Kite	TSC Act-V	The Square-tailed Kite inhabits Open Forests and Woodlands, particularly those on fertile soils with abundant passerines. They may also range into nearby open habitats but not into extensive treeless regions.	**Moderate** Due to the generalist habitat requirements of this species habitat was considered to be present within the site.	**Yes**
Erythrotriorchis radiatus Red Goshawk	TSC Act-E4A EPBC Act - V	In NSW, preferred habitats include mixed subtropical rainforest, *Melaleuca* swamp forest and riparian *Eucalyptus* forest of coastal rivers.	**Low** Suitable habitat was present.	**Yes**
Hieraaetus morphnoides Little Eagle	TSC Act-V	The Little Eagle occupies habitats rich in prey within open eucalypt forest, woodland or open woodland. Sheoak or acacia	**Moderate** Due to the generalist	**Yes**

SPECIES	STATUS	HABITAT DESCRIPTION AND LOCALLY KNOWN POPULATIONS	LIKELYHOOD OF OCCURRENCE WITHIN THE STUDY AREA	7-PART TEST REQUIRED
		woodlands and riparian woodlands of interior NSW are also used (Marchant and Higgins 1993; Aumann 2001a). For nest sites it requires a tall living tree within a remnant patch, where pairs build a large stick nest in winter and lay in early spring.	requirements of this species habitat was considered to be present within the site.	
Haliaeetus leucogaster White-bellied Sea Eagle	EPBC Act-M	Occupies habitat characterised by the presence of large areas of open water and feeds opportunistically on a variety of fish, birds, reptiles, mammals and crustaceans. The nests are built in a variety of sites including tall trees, bushes, mangroves, cliffs, rocky outcrops, caves, crevices, on the ground or even in artificial structures.	**High – Recorded within study area.** Hunting and nesting habitat was present.	Not required under state legislation. Has been addressed in Section 9 of this report.
Ninox connivens Barking Owl	TSC Act-V	This species is found in forest and woodland, encountered most commonly in savanna and paperbark woodlands. It sometimes roosts in rainforests, but it requires the more open country for hunting and hollow Eucalypts for breeding.	**Moderate** Suitable hunting and limited roosting habitat was present within the study area. Suitable hunting, roosting and nesting habitat was present.	**Yes**
Ninox strenua Powerful Owl	TSC Act-V	Inhabits a wide range of vegetation types from wet Eucalypt forests with a Rainforest understorey to Dry Open Forests and Woodlands. The species has been recorded utilising disturbed habitats such as exotic pine plantations and large trees in parks and gardens. Powerful Owls nest in a slight depression in the wood-mould on the base of a cavity in a large old tree, sometimes in excess of 25 metres above the ground.	**Moderate-High** Suitable hunting, roosting and nesting habitat was present.	**Yes**
Tyto longimembris Eastern Grass Owl	TSC Act-V	This species roost and nest on the ground, in crops or in thick grass tussock often associated with swamps.	**Low** Marginal habitat was considered to be available within the area of Swamp Forest in the south of the study area.	**Yes**
Tyto novaehollandiae Masked Owl	TSC Act-V	A range of wooded habitats that contain mature trees with large hollows for roosting and nesting, and more open areas for hunting.	**Moderate-High** – Suitable hunting, roosting and nesting habitat was present.	**Yes**
Tyto tenebricosa Sooty Owl	TSC Act-V	Prefers dense dimly-lit forests, inhabiting pockets of rainforest and wet sclerophyll forest mainly in mountainous areas, often in south-east facing gullies.	**Unlikely** – Due to the lack of rainforest and tall wet sclerophyll forest the Sooty Owl would be considered unlikely to be present	**No**

SPECIES	STATUS	HABITAT DESCRIPTION AND LOCALLY KNOWN POPULATIONS	LIKELYHOOD OF OCCURRENCE WITHIN THE STUDY AREA	7-PART TEST REQUIRED
			on site.	
Planigale maculata Common Planigale	TSC Act-V	In NSW it is found along the coastal strip, occupying a variety of habitats ranging from rainforest, wet and dry sclerophyll forests to grasslands, marshlands and rocky areas.	**Low** Suitable habitat was present within the study area. Few records for this species are known from the locality.	**Yes**
Dasyurus maculatus maculatus Tiger Quoll	TSC Act-V	Inhabits sclerophyll forests, rainforests and coastal woodlands. Nests are made in rock caves and hollow logs or trees, and basking sites are usually found nearby.	**Moderate - High** Suitable habitat was present over the majority of the study area.	**Yes**
Phascogale tapoatafa Brush-tailed Phascogale	TSC Act-V	Sparsely distributed outside the semi-arid zone in dry sclerophyll forest and monsoonal forest and woodland.	**High** Foraging and nesting habitat was present over much of the study area. Has been recorded within the adjoining property to the east (B & L Lane 2012, **pers**. comm., 3 July).	**Yes**
Phascolarctos cinereus Koala	TSC Act-V EPBC Act – V (NSW & Qld)	Coastal woodland and open forest containing suitable food trees.	**High – Evidence of Koala activity on site.** Preferred feed trees, *Eucalyptus robusta* (Swamp Mahogany) and *Eucalyptus microcorys* (Tallowwood) were present.	**Yes**
Macropus parma Parma Wallaby	TSC Act-V	Preferred habitat is moist eucalypt forest with thick, shrubby understorey, often with nearby grassy areas, rainforest margins and occasionally drier eucalypt forest.	**Unlikely** Suitable habitat was considered to be present, however due to the lack of local records this species would be unlikely to be present within the study area.	**No**
Petrogale penicillata Brush-tailed Rock-wallaby	TSC Act – E1 EPBC Act – E	Found in steep rocky sites in sclerophyll forests with a grassy understorey.	**Unlikely** No suitable habitat was present within the study area.	**No**
Aepyprymnus rufescens Rufous Bettong	TSC Act-V	Occupies a variety of habitats ranging from coastal Eucalypt forests to tall Wet Sclerophyll Forests along the east coast of Australia. West of the Great Dividing Range it occupies Low Open Woodland. It tends to favour those areas where there is a	**Low** Suitable habitat was considered to be present. Due to the paucity of local records the occurrence of	**Yes**

SPECIES	STATUS	HABITAT DESCRIPTION AND LOCALLY KNOWN POPULATIONS	LIKELYHOOD OF OCCURRENCE WITHIN THE STUDY AREA	7-PART TEST REQUIRED
		sparse or grassy understorey.	this species would be low.	
Potorous tridactylus tridactylus Long-nosed Potoroo	TSC Act-V	This species is known from a variety of habitats, including Rainforest, Open Forests and Woodlands with dense groundcover, and dense, wet coastal heathlands. Soft (often sandy) substrates are preferred by this species.	**Moderate** Suitable habitat was available within the study area.	**Yes**
Cercartetus nanus Eastern Pygmy-possum	TSC Act-V	Feeds mostly on the pollen and nectar from banksias, eucalypts and understorey plants and will also eat insects, seeds and fruit. Hollow bearing trees are favoured for shelter and nesting although spherical nests constructed of short shredded bark have been found between the wood and bark of eucalypts.	**Moderate** Foraging and nesting habitat was present.	**Yes**
Petaurus australis Yellow-Bellied Glider	TSC Act-V	This species occupies tall, mature wet eucalypt forest.	**Moderate-High** Foraging and nesting habitat was present.	**Yes**
Petaurus norfolcensis Squirrel Glider	TSC Act-V	Dry sclerophyll forests and woodlands with exudates for foraging and hollows for nesting.	**High** Foraging and nesting habitat was present.	**Yes**
Pseudomys gracilicaudatus Eastern Chestnut Mouse	TSC Act-V	Found in heathland, wet heathland and swamps.	**Low - Moderate** Suitable habitat was present within the study area.	**Yes**
Psuedomys novaehollandiae New Holland Mouse	EPBC Act – E	Known to inhabit open heathlands, open woodlands with a heathland understorey and vegetated sand dunes.	**Moderate** Suitable habitat was present within the south of the study area.	Not required under state legislation. Has been addressed in Section 9 of this report.
Pteropus poliocephalus Grey-headed Flying-Fox	TSC Act-V EPBC Act-V	Wet and Dry Sclerophyll Forests, Rainforest, Mangroves and Paperbark swamps and Banksia Woodlands.	**High – Recorded within study area.** Seasonal foraging habitat was present over the majority of the study area. Limited roosting habitat was also likely to be present.	**Yes**
Syconycteris australis Common Blossom-bat	TSC Act-V	Occurs within coastal areas of northeast NSW and eastern Queensland. Often roost in littoral rainforest and feed on flowers in adjacent heathland and paperbark swamps. Has been recorded	**Low - Moderate** Suitable habitat was present within the study area. The study	**Yes**

SPECIES	STATUS	HABITAT DESCRIPTION AND LOCALLY KNOWN POPULATIONS	LIKELYHOOD OF OCCURRENCE WITHIN THE STUDY AREA	7-PART TEST REQUIRED
		just north of Hawks Nest (Wildthing Environmental Consultants, 2012).	area would be considered to be on the far southern limit of the distribution of this species.	
Kerivoula papuensis Golden-tipped Bat	TSC Act-V	Found in rainforest and adjacent wet and dry sclerophyll forest up to 1000m. It is also recorded in tall open forest. This species roosts mainly in abandoned hanging Yellow-throated Scrubwren and Brown Gerygone nests, also in tree hollows, dense foliage and epiphytes; located in rainforest gullies on small first and second-order streams. There is a paucity of local record of this species.	**Low** Suitable hunting and roosting habitat was present.	**Yes**
Saccolaimus flaviventris Yellow-bellied Sheathtail-bat	TSC Act-V	This microchiropteran bat species occupies a range of habitats including eucalypt forests, Mallee or open country. Roosts in tree hollows, animal burrows, dry clay cracks, under rock slabs and in abandoned Sugar Glider nests.	**Moderate** Suitable hunting and roosting habitat was present.	**Yes**
Mormopterus norfolkensis East Coast Freetail-bat	TSC Act-V	This species appears to live in Sclerophyll Forests and Woodland. Roosts in tree hollows or under loose bark.	**Moderate - High** Suitable hunting and roosting habitat was present on site.	**Yes**
Falsistrellus tasmaniensis Eastern False Pipistrelle	TSC Act-V	Inhabits sclerophyll forests and has been observed roosting in holes and hollow trunks of eucalypts.	**Moderate - High** Suitable hunting and roosting habitat was present on site.	**Yes**
Miniopterus australis Little Bentwing-bat	TSC Act-V	Tropical Rainforest to warm-temperate Wet and Dry Sclerophyll Forest; caves or similar structures for roosting.	**High – recorded on within study area.** Suitable hunting habitat was present. No preferred roosting habitat was present.	**Yes**
Miniopterus schreibersii oceanensis Large Bentwing-bat	TSC Act-V	Wet and Dry Tall Open Forest, Rainforest, Monsoon Forest, Open Woodland, Paperbark Forests and Open Grasslands; caves or similar structures for roosting. It occasionally uses tree hollows.	**Moderate-High** Suitable hunting habitat was present. No preferred roosting habitat was present.	**Yes**
Myotis macropus Eastern Myotis	TSC Act-V	Various habitats of the coast and adjacent ranges with suitable waterbodies for hunting; caves or similar structures for roosting. It occasionally uses tree hollows.	**Moderate** Suitable hunting habitat was present on site.	**Yes**
Scoteanax rueppellii Greater Broad-nosed Bat	TSC Act-V	Tree-lined creeks, woodland/clearing ecotones and rainforest creeks, roosting mainly in tree hollows.	**High – recorded on site.** Suitable hunting and roosting habitat was present.	**Yes**

SPECIES	STATUS	HABITAT DESCRIPTION AND LOCALLY KNOWN POPULATIONS	LIKELYHOOD OF OCCURRENCE WITHIN THE STUDY AREA	7-PART TEST REQUIRED
Chalinolobus dwyeri Large-eared Pied Bat	TSC Act-V	This species has been found occupying Dry Sclerophyll Forest and Woodland. Roosts in caves, abandoned mud-nests of Fairy Martins and mine tunnels.	**Low-Moderate** Suitable hunting habitat was present on site. No suitable roosting habitat was considered to be present.	**Yes**
Vespadelus troughtoni *Eastern Cave Bat*	TSC Act-V	The Eastern Cave Bat roosts in caves and occurs in wet/dry sclerophyll forests to the semi arid zone. It has been found roosting in small groups in sandstone overhangs, in mine tunnels and occasionally buildings.	**Moderate** Suitable hunting habitat was present. No suitable roosting habitat was considered to be present.	**Yes**

5.3 FAUNA APPRAISAL RESULTS

A full list of fauna species observed during the survey is contained in Appendix D.

5.3.1 SMALL TERRESTRIAL MAMMAL TRAPPING

During this component of the survey two species of mammal, *Antechinus stuartii* (Brown Antechinus) and *Rattus fuscipes* (Bush Rat) were captured. Additional species captured included *Egernia major* (Land Mullet) and *Pseudechis porphyriacus* (Red Bellied Black Snake). The results of the small terrestrial mammal survey are shown in Table 9.

Table 9: Small Terrestrial Mammal Trapping Results.

DATE	TRAP NO	SPECIES	SEX
Tuesday	T7	*Rattus fuscipes* (Bush Rat)	Male
19/10/10	T8	*Antechinus stuartii* (Brown Antechinus)	Female
	T11	*A. stuartii*	Female
	T13	*Egernia major* (Land Mullet)	
	T17	*A. stuartii*	Female
	T20	*R. fuscipes*	Female
	T21	*A. stuartii*	Female
	T26	*R. fuscipes*	Male
	T35	*R. fuscipes*	Male
	T46	*R. fuscipes*	Female
	T49	*R. fuscipes*	Male
Wednesday	T8	*A. stuartii*	Female
20/10/10	T13	*R. fuscipes*	Female
	T17	*A. stuartii*	Female
	T23	*A. stuartii*	Female
	T35	*R. fuscipes*	Female
	T36	*R. fuscipes*	Female
	T43	*R. fuscipes*	Male
Thursday	T7	*R. fuscipes*	Male
21/10/10	T8	*A. stuartii*	Female
	T9	*R. fuscipes*	Female
	T10	*A. stuartii*	Female
	T15	*A. stuartii*	Female
	T21	*A. stuartii*	Female
	T23	*A. stuartii*	Female
	T33	*R. fuscipes*	Male
	T39	*A. stuartii*	Female
	T43	*R. fuscipes*	Male
Friday	T7	*R. fuscipes*	Female
22/10/10	T8	*A. stuartii*	Female
	T9	*A. stuartii*	Female
	T10	*A. stuartii*	Female
	T15	*A. stuartii*	Female
	T26	*R. fuscipes*	Female
	T34	*Pseudechis porphyriacus* (Red Bellied Black Snake)	
	T37	*R. fuscipes*	Female
	T39	*R. fuscipes*	Female
	T45	*R. fuscipes*	Male
	T49	*R. fuscipes*	Male

5.3.2 MEDIUM TERRESTRIAL MAMMAL TRAPPING

During this component of the survey one species of reptile, *Varanus varius* (Lace Monitor) was captured. The results of the medium terrestrial mammal survey are shown in Table 10.

Table 10: Medium Terrestrial Mammal Trapping Results.

DATE	TRAP NO	SPECIES
Tuesday 19/10/10		No captures
Wednesday 20/10/10	C12	*Varanus varius* (Lace Monitor)
Thursday 21/10/10	C12	*V. varius*
Friday 22/10/10	C5 C12	*V. varius* *V. varius*

5.3.3 ARBOREAL MAMMAL TRAPPING

During this component of the survey one species of mammal, *Antechinus stuartii* (Brown Antechinus) was captured. The results of the small terrestrial mammal survey are shown in Table 11.

Table 11: Arboreal Mammal Trapping Results.

DATE	TRAP NO	SPECIES	SEX
Tuesday 19/10/10	A7	*Antechinus stuartii* (Brown Antechinus)	Female
Wednesday 22/10/10	A7	*A. stuartii*	Female
Thursday 23/10/10		No captures	
Friday 24/10/10		No captures	

5.3.4 HARP TRAPPING

During the harp trapping component of the survey nine species of microchiropteran bat; *Vespadelus vulturnus* (Little Forest Bat), *Miniopterus australis* (Little Bentwing-bat), *Scoteanax rueppellii* (Greater Broad-nosed Bat), *Chalinolobus morio* (Chocolate Wattled Bat), *Nyctophilus geoffroyi* (Lesser Long-eared Bat), *Nyctophilus gouldi* (Gould's Long-eared Bat), *Chalinolobus gouldi* (Gould's Wattled Bat) and *Mormopterus* sp. 2 were captured.

Two of these species, *M. australis* and *S. rueppellii* are listed as threatened species under the TSC Act 1995 and have been further assessed in Section 6 and Appendix A. The results of the harp trapping survey are shown in Table 12. The location of both threatened microchiropteran bat species is shown in Figure 28.

KEY

- *Crinia tinnula* (Wallum Froglet)
- *Glossopsitta pusilla* (Little Lorikeet)
- *Scoteanax rueppellii* (Greater Broad-nosed Bat)
- *Miniopterus australis* (Little Bentwing-bat)
- *Pteropus poliocephalus* (Grey-headed Flying-fox)
- Koala Scat

Aerial Photo: Land and Property Information 2013.

Figure 28: Location of threatened fauna within study area.

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Table 12: Harp Trapping Results.

DATE	TRAP NO.	SPECIES	SEX
Tuesday 19/10/10	Trap 1	*Scoteanax rueppellii* (Greater Broad-nosed Bat)	Female
		Vespadelus vulturnus (Little Forest Bat)	Male
		V. vulturnus	Male
		V. vulturnus	Male
		V. vulturnus	Male
		V. vulturnus	Male
		Chalinolobus morio (Chocolate Wattled Bat)	Male
		C. morio	Male
		Mormopterus sp. 2	Female
		M. sp 2	Male
		Nyctophilus gouldi (Gould's Long-eared Bat)	Male
		N. gouldi	Female
		Chalinolobus gouldii (Gould's Wattled Bat)	Male
		C. gouldii	Female
		Nyctophilus geoffroyi (Lesser Long-eared Bat)	Male
	Trap 2	No captures	
Wednesday 20/10/10	Trap 1	*Miniopterus australis* (Little Bentwing-bat)	Female
		V. vulturnus	Female
		N. geoffroyi	Male
	Trap 2	No captures	
Thursday 21/10/10	Trap 1	No captures	
	Trap 2	No captures	
Friday 22/10/10	Trap 1	*C. morio*	Male
	Trap 2	No captures	

5.3.5 MICROCHIROPTERAN BAT CALL DETECTION

Five species of microchiropteran bat, *Chalinolobus gouldii* (Gould's Wattled Bat), *Chalinolobus morio* (Chocolate Wattled Bat), *Mormopterus* sp. 2, *Scoteanax rueppellii* (Greater Broad-nosed Bat) and *Vespadelus vulturnus* (Little Forest Bat) were positively identified during the bat call survey. The audible *Nyctinomus australis* (White-striped Freetail-bat) was also recorded. A number of calls attributed to the Genus *Nyctophilus* were likely to be either *N. geoffroyi* or *N. gouldi* which were both captured during harp trapping. Calls attributed to the Genus Vespadelus were probably *Vespadelus vulturnus* (Little Forest Bat) which was captured during the trapping survey.

As previously mentioned *S. rueppellii* is listed as vulnerable under the TSC Act (1995) and has been further assessed within Section 6 and Appendix A of this report.

5.3.6 AMPHIBIAN SURVEY

Ten species of amphibian, *Crinia signifera* (Common Eastern Froglet), *Crinia tinnula* (Wallum Froglet), *Limnodynastes peronii* (Striped Marsh Frog), *Pseudophryne bibronii* (Bibron's Toadlet), *Pseudophryne coriacea* (Red-backed Toadlet). *Litoria fallax* (Dwarf Tree Frog), *Litoria peronii* (Peron's Tree Frog), *Litoria tyleri* (Tyler's Tree Frog), *Uperoleia laevigata* (Smooth Toadlet) and *Paracrinia*

haswelli (Haswell's Froglet) were recorded within the study area during targeted and incidental surveys. Another amphibian *Litoria jervisensis* (Jervis Bay Tree Frog) was also recorded during a previous survey (Wildthing Environmental Consultants, 2008a). All of these frogs with the exception of *P. bibronii, P. coriacea* and *U. laevigata* were found to inhabit areas of wetland within the Swamp Forest in the south of the study area. *Pseudophryne coriacea* was found within the minor ephemeral drainage lines, *Pseudophryne bibronii* was heard calling within moist forest litter and *U. laevigata* was recorded around the dam in the far north of the site.

Crinia tinnula is listed as vulnerable under the TSC Act (1995) and as a consequence has been further assessed within Section 6 and Appendix A of this report. The location of *C. tinnula* is shown in Figure 28.

5.3.7 REPTILE SURVEY

Five species of reptile, *Lampropholis delicata* (Grass Skink), *Varanus varius* (Lace Monitor), *Egernia major* (Land Mullet), *Saiphos equalis* (Three-toed Skink) and *Pseudechis porphyriacus* (Red-bellied Black Snake) were recorded within the site during targeted and incidental surveys. An additional reptile *Morelia spilota* ssp. *spilota* (Diamond Python) was also recorded within the study area during a previous survey (Wildthing Environmental Consultants, 2008b).

None of these reptile species are regarded as threatened according to State or National legislation.

5.3.8 DIURNAL AVIFAUNA SURVEY

An array of avifauna species was found to be present within the varius habitat across site.

Within the Open Forest areas avifauna species commonly encountered included *Rhipidura fuliginosa* (Grey Fantail), *Cormobates leucophaea* (White-throated Treecreeper), *Lichenostomus chrysops* (Yellow-faced Honeyeater), *Todiramphus sancta* (Sacred Kingfisher), *Philemon corniculatus* (Noisy Miner), *Philemon corniculatus* (Noisy Friarbird), *Meliphaga lewinii* (Lewin's Honeyeater), *Platycercus eximius* (Eastern Rosella) and *Acanthiza pusilla* (Brown Thornbill).

Avifauna species recorded on the Mangrove/Mudflat/Sandflat area included *Egretta novaehollandiae* (White-faced Heron), *Larus novaehollandiae* (Silver Gull), *Cygnus atratus* (Black Swan), *Numenius madagascariensis* (Eastern Curlew), *Numenius phaeopus* (Whimbrel) and *Butorides striatus* (Striated Heron). A dead specimen of *Puffinus tenuirostris* (Short-tailed Shearwater) was also found washed up on the foreshore.

Birds of prey recorded included *Haliastur sphenurus* (Whistling Kite), *Accipiter novaehollandiae* (Grey Goshawk) and *Haliaeetus leucogaster* (White-breasted Sea-Eagle).

One threatened avifauna species *Glossopsitta pusilla* (Little Lorikeet) listed as vulnerable under the TSC Act (1995) was observed within open forest in the south of the study area (Figure 28). This species has been further assessed within Section 6 and Appendix A of this report.

Rhipidura rufifrons (Rufous Fantail), *Haliaeetus leucogaster* (White-bellied Sea-eagle), *Numenius madagascariensis* (Eastern Curlew) and *Numenius phaeopus* (Whimbrel) are recognised as Migratory Bird species under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) and have been further addressed in Section 9 of this report.

Also there was:

- no whitewash, regurgitation pellets or prey remains consistent with that of Owls species noted, and
- no chewed (*Allo)casuarina* cones found on site consistent with those eaten by Glossy Black Cockatoos.

All birds observed on site during this and the previous surveys are indicated in the Total Fauna Species List in Appendix D.

5.3.9 NOCTURNAL AVIFAUNA SURVEY

Ninox boobook (Southern Boobook) was observed and commonly heard calling during nocturnal surveys. *Podargus strigoides* (Tawny Frogmouth) has been recorded within the site during a previous survey (Wildthing Environmental Consultants, 2002). There were no responses as a result of the owl calls played during the survey.

5.3.10 SPOTLIGHTING SURVEY

Three species of native mammal *Trichosurus vulpecula* (Brush-tailed Possum), *Macropus giganteus* (Eastern Grey Kangaroo) and *Pteropus poliocephalus* (Grey-headed Flying-fox) were observed during spotlighting. *Trichosurus vulpecula* was commonly encountered within the forest canopy with *M. giganteus* observed grazing within the cleared areas. The Grey-headed Flying-fox was observed foraging within the canopy of a number of flowering Ironbark species (Figure 28) and has also been recorded within the study area during a previous survey feeding on winter flowering *Eucalyptus robusta* (Swamp Mahogany) (Wildthing Environmental Consultants, 2002).

Additional fauna species recorded during past spotlighting surveys were *Pseudocheirus peregrinus* (Common Ringtail Possum) and *Wallabia bicolor* (Swamp Wallaby) (Wildthing Environmental Consultants, 2002).

There were no responses as a result of the mammal calls played during the survey.

The Grey-headed Flying-fox is listed as 'Vulnerable' under both state and national legislation and has been further addressed in Section 6 and 9 and Appendix A of this report.

5.3.11 STAGWATCHING SURVEY

A number of specimens of *Trichosurus vulpecula* were observed during the stag watching survey.

5.3.12 INCIDENTIAL OBSERVATIONS AND SECONDARY INDICATIONS

A number of incidental observations and secondary indications of fauna were observed during the survey and included:

- No Koalas were directly observed within the study area during targeted and incidental surveys completed for this report or previous reports (Wildthing Environmental Consultants, 2002, 2008a & 2008b). However evidence of Koala activity in the form of characteristic scratches on the boles of tree and a small number of scats associated with specimens of *Eucalyptus robusta* (Swamp Mahogany) were located within the area mapped as Swamp Sclerophyll Forest. Previous studies also reported Koala activity within this area in the form of scratches and scats (Wildthing Environmental Consultants, 2002). One record of a Koala within the eastern portion of the study area dating back to 1995 was present on the Atlas of NSW Wildlife (OEH, 2012). As the Koala is listed as 'Vulnerable' under the TSC Act 1995 it has been further addressed in Section 6 of this report.
- A number of small conical diggings attributed to Bandicoot species *Perameles nasuta* (Long-nosed Bandicoot) or *Isoodon macrourus* (Northern Brown Bandicoot) were commonly found throughout the study area;
- Scats and footprints consistent with that of a macropod were found to be common throughout the site. Larger scats and prints were most likely from *Macropus giganteus* (Eastern Grey Kangaroo) observed within the study area during this survey. Smaller prints were found to be consistent with *Wallabia bicolor* (Swamp Wallaby) which has been recorded within the study area during a previous survey (Wildthing Environmental Consultants, 2002);
- A disjunct population of *Vombatus ursinus* (Common Wombat) has been previously reported within the locality at Fame Cove (Scotts *et al*. 1997). Any local record of this species within the locality would be considered to be significant. No evidence such as burrows, scats and direct observation of the Wombat were recorded during the surveys or past surveys within the study area.

5.3.13 SURVEY LIMITATIONS

As with all reports of this type the main survey limitation for the survey is considered to be the short period of time in which the fieldwork was carried out during one season. Limitations to the likelihood of detecting certain subject species were also encountered during this survey. Such limitations were generally related to the seasonal delectability of species, be it as a result of known flowering periods for flora or migratory movements by fauna.

These limitations have been overcome by applying the precautionary principle in all cases where the survey methodology may have given a false negative result. This precautionary principle was achieved by recognising that most threatened species are rare and therefore unlikely to be encountered during a survey even if they may utilise the site at other times. These species have been assessed on the basis of the presence of their habitat and the likely significance of that habitat to a viable local population.

6.0 CONSIDERATIONS UNDER SECTION 5A OF THE EPA ACT

Considerations of the effects of the proposal under the guidelines of Section 5A of the Environmental Planning and Assessment Act (1995) are given in Appendix A. The species dealt with were those species identified on site during the fieldwork and those considered to have potential habitat available within the study area as detailed in Section 4.2.2 of this report.

Approximately 7ha of Swamp Mahogany – Paperbark Forest present on lower ground within the south of the study area was found to contain floristic components consistent with the Endangered Ecological Community - Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions. The area of Swamp Sclerophyll Forest formed part of a larger area of adjoining Swamp Sclerophyll Forest to the east and west. The proposed building footprint is located outside the area of Swamp Sclerophyll Forest however it will be situated a relatively short distance to the north of this EEC. Due to the close proximity of the proposed facility to the EEC there is the potential for secondary impacts such as stormwater runoff, sedimentation and increased weed infestation. Strict controls will have to be applied to the building precinct to prevent any future degradation to the area of Swamp Sclerophyll Forest. The intake/outtake pipes connecting the proposed facility to the waters of Port Stephens will be required to cross the area of Swamp Forest. To reduce the impact on the Endangered Ecological Community the pipeline will be installed above the ground north of the pumphouse on supports along a narrow corridor and manoeuvred to avoid the removal of any trees. Some disturbance to the understorey vegetation is likely to occur during construction however the understorey should not take long to recover. A vegetation management plan recommended for the proposal will help ensure the long-term viability of this community within the study area during and post construction. Given the recommendations the proposal is unlikely to cause extinction of this endangered ecological community in the locality.

Saltmarsh occupied a large portion of the intertidal zone of Pig Station Creek where the emergency egress in the form of a boardwalk is proposed to be positioned. This area of Saltmarsh was generally intact however had been subject to some disturbances from past crossing of Pig Station Creek by vehicles. The boardwalk will be designed to require minimal disturbance to this community.

Areas of Swamp Oak Floodplain Forest were found to occur within the vicinity of the proposed emergency egress crossing. The proposal will not require the removal of any areas of Swamp Oak Floodplain Forest.

No other Endangered Ecological Communities were found to be present within the study area.

Despite targeted searches no threatened flora species were recorded during the survey. Suitable habitat of varying quality was found to be present for 18 of the 26 species addressed in this report.

- *Cryptostylis hunteriana* (Leafless Tongue Orchid)
- *Diuris arenaria* (Tomaree Doubletail)
- *Diuris praecox* (Newcastle Doubletail)
- *Corybas dowlingii* (Red Helmet Orchid)
- *Rhizanthella slateri* (Eastern Underground Orchid)
- *Asperula asthenes* (Trailing Woodruff)
- *Angophora inopina* (Charmhaven Apple)
- *Callistemon linearifolius* (Netted Bottlebrush)
- *Tetratheca juncea* (Black-eyed Susan)
- *Eucalyptus parramattensis* ssp. *decadens* (Drooping Red Gum)
- *Melaleuca biconvexa* (Biconvex Paperbark)
- *Melaleuca groveana* (Grove's Paperbark)
- *Syzygium paniculatum* (Magenta Lilly Pilly)
- *Maundia triglochinoides*
- *Persicaria elatior* (Tall Knotweed)
- *Cynanchum elegans* (White-flowered Wax Plant)
- *Chamaesyce psammogeton* (Sand Spurge)
- *Senecio spathulatus* (Coastal Fireweed)

Of these threatened flora species the most likely habitat was considered to be present for *T. juncea* within the study area. A record of the species was found to be present close to the north-west boundary of the study area (NPWS, 2011). Any occurrence of *T. juncea* within the study area would be largely confined to the area mapped as Smooth-barked Apple/Stringybark Forest which occurs outside the proposed development area. A small number of records of *A. asthenes* and *M. groveana* were also present on the northern shore of Port Stephens. Any habitat for either *M. groveana* or *A.* asthenes within the study area was also considered to be present to the north of the proposal. *Melaleuca groveana* is most likely to be associated with volcanic rock, which was absent from the study area. There is a paucity of local records on the northern shore of Port Stephens for the remainder of the addressed species considered to have suitable habitat within the study area. This may in part be the result of the lower number of environmental assessments conducted within this area.

Five threatened fauna species were recorded on site during the survey:

- *Crinia tinnula* (Wallum Froglet)
- *Glossopsitta pusilla* (Little Lorikeet)
- *Pteropus poliocephalus* (Grey-headed Flying-fox)
- *Miniopterus australis* (Small Bentwing-bat)
- *Scoteanax rueppellii* (Greater Broad-nosed Bat)

One additional species *Phascolarctos cinerea* (Koala) was also considered to utilise the site as a result of the present of characteristic scratches and scats.

Crinia tinnula (Wallum Froglet)

The Wallum Froglet was recorded within the low lying areas of Swamp Mahogany Paperbark Forest in the southern portion of the study area. This frog species was also heard calling from adjoining habitat within Lot 1 DP 1014683 and within similar habitat in the electricity easement running parallel to the south-eastern boundary. The proposed building footprint will be located a short distance to the north of the area of Swamp Mahogany Paperbark Forest. Due to the close proximity of the proposed facility to suitable habitat for *C. tinnula* there is the potential for secondary impacts such as stormwater runoff and increased weed infestation. Strict controls will have to be applied to prevent any future degradation of suitable habitat. The intake/outtake pipes connecting the proposed facility to the waters of Port Stephens will cross the area of Swamp Mahogany Paperbark Forest Swamp Forest. These pipes will be raised on supports north of the pumphouse allowing for the movement of frogs underneath. South of the pumphouse the pipelines will be buried and the natural ground levels reinstated. The construction of the intake/outtake pipeline will result in a short term disturbance to a narrow area of known habitat however is unlikely to cause the extinction of *C. tinnula* in the local area.

Glossopsitta pusilla (Little Lorikeet)

Up to three specimens of *Glossopsitta pusilla* (Little Lorikeet) were recorded within a tree in the far south of the study area. Suitable foraging and nesting habitat was present across over the majority the forested areas of the study area. The proposal will involve removal of approximately 1ha of suitable foraging and nesting habitat. Additional areas of habitat will also be thinned and underscrubbed to comply with the required Bushfire Asset Protection Zones. The proposal will result in a small incremental reduction of habitat for the Little Lorikeet. Taking into account the relatively large amount of suitable surrounding habitat it is considered that the proposal is unlikely to cause extinction of the local population of this highly mobile species. To help reduce the impact on this parrot species it is recommended that suitable compensatory nesting habitat in the form of nestboxes be erected within the subject site.

Phascolarctos cinerea (Koala)

No Koalas were directly observed within the study area during fieldwork completed for this report. However evidence of Koala activity in the form of characteristic scratches on trees and scats were found to be present within the area of Swamp Forest in the south of the study area. One record of Koalas occurring within the western side of the study area dating back to 1995 was also present on the OEH database. Koala records documented by the Myall Koala & Environment Group Inc show a small number of more recent records from within the locality. These records include a mother and young sighted on 5 November 2012 on Clarke Street adjacent to the neighboring Lot 3. Two other records along Clarke Street are known from October 2010 and April 2004. The later sighting was a

sick Koala which later died in care. Although no direct sightings were recorded during previous surveys (Wildthing Environmental Consultants, 2002) characteristic scratches on trees and scats were noted within the study area. The study area contained two species of 'Koala Feed Tree', *Eucalyptus robusta* (Swamp Mahogany) and *Eucalyptus microcorys* (Tallowwood). These eucalypt species were largely confined to the southern portion of the study area. Koala activity was found to be largely confined to specimens of *E. robusta*. The evidence suggests that the study area particularly the area of Swamp Forest has been periodically utilised by a small number of Koalas over a period of time. Given the lack of Koala sightings and low level of Koala activity it is not considered that the study area constitutes 'Core Koala Habitat'.

The proposal will result in the removal of approximately 24 specimens of *E. microcorys* however no specimens of *E. robusta* will be removed. To reduce the impact on Koalas it is recommended that as many specimens of *E. microcorys* are retained within the scope of the development. Structures containing water will need to be designed to avoid any unintended drowning of Koalas. It is also recommended that pipelines or fences do not create any barriers to the movement of Koalas. The pipeline will be raised on supports north of the pumphouse to allow the movement of Koalas underneath within the area of Swamp Sclerophyll Forest and parts of Coastal Sand Blackbutt Open Forest. According to the Port Stephens Comprehensive Koala Plan of Management CKPoM the pipeline should be raised to have at least a 200mm gap underneath to allow Koala movement underneath. Taking the recommendations into consideration the action is unlikely to have an adverse effect on the life cycle of the species such that the local population of Koalas may be placed at risk of extinction.

Pteropus poliocephalus (Grey-headed Flying-fox)

The Grey-headed Flying-fox was observed foraging within the canopy of a small number of flowering Ironbark species during the nocturnal survey. The Grey-headed Flying-fox has also been recorded within the study area during a previous survey foraging on flowering *E. robusta* (Wildthing Environmental Consultants, 2002). The majority of the study area contained suitable foraging habitat in the form of seasonally flowering myrtaceous species, particularly *E. robusta* and *Melaleuca quinquenervia* (Broad-leaved Paperbark). Potential camp sites were also considered to be present within the denser areas of vegetation, however, no camps were found to be present. The proposal will result in the removal of a small amount of foraging habitat, which may be seen as an incremental loss of habitat within the locality. Taking into account the relatively large amount of suitable surrounding habitat it is considered that the proposal is unlikely to cause extinction of the local population of this highly mobile species.

Miniopterus australis (Small Bentwing-bat)

One specimen of *M. australis* was captured within the study area during the harp trapping component of the survey. Calls not inconsistent with those of *M. australis* were also recorded during the bat call survey. A previous survey (Wildthing Environmental Consultants, 2002) also recorded calls from *M. australis* within the study area. The majority of the study area contains suitable hunting habitat for this microchiropteran bat species. No preferred roosting habitat in the form of caves, culverts or other similar man-made structures was found to be present. The proposal is likely to result in a small incremental reduction in quality of hunting habitat in the local area. Taking into consideration the relatively large amount of suitable hunting habitat in the local area and absence of preferred roosting habitat within the study area the proposal is unlikely to disrupt the life cycle of this microchiropteran bat species such that local extinction would occur.

Scoteanax rueppellii (Greater Broad-nosed Bat)

One specimen of *S. rueppellii* (Greater Broad-nosed Bat) was captured within the study area during fieldwork. Calls not inconsistent with those of *S. rueppellii* were also recorded during the bat call survey. The majority of the study area was considered to contain suitable hunting habitat for this species. Roosting habitat in the form of tree hollows was also common throughout the study area. The proposal will result in a small incremental reduction in hunting habitat and the removal of up to 13 hollow-bearing trees. Taking into consideration the relatively large amount of suitable hunting and roosting habitat in the local area the proposal is considered unlikely to result in the extinction of any local population of this species. To help reduce the impact on this microchiropteran bat species it is recommended that suitable compensatory nesting habitat in the form of custom designed nest boxes be erected within the subject site.

No other threatened species were recorded within the site. However it is considered that foraging/hunting/nesting resources of varying quality was available for 53 of the 83 remaining threatened fauna species assessed.

- *Litoria aurea* (Green and Golden Bell Frog)
- *Litoria brevipalmata* (Green-thighed Frog)
- *Caretta caretta* (Loggerhead Turtle)
- *Chelonia mydas* (Green Turtle)
- *Hoplocephalus bitorquatus* (Pale-headed Snake)
- *Hoplocephalus stephensii* (Stephen's Banded Snake)
- *Limicola falcinellus* (Broad-billed Sandpiper)
- *Limosa limosa* (Black-tailed Godwit)
- *Xenus cinereus* (Terek Sandpiper)
- *Charadrius leschenaultii* (Greater Sand-plover)
- *Charadrius mongolus* (Lesser Sand-plover)
- *Calidris ferruginea* (Curlew Sandpiper)
- *Haematopus fuliginosus* (Sooty Oystercatcher)
- *Haematopus longirostris* (Pied Oystercatcher)
- *Esacus neglectus* (Beach Stone-curlew)

- *Sterna albifrons* (Little Tern)
- *Rostratula benghalensis australis* (Australian Painted Snipe)
- *Botaurus poiciloptilus* (Australasian Bittern)
- *Ixobrychus flavicollis* (Black Bittern)
- *Ephippiorhynchus asiaticus* (Black-necked Stork)
- *Ptilinopus magnificus* (Wompoo Fruit-Dove)
- *Ptilinopus regina* (Rose-crowned Fruit-Dove)
- *Ptilinopus superbus* (Superb Fruit-Dove)
- *Callocephalon fimbriatum* (Gang-gang Cockatoo)
- *Calyptorhynchus lathami* (Glossy Black-Cockatoo)
- *Lathamus discolor* (Swift Parrot)
- *Neophema pulchella* (Turquoise Parrot)
- *Melithreptus gularis gularis* (Black-chinned Honeyeater)
- *Anthochaera phrygia* (Regent Honeyeater)
- *Daphoenositta chrysoptera* (Varied Sittella)
- *Pandion cristatus* (Eastern Osprey)
- *Hieraaetus morphnoides* (Little Eagle)
- *Lophoictinia isura* (Square-tailed Kite)
- *Ninox connivens* (Barking Owl)
- *Ninox strenua* (Powerful Owl)
- *Tyto novaehollandiae* (Masked Owl)
- *Tyto longimembris* (Eastern Grass Owl)
- *Dasyurus maculatus maculatus* (Tiger Quoll)
- *Planigale maculata* (Common Planigale)
- *Potorous tridactylus tridactylus* (Long-nosed Potoroo - SE Mainland)
- *Aepyprymnus rufescens* (Rufus Bettong)
- *Cercartetus nanus* (Eastern Pygmy –possum)
- *Petaurus australis* (Yellow-bellied Glider)
- *Petaurus norfolcensis* (Squirrel Glider)
- *Phascogale tapoatafa* (Brush-tailed Phascogale)
- *Pseudomys gracilicaudatus* (Eastern Chestnut Mouse)
- *Falsistrellus tasmaniensis* (Eastern False Pipistrelle)
- *Saccolaimus flaviventris* (Yellow-bellied Sheathtail-bat)
- *Myotis macropus* (Southern Myotis)
- *Miniopterus schreibersii oceanensis* (Large Bentwing-bat)
- *Mormopterus norfolkensis* (Eastern Freetail Bat)
- *Vespadelus troughtoni* (Eastern Cave Bat)
- *Chalinolobus dwyeri* (Large-eared Pied Bat)

Taking the habitat and local records into consideration the most likely of these species to utilise the study area would include *C. lathami, D. chrysoptera, N. strenua, P. cristatus, D. maculatus maculatus, P. australis, P. norfolcensis, P. tapoatafa, M. schreibersii oceanensis, M. norfolkensis* and a number of the waders. The proposal will result in an incremental loss of potential habitat for these addressed threatened fauna species, however taking into consideration the relatively large amount of suitable habitat in the local area and the relatively small area of disturbance the proposal is unlikely to disrupt the life cycle the addressed threatened species such that local extinction would occur.

Within the NSW North Coast Bioregion and Port Stephens LGA the population of the Emu has been listed as Endangered. The Emu was not recorded within the study area during the survey. The Emu

prefers more open vegetation however, open forest which covers the majority of the study area would be considered to offer marginal habitat. Taking into consideration the large amount of similar habitat in the locality and the relatively small area that will impacted upon the proposal is unlikely to result in the local extinction of a viable local population of the Emu.

7.0 CONSIDERATIONS UNDER SEPP 44 – 'KOALA HABITAT PROTECTION'

The principal aim of State Environment Planning Policy 44 - Koala Habitat Protection, is to encourage the proper conservation and management of areas of natural vegetation that provide habitat for Koalas to ensure a permanent free-living population over their present range and to reverse the current trend of Koala population decline.

This policy applies to areas of more than one hectare or an area, which has together with any adjoining land in the same ownership an area of more than 1 hectare, whether or not the development application applies to the whole, or only part of the land. In addressing SEPP44 there are two questions to be considered.

7.1 FIRST CONSIDERATION - IS THE LAND 'POTENTIAL KOALA HABITAT'?

'Potential Koala Habitat' is defined in SEPP 44 as, "...an area of native vegetation where trees of the type listed in Schedule 2 (Koala feed tree species) constitute at least 15% of the total number of trees in the upper or lower strata of the tree component".

Two species of 'Koala Feed Tree', *Eucalyptus robusta* (Swamp Mahogany) and *Eucalyptus microcorys* (Tallowwood) were recorded within the study area. A previous survey within the study area (Wildthing Environmental Consultants, 2002) recorded the additional listed feed tree species, *Eucalyptus punctata* (Grey Gum). After examination of a number of specimens of Grey Gum these trees were found to be *Eucalyptus propinqua* (Small-fruited Grey Gum). *Eucalyptus propinqua* is not listed in Schedule 2, however is known to be utilised by Koalas in the region. Despite the apparent absence of *E. punctata* the SEPP 44 assessment revealed that *E. robusta* and *E. microcorys* would comprise over 15% of the total trees present in some locations, particularly the far southern portion of the study area where the proposal is situated. Therefore the study area would be considered to constitute 'Potential Koala Habitat', and accordingly further provisions of this policy apply to the site.

7.2 SECOND CONSIDERATION - IS THE LAND 'CORE KOALA HABITAT'?

'Core Koala Habitat' is defined in SEPP 44 as "…an area of land with a resident population of Koalas, evidenced by attributes such as breeding females (that is, females with young) and recent sightings of and historical records of a Koala population".

No Koalas were directly observed within the study area during fieldwork completed for this report or previous reports (Wildthing Environmental Consultants, 2002, 2008a & 2008b). However evidence of Koala activity within the study area was found in the form of characteristic scratches on the trunks of trees and a small number of scats. Koala activity appeared to be low and largely confined to the area of Swamp Sclerophyll Forest within the south of the study area and was associated with specimens of *E. robusta*. No positive evidence of Koala activity was noted on and around specimens

of *E. microcorys*. Previous studies also reported Koala activity within this area in the form of scratches and scats (Wildthing Environmental Consultants, 2002). One record of a Koala within the eastern portion of the study area dating back to 1995 was present on the Atlas of NSW Wildlife (OEH, 2012). The Atlas of NSW Wildlife also contained a small number of additional records in the vicinity of the study area. Koala records documented by the Myall Koala & Environment Group Inc show a small number of more recent records from within the locality. These records include a mother and young sighted on 5 November 2012 to the north-west of the study area on Clarke Road adjacent to the neighboring Lot 3. Two other records along Clarke Street are known from October 2010 and April 2004. The later sighting was a sick Koala which later died in care. The evidence suggests that the study area particularly the area of Swamp Sclerophyll Forest in the south constitutes part of a larger area of habitat within the Pindimar area which is utilised by a small number of Koalas.

Given the lack of Koala sightings and low level of Koala activity it is not considered that the study area constitutes 'Core Koala Habitat'. Therefore an Individual Koala Plan of Management would not be required.

8.0 SEPP 14 – COASTAL WETLANDS

State Environmental Planning Policy 14 – Coastal Wetlands (SEPP 14) aims to protect coastal wetlands for the environmental and economic interests of the state. The types of wetland vegetation protected by SEPP 14 are Mangroves, Saltmarshes, Melaleuca forests, Casuarina forests, Sedgelands, Wet Meadow, Brackish Swamps and Freshwater Swamps. SEPP 14 only applies to the following development types when they are proposed within mapped wetlands, being: clearing, levee construction, draining and filling.

Two wetlands listed under SEPP 14 – Coastal Wetlands are located to the east (Wetland No. 757a) and the west (Wetland No. 757b) of the southern portion of the study area (Figure 2). The alternate Bushfire evacuation egress in the form of a boardwalk over Pig Station Creek within the unformed section of Cambage Street will be required to be positioned just to the west of the mapped boundary of Wetland No. 757a (Australian Bushfire Protection Planners Pty Limited, 2013). The remainder of the egress which links up with the formed Cambage Street will cross through approximately 110 metres of Wetland No. 757a. This section of egress which would not require any additional modification consists of a vehicle track previously built up above the high water mark by outside fill.

The egress is proposed to consist of a wooden boardwalk approximately 2m wide that will provide only pedestrian access. The boardwalk will require minimal removal of vegetation to allow for holes for the pylons. The boardwalk is to be raised so as to allow the vegetation to grow out from underneath and to allow continued movement through the area by terrestrial and aquatic fauna.

A vegetation management plan recommended for the proposal will help ensure their long-term viability of this wetland during and post construction. The egress may also prevent illegal vehicle access to the site. Given the recommendations the proposal is unlikely to have any significant effect on the SEPP 14 Wetland.

9.0 CONSIDERATIONS UNDER THE COMMONWEALTH ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

Considerations have been made to the Commonwealth Environment Protection and Biodiversity Conservation (EPBC) Act 1999. Assessments have been made to determine whether or not the proposal or activity has, will have, or is likely to have a significant impact on a matter of National Environmental Significance. The matters of National Environmental Significance and the appropriate responses are listed below:

- *World Heritage properties;*

The proposed development is not considered to affect any World Heritage properties.

- *wetlands recognised under the Ramsar convention as having international significance;*

The study area occurs under 2km to the east of Fame Cove inlet which is included within the greater Myall Lakes Ramsar area. The proposal is unlikely to have any impact on this Ramsar site.

- *listed threatened species and communities;*

Thirty-six nationally threatened species were recorded on the SEWPaC database as occurring or having potential habitat available within 10km of the site, these being:

- *Cryptostylis hunteriana* (Leafless Tongue Orchid)
- *Allocasuarina defungens* (Dwarf Heath Casuarina)
- *Diuris praecox* (Newcastle Doubletail)
- *Angophora inopina* (Charmhaven Apple)
- *Eucalyptus parramattensis* ssp. *decadens* (Drooping Red Gum)
- *Melaleuca biconvexa* (Biconvex Paperbark)
- *Prostanthera densa* (Villous Mintbush)
- *Tetratheca juncea* (Black-eyed Susan)
- *Litoria aurea* (Green and Golden Bell Frog)
- *Mixophyes balbus* (Stuttering Frog)
- *Caretta caretta* (Loggerhead Turtle)
- *Chelonia mydas* (Green Turtle)
- *Dermochelys coriacea* (Leatherback Turtle)
- *Eretmochelys imbricate* (Hawksbill Turtle)
- *Natator depressus* (Flatback Turtle)
- *Diomedea antipodensis* (Antipodean Albatross)
- *Diomedea gibsoni* (Gibson's Albatross)
- *Lathamus discolor* (Swift Parrot)
- *Macronectes giganteus* (Southern Giant-Petrel)
- *Macronectes halli* (Northern Giant-Petrel)
- *Pterodroma neglecta neglecta* (Kermadec Petrel) (Western)
- *Thalassarche bulleri* (Buller's Albatross)
- *Thalassarche cauta cauta* (Shy Albatross)
- *Thalassarche salvini* (Salvin's Albatross)
- *Thalassarche steadi* (White-capped Albatross)
- *Thalassarche impavida* (Campbell Albatross)

- *Rostratula benghalensis australis* (Australian Painted Snipe)
- *Anthochaera phrygia* (Regent Honeyeater)
- *Chalinolobus dwyeri* (Large-eared Pied Bat)
- *Phascolarctos cinereus* (Koala)
- *Dasyurus maculatus maculatus* (Tiger Quoll)
- *Potorous tridactylus tridactylus* (Long-nosed Potoroo)
- *Pteropus poliocephalus* (Grey-headed Flying Fox)
- *Pseudomys novaehollandiae* (New Holland Mouse)
- *Eubalaena australis* (Southern Right Whale)
- *Megaptera novaeangliae* (Humpback Whale)

Under the EPBC Act Policy Statement 1.1 – Significant Impact Guidelines (DEWHA, 2009) an action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

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

One nationally threatened species *Pteropus poliocephalus* (Grey-headed Flying-fox) was recorded foraging within the site during fieldwork. Additionally the recently listed *Phascolarctos cinereus* (Koala) was also identified as utilising the study area from the presence of scratches on trees and scats.

Pteropus poliocephalus (Grey-headed Flying-fox)

The proposal will result in the removal of a relatively small amount of seasonal foraging habitat for *P. poliocephalus,* however, given the abundance of similar food resources in the local area for this highly mobile species it is considered that the proposal is unlikely to significantly impact upon or cause extinction to the local population of this megachiropteran bat species.

Phascolarctos cinereus (Koala)

The proposal will result in the removal of approximately 24 specimens of *Eucalyptus microcorys* (Tallowwood). Taking the recommendations pertaining to the Koala into consideration the proposal is unlikely to have an adverse effect on the life cycle of the species such that the local population of Koalas may be placed at risk of extinction.

No other nationally threatened species were recorded on site during the survey. Of the listed species those terrestrial species most likely to occur/utilise the site are include *T. juncea, D. maculatus maculatus* and *P. novaehollandiae.* The listed marine turtle species may utilise the study area at high tide. Marginal habitat at best was considered to be available for a number of the listed Albatross and Petrel species, however these species would rarely occur within proximity to the study area.

The majority of these nationally listed species that were considered to have some habitat within the study area have been addressed under the provisions of state legislation (ie: Section 5A of the NSW Environmental Planning and Assessment Act 1979). As stated within Section 6, the proposal will lead to a small incremental loss of habitat within the locality, however it is not considered to be locally significant.

- *migratory species protected under international agreements;*

Forty-two nationally listed migratory species were recorded on the DSEWPC on-line database as occurring or having potential habitat available within 10km of the study area, these being:

Migratory Terrestrial Species:

- *Haliaeetus leucogaster* (White-bellied Sea-Eagle)
- *Hirundapus caudacutus* (White-throated Needletail)
- *Merops ornatus* (Rainbow Bee-eater)
- *Monarcha melanopsis* (Black-faced Monarch)
- *Monarcha trivirgatus* (Spectacled Monarch)
- *Myiagra cyanoleuca* (Satin Flycatcher)
- *Rhipidura rufifrons* (Rufous Fantail)
- *Anthochaera phrygia* Regent Honeyeater

Migratory Wetland Species:

- *Actitis hypoleucos* (Common Sandpiper)
- *Ardea alba* (Great Egret)
- *Arenaria interpres* (Ruddy Turnstone)
- *Calidris canutus* (Red Knot)
- *Calidris ferruginea* (Curlew Sandpiper)
- *Calidris ruficollis* (Red-necked Stint)
- *Calidris tenuirostris* (Great Knot)
- *Charadrius bicinctus* (Double-banded Plover)
- *Charadrius mongolus* (Lesser Sand Plover)
- *Gallinago hardwickii* (Latham's Snipe)
- *Heteroscelus brevipes* (Grey-tailed Tattler)
- *Limosa limosa* (Black-tailed Godwit)
- *Numenius madagascariensis* (Eastern Curlew)
- *Numenius minutus* (Little Curlew)
- *Numenius phaeopus* (Whimbrel)
- *Pluvialis fulva* (Pacific Golden Plover)
- *Pluvialis squatarola* (Grey Plover)
- *Rostratula benghalensis* (Painted Snipe)
- *Tringa stagnatilis* (Marsh Sandpiper)
- *Xenus cinereus* (Terek Sandpiper)

Migratory Marine Birds

- *Apus pacificus* (Fork-tailed Swift)
- *Ardea alba* (Great Egret)
- *Ardea ibis* (Cattle Egret)
- *Calonectris leucomelas* (Streaked Shearwater)
- *Sterna albifrons* (Little Tern)
- *Diomedea antipodensis* (Antipodean Albatross)
- *Diomedea gibsoni* (Gibson's Albatross)
- *Macronectes giganteus* (Southern Giant-Petrel)
- *Macronectes halli* (Northern Giant-Petrel)
- *Thalassarche bulleri* (Buller's Albatross)
- *Thalassarche cauta cauta* (Shy Albatross)
- *Thalassarche salvini* (Salvin's Albatross)
- *Thalassarche steadi* (White-capped Albatross)
- *Thalassarche impavida* (Campbell Albatross)

Four of these listed migratory species, the White-bellied Sea-Eagle, Rufous Fantail, Eastern Curlew and Whimbrel were recorded within the study area during fieldwork. The White-bellied Sea Eagle was observed flying over the southern portion of the study area on a number of occasions. No large nests that would be attributed to this species were noted. However an active breeding pair of White-bellied Sea Eagles are known to occupy a large nest to the west of the study area. The waters of Port Stephens occurring within the study area provide suitable hunting habitat as part of a much larger hunting range. The large trees particularly in the southern portion of the study area would also offer suitable nesting habitat. A single Rufous Fantail was observed within the area of Blackbutt/Tallowwood Forest. Open Forest particularly that occurring within the south of the study area would offer both potential foraging and nesting habitat for this species. Both the Eastern Curlew and Whimbrel were recorded foraging within the intertidal mudflats. The Eastern Curlew was also recorded within the study area during previous studies (Wildthing Environmental Consultants, 2002).

The study area would provide areas of suitable habitat for a number of the migratory species assessed. However the relatively shallow mostly intertidal water contained within the study area would only provide marginal habitat at best for the listed pelagic birds such as Shearwaters, Petrels and Albatrosses.

Under the EPBC Act Policy Statement 1.1 – Significant Impact Guidelines (Department of the Environment, Water, Heritage and the Arts, 2009) an action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

- Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species.
- Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or

- Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

Considering the relatively commonality of the four migratory species recorded within local area and the relatively small impact on habitat in the locality it is unlikely that these species or any of the listed migratory species would be significantly impacted by the development.

- *nuclear activities;*

The proposal does not involve any type of nuclear activity.

- *the Commonwealth marine environment;*

The proposal does not involve the modification of the Commonwealth marine environment.

10.0 PROPOSED CONSERVATION AREA

The proponent proposes to set aside a portion of high quality land within the study area to offset land required to be cleared and/or modified for the development. The proposed offset area is 5.14ha and encompasses two ephemeral drainage lines within the Pig Station Creek catchment within the northern portion of the study area (Figure 29). Taking the proposed area of clearing (1.16ha) and area to be modified/disturbed (1.24ha) the offset ratio would be approximately 2:1. Vegetation communities within the proposed offset area include Moist Riparian Forest, Spotted Gum – Ironbark Open Forest, Smooth-barked Apple/Stringybark Open Forest and the Endangered Ecological Community – Swamp Mahogany – Paperbark Forest. This offset area as proposed has been supported by the OEH during consultation and will be maintained for perpetuity for conservation purposes. An appropriate legal conservation mechanism has not as yet been determined and will be confirmed should the project be granted approval.

The vegetation management plan covering habitat in and around the proposed development area will also cover the management of the conservation area.

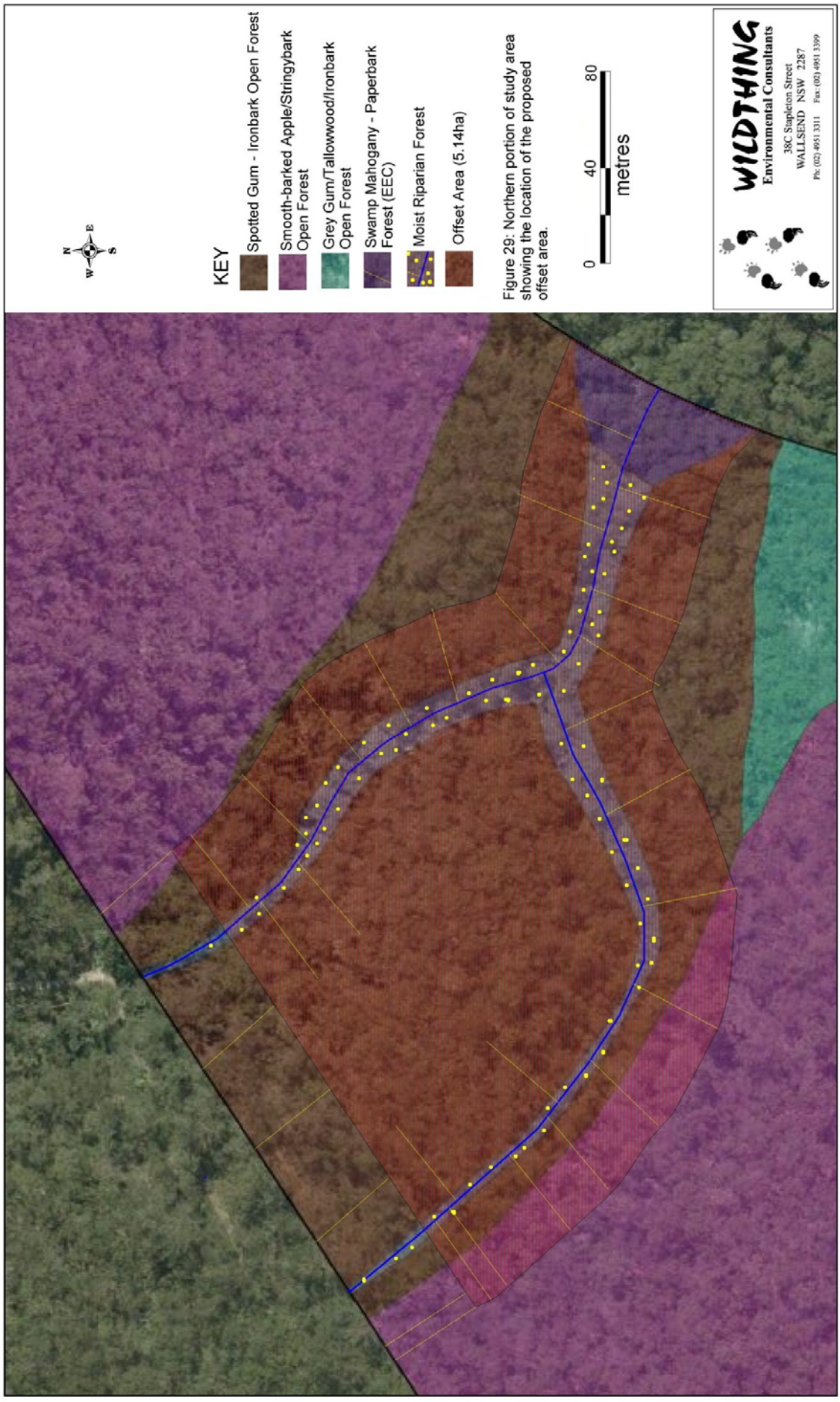

Figure 29: Northern portion of study area showing the location of the proposed offset area.

11.0 RECOMMENDATIONS

The recommendations given in the report have been listed here along with a brief discussion of their implementation.

- Consideration is to be given to retaining known Koala Feed Tree species within the scope of the development. It is also recommended that no barriers which would impact the safe movement of Koalas are put in place. The pipelines will be raised on supports north of the pumphouse to allow the movement of Koalas underneath within the area of Swamp Sclerophyll Forest and parts of Coastal Sand Blackbutt Open Forest. A gap of at least 200mm would be required.
- Where possible it is recommended that hollow-bearing trees be retained. Hollow-bearing trees which are required to be removed are to be compensated by suitable nestboxes at a ratio of 2:1. Additionally any removal of hollow-bearing trees from the site will be required to be supervised by a suitably qualified and experienced fauna ecologist;
- All infestations of invasive weeds species, particularly *Lantana camara* (Lantana) and *Chrysanthemoides monilifera* (Bitou Bush) are to be controlled within proximity to the facility;
- Strict controls will need to be applied to the development to prevent any future degradation to surrounding native habitat in the form of stormwater runoff and sedimentation;
- In relation to the construction of the emergency egress boardwalk the auger holes are to be the same diameter to the pylons to minimise the amount of sediment to be removed. The spoil from the holes is to be removed from the site. To avoid toxic ions leaching into the environment timber preservative treatments in the form of copper, chromium and arsenic should not be used;
- Artificial lighting used to operate at night or used for security may influence nocturnal fauna. It is recommended that lighting be minimised and confined wherever possible.
- An arborist is to be consulted during the construction of the pipelines to reduce the impact on the root zones of nearby trees.

To help ensure these recommendations are carried out, a vegetation management plan should be developed to address any likely impacts during construction and ensure the long-term viability of the nearby surrounding environment including the proposed conservation area.

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APPENDIX A
CONSIDERATIONS UNDER SECTION 5A OF THE EPA ACT

CONSIDERATIONS UNDER SECTION 5A OF THE EPA ACT - SIGNIFICANT EFFECT ON THREATENED SPECIES, POPULATIONS OR ECOLOGICAL COMMUNITIES, OR THEIR HABITATS.

Consideration of this development under the guidelines of Section 5A of the Environmental Planning & Assessment Act (1979) as amended by the Environmental Planning and Assessment Amendment Act (1997) has been made. The heads of consideration of this Section are given in italics followed by the answers applicable to this site. Each species is dealt with separately.

Endangered ecological communities recorded within the study area:

1. Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-east Corner bioregions

2. Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions.

Threatened fauna species present within the study area:

3.	*Crinia tinnula*	Wallum Froglet
4.	*Glossopsitta pusilla*	Little Lorikeet
5.	*Pteropus poliocephalus*	Grey-headed Flying-fox
6.	*Miniopterus australis*	Little Bentwing-bat
7.	*Scoteanax rueppellii*	Greater Broad-nosed Bat

Threatened Fauna species recorded within the study area as a result of secondary evidence:

8.	*Phascolarctos cinereus*	Koala

Flora species considered to have potential habitat within the study area:

9.	<u>Orchids</u>	
	Corybas dowlingii	Red Helmet Orchid
	Cryptostylis hunteriana	Leafless Tongue Orchid
	Diuris arenaria	Tomaree Doubletail
	Diuris praecox	Newcastle Doubletail
	Rhizanthella slateri	Eastern Underground Orchid
10.	<u>Wetland Plants</u>	
	Maundia triglochinoides	Maundia
	Persicaria elatior	Tall Knotweed
11.	<u>Foreshore flora species</u>	
	Chamaesyce psammogeton	Sand Spurge
	Senecio spathulatus	Coastal Fireweed
12.	<u>Small Shrubs</u>	
	Grevillea parviflora ssp. *parviflora*	Small-flowered Grevillea
13.	<u>Shrub Species</u>	
	Callistemon linearifolius	Netted Bottlebrush
	Prostanthera densa	Villous Mintbush
14.	<u>Small Trees</u>	
	Angophora inopina	Charmhaven Apple
	Eucalyptus parramattensis ssp. *decadens*	Drooping Red Gum
	Melaleuca biconvexa	Biconvex Paperbark
	Melaleuca groveana	Grove's Paperbark
	Syzygium paniculatum	Magenta Lilly Pilly
15.	<u>Other flora species</u>	
	Asperula asthenes	Trailing Woodruff
	Cynanchum elegans	White-flowered Wax Plant

Fauna species considered to have potential habitat within the study area:

16.	Invertebrates	
	Petalura gigantea	Giant Dragonfly
17.	Frogs	
	Litoria aurea	Green and Golden Bell Frog
	Litoria brevipalmata	Green-thighed Frog
18.	Marine Reptiles	
	Caretta caretta	Loggerhead Turtle
	Chelonia mydas	Green Turtle
19.	Arboreal Reptiles	
	Hoplocephalus bitorquatus	Pale-headed Snake
	Hoplocephalus stephensii	Stephen's Banded Snake
20.	Waders	
	Limicola falcinellus	Broad-billed Sandpiper
	Limosa limosa	Black-tailed Godwit
	Xenus cinereus	Terek Sandpiper
	Calidris ferruginea	Curlew Sandpiper
	Calidris tenuirostris	Great Knot
	Charadrius leschenaultii	Greater Sand-plover
	Charadrius mongolus	Lesser Sand-plover
	Haematopus fuliginosus	Sooty Oystercatcher
	Haematopus longirostris	Pied Oystercatcher
	Esacus neglectus	Beach Stone-curlew
21.	Sea Birds	
	Sterna albifrons	Little Tern
22.	Waterbirds	
	Ephippiorhynchus asiaticus	Black-necked Stork
	Rostratula benghalensis australis	Australian Painted Snipe
	Botaurus poiciloptilus	Australasian Bittern
	Ixobrychus flavicollis	Black Bittern
23.	Fruit Doves	
	Ptilinopus magnificus	Wompoo Fruit-Dove
	Ptilinopus regina	Rose-crowned Fruit-Dove
	Ptilinopus superbus	Superb Fruit-Dove
24.	Cockatoos & Parrots	
	Callocephalon fimbriatum	Gang-gang Cockatoo
	Calyptorhynchus lathami	Glossy Black-Cockatoo
	Lathamus discolor	Swift Parrot
	Neophema pulchella	Turquoise Parrot
25.	Woodland Birds	
	Melithreptus gularis gularis	Black-chinned Honeyeater
	Pyrrholaemus sagittatus	Speckled Warbler
	Anthochaera phrygia	Regent Honeyeater
	Daphoenositta chrysoptera	Varied Sittella
26.	*Burhinus grallarius*	Bush Stone-curlew
27.	Birds of Prey	
	Pandion haliaetus	Osprey
	Hieraaetus morphnoides	Little Eagle

	Lophoictinia isura	Square-tailed Kite
28.	Owls	
	Ninox connivens	Barking Owl
	Ninox strenua	Powerful Owl
	Tyto novaehollandiae	Masked Owl
29.	Medium terrestrial marsupials	
	Dasyurus maculatus maculatus	Tiger Quoll
30.	Small Marsupials	
	Planigale maculata	Common Planigale
	Phascogale tapoatafa	Brush-tailed Phascogale
31.	Potoroos and Bettongs	
	Potorous tridactylus tridactylus (SE Mainland)	Long-nosed Potoroo
	Aepyprymnus rufescens	Rufous Bettong
32.	Arboreal Marsupials	
	Cercartetus nanus	Eastern Pygmy –possum
	Petaurus australis	Yellow-bellied Glider
	Petaurus norfolcensis	Squirrel Glider
	Phascogale tapoatafa	Brush-tailed Phascogale
33.	Native Rodents	
	Pseudomys gracilicaudatus	Eastern Chestnut Mouse
34.	Megachiropteran Bats	
	Syconycteris australis	Common Blossom Bat
35.	Microchiropteran Bats	
	Kerivoula papuensis	Golden-tipped Bat
	Falsistrellus tasmaniensis	Eastern False Pipistrelle
	Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat
	Myotis macropus	Large-footed Myotis
	Miniopterus schreibersii oceanensis	Large Bentwing-bat
	Mormopterus norfolkensis	Eastern Freetail Bat
	Vespadelus troughtoni	Eastern Cave Bat
	Chalinolobus dwyeri	Large-eared Pied Bat

36. Endangered Populations

Dromaius novaehollandiae (Emu) – population in the NSW North Coast Bioregion and Port Stephens LGA.

Endangered Ecological Communities recorded within the study area

1. Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions.

Conservation Status
Threatened Species Conservation Act 1995 – Listed as an Endangered Ecological Community

Description
Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-east Corner bioregions is associated with humic clay loams and sandy loams, on waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains (New South Wales Scientific Committee, 2004). The structure of the community is typically open forest, although partial clearing may have reduced the canopy to scattered trees. The most widespread and abundant dominant trees include *Eucalyptus robusta* (Swamp Mahogany) and *Melaleuca quinquenervia* (Broad-leaved Paperbark). South from Sydney *Eucalyptus botryoides* (Bangalay) and *Eucalyptus longifolia* (Woollybut) are common. Other common trees include *Eucalyptus resinifera* (Red Mahogany), *Livistona australis* (Cabbage Gum), *Callistemon salignus* (Willow Bottlebrush) and *Casuarina glauca* (Swamp Oak).

Distribution
Found on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-east Corner bioregions

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

Not applicable.

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

Not applicable.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Approximately 7.4ha of Swamp Mahogany – Paperbark Forest present within the study area was found to contain floristic components consistent with the Endangered Ecological Community - Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions. Swamp Sclerophyll Forest was present on lower ground in the south of the study area and formed part of a larger area of adjoining Swamp Sclerophyll Forest to the east and west.

The proposed building footprint will be located a short distance to the north of the area of Swamp Sclerophyll Forest boundary. However the intake and outtake pipes connecting the proposed facility to the waters of Port Stephens will be required to cross the area of Swamp Sclerophyll Forest. To reduce the impact on the Endangered Ecological Community the pipeline will be raised off the ground on supports and manoeuvred to avoid the removal of any trees. The construction will result in the disturbance to the understorey vegetation however would be only considered to be short-term. Due to the close proximity of the proposed facility to the EEC there is the potential for secondary impacts such as stormwater runoff and increased weed infestation. Strict controls will have to be applied to the building and pipeline precincts to prevent any future degradation to the area of Swamp Sclerophyll Forest. It is recommended that a vegetation management plan be completed for these areas to ensure the long-term viability of Swamp Sclerophyll Forest within the study area. Given the recommendations the proposal is unlikely to cause extinction of this endangered ecological community in the locality.

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

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

The proposed Abalone farm will be positioned over a development area of approximately 5 hectares in the south of the study area. Within this area a total building footprint of 1.13ha will be situated within an area containing Coastal Sand Blackbutt and Ironbark/Tallowwood Open Forest. Additional areas of these two communities may also have to be thinned and underscrubbed to comply with the required 20m Bushfire Asset Protection Zones to the north, east and south, and 30m to the west and north-west of the building precinct. Separate intake and outtake and outlet pipes, extending from the building precinct into the waters of Port Stephens (Crown Land in the LGA of Port Stephens). These pipes will run on supports through the area identified as Swamp Sclerophyll Forest. To reduce the impact on the Endangered Ecological Community the pipeline will be raised off the ground on supports north of the pumphouse and manoeuvred to avoid the removal of any trees. Below the pumphouse the pipelines will be buried below ground with the natural ground levels reinstated. The construction will result in the disturbance to approximately 0.14ha of understorey vegetation, however, this disturbance would be only be short-term.

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

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

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

The construction of the building precinct and associated Bushfire Asset Protection Zones will not involve any direct impacts on Swamp Sclerophyll Forest. However due to the close proximity of the area of Swamp Sclerophyll Forest to the building precinct there is the potential for secondary impacts such as stormwater runoff and increased weed infestation. Strict controls will need to be applied to the development to prevent any future degradation to this EEC. The intake/outtake pipes connecting the proposed facility to the waters of Port Stephens will be required to cross the area of Swamp Forest. To reduce the impact on the Endangered Ecological Community the pipeline will be raised off the ground on supports along a narrow corridor of approximately 4.5m and manoeuvred to avoid the removal of any trees. Below the pumphouse the pipelines will be buried below the ground with the natural ground levels reinstated. The narrow disturbed area will regenerate naturally however periodic monitoring for weeds should be undertaken along the route. A vegetation management plan

which includes weed monitoring and control will help ensure their long-term viability of this community within the study area during and post construction. Given the recommendations the proposal is unlikely to cause extinction of this endangered ecological community in the locality.

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

None of the study area has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for Swamp Sclerophyll Forest. However the Department of Environment, Climate Change and Water has prepared a number of strategies to promote the recovery of this Endangered Ecological Community. Each strategy has a number of priority actions within it. Strategies most applicable to the study area would include:

- *Habitat management: Site Protection*
  Identify and prioritise other specific threats and undertake appropriate on ground site management strategies where required.
- *Habitat management weed control*
  Undertake weed control for Bitou Bush and Boneseed at priority site in accordance with the approved abatement plan and associated PAS actions.

It is recommended that a vegetation management plan be completed which will address likely impacts during construction and ensure the long-term viability of this Endangered Ecological Community.

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

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the study area have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. No areas of Swamp Sclerophyll Forest are required to be removed as a result of the proposal.
- **Invasion of native plant communities by exotic perennial grasses:** This threatening process is already present with a small number of introduced grasses such as *Andropogon virginicus* (Whisky Grass) and *Axonopus affinis* (Narrow-leaved Carpet Grass) present within the endangered community. There is the potential for further infestation, however, given the recommendation for a vegetation management plan for this area which will include regular weed control the impact from this threatening process would be reduced.
- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused the study area. The proposal is unlikely to result in a change in the frequency of fire in the local area.
- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera*: (Bitou Bush).** Bitou Bush was present within the study area and within the EEC. It is recommended that this species be controlled within the study area.
- ***Lantana camara* (Lantana):** Lantana was found to be common within the study area and formed small thickets in some areas. The Lantana present has the potential for further infestation within this Endangered Ecological Community regardless of the proposal. However given the recommendation for a vegetation management plan for this area which will include regular weed control the impact from this threatening process would be minimised.

Bibliography:

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2. Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions.

Conservation Status
Threatened Species Conservation Act 1995 – Listed as an Endangered Ecological Community

Description
Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions is the name given to the ecological community occurring in the intertidal zone on the shores of estuaries and lagoons including when they are intermittently closed along the NSW coast. Coastal saltmarsh

Distribution
Has been recorded from sites along the NSW coast. (NSW North Coast, Sydney Basin and South East Corner Bioregions).

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

Not applicable.

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

Not applicable.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(ii) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Approximately 0.5ha of Saltmarsh was found to occupy the outer edges of Pig Station Creek within the study area. The proposed emergency egress across Pig Station Creek will pass through approximately 20m of Saltmarsh along an unformed section of Cambage Street. Some disturbance from illegal vehicle crossings was noted along the route. The egress is proposed to consist of a wooden boardwalk approximately 2m wide that will provide only pedestrian access. The boardwalk will require only minimal removal of vegetation to allow for holes for the pylons. The boardwalk is to be raised so as to allow the vegetation to grow out from underneath and to allow continued movement through the area by terrestrial and aquatic fauna. The site is likely to overlie potential acid sulfate soils. However considering the minimal amount of digging it would not be considered to be significant. It is recommended that auger holes only be the same diameter to the pylons to minimise the amount of sediment to be removed and the spoil from the holes is to be removed from the site. To avoid toxic ions leaching into the environment timber preservative treatments in the form of copper, chromium and arsenic should not be used.

A vegetation management plan recommended for the proposal will help ensure their long-term viability of this community within the study area during and post construction. The egress may also prevent illegal vehicle access to the site. Given the recommendations the proposal is unlikely to cause extinction of this endangered ecological community in the locality.

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

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

The boardwalk will require only minimal removal of vegetation to allow for holes for the pylons. The boardwalk is to be raised so as to allow the vegetation to grow out from underneath and to allow continued movement through the area by terrestrial and aquatic fauna. The site is likely to overlie Potential Acid Sulfate Soils. However considering the minimal amount of digging it would not be considered to be significant.

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

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

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

Given the recommendations no area of habitat will be removed, modified, fragmented or isolated that is important to the long-term survival of this Endangered Ecological Community in the local area.

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

None of the study area has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for Salt Marsh. However the OEH has prepared a number of strategies to promote the recovery of this Endangered Ecological Community. Each strategy has a number of priority actions within it. Strategies most applicable to the study area would include:

- Habitat management: Site Protection

Identify and prioritise other specific threats and undertake appropriate on ground site management strategies where required.

It is recommended that a vegetation management plan be completed which will address likely impacts during construction and ensure the long-term viability of this Endangered Ecological Community.

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

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the study area have been listed in bold below followed by an assessment of the applicability of the

threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. No significant areas of Saltmarsh are proposed to be removed.

Bibliography:

NSW Scientific Committee (2004). *Coastal saltmarsh in the NSW North Coast, Sydney Basin and South East Corner bioregions - Endangered ecological community determination - final*. DEC (NSW), Sydney

Threatened fauna species present within study area.

3. *Crinia tinnula* Wallum Froglet

Description
Crinia tinnula (Wallum Froglet) is a small frog with a highly variable colouration and pattern. The snout is pointed in profile and projects beyond the lower jaw. It can be described as having a white or light brown belly with a little mottling or flecking and a mid line of white dots along the throat.

Conservation Status
Threatened Species Conservation Act 1995 – Listed as Endangered under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not Listed.

Habitat Requirements and Ecology
The Wallum Froglet is an inhabitant of shallow acid swamps (temporary / semi-permanent) and associated connecting channels and deeper water holes (permanent)(pH < 6.0). The vegetation type in these areas consists of hard-leafed heaths, shrubs and woodland on coastal plains and dunes and associated sedgelands and swamps in low lying areas collectively known as wallum. This frog is a winter breeder with females laying approximately 120 eggs. Males are vocal between May and September making identification of the species at this time easier. Due to the morphological similarities with *C. signifera*, positive identification of *C. tinnula* is usually by call. The call of the male is described as being a bell like tinkling: "tching.....tching".

Distribution
The Wallum Froglet has a distribution range from Maryborough in Queensland south to Kurnell near Sydney. Large populations have been recorded in the Myall Lakes and Tomaree National Parks.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

The Wallum Froglet was observed and heard calling within the wetter areas of Swamp Mahogany Paperbark Forest in the southern portion of the study area. This frog species was also heard calling from adjoining habitat within Lot 1 1014683 and within similar habitat in the electricity easement which runs parallel to the south-eastern boundary. The proposed building footprint will be located a short distance to the north of the area of Swamp Mahogany Paperbark Forest. Due to the close proximity of the proposed facility to suitable habitat for *C. tinnula* there is the potential for secondary impacts such as stormwater runoff and increased weed infestation. Strict controls will have to be applied to prevent any future degradation of suitable habitat. The intake and outtake pipes connecting the proposed facility to the waters of Port Stephens will cross the area of Swamp Mahogany Paperbark Forest Swamp Forest. To reduce the impact on *C. tinnula* and allow movement across the pipes, the pipelines will be raised off the ground on supports along a narrow corridor of approximately 4.5m wide and manoeuvred to avoid the removal of any trees. South of the pumphouse the pipelines will be buried below the ground and the naturals ground levels will be reinstated. Taking the recommendations into consideration the proposal is unlikely to cause extinction of *C. tinnula* in the local area.

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

Not applicable.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

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

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The construction of the proposed facilities building precinct is unlikely to have any direct impact on habitat for *C. tinnula*. However as a result of the close proximity of the facility to suitable habitat for *C. tinnula* there is the potential for secondary impacts such as stormwater runoff and increased weed infestation. The intake and outtake pipes connecting the proposed facility to the waters of Port Stephens will be required to cross known habitat for *C. tinnula*. The construction of this pipeline will result in some disturbance to the habitat of this frog species along a narrow corridor (approximately 4.5m wide). Given the pipelines will be raised off the ground on supports north of the pumphouse along a narrow corridor and manoeuvred to avoid the removal of any trees the proposal is unlikely to cause extinction of *C. tinnula* in the local area.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for *C. tinnula*. However the Department of Environment, Climate Change and Water has prepared a number of strategies to help recover this threatened frog. The strategies contain a number of priority actions. Those pertinent to the subject site include:

<u>Habitat management</u>

- Control, and where practicable, eradicate the Plague Minnow in accordance with approved Threat Abatement Plan;
- Protect swamps from fire;
- Control stormwater, drainage, groundwater extraction and associated changes in water chemistry, pH, quality and quantity that may adversely impact on habitats and/or species

populations;
- Control invasion of weeds that may adversely impact on Wallum habitats.

It is recommended that a vegetation management plan be completed which will address likely impacts during construction and ensure the long-term viability of this frog species.

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

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to this site and species have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. Any future removal of vegetation particularly within the wetter areas of swamp forest is likely to result in an incremental reduction in habitat for this species in the local area and may be viewed as being part of this Key Threatening Process. However it is not considered to be significant in relation to this frog species.
- **Predation by *Gambusia holbrooki* (Plague Minnow):** This introduced species of fish was not observed within the swamp forest during fieldwork and was probably absent due to the ephemeral nature of the swamp. The proposal is unlikely to result in the introduction of the Plague Minnow within the study area.
- **Infection of frogs by amphibian chytrid fungus causing the disease chytridiomycosis:** It is possible that this fungus has an impact on frogs in the local area. However the proposal is unlikely to have any impact on this threatening process.
- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused the site. Past fire within the study area was evidenced by blackened parts of tree trunks. The proposal is considered to have little impact on fire frequency.
- **Human-caused Climate Change**: Has the potential to have an adverse effect on these frog species. The proposal is unlikely to significantly contribute to Climate Change.

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4. *Glossopsitta pusilla* Little Lorikeet

Description
The Little Lorikeet is a small green bird with a black bill and red patch covering forehead/throat, but not ear-coverts. The eyes are orange yellow.

Conservation Status
Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not Listed.

Habitat Requirements and Ecology
This Lorikeet species occurs in forests, woodlands, large trees within open country, timbered watercourses, shelterbelts and street trees. Nests in a small hollow within a eucalypt.

Distribution
This species is endemic to Australia and the main distribution of the Turquoise Parrot is in the grassy woodlands of the western slopes and tablelands from the Darling Downs in Queensland to northern Victoria, particularly along watercourses.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

Up to three specimens of *Glossopsitta pusilla* (Little Lorikeet) were recorded within a large specimen of *Eucalyptus pilularis* (Blackbutt) in the far southern portion of the study area during the survey. Suitable foraging and nesting habitat was present across the forested habitats of the study area. The proposal will result in the clearing of approximately 1ha of suitable foraging and nesting habitat composed of Coastal Sand Blackbutt and Ironbark/Tallowwood Open Forest. Additional areas of these two communities will also have to be thinned and underscrubbed to comply with the required 20m Bushfire Asset Protection Zones to the north, east and south, and 30m to the west and north-west of the building precinct. Up to 13 potential nesting hollows will also be required to be removed. The construction of outtake and outlet pipes, extending from the building precinct into the waters of Port Stephens is unlikely to result in the removal of any significant habitat for this species. The proposal is considered unlikely to result in the extinction of any local population of this lorikeet species. To help reduce the impact on this parrot species it is recommended that suitable compensatory nesting habitat in the form of nest boxes be erected within the subject area.

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

Not applicable.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

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

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

The proposed Abalone farm will be positioned over a development area of approximately 5 hectares in the south of the study area. Within this area a total building footprint of 1ha will be situated within an area containing Coastal Sand Blackbutt and Ironbark/Tallowwood Open Forest. Approximately sixty-five trees will be required to be removed including four potential nesting trees. Additional areas of these two communities will also have to be thinned and underscrubbed to comply with the required 20m Bushfire Asset Protection Zones to the north, east and south, and 30m to the west and north-west of the building precinct. Separate intake and outtake and outlet pipes, extending from the building precinct into the waters of Port Stephens (Crown Land in the LGA of Port Stephens). These pipes will run through the area of Swamp Sclerophyll Forest, however no trees will be required to be removed.

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

No important areas of habitat are likely to be fragmented or isolated for this mobile species.

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

The construction of the building precinct will result in a small incremental reduction of foraging and nesting habitat in the local area for this parrot species. However taking into consideration the relatively large amount of suitable surrounding habitat the proposal is unlikely to result in the removal, modification, fragmentation or isolation of an area of habitat important to the long term survival of the Little Lorikeet.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for the Little Lorikeet. However the OEH has prepared Priority Action Statements (PAS) to promote the recovery of these species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help these species recover in NSW. It is considered that the proposal does not

significantly conflict with the PAS for this bird species.

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

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of an area of open forest will lead to an incremental reduction of habitat for this bird species however is not considered to be significant.
- **Predation by the European Red Fox *Vulpes vulpes*:** The Red Fox was not recorded within the study area at the time of the survey however would be considered to have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in the number of this introduced species.
- **Predation by the Feral Cat *Felis catus.*** The Feral Cat was not recorded within the study area at the time of the survey however would be considered to have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in the number of this introduced species.
- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused the study area..
- **Loss of Hollow-bearing Trees**: The proposal will result in the loss of a number of hollow-bearing trees. It is recommended that hollow-bearing trees be avoided where possible and compensatory nestboxes be placed into the nearby area to replace those hollows removed.
- **Competition from feral honeybees *Apis mellifera:*** This species was not observed within the study area however, the feral honeybee has the potential to occupy tree hollows utilised by the Little Lorikeet.

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5. *Pteropus poliocephalus* Grey-headed Flying-fox

Description
The Grey-headed Flying-fox is a large species of megachiropteran bat which possess a mantle of rusty brown fur that full encircles the neck. The fur on the back is dark grey and as the common name suggests, the head is covered with light grey fur. The grey belly fur is often flecked with white and ginger. The fur extends down the legs to the toes. which contrasts with other *Pteropus* species, which are furred only to the knees. This species weighs up to a kilogram and has a forearm length of up to 180mm.

Conservation Status
Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Listed as Vulnerable.

Habitat Requirements and Ecology
Grey-headed Flying-foxes are known to occupy a variety of habitats, including wet and dry sclerophyll forests, rainforest, mangroves and paperbark swamps and *Banksia* woodlands. Here they forage on a range of fruits and blossoms. Their diet is so varied that they have been recorded eating the fruit or blossom of more than 80 species of plant. The predominant food source is Eucalypt blossom and fruits from trees such as *Ficus* spp. (Figs). It is likely to act as an important pollinator for many of the trees on which they utilise blossoms. They also inhabit cultivated areas where they feed on introduced trees including commercial food crops, and can become a 'pest' animal in these areas. Ironically, this has led to this species being the most intensively researched bat in Australia.

As with most species of Flying-fox, *P. poliocephalus* roost communally where they form large communal colonies called 'camps'. Camps are mostly in rainforest patches, mangroves, paperbark forests and modified vegetation in urban areas. These camps may contain thousands of individuals, and up to 200 000 individuals have been recorded at one camp. They may move up to 70km from the camp each night to forage. Young are raised in maternity camps after birthing in September to October. The young are able to fly at 3 months of age and puberty is reached at 18 months, although males do not achieve effective fertility until 30 months. Vocal communication is highly sophisticated, with over 20 different situation-specific calls being recorded. Recently, it has been identified as being a potential carrier of viral pathogens, such as Lyssa-virus.

Distribution
The Grey-headed Flying-fox is distributed predominantly along the sub-tropical east coast, from Rockhampton (Qld) through NSW to SE Victoria.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

The Grey-headed Flying-fox was observed foraging within the canopy of a small number of flowering specimens of *Eucalyptus siderophloia* (Northern Grey Ironbark) during the nocturnal survey. The Grey-headed Flying-fox was also recorded within the study area during a previous survey feeding on specimens of the winter flowering *Eucalyptus robusta* (Swamp Mahogany) (Wildthing Environmental Consultants, 2002). The majority of the study area contained suitable foraging habitat in the form of seasonally flowering myrtaceous species, particularly *E. robusta* and *Melaleuca quinquenervia* (Broad-leaved Paperbark). Potential camp sites were also considered to be present within the denser areas of vegetation, however, no camps were found to be present. The proposal will result in the

removal of a small amount of foraging habitat, which may be seen as an incremental loss of habitat within the locality. Taking into account the relatively large amount of suitable surrounding habitat it is considered that the proposal is unlikely to cause extinction of the local population of this mobile species.

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

Not applicable.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

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

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

The proposed Abalone farm will be positioned over a development area of approximately 5 hectares in the south of the study area. A building footprint of 1ha will be situated within an area containing suitable foraging habitat in the form of Coastal Sand Blackbutt and Ironbark/Tallowwood Open Forest. Additional areas of these two communities will also have to be thinned and underscrubbed to comply with the required 20m Bushfire Asset Protection Zones to the north, east and south, and 30m to the west and north-west of the building precinct. No specimens of *E. robusta* will be required to be removed within the building precinct or as a result of the intake and outtake pipes.

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

No areas of habitat will become fragmented or isolated for this highly mobile species.

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

The construction of the building precinct will result in a small incremental reduction in foraging habitat in the local area for *P. poliocephalus*. However taking into consideration the relatively large amount of suitable surrounding habitat the proposal is unlikely to result in the removal, modification, fragmentation or isolation of an area of habitat important to the long term survival of *P. poliocephalus*.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

A Recovery Plan has been completed for the Grey-headed Flying-fox. The plan recommends the retention of as many foraging species as possible. The proposal is not considered to significantly compromise this recovery plan.

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

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of native vegetation is a key threat to this microchiropteran bat species. The removal of vegetation for the proposal is not considered to be significant.
- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused to the study area. The proposal is unlikely to result in any change to the fire frequency within the study area.
- **Predation by the European Red Fox *Vulpes vulpes:*** The European Red Fox would rarely come into contact with this species of flying-fox. There is the potential of the predation of young that have fallen to the ground particularly within campsites. The European Red Fox would have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in fox numbers.
- **Predation by the Feral Cat *Felis catus*:** The Feral Cat would rarely come into contact with this species of flying-fox. There is the potential of the predation of young that have fallen to the ground particularly within campsites. The Feral Cat was not observed within the study area during the survey however, would have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in feral cat numbers.

Other threats include persecution in the form of shooting of animals. This oppression may be a result of Grey-headed Flying-foxes being a perceived pest in agricultural areas or as presenting a noise problem in more urbanised areas. Another threat is from competition and hybridisation with *Pteropus alecto* (Black Flying-fox).

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6. *Miniopterus australis* Little Bentwing-bat

Description
Miniopterus australis (Little Bentwing-bat) has uniform chocolate fur on the back and slightly lighter fur on the belly. It has a short muzzle and domed head. The ears are short and rounded. The last phalanx on the third finger of the wing is about four times the length of the middle phalanx. This species is very similar to *Miniopterus schreibersii oceanensis* (Large Bentwing-bat) but has a smaller forearm (37 to 41mm).

Conservation Status
Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements and Ecology
This species inhabits tropical rainforest to warm-temperate wet and dry sclerophyll forest occurring along the coastal plains and adjacent ranges from Cape York to north-eastern N.S.W. It is a sub-canopy hunter with a preference for well-timbered areas but it is also known to hunt in clearings adjacent to forests. Prey items include crane flies, ants, moths and wasps. Flight characteristics include rapid movement with considerable maneuverability.

The species is a cave dweller that congregates in the summer months in maternity roost colonies and disperses during winter. In the southern part of their range they hibernate during winter but in the north they remain active throughout the year. Recorded roosts include caves, mines, stormwater drains, disused railway tunnels and houses. Mating, fertilisation and implantation occur from July to August, followed by a period of retarded embryonic development until mid-September. Pregnant females congregate in specified large nursery caves to rear their young. Births occur in December, when single young are born. It is often found to roost with the Large Bentwing-bat (*Miniopterus schreibersii*), and benefits from this larger species' ability to increase the roost temperature using metabolic heat. There is a huge nursery colony of 100,000 adult bats at Mt. Etna caves, in central Queensland.

Distribution
This species inhabits tropical rainforest to warm-temperate wet and dry sclerophyll forest occurring along the coastal plains and adjacent ranges from Cape York to north-eastern N.S.W. around the Hunter River. Its distribution within Australia becomes increasingly coastal towards the southern limit of its range in N.S.W.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

One specimen of *Miniopterus australis* (Little Bentwing-bat) was captured within the study area during the harp trapping component of the survey. Calls not inconsistent with those of *M. australis* were also recorded during the bat call survey. A previous survey (Wildthing Environmental Consultants, 2002) also recorded calls from *M. australis* within the study area. The majority of the study area contains suitable hunting habitat for this microchiropteran bat species. However no preferred roosting habitat in the form of caves, culverts or other similar man-made structures was found to be present. Taking into consideration the relatively large amount of suitable foraging habitat in the local area and absence of preferred roosting habitat within the study area the proposal is unlikely to disrupt the life cycle of this microchiropteran bat species such that local extinction would occur.

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

No applicable.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

No applicable.

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

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

The proposed Abalone farm will be positioned over a development area of approximately 5 hectares in the south of the study area. Within this area a total building footprint of 1ha will be situated within an area containing suitable foraging habitat in the form of Coastal Sand Blackbutt and Ironbark/Tallowwood Open Forest. Additional areas of these two communities (approximately 1ha) will also have to be thinned and underscrubbed to comply with the required 20m Bushfire Asset Protection Zones to the north, east and south, and 30m to the west and north-west of the building precinct. No trees will be required to be removed as a result of the intake and outtake pipes.

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

No areas of habitat will become fragmented or isolated for this highly mobile species.

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

The construction of the building precinct may result in a small incremental reduction in the quality of hunting habitat in the local area for *M. australis*. However taking into consideration the relatively large amount of suitable surrounding habitat and lack of preferred roost sites within the study area the proposal is unlikely to result in the removal, modification, fragmentation or isolation of an area of habitat important to the long term survival of *M. australis*.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for this microchiropteran bat species. However the OEH has prepared Priority Action Statements (PAS) to promote the recovery of this species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help these species recover in NSW. It is considered that the proposal does not significantly conflict with the PAS for these species.

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

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relavant to the site, have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of vegetation for the proposal is will result in the removal of roosting habitat and a possible incremental decline of hunting habitat however for unlikely to result in a significant loss of habitat for this species.
- **Predation by the European Red Fox *Vulpes vulpes*:** The Red Fox was not recorded within the study area at the time of the survey however would be considered to have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in the number of this introduced species.
- **Predation by the Feral Cat *Felis catus.*** The Feral Cat was not recorded within the study area at the time of the survey however would be considered to have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in the number of this introduced species.
- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: Past fires were evidenced by a number of blackened tree trunks. It is difficult to ascertain the disruption and structural changes, if any, past fires have caused the study area.

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7. *Scoteanax rueppellii* Greater Broad-nosed Bat

Conservation Status
Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements and Ecology
This species apparently feeds on large moths and beetles, and some small vertebrates, emerging just after sundown, flying slowly and directly at a height of 3-6 metres, deviating only slightly to catch larger insects. It is also predatory on vertebrates including other bats, and is a noted carnivore on other captured bats in bat traps. *S. rueppellii* is known to hunt along tree-lined creeks, the junction of woodland and cleared paddocks, and low along rainforest creeks. It may have a preference for wet gullies in tall timber country.

The species roosts mainly in tree hollows but it has also been found in the roof spaces of old buildings. Little is known of the reproductive cycle, but it is suggested that the species follows the typical Vespertilionid pattern. What is known is that females congregate in maternity colonies and single young are born in January, slightly later than the other Vespertilionid bats that share its range. Males appear to be excluded from the colony during the birthing and rearing of the young.

Distribution
The Greater Broad-nosed Bat occurs only along the eastern coastal strip of Queensland and NSW where it is restricted to the coast and adjacent areas of the Great Dividing Range. In NSW it extends as far south as the Bega Plain. They are only found at low altitudes (below 500m).

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

One specimen of *Scoteanax rueppellii* (Greater Broad-nosed Bat) was captured within the study area during the harp trapping component of the survey. Calls not inconsistent with those of *S. rueppellii* were also recorded during the bat call survey. The majority of the study area contains suitable hunting habitat for this microchiropteran bat species. Roosting habitat in the form of tree hollows was also common throughout the study area particularly within the larger myrtaceous trees in the southern portion. The proposal will result in the clearing of approximately 1ha of suitable hunting and roosting habitat (Approximately 65 trees including up to 13 suitable roosting trees). To help reduce the impact on this microchiropteran bat species it is recommended that suitable compensatory nesting habitat in the form of nestboxes be erected within the subject area. Taking the recommendation into consideration the proposal is considered unlikely to result in the extinction of any local population of this microchiropteran bat species.

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

Not applicable.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

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

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

The proposed Abalone farm will be positioned over a development area of approximately 5 hectares in the south of the study area. Within this area a total building footprint of 1ha will be situated within an area containing suitable hunting and roosting habitat in the form of Coastal Sand Blackbutt and Ironbark/Tallowwood Open Forest. (Approximately 65 trees including up to 13 suitable roosting trees). Additional areas of these two communities will also have to be thinned and underscrubbed to comply with the required 20m Bushfire Asset Protection Zones to the north, east and south, and 30m to the west and north-west of the building precinct. No trees will be required to be removed as a result of the intake and outtake pipes.

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

No areas of habitat will become fragmented or isolated for this highly mobile species.

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

The construction of the building precinct may result in a small incremental reduction in hunting and roosting habitat in the in the local area for *S. rueppellii*. However taking into consideration the relatively large amount of suitable surrounding habitat the proposal is unlikely to result in the removal, modification, fragmentation or isolation of an area of habitat important to the long term survival of *S. rueppellii.*

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for this microchiropteran bat species. However the OEH has prepared Priority Action Statements (PAS) to promote the recovery of this species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help these species recover in NSW. It is considered that the proposal does not significantly conflict with the PAS for these species.

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

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site, have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of vegetation for the proposal is will result in the removal of roosting habitat and a possible incremental decline of hunting habitat however it is unlikely to result in a significant loss of habitat for this species.
- **Loss of Hollow-bearing Trees***:* The proposal will result in the loss of a number of hollow-bearing trees resulting in an incremental decline of roosting habitat for this hollow-dependant microchiropteran bat. However considering the presence of hollow-bearing trees occurring outside the development footprint and the recommendation of compensatory nestboxes the proposal is unlikely to result in a significant loss of habitat for *S. rueppellii*.
- **Predation by the European Red Fox *Vulpes vulpes:*** The Red Fox was not observed within the site during the survey period although it would be considered likely to be having some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Predation by the Feral Cat *Felis catus*:** The Feral Cat was not observed within the site during the survey period although it would be considered likely to be having some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Removal of dead wood and dead trees**: Dead wood and dead trees were present in the site. However the action is unlikely to be responsible for the loss of any significant habitat.

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Threatened Fauna species recorded within the study area as a result of secondary evidence:

8. *Phascolarctos cinereus* Koala

Description
The *Phascolarctos cinereus* (Koala) is the sole member of the family Phascolarctidae. It is a short stocky arboreal marsupial with large furry ears and a vestigial tail. The fur colour of the koala varies from pale grey in the northern parts of its range to grey-brown in the south.

Conservation Status
Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Listed as Vulnerable in NSW & Victoria.

Habitat Requirements
The Koala is limited to areas where there are acceptable food trees. Its diet is generally restricted to that of Eucalypt leaves and much less-often, non-Eucalypt foliage. The foliage of *Eucalyptus camaldulensis* (River Red Gum), *E. tereticornis* (Forest Red Gum), *E. punctata* (Grey Gum), *E. viminalis* (Manna Gum), and *E. robusta* (Swamp Mahogany) are some of the preferred Eucalypt species. Koalas use a wide variety of tree sizes, and do not preferentially use large or tall trees in NSW forests, although this has been listed as a habitat preference in areas where trees are generally small, stunted, or nutrient deprived.

Koalas sleep in the fork of a tree during the day and feed at night with the peak of activity just after sunset. It is generally a solitary animal with a social behaviour pattern that influences its breeding biology. Breeding biology of the Koala is characterised by the occurrence of discrete core breeding groups which are sedentary. A core group may comprise up to several dozen individuals that are usually well separated from other breeding groups. These core groups produce a continual supply of dispersing nomadic sub-adults. Individual Koalas within core breeding groups occupy semi-exclusive territories. There is interaction with and marginal overlap of territories between adjacent individual animals. The territories of breeding males generally occur within a matrix of adjacent territories of breeding females. In the overlap zones of adjacent territories of breeding Koalas, individual trees occur that are habitually used for interaction between the two animals concerned. These breeding core interaction trees (sometimes termed "home range trees") are readily identifiable by scratched "trails" up the bole and copious dung deposits at the base of the tree. Breeding occurs in summer and young females produce one young (rarely twins) each year.

Distribution
The Koala occurs along the east coast of Australia and extends into woodland, mulga and River Red Gum forests west of the Great Dividing Range. In drier forested areas, Koalas are generally observed as individuals in low densities. They are more abundant in coastal woodland and in open forest. They are rare or absent in wet forests in the south above 600 m which may be due more to distribution of Eucalypt species than climate.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

No Koalas were directly observed within the study area during fieldwork completed for this report and previous reports (Wildthing Environmental Consultants, 2002, 2008a & 2008b). However

evidence of Koala activity in the form of characteristic scratches and a small number of scats was found to be present within the study area. The characteristic scats and scratches were found to be largely associated with specimens of *Eucalyptus robusta* (Swamp Mahogany) located within the area mapped as Swamp Sclerophyll Forest. Previous studies have also reported Koala activity within this area in the form of scratches and scats (Wildthing Environmental Consultants, 2002). One record of a Koala within the eastern portion of the study area dating back to 1995 was present on the Atlas of NSW Wildlife (OEH, 2012). The Atlas of NSW database also contained a small number of additional records in the vicinity of the study area. Koala records documented by the Myall Koala & Environment Group Inc show a small number of more recent records from within the locality. These records include a mother and young sighted on 5 November 2012 north-east of the study area on Clarke Road adjacent to the neighboring Lot 3. Two other records along Clarke Street are known from October 2010 and April 2004. The later sighting was a sick Koala which later died in care.

Two species of 'Koala Feed Tree', *E. robusta* (Swamp Mahogany) and *Eucalyptus microcorys* (Tallowwood) were recorded within the study area and were largely confined to the southern portion. Koala activity was found to be largely confined to specimens of *E. robusta*. A previous survey within the study area (Wildthing Environmental Consultants, 2002) recorded the additional listed feed tree species, *Eucalyptus punctata* (Grey Gum). After examination of a number of specimens of Grey Gum these trees were found to be *Eucalyptus propinqua* (Small-fruited Grey Gum). *Eucalyptus propinqua* is not listed as a Schedule 2 feed tree species in SEPP 44, however is known to be utilised by Koalas in the region.

The evidence suggests that the study area particularly the area of Swamp Sclerophyll Forest in the south constitutes part of a larger area of habitat within the Pindimar area which is utilised by a small number of Koalas. The proposal will result in the clearing of approximately 1ha of suitable habitat in the form of Coastal Sand Blackbutt and Ironbark/Tallowwood Open Forest. Additional areas of these two communities will also have to be thinned and underscrubbed to comply with the required 20m Bushfire Asset Protection Zones to the north, east and south, and 30m to the west and north-west of the building precinct. No specimens of *E. robusta* are required to be removed although approximately 24 specimens of *E. microcorys* occur within the building precinct and are likely to be removed. The proposed outtake and outlet pipes, extending from the building precinct into the waters of Port Stephens will cross the area of Swamp Sclerophyll Forest, however as they will be positioned to avoid trees specimens of *E. robusta* and other tree species present.

To reduce the impact on Koalas it is recommended that as many specimens of *E. microcorys* be retained as possible within the scope of the development, particularly within the required Bushfire Asset Protection Zones. Tanks or settling ponds will be required to be appropriately fenced to prevent Koala drownings. It is also recommended that the proposal does not create any barriers that will impact the safe movement of Koalas through the area. The pipeline will be raised on supports north of the pumphouse to allow the movement of Koalas underneath within the area of Swamp Sclerophyll Forest and parts of Coastal Sand Blackbutt Open Forest. According to the Port Stephens Comprehensive Koala Plan of Management CKPoM the pipeline should be raised to have at least a 200mm gap underneath to allow Koala movement underneath.

Given the lack of Koala sightings and low level of Koala activity it is not considered that the study area constitutes 'Core Koala Habitat'. Therefore an Individual Koala Plan of Management would not be required. Taking the recommendations into consideration proposal is unlikely to have an adverse effect on the life cycle of the species such that the local population of Koalas may be placed at risk of extinction.

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

Two endangered Koala populations are listed in the NPWS database, the Hawks Nest and Tea Gardens population and the Pittwater Local Government Area population. As the boundary of the Hawks Nest Koala Population occurs to the east, outside of the study area this question is not applicable.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

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

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

The proposed Abalone farm will be positioned over a development area of approximately 5 hectares in the south of the study area. Within this area a total building footprint of 1ha will be situated within an area containing Coastal Sand Blackbutt and Ironbark/Tallowwood Open Forest. Additional areas of these two communities will also have to be thinned and underscrubbed to comply with the required 20m Bushfire Asset Protection Zones to the north, east and south, and 30m to the west and north-west of the building precinct. Approximately 24 specimens of *E. microcorys* will be required to be removed to make way for the facility. The intake and outtake pipes will be manoeuvred to avoid the removal of any specimens of *E. robusta.*

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

Provided the intake and outtake pipes don't provide a barrier for Koalas and no other barriers such as fences are erected no areas of habitat for the Koala are likely to become fragmented or isolated.

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

The construction of the building precinct will result in a small incremental reduction of habitat in the local area for the Koala. However taking into consideration the likely requirement for a Koala plan of management the proposal is unlikely to result in the removal, modification, fragmentation or isolation of an area of habitat important to the long term survival of the Koala.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

A Recovery Plan has been completed for the Koala (DECC, 2008). A number of recovery actions have been developed for each of the specific objectives, each with a performance criterion or criteria, and in most cases these actions address the broad actions of the National Koala Conservation Strategy.
Objective 1: To conserve koalas in their existing habitat.
Objective 2: To rehabilitate and restore koala habitat and populations.
Objective 3: To develop a better understanding of the conservation biology of koalas.
Objective 4: To ensure that the community has access to factual information about the distribution, conservation and management of koalas at a national, state and local scale.
Objective 5: To manage captive, sick or injured koalas and orphaned wild koalas to ensure consistent and high standards of care.
Objective 6: To manage overbrowsing to prevent both koala starvation and ecosystem damage in discrete patches of habitat.
Objective 7: To coordinate, promote the implementation, and monitor the effectiveness of the NSW Koala Recovery Plan across NSW.

The proposal is unlikely to significantly compromise these actions developed to assist the recovery of the Koala.

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

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of an area of open forest contain Koala Feed Tree species will lead to an incremental reduction of habitat for the Koala however is not considered to be significant.
- **Predation by the European Red Fox *Vulpes vulpes*:** The Red Fox was not recorded within the study area at the time of the survey however would be considered to have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in the number of this introduced species.
- **Predation by the Feral Cat *Felis catus.*** The Feral Cat was not recorded within the study area at the time of the survey however would be considered to have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in the number of this introduced species.
- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: Past fires were evidenced by a number of blackened tree trunks. It is difficult to ascertain the disruption and structural changes, if any, past fires have caused the study area.

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Flora species considered to have potential habitat within the study area:

9. Orchids

Corybas dowlingii **Red Helmit Orchid**

Description

Corybas dowlingii is a tuberous orchid species, with a leaf that is dark green above and slightly reddish beneath. The flower is erect and dark reddish with whitish areas within the labellum.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.

Habitat Requirements and Ecology

Forms colonies and typically grows in gullies in tall open forest on well-drained gravelly soil at elevations of 10-200m. Flowering period June – August.

Distribution

Is restricted to New South Wales where it is currently known from 4 localities including Port Stephens (2 localities), Bulahdelah and Freemans Waterhole south of Newcastle. A population is known from Port Stephens at Stoney Ridge Reserve Soldiers Point.

Cryptostylis hunteriana **Leafless Tongue Orchid**

Description

Cryptostylis hunteriana is a distinctive species recognised by its leafless habit and reddish black hairy labellum with a central, raised, hairy callus.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Endangered under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Endangered

Habitat Requirements and Ecology

This species is a saprophyte, which grows in small, localised colonies on flat plains close to the coast. This species has also been recorded in mountainous areas growing in moist depressions as well as in swampy habitats. Flowering time is December - February.

Distribution

The Leafless Tongue Orchid occurs from the Gibraltar Range (N.S.W) to eastern Victoria.

Diuris arenaria **Sand Doubletail**

Description

Diuris arenaria is a terrestrial orchid with moderate-sized purple flowers, a darker labellum and a very narrow tubular base to the flower, the area between the callus ridges are ochre yellow and purple (Jones, 1999).

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Endangered under schedule 2.
This species has not been ROTAP-listed.

Habitat Requirements and Ecology

Occurs in Coastal heath, Dry Sclerophyll Forest with patches of *Themeda triandra* (Kangaroo Grass) on sandy flats (Bishop, 1996). *Diuris arenaria* flowers in October (Harden, 1993).

Distribution

This species is known from three main locations on the Tomaree Peninsula (Port Stephens), two of which are reserved (NSW Scientific Committee, 2000).

Diuris praecox **Newcastle Doubletail**

Description

Diuris praecox is a terrestrial orchid with 6 – 10 yellow flowers with a few dark brown markings on the base of the labellum and dorsal sepal. This species has two or three linear leaves up to 400mm long.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Vulnerable.
ROTAP – 2VC-

Habitat Requirements and Ecology

This species grows in coastal areas in eucalypt forest, often on hilltops or slopes. Is an early-flowering species, flowering July to early August.

Distribution

This species is known from coastal areas between Ourimbah and Nelson Bay.

Rhizanthella slateri **Eastern Underground Orchid**

Description

Rhizanthella slateri (Eastern Underground Orchid) is a terrestrial saprophytic orchid with a fleshy underground stem. The flower head matures below the soil surface and may extend up to 2cm above the ground.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Endangered.

Habitat Requirements and Ecology

The Eastern Underground Orchid grows in eucalypt forest. As it grows almost completely below the soil this species is difficult to detect. It flowers from October to November.

Distribution

The Eastern Underground Orchid is restricted to NSW and is currently only known from 10 locations, including near Bulahdelah, the Watagan Mountains, the Blue Mountains, Wiseman's Ferry, Agnes Banks and Nowra. The population in the Great Lakes area is the known northern limit of the species and is disjunct from other known populations. The largest known population occurs at Alum Mountain near Buladelah.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

Neither *Corybas dowlingii* (Red Helmit Orchid), *Cryptostylis hunteriana* (Leafless Tongue Orchid), *Diuris arenaria* (Sand Doubletail), *Diuris praecox* (Newcastle Doubletail) nor *Rhizanthella slateri* (Eastern Underground Orchid) were recorded within the study area despite targeted and incidental surveys for this and past reports (Wildthing Environmental Consultants, 2002, 2008a & 2008b). Suitable habitat was considered to be present within the study area for all of these orchid species. It must be noted that neither *D. arenaria* nor *D. praecox* have been recorded on the northern side of Port Stephens and there are few records of the remaining orchid species within the local area. The proposal will result in the clearing of an area of suitable habitat, however, considering the absence of

these species during targeted surveys it is unlikely to result in the extinction of any local population of these orchid species.

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

Not applicable.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

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

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

The proposed Abalone farm will be positioned over a development area of approximately 5 hectares in the south of the study area. Within this area a total building footprint of 1ha will be situated within an area containing suitable hunting and roosting habitat in the form of Coastal Sand Blackbutt and Ironbark/Tallowwood Open Forest. Additional areas of these two communities will also have to be thinned and underscrubbed to comply with the required 20m Bushfire Asset Protection Zones to the north, east and south, and 30m to the west and north-west of the building precinct. The intake/outtake pipes will cross and areas of Swamp and Coastal Sand Blackbutt Forest and result in the disturbance of approximately 0.2ha of understorey vegetation along a 4.5m wide area.

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

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

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

The proposal may result in the incremental reduction of suitable habitat for these threatened orchid species in the local area. As no known habitat will be impacted no areas of habitat important to the long-term survival of these orchid species will be removed, modified, fragmented or isolated.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for these threatened orchid species. However the OEH has prepared Priority Action Statements (PAS) to promote the recovery of these species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help these flora species recover in NSW. It is considered that the proposal does not significantly conflict with the PAS for these orchid species.

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

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal/modification habitat for the proposal is not considered to be significant for these orchid species.
- **Invasion of native plant communities by exotic perennial grasses:** Introduced grasses such as *Andropogon virginicus* (Whisky Grass) were present within the more disturbed areas of the study area. These grasses have the potential to further invade parts of the study area.
- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused to the study area.
- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera*: (Bitou Bush).** Bitou Bush was present within the study area. It is recommended that this species be controlled within the study area.
- ***Lantana camara* (Lantana):** Lantana was found to be common within the study area and formed small thickets in some areas. The Lantana present has the potential for further infestation regardless of the proposal. However given the recommendation for a vegetation management plan for this area which will include regular weed control the impact from this threatening process would be reduced.

Bibliography:
Harden, G. (2000*) (Revised Ed). Flora of NSW - Vol. 1*-4. New South Wales Uni Press, Sydney.

Jones, D,.J. (2006). *A Complete Guide to Native Orchids of Australia including the Island Territories.* New Holland Publishers Australia Pty Ltd.

10. Wetland Plants

Maundia triglochinoides
Description
Maundia triglochinoides, of the family Juncaginaceae, is a perennial aquatic plant with emergent tufts of leaves arising along the length of the rhizomes. These leaves are triangular in cross-section up to 80cm long, 5-10mm wide and are confusable with the leaves of more common species such as *Phylidrum lanuginosum* (Woolly Frogsmouth) and *Triglochin procerum* (Water Ribbons). The carpels are 6-8mm long, each with a spreading beak and flowers during the warmer months. The single member of the *Maundia* genus, it is endemic to Australia.

Conservation Status
Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.
This species has not been ROTAP-listed.

Habitat Requirements and Ecology
It grows in swamps or in shallow fresh water on heavy clay soils.

Distribution
Restricted to coastal NSW and extending into southern Queensland. The current southern limit is Wyong. Is now considered to be extinct around Sydney.

Persicaria elatior **Tall Knotweed**
Description
Persicaria elatior (Tall Knotweed) a member of the Polygonaceae family, is an erect, branched herb up to 1m tall. It has narrowly oval leaves and a loose papery tube around the stem where the leaves attach. It produces pink flowers which are held in dense long spikes, and develops into black, shiny lentil-shaped nuts (NPWS, 2002)

Conservation Status
Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Vulnerable.
This species is ROTAP-coded 3V

Habitat Requirements and Ecology
Persicaria elatior occurs in damp places such as swamps and margins of dams.

Distribution
It is distributed throughout Queensland and eastern NSW.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

Neither *Persicaria elatior* nor *Maundia triglochinoides* were recorded within the study area during fieldwork. Limited habitat was considered to be available for both species within the areas of Swamp Forest that contained surface water. The presence of this two wetland species would be marginalised by the paucity of local records. The proposed building footprint will be located a short distance to the north of the area of Swamp Forest boundary. Due to the close proximity of the proposed facility to an

area of marginal habitat there is the potential for secondary impacts such as stormwater runoff and increased weed infestation. The inlet and outlet pipes connecting the proposed facility to the waters of Port Stephens will be required to cross the area of Swamp Forest. As *M. triglochinoides* and *P. elatior* have not been recorded within the locality and given the recommendations pertaining to stormwater and sediment control the proposal is unlikely to cause extinction of these wetland flora species.

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

No applicable.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

No applicable.

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

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The construction of the intake/outtake pipeline will result in the disturbance of approximately 0.14ha of suitable habitat for *M. triglochinoides* and *P. elatior* in the form of Swamp Sclerophyll Forest. This area will be allowed to regenerate naturally. No area of suitable habitat within the building precinct will be removed or modified as a result of the proposal. As a result of the close proximity of the facility to suitable habitat there is the potential for secondary impacts such as stormwater runoff and increased weed infestation. Given the recommendations pertaining to the area of Swamp Sclerophyll Forest the proposal unlikely to result in the removal, modification, fragmentation or isolation of an area of habitat important to the long-term survival of either *M. triglochinoides* or *P. elatior*.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for either *M. triglochinoides* or *P. elatior.* However the OEH has prepared Priority Action Statements (PAS) to promote the recovery of this species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help these plants recover in NSW. It is considered that the proposal does not significantly conflict with the PAS for this species.

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

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal/modification habitat for the proposal is not considered to be significant for these wetland species.
- **Invasion of native plant communities by exotic perennial grasses:** Introduced grasses such as *Andropogon virginicus* (Whisky Grass) were present within the more disturbed areas of the study area. These grasses have the potential to further invade parts of the study area.
- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused to the study area.
- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera*: (Bitou Bush).** Bitou Bush was present within the study area. It is recommended that this species be controlled within the study area.
- ***Lantana camara* (Lantana):** Lantana was found to be common within the study area and formed small thickets in some areas. The Lantana present has the potential for further infestation regardless of the proposal. However given the recommendation for a vegetation management plan for this area which will include regular weed control the impact from this threatening process would be reduced.

Bibliography:

Briggs, J.D. and Leigh, J.H. (1995). *Rare or Threatened Australian Plants*. CSIRO Publishing, Victoria.

Carolin, R.C. and Tindale, M.D. (1993*). Flora of the Sydney Region (4th edn.).* Reed, Sydney.

Fairley, A. (2004). *Seldom Seen, Rare Plants of Greater Sydney*. New Holland Publishers (Australia) Pty Ltd.

Harden, G. (Ed) (1992). *Flora of NSW - Vol 3*. New South Wales Uni Press, Sydney.

11. Foreshore Plants

Chamaesyce psammogeton **Sand Spurge**

Description

Chamaesyce psammogeton (Sand Spurge) is a prostrate perennial herb with short, trailing, reddish stems and elliptical leaves, growing on foredunes and exposed sites on headlands. This species is a member of the Euphorbiaceae family

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Endangered under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements and Ecology

Grows on foredunes and exposed sites on headlands. It is not known whether a seed bank is retained in the soil but the seeds float, allowing dispersal between beaches. Due to disturbance to foredune habitat and overgrowth by *Chrysanthemoides monilifera* (Bitou Bush).

Distribution

Has been recorded along the New South Wales coast northwards from Jervis Bay and also from Lord Howe Island.

Senecio spathulatus **Coastal Fireweed**

Description

Senecio spathulatus (Coastal Fireweed) is a low-growing smooth-stemmed daisy, often forming hummocks to 30cm tall.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Endangered under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements and Ecology

Grows on primary sand dunes

Distribution

Occurs in Nadgee Nature Reserve and between Kurnell in Sydney and Myall Lakes National Park.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

Despite targeted and incidental surveys no specimens of *Senecio spathulatus* or *Chamaesyce psammogeton* were recorded during the survey. Marginal habitat was considered to be available for both of these species within the narrow strip of sand along the foreshore within the study area. The proposal will result in the disturbance to a small narrow area of this habitat as a result of the burial of the intake/outtake pipes. This disturbance to suitable habitat will only be short term. As these flora species were not recorded within the study area and considering the temporary nature of the disturbance the proposal is not considered likely to result in the extinction of any local population of these flora species.

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

Not applicable.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

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

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

The proposal will result in the temporary disturbance of marginal habitat for both *S. spathulatus* and *C. psammogeton* in the form of a narrow strip of sand along the foreshore of the study area as a result of the construction of the inlet outlet pipes.

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

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

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

The proposal will result in the disturbance of a narrow area of marginal habitat, however, it is unlikely to result in the modification, fragmentation or isolation of any areas of habitat important to the long-term survival of these species.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for *S. spathulatus* and *C. psammogeton*. However the OEH has prepared Priority Action Statements (PAS) to promote the recovery of these species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help these flora species recover in NSW. It is considered that the proposal does not significantly conflict with the PAS for this species.

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

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the study area and subject site for this species have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal/modification habitat for the proposal is not considered to be significant for these flora species.
- **Invasion of native plant communities by exotic perennial grasses:** Introduced grasses such as *Andropogon virginicus* (Whisky Grass) were present within the more disturbed areas of the study area. These grasses have the potential to further invade parts of the study area.
- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused to the study area.
- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera*: (Bitou Bush).** Bitou Bush was present within the study area. It is recommended that this species be controlled within the study area.
- ***Lantana camara* (Lantana):** Lantana was found to be common within the study area and formed small thickets in some areas. The Lantana present has the potential for further infestation regardless of the proposal. However given the recommendation for a vegetation management plan for this area which will include regular weed control the impact from this threatening process would be reduced.

Bibliography:

Murray, M., Bell, S., Hoye, G. (2002). *Flora and Fauna survey Guidelines: Lower Hunter & Central Coast Region.* Lower Hunter & Central Coast Regional Environmental Management Strategy, Callaghan.

Wyong Shire Council (1999). *Flora and Fauna Guidelines for Development*. Wyong Shire Council.

12. Small shrubs

Tetratheca juncea **Black-eyed Susan**

Description

Tetratheca juncea (Black-eyed Susan) occurs as a small shrub, with prostrate stems up to 60 cm long, usually less than 20 cm high. It has distinctly angular stems and branches with the leaves reduced to minute scales. It produces four petalled purple to pink flowers.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Vulnerable.
ROTAP – 3VCa

Habitat Requirements and Ecology

Flowers mainly from August to November, although flowering outside these times are not uncommon.

Distribution

This species is distributed in generally coastal districts from about Buladelah south to the Lake Macquarie region. Populations were once known from the Port Jackson and Botany Bay areas, although it is thought that these may now be extinct.

Grevillea parviflora **ssp.** ***parviflora*** **Small-flowered Grevillea**

Description

Grevillea parviflora ssp. *parviflora* is a low spreading to erect shrub usually less than a metre high. Its erect narrow leaves are 2-3.5 mm long and less than 1.3mm wide with silky hairs on the underside and a short pointed tip. Leaf margins are curved back, or even rolled completely under. The small flowers are spider-like and clustered in groups of 6-12. The whole flower, both tube and protruding style, is white.

Conservation Status

Threatened Species Conservation Act 1995 – Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Vulnerable
This sub-species is not ROTAP-listed.

Habitat Requirements and Ecology

This Grevillea grows in sandy or light clay soils usually over thin shales and occurs in a range of vegetation types from heath and shrubby woodland to open forest. It is found over a range of altitudes from flat, low-lying areas to upper slopes and ridge crests, and commonly occurs in open, slightly disturbed sites such as along tracks. Plants are capable of suckering from a rootstock and most populations demonstrate a degree of vegetative spread, particularly after disturbance such as fire. Flowering has been recorded between July to December as well as April-May. Flowers are insect-pollinated and seed dispersal is limited.

Distribution

Sporadically distributed throughout the Sydney Basin with the main occurrence centred around Picton, Appin and Bargo (and possibly further south to the Moss Vale area). Separate populations are also known further north from Putty to Wyong and Lake Macquarie on the Central Coast and Cessnock and Kurri Kurri in the Lower Hunter.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

Neither *Tetratheca juncea* or *Grevillea parviflora* ssp. *parviflora* were recorded within the study area during fieldwork. Targeted surveys for *Tetratheca juncea* were conducted within the flowering season for this species. Suitable habitat for *T. juncea* was largely confined to a relatively large area of Smooth-barked Apple – Stringybark Forest associated with Carboniferous sandstone within the northern portion of the study area. Records of *T. juncea* exist within similar habitats on the northern side of Port Stephens (OEH, 2012) and has been recorded within the neighbouring property to the east (NPWS, 2011).

Limited habitat for *Grevillea parviflora* ssp. *parviflora* was also considered to be present within the northern portion of the study area. A small number of records of this Grevillea species are known from the north-western side of Port Stephens, however there were no records within the vicinity of the study area.

No suitable habitat for either *T. juncea* or *G. parviflora* ssp. *parviflora* was considered to be present within the vegetation assemblages in the southern portion of the study area where the Abalone Farm is to be situated. As no suitable habitat for *T. juncea* or *G. parviflora* ssp. *parviflora* will be cleared/altered the proposal is unlikely to result in the extinction of any local population of these species.

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

Not applicable.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

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

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

Suitable habitat for *T. juncea* and *G. parviflora* ssp. *parviflora* was considered to be confined to the northern portion of the study area outside the area proposed to be developed. The action is not likely to result in the fragmentation or isolation of any areas of habitat for these species. Considering no areas of associated habitat are likely to be removed the proposal is unlikely to result in the removal, modification, fragmentation or isolation of an area of habitat important to the long term survival of *T. juncea* or *G. parviflora* ssp. *parviflora*.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for *T. juncea* or *G. parviflora* ssp. *parviflora*. However the OEH has prepared Priority Action Statements (PAS) to promote the recovery of this species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help these species recover in NSW. It is considered that the proposal does not significantly conflict with the PAS for these species.

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

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal/modification habitat for the proposal is not considered to be significant for these flora species.
- **Invasion of native plant communities by exotic perennial grasses:** Introduced grasses such as *Andropogon virginicus* (Whisky Grass) were present within the more disturbed areas of the study area. These grasses have the potential to further invade parts of the study area.
- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused to the study area.
- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera*: (Bitou Bush).** Bitou Bush was present within the study area. It is recommended that this species be controlled within the study area.
- ***Lantana camara* (Lantana):** Lantana was found to be common within the study area and formed small thickets in some areas. The Lantana present has the potential for further infestation regardless of the proposal. However given the recommendation for a vegetation management plan for this area which will include regular weed control the impact from this threatening process would be reduced.

Bibliography:

Briggs, J.D. and Leigh, J.H. (1995). *Rare or Threatened Australian Plants*. CSIRO Publishing, Victoria.

Carolin, R.C. and Tindale, M.D. (1993). *Flora of the Sydney Region* (4th edn.). Reed, Sydney.

Harden, G. (ed) (1992). Flora of NSW - Vol 3. New South Wales Uni Press, Sydney.

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July 2001).

Payne, R. (1998). Lake Macquarie *Tetratheca juncea* Conservation Management Plan - Interim report prepared for NSW NPWS, BHP Pty. Ltd. and LMCC, September 1998

13. Shrub Species

Callistemon linearifolius **Netted Bottlebrush**

Description

This shrub is up to 3-4 m tall, with linear (long and narrow) to linear-lanceolate (lance shaped) leaves 8-10 cm long, and 5-7 mm wide with an sharp tip, thickened margins, and distinct lateral veins. The brushes (flowers) are red and usually 9-10 cm long and approximately 50 mm in diameter. The stem upon which the filaments occur are covered in a soft downy hair at flowering. The seed capsules are approximately 7 mm in diameter.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not currently listed.
ROTAP – 2VCi

Habitat Requirements and Ecology

Grows in dry sclerophyll forest on the coast and adjacent ranges. Flowers spring – summer.

Distribution

Recorded from the Georges River to Hawkesbury River in the Sydney area, and north to the Nelson Bay area of NSW.

Prostanthera densa **Villous Mintbush**

Description

Villous Mintbush is an erect mint-smelling shrub to 2 m tall, though in the southern part of its range it is rarely more than 1 m tall. Branches and leaves are covered with long, spreading hairs. The leaves are in pairs and almost triangular in shape, to 15 mm long and 12 mm wide. They are dark green above and paler below, with curled-under edges. The tubular flowers are mauve with orange markings and grow in the angles where the leaves meet the stems.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Vulnerable.

Habitat Requirements and Ecology

Villous Mintbush is generally grows in sclerophyll forest and shrubland on coastal headlands and near coastal ranges, chiefly on sandstone, and rocky slopes near the sea. Plants regenerate from rootstock after fire and flower within the first year or two. Flowering has been observed throughout the year, but occurs chiefly in spring or from May - December.

Distribution

This species has been recorded from the Currarong area in Jervis Bay, Royal National Park, Cronulla, Garie Beach and Port Stephens (Gan Gan Hill, Nelson Bay).

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

Despite targeted and incidental surveys neither *Callistemon linearifolius* nor *Prostanthera densa* were recorded within the study area. Suitable habitat for *C. linearifolius* was found to be present within the

drier areas of sclerophyll forest within the study area. Only marginal habitat for *P. densa* was considered to be available on the higher ground in the far north of the study area. Local records for *P. densa* are currently confined to the area around Gan Gan Hill on the southern side of Port Stephens. The proposal will result in the removal of up to 1ha of suitable habitat for *C. linearifolius* resulting in a small incremental reduction in habitat in the local area. No habitat for *P. densa* is likely to be removed. As neither *C. linearifolius* or *P. densa* were recorded within the study area and considering the lack of local records along the northern shore of Port Stephens the proposal is unlikely to result in the extinction of any local population of these shrub species.

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

Not applicable.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

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

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

The proposed Abalone farm will be positioned over a development area of approximately 5 hectares in the south of the study area. Within this area a total building footprint of 1ha will be situated within an area of Open Forest containing suitable habitat for *C. linearifolius*. No suitable habitat for *P. densa* will be affected.

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

No areas of habitat for either *C. linearifolius* or *P. densa* are likely to become fragmented or isolated from other areas of habitat as a result of the proposed action.

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

The proposal may result in the incremental reduction in suitable habitat for *C. linearifolius*. However considering specimens of *C. linearifolius* or *P. densa* will be affected it is considered that no area of habitat important to the long-term survival of these species will be removed, modified, fragmented or isolated.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for this two flora species. However the OEH has prepared Priority Action Statements (PAS) to promote the recovery of these species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help this species recover in NSW. It is considered that the proposal does not significantly conflict with the PAS for this species.

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

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the study area and subject site for this species have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal/modification habitat for the proposal is not considered to be significant for these shrub species.
- **Invasion of native plant communities by exotic perennial grasses:** Introduced grasses such as *Andropogon virginicus* (Whisky Grass) were present within the more disturbed areas of the study area. These grasses have the potential to further invade parts of the study area.
- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused to the study area.
- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera*: (Bitou Bush).** Bitou Bush was present within the study area. It is recommended that this species be controlled within the study area.
- ***Lantana camara* (Lantana):** Lantana was found to be common within the study area and formed small thickets in some areas. The Lantana present has the potential for further infestation regardless of the proposal. However given the recommendation for a vegetation management plan for this area which will include regular weed control the impact from this threatening process would be reduced.

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14. Small Tree Species

***Angophora inopina* (Charmhaven Apple)**
Description
Angophora inopina (Charm Haven Apple) is a small to large tree to 8m tall, often multi-stemmed with persistent shortly fibrous bark throughout.

Conservation Status
Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Vulnerable.

Habitat Requirements and Ecology
Angophora inopina is found within Open Woodland/Forest assemblages in co-dominant distribution with *Eucalyptus haemastoma* (Scribbly Gum), *Corymbia gummifera* (Red Bloodwood) and *Eucalyptus capitellata* (Brown Stringybark), as well as within wet-dry heath and Swamp Forest communities. These vegetation habitat attributes are located mainly on the Doyalson, Gorokan and Wyong soil landscapes (Bell, 2001).

Distribution
Angophora inopina has a restricted distribution in New South Wales occurring mostly between Toronto and Wyee. Recent survey work has revealed disjunct populations near Karuah and Medowie.

***Eucalyptus parramattensis* ssp. *decadens* (Drooping Red Gum)**
Description
Eucalyptus parramattensis ssp. *decadens* (Drooping Red Gum) is a small smooth-barked eucalypt from the red gum family.

Conservation Status
Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Vulnerable
ROTAP – 2V

Habitat Requirements and Ecology
It occurs in woodland on sandy soils in wet sites. Any occurrences are likely to be restricted to areas along riparian vegetation strips or within close proximity to the water table. In the Port Stephens area, the Drooping Red Gum occurs in open wet sclerophyll woodland on heavy, often waterlogged, interbarrier depression soils. It is distinguished from *E. p. parramattensis* by the larger fruit, which are greater than 7mm in diameter. It is commonly associated with *Melaleuca quinquenervia* (Broad-leaved Paperbark) and *Eucalyptus robusta* (Swamp Mahogany). This sub-species is ROTAP listed 2V.

Distribution
Eucalyptus parramattensis ssp. *decadens* is endemic to the Hunter Region. There are two metapopulations present in the region, one on the Tomago Sandbeds and the other in the Cessnock-Kurri area.

***Melaleuca biconvexa* Biconvex Paperbark**
Description
M. biconvexa is a shrub to small tree with papery bark which flowers in summer.

Conservation Status
Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements and Ecology
It may occur in dense stands adjacent to watercourses, in association with other *Melaleuca* species or as an understorey species in wet forest. Present populations are threatened by land clearing, filling, excavation for construction of floodwater detention basins and alteration to water tables. This species is not ROTAP-listed.

Distribution
Melaleuca biconvexa occurs in disjunct populations in coastal NSW from Jervis Bay to Port Macquarie with the main concentration of records in the Gosford/Wyong Area.

Melaleuca groveana **Grove's Paperbark**
Description
Melaleuca groveana (Grove's Paperbark) is an erect evergreen shrub which grows to a height of 3m with an open crown and a spread of 1.5m. Inflorescences are bottlebrush like and cream in colour. Fruit are small woody capsules. Leaves are elliptical in shape and are usually up to 3.5cm long.

Conservation Status
Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.
ROTAP – 3RC-

Habitat Requirements and Ecology
In Tomaree National Park, *M. groveana* occurs in closed heath communities on rhyodacite volcanic rock and is considered to exist in the park at the most southerly limit of its distribution. Flowering in late spring and summer,

Distribution
This species is generally found in north eastern NSW and south east Queensland

Syzygium paniculatum **Magenta Lilly Pilly**
Description
The Magenta Lilly Pilly is a small to medium sized rainforest tree that grows to 8 m tall. The bark is flaky and the leaves are shiny, dark-green above and paler underneath. Leaves can be up to 10 cm long. The deep magenta fruits, which may be spherical or egg-shaped, mature in May, and contain a single seed.

Conservation Status
Threatened Species Conservation Act 1995 – Listed as Endangered under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Vulnerable.
ROTAP – 3VCi

Habitat Requirements and Ecology
On the central coast Magenta Lilly Pilly occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities. On the south coast the Magenta Lilly Pilly occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest.

Distribution
The Magenta Lilly Pilly is found only in NSW, in a narrow, linear coastal strip from Bulahdelah to Conjola State Forest.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

Despite targeted and incidental surveys neither *Angophora inopina* (Charmhaven Apple), *Eucalyptus parramattensis* ssp. *decadens* (Drooping Red Gum), *Melaleuca biconvexa* (Biconvex Paperbark), *Melaleuca groveana* (Grove's Paperbark) nor *Syzygium paniculatum* (Magenta Lilly Pilly) were recorded within the study area during the survey. Parts of the study area were found to contain some habitat of varying suitability for all of these flora species. Habitat for *A. inopina* containing known vegetation associations would be confined to the area of Smooth-barked Apple Forest within the northern portion of the study area. The area of Swamp Sclerophyll Forest within the far south of the study area contains suitable habitat for *E. parramattensis* ssp. *decadens*. Habitat for *M. biconvexa* would be confined to the area of moist riparian forest within the central region of the study area. Marginal habitat for *S. paniculatum* was confined to the moist areas of open forest and drainage lines. Higher ground in the far north of the study area may contain suitable habitat for *M. groveana*. Of these species only *A. inopina*, *M. groveana* and *E. parramattensis* ssp. *decadens* have been reported from the local area. A small population of *M. groveana* was known to occur on top of a hill of volcanic origin approximately 2km to the west of the study area (Wildthing Environmental Consultants, 2004). The total building footprint of 1ha will be situated within an area of Open Forest containing only marginal habitat for *S. paniculatum.* No habitat for the other addressed threatened tree species was considered to be present within this area. Suitable habitat for *E. parramattensis* ssp. *decadens* was considered to be present within the area mapped as Swamp Sclerophyll Forest. The proposal may result in the removal/modification of approximately 1ha of marginal habitat for *S. paniculatum.* Considering the fact that this species and the other addressed tree species were not recorded within the study area it is unlikely that the proposal will result in the extinction of any local population of these tree species.

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

Not applicable.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

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

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

The proposed Abalone farm will be positioned over a development area of approximately 5 hectares in the south of the study area. Within this area a total building footprint of 1ha will be situated within an area of Open Forest containing only marginal habitat for *S. paniculatum.* No habitat for the other addressed threatened tree species was considered to be present within the building precinct. However

suitable habitat for *E. parramattensis* ssp. *decadens* was considered to be present within the area mapped as Swamp Sclerophyll Forest.

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

No areas of habitat for any of the addressed tree species is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action.

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

The proposal may result in the incremental reduction in marginal habitat for *S. paniculatum*. However considering that none of the threatened tree species were recorded within the study area it is considered that no area of habitat important to the long-term survival of these species will be removed, modified, fragmented or isolated.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

A technical report and conservation Management Plan for *A. inopina* as been completed (Bell, 2001). The report consists of five specific objectives:

- To ensure that viable areas of *A. inopina* habitat are protected from habitat loss and managed for conservation;
- To minimise the risk of *A. inopina* populations declining in the long term through encouraging the implementation of appropriate threat and habitat management practices;
- To ensure that all populations of *A. inopina* have been discovered and mapped;
- To ensure that the management of *A. inopina* habitat is informed by essential aspects of the biology and ecology of the species;
- To raise awareness among the broader community about the conservation status of *A. inopina* and to involve the community in the development of a recovery plan for the species.

As *A. inopina* was not recorded within the study area the proposal is unlikely to compromise these objectives.

No Recovery or Threat Abatement Plans have been developed for the remaining tree species. However the OEH has prepared Priority Action Statements (PAS) to promote the recovery of these tree species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help these species recover in NSW. It is considered that the proposal does not conflict with the PAS for these species.

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

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to

the study area and subject site for this species have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal/modification habitat for the proposal is not considered to be significant for these tree species.
- **Invasion of native plant communities by exotic perennial grasses:** Introduced grasses such as *Andropogon virginicus* (Whisky Grass) were present within the more disturbed areas of the study area. These grasses have the potential to further invade parts of the study area.
- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused to the study area.
- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera*: (Bitou Bush).** Bitou Bush was present within the study area. It is recommended that this species be controlled within the study area.
- ***Lantana camara* (Lantana):** Lantana was found to be common within the study area and formed small thickets in some areas. The Lantana present has the potential for further infestation regardless of the proposal. However given the recommendation for a vegetation management plan for this area which will include regular weed control the impact from this threatening process would be reduced.

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15. Other flora species

Cynanchum elegans **White-flowered Wax-plant**

Description

Cynanchum elegans, a member of the Asclepiadaceae family is an evergreen vine which grows to 10m in length. The stems and branches are corky. The leaves are opposite.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Endangered under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Endangered.
ROTAP – 3ECi

Habitat Requirements and Ecology

This climber grows mainly in dry vine thickets on richer clay-shales and fertile volcanic soils. Has also been recorded in littoral rainforests, open forest and on sand. It flowers in summer (November – March) producing clusters of white, tubular and lobed flowers.

Distribution

Cynanchum elegans is endemic to New South Wales and occurs from Gloucester to the Illawarra. areas.

Asperula asthenes **Trailing Woodruff**

Description

Asperula asthenes, of the family Rubiaceae, is a decumbent perennial herb with weak, trailing stems to 30cm long. The leaves and stipules occur irregularly in whorls of 4 and range from linear to oblanceolate to narrow elliptic (Harden, 1992). The leaves are generally 10-20mm long. The flowers are small, white and occur in terminal cymes, typical of the *Asperula* genus.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.
ROTAP-coded 3VC-.

Habitat Requirements and Ecology

Asperula asthenes inhabits damp sites, often along river banks. This species flowers in spring.

Distribution

Asperula asthenes ranges from approximately Taree to Bulahdelah. Populations are known to be protected on the Wallis Island Nature Reserve.

Lindernia alsinoides **Noah's False Chickweed**

Description

Diffuse or erect often multi-stemmed annual herb to 30cm in height. Leaves are opposite, 5-10 mm long and 1.5-5 mm wide, oval-shaped to more or less circular at the base of the plant and almost linear near the flowers. There are 3 veins from the base of the leaf. The leaf stalk is 3 mm long. There are 1-8 blue flowers, approximately 5.5-8.5 mm long. Flowers have been recorded in November.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Endangered under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements and Ecology

Grows in swampy sites in sclerophyll forest and coastal heath. Often found around the edges of dunal Swamp Sclerophyll Forest communities that fringe freshwater wetlands and within regenerating Swamp Sclerophyll Forest that have been subject to disturbance events.

Distribution
Has been recorded from Port Stephens, Great Lakes and Greater Taree Councils. It has been recorded as far south as Williamtown.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

Neither *Asperula asthenes, Cynanchum elegans* or *Lindernia alsinoides* were recorded within the study area during fieldwork. According to the Atlas of NSW database (OEH, 2012) few records for *C. elegans* were present within the local area. However a small number of local records were found to be present for *A. asthenes*. Marginal habitat within the study area for both *C. elegans* and *A. asthenes* was considered to be confined to the moist gullies outside the proposed building precinct and area for the inlet/outlet pipes. As these two flora species were not recorded within the study area and no preferred habitat is likely to be removed the proposal is unlikely to cause extinction of this endangered ecological community in the locality.

Suitable habitat for *L. alsinoides* was considered to be present in and around the area of Swamp Forest within the southern portion of the study area. Due to the close proximity of the proposed facility to an area of suitable habitat there is the potential for secondary impacts such as stormwater runoff and increased weed infestation. The inlet and outlet pipes connecting the proposed facility to the waters of Port Stephens will be required to cross the area of Swamp Forest. As *L. alsinoides* was not recorded within the locality and given the recommendations pertaining to stormwater and sediment control the proposal is unlikely to cause extinction of these wetland flora species.

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

No applicable.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

No applicable.

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

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

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

No area of suitable habitat for either *Asperula asthenes* or *Cynanchum elegans* is likely to be removed or modified as a result of the proposal. However as a result of the close proximity of the facility to suitable habitat for *L. alsinoides* there is the potential for secondary impacts such as stormwater runoff and increased weed infestation. The inlet/outlet pipes connecting the proposed facility to the waters of Port Stephens will also be required to cross suitable habitat. To reduce the impact on this habitat the pipelines will be raised off the ground on supports along a narrow corridor of up to 4.5m. Given the recommendations the proposal is unlikely to cause extinction of *L. alsinoides* in the locality.

No area of suitable habitat will be fragmented or isolated. The proposal unlikely to result in the removal, modification, fragmentation or isolation of an area of habitat important to the long term survival of these two flora species.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for *A. asthenes* or *C. elegans.* However the OEH has prepared Priority Action Statements (PAS) to promote the recovery of these species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help *A. asthenes* or *C. elegans* recover in NSW. It is considered that the proposal does not significantly conflict with the PAS for this species.

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

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal/modification habitat for the proposal is not considered to be significant for these flora species.
- **Invasion of native plant communities by exotic perennial grasses:** Introduced grasses such as *Andropogon virginicus* (Whisky Grass) were present within the more disturbed areas of the study area. These grasses have the potential to further invade parts of the study area.
- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused to the study area.
- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera*: (Bitou Bush).** Bitou Bush was present within the study area. It is recommended that this species be controlled within the study area.
- ***Lantana camara* (Lantana):** Lantana was found to be common within the study area and formed small thickets in some areas. The Lantana present has the potential for further infestation regardless of the proposal. However given the recommendation for a vegetation

management plan for this area which will include regular weed control the impact from this threatening process would be reduced.

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Fauna species considered to have potential habitat within the study area:

16. Invertebrates

Petalura gigantea **Giant Dragonfly**

Description

The *Petalura gigantea* Giant Dragonfly is the second largest Dragonfly in Australia with the adult stage having a wingspan of more than 13cm and a body length of up to 14.5cm (NSW National Parks and Wildlife Service.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Endangered under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements and Ecology

Inhabits boggy seepages and swamps between and altitude of 0 – 1150m (Theischinger, & Hawking, 2006). The larvae live in permanent long chambered burrows up to 1.5m long built under swamps and emerge from terrestrial entrances above water level at night to feed. The larval stage is considered to take from 10 to 30 years and the adults emerge from October to November and fly until late January. The adults however have a very limited dispersal due to a poor flying ability.

Distribution

This dragonfly species was known to occur in SE Australia, from Moss Vale to southern Queensland. A population of the Giant Dragonfly is known from Wingecarribee Swamp south-west of Sydney. This species has been recorded at Chittaway Point on the Central Coast (Wyong Shire Council, 1999) and within the in the vicinity of Horizons Golf Course Salamander Bay in 2006 (DECC Database).

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

No large dragonflies consistent with *Petalura gigantea* (Giant Dragonfly) were recorded within the study area during incidental surveys. The survey was undertaken within the time when this species would be considered to have emerged from its larval form (October to late January). The Giant Dragonfly has been recorded within Mambo Swamp on the southern shore of Port Stephens (OEH, 2012). Suitable habitat was considered to be present within the wetter areas of swamp forest in the far south of the study area.

The proposed building footprint will be located a short distance to the north of the area of the Swamp Sclerophyll Forest boundary. Due to the close proximity of the proposed facility to suitable habitat there is the potential for secondary impacts such as stormwater runoff and increased weed infestation. Strict controls will have to be applied to the building precinct area to prevent any future degradation to the area of swamp forest. The intake/outtake pipes connecting the proposed facility to the waters of Port Stephens will be required to cross the area of Swamp Forest. To reduce the impact on the Endangered Ecological Community the pipe line will be raised on supports north of the pumphouse and manoeuvred to avoid the removal of any trees. South of the pumphouse the pipelines will be buried below ground with the natural ground levels reinstated. Approximately 0.14ha of understorey vegetation will be disturbed along a 4.5m wide area. This understorey vegetation would be expected to regenerate naturally. It is recommended that a vegetation management plan be completed for these areas to ensure their long-term viability of this area of habitat. Given the recommendations the proposal is unlikely to cause extinction of this Dragonfly species in the locality.

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

Not applicable.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(iii) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

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

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

The construction of the building precinct and associated Bushfire Asset Protection Zones will not involve any direct impacts on Swamp Sclerophyll Forest. However due to the close proximity of the area of Swamp Sclerophyll Forest to the building precinct there is the potential for secondary impacts such as stormwater runoff and increased weed infestation. Strict controls will need to be applied to the development to prevent any future degradation to this EEC. The intake/outtake and outlet pipes connecting the proposed facility to the waters of Port Stephens will be required to cross the area of Swamp Forest. To reduce the impact on the Endangered Ecological Community the pipeline will be raised on supports north of the pumphouse and manoeuvred to avoid the removal of any trees.

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

No areas of habitat are likely to become fragmented, isolated for this Dragonfly species.

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

Given the recommendations such as strict sediment and weed control within the building precinct no areas of habitat important to the long-term survival of these species will be removed, modified, fragmented or isolated.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for the Giant Dragonfly. However the OEH has prepared Priority Action Statements (PAS) to promote the recovery of these species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help this Dragonfly recover in NSW. Actions pertinent to the site include:

- The maintenance of the hydrological regime of Swamp Forest Habitat.
- Prevent erosion and subsequent erosion of suitable habitat.

Provided the recommendations are adhered to it is unlikely that the proposal will significantly compromise the Priority Action Plans.

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

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. However it is not considered to be significant in relation to this Dragonfly species.
- **Predation by the European Red Fox *Vulpes vulpes*:** The Red Fox was not recorded within the study area at the time of the survey however would be considered to have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in the number of this introduced species.
- **Predation by the Feral Cat *Felis catus.*** The Feral Cat was not recorded within the study area at the time of the survey however would be considered to have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in the number of this introduced species.
- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: Past fires were evidenced by a number of blackened tree trunks. It is difficult to ascertain the disruption and structural changes, if any, past fires have caused the study area.

Other pertinent threats include the reduction in water quality within swamps the use of chemical such as herbicides or insecticides within or near swamps.

Bibliography:

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Wyong Shire Council. (1999). *Flora and Fauna Guidelines for Development*. Prepared by Wyong Shire Council.

17. Frogs

Litoria aurea **Green & Golden Bell Frog**

Description

The Green and Golden Bell Frog belonging to the Tree Frog Family Hylidae is a relatively large robust frog with a variable dorsal colouration of vivid pea green splotched with almost a metallic brass brown or gold. Adult size ranges from approximately 45mm to 100mm long (Department of Environment and Conservation NSW, 2005). Males are generally smaller than females.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Endangered under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Listed as Vulnerable.

Habitat Requirements and Ecology

This frog species inhabits swamps, lagoons, streams and ponds as well as dams, drains and storm water basins. The Green and Golden Bell Frog is a summer breeder and voraciously cannibalistic. The males call from August through to January using a distinctive four part call: "crawk-awk, crawk, crok, crok". The common name of *L. aurea* is derived from its body colouration described as being dull olive to bright emerald green above with blotches of brown or golden-bronze.

Distribution

Litoria aurea was formerly known to inhabit the eastern seaboard of New South Wales and Victoria from Byron Bay through to the Gippsland Lake Region as well as highland sites (New England District, south-western slopes of N.S.W. and Monaro District). Recent literature indicates that the northern and southern distribution limits have not changed, however, *L. aurea* is no longer found on sites above an altitude of 300m above sea level.

Litoria brevipalmata **Green-thighed Frog**

Description

Litoria brevipalmata (Green-thighed Frog) is a ground dwelling frog approximately 40mm in length. It has chocolate brown on its back with black flecks. A dark stripe runs from the snout, through the eye and tympanum, breaking up into blotches down the side of the body. The upper lip has a white edge which continues to the base of the arm. The sides of the body are yellowish with black flecks. The groin and the backs of the thighs are bright blue, green or blue-green with black spots. The belly is granular and white or yellow. The skin on the back is smooth to slightly granular. The finger and toe pads are medium sized, and the toes are one-third webbed.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not Listed

Habitat Requirements and Ecology

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.

Distribution

Inhabits the costal zone from south-eastern Queensland to Ourimbah on the Central Coast of NSW.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

Neither *Litoria aurea* (Green and Golden Bell Frog) nor *Litoria brevipalmata* (Green-thighed Frog) were recorded within the study area despite targeted surveys. The wetter area of Swamp Forest within the south of the study area is considered to contain suitable habitat for the *L. aurea* and a lesser extent *L. brevipalmata*. The two small dams were also found to contain some habitat for these frog species. *Litoria aurea* would have once been one of the more commonly encountered frogs within the local area before its severe contraction in distribution in the 1970's and 1980's. The nearest known populations of Green and Golden Bell Frogs are currently located Broughton Islands (Department of Environment and Conservation NSW, 2005) and Medowie (Umwelt, 2006).

The proposal will result in the removal of one small man-made dam to make way for the building precinct. Due to the close proximity of the proposed facility to suitable habitat there is the potential for secondary impacts such as stormwater runoff and increased weed infestation. Strict controls will have to be applied to the building precinct area to prevent any future degradation to the area of swamp forest. The inlet and outlet pipes connecting the proposed facility to the waters of Port Stephens will be required to cross the area of Swamp Forest. To reduce this impact the pipelines will be raised on supports not of the pumphouse and manoeuvred to avoid the removal of any trees. South of the pumphouse the pipelines will be buried under the ground with the naturals ground levels reinstated. Given the recommendations the proposal is unlikely to cause extinction of these frog species in the locality.

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

Not applicable.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

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

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

Beside the removal of a small man-made dam occurring within the building precinct the proposal is unlikely to have any direct impact on habitat for *L. aurea* or *L. brevipalmata*. However as a result of the close proximity of the facility to suitable habitat for these frog species there is the potential for secondary impacts such as stormwater runoff and increased weed infestation. The construction of the pipeline will result in some disturbance to the habitat of this frog species. To reduce the impact on suitable habitat the pipe line will be raised on supports to allow the movement of frogs under the pipe.

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

To reduce the possibility of the pipeline creating a barrier for some frog species the pipelines will be raised on supports allow movement underneath.

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

As *L. aurea* nor *L. brevipalmata* were not recorded within the study area and taking into consideration the lack of recent local records no areas of habitat important to the long-term survival of these frog species will be removed, modified, fragmented or isolated.

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

To date no Critical Habitat, as defined under Part 3 of the TSC Act has not been declared for either *L. aurea* or *L. brevipalmata.*

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

A Draft Recovery Plan has been developed for *L. aurea*. Objectives include:

- To avoid direct impacts and retain habitat;
- Minimise impacts where ever possible;
- Mitigate or ameliorate impacts; and as a last resort;
- Compensate or offset for any unavoidable impacts.

Given the lack of known key populations in the locality it is considered that the proposal development will not significantly conflict with this draft recovery plan.

No Recovery or Threat Abatement Plans have been developed for *L. brevipalmata*. However the OEH has prepared Priority Action Statements (PAS) to promote the recovery of this frog species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help these species recover in NSW. It is considered that the proposal does not conflict with the PAS for these species.

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

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to this site and species have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. Any future removal of vegetation particularly within the wetter areas of swamp forest may result in an incremental reduction in habitat for these species in the local area and may be viewed as being part of this Key Threatening Process. However it is not considered to be significant in relation to these frog species.
- **Predation by *Gambusia holbrooki* (Plague Minnow):** This species of fish was not observed during the survey. This is most probably due to the ephemeral nature of the wetland. The proposal is not likely to increase the likelihood of this fish species.

- **Infection of frogs by amphibian chytrid fungus causing the disease chytridiomycosis:** It is possible that this fungus has an impact on frogs in the local area. However the proposal is unlikely to have any impact on this threatening process.
- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused the site. Past fire within the study area was evidenced by blackened parts of tree trunks. The proposal is considered to have little impact on fire frequency.
- **Human-caused Climate Change**: Has the potential to have an adverse effect on these frog species. The proposal is unlikely to significantly contribute to Climate Change.

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18. Marine Reptiles

Caretta caretta **Loggerhead Turtle**

Description

The Loggerhead Turtle is a large sea turtle to 1.5 m in length. The shell is an elongated heart-shape, dark brown above and white, cream or yellowish below. The large head is dark brown on top becoming pale at the sides, with darker blotches.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Endangered under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Endangered.

Habitat Requirements and Ecology

Loggerhead Turtles are ocean-dwellers, foraging in deeper water for fish, jellyfish and bottom-dwelling animals. The female comes ashore to lay her eggs in a hole dug on the beach in tropical regions during the warmer months.

Distribution

Loggerhead Turtles are found in tropical and temperate waters off the Australian coast. In NSW they are seen as far south as Jervis Bay and have been recorded nesting on the NSW north coast and feeding around Sydney.

Chelonia mydas **Green Turtle**

Description

A large sea-turtle that grows up to 1 m in length. Its heart-shaped shell is olive-green, brown and black, and the scales on the side of the face and limbs have distinctive pale edges.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Vulnerable.

Habitat Requirements and Ecology

The Green Turtle is an ocean-dwelling species spending most of its life at sea. The young are carnivorous when young but as adults they feed only on marine plant material. Eggs laid in holes dug in beaches throughout their range.

Distribution

Widely distributed in tropical and sub-tropical seas. Usually found in tropical waters around Australia but also occurs in coastal waters of NSW, where it is generally seen on the north or central coast, with occasional records from the south coast.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

Neither *Caretta caretta* (Loggerhead Turtle) nor *Chelonia mydas* (Green Turtle) were noted within the adjacent waters of Port Stephens during fieldwork. As the far southern area of the study area forms part of the waters of Port Stephens suitable shallow water marine habitat was considered to be present for both turtle species within this area. According to the Atlas of NSW Wildlife (OEH, 2012)

both species of turtle have been recorded in the locality. Suitable foraging habitat was considered to be available for both turtle species particularly the Green Sea Turtle which forages on seagrasses. Two species of seagrass *Zostera capricorni* (Zostera) and *Posidonia australis* (Posidonia) have been previously recorded within the study area (Wildthing Environmental Consultants, 2003). As only a narrow band of sand occurs above the high tide mark and the preference for nesting in tropical area suitable nesting habitat is likely to be absent from the study area. The construction of the inlet and outlet pipes will involve the removal and disturbance of a narrow area of seagrasses which will contribute to a small percentage of foraging habitat for the Green Turtle within the port. The proposal is unlikely to disrupt the life cycle of these turtle species such that a local extinction would occur.

The impacts of the proposal on the marine environment are discussed in more detail in the Aquatic Ecology Report (BIO-ANALYSIS, 2013).

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

Not applicable.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(ii) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

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

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

The construction of the intake and outtake pipes will involve the removal and disturbance of a narrow area of seagrasses which will contribute to a small percentage of foraging habitat for the Green Turtle within the port. No suitable nesting habitat for either species is likely to be impacted upon.

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

No areas of habitat are likely to become fragmented or isolated as a result of the action.

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

The construction of the intake and outtake pipes will involve the removal and disturbance of a narrow area of seagrasses which will contribute to a small percentage of foraging habitat for the Green Turtle within the port. No suitable nesting habitat for either species is likely to be impacted upon.

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

To date no Critical Habitat, as defined under Part 3 of the TSC Act has not been declared for the these turtle species.

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

No Recovery or Threat Abatement Plans have been developed for these two marine turtles. However the OEH has prepared Priority Action Statements (PAS) to promote the recovery of these turtle species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help these species recover in NSW. It is considered that the proposal does not conflict with the PAS for these species.

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

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to this site and species have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal.

- **Predation by the European Red Fox *Vulpes vulpes*:** The Red Fox was not recorded within the study area at the time of the survey however would be considered to have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in the number of this introduced species.
- **Predation by the Feral Cat *Felis catus.*** The Feral Cat was not recorded within the study area at the time of the survey however would be considered to have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in the number of this introduced species.
- **Entanglement in or ingestion of anthropogenic debris in marine and estuarine environments:** Marine Turtle species are unlikely to become entangled as a result of the proposed pipelines.
- **Human caused climate change:** Has the potential to have an adverse effect on these turtle species. The proposal is unlikely to significantly contribute to Climate Change.

Other threats include:

- Collision with boats and other marine traffic;
- Accidental entanglement in shark nets, traps, longlines and other fishing gear;
- Marine debris, particularly plastic, which is mistaken for jellyfish and can cause asphyxiation, abrasion, infection and blockages in the turtle's system when swallowed;
- Predation at nest site by feral pigs;
- Disturbance to nest sites.

Bibliography:

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NSW Scientific Committee (2001) *Loggerhead turtle - Endangered species determination - final. DEC (NSW),* Sydney.

19. Arboreal Reptiles

Hoplocephalus bitorquatus **Pale-headed Snake**

Description

The Pale-Headed Snake is a medium-sized largely tree-dwelling snake to 90 cm long. It is a uniform light brown or grey above with a white or cream band on the nape, bordered by a narrow blackish bar which may be solid, or broken in the middle. The top of the head is grey, and may have a series of black spots, which are most prominent along the edge of the white nape. The lips may have black vertical bars. The belly is creamy grey sometimes with darker flecks.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not Listed.

Habitat Requirements and Ecology

The Pale-Headed Snake is found mainly in dry eucalypt forests and woodlands, cypress woodland and occasionally in rainforest or moist eucalypt forest. Favours streamside areas, particularly in drier habitats. This snake shelters during the day between loose bark and tree-trunks, or in hollow trunks and limbs of dead trees. The main prey is tree frogs although lizards and small mammals are also taken.

Distribution

A patchy distribution from north-east Queensland to north-east NSW. In NSW it occurs from the coast to the western side of the Great Divide as far south as Tuggerah.

Hoplocephalus stephensii **Stephen's Banded Snake**

Description

Stephens' Banded Snake is a medium-sized partly tree-dwelling snake up to one metre long. It is brown or yellow-brown above, with a series of irregular, broad, dark crossbands. The head is black with a brown crown and a brown or cream patch on either side of the nape and the lips are barred with black and cream.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not Listed

Habitat Requirements and Ecology

Stephen's Banded Snake is found in rainforest and eucalypt forests and rocky areas up to 950 m in altitude. This nocturnal snake shelters between loose bark and tree trunks, amongst vines, or in hollow trunks limbs, rock crevices or under slabs during the day. At night it hunts frogs, lizards, birds and small mammals.

Distribution

Coast and ranges from Southern Queensland to Gosford in NSW.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

Neither *Hoplocephalus bitorquatus* (Pale-headed Snake) nor *Hoplocephalus stephensii* (Stephen's

Banded Snake) were noted within the study area. Suitable habitat for both snakes was found to be present within the open forest assemblages. Tree hollows which these arboreal snakes are dependant upon are also relatively common throughout much of the study area. According to the Atlas of NSW Wildlife (OEH, 2012) there were no records for either snake species within the local area. The proposal will involve the removal of an area of suitable habitat including a number of tree hollows resulting in an incremental reduction of suitable habitat in the local area. However considering the lack of local records the proposal is unlikely to cause extinction of these snake species in the locality.

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

Not applicable.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

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

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The proposed Abalone farm will be positioned over a development area of approximately 5 hectares in the south of the study area. Within this area a total building footprint of 1ha will be situated within an area containing Coastal Sand Blackbutt and Ironbark/Tallowwood Open Forest. Approximately sixty-five trees will be required to be removed including up to 13 containing hollows. Additional areas of these two communities will also have to be thinned and underscrubbed to comply with the required 20m Bushfire Asset Protection Zones to the north, east and south, and 30m to the west and north-west of the building precinct. Separate intake and outtake and outlet pipes, extending from the building precinct into the waters of Port Stephens (Crown Land in the LGA of Port Stephens). These pipes will run through the area of Swamp Sclerophyll Forest, however, no trees will be required to be removed. No areas of habitat for these arboreal snakes are likely to become fragmented or isolated from other areas of habitat as a result of the proposed action. The proposal may result in the incremental reduction of suitable habitat for these threatened species in the local area, however, it is considered that no area of habitat important to the long-term survival of these snake species will be removed, modified, fragmented or isolated.

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

To date no Critical Habitat, as defined under Part 3 of the TSC Act has not been declared for these

snake species.

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

No Recovery or Threat Abatement Plans have been developed for these two arboreal snakes. However the Department of Environment and Climate Change has prepared Priority Action Statements (PAS) to promote the recovery of this frog species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help these species recover in NSW. It is considered that the proposal does not conflict with the PAS for these species.

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

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to this site and species have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. Any future removal of vegetation particularly within the wetter areas of swamp forest is likely to result in an incremental reduction in habitat for this species in the local area and may be viewed as being part of this Key Threatening Process. However it is not considered to be significant in relation to these snake species.
- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused the study area. The proposal is unlikely to result in a change in the frequency of fire in the local area.
- **Loss of Hollow-bearing Trees***:* A number of hollow bearing trees will need to be removed within the area of open forest resulting in an incremental reduction of this habitat resource in the local area. The loss of hollow bearing trees is not considered to be significant.
- **Removal of dead wood and dead trees:** Dead wood and dead trees were present within the study area. No significant areas of dead wood and dead trees will be removed as a result of the proposal.
- **Predation by the European Red Fox *Vulpes vulpes*:** The Red Fox was not recorded within the study area at the time of the survey however would be considered to have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in the number of this introduced species.
- **Predation by the Feral Cat *Felis catus.*** The Feral Cat was not recorded within the study area at the time of the survey however would be considered to have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in the number of this introduced species.

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20. Waders

Limicola falcinellus **Broad-billed Sandpiper**

Description

The Broad-billed Sandpiper is a little larger than the Red-necked Stint, has a longer bill curving down slightly at the tip, and its long, pale eye-stripe has a smaller one branching from it on the crown on each side of its head.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not Listed.

Habitat Requirements and Ecology

They prefer estuarine sand and mudflats, saltmarshes and reefs, occasionally found on sewage farms and shallow freshwater lagoons (NPWS, 1999). They mainly eat small crustaceans, molluscs and marine worms. Breeds in the Arctic Eurasia between June and August (Pizzey and Knight, 1997). No breeding of this species has been recorded in Australia.

Distribution

The eastern form of this species breeds in northern Siberia before migrating southwards in winter to Australia. In Australia, Broad-billed Sandpipers overwinter on the northern coast, particularly in the north-west, with birds located occasionally on the southern coast. In NSW, the main site for the species is the Hunter River estuary, with birds occasionally reaching the Shoalhaven estuary. There are few records for inland NSW.

Limosa limosa **Black-tailed Godwit**

Description

The Broad-billed Sandpiper is a small, stint-like sandpiper reaching 18 cm in length. The bill is initially straight and tapering, then downturned and flattened, remaining quite broad at the tip. In non-breeding plumage, the forehead, crown, hind-neck and sides of neck are pale grey-brown, streaked black. The fore-neck and breast are pale grey-brown, with a fine dark streaking, and the underparts are mostly white. The head feathers have a snipe-like pattern, with two light stripes above the eyes and a dark median stripe.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not Listed.

Habitat Requirements and Ecology

This migratory species begins arriving in Australia in August each year, from breeding grounds in Mongolia and eastern Siberia. Habitat utilised by this species is primarily coastal, including tidal mudflats, river edges, sandy beaches, brackish swamps as well as the shallows of lakes, reservoirs and sewage farms. However, this species also occurs inland on mudflats, muddy lakes and swamps at low tide (Higgins and Davies, 1996). Black-tailed Godwits feed by probing their bills deep into the mud in search of crustaceans, molluscs and various aquatic worms.

Distribution

The Black-tailed Godwit breeds in Mongolia and Siberia, coming to the Australian coast in August until March (Higgins and Davies, 1996) and occasionally has been observed inland. In N.S.W. there are records on the coast as far south as Narooma and scattered inland records occur within the Murray-Darling Basin, the Northern Tablelands and on the western slopes of the Great Dividing Range and it is regularly recorded on Kooragang Island (Higgins and Davies, 1996).

Calidris ferruginea **Curlew Sandpiper**

Description

The Curlew Sandpiper is a small migratory shorebird (18-23cm) with a medium-length down-curved bill and longish black legs (Pizzey, 2001).

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Listed as a migratory species.

Habitat Requirements and Ecology

Forages on exposed intertidal mudflats and less frequently on inland freshwater wetlands (Geering. et. el, 2008).

Distribution

Breeds in high arctic tundra of Central and Eastern Siberia. Migrates to Africa, southern Asia and Australasia.

Calidris tenuirostris **Great Knot**

Description

A medium-large, stocky shorebird with medium-length slender bill that is slightly decurved at the tip.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Listed as a migratory species.

Habitat Requirements and Ecology

Forages on small to large intertidal mud and sandflats.

Distribution

Breeds in alpine tundra of north-east Siberia. The majority of the population migrates to Australia, particularly along the northern coastline.

Xenus cinereus **Terek Sandpiper**

Description

The Terek Sandpiper is a medium-sized wader. Individuals are greyish-brown above and white below, with some white on the outer tail feathers and a noticeable white bar on the tips of the secondaries. The species may be distinguished from other waders by its long, slender, upturned black bill, which is dull orange at the base, and its orange legs and feet.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not Listed.

Habitat Requirements and Ecology

The Terek Sandpiper is a migratory species, breeding in the northern summer in the Tundra region and wintering in the Southern Hemisphere. Migrating birds begin to arrive in Australia around September each year. The Tundra breeding grounds are situated below the Arctic Circle from southern Finland to north-eastern Siberia. This species inhabits tidal mudflats, estuaries, shores and reefs, offshore islands and muddy edges of coastal swamps. Terek Sandpipers probe the mud for a variety of invertebrates including segmented worms, crustaceans and small shellfish. This species is listed under the Japan Australia Migratory Bird Agreement (JAMBA) and China Australia Migratory Bird Agreement (CAMBA).

Distribution
Terek Sandpipers are distributed around the Australian coastline except for Tasmania where any individuals are considered vagrants.

Charadrius leschenaultii **Greater Sand-plover**
Description
The non-breeding Greater Sand Plover has a grey-brown crown, nape, back and breast patches. The lores, bill and upperwing are dark, with dusky ear-coverts. There is prominent white plumage on the forehead, chin, throat and underparts, including the underwing. The legs and feet are greenish-grey; this helps distinguish it from the very similar Lesser Sand Plover, with dark grey legs.

Conservation Status
Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not Listed.

Habitat Requirements and Ecology
This migratory species breeds in the northern hemisphere from June to July. They are believed to migrate from breeding grounds through south China, the Philippines and Borneo arriving in Australia from September onwards each year. During the non-breeding season Greater Sand Plovers are gregarious, freely joining other waders when feeding or roosting, often forming mixed flocks with other waders, particularly Lesser Sand Plovers (*C. mongolus*). In Australia this species inhabits littoral and estuarine habitats such as sheltered, sandy, shelly or muddy beaches with large intertidal mudflats or sandbanks (Marchant and Higgins, 1993). Molluscs, worms, crustaceans, insects and occasionally lizards form the diet of this species.

Distribution
The Greater Sand Plover breeds in central Asia from Armenia to Mongolia, moving further south for winter. In Australia the species is commonly recorded in parties of 10-20 on the west coast, with the far northwest being the stronghold of the population. The species is apparently rare on the east coast, being found usually singly. In NSW, the species has been recorded between the northern rivers and the Illawarra, with most records coming from the Clarence and Richmond estuaries.

Charadrius mongolus **Lesser Sand-plover**
Description
The non-breeding Lesser Sand Plover has a grey-brown crown, nape, back and breast patches. The forehead, lores, bill and upperwing are dark; ear coverts are dusky. There is prominent white plumage on the forehead, chin, throat and underparts, including the underwing. The Lesser Sand Plover is distinguished from the Greater Sand Plover by a smaller body with a more upright stance, more compact appearance and dark grey, rather than greenish legs.

Conservation Status
Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not Listed.

Habitat Requirements and Ecology
Lesser Sand Plovers inhabit sheltered bays, harbours and estuaries with large intertidal sandflats or mudflats. During the non-breeding season this species is gregarious, freely joining other waders when feeding or roosting, in particular the Greater Sand Plover (*C. leschenaultii*) with which it can be easily confused. Lesser Sand Plovers forage mostly on freshly exposed intertidal sandflats and mudflats. Prey includes molluscs, worms, crustaceans and insects.

Distribution
The Lesser Sand Plover is a migratory species residing in Australia from September to March. From March to late April, Lesser Sand Plovers begin migrating to breeding grounds in central and north-east Asia. This species is distributed around the Australian coast, including Tasmania.

Haematopus fuliginosus **Sooty Oystercatcher**

Description

The Sooty Oystercatcher is an unmistakable, large wader with black plumage, reaching 50 cm in length. It has a bright orange-red bill, eye-ring and iris, and coral pink legs and feet. Sexes are separable when together, with the female having a longer, more slender bill. The call is similar to the Pied Oystercatcher's, although sharper and more piercing.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not Listed.

Habitat Requirements and Ecology

It prefers rocky intertidal shorelines with little foliose algae, coral reefs or sandy beaches near intertidal mud flats across which they forage for molluscs, crustaceans, polychaetes, ascidians, echinoderms and small fish. Sooty Oystercatchers do not migrate but apparently do move locally in search of new feeding grounds. The breeding season for this species extends form August to January with usually two eggs laid per clutch. Nests are a scrape in the ground, which may be lined with gravel, pebbles, shells, grass or seaweed and are usually situated above the high tide line.

Distribution

This species is endemic to the eastern, southern and western shores of Australia.

Haematopus longirostris **Pied Oystercatcher**

Description

The Pied Oystercatcher is a large, black and white wader, reaching 50 cm in length. The sexes are similar, yet may be separable when together with the female having a slightly longer, more slender bill. When not in flight, the Pied Oystercatcher appears entirely black above, with white underparts. The back, head and breast are black, and the belly, rump and tail are white. The tail is tipped black. The wings are black with a narrow white bar on the upperwing and white underwing coverts. The eye-ring, iris and bill of the Pied Oystercatcher are brilliant scarlet and its legs are stout and coral pink. The most often heard call is a loud, sharp, high-pitched 'kurvee-kurvee-kurvee', usually given in alarm, which increases in pitch and rapidity when a nest site is approached.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not Listed.

Habitat Requirements and Ecology

Oystercatchers mainly roost on sandy beaches, spits, dunes, lagoons and inlets, particularly if there are mud flats nearby. They forage on exposed sand, mud, rock or coral for molluscs, worms, crabs and small fish. The Pied Oystercatcher undergoes seasonal movement with large flocks forming during the non-breeding season (January - August). The breeding population of this species shows strong fidelity to breeding sites. Nests consists of a scrape in the ground either unlined or lined with shells, seaweed and grass, and are positioned on beaches, shores of tidal lagoons, estuaries and tidal creeks. The Pied Oystercatcher has suffered disturbance from people and dogs using beaches for recreation, limiting the available sites for breeding.

Distribution

The Pied Oystercatcher is continuously distributed around the Australian coastline, including offshore islands (except where cliffs replace sandy beaches).

Esacus neglectus **Beach Stone-curlew**

Description

The Beach Stone-curlew is a large, heavy-set wader (up to 56 cm in body length, and with a wingspan of up to 1.1 m), with a large-headed appearance, emphasised by its massive bill, strong legs and a

short tail. Adults have largely grey-brown upperparts with a distinctive black-and-white striped face and shoulder-patch. The throat and breast are a paler grey and the belly white. The eyes are yellow and there is a yellow patch at the base of the bill.

Conservation Status
Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not Listed.

Habitat Requirements and Ecology
They inhabit undisturbed sandy beaches, especially those with extensive mangrove-backed sandflats, mudflats or reefs exposed at low tide. The species has also been recorded utilising cane fields that are located in proximity to tidal areas. Crabs and other marine invertebrates form the diet of this species. They are most active at dusk and dawn as well as during the evening. The breeding season for the Beach Stone-curlew is July to October in northern Australia and September to November in temperate Australia. Nests may be sited in various habitats including sandbanks, sandspits, coral ridges, among mangroves and among branches of fallen trees. Nests consist of a shallow depression into which an egg is laid.

Distribution
The Beach Stone-curlew occurs from the Malay Peninsula through to New Guinea, the Solomon Islands and Australia. Within Australia, the species ranges from Point Cloates (Western Australia) north around the coast to Nambucca Heads on the east coast. The species appears to be extending its range southward in N.S.W. (Pizzey 1997).

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

The Broad-billed Sandpiper, Terek Sandpiper, Great Knot, Curlew Sandpiper, Black-tailed Godwit, Greater Sand-plover, Lesser Sand Plover, Sooty Oystercatcher, Pied Oystercatcher nor Beach Stone-curlew were not recorded within the study area despite targeted surveys. The intertidal habitat occurring within the far south of the study area was considered to contain suitable habitat for all of these wader species. The construction of the intake and outtake pipes will involve the removal/disturbance of a narrow area of intertidal habitat which will contribute to a small percentage of foraging habitat within the Port Stephens. The disturbed intertidal habitat areas are expected to recover naturally over a short period of time. Taking into consideration the small amount of disturbance to intertidal habitat within the study area the proposal is unlikely to cause extinction of these threatened wader species in the local area.

The impacts of the proposal on the marine environment are discussed in more detail in the Aquatic Ecology Report (BIO-ANALYSIS, 2013).

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

Not applicable.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(ii) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

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

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

The construction of the inlet and outlet pipes will involve the disturbance/removal of a narrow area of intertidal mudflat which will contribute to a small percentage of foraging habitat for the addressed wader species within Port Stephens. As the pipes will be buried this disturbance will be only short term.

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

No areas of habitat are likely to become fragmented or isolated as a result of the action for these addressed waders species.

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

The construction of the inlet and outlet pipes will involve the removal and disturbance of a narrow area of mudflat which will contribute to a small percentage of foraging habitat within the port. No areas of habitat for any of the addressed tree species is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action. Considering the small scale and temporary nature of the disturbance it is considered that no area of habitat important to the long-term survival of these waders will be removed, modified, fragmented or isolated.

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

To date no Critical Habitat, as defined under Part 3 of the TSC Act has not been declared for these wader species.

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

No Recovery or Threat Abatement Plans have been developed for these wader species. However the Department of Environment and Climate Change has prepared Priority Action Statements (PAS) to promote the recovery of these wader species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help these species recover in NSW. It is considered that the proposal does not conflict with the PAS for these species.

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

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to this site and species have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal.

- **Predation by the European Red Fox *Vulpes vulpes*:** The Red Fox was not recorded within the study area at the time of the survey however would be considered to have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in the number of this introduced species.
- **Predation by the Feral Cat *Felis catus.*** The Feral Cat was not recorded within the study area at the time of the survey however would be considered to have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in the number of this introduced species.

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21. Sea Birds

Sterna albifrons **Little Tern**

Description

The Little Tern is 20-28 cm long, with a wingspan of 45-55 cm and a weight of approximately 50g. It is white in colour, with pale blue-grey wings and back, and a black cap. The bill is approximately as long as the head and is yellow with a black tip in breeding birds, changing to all black in non-breeding birds.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements and Ecology

The population of this species consists of breeding and non-breeding individuals. Little Terns nest only on or near the coast in N.S.W. and may breed as solitary pairs or in colonies. The typical features of the nesting area are a sandy substrate, flat or gently sloping topography, abundant shells and pebbles and little vegetation. The Little Tern is present in N.S.W. from September to May. Breeding is from August to January with usually 2 eggs laid in a clutch. The nest is a simple hollow occasionally decorated with seaweed. Factors influencing the breeding success of this species include; nest flooding, overgrowth of vegetation (thus obstructing view of approaching predators), predators (both native and introduced), human disturbance and development. Fish such as Hardyheads (*Atherinosoma sp.*) form part of the diet of the Little Tern which may be supplemented with crustaceans, insects, annelids and molluscs.

Distribution

This species occurs in North America, Africa, Europe, Central Asia, Japan and Australia. Within Australia the distribution of the Little Tern extends from Broome (W.A.) east to Cape York Peninsula and south to the Lakes Entrance (Vic.).

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

The Little Tern was not recorded within the study area during fieldwork. Suitable feeding habitat was considered to be present within the waters of Port Stephens including the area along the proposed pipeline route. Nesting habitat was considered to be absent due to the narrowness of the strip of sand between the high tide mark and the area of open forest. The initial construction of the pipeline route may result in the disturbance to a narrow area of habitat which would equate to a very small proportion of suitable habitat in the local area. This disturbance is envisaged to only be short term and not considered to affect the habitat attributes of this area in the long-term. Considering the lack of suitable nesting habitat and the fact that extensive areas of similar habitat occur around the shore of Port Stephens it is unlikely that the proposal would result in the extinction of any local population of the Little Tern.

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

Not applicable.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

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

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

The construction of the inlet and outlet pipes will involve the disturbance of a narrow area of habitat which may contribute to a small percentage of foraging habitat for the Little Tern within the port. This disturbance is envisaged to be only short term. No suitable nesting habitat is likely to be affected.

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

No areas of habitat are likely to become fragmented or isolated for this highly mobile bird species.

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

The construction of the inlet and outlet pipes will involve the disturbance of a narrow area of potential feeding habitat. However considering that no nesting areas will be affected no area of habitat important to the long-term survival of the Little Tern will be removed, modified, fragmented or isolated.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

A recovery plan has been prepared for the Little Tern. This recovery plan seeks to increase the number of breeding pairs within NSW. To achieve this objective, this Recovery Plan seeks to implement a management regime that:

- promotes *in situ* habitat management, including recommendations for threat abatement and liaison and consultation with other land managers;
- intensively manages eight major colonies and selected minor colonies of the Little Tern in NSW;
- seeks to enhance habitat through the evaluation and possible creation of new nesting habitat;
- informs and guides management through survey, monitoring and research;
- promotes a co-ordinated Statewide approach to Little Tern management; and
- continues to educate and welcome community participation in the Recovery Program.

It is considered that the proposal does not significantly conflict with this recovery plan.

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

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal/modification habitat for the proposal is not considered to be significant for this seabird.
- **Invasion of native plant communities by exotic perennial grasses:** Introduced grasses such as *Andropogon virginicus* (Whisky Grass) were present within the more disturbed areas of the study area. These grasses have the potential to further invade parts of the study area.
- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused to the study area.
- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera*: (Bitou Bush).** Bitou Bush was present within the study area. It is recommended that this species be controlled within the study area.

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22. Waterbirds

Rostratula benghalensis australis **Australian Painted Snipe**

Description

The Australian Painted Snipe is a medium-sized freshwater wader with a long bill that drops slightly at the tip. It is strongly patterned and has fairly short legs.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Vulnerable.

Habitat Requirements and Ecology

It is usually found in pairs, frequenting the margins of swamps and streams, chiefly those covered with low and stunted vegetation. It probes in mud along the shore to gather snails, water insects and aquatic plants. When flushed, it flies close to the ground, making for the nearest cover, and is then exceedingly difficult to flush again. The Painted Snipe appears to be nomadic, with movements mainly north in winter and south in summer. It requires shallow fresh water for breeding, though the nest is not deserted if the water dries up. Nests are usually in groups, and consist of a shallow depression in the ground, lined with grass or leaves and frequently sheltered by a low bush or tuft of grass. Nests have been recorded at a density of 24 nests/ha but other smaller colonies have had distances of 15-50 m between nests.

Distribution

The better watered areas of Eastern Australian.

Botaurus poiciloptilus **Australasian Bittern**

Description

The Australasian Bittern is a large, stocky heron-like water bird with a long thin neck and long straight bill.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements and Ecology

The Australasian Bittern lives alone or in loose groups and favours permanent fresh-waters with tall dense vegetation dominated by sedges, rushes, reeds or cutting grasses (eg. Phragmites, Scirpus, Eleocharis, Juncus, Typha, Baumea and Gahnia). Breeding is sometimes loosely colonial but in other cases pairs have been observed to maintain territories when several are present in a reedbed. The Australasian Bittern feeds on insects, small fish, eels, frogs and other aquatic life, sometimes in ricefields. It is partly nocturnal in habits, and, keeping as it does to the depths of reedy swamps, is seldom seen during the day unless flushed. The breeding season is from October to January and it is during this time that the distinct 'booming' calls can be heard.

Distribution

Within Australia, the Australasian Bittern occurs in the south-east and south-west, as well as in Tasmania and is also known as a vagrant in the north-west of Australia. This species is probably sedentary in permanent habitat with possible regular short distance movements during winter and is occasionally irruptive following heavy rains and floods, or drought elsewhere.

Ixobrychus flavicollis **Black Bittern**

Description

The Black Bittern is a dark grey to black heron with buff streaks on the throat and a characteristic yellow streak on the sides of the head and down the neck.

Conservation Status
Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements and Ecology
It is solitary, and inhabits terrestrial, littoral and estuarine wetlands, preferring areas of permanent water, which are lined by dense vegetation (Marchant and Higgins, 1990). This species has been known to occur in flooded grasslands, forest, woodland, rainforest and mangroves (Marchant and Higgins, 1990). In the south-west region it lives in vegetation such as paperbark woodland surrounding running water or coastal swamps. Pairs may be within hearing distance along a watercourse. The Black Bittern forages at the edge of running or still water, feeding on small fish and invertebrates. The nest consists of a platform of sticks placed in a tree, usually on a branch overhanging water with the breeding season from September to January. The decline of this species in the south-west region has coincided with increases in the rate of clearing for agriculture and in the salinity of streams.

Distribution
The Black Bittern lives in south-eastern Asia, New Guinea and western, northern and eastern Australia (chiefly coastal areas). In N.S.W. they are found coastally and around inland rivers, but rarely south of Sydney (Pizzey and Knight, 1997).

Ephippiorhynchus asiaticus **Black-necked Stork**
Description
The Black-necked Stork, formerly known as the Jabiru, is a large glossy black and white stork with very long red legs and a large straight black bill.

Conservation Status
Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements and Ecology
The Black-necked Stock inhabits shallow, permanent, freshwater terrestrial wetlands, and surrounding marginal vegetation, including swamps, floodplains, watercourses and billabongs, freshwater meadows, wet heathland, farm dams and shallow floodwaters, as well as extending into adjacent grasslands, paddocks and open savannah woodlands. They also forage within or around estuaries and along intertidal shorelines, such as saltmarshes, mudflats and sandflats, and mangrove vegetation. They mainly forage in shallow, still water, preferring open wetlands, and taking a variety of prey, including eels and other fish, frogs, turtles, snakes, and small invertebrates, such as crabs and small insects. Vertebrates form the main mass of the diet, with medium-sized eels contributing the greatest biomass and were also the only food seen to be delivered to nestlings.

In NSW, breeding activity has been recorded in most months, with activities from nest coinstruction to fledging of young recorded from May to January. Most activity, however, takes place between June and December, and clutches present May to September. In NSW, Storks usually nest in a tall, live and isolated padock tree, but also in other trees, including paperbarks, or even lower shrubs within wetlands. The nest is a large platform, 1-2 m in diameter, made in a live or dead tree, in or near a freshwater swamp.

Distribution
The Black-necked Stork ranges through India, south-eastern Asia, southern New Guinea and into northern and eastern Australia. Its core distribution in Australian is in the north. In eastern Australia the Black-necked Stork has been recorded as far south as Victoria and inland to the Macquarie Marshes and Griffith.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

Neither the Australian Painted Snipe, Australasian Bittern, Black Bittern or Black-necked Stork were recorded within the study area during fieldwork. Marginal habitat was considered to be present for the Australian Painted Snipe, Australasian Bittern and Black Bittern around the low lying areas of swamp forest in the south of the study area. Habitat for these three bird species would be limited by the ephemeral nature of the wetland. Additional habitat for the black bittern was also thought to be available within the area of mangroves within the intertidal zone. Habitat for the Black-necked Stock would be confined to the tidal mudflat areas of the study area. The construction of the intake and outtake pipes will involve the removal/disturbance of a narrow area of intertidal habitat. The inlet outlet pipes connecting the proposed facility to the waters of Port Stephens will also be required to cross the area of Swamp Forest habitat. To reduce this impact the pipelines will be raised up on supports north of the pumphouse within the area of swamp forest and maneuvered slightly to avoid the removal of any trees. Due to the close proximity of the proposed facility to suitable habitat there is the potential for secondary impacts such as stormwater runoff and increased weed infestation. Strict controls will have to be applied to the building precinct area to prevent any future degradation to the area of swamp forest. Any disturbance as a result of the construction of the pipelines is envisaged to only be short-term. Given the recommendations the proposal is unlikely to cause extinction of these waterbird species in the locality.

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

Not applicable.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

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

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The construction of the inlet and outlet pipes will involve the disturbance of a narrow area of suitable habitat for these waterbird species. No areas of habitat for any of the addressed tree species are likely

to become fragmented or isolated from other areas of habitat as a result of the proposed action. However considering the small scale of the disturbance it is considered that no area of habitat important to the long-term survival of these waterbirds will be removed, modified, fragmented or isolated.

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

None of the study area has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for The Australian Painted Snipe, Black Bittern, Australasian Bittern or Black-necked Stork. However the OEH has prepared Priority Action Statements (PAS) to promote the recovery of these species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help these species recover in NSW. It is considered that the proposal does not significantly conflict with the PAS for these species.

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

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of remnant vegetation within the study area may be viewed as being part of this Key Threatening Process however is unlikely to be significant in relation to these waterbird species.
- **Predation by the European Red Fox *Vulpes vulpes*:** The Red Fox was not recorded within the study area at the time of the survey however would be considered to have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in the number of this introduced species.
- **Predation by the Feral Cat *Felis catus.*** The Feral Cat was not recorded within the study area at the time of the survey however would be considered to have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in the number of this introduced species.

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23. Fruit Doves

Ptilinopus magnificus **Wompoo Fruit-Dove**

Description

The Wompoo Fruit-dove is a large rainforest pigeon, almost twice the size of other coloured fruit-doves. It is up to 56 cm long, with a pale grey head shading into rich green back and wings. There is a broken yellow band across each wing. The breast and belly are plum-purple and the underparts are yellow.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not Listed.

Habitat Requirements and Ecology

This Fruit-Dove is a frugivorous Rainforest specialist inhabiting the canopy of Sub-tropical, Warm-temperate and Littoral Rainforests. Occasionally it will stray to fruiting trees outside of Rainforest areas. Breeding occurs between July and December and is linked to the fruiting cycles of favoured feed trees including Figs, Laurels, Myrtles and native Tamarind. The females lay one egg on a flimsy platform of vine tendrils on a slender horizontal branch. This species prefers relatively undisturbed to completely intact Rainforest.

Distribution

The Wompoo Fruit-Dove is distributed from Cape York (Qld.) along the coast and ranges south to the Hunter River (N.S.W.). The southern part of the species range has decreased, having once extended to the Shoalhaven River.

Ptilinopus regina **Rose-crowned Fruit-Dove**

Description

The Rose-crowned Fruit-doves is a small, colourful rainforest pigeon to 24 cm in length. Males have a rose crown edged with yellow, and the head and breast are blue-grey, spotted white. The upper parts are grey-green, the tail-tip yellow and the abdomen are orange. Females are mostly grey-green.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not Listed.

Habitat Requirements and Ecology

The Rose-crowned Fruit-Dove generally lives in Rainforest, though it also frequents nearby drier forests as well as Mangroves. It usually feeds on Figs or other fruit and berry-bearing trees. The breeding season is from October to February, with a flimsy nest being constructed of twigs on a scanty platform in a low tree or bush. A seasonal movement of birds from the southern end of the range to the north occurs in winter, whilst others have been found to move seasonally in relation to the availability of fruit, with distance and direction travelled varying from one year to the next. The call is a loud, explosive, repeated 'hookcoo' which becomes faster and on declining notes as a rapid 'coocoocoocoocoo'.

Distribution

The Rose-crowned Fruit-Dove occurs in Eastern Australia, from Cape York south to the vicinity of Port Stephens. Occasionally it extends into Victoria.

Ptilinopus superbus **Superb Fruit-Dove**

Description

The Superb Fruit-dove is a small pigeon, approximately 24 cm in length. The male is brightly coloured, with golden-green upperparts, a brilliant orange-vermilion neck, and a rich purple crown. The tail is short and tipped with white. The throat and breast are grey with a lilac tinge, and a broad black band on the lower breast separates the grey breast from the creamy-white belly and green

flanks. The female is light green on the back, has a small purple spot on the crown, and no dark breast band.

Conservation Status
Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not Listed.

Habitat Requirements and Ecology
The Superb Fruit-Dove lives mainly in Rainforest but will feed in adjacent Mangroves or Eucalypt forest, venturing into coastal habitats at various times of the year, particularly during winter. Many winter-migrating birds in N.S.W often perish by flying into windows in residential areas (A. Morris, NSW FOC, pers. comm.). It usually feeds on Figs or other fruit-bearing trees. Breeding season is from October to February. The nest is usually a platform about 10cm in diameter, composed of a few twigs; built in a small tree on a horizontal fork, usually about 3 metres from the ground, and situated in Open Forest at the edge of scrub. The species may have one of the shortest nesting periods of any Pigeon, being perhaps no more than seven days. The call is a distinctive cooing, rising in pitch and volume to a loud and clear 'whoop, whoop'. Also gives a low 'oom' in a steady sequence.

Distribution
The Superb Fruit-Dove is quite common north of Cardwell, Queensland; becoming uncommon nomads or non-breeding migrants further south to the Hunter River, with rare sightings recorded south to Tasmania.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

Neither the Wompoo, Rose-crowned or Superb Fruit-Doves were recorded within the study area during the survey despite targeted and incidental searches. No areas of preferred habitat were found to be present within the study area. Open Forest occurring within the southern portion of the study area was considered to contain secondary transitory foraging habitat. The fruiting *Endiandra sieberi* (Corkwood) would be the most likely foraging species within this area. The proposed Abalone farm will be positioned over a development area of approximately 5 hectares in the south of the study area. Within this area a total building footprint of 1ha will be situated within an area containing Coastal Sand Blackbutt and Ironbark/Tallowwood Open Forest, which contain a number of specimens of *E. sieberi.* Additional areas of these two communities may also have to be thinned and underscrubbed to comply with the required Bushfire Asset Protection Zones. This will result in an incremental reduction of secondary habitat within the local area. Considering the fact that no preferred habitat will be removed the proposal is unlikely to cause extinction of any local population of these three Fruit-Dove species.

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

Not applicable.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

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

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

The proposed Abalone farm will be positioned over a development area of approximately 5 hectares in the south of the study area. Within this area a total building footprint of 1ha will be situated within an area containing suitable secondary foraging habitat in the form of Coastal Sand Blackbutt and Ironbark/Tallowwood Open Forest. Additional areas of these two communities may also have to be thinned and underscrubbed to comply with the required 20m Bushfire Asset Protection Zones to the north, east and south, and 30m to the west and north-west of the building precinct. No trees will be required to be removed as a result of the intake and outtake pipes.

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

No areas of habitat will become fragmented or isolated for this highly mobile species.

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

The construction of the building precinct will result in a small incremental reduction in secondary foraging habitat, particularly in the form of a number of specimens of *E. sieberi*. However taking into consideration the relatively large amount of similar surrounding habitat and lack of preferred habitat within the study area the proposal is unlikely to result in the removal, modification, fragmentation or isolation of an area of habitat important to the long term survival of these three Fruit-dove species.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for the assessed Fruit-dove species. However the OEH has prepared Priority Action Statements (PAS) to promote the recovery of these species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help this species recover in NSW. It is considered that the proposal does not significantly conflict with the PAS for these species.

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

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of remnant vegetation within the study area may be viewed as being part of this Key Threatening Process however is unlikely to be significant in relation to these Fruit-dove species.
- **Predation by the European Red Fox *Vulpes vulpes*:** The Red Fox was not recorded within the study area at the time of the survey however would be considered to have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in the number of this introduced species.
- **Predation by the Feral Cat *Felis catus.*** The Feral Cat was not recorded within the study area at the time of the survey however would be considered to have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in the number of this introduced species.
- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: Past fires were evidenced by a number of blackened tree trunks. Frequent fires can lead to a reduction in foraging habitat. It is difficult to ascertain the disruption and structural changes, if any, past fires have caused the study area.

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24. Cockatoos & Parrots

Calyptorhynchus lathami **Glossy-Black Cockatoo**

Description

The Glossy Black-cockatoo is a dusky brown to black cockatoo with a massive, bulbous bill and a broad, red band through the tail.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not Listed.

Habitat Requirements and Ecology

The Glossy Black-Cockatoo inhabits Wet and Dry Sclerophyll Forests and Woodlands. It prefers highland habitats in the northern part of its range but may be found closer to the coast when and where conditions are suitable. In the south they are widespread in lowland coastal forests, dense mountain forests, semi-arid woodland and trees bordering watercourses.

Glossy Black-Cockatoos forage primarily on the seeds of (*Allo*)*Casuarina* species, but will also take wood borers from large *Acacia* stems. *Allocasuarina torulosa, A. verticillata* and *A. littoralis* are the predominant food trees in N.S.W. On Kangaroo Island, *Casuarina stricta* is the predominant food source. They have also been observed eating *Angophora, Acacia* and *Eucalyptus* seeds. It now appears to supplement its diet with the seeds of exotic pine trees. A sign that foraging individuals have recently fed at a site is a scattering of leaves, twigs and freshly chewed cones under the (*Allo*)*Casuarina* trees. While feeding they are tame and relatively easy to approach. Flocks of Glossy Black-Cockatoos have been seen but are not common. They are usually seen in pairs or threes (being a pair and their young), or as feeding groups consisting of 10-12 birds that are likely to be loose family aggregations. Such groups seem to occupy an area permanently and have a distinctive flight pattern of slow, shallow wing-beats. Nesting takes place from March to August in the hollows of large Eucalypts, 10-20m above the ground, where a single egg is laid.

Distribution

The Glossy Black-Cockatoo inhabits Sclerophyll Forests and Woodlands of eastern Victoria to central Queensland, extending to the western slopes in New South Wales. A subspecies, *C. l. halmaturinus* exists on Kangaroo Island, South Australia.

Callocephalon fimbriatum **Gang Gang Cockatoo**

Description

The Gang Gang Cockatoo is a small dark grey cockatoo. The males have a fiery red-head and raffish crest. Females have a grey head and crest.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not Listed.

Habitat Requirements and Ecology

In summer they are generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter they move to lower altitudes and drier more open eucalypt forests and woodlands, and often found in urban areas. In winter they show a preference for more open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or in dry forest in coastal areas. Favours old growth attributes for nesting and roosting. Breeding usually occurs between October and January in tall mature sclerophyll forests that have a dense understorey, and occasionally in coastal forests. Nests are most commonly recorded in eucalypt hollows in live trees close to water.

Distribution

The Gang-gang Cockatoo is distributed from southern Victoria through south and central-eastern New

South Wales. In New South Wales, the Gang-gang Cockatoo is distributed from the south-east coast to the Hunter region, and inland to the Central Tablelands and southwest slopes. It is rare at its extremities of its range, with isolated records known from as far west as Mudgee.

Lathamus discolor **Swift Parrot**

Description

The Swift Parrot is most closely related to Rosellas, though its habits are most closely aligned with those of the Lorikeets, which it also resembles morphologically. The main distinction of the Swift Parrot is the long red tail that is not found in Lorikeets, which generally have dumpier green tails.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Endangered under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Vulnerable.

Habitat Requirements

The Swift Parrot prefers Dry Sclerophyll Forest in Tasmania and Open Forest to Woodland in the north on the mainland. It has also been recorded utilising street trees and in parks and gardens. Swift Parrots forage on the nectar of Eucalypts, often in mixed flocks with Lorikeets. The preferred winter food species are *Eucalyptus sideroxylon* (Red Ironbark), *E. albens* (White Box), *E. ovata* (Swamp Gum), *E. robusta* (Swamp Mahogany) and *E. melliodora* (Yellow Gum) and have also been observed eating the seeds and flowers of *Xanthorrhoea* spp. (Grass Trees). They also feed on insects and their larvae, fruits, berries, seeds and vegetable matter. While feeding, individuals may be approached and watched from under the feed tree. When there is an abundance of food, large congregations of hundreds of birds may gather in noisy and crowded roosts. Nesting occurs from September to January in a hollow branch of Eucalypts and they return to the mainland during March and April.

Distribution

The species is patchily distributed within the south-eastern corner of mainland Australia and Tasmania. During winter the Swift Parrot inhabits mainland Australia from Adelaide (S.A.) through Victoria, and up the east coast to south-east Queensland, as well as visiting the south and central western slopes and the Riverina in N.S.W. The Swift Parrot returns to eastern Tasmania in spring to breed.

Neophema pulchella **Turquoise Parrot**

Description

This 'grass parrot' is a striking green with brilliant blue edges to the wings, on which the male of the species also displays a bright red patch.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not Listed.

Habitat Requirements

It lives on the edges of Eucalypt woodland adjoining clearings and on timbered ridges and creeks in farmland. It has been known to utilise gullies, rolling hills, valleys and river-flats as well as roadside verges and orchards. They are usually seen in pairs or small groups and spend most of the day on the ground. This species forages primarily on the seeds of shrubs, grasses and herbs, both native and introduced, and the spore cases of moss. They are approachable when feeding and have a characteristic flight call, which is described as a weak tinkling. Partly nomadic, flocks move locally and regionally following seasonal abundances of seed. Breeding pairs nest in small hollow branches of Eucalypts, usually 1m above the ground from August through December and from April to May. Two to five eggs are laid and young leave the nest after 30 days though remain with the parents.

Distribution

This species is endemic to Australia and the main distribution of the Turquoise Parrot is in the grassy woodlands of the western slopes and tablelands from the Darling Downs in Queensland to northern

Victoria, particularly along watercourses.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

Despite targeted and incidental surveys neither the Glossy-Black Cockatoo, Gang Gang Cockatoo, Swift Parrot nor Turquoise Parrot were noted within the study area during fieldwork. Of these four bird species the study area was considered to contain the most likely habitat for the Glossy-Black Cockatoo. This cockatoo species has been recorded on a number of occasions in the local area (OEH, 2012 and Wildthing Environmental Consultants, 2004). The study area contained suitable foraging habitat for the Glossy Black Cockatoo in the form of *Allocasuarina torulosa* (Forest Oak), *Allocasuarina littoralis* (Black Sheoak) and to a lesser extent *Casuarina glauca* (Swamp Oak) seed cones. However secondary indications of foraging by the Glossy Black Cockatoo in the form of distinctly chewed cones were not noted under suitable foraging trees during fieldwork.

The study area was considered to contain suitable habitat for the remaining three bird species however, these species would be considered to be infrequent visitors to the local area. These bird species particularly the Swift Parrot are generally more commonly recorded inland from the coast, however, are know to come to the coast during drier inland periods or as a result of seasonal movements. Specimens of the large flowered *Eucalyptus robusta* (Swamp Mahogany) which were present within the study area would provide preferred coastal foraging habitat for the Swift Parrot. With the exception of the Swift Parrot which breeds in Tasmania suitable nesting hollows were considered to be present for the remainder of these bird species.

The proposed Abalone farm will be positioned over a development area of approximately 5 hectares in the south of the study area. Within this area a total building footprint of 1ha will be situated within an area containing Coastal Sand Blackbutt and Ironbark/Tallowwood Open Forest which contain a number of specimens of *A. torulosa.* No specimens of *E. robusta* are required to be removed. The proposal will result in the incremental reduction of habitat for these bird species within the local area however taking into account the relatively large amount of suitable surrounding habitat it is considered unlikely to cause extinction of the local population of these mobile species.

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

No applicable.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

No applicable.

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

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

The proposed Abalone farm will be positioned over a development area of approximately 5 hectares in the south of the study area. Within this area a total building footprint of 1ha will be situated within an area containing Coastal Sand Blackbutt and Ironbark/Tallowwood Open Forest. Approximately sixty-five trees will be required to be removed including up to 13 hollow-bearing trees. Additional areas of these two communities will also have to be thinned and underscrubbed to comply with the required 20m Bushfire Asset Protection Zones to the north, east and south, and 30m to the west and north-west of the building precinct. Separate intake and outtake and outlet pipes, extending from the building precinct into the waters of Port Stephens (Crown Land in the LGA of Port Stephens). These pipes will run through the area of Swamp Sclerophyll Forest, however no trees will be required to be removed. The proposal will result in the removal of a number of specimens of *A. torulosa* a known foraging species of the Glossy Black Cockatoo.

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

No areas of habitat will become fragmented or isolated for these highly mobile bird species.

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

The proposal will result in the removal of a small amount of suitable foraging and nesting habitat for these bird species leading to a small incremental reduction in the local area. However it is unlikely that an area of habitat important to the long-term survival of these bird species is likely to be removed, modified, fragmented or isolated as a result of the proposal.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for these bird species. However the OEH has prepared Priority Action Statements (PAS) to promote the recovery of these species and the abatement of key threatening processes in NSW. The Priority Action Statements identified a number of broad strategies to help these species recover in NSW. The proposal is unlikely to significantly compromise these priority actions developed to assist the recovery of these bird species.

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

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor

contributing to the loss of biological diversity. The removal of native vegetation within the study area may be viewed as being part of this Key Threatening Process however is unlikely to be significant in relation to these bird species.

- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused the study area. The proposal is unlikely to result in a change in the frequency of fire in the local area.
- **Loss of Hollow-bearing Trees***:* Four hollow bearing trees will need to be removed within the area of open forest resulting in an incremental reduction of this habitat resource in the local area. The loss of hollow bearing trees is not considered to be significant.
- **Removal of dead wood and dead trees:** Dead wood and dead trees were present within the study area. No significant areas of dead wood and dead trees will be removed as a result of the proposal.
- **Predation by the European Red Fox *Vulpes vulpes*:** The Red Fox was not recorded within the study area at the time of the survey however would be considered to have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in the number of this introduced species.
- **Predation by the Feral Cat *Felis catus.*** The Feral Cat was not recorded within the study area at the time of the survey however would be considered to have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in the number of this introduced species.
- **Competition from feral honeybees *Apis mellifera:* T**he Feral Honeybee has the potential to occupy potential nesting hollows within the study area.

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25. Woodland Birds

Anthochaera phrygia **Regent Honeyeater**

Description

The Regent Honeyeater is a medium distinctive, medium-sized, black and yellow honeyeater with a sturdy, curved bill. Adults weigh 35 - 50 grams, are 20 - 24 cm long and have a wings-pan of 30 cm. Its head, neck, throat, upper breast and bill are black and the back and lower breast are pale lemon in colour with a black scalloped pattern. Its flight and tail feathers are edged with bright yellow. There is a characteristic patch of dark pink or cream-coloured facial-skin around the eye.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Endangered under schedule 2. (Has been preliminary listed as Critically Endangered).
Environmental Protection and Biodiversity Conservation Act 1999 – Endangered.

Habitat Requirements and Ecology

It occurs in temperate woodlands and open forest, including forest edges. Seasonal movements appear to be dictated by the flowering of various species of Eucalypts that are characteristic of the dry forests and woodlands of south-eastern Australia. The Regent Honeyeater prefers to forage on large-flowered Eucalypts (e.g. *Eucalyptus sideroxylon*, *E. melliodora*, *E. albens, E. leucoxylon*), particularly where these trees grow in more productive areas and yield plentiful and predictable nectar flows. They also forage on mistletoe and *Banksia* flowers, and arthropods. In parts of coastal N.S.W. they are also attracted to stands of *Eucalyptus robusta* (Swamp Mahogany). Nests are constructed of strips of Eucalypt bark, dried grass and other plant material. They are placed in an upright fork 4 to 25m above ground, and 2-3 eggs are laid. Nesting occurs mainly between November and January, but breeding has been recorded in all months between July and February.

Distribution

It is nomadic, although it does seem to return to nesting areas sporadically. Small flocks regularly, sometimes annually, visit the northern tablelands and the north western and central western slopes of N.S.W. in the spring and summer. Individuals also appear on the N.S.W. coast at most times of year but primarily in winter.

Daphoenositta chrysoptera **Varied Sittella**

Description

The Varied Sittella is a small songbird with a sharp, slightly upturned bill, short tail, barred undertail, and yellow eyes and feet.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not Listed.

Habitat Requirements and Ecology

The Varied Sittella inhabits Eucalypt forests, woodlands, mallee orchards and golf courses. This species is not found in treeless deserts, open grasslands and heavier rainforests. It prefers rough-barked species and mature smoothed-barked gums with dead branches. The Varied Sittella feeds from arthropods gleaned from crevices and decorticating bark of standing live and dead trees.

Distribution

The Varied Sittella is sedentary and inhabits most of mainland Australia apart from those areas mentioned in the habitat requirements.

Melithreptus gularis gularis **Black-chinned Honeyeater**

Description

The Black-chinned Honeyeater reaches up to 17 cm in length and has a black cap with a white

crescent around the nape. A diagnostic black 'chin' occurs beneath the bill and extends down the white throat. There is a small crescent of blue skin above the eye. The back and wings are a dull olive-green and the tail is greyish-brown. The underparts are white, with a greyish-buff tint on the breast. The bill is short, black and slightly downcurved. The call is a ringing, bubbling trill, repeated several times.

Conservation Status
Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not Listed.

Habitat Requirements and Ecology
In N.S.W., this species is mainly found in drier sclerophyll forests and woodlands containing box-ironbark associations and River Red Gum. It is rarely recorded east of the Great Dividing Range, although it has also been recorded at a few scattered sites in the Hunter, Central Coast and Illawarra regions.

Distribution
Within its eastern range, the Black-chinned Honeyeater is found predominantly west of the Great Dividing Range in a narrow belt through from southern Queensland, through N.S.W. and south into Victoria and South Australia.

Epthianura albifrons **White-fronted Chat**
Description
The White-fronted Chat is an endemic Australian passerine bird, measuring 12 cm in length with a short slender bill, long spindly legs, a short square-tipped tail and rounded wings (Higgins *et al.* 2001). Chats from which it is easily distinguished by its black and white colouration. The plumage of the male is more striking than that of the female with the juvenile plumage being most similar to the female. The voice is a distinctive ‘tang, tang’ used as a contact call (Higgins *et al.* 2001).

Conservation Status
Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not Listed.

Habitat Requirements and Ecology
The White-fronted Chat is found in damp open habitats, particularly wetlands containing saltmarsh areas that are bordered by open grasslands or lightly timbered lands. Along the coastline, White-fronted Chats are found in estuarine and marshy grounds with vegetation less than 1 m tall. The species is also observed in open grasslands and sometimes in low shrubs bordering wetland areas. Inland, the White-fronted Chat is often observed in open grassy plains, saltlakes and saltpans that are along the margins of rivers and waterways. The species is sensitive to human disturbance and is not found in built areas (Jenner 2008).

Distribution
The distribution of the White-fronted Chat extends across the southern half of Australia, from the southernmost areas of Queensland to southern Tasmania and across to Western Australia as far north as Carnarvon (Barrett *et al.* 2003).

Petroica boodang **Scarlet Robin**
Description
The Scarlet Robin is a small (13 cm) songbird with black upperparts and chin, red breast, white lower belly, a large white forehead spot, and white flashes in the wings and tail.

Conservation Status
Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.

Habitat Requirements and Ecology
The Scarlet Robin breeds in drier eucalypt forests and temperate woodlands, often on ridges and slopes, within an open understorey of shrubs and grasses and sometimes in open areas. Abundant logs and coarse woody debris are important structural components of its habitat. In autumn and winter it migrates to more open habitats such as grassy open woodland or paddocks with scattered trees. It forages from low perches, feeding on invertebrates taken from the ground, tree trunks, logs and other coarse woody debris. The Scarlet Robin builds an open cup nest of plant fibres and cobwebs, sited in the fork of tree (often a dead branch in a live tree, or in a dead tree or shrub) which is usually more than 2 m above the ground.

Distribution
The Scarlet Robin is found in south-eastern Australia (extreme south-east Queensland to Tasmania, western Victoria and south-east South Australia) and south-west Western Australia. In NSW it occupies open forests and woodlands from the coast to the inland slopes (Higgins and Peter 2002). Some dispersing birds may appear in autumn or winter on the eastern fringe of the inland plains.

Petroica phoenicea **Flame Robin**
Description
The Flame Robin is a small (14 cm) songbird with dark grey upperparts, orange-red underparts from chin to belly, a small white forehead spot, and white flashes in the wings and tail. The female is brown with white flashes in the wings and tail.

Conservation Status
Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.

Habitat Requirements and Ecology
In NSW it breeds in upland moist eucalypt forests and woodlands, often on ridges and slopes, in areas of open understorey. It migrates in winter to more open lowland habitats such as grassland with scattered trees and open woodland on the inland slopes and plains (Higgins and Peter 2002). There may be two disjunct breeding populations in NSW on the Northern Tablelands and the Central–Southern Tablelands (inferred from distributional data in Barrett *et al.* 2003 and the NSW Wildlife Atlas).

Distribution
The Flame Robin is found in south-eastern Australia (Queensland border to Tasmania, western Victoria and south-east South Australia).

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

Despite targeted and incidental searches neither the Regent Honeyeater, Varied Sittella, Black-chinned Honeyeater, White-fronted Chat nor Scarlet and Flame Robins were recorded within the study area during the survey. Of these three bird species the most likely species to utilise the study area on a regular basis would be the Varied Sittella. Open Forest occurring over the majority of the study area would provide suitable foraging and nesting habitat for the Varied Sittella.

The Regent Honeyeater, Black-chinned Honeyeater, Scarlet Robin and Flame Robin would be more commonly recorded inland from the coast particularly on the western slopes of the Great Dividing Range and would be an infrequent visitor to the local area. The Regent Honeyeater is known to come to the coast during events such as drier inland weather periods. The large flowering *Eucalyptus robusta* (Swamp Mahogany) found in the southern portion of the study area would provide preferred foraging habitat for this species of Honeyeater. No species of *E. robusta* will be removed as a result of the proposal.

Habitat for the White-fronted Chat within the study area would be largely confined to the more open areas of Swamp Forest and Mangroves in the far south of the study area.

The proposal will result a small incremental reduction of foraging and nesting habitat for the Varied Sittella. No preferred habitat is likely to be removed for the White-fronted Chat, Regent Honeyeater, Black-chinned Honeyeater nor Scarlet and Flame Robins. Taking into account the relatively large amount of suitable surrounding habitat it is considered unlikely to cause extinction of the local population of these bird species.

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

Not applicable.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

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

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

The proposed Abalone farm will be positioned over a development area of approximately 5 hectares in the south of the study area. Within this area a total building footprint of 1ha will be situated within an area containing suitable secondary foraging habitat in the form of Coastal Sand Blackbutt and Ironbark/Tallowwood Open Forest. Additional areas of these two communities may also have to be

thinned and underscrubbed to comply with the required 20m Bushfire Asset Protection Zones to the north, east and south, and 30m to the west and north-west of the building precinct. No trees will be required to be removed as a result of the intake and outtake pipes.

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

No areas of habitat will become fragmented or isolated for these highly mobile bird species.

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

The proposal will result in the removal of a small amount of suitable habitat for these bird species leading to a small incremental reduction in the local area. However it is unlikely that an area of habitat important to the long-term survival of these bird species is likely to be removed, modified, fragmented or isolated as a result of the proposal.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

A Recovery Plan has been completed for the Regent Honeyeater. The plan recommends the retention of preferred foraging and Mistletoe. As specimens of *E. robusta* a preferred foraging resource in the local will not be removed the proposal is unlikely to significantly compromise the Recovery Plan.

No Recovery or Threat Abatement Plan has been developed for the Varied Sittella, Black-chinned Honeyeater or White-fronted Chat. However the OEH has prepared Priority Action Statements (PAS) to promote the recovery of these species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help these species recover in NSW. It is considered that the proposal does not significantly conflict with the PAS for these bird species.

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

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. The removal of native vegetation within the study area may be viewed as being part of this Key Threatening Process however is unlikely to be significant in relation to these bird species.
- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused the study area. The proposal is unlikely to result in a change in the frequency of fire in the local area.

- **Removal of dead wood and dead trees:** Dead wood and dead trees were present within the study area. No significant areas of dead wood and dead trees will be removed as a result of the proposal.
- **Predation by the European Red Fox *Vulpes vulpes*:** The Red Fox was not recorded within the study area at the time of the survey however would be considered to have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in the number of this introduced species.
- **Predation by the Feral Cat *Felis catus.*** The Feral Cat was not recorded within the study area at the time of the survey however would be considered to have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in the number of this introduced species.

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26. *Burhinus grallarius* Bush Stone-curlew

Description

The Bush Stone-curlew is a large, long-legged ground dwelling bird. It has a rounded head, large yellow eyes, a black eye-stripe and a short dark bill.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements and Ecology

The Bush Stone-curlew inhabits dry open forest and woodland with an open grassy understorey that has not been overgrazed. It prefers woodland with many fallen branches where it roosts during the day. It has also been known to utilise coastal scrub, mangrove fringes, golf courses and plantations. It is active at night and is detected by its characteristic eerie call. Breeding occurs between July and January. The food of the Bush Stone-curlew is primarily insects, spiders and other invertebrates. Occasionally fruits are eaten when they become available.

Distribution

The Bush Stone-curlew is an endemic bird which was once found throughout Australia. It is widespread in north and north-east Australia, however is know very rare in southern Australia and extinct in Tasmania. Within N.S.W. this species has been recorded mainly in pastoral areas of the western slopes and plains. It is rare east of the Great Divide, however, isolated populations have been recorded from Western Sydney, Gosford, Port Macquarie and Northern Rivers around Grafton and Brunswick Heads (Marchant and Higgins, 1993).

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

The Bush Stone-curlew was not recorded within the study area during this or previous surveys. Also there was no response to Bush Stone-curlew call playback conducted during nocturnal fieldwork. The Bush Stone-curlew has been reported within the adjoining property (Lot 3) to the east (NPWS, 2011). Suitable habitat was considered to be present within the more open areas of open forest with a less dense understorey. The proposal will result a small incremental reduction of foraging and nesting habitat for the Bush Stone-curlew. However considering the absence of this species during the site studies and taking into account the relatively large amount of suitable surrounding habitat it is considered unlikely to cause extinction of the local population of the Bush Stone-curlew.

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

Not applicable.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(ii) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

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

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

The proposed Abalone farm will be positioned over a development area of approximately 5 hectares in the south of the study area. Within this area a total building footprint of 1ha will be situated within an area containing suitable habitat for the Bush Stone-curlew in the form of Coastal Sand Blackbutt and Ironbark/Tallowwood Open Forest. Additional areas of these two communities will also have to be thinned and underscrubbed to comply with the required 20m Bushfire Asset Protection Zones to the north, east and south, and 30m to the west and north-west of the building precinct. No trees will be required to be removed as a result of the intake and outtake pipes.

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

No areas of habitat will become fragmented or isolated for the Bush Stone-curlew.

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

The proposal will result in the removal of a small amount of suitable habitat for this bird species leading to a small incremental reduction in the local area. However it is unlikely that an area of habitat important to the long-term survival of these bird species is likely to be removed, modified, fragmented or isolated as a result of the proposal.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

A recovery plan has been developed for the Bush Stone-curlew which considers the conservation requirements of the species across its known range within New South Wales (Department of Environment and Conservation, 2006). A number of objectives were given to aid the recovery of this species. It is considered that the proposal does not significantly conflict with this recovery plan.

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

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. Any future removal of vegetation is likely to result in an incremental reduction in habitat for this species in the local area and may be viewed as being part of this Key Threatening Process. However it is not considered to be significant in relation to the Bush Stone-curlew.
- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused the study area. The proposal is unlikely to result in a change in the frequency of fire in the local area.
- **Removal of dead wood and dead trees:** Dead wood and dead trees were present within the study area. No significant areas of dead wood and dead trees will be removed as a result of the proposal.
- **Predation by the European Red Fox *Vulpes vulpes*:** The Red Fox was not recorded within the study area at the time of the survey however would be considered to have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in the number of this introduced species.
- **Predation by the Feral Cat *Felis catus.*** The Feral Cat was not recorded within the study area at the time of the survey however would be considered to have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in the number of this introduced species.
- **Invasion of native plant communities by exotic perennial grasses:** This threatening process is already present with a small number of introduced grasses such as *Andropogon virginicus* (Whisky Grass) and *Axonopus affinis* (Narrow-leaved Carpet Grass). There is the potential for further infestation, however, given the recommendation for a vegetation management plan for this area which will include regular weed control the impact from this threatening process would be reduced.
- **Invasion of Native Plant Communities by *Chrysanthemoides monilifera*: (Bitou Bush).** Bitou Bush was present within the study area. It is recommended that this species be controlled within the study area.
- ***Lantana camara* (Lantana):** Lantana was found to be common within the study area and formed small thickets in some areas. The Lantana present has the potential for further infestation within the study area. However given the recommendation for a vegetation management plan which will include regular weed control the impact from this threatening process would be reduced.

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27. Birds of Prey

Hieraaetus morphnoides **Little Eagle**

Description

The Little Eagle is a medium-sized (45-55 cm) bird of prey that occurs in two colour forms: either pale brown with an obscure underwing pattern, or dark brown on the upperparts and pale underneath, with a rusty head and a distinctive underwing pattern of rufous leading edge, pale 'M' marking and black-barred wingtips. Both forms have a black-streaked head with a slight crest, a pale shoulder band on the upperwings, a rather short and square-tipped barred tail, and feathered legs.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements and Ecology

The Little Eagle occupies habitats rich in prey within open eucalypt forest, woodland or open woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW are also used (Marchant and Higgins 1993; Aumann 2001a). For nest sites it requires a tall living tree within a remnant patch, where pairs build a large stick nest in winter and lay in early spring. Young fledge in early summer.

Distribution

The Little Eagle is distributed throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment (Marchant and Higgins 1993). It occurs as a single population throughout NSW.

Lophoictinia isura **Squared-tailed Kite**

Description

The Square-tailed Kite is a reddish, medium-sized, long-winged raptor. Adults have a white face with thick black streaks on the crown and finer streaks elsewhere. The saddle, rump and central upper tail coverts are blackish with grey-brown barring. The underparts are predominantly grey-brown with black tips on the grey, square-tipped tail and wing edges. A key character in flight is the long fingered, upswept wings with a large white patch at the base of the barred 'fingers'.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements and Ecology

The Square-tailed Kite inhabits Open Forests and Woodlands, particularly those on fertile soils with abundant passerines. They may also range into nearby open habitats but not into extensive treeless regions. The Square-tailed Kite hunts mostly Passerines and foliage insects, though it also known to prey on mammals and lizards. Prey taken has also included fledging birds, insects and rabbits. Breeding occurs from July to February with an average clutch size of 3 eggs. Nests are built as a platform or bowl of sticks lined with green *Eucalyptus* leaves in forks or large horizontal branches of Eucalypts, *Angophora* or *Melaleuca* trees and may be used in successive years.

Distribution

This raptor is endemic to Australia and is widespread throughout the mainland (absent from Tasmania). The species is migratory throughout its range and is a spring-summer breeding migrant to south-eastern, southern and south-western Australia.

Pandion haliaetus **Osprey**

Description

The Osprey is a large fishing raptor with a distinct brown band passing through the eye.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements and Ecology

The Osprey can be found in open and swamp forest adjacent to the coast or estuaries and fishes in brackish or salt water, seldomly in fresh water bodies. It feeds on live fish, usually 20-40 cm in length. Plunging into the water feet first, from heights up to 50 metres above the water, it will submerge itself to at least 1m when fishing. It builds a conspicuous stick nest on a dead tree or branch, which it uses for breeding between April and November. Nesting sites are also found on man-made structures such as pylons or tall telegraph poles. The nest is added to by breeding pairs each year until they reach a massive size. In some parts of its range overseas nests are as little as 10m apart but in Australia most are separated by at least 1 km.

Distribution

The Osprey is a very cosmopolitan species, found in most continents across the Earth. A single subspecies, *P. h. cristatus*, breeds in Australia and New Guinea. Southern and inland records show that the Osprey in Australia is able to travel long distances and have been recorded as far inland as the Finke River in Central Australia. Individuals are sometimes seen inland along the larger northern rivers and the Murray River though breeding is usually confined to the coast and islands.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

Neither the Square-tailed Kite, Little Eagle or Osprey were recorded in or within the vicinity of the study area during fieldwork. No large nests consistent with that of a bird of prey where also noted within trees. The study area contained suitable habitat as part of a much larger home range for all of these three birds of prey. The open forest habitats within the study area would provide suitable hunting and nesting habitat for the Square-tailed Kite and Little Eagle. The waters of Port Stephens provide hunting habitat for the Osprey. Large tree species within the southern portion of the study area would also offer suitable nesting habitat for the Osprey. The proposal is likely to result in a modification/loss of a very small amount of habitat within the area where the building precinct will be located and may be viewed as an incremental decline of habitat in the local area. However taking into consideration the relatively large amount of suitable surrounding habitat it is considered unlikely to cause extinction of the local population of the these three birds of prey.

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

Not applicable.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

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

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

Not applicable.

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

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

The proposed Abalone farm will be positioned over a development area of approximately 5 hectares in the south of the study area. Within this area a total building footprint of 1ha will be situated within an area containing suitable nesting and hunting habitat for the Square-tailed Kite and Little Eagle and nesting habitat only for the Osprey in the form of Coastal Sand Blackbutt and Ironbark/Tallowwood Open Forest. Additional areas of these two communities may will have to be thinned and underscrubbed to comply with the required 20m Bushfire Asset Protection Zones to the north, east and south, and 30m to the west and north-west of the building precinct. No trees will be required to be removed as a result of the intake and outtake pipes.

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

No areas of habitat will become fragmented or isolated for these highly mobile birds.

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

The proposal will result in the removal of a small amount of suitable habitat for these birds of prey leading to a small incremental reduction of habitat in the local area. However it is unlikely that an area of habitat important to the long-term survival of these bird species is likely to be removed, modified, fragmented or isolated as a result of the proposal.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

A recovery plan has been produced for the Red Goshawk. The specific objectives of this Recovery Plan are to:

1. improve the co-operation and co-ordination of recovery efforts between NSW and Qld;
2. review the legal status of the species at the National level;
3. standardise survey method;
4. increase awareness of the conservation status and threats affecting the Red Goshawk; and
5. identify and protect any known habitat or nest sites that occur in NSW.

The action is not likely to have resulted in the removal of habitat that would significantly compromise

the Recovery Plan.

No Recovery or Threat Abatement Plan has been developed for the remaining birds of prey species although a Priority Action Statement (PAS) has been developed for each species. The objective of the PAS is to promote the recovery of threatened species, populations and ecological communities and manage key threatening processes. It is considered that the proposal does not conflict with the PAS for the above birds of prey.

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

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. Any future removal of vegetation is likely to result in an incremental reduction in habitat for this species in the local area and may be viewed as being part of this Key Threatening Process. However it is not considered to be significant in relation to these three birds of prey.
- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused the study area. The proposal is unlikely to result in a change in the frequency of fire in the local area.
- **Predation by the European Red Fox *Vulpes vulpes*:** The Red Fox was not recorded within the study area at the time of the survey however would be considered to have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in the number of this introduced species.
- **Predation by the Feral Cat *Felis catus.*** The Feral Cat was not recorded within the study area at the time of the survey however would be considered to have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in the number of this introduced species.

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28. Owls

Ninox connivens **Barking Owl**

Description

The Barking Owl is medium-sized owl (42 cm, 650 g) smaller than the similar Powerful Owl and larger than the Southern Boobook. It has bright yellow eyes and no facial-disc. Upperparts are brown or greyish-brown, and the white breast is vertically streaked with brown. The large talons are yellow.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements and Ecology

The Barking Owl is found in forest and woodland, encountered most commonly in savanna and paperbark woodlands. It sometimes roosts in rainforests, but it requires the more open country for hunting and hollow Eucalypts for breeding. These owls are usually found in pairs which occupy permanent territories, generally greater than 100 ha. The main call of the species is a repetitive barking 'wook wook', hence the common name. It does occasionally produce a rather loud and disturbing scream that has earnt it a second common name of the 'screaming woman bird'. Mammals and birds are the main prey, though it also feeds on insects and other invertebrates. In Southern Australia it feeds particularly on rabbits. It also kills hares, rats, mice, occasional small bats and some marsupials, including possums. It kills birds up to the size of Magpies and Tawny Frogmouths.

Distribution

The Barking Owl is found throughout continental Australia except for the central arid regions. Although common in parts of northern Australia, the species has declined greatly in southern Australia and now occurs in a wide but sparse distribution in NSW. Core populations exist on the western slopes and plains (especially the Pilliga) and in some northeast coastal and escarpment forests.

Ninox strenua **Powerful Owl**

Description

The Powerful Owl is the largest owl in Australasia. It is a typical hawk-owl, with staring yellow eyes and no facial-disc. Adults reach 60 cm in length, have a wingspan of up to 140 cm and weigh up to 1.45 kilograms.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not Listed.

Habitat Requirements and Ecology

The Powerful Owl inhabits a wide range of vegetation types from wet Eucalypt forests with a Rainforest understorey to Dry Open Forests and Woodlands. The species has been recorded utilising disturbed habitats such as exotic pine plantations and large trees in parks and gardens. The Powerful Owl is the largest predator of nocturnal forest-dwelling animals in Australian forests. Major prey species in NSW forests are the Greater Glider, Common Ringtail Possum, Sugar Glider, Grey-headed Flying Fox, and several species of diurnal birds, including the Pied Currawong, Magpie and Lorikeets. It rests during the day amid thick foliage, often grasping food-remains. The male of the species employs a slow, far-carrying 'whoo-hoo' call, more deliberate than the female call, which is higher pitched with the second note slightly higher than the first. Powerful Owls nest in a slight depression in the wood-mould on the base of a cavity in a large old tree, sometimes in excess of 25 metres above the ground. These trees are usually found growing on a hillside in heavy forest and may be utilised intermittently for several years. The breeding season of the Powerful Owl is highly synchronised, being strictly winter breeders. Pairs appear to mate for life and occupy exclusive territories that can be greater than 800ha in size (Kavanagh, 2000).

Distribution
The Powerful Owl is found in the coastal areas and adjacent ranges of eastern Australia from South Australia to around Rockhampton in Queensland, generally within 200km from the coast. Within N.S.W., Powerful Owls are distributed throughout the length of the Great Dividing Range, which is their stronghold, and extend from the coast to the western slopes where they occur in much lower numbers

Tyto novaehollandiae **Masked Owl**
Description
A medium-sized owl to 40 - 50 cm long, with dark eyes set in a prominent flat, heart-shaped facial disc that is encircled by a dark border. The feet are large and powerful, with fully feathered legs down to the toes.

Conservation Status
Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements and Ecology
Within this range they inhabit a range of wooded habitats that contain both mature trees for roosting and nesting and more open areas for hunting. They are most commonly encountered within Open Forest with a sparse understorey as well as along the ecotones of these areas to more or less densely vegetated habitats. Their diet comprises mainly ground-dwelling prey, including several species of native and introduced Rodents, *Antechinus* spp. and Bandicoots. On occasions, other prey such as Possums, Gliders and other birds are taken. Masked Owls usually roost in large hollows inside large, old living trees, most often Eucalypts. Within dry forests they often choose hollow trees in gullies or drainage lines. Pairs appear to mate for life and occupy exclusive territories in order of 1000ha in size.

Distribution
Masked Owls in N.S.W. are distributed throughout the length of the Great Dividing Range and extend from the coast to the western slopes.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

Neither the Barking, Powerful or Masked Owl were observed within the study area during the survey. No evidence of their presence was found (ie whitewash, regurgitation pellets, prey remains) nor was a response heard during the call playback census. Hunting habitat for these owl species was present over the majority of the study area. A number of potential large nesting hollows were also present. The proposal will result a small incremental reduction of hunting and potential nesting habitat for all of these owl species. However taking into account the relatively large amount of suitable surrounding habitat it is considered unlikely that the proposal would cause the extinction of a viable local population of these three threatened owl species.

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

Not applicable.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

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

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

The proposed Abalone farm will be positioned over a development area of approximately 5 hectares in the south of the study area. Within this area a total building footprint of 1ha will be situated within an area containing suitable hunting and roosting habitat in the form of Coastal Sand Blackbutt and Ironbark/Tallowwood Open Forest. (Approximately 65 trees including up to 13 hollow-bearing trees). Additional areas of these two communities will also have to be thinned and underscrubbed to comply with the required 20m Bushfire Asset Protection Zones to the north, east and south, and 30m to the west and north-west of the building precinct. No trees will be required to be removed as a result of the intake and outtake pipes.

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

No areas of habitat will become fragmented or isolated for these mobile owls.

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

The proposal will result in the removal of a small amount of hunting and potential nesting habitat for these owls leading to a small incremental reduction of habitat in the local area. However it is unlikely that an area of habitat important to the long-term survival of these owl species is likely to be removed, modified, fragmented or isolated as a result of the proposal.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

A Recovery Plan has been completed for Large Forest Owls (Powerful, Masked & Sooty Owls) (DEC, 2006) and a draft Recovery Plan has been completed for the Barking Owl (NPWS, 2003). The recovery plans recommend that developments containing bushland protect nest and roost sites, patches of habitat and prey bases. The proposal will result in the future removal of a small amount of hunting habitat and potential nesting hollows. However as the majority of habitat will remain within the study area it is considered that the proposal is unlikely to significantly compromise these recovery plans.

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

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. Any future removal of vegetation will result in an incremental reduction in habitat for these owl species in the local area and may be viewed as being part of this Key Threatening Process. However it is not considered to be significant in relation to these owl species.
- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused the study area. The proposal is unlikely to result in a change in the frequency of fire in the local area.
- **Loss of Hollow-bearing Trees***:* Four trees containing hollows will be required to be removed within the building precinct. The loss of hollow bearing trees is not considered to be significant.
- **Predation by the European Red Fox *Vulpes vulpes*:** The Red Fox was not recorded within the study area at the time of the survey however would be considered to have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in the number of this introduced species.
- **Predation by the Feral Cat *Felis catus.*** The Feral Cat was not recorded within the study area at the time of the survey however would be considered to have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in the number of this introduced species.
- **Competition from feral honeybees *Apis mellifera:*** The Feral Honeybee has the potential to occupy potential nesting hollows. No feral Honeybees were noted within the study area.

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29. Medium Carnivorous Marsupials

Dasyurus maculatus maculatus **Tiger Quoll**

Description

The Tiger Quoll (*Dasyurus maculatus maculatus*) is the largest marsupial carnivore on the Australian mainland.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Listed as Endangered

Habitat Requirements

It is an agile climber but spends most of its time on the floor of sclerophyll forests, rainforests and coastal woodlands and heathlands. It has occasionally been seen utilising open country, grazing lands and rocky outcrops (NPWS, 1999). Nests are made in rock caves and hollow logs or trees, and basking sites are usually found nearby. A large area of relatively good quality vegetation is required for foraging. It is an opportunistic hunter of a variety of prey, including birds and their young, rats and other small terrestrial and arboreal mammals, gliders, small Macropods, reptiles and Arthropods.

Distribution

The Tiger Quoll is widespread in eastern Australia, with its distribution being spread between two subspecies. The nominate subspecies, *D. m. maculatus* occurs from southern Queensland to Tasmania whereas *D. m. gracilus* occurs in northern Queensland.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

The Tiger Quoll was not recorded within the study area despite targeted surveys, which involved trapping and spotlighting. Habitat for the Tiger Quoll in the form of open forest covered the majority of the study. The Atlas of NSW Wildlife database (OEH, 2012) contained a small number of local records of the Tiger Quoll within the local area on the northern side of Port Stephens. Considering the large area of adjoining habitat within the local area it is likely that the Tiger Quoll would utilise habitat within the study area. The proposal will result in a small incremental removal of habitat for this carnivorous marsupial, however, is not likely to result in the extinction of any local population of the Tiger Quoll.

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

Not applicable.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

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

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

The proposed Abalone farm will be positioned over a development area of approximately 5 hectares in the south of the study area. Within this area a total building footprint of 1ha will be situated within an area containing suitable habitat for the Tiger Quoll in the form of Coastal Sand Blackbutt and Ironbark/Tallowwood Open Forest. Additional areas of these two communities may also have to be thinned and underscrubbed to comply with the required 20m Bushfire Asset Protection Zones to the north, east and south, and 30m to the west and north-west of the building precinct. No trees will be required to be removed as a result of the intake and outtake pipes.

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

No areas of habitat will become fragmented or isolated for the Tiger Quoll.

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

The proposal will result in a small incremental reduction of habitat in the local area. However it is unlikely that an area of habitat important to the long-term survival of the Tiger Quoll is likely to be removed, modified, fragmented or isolated as a result of the proposal.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for the Tiger Quoll. However the OEH has prepared Priority Action Statements (PAS) to promote the recovery of these species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help this species recover in NSW. It is considered that the proposal does not significantly conflict with the PAS for this species.

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

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. Any future removal of vegetation will result in an incremental reduction in habitat for the Tiger Quoll in the local area and may be viewed as being part of this Key Threatening Process. However it is not considered to be significant in relation to the Tiger Quoll.
- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused the study area. The proposal is unlikely to result in a change in the frequency of fire in the local area.
- **Predation by the European Red Fox *Vulpes vulpes*:** The Red Fox was not recorded within the study area at the time of the survey however would be considered to have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in the number of this introduced species.
- **Predation by the Feral Cat *Felis catus.*** The Feral Cat was not recorded within the study area at the time of the survey however would be considered to have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in the number of this introduced species.
- **Competition from feral honeybees *Apis mellifera:*** The Feral Honeybee has the potential to occupy potential nesting hollows. No feral Honeybees were noted within the study area.
- **Removal of dead wood and dead trees:** Dead wood and dead trees were present within the study area. No significant areas of dead wood and dead trees will be removed as a result of the proposal.

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30. Small carnivorous marsupials

Planigale maculata **Common Planigale**

Description

Formerly a part of the Antechinus complex, the Planigales differ mainly in that they possess a backward-facing pouch, typical of a burrowing species. The Common Planigale is the largest of the Planigales, though still small in terms of the prey that it feeds on.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Endangered under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements and Ecology

In NSW it is found along the coastal strip, occupying a variety of habitats ranging from rainforest, wet and dry sclerophyll forests to grasslands, marshlands and rocky areas. In these habitats it shelters under logs and rocks and any available burrows. It is a ferocious predator of small insects, often tackling prey of its own size. In NSW, the young may be born from late spring to summer and presumably the males die after reproduction, typical of small Dasyurids.

Distribution

The Common Planigale is found throughout eastern Australia.

Phascogale tapoatafa **Brush-tailed Phascogale**

Description

The Brush-tailed Phascogale is tree-dwelling marsupial carnivore with a characteristic, black, bushy 'bottlebrush' tail, with hairs up to 4 cm long. Its fur is grey above and pale cream below and it has conspicuous black eyes and large naked ears.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements

The Brush-tailed Phascogale is known from a variety of forest types from Rainforest to Woodland, but is most frequently recorded in the drier Sclerophyll Forests with little ground cover, on ridges up to 600m altitude. A nocturnal species, the Brush-tailed Phascogale is mainly arboreal but also forages on the ground, eating insects and occasionally small vertebrates. It requires small tree hollows and suitable foraging sites in the canopy, sub-canopy, and ground layer of vegetation. During the day it sleeps in a nest lined with leaves or shredded bark in a tree hollow, emerging at dusk to feed. Animals may return to the nest occasionally through the night and, when several share a nest, they tend to show a similar pattern of nocturnal activity.

Distribution

The Brush-tailed Phascogale has a patchy distribution around the coast of Australia. In NSW it is mainly found east of the Great Dividing Range although there are occasional records west of the divide.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

Neither *Planigale maculata* (Common Planigale) nor *Phascogale tapoatafa* (Brush-tailed Phascogale) were recorded within the study area despite targeted trapping and spotlighting surveys. The Brush-tailed Phascogale has been recorded within the adjoining property to the east (Lot 3 DP 528723) (B & L Lane 2012, pers. comm., 3 July) in Spotted Gum – Ironbark Forest. This species is also commonly recorded within other nearby areas such as North Arm Cove to the west. A large portion of the study area would provide suitable foraging and nesting habitat for the Brush-tailed Phascogale. Preferred habitat within the study area would be likely to occur within areas of Ironbark/Tallowwood Forest and Spotted Gum – Ironbark Forests.

Few records of the Common Planigale are known from the local area. Open forest which covered the majority of the study area would provide suitable foraging and nesting habitat for this small marsupial.

The proposal will result in a small incremental reduction of habitat including up to 13 hollow-bearing trees for both these small marsupials, however, considering the large area of adjoining habitat within the local area the proposal is not likely to result in the extinction of any local population of either *P. maculata* or *P. tapoatafa*.

To reduce the impact on these species it is recommended that a suitably experienced ecologist be present when hollow-bearing trees are removed. Compensatory nest boxes suitable for these species are to be installed outside the development footprint. Artificial lighting used to operate at night or for security may influence the behaviour of these nocturnal marsupials. It is recommended that lighting be minimised and confined wherever possible.

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

Not applicable.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

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

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

The proposed Abalone farm will be positioned over a development area of approximately 5 hectares in the south of the study area. Within this area a total building footprint of 1ha will be situated within an area containing suitable hunting and roosting habitat in the form of Coastal Sand Blackbutt and Ironbark/Tallowwood Open Forest. (Approximately 65 trees including up to 13 potential nesting trees). Additional areas of these two communities will also have to be thinned and underscrubbed to comply with the required 20m Bushfire Asset Protection Zones to the north, east and south, and 30m to the west and north-west of the building precinct. No trees will be required to be removed as a

result of the intake and outtake pipes.

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

No areas of habitat will become fragmented or isolated for either *P. maculata* or *P. tapoatafa.*

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

The proposal will result in a small incremental reduction of foraging and nesting habitat in the local area. However it is unlikely that an area of habitat important to the long-term survival of either of these two small marsupials is likely to be removed, modified, fragmented or isolated as a result of the proposal.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for either *P. maculata* or *P. tapoatafa*. However the OEH has prepared Priority Action Statements (PAS) to promote the recovery of these species and the abatement of key threatening processes in NSW. The Priority Action Statements identified a number of broad strategies to help these species recover in NSW. These actions include ensuring the largest hollow-bearing trees (including dead trees) are given highest priority for retention. The proposal will result in the removal of a number of hollow-bearing trees however is unlikely to significantly compromise these priority actions developed to assist the recovery of *P. maculata* or *P. tapoatafa*.

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

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. Any future removal of vegetation will result in an incremental reduction in habitat for these small marsupial species in the local area and may be viewed as being part of this Key Threatening Process. However it is not considered to be significant in relation to these species.
- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused the study area. The proposal is unlikely to result in a change in the frequency of fire in the local area.
- **Loss of Hollow-bearing Trees***:* Four hollow-bearing trees will be required to be removed within the building precinct. The loss of hollow bearing trees is not considered to be significant. It is recommended that compensatory nest boxes be installed into the study area.
- **Predation by the European Red Fox *Vulpes vulpes*:** The Red Fox was not recorded within the study area at the time of the survey however would be considered to have an impact on

native fauna in the local area. The proposal is unlikely to result in an increase in the number of this introduced species.

- **Predation by the Feral Cat *Felis catus.*** The Feral Cat was not recorded within the study area at the time of the survey however would be considered to have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in the number of this introduced species.
- **Competition from feral honeybees *Apis mellifera:*** The Feral Honeybee has the potential to occupy potential nesting hollows. No feral Honeybees were noted within the study area.

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31. Potoroos and Bettongs

Potorous tridactylus tridactylus **Long-nosed Potoroo (SE mainland)**

Description

The Long-nosed Potoroo (SE Mainland) is a medium sized marsupial of the order Diprotodontia. The Long-nosed Potoroo (SE Mainland) can be identified by a brown to grey upper body and paler underbody. They have a long nose that tapers with a small patch of skin extending from the snout to the nose. The length of the feet is shorter than their head length. They are smaller than the Long-footed *Potorous longipes* (Potoroo).

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Vulnerable.

Habitat Requirements

Inhabits coastal heaths and dry and wet sclerophyll forests. Dense understorey with occasional open areas is an essential part of habitat, and may consist of grass-trees, sedges, ferns or heath, or of low shrubs of tea-trees or melaleucas. In NSW it is generally restricted to coastal heaths and forests east of the Great Dividing Range, with an annual rainfall exceeding 760 mm. A sandy loam soil is also a common feature. The fruit-bodies of hypogeous (underground-fruiting) fungi are a large component of the diet of the Long-nosed Potoroo. They also eat roots, tubers, insects and their larvae and other soft-bodied animals in the soil. Mainly nocturnal, hiding by day in dense vegetation - however, during the winter months animals may forage during daylight hours. Individuals are mainly solitary, non-territorial and have home range sizes ranging between 2-5 ha. Breeding peaks typically occur in late winter to early summer and a single young is born per litter. Adults are capable of two reproductive bouts per annum.

Distribution

The Long-nosed Potoroo is found on the south-eastern coast of Australia, from Queensland to eastern Victoria and Tasmania, including some of the Bass Strait islands. There are geographically isolated populations in western Victoria.

Aepyprymnus rufescens **Rufous Bettong**

Description

Rufous Bettongs are small marsupials, 70 to 80 cm long from nose to tail. They have reddish-brown fur, including on the muzzle.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Vulnerable.

Habitat Requirements

The Rufous Bettong occupies a variety of habitats ranging from coastal Eucalypt forests to tall Wet Sclerophyll Forests along the east coast of Australia. West of the Great Dividing Range it occupies Low Open Woodland. It tends to favour those areas where there is a sparse or grassy understorey. The Rufous Bettong constructs a nest of fibrous vegetation which is occupied during the day. It emerges just after dusk and forages on grasses and herbs as well as tubers and roots. Females are able to reach sexual maturity at 11 months and have four teats with a forward opening pouch. A single young leaves the pouch at approximately 16 weeks and follows its mother until 23 weeks.

Distribution

The original range from Coen in north Queensland to central Victoria has been reduced to a patchy distribution from Cooktown, Queensland, to north-eastern NSW as far south as Mt Royal National

Park. In NSW it has largely vanished from inland areas but there are sporadic, unconfirmed records from the Pilliga and Torrington districts.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

Neither the Long-nosed Potoroo nor Rufous Bettong were recorded within the study area despite targeted surveys, which involved trapping and spotlighting. Open forest which occupied a large portion of the study area was considered to contain suitable habitat for both species. It must be noted that there is a paucity of local records of these two species in the local area on the OEH database. The proposal will result in the incremental removal of suitable habitat for these two marsupials, however considering lack of local records and the large area of adjoining habitat within the local area the proposal is not likely to result in the extinction of any local population of either species.

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

Not applicable.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

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

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

The proposed Abalone farm will be positioned over a development area of approximately 5 hectares in the south of the study area. Within this area a total building footprint of 1ha will be situated within an area containing suitable foraging and nesting habitat for both marsupial species in the form of Coastal Sand Blackbutt and Ironbark/Tallowwood Open Forest. Additional areas of these two communities may also have to be thinned and underscrubbed to comply with the required 20m Bushfire Asset Protection Zones to the north, east and south, and 30m to the west and north-west of the building precinct. No trees will be required to be removed as a result of the intake and outtake pipes.

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

No areas of habitat will become fragmented or isolated for either the Long-nosed Potoroo or Rufous Bettong.

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

The proposal will result in a small incremental reduction of habitat in the local area. However it is unlikely that an area of habitat important to the long-term survival of either of these two small marsupials is likely to be removed, modified, fragmented or isolated as a result of the proposal.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for the Long-nosed Potoroo or Rufous Bettong. However the OEH has prepared Priority Action Statements (PAS) to promote the recovery of these species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help this species recover in NSW. It is considered that the proposal does not significantly conflict with the PAS for these species.

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

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Predation by the European Red Fox *Vulpes vulpes:*** Scats consistent with the European Red Fox were observed within the site. This fox species would have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in fox numbers.
- **Predation by the Feral Cat *Felis catus*:** The Feral Cat was not observed within the site during the survey period although it would be considered likely to be having some impact on native fauna in the local area. The proposal is unlikely to increase numbers of this species.
- **Loss of Hollow-bearing Trees***:* Four hollow-bearing trees will need to be removed as a result of the proposal.
- **Removal of dead wood and dead trees:** Dead wood and dead trees were present within the study area. This action is unlikely to be significant for these marsupial species.

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32. Arboreal Marsupials

Cercartetus nanus **Eastern Pygmy –possum**

Description

The Eastern Pygmy –possum (*Cercartetus nanus*) is a small arboreal marsupial approximately the size of a mouse. It has soft dense fur, fawn-grey to olive brown above and light grey to white below. The rounded head has very large eyes and ears and long whiskers. The prehensile tail has a seasonally flattened base is almost naked and tapers to a fine point.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements

The species is found from rainforest through sclerophyll forest to tree heath. In New South Wales the species is found in coastal areas. Pygmy-Possums are agile climbers that feed mostly on the pollen and nectar from banksias, eucalypts and understorey plants when in flower, insects throughout the year, and seeds and soft fruits when flowers are unavailable. Individual Pygmy-possums have numerous nests which are slept in during the day. These are usually within tree hollows or constructed spherical nests (drays) made from shredded bark and wood from eucalypts, abandoned bird nests and tea-trees.

Distribution

The species is patchily distributed within the south-eastern corner of mainland Australia and Tasmania.

Petaurus australis **Yellow-bellied Glider**

Description

The Yellow-bellied Glider (*Petaurus australis*) is the largest of the Australian Petaurids and is the most vocal.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements

It occurs patchily in tall, mature Wet Eucalypt Forest, at a density 0.05-0.14 individuals per hectare in preferred habitat. Plant and insect exudates (sap, nectar, honeydew and manna) make up the bulk of its diet. Eucalypt sap is consumed throughout the year. Eucalypt blossom provides valuable food when available, while insects, spiders and pollen provide most of the protein in the diet. During the day, the Yellow-bellied Glider rests in a den in a hollow branch, usually in a living, smooth-barked Eucalypt. It emerges at night to forage, sometimes travelling more than 2km from the den. The home range is of the order of 35 hectares. Young are born mostly from August to September in the southern part of the range and from May to September in the northern parts (although some births have been recorded throughout the year). Pouch life is 90-100 days, after which the young is suckled in the den for 40-60 days.

Distribution

It ranges throughout eastern Australia from Portland, Victoria to central-coastal Queensland. A separate population of the subspecies (*P. a. reginae*) occurs on the western Rainforest slopes in northern Queensland.

Petaurus norfolcensis **Squirrel Glider**

Description

The Squirrel Glider (*Petaurus norfolcensis*) is a medium sized arboreal gliding marsupial with long

grey fur and a pronounced black dorsal strip extending from between the eyes to the base of the tail. The belly fur is white and the tail is grey and fluffy. The gliding membrane (patagium) extends from the wrist to the ankle. The Squirrel Glider is similar to the Sugar Glider (*Petaurus breviceps*) however is larger with a longer pointed face, longer and narrower ears and a much bushier furred tail.

Conservation Status
Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements
Throughout its range *P. norfolcensis* is found in dry forest and woodland associations dominated by winter flowering eucalypts or with an understorey of winter flowering Banksias or gum producing Acacias (Smith, 2002). Squirrel Gliders nest in tree hollows or "dens" with a range of entrance diameters of 4-15cm. Squirrel Glider colonies and individuals may change nest sites frequently within their home range. The Squirrel Glider eats a high proportion of invertebrates from the foliage of Eucalypts and *Acacias* supplemented by plant exudates in the form of Eucalypt and *Melaleuca* sap and *Acacia* gum.

Distribution
The Squirrel Glider is distributed throughout the dry sclerophyll forests and woodlands of eastern Australia from South Australia to Cairns.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

Neither *Petaurus norfolcensis* (Squirrel Glider), *Petaurus australis* (Yellow-bellied Glider) nor *Cercartetus nanus* (Eastern Pygmy –possum) were recorded within the study area despite targeted trapping and spotlighting surveys. Open forest habitat covering the majority of the study area was thought to provide suitable foraging and nesting habitat for these three arboreal species. The proposal will result in a small incremental reduction of habitat for both these small marsupials, however, considering the large area of adjoining habitat within the local area the proposal is not likely to result in the extinction of any local population of either species.

To reduce the impact of the proposal in relation to these three arboreal marsupials it is recommended that the removal of hollow-bearing trees be supervised by a suitably qualified and vaccinated ecologist. It is also recommended that suitable compensatory nestboxes be installed within the remaining area of open forest and adjacent areas prior to clearing to replaced lost nesting hollows. Artificial lighting used to operate at night or used for security may influence these nocturnal marsupials. Artificial lighting used to operate at night or used for security may influence nocturnal fauna. It is recommended that lighting be minimised and confined wherever possible.

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

Not applicable.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

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

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

The proposed Abalone farm will be positioned over a development area of approximately 5 hectares in the south of the study area. Within this area a total building footprint of 1ha will be situated within an area containing suitable foraging and nesting habitat for both marsupial species in the form of Coastal Sand Blackbutt and Ironbark/Tallowwood Open Forest. Approximately 65 trees including up to 13 suitable nesting trees will be required to be removed. Additional areas of these two communities will also have to be thinned and underscrubbed to comply with the required 20m Bushfire Asset Protection Zones to the north, east and south, and 30m to the west and north-west of the building precinct. No trees will be required to be removed as a result of the intake and outtake pipes.

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

No areas of habitat will become fragmented or isolated for these arboreal species.

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

The proposal will result in a small incremental reduction of foraging and nesting habitat in the local area. However it is unlikely that an area of habitat important to the long-term survival of either of these arboreal marsupials is likely to be removed, modified, fragmented or isolated as a result of the proposal.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

A recovery plan has been released for the Yellow-bellied Glider. The plan recommends the retention of suitable habitat and nest trees. As only a relatively small amount of foraging and nesting habitat will be affected the proposal would not be considered to significantly compromise this recovery plan.

No Recovery or Threat Abatement Plan has been developed for the Squirrel Glider or Eastern Pigmy Possum. However the OEH has prepared Priority Action Statements (PAS) to promote the recovery

of these two species and the abatement of key threatening processes in NSW. The Priority Action Statements identified a number of broad strategies to help these species recover in NSW. These actions include:

- Ensure the largest hollow-bearing trees (including dead trees) are given highest priority for retention.

The proposal is unlikely to significantly compromise these priority actions developed to assist the recovery of the Squirrel Glider or Eastern Pigmy Possum.

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

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. Any future removal of vegetation will result in an incremental reduction in habitat for these marsupial species in the local area and may be viewed as being part of this Key Threatening Process. However it is not considered to be significant in relation to these species.
- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused the study area. The proposal is unlikely to result in a change in the frequency of fire in the local area.
- **Loss of Hollow-bearing Trees***:* A number of hollow-bearing trees will be required to be removed within the building precinct. The loss of hollow bearing trees is not considered to be significant.
- **Predation by the European Red Fox *Vulpes vulpes*:** The Red Fox was not recorded within the study area at the time of the survey however would be considered to have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in the number of this introduced species.
- **Predation by the Feral Cat *Felis catus.*** The Feral Cat was not recorded within the study area at the time of the survey however would be considered to have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in the number of this introduced species.
- **Competition from feral honeybees *Apis mellifera:*** The Feral Honeybee has the potential to occupy potential nesting hollows. No feral Honeybees were noted within the study area.

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33. Native Rodents

Psuedomys gracilicaudatus **Eastern Chestnut Mouse**

Description

The Eastern Chestnut Mouse is a large, stocky mouse, up to twice the body length of a House Mouse, and three to four times the weight. It is chestnut-brown above and grey underneath. Its feet have long brown hairs on top and are pale beneath. The tail is sparsely hairy.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements

This species is most often found in heathland and in dense and wet heathy areas, though it has also been recorded from Open Woodland. Its' optimal habitat however, has been identified as regenerating vegetation. These animals are mainly nocturnal resting in grass nests or burrows by day and emerging at dusk to forage for seeds, stems, fungi and insects. Within NSW the breeding season is from September to March, however, in good seasons, mating extends from mid-August to the end of March.

Distribution

This species is distributed along the east coast and ranges of Australia from the Cairns district to the lower north coast of New South Wales.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

The Eastern Chestnut Mouse was not recorded within the study area despite targeted surveys such as small mammal trapping. The study area was considered to contain some suitable habitat for this rodent species. No optimal habitat was considered to be present however the most likely habitat would include areas mapped as Smooth-barked Apple/Stringybark Forest and Smooth-barked Apple Heath. The proposal is unlikely to result in the removal of any preferred habitat therefore is not likely to result in the extinction of any local population of the Eastern Chestnut Mouse.

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

Not applicable.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

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

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

The proposed Abalone farm will be positioned over a development area of approximately 5 hectares in the south of the study area. Within this area a total building footprint of 1ha will be situated within an area containing suitable foraging and nesting habitat for both marsupial species in the form of Coastal Sand Blackbutt and Ironbark/Tallowwood Open Forest. Additional areas of these two communities will also have to be thinned and underscrubbed to comply with the required 20m Bushfire Asset Protection Zones to the north, east and south, and 30m to the west and north-west of the building precinct. No trees will be required to be removed as a result of the intake and outtake pipes. No optimal habitat will be removed as a result of the proposal.

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

No areas of habitat will become fragmented or isolated for the Eastern Chestnut Mouse.

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

As no preferred habitat will be removed it is unlikely that the proposal will remove, modify, fragment or isolated an area of habitat important to the long-term survival of the Eastern Chestnut Mouse.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for the Eastern Chestnut Mouse. However the OEH has prepared Priority Action Statements (PAS) to promote the recovery of these species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help this species recover in NSW. It is considered that the proposal does not significantly conflict with the PAS for this rodent species.

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

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. Any future removal of vegetation particularly specimens within the wetter areas of swamp forest is likely to result in an incremental reduction in habitat for this species in the local area and may be viewed as being part of this

Key Threatening Process. However it is not considered to be significant in relation to this species of rodent.

- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused the study area. The proposal is unlikely to result in a change in the frequency of fire in the local area.
- **Removal of dead wood and dead trees:** Dead wood and dead trees were present within the study area. No significant areas of dead wood and dead trees will be removed as a result of the proposal.
- **Predation by the European Red Fox *Vulpes vulpes*:** The Red Fox was not recorded within the study area at the time of the survey however would be considered to have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in the number of this introduced species.
- **Predation by the Feral Cat *Felis catus.*** The Feral Cat was not recorded within the study area at the time of the survey however would be considered to have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in the number of this introduced species.

Bibliography:

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34. Megachiropteran Bats

Syconycteris australis **Common Blossom-bat**

Description

Syconycteris australis (Common Blossom-bat) is a miniature species of flying-fox with fawn to reddish brown fur. It has large eyes, a long thin muzzle with raised nostrils and a very long tongue.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements and Ecology

In the southern part of its range (i.e. NSW) the combination of heathlands and coastal rainforest is essential. They have a foraging area of about 13ha of heathland and use the same area each night. The foraging area is rarely more than 4km from the roosting habitat. Banksias are the staple food source, however southern populations of *Syconycteris australis* also feed on the blossoms of paperbarks, bottlebrushes, bloodwoods and cultivated bananas. They actively forage for most of the night and continue to forage during rain and on strongly moonlit nights.

Roosting occurs amongst large leaves or amongst dense vines, with a number of different roost sites utilised. Roosts vary from canopy to sub-canopy and from forest edge to centre depending on the current weather conditions. These bats enter daily torpor if they have not eaten the previous night and the temperature falls below 26 degrees celsius. When in torpor their metabolic rate drops to 15% of their normal resting metabolic rate. In NSW, one young is usually born in October or November and another between February and April. Lactation lasts for up to 3 months. In northern Queensland breeding seems to occur continuously.

Distribution

Its distribution extends from the tropics, down eastern coast of Australia to south of the Port Macquarie area in NSW. It has recently been recorded at North Hawks Nest (Wildthing Environmental Consultants, 2012).

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

The Common Blossom Bat was not recorded within the study area during fieldwork. Open forest habitats within the study area were considered to provide suitable foraging and roosting habitat of varying quality. *Banksia serrata* (Old Man Banksia) a preferred foraging species was present within the southern portion of the study area along with secondary foraging species such as *Melaleuca quinquenervia* (Broad-leaved Paperbark) and *Corymbia gummifera* (Red Bloodwood). The study area is situated just south of the known distribution of this megachiropteran bat species with the nearest records located at North Hawks Nest (Wildthing Environmental Consultants, 2012). The proposal will involve the removal of a small number of foraging species such as *B. serrata* resulting in an incremental reduction of habitat in the local area. Specimens of *M. quinquenervia* will be avoided as a result of the installation of the inlet and outlet pipes. Taking into consideration the location of the study area occurring outside the known distribution of the Common Blossom Bat and the large areas of suitable adjoining habitat within the local area the proposal is not likely to result in the extinction of any local population of this mobile species.

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

Not applicable.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

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

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

The proposed Abalone farm will be positioned over a development area of approximately 5 hectares in the south of the study area. Within this area a total building footprint of 1ha will be situated within an area containing suitable foraging habitat in the form of Coastal Sand Blackbutt and Ironbark/Tallowwood Open Forest. A small number of the preferred foraging species *B. serrata* will also be required to be removed. Additional areas of these two communities may also have to be thinned and underscrubbed to comply with the required 20m Bushfire Asset Protection Zones to the north, east and south, and 30m to the west and north-west of the building precinct. No trees will be required to be removed as a result of the intake and outtake pipes.

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

No areas of habitat will become fragmented or isolated for this highly mobile species.

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

The proposal will result in a small incremental reduction of habitat in the local area. However considering the fact that the site is located outside the currently known distribution of the Common Blossom Bat it is unlikely that an area of habitat important to the long-term survival is likely to be removed, modified, fragmented or isolated as a result of the proposal.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for the Common Blossom Bat. However the OEH has prepared Priority Action Statements (PAS) to promote the recovery of this species and

the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help this species recover in NSW. It is considered that the proposal does not significantly conflict with the PAS for these species.

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

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of native vegetation is a key threat to the Common Blossom Bat. The clearing of vegetation for the proposal will result in a small incremental removal of food resources in the local area however it is not considered to be significant in relation to the Common Blossom Bat.
- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused to the study area. The proposal is unlikely to result in any change to the fire frequency within the study area.
- **Predation by the European Red Fox *Vulpes vulpes:*** The European Red Fox was not observed within the study area during the survey however, would have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in fox numbers.
- **Predation by the Feral Cat *Felis catus*:** The Feral Cat was not observed within the study area during the survey however, would have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in fox numbers.

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35. Microchiropteran Bats

Kerivoula papuensis **Golden-tipped Bat**

Description

The Golden-tipped Bat has dark brown, curly fur with bright golden tips. The distinctively coloured fur extends along the wings, legs and tail. It has a short, pointed, over-hanging muzzle and pointy, funnel-shaped ears. Adults weigh about 6 grams and have a wingspan of about 25 cm.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements and Ecology

The Golden-tipped Bat is found in rainforest and adjacent wet and dry sclerophyll forest up to 1000m. It is also recorded in tall open forest, Casuarina-dominated riparian forest and coastal Melaleuca forests. This species roosts mainly in abandoned hanging Yellow-throated Scrubwren and Brown Gerygone nests, also in tree hollows, dense foliage and epiphytes; located in rainforest gullies on small first and second-order streams. It is a specialist feeder on small web-building spiders.

Distribution

The Golden-tipped Bat is distributed along the east coast of Australia in scattered locations from Cape York Peninsula in Queensland to south of Eden in southern NSW. Also occurs in New Guinea.

Falsistrellus tasmaniensis **Eastern False Pipistrelle**

Description

The Eastern False Pipistrelle is relatively large with a head-body length of about 65 mm. It weighs up to 28 grams. It is dark to reddish-brown above and paler grey on its underside. It has long slender ears set well back on the head and some sparse hair on the nose.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements and Ecology

These bats inhabit sclerophyll forests from the Great Divide to the east coast. In Tasmania they are found in wet sclerophyll and coastal mallee. A preference has been noted for wet habitats where trees are more than 20m high. Based upon the size and shape of its wings the bat it thought to be highly mobile with a relatively large hunting range. A specimen of this species has been radio-tracked and found to move 12km from where it was hunting to where it was roosting in a very large tree.

On the mainland they eat moths, rove beetles, chafers, weevils, plant bugs, flies and ants. Their flight is swift and direct, within or just below the tree canopy. They tend to fly fast in a fixed horizontal plane with sudden darting changes in course. It has been observed roosting in holes and hollow trunks of Eucalypts, with recorded colony sizes ranging from 3 to 36 individuals. Colonies are usually almost entirely male or female groups, although evenly mixed colonies sometimes occur. They have been recorded roosting in a cave at Jenolan, NSW, and they are occasionally found in old wooden buildings.

Males produce sperm in late summer and store it in the epididymis over the winter. Females produce a large 'hibernation follicle' in autumn. Ovulation, fertilisation and pregnancy occur in late spring and early summer. Single young is born in December. Lactation continues through January and February. The Eastern Falsistrelle hibernates generally during winter, particularly in the southern extent of its range.

Distribution

The Eastern Falsistrelle occurs along the coastal ranges from southern Queensland to western Victoria, and is endemic to Australia.

Saccolaimus flaviventris **Yellow-bellied Sheathtail Bat**

Description

The Yellow-bellied Sheathtail-bat is a large, insectivorous bat up to 87 mm long. It has long, narrow wings, a glossy, jet-black back, and a white to yellow belly extending to the shoulders and just behind the ear. It has a flattened head and a sharply-pointed muzzle. The tail is covered with an extremely elastic sheath that allows variation in the tail-membrane area. Males have a prominent throat pouch; females have a patch of bare skin in the same place.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements and Ecology

It has been reported from a wide variety of habitats. Hunting height appears to vary depending upon the height of the dominant vegetation in Eucalypt forests it feeds above the canopy, but in Mallee or open country it comes lower to the ground. Prey species include Beetles, Long-horned Grasshoppers, Shield Bugs and Flying Ants.

Usually solitary, but occasionally occurring in colonies of less than ten individuals, the Yellow-bellied Sheathtail-bat roosts in tree hollows, animal burrows, dry clay cracks, under rock slabs and in abandoned Sugar Glider nests. It has also been found resting on the walls of buildings in broad daylight, and one such individual, caught at Queanbeyan (NSW), appeared to be so exhausted that it made no effort to escape. Similar reports suggest that it is migratory in southern Australia and that individuals found resting in the open are in the course of a winter migration from the cooler to warmer areas. They have been reported from southern Australia only between January and June.

Males have a prominent throat-pouch which is devoid of glandular tissue but a sub-cutaneous gland lies behind it. The throat-pouch is represented by a rudimentary fold of skin in the female. There is no seasonal difference in testicular size in males and there is no relationship between reproductive condition in males and the size of the throat pouch. Pregnancy is always restricted to the right uterine horn. Single young are born between December and mid-March. Sub-adults have only been collected in January and February.

Distribution

This species is widespread across Australia and its apparent rarity is probably due to its flying so high and fast that it is seldom collected.

Myotis macropus **Southern Myotis**

Description

Myotis macropus (Large-footed Myotis) is similar to most other bats with a grey-brown fur colour. The main distinguishing feature of this species is its unusually large feet.

Conservation Status

Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements and Ecology

Myotis macropus seldom occurs far from suitable water bodies which range from rainforest streams to large reservoirs and even brackish water. It hunts by raking the surface of the water for aquatic insects and small fish. Some aerial hunting also occurs for prey items include moths, beetles, crickets, cockroaches, flies and many water insects. It roosts in small colonies of between 15 and several hundred individuals with recorded roosts including caves, mines and disused railway tunnels as well

as dense rainforest foliage in the tropical parts of its range. Some occurrences of roosting in tree hollows are also noted.

Distribution
The Large-footed Myotis has been recorded along much of the coastal strip of Australia occurring from the east of South Australia, around the Victorian, New South Wales, Queensland and Northern Territory coasts and into Western Australia as far as the Kimberleys (the northern population is likely to be a different subspecies - currently undergoing taxonomic revision). In N.S.W., the Large-footed Myotis is found in various habitats of the coast and adjacent ranges. Recently, it has also been found along the Murray River valley well into South Australia.

Miniopterus schreibersii oceanensis **Large Bent-wing Bat**
Description
The *Miniopterus schreibersii oceanensis* (Large Bent-wing Bat) has chocolate to reddish-brown fur on its back and slightly lighter coloured fur on its belly. It has a short snout and a high 'domed' head with short round ears. The wing membranes attach to the ankle, not to the base of the toe. The last bone of the third finger is much longer than the other finger-bones giving the "bent wing" appearance.

Conservation Status
Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements and Ecology

The Large Bentwing-bat hunts in forested areas, catching moths and other flying insects above the tree tops. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Cold caves are used for hibernation in southern Australia. Breeding or roosting colonies can number from 100 to 150,000 individuals.

Distribution
The Large Bent-wing Bats occur along the east and north-west coasts of Australia.

Mormopterus norfolkensis **Eastern Freetail-bat**
Description
Mormopterus norfolkensis (Eastern Freetail-bat) has dark brown to reddish brown fur on the back and is slightly paler below. Like other freetail-bats it has a long (3 - 4 cm) bare tail protruding from the tail membrane. Like other freetail-bats they have hairless faces with wrinkled lips and triangular ears.

Conservation Status
Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements and Ecology

Mormopterus norfolkensis occurs in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. It roosts mainly in tree hollows but will also roost under bark or in man-made structures. Usually solitary but also recorded roosting communally, probably insectivorous.

Distribution

The Eastern Freetail-bat is found along the east coast from south Queensland to southern NSW.

Chalinolobus dwyeri **Long-eared Pied Bat**
Description
Chalinolobus dwyeri (Long-eared Pied Bat) is a small to medium-sized bat with long, prominent ears

and glossy black fur. The lower body has broad white fringes running under the wings and tail-membrane, meeting in a V-shape in the pubic area.

Conservation Status
Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Vulnerable.

Habitat Requirements and Ecology

This species has been found occupying dry sclerophyll forest and woodland, both to the east and west of the Great Divide. Recordings of this species have also been made in subalpine woodland and at the ecotone of rainforest and wet Eucalypt forest. The Large-eared Pied Bat roosts in caves, abandoned mud-nests of Fairy Martins and mine tunnels. Colonies recorded have ranged in size from 3 to 37 individuals, and are usually located in the twilight area not far from the cave entrance.

Distribution

Found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW. There are scattered records from the New England Tablelands and North West Slopes.

Vespadelus troughtoni **Eastern Cave Bat**
Description
Vespadelus troughtoni (Eastern Cave Bat) is a small bat with light brown fur on its back and ginger tips mainly around the head. Fur on the belly is dark at the base with light fawn tips.

Conservation Status
Threatened Species Conservation Act 1995 – Listed as Vulnerable under schedule 2.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements and Ecology
It is a cave-dweller, known from wet sclerophyll forest and tropical woodlands from the coast and Dividing Range to the drier forests of the semi-arid zone. It has been found roosting in small groups in sandstone overhangs, in mine tunnels and occasionally in buildings. In all situations, the roost sites are frequently in reasonably well-lit areas. Single-sex colonies varying in size from 6 to 50 individuals are more commonly recorded; however a large colony of 500 individuals of equal sex ratio has been recorded in a mine. Little is known of its diet and hunting behaviour. Similarly, information on reproductive activities is limited to the noted capture of lactating females in December in the Atherton Tablelands.

Distribution
Although it is widely distributed, relatively few records of this species exist, particularly in the southern part of its range where it appears to be localised. The main population stretches from Cape York south to the mid-north coast of NSW.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

Neither *Kerivoula papuensis* (Golden-tipped Bat), *Falsistrellus tasmaniensis* (Eastern False

Pipistrelle), *Saccolaimus flaviventris* (Yellow-bellied Sheathtail Bat), *Chalinolobus dwyeri*, *Myotis macropus*, *Miniopterus schreibersii oceanensis* nor *Vespadelus troughtoni* (Eastern Cave Bat) were identified within the study area during fieldwork despite the undertaking of harp trapping and echolocation call recording. The study area provided hunting habitat for all of these threatened microchiropteran bat species. Preferred hunting habitat in the form of suitable areas of surface water for *M. macropus* would be present on ephemeral areas of water within the Swamp Sclerophyll Forest. The two constructed dams may also provide limited hunting habitat for this species. Preferred roosting habitat in the form of tree hollows was present over the majority of the study area for *K. papuensis, F. tasmaniensis, S. flaviventris* and to a lesser extent *M. macropus*. Roosting habitat in the form of caves and similar man made structures was not present within the study area for *M. schreibersii oceanensis, C. dwyeri* and *V. troughtoni*.

The proposal will result in a small reduction/modification of hunting habitat in the local area and the removal of a small amount of roosting habitat for those addressed hollow dependant bats. Taking into consideration the large areas of similar adjoining habitat within the local area the proposal is not likely to result in the extinction of any local population of these microchiropteran bat species.

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

Not applicable.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

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

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

The proposed Abalone farm will be positioned over a development area of approximately 5 hectares in the south of the study area. Within this area a total building footprint of 1ha will be situated within an area containing suitable hunting and roosting habitat in the form of Coastal Sand Blackbutt and Ironbark/Tallowwood Open Forest. (Approximately 65 trees including up to 13 suitable roosting trees). Additional areas of these two communities will also have to be thinned and underscrubbed to comply with the required 20m Bushfire Asset Protection Zones to the north, east and south, and 30m to the west and north-west of the building precinct. No trees will be required to be removed as a result of the intake and outtake pipes.

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

No areas of habitat will become fragmented or isolated for these highly mobile species.

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

The construction of the building precinct may result in a small incremental reduction in the quality of hunting and roosting habitat in the local area. However taking into consideration the relatively large amount of suitable surrounding habitat and lack of preferred roost site for some species the proposal is unlikely to result in the removal, modification, fragmentation or isolation of an area of habitat important to the long term survival of these microchiropteran bat species.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for these microchiropteran bat species. However the OEH has prepared Priority Action Statements (PAS) to promote the recovery of this species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help these species recover in NSW. It is considered that the proposal does not significantly conflict with the PAS for these species.

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

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. Any future removal of vegetation will result in an incremental reduction in habitat for these microchiropteran bat species in the local area and may be viewed as being part of this Key Threatening Process. However it is not considered to be significant in relation to these species.
- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused the study area. The proposal is unlikely to result in a change in the frequency of fire in the local area.
- **Loss of Hollow-bearing Trees***:* Four hollow-bearing trees will be required to be removed within the building precinct. The loss of hollow bearing trees is not considered to be significant.
- **Predation by the European Red Fox *Vulpes vulpes*:** The Red Fox was not recorded within the study area at the time of the survey however would be considered to have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in the number of this introduced species.
- **Predation by the Feral Cat *Felis catus.*** The Feral Cat was not recorded within the study area at the time of the survey however would be considered to have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in the number of this introduced species.
- **Competition from feral honeybees *Apis mellifera:*** The Feral Honeybee has the potential to occupy potential roosting hollows. No feral Honeybees were noted within the study area.

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36. Endangered Populations

***Dromaius novaehollandiae* (Emu) – population in the NSW North Coast Bioregion and Port Stephens LGA.**

Description
Dromaius novaehollandiae (Emu) is a is a large flightless bird that stands up to 1.9 m tall, with long legs and neck and shaggy grey-brown to dark-brown or grey-black plumage.

Conservation Status
Threatened Species Conservation Act 1995 – Listed as an Endangered Population.
Environmental Protection and Biodiversity Conservation Act 1999 – Not listed.

Habitat Requirements and Ecology
It occupies a range of predominantly open habitats, including plains, grasslands, woodlands and scrubs, and may occur occasionally in forest.

Distribution
The Emu is distributed broadly but patchily through NSW and elsewhere in Australia. An isolated population of Emus occurs in the NSW North Coast Bioregion and Port Stephens LGA. The population is disjunct from other populations in the Sydney Basin and New England Tableland Bioregion. The population of Emus in the NSW North Coast Bioregion and Port Stephens LGA represents the north-eastern limit of the species in NSW.

For the purposes of the Environmental Planning and Assessment Act 1979 and, in particular, in the administration of sections 78, 79 and 112, the following factors have been taken into account in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats:

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

Not applicable.

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

The Emu was not recorded within the study area during fieldwork. Few recent local records for this bird species were present on the DECCW database. Although the Emu prefers more open areas such as grassland and woodlands, open forest covering the majority of the study area would provide some habitat for this flightless bird. The proposal will involve the removal of an area of suitable habitat resulting in an incremental reduction of habitat in the local area. However taking into consideration the paucity of local records and the relatively large amount of suitable surrounding habitat it is considered unlikely to cause extinction of the local population of the Emu.

c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

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

community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

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

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

The proposed Abalone farm will be positioned over a development area of approximately 5 hectares in the south of the study area. Within this area a total building footprint of 1ha will be situated within an area containing suitable habitat in the form of Coastal Sand Blackbutt and Ironbark/Tallowwood Open Forest. Additional areas of these two communities will also have to be thinned and underscrubbed to comply with the required 20m Bushfire Asset Protection Zones to the north, east and south, and 30m to the west and north-west of the building precinct. No trees will be required to be removed as a result of the intake and outtake pipes.

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

No areas of habitat will become fragmented or isolated for the Emu.

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

The proposal will result in the removal of a small amount of suitable habitat for these bird species leading to a small incremental reduction in the local area. However it is unlikely that an area of habitat important to the long-term survival of the Emu is likely to be removed, modified, fragmented or isolated as a result of the proposal.

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

None of the site has been designated 'critical habitat' under Part 3 of the TSC Act.

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

No Recovery or Threat Abatement Plan has been developed for the Emu population in the NSW North Coast Bioregion and Port Stephens LGA. However the Department of Environment and Climate Change has prepared Priority Action Statements (PAS) to promote the recovery of this species and the abatement of key threatening processes in NSW. The Priority Action Statement identified a number of broad strategies to help these species recover in NSW. It is considered that the proposal does not significantly conflict with the PAS for this species.

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

The 'Key Threatening Processes' currently listed under Schedule 3 of the TSC Act that are relevant to the site have been listed in bold below followed by an assessment of the applicability of the threatening process in regards to the proposal and the species considered.

- **Clearing of Native Vegetation**: The clearing of vegetation is listed as a major factor contributing to the loss of biological diversity. Any future removal of vegetation will result in an incremental reduction in habitat for the Emu in the local area and may be viewed as being part of this Key Threatening Process. However it is not considered to be significant in relation to these species.
- **High frequency fire resulting in the disruption of life cycle processors in plants and animals and loss of vegetation structure and composition**: It is difficult to ascertain the disruption and structural changes, if any, past fires have caused the study area. The proposal is unlikely to result in a change in the frequency of fire in the local area.
- **Predation by the European Red Fox *Vulpes vulpes*:** The Red Fox was not recorded within the study area at the time of the survey however would be considered to have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in the number of this introduced species.
- **Predation by the Feral Cat *Felis catus.*** The Feral Cat was not recorded within the study area at the time of the survey however would be considered to have an impact on native fauna in the local area. The proposal is unlikely to result in an increase in the number of this introduced species.

Bibliography:

NSW Scientific Committee (2002) *Emu Population in the NSW North Coast Bioregion and Port Stephens Local Government Area - Endangered Population Listing.* NSW Scientific Committee Final Determination. NSW Department of Environment, Climate Change and Water: Sydney.

APPENDIX B

TOTAL FLORA LIST

Key
Introduced species are indicated by an asterisk ("*").

The following standard abbreviations are used to indicate subspecific taxa:

ssp. - subspecies
var.- variety
× **-** hybrid between the two indicated species

Threatened Species Conservation Act 1995 (TSC Act)

V Vulnerable
E1 Endangered
E2 Endangered Population
E4A Critically Endangered Population

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

V Vulnerable
E Endangered

ROTAP (Rare or Threatened Australian Plants)

Distribution

1. – Known from only one collection
2. – Geographic range in Australia less than 100km
3. – Geographic range in Australia greater than 100km.
+ - Also occurs overseas.

Conservation Status

E. – Endangered. Species at risk of disappearing from the wild within 20 years. Includes populations of 100 or less individual plants.
V. – Vulnerable. Species not presently endangered, but at risk over 20-50 years.
R. – Rare in Australia, but not currently under threat. Includes species within a very restricted area or small populations over a wide range.
K. – Poorly known. Accurate knowledge is inadequate.
C. – Reserved. The species has at least one population within a national park or other reserve.

Size of Reserved Populations

a. – 1000 plants or more known within a conservation reserve.
i. – Less than 1000 plants known within a conservation reserve.
- - Reserved population size not accurately known.
t - Total known population reserved.

Vegetation community type within study area

Within Lot 2:

1. Swamp Mahogany – Paperbark Forest
2. Smooth-barked Apple Swamp Forest
3. Coastal Sand Blackbutt Open Forest
4. Ironbark/Tallowwood Open Forest
5. Grey Gum/Tallowwood/Ironbark
6. Spotted Gum/Ironbark Forest
7. Smooth-barked Apple/Stringybark Open Forest
8. Moist Riparian Forest
9. Cleared Modified
10. Dam

Outside Lot 2:

11. Mangrove
12. Foreshore
13. Saltmarsh
14. Swamp Oak

FLORA LIST FOR THE STUDY AREA

SCIENTIFIC NAME	COMMON NAME	TSC ACT	EPBC ACT	ROTAP	REGIONALLY SIGNIFICANT	VEGETATION COMMUNITY
CLASS FILICOPSIDA (Ferns)						
Adiantaceae						
Adiantum aethiopicum	Common Maidenhair Fern					4,8
Adiantum hispidulum	Rough Maiden Hair Fern					8
Aspleniaceae						
Asplenium australasicum	Birdnest Fern					8
Blechnaceae						
Blechnum cartilagineum	Gristle Fern					8
Blechnum indicum	Swamp Water Fern					1
Doodia aspera	Rasp Fern					4,8
Dennstaedtiaceae						
Hypolepis muelleri	Harsh Ground Fern					1
Pteridium esculentum	Bracken					1,2,3,4,5,6,7,8
Dicksoniaceae						
Calochlaena dubia	Soft Bracken Fern					1,2,3
Lindaeaceae						
Lindsaea linearis	Screw Fern					8
Polypodiaceae						
Platycerium bifurcatum	Elk Horn					8
Schizaeaceae						
Cheilanthes sieberi ssp. *sieberi*	Mulga Fern					4,7
Sinopteridaceae						
Pellaea falcata ssp. *falcata*						2,8

SCIENTIFIC NAME	COMMON NAME	TSC ACT	EPBC ACT	ROTAP	REGIONALLY SIGNIFICANT	VEGETATION COMMUNITY
Thelypteridaceae						
Christella dentata						8
MAGNOLIOPSIDA: Magnoliidae						
LILOPSIDA: (Monocotyledons)						
Anthericaceae						
Caesia parviflora var. *parviflora*						4
Araceae						
Gymnostachys anceps	Settlers Flax					8
Arecaceae						
Livistona australis	Cabbage-tree Palm					1,3,4
Commelinaceae						
Commelina cyanea						1,2,3,4,5,6,8,9
Cyperaceae						
Baumea articulata						1
Baumea juncea						1,13,14
Baumea rubiginosa	Soft Twigrush					1
Carex appressa						1
Carex longebrachiata						8
Carex maculata						1
Cyperus brevifolius	Mullumbimby Couch					9
**Cyperus eragrostis*						1,9
Isolepis nodosa						1,13
Gahnia aspera						4
Gahnia clarkei	Sword Grass					1
Gahnia sieberiana	Sword Grass					8
Lepidosperma gunnii						8
Lepidosperma elatius						8
Lepidosperma laterale	Sword Sedge					4,5,9

SCIENTIFIC NAME	COMMON NAME	TSC ACT	EPBC ACT	ROTAP	REGIONALLY SIGNIFICANT	VEGETATION COMMUNITY
Ptilothrix deusta						7
Schoenoplectus mucronatus						10
Haemodraceae						
Haemodorum corymbosum	Blood Root					7
Iridaceae						
Pattersonia sericea	Silky Purple Flag					7
Juncaceae						
Juncus cognatus						1,9
Juncus kraussii	Sea Rush					13
Juncus prismatocarpus						10
Juncus usitatus	Common Rush					10
Lomandraceae						
Lomandra cylindrica						7
Lomandra confertifolia						4,5
Lomandra longifolia	Spiny Mat Rush					1,3,4,5
Lomandra multiflora ssp. *multiflora*						7
Lomandra obliqua	Fish Bones					4,7
Liliaceae						
**Protasparagus aethiopicus*	Asparagus Fern					1,9
Thysanotus sp.	Fringe Lilly					7
Orchidaceae						
Acianthus fornicatus	Pixie Orchid					2,3,4
Caledenia carnea	Pink Fingers					3
Caladenia catenata	White Fingers					3
Calochilus sp.	Bearded Orchid					4
Cryptostylis subulata						7
Cymbidium suave	Snake Flower					1
Dendrobium aemulum	Ironbark Orchid					4

SCIENTIFIC NAME	COMMON NAME	TSC ACT	EPBC ACT	ROTAP	REGIONALLY SIGNIFICANT	VEGETATION COMMUNITY
Dipodium variegatum	Hyacinth Orchid					3
Microtis parviflora	Slender Onion Orchid					4
Petalochilus quaddrifarus						
Prasophyllum brevilabre	Leek Orchid					1
Pterostylis baptistii	King Greenhood					1,4
Pterostylis curta	Blunt Greenhood`					3,4
Pterostylis longifolia	Common Leafy Greenhood					4
Pterostylis nutans	Nodding Greenhood					3,4,6
Philesiaceae						
Eustrephus latifolius	Wombat Berry					1,3,4
Geitonoplesium cymosum	Scrambling Lily					4,7
Philydraceae						
Philydrum lanuginosum	Woolly Frogmouth					10
Phormiaceae						
Dianella caerulea var. *producta*	Blue Flax Lily					1,2,3,4,5,6,7,8
Poaceae						
**Andropogon virginicus*	Whisky Grass					1,3
**Anthoxanthum odoratum*	Sweet Vernal Grass					9
Aristida vagans	Three-awn Speargrass					7
Austrodanthonia sp.	Wallaby Grass					4,7
Austrostipa pubescens	Tall Speargrass					4,7
**Axonopus affinis*	Narrow-leaved Carpet Grass					1,9
Briza maxima	Quaking Grass					9
Briza minor						9
**Bromus catharticus*	Prairie Grass					9
Cynodon dactylon	Common Couch					1
Cymbopogon refractus	Barbed Wire Grass					7
Dichelachne micrantha	Plume Grass					7
Digitaria parviflora	Smallflower Fingergrass					4,6
Echinopogon caespitosus var. *caespitosus*	Hedgehog Grass					4

SCIENTIFIC NAME	COMMON NAME	TSC ACT	EPBC ACT	ROTAP	REGIONALLY SIGNIFICANT	VEGETATION COMMUNITY
Echinopogon ovatus						5
**Ehrhartia erecta*	Panic Veldt Grass					1,9
Entolasia marginata	Bordered Panic					1, 3,4,5,6,7,8
Entolasia stricta	Wiry Panic					5
Eragrostis brownii	Browns Love Grass					
Bromus catharticus	Soft Brome					10
Cynodon dactylon	Common Couch					10
Imperata cylindrica var. *major*	Blady Grass					1,2,3,4,5,6
Ischaemum australe						
Joycea pallida	Red-anthered Wallaby Grass					7
Microlaena stipoides var. stipoides	Weeping Meadow Grass					1, 3,4,8,9
Oplismenus aemulus	Basket Grass					1,3,4
Panicum simile	Two Colour Panic					4,7
Paspalum dilatatum	Paspalum					1,9
Poa labillardieri	Tussock Grass					4
Phragmites australis	Native Reed					1
Sporobolus creber	Slender Rats Tail					9
**Stenotaphrum secundatum*	Buffalo Grass					1,9
Themeda australis	Kangaroo Grass					1,2,3,4,5,7
Restionaceae						
Baloskion tetraphyllum ssp. *meiostachyum*	Plume Rush					1,2
Smilacaceae						
Smilax australis	Smilax					3,4
Smilax glyciphylla	Native Sarsaparilla					3,4,7
Typhaceae						
Typha orientalis	Cumbungi					10
Xanthorrhoeaceae						
Xanthorrhoea macronema						3

SCIENTIFIC NAME	COMMON NAME	TSC ACT	EPBC ACT	ROTAP	REGIONALLY SIGNIFICANT	VEGETATION COMMUNITY
MAGNOLIIDAE (Dicotyledons)						
Acanthaceae						
Brunoniella australis	Blue Trumpet					6
Pseuderanthemum variabile	Pastel Flower					3,4
Aizoaceae						
Carpobrotus glaucescens	Pig Face					12
Tetragonia tetragonioides	New Zealand Spinach					12
Apiaceae						
Centella asiatica						1
**Hydrocotyle bonariensis*	Kurnell Curse					1,9
Hydrocotyle tripartia						
Platysace lanceolata						3
Apocynaceae						
Parsonsia straminea var. *straminea*	Common Silkpod					1,3,4,5,8
Araliaceae						
Polyscias sambucifolia	Elderberry Panax					1,3,4,5,8
Asclepiadaceae						
Marsdenia rostrata	Common Milk Vine					1,3,4,5
Asteraceae						
**Ambrosia artemisiifolia*	Annual Ragweed					9
**Bidens pilosa*	Cobblers Pegs					9
Brachycome sp.						6
Cassinia arcuata	Chinese Scrub					7
**Cirsium vulgare*	Spear Thistle					9
**Conyza bonariensis*	Flax-leaved Fleabane					1,9
**Chrysanthemoides monilifera* ssp. *monilifera*	Bitou Bush					1,2,3,4,5,9
Epaltes australis						4

SCIENTIFIC NAME	COMMON NAME	TSC ACT	EPBC ACT	ROTAP	REGIONALLY SIGNIFICANT	VEGETATION COMMUNITY
Euchiton involucratus	Cudweed					1,9
**Hypochaeris radicata*	Catsear					1,3,5,9
Lagenifera stipitata						6,
**Senecio madagascariensis*	Fireweed					9
Sigesbeckia orientalis	Indian-Weed					
**Sonchus oleraceus*	Common Sow Thistle					10
Vernonia cinerea var. *cinerea*						1,3
Avicenniaceae						
Avicennia marina var. *australasia*	Grey Mangrove					11,13
Bignoniaceae						
Pandorea pandorana	Wonga-wonga Vine					1,2,3,4,5,6,7,8
Campanulaceae						
Wahlenbergia gracillis	Native Bluebell					7
Cassythaceae						
Cassytha glabella	Slender Devil's Twine					7
Casuarinaceae						
Allocasuarina littoralis	Black She-oak					7
Allocasuarina torulosa	Forest Oak					3,4
Casuarina glauca	Swamp She-oak					1,13,14
Celastraceae						
Maytenus silvestris	Narrow-leaf Orange Bark					3,4,6
Chenopodiaceae						
Atriplex cinerea	Grey Saltbush					12
Einadia nutans	Nodding Saltbush					12
Convolvulaceae						
Convolvulus erubescens	Australian Bindweed					1

SCIENTIFIC NAME	COMMON NAME	TSC ACT	EPBC ACT	ROTAP	REGIONALLY SIGNIFICANT	VEGETATION COMMUNITY
Dichondra repens	Kidney Weed					1,3,4,5,6,8
**Ipomoea cairica*	Coastal Morning Glory					1,9
Polymeria calycina	Swamp Bindweed					1
Cunoniaceae						
Callicoma serratifolia	Black Wattle					3
Ceratopetalum gummiferum	New South Wales Christmas Bush					3
Dilleniaceae						
Hibbertia aspera	Rough Guinea Flower					1,4,5,6,7
Hibbertia dentata	Twining Guinea Flower					1
Hibbertia linearis	Showy Guinea Flower					2
Hibbertia riparia						5
Hibbertia scandens	Climbing Guinea Flower					1,3
Dioscoreaceae						
Dioscorea transversa	Native Yam					1
Droseraceae						
Drosera peltata ssp. *peltata*						1
Epacridaceae						
Epacris pulchella	NSW Coral Heath					7
Leucopogon lanceolatus	Lance Beard-heath					1,2,3,4
Leucopogon margarodes						2,3
Leucopogon juniperinus	Bearded Heath					4
Monotoca elliptica	Tree Broom Heath					2,3
Euphorbiaceae						
Breynia oblongifolia	Coffee Bush					1,3,4
Euphorbia peplus	Petty Spurge					9
Glochidion ferdinandi var. *ferdinandi*	Cheese Tree					1,2,3,4,5,6,8
Omalanthus populifolius	Bleeding Heart					1
Phyllanthus hirtellus	Thyme Spurge					4,7

SCIENTIFIC NAME	COMMON NAME	TSC ACT	EPBC ACT	ROTAP	REGIONALLY SIGNIFICANT	VEGETATION COMMUNITY
Poranthera microphylla						3,7
Fabaceae (Faboideae)						
Aotus ericoides	Heath Aotus					2,3
Daviesia ulicifolia	-					1,2,3,5,7
Desmodium rhytidophyllum						3
Desmodium varians						3,5
Dillwynia retorta ssp. *retorta*	Heathy Parrot Pea					2,3,4,5
Glycine clandestina sp. complex	Love Creeper					1,2,3,4,5
Gompholobium latifolium	Giant Wedge Pea					7
Gompholobium pinnatum						7
Hardenbergia violacea	False Sarsaparilla					1,2,3,4,5
Indigofera australis	Austral Indigo					6
Kennedia rubicunda	Dusky Coral Pea					1
**Medicargo polymorpha*	Burr Medic					9
Mirbelia rubiifolia						7
Oxylobium robustum	Tree Shaggy Pea					3
Platylobium formosum	Handsome Flat-pea					1,2,3,6,7
Podalobium ilicifolium	Native Holly					3
Pultenaea daphnoides						6,7
Pultenaea euchila						7
Pultenaea flexilis	Graceful Bush Pea					1,3
Pultenaea paleacea ssp. *paleacea*	Chaffy Bush Pea					8
Pultenaea retusa	Blunt Bush Pea					1,7
Pultenaea scabra var. *scabra*						7
Pultenaea villosa						4
**Trifolium repens*	White Clover					9
Viminaria juncea	Golden Spray					1
Geraniaceae						
Geranium sp.						1,3,4,5
Goodeniaceae						
Goodenia heterophylla	Varible-leaved Goodenia					1,2,3,4,5

SCIENTIFIC NAME	COMMON NAME	TSC ACT	EPBC ACT	ROTAP	REGIONALLY SIGNIFICANT	VEGETATION COMMUNITY
Goodenia ovata	Hop Goodenia					1
Goodenia paniculata	Branched Goodenia					1
Haloragaceae						
Gonocarpus micranthus ssp. *micranthus*						1
Gonocarpus teucrioides	Germander Raspwort					2,3
Lamiaceae						
Plectranthus parviflorus						8
Lauraceae						
**Cinnamomum camphora*	Camphor Laurel					1
Endiandra sieberi	Corkwood					1,2,3
Lobeliaceae						
Lobelia anceps						1
Pratia purpurascens	White Root					1,3,4,5
Loranthaceae						
Dendrophthoe vitellina						6
Malvaceae						
**Sida rhombifolia*	Paddys Lucerne					9
Meliaceae						
Melia azedarach var. *australasica*	White Cedar					3
Synoum glandulosum ssp. *glandulosum*	Scentless Rosewood					3
Toona ciliata	Red Cedar (planted)					9
Menispermaceae						
Sarcopetalum harveyanum	Pearl Vine					4
Stephania japonica var. japonica	Snake Vine					1,3,4,6,8

SCIENTIFIC NAME	COMMON NAME	TSC ACT	EPBC ACT	ROTAP	REGIONALLY SIGNIFICANT	VEGETATION COMMUNITY
Menyanthaceae						
Villarsia exaltata	Yellow-marsh Flower					1
Mimosoideae						
Acacia falcata	Falcate Wattle					6,7
Acacia irrorata ssp. *irrorata*						3,8
Acacia longifolia	Sydney Golden Wattle					1,2,3
Acacia suaveolens	Sweet-scented Wattle					1,2,3,4
Acacia terminalis	Sunshine Wattle					
Acacia ulicifolia	Prickly Moses					1,2,3,4
Moraceae						
Ficus coronata	Sandpaper Fig					8
Ficus macrophylla ssp. *macrophylla*	Moreton Bay Fig					8
Myrtaceae						
Angophora costata	Smooth-barked Apple					1,2,3,7
Callistemon salignus	Willow Bottlebrush					1
Corymbia gummifera	Red Bloodwood					1,2,3,4,5,7
Corymbia maculata	Spotted Gum					6
Eucalyptus acmenoides	White Mahogany					5
Eucalyptus capitellata	Brown Stringybark					7
Eucalyptus globoidea	White Stringybark					7
Eucalyptus microcorys	Tallowwood					3,4,5,6
Eucalyptus paniculata ssp. *paniculata*	Grey Ironbark					6
Eucalyptus pilularis ssp. *pilularis*	Blackbutt					1,2,3,4,5
Eucalyptus piperita	Sydney Peppermint					7
Eucalyptus propinqua	Small-fruited Grey Gum					4,5,6
Eucalyptus resinifera	Red Mahogany					4,5
Eucalyptus robusta	Swamp Mahogany					1
Eucalyptus siderophloia	Northern Grey Ironbark					4,5,6
Eucalyptus umbra	White Mahogany					7
Leptospermum juniperinum	Prickly Tea-tree					1,8
Leptospermum polygalifolium ssp.	Teatree					1,2,3,4,5,6,7

SCIENTIFIC NAME	COMMON NAME	TSC ACT	EPBC ACT	ROTAP	REGIONALLY SIGNIFICANT	VEGETATION COMMUNITY
polygalifolium						
Leptospermum triervium	Paperbark Teatree					7
Melaleuca ericifolia	Swamp Paperbark					1,13
Melaleuca lineariifolia	Snow in Summer					8
Melaleuca nodosa	Ball Honeymyrtle					7
Melaleuca quinquenervia	Broad-leaved Paperbark					1,2
Melaleuca sieberi						8
Melaleuca styphelioides	Prickly-leaved Paperbark					1,8
Syncarpia glomulifera	Turpentine					3,4,5
Mysineaceae						
Mysine variabilis	Muttonwood					5,8
Oleaceae						
Notelea longifolia	Mock Olive					1,4,5
Notelea ovata	Mock Olive					4
Oxalidaceae						
Oxalis corniculata	Creeping Oxalis					4
Oxalis perennans	-					4,5
Phytolaccaceae						
**Phytolacca octandra*	Inkweed					9
Primulaceae						
**Anagallis arvensis* var. *arvensis*	Scarlet Pimpernel					1,9
Pittosporaceae						
Billardiera scandens	Apple Dumplings					1,3,4,5,6,7
Bursaria spinosa ssp. *spinosa*	Blackthorn					4,6
Pittosporum revolutum	Rough-fruit Pittosporum					1,4
Pittosporum undulatum	Sweet Pittosporum					4,5

SCIENTIFIC NAME	COMMON NAME	TSC ACT	EPBC ACT	ROTAP	REGIONALLY SIGNIFICANT	VEGETATION COMMUNITY
Polygalaceae						
Comesperma ericinum	Matchheads					7
**Polygala myrtifolia* var. *myrtifolia*						7
Polygonaceae						
Rumex brownii	Swamp Dock					1
Proteaceae						
Banksia integrifolia	Silver Banksia					2
Banksia oblongifolia						1,7
Banksia serrata	Old Man Banksia					2,3
Banksia spinulosa ssp. *collina*	Hair-pin Banksia					7
Lambertia formosa	Mountain Devil					7
Lomatia silaifolia	Crinkle Bush					4,7
Persoonia linearis	Narrow-leaved Geebung					2,3,4,5
Persoonia levis	Smooth Geebung					7
Plantaginaceae						
Plantago lanceolata	Plantain					9
Ranunculaceae						
Clematis aristida	Old Man's Beard					1,3,4,6
Ranunculus inundatus	River Buttercup					1
Ranunculus lappaceus	Common Buttercup					1
Rhamnaceae						
Alphitonia excelsa	Red Ash					4
Pomaderris lanigera	Woolly Pomaderris					8
Rosaceae						
Rubus parvifolius	Native Raspberry					4,5,8
Rubiaceae						
Morinda jasminoides	Jasmine Morinda					3,8

SCIENTIFIC NAME	COMMON NAME	TSC ACT	EPBC ACT	ROTAP	REGIONALLY SIGNIFICANT	VEGETATION COMMUNITY
Opercularia disphylla	Stink Weed					3
Pomax umbulata	Pomax					1,2,3,7
Rutaceae						
Boronia polygalifolia	Milkwort Boronia					4
Correa reflexa	Correa					2,4,7
Zieria smithii	Sandfly Zieria					3
Sapindaceae						
Cupaniopsis anacardioides	Tuckeroo					3
Dodonea triquetra	Hop Bush					3,4,5,6
Scrophulariaceae						
**Verbascum virgatum*	Twiggy Mullein					9
Veronica plebeia	Speedwell					4
Solanaceae						
Duboisia myoporoides	Corkwood					3
Solanum brownii						4
**Solanum mauritianum*	Wild Tobacco					9
**Solanum nigrum*	Blackberry Nightshade					9
Solanum prinophyllum	Forest Nightshade					4
Stylidiaceae						
Stylidium graminifolium	Trigger Plant					4,5,7
Thymelaeaceae						
Pimelea linifolia	Rice Flower					3,4
Tremandraceae						
Tetratheca thymifolia						3,7
Ulmaceae						
Trema tomentosa var. *viridis*	Poison Peach					8

SCIENTIFIC NAME	COMMON NAME	TSC ACT	EPBC ACT	ROTAP	REGIONALLY SIGNIFICANT	VEGETATION COMMUNITY
Verbenaceae						
Clerodendrum tomentosum	Hairy Clerodendrum					3,4
**Lantana camara*	Lantana					3,4,6
**Verbena bonariensis*	Purple Top					9
**Verbena rigida* var. *rigida*	Veined Verbena					9
Vitaceae						
Cayratia clematidea	Slender Grape					4
Cissus hypoglauca	Native Grape					8
Violaceae						
Viola betonicifolia	Purple Violet					1
Viola hederacea	Native Violet					1

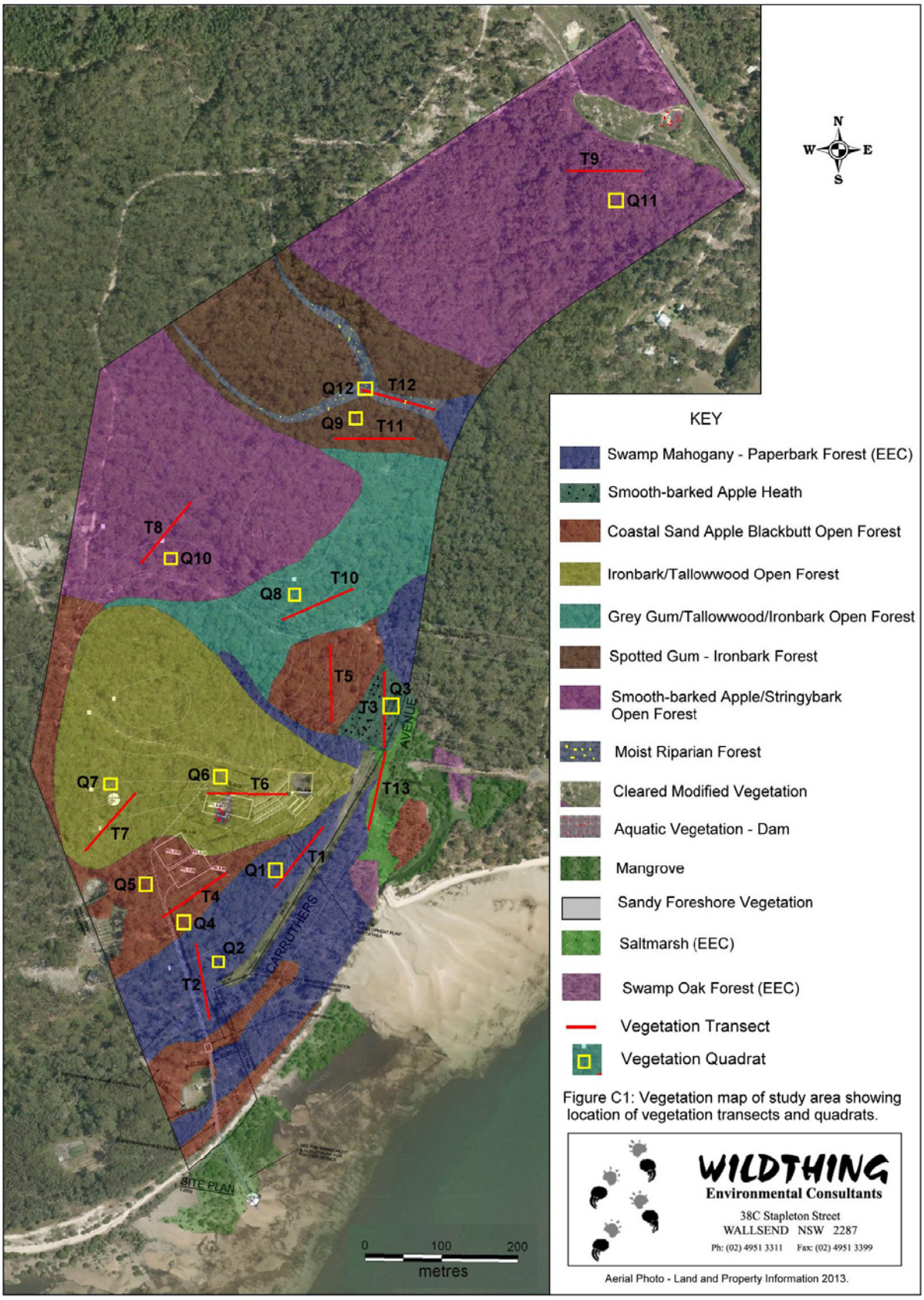
APPENDIX C

VEGETATION TRANSECT & QUADRAT DATA

1.0 TRANSECT METHODOLOGY

Thirteen walking transects were undertaken within the bounds of the site to provide detail on the floral assemblages occurring therein. The location of transects are shown in Figure C1.

Transect 1 - Swamp Mahogany – Paperbark Forest
Transect 2 - Swamp Mahogany – Paperbark Forest
Transect 3 - Smooth-barked Apple Heath
Transect 4 - Coastal Sand Blackbutt Forest
Transect 5 - Coastal Sand Blackbutt Forest
Transect 6 - Ironbark – Tallowwood Open Forest
Transect 7 - Ironbark – Tallowwood Open Forest
Transect 8 – Smooth-barked Apple/Stringybark Open Forest
Transect 9 - Smooth-barked Apple/Stringybark Open Forest
Transect 10 - Small-fruited Grey Gum/Tallowwood/Ironbark Open Forest
Transect 11 - Spotted Gum – Ironbark Open Forest
Transect 12 - Moist Riparian Forest
Transect 13 – Saltmarsh


N
W
E
S
T9
Q11
Q12
T12
Q9
T11
T8
Q10
T10
Q8
T5
Q3
J3
AVENUE
Q7
Q6
T6
T13
T7
Q1
T1
Q5
T4
Q4
Q2
T2
CARRUTHERS
SITE PLAN
0
100
200
metres
KEY
Swamp Mahogany - Paperbark Forest (EEC)
Smooth-barked Apple Heath
Coastal Sand Apple Blackbutt Open Forest
Ironbark/Tallowwood Open Forest
Grey Gum/Tallowwood/Ironbark Open Forest
Spotted Gum - Ironbark Forest
Smooth-barked Apple/Stringybark Open Forest
Moist Riparian Forest
Cleared Modified Vegetation
Aquatic Vegetation - Dam
Mangrove
Sandy Foreshore Vegetation
Saltmarsh (EEC)
Swamp Oak Forest (EEC)
Vegetation Transect
Vegetation Quadrat
Figure C1: Vegetation map of study area showing location of vegetation transects and quadrats.
WILDTHING
Environmental Consultants
38C Stapleton Street
WALLSEND NSW 2287
Ph: (02) 4951 3311 Fax: (02) 4951 3399
Aerial Photo - Land and Property Information 2013.

Transect 1

Community - Swamp Mahogany – Paperbark Forest

*AMG Reference. E – 414260, N – 6383485 to E – 414200, N – 6383390
*Length 100m
*Aspect – Relatively Flat
*Soils – Sandy Loam

*Species Recorded

Gahnia clarkei	Sword Grass
Glochidion ferdinandi var. *ferdinandi*	Cheese Tree
Imperata cylindrica var. *major*	Blady Grass
Pittosporum revolutum	Rough-fruited Pittosporum
Melaleuca quinquenervia	Broad-leaved Paperbark
Lantana camara	Lantana
Breynia oblongifolia	Breynia
Themeda australis	Kangaroo Grass
Eustrephus latifolius	Wombat Berry
Dianella caerulea var. *producta*	Blue Flax Lily
Eucalyptus robusta	Swamp Mahogany
Baloskion tetraphyllum ssp. *meiostachyum*	Plume Rush
Acacia longifolia	Sydney Golden Wattle
**Chrysanthemoides monilifera* ssp. *monilifera*	Bitou Bush
Pteridium esculentum	Bracken
Goodenia heterophylla	Variable-leaved Goodenia
Hardenbergia violacea	False Sarsaparilla
Polyscias sambucifolia	Elderberry Panax
Billardiera scandens	Apple Dumplings
Hibbertia aspera	Rough Guinea Pea
Pultenaea retusa	Blunt Bush Pea
Dichondra repens	Kidney Weed
Leucopogon lanceolatus	Lance Beard Heath
Blechnum indicum	Swamp Water Fern
Villarsia exaltata	Yellow Marsh Flower
Baumea rubiginosa	Soft Twig Rush
Melaleuca lineariifolia	Snow in Summer
Livistona australis	Cabbage Tree Palm
Goodenia ovata	Hop Goodenia
Calochlaena dubia	Soft Bracken Fern
Baumea juncea	
Gonocarpus micranthus ssp. *micranthus*	
Pultenaea flexilis	
Gonocarpus teucrioides	Germander Raspwort
Angophora costata	Smooth-barked Apple

Number of species: 35

Transect 2

Community - Swamp Mahogany – Paperbark Forest

(Within the vicinity of the inlet outlet pipes)
*AMG Reference. E - 414090 N – 6383320 to E - 414110 N - 6383230
*Length 100m
*Aspect – Relatively Flat
*Soils – Sandy Loam

*Species Recorded	
Pteridium esculentum	Bracken
Baloskion tetraphyllum ssp. *meiostachyum*	Plume Rush
Gahnia clarkei	Sword Grass
Calochlaena dubia	Soft Bracken Fern
Pultenaea flexilis	
Eucalyptus robusta	Swamp Mahogany
Blechnum indicum	Swamp Water Fern
Hibbertia scandens	Climbing Guinea Flower
Imperata cylindrica var. *major*	Blady Grass
Livistona australis	Cabbage Tree Palm
Lobelia anceps	
Dianella caerulea var. *producta*	Blue Flax Lily
Hardenbergia violacea	False Sarsaparilla
Villarsia exaltata	Yellow Marsh Flower
Acacia longifolia	Sydney Golden Wattle
Goodenia heterophylla	Variable-leaved Goodenia
**Axonopus affinis*	Narrow-leaved Carpet Grass
Hydrocotyle tripartia	
Baumea rubiginosa	Soft Twig Rush
Viminaria juncea	Golden Spray
**Andropogon virginicus*	Whisky Grass
Goodenia paniculata	Branched Goodenia
Breynia oblongifolia	Breynia
Kennedia rubicunda	Dusky Coral Pea
Vernonia cinerea var. *cinerea*	
Glochidion ferdinandi var. *ferdinandi*	Cheese Tree
Cyperus sp.	

Number of species: 27

Transect 3

Community – Smooth-barked Apple Heath Open Forest

*AMG Reference. E - 414337 N - 6383673
*Aspect – Relatively Flat
*Soils – Sandy

*Species Recorded

Baloskion tetraphyllum ssp. *meiostachyum*	
Pomax umbulata	Pomax
Acacia ulicifolia	Prickly Moses
Correa reflexa	
Dodonaea triquetra	Hop Bush
Acacia suaveolens	Sweet-scented Wattle
Pteridium esculentum	Bracken
Gonocarpus teucrioides	Germander Raspwort
Leucopogon lanceolatus	Lance Beard Heath
Hardenbergia violacea	False Sarsaparilla
Eucalyptus pilularis	Blackbutt
Angophora costata	Smooth-barked Apple
Dillwynia retorta ssp. *retorta*	Heathy Parrot Pea
Breynia oblongifolia	Breynia
Leucopogon margarodes	
Lomandra longifolia	Spiny Mat Rush
Dianella caerulea var. *producta*	Blue Flax Lily
Aotus ericoides	Aotus
Pandorea pandorana	Wonga Wonga Vine
Hibbertia linearis	Showy Guinea Flower
Monotoca elliptica	Tree Broom Heath
Tetratheca thymifolia	
Endiandra sieberi	Corkwood
Platylobium formosum	Handsome Flat-pea
Pultenaea flexilis	
Callicoma serratifolia	Black Wattle
Persoonia linearis	Narrow-leaved Geebung
Banksia integrifolia	Silver Banksia

Number of species: 28

Transect 4

Community – Coastal Sand Blackbutt Forest

*AMG Reference. E - 414050 N – 6383360 to E - 414130 N – 6383410
*Aspect – Level ground
*Soils – Sandy

*Species Recorded

Themeda australis	Kangaroo Grass
Hibbertia linearis	Showy Guinea Flower
Leucopogon margarodes	
Podalobium ilicifolium	Native Holly
Smilax australis	Smilax
Imperata cylindrica var. *major*	Blady Grass
Pteridium esculentum	Bracken
Dianella caerulea var. *producta*	Blue Flax Lily
Pomax umbulata	Pomax
Dodonaea triquetra	Hop Bush
Pandorea pandorana	Wonga Wonga Vine
Dipodium variegatum	Hyacinth Orchid
Breynia oblongifolia	Breynia
Lomandra longifolia	Spiny Mat Rush
Hibbertia scandens	Climbing Guinea Flower
Livistona australis	Cabbage Tree Palm
Angophora costata	Smooth-barked Apple
Smilax glyciphylla	Native Sarsaparilla
Eucalyptus pilularis	Blackbutt
Endiandra sieberi	Corkwood
Hardenbergia violacea	False Sarsaparilla
Acacia suaveolens	Sweet-scented Wattle
Leucopogon lanceolatus	Lance Beard Heath
Gonocarpus teucrioides	Germander Raspwort
Desmodium rhytidophyllum	
Panicum simile	Two Colour Panic
Corymbia gummifera	Red Bloodwood
Banksia serrata	Old Man Banksia
Xanthorrhoea macronema	
Calochlaena dubia	Soft Bracken Fern
Desmodium varians	
Oxylobium robustum	Tree Shaggy Pea
**Andropogon virginicus*	Whisky Grass
**Axonopus affinis*	Narrow-leaved Carpet Grass
Aotus ericoides	Heath Aotus
Monotoca elliptica	Tree Broom Heath

Number of species: 36

Transect 5

Community – Coastal Sand Blackbutt Forest

*AMG Reference. E - 414271 N – 6383711 to E - 414268 N – 6383612
*Aspect – Slight Southerly
*Soils – Sandy

*Species Recorded

Eucalyptus microcorys	Tallowwood
Corymbia gummifera	Red Bloodwood
Themeda australis	Kangaroo Grass
Entolasia marginata	Bordered Panic
Panicum simile	Two Colour Panic
Dodonaea triquetra	Hop Bush
Allocasuarina torulosa	Forest Oak
Eustrephus latifolius	Wombat Berry
Notelea longifolia	Mock Olive
Persoonia linearis	Narrow-leaved Geebung
Pteridium esculentum	Bracken
Endiandra sieberi	Corkwood
Platylobium formosum	Handsome Flat Pea
Livistona australis	Cabbage Tree Palm
Billardiera scandens	Apple Dumplings
Eucalyptus pilularis	Blackbutt
Pittosporum revolutum	Rough-fruit Pittosporum
Monotoca elliptica	Tree Broom Heath
Sarcopetalum harveyanum	Pearl vine
Leucopogon lanceolatus	Lance Beard Heath
Calochlaena dubia	Soft Bracken Fern
Lomandra longifolia	Spiny Mat Rush
Leucopogon margarodes	
Acacia suaveolens	Sweet-scented Wattle
**Chrysanthemoides monilifera* ssp. *monilifera*	Bitou Bush
Glochidion ferdinandi var. *ferdinandi*	Cheese Tree
Acacia ulicifolia	Prickly Moses
Pandorea pandorana	Wonga Wonga Vine
Breynia oblongifolia	Breynia

Number of species: 29

Transect 6

Community – Ironbark – Tallowwood Open Forest

*AMG Reference. E - 414210 N – 6383510 to E - 414110 N – 6383518
*Aspect – Southerly
*Soils – Sandy loam.

*Species Recorded

Imperata cylindrica var. *major*	Blady Grass
Dodonaea triquetra	Hop Bush
Billardiera scandens	Apple Dumplings
Entolasia stricta	Wiry Panic
Allocasuarina torulosa	Forest Oak
Persoonia linearis	Narrow-leaved Geebung
Monotoca elliptica	Tree Broom Heath
Gahnia aspera	
Leucopogon margarodes	
Leptospermum laterale	Sword Sedge
Lomandra longifolia	Spiny Mat Rush
Poa labillardieri	Tussock Grass
Hibbertia aspera	Rough Guinea Pea
Dichondra repens	Kidney Weed
Leucopogon lanceolatus	Lance Beard Heath
Pultenaea retusa	Blunt Bush Pea
Breynia oblongifolia	Breynia
Dianella caerulea var. *producta*	Blue Flax Lily
Eucalyptus siderophloia	Ironbark
Vernonia cinerea var. *cinerea*	
Pseuderanthemum variabile	Pastel Flower
Sarcopetalum harveyanum	Pearl Vine
Digitaria parviflora	Small-flower Fingergrass
Desmodium varians	
Pandorea pandorana	Wonga Wonga Vine
Themeda australis	Kangaroo Grass
Caesia parviflora var. *parviflora*	
Eucalyptus microcorys	Tallowwood
Mysine variabilis	Muttonwood
Pultenaea villosa	
Hibbertia scandens	Climbing Guinea Flower
Notelea longifolia	Mock Olive
Lantana camara	Lantana
Cheilanthes sieberi ssp. *sieberi*	Mulga Fern
Geitonoplesium cymosum	Scrambling Lily
Glycine clandestina sp. complex	Love Creeper
Echinopogon ovatus	
Cymbidium suave	Snake Flower
Eustrephus latifolius	Wombat Berry
Leucopogon juniperinus	Bearded Heath
Hibbertia riparia	
Alphitonia excelsa	Red Ash
Oplismenus aemulus	Basket Grass

Number of species: 43

Transect 7

Community – Ironbark – Tallowwood Open Forest

*AMG Reference. E - 413950 N – 6383440 to E - 414011 N – 6383513
*Aspect – Southerly
*Soils – Sandy loam

*Species Recorded	
Eucalyptus umbra	White Mahogany
Lepidosperma laterale	Sword Grass
**Lantana camara*	Lantana
Pandorea pandorana	Wonga Wonga Vine
Imperata cylindrica var. major	Blady Grass
Dodonaea triquetra	Hop Bush
Notelaea longifolia	Mock Olive
Bursaria spinosa ssp. *spinosa*	Blackthorn
Billardiera scandens	Apple Dumplings
Pseuderanthemum variabile	Pastel Flower
Gahnia aspera	
Breynia oblongifolia	Breynia
Allocasuarina torulosa	Forest Oak
Goodenia heterophylla	Variable-leaved Goodenia
Geitonoplesium cymosum	Scrambling Lily
Zieria smithii	Sandfly Zieria
Lomandra longifolia	Spiny Mat Rush
Themeda australis	Kangaroo Grass
Desmodium varians	
Doodia aspera	Rasp Fern
Xanthorrhoea macronema	
Eucalyptus siderophloia	Ironbark
Entolasia marginata	
Persoonia linearis	Narrow-leaved Geebung
Cheilanthes sieberi ssp. *sieberi*	Mulga Fern
Cymbopogon refractus	Barbed Wire Grass
Dichondra repens	Kidney Weed
**Hypochaeris radicata*	Catsear
Adiantum aethiopicum	Common Maidenhair Fern
Echinopogon ovatus	
Desmodium rhytidophyllum	
Rubus parvifolius	Native Raspberry
Dianella caerulea var. *producta*	
Pittosporum undulatum	Sweet Pittosporum
Panicum simile	Two Colour Panic
Marsdenia rostrata	Common Milk Vine
Lagenifera stipitata	
Caesia parviflora var. *parviflora*	

Number of species: 38

Transect 8

Community – Smooth-barked Apple/Stringybark Open Forest

*AMG Reference. E - 414021 N – 6383811 to 414080 N – 6383892
*Aspect – Southerly
*Soils – Sandy loam.

*Species Recorded

Dodonaea triquetra	Hop Bush
Goodenia heterophylla	Variable-leaved Goodenia
Pultenaea villosa	
Lomandra longifolia	Spiny Mat Rush
Daviesia ulicifolia	
Pultenaea paleacea ssp. *paleacea*	Chaffy Bush Pea
Epacris pulchella	NSW Coral Heath
Pultenaea euchila	
Themeda australis	Kangaroo Grass
Billardiera scandens	Apple Dumplings
Entolasia stricta	Wiry Panic
Polyscias sambucifolia	Elderberry Panax
Hibbertia aspera	Rough Guinea Pea
Lomandra obliqua	Fishbones
Angophora costata	Smooth-barked Apple
Corymbia gummifera	Red Bloodwood
Ptilothrix deusta	
Lepidosperma gunnii	
Phyllanthus hirtellus	Thyme Spurge
Eucalyptus resinifera	Red Mahogany
Allocasuarina littoralis	Black She-oak
Pattersonia sericea	Silky Purple Flag
Austrostipa pubescens	Tall Speargrass
Panicum simile	Two Colour Panic
Platylobium formosum	Handsome Flat Pea
Lindsaea linearis	Screw Fern
Eucalyptus pilularis	Blackbutt
Smilax glyciphylla	Native Sarsaparilla
Correa reflexa	Correa
Pomax umbulata	Pomax
Dianella caerulea var. *producta*	Blue Flax Lily

Number of species: 31

Transect 9

Community – Smooth-barked Apple/Stringybark Open Forest

*AMG Reference. E – 414658, N – 6384320 to E – 414570,N – 6384321
*Date – 15/03/11
*Aspect – Southerly
*Soils – Sandy loam.

*Species Recorded

Dodonaea triquetra	Hop Bush
Imperata cylindrica var. *major*	Blady Grass
Epacris pulchella	NSW Coral Heath
Eucalyptus umbra	
Hardenbergia violacea	False Sarsaparilla
Dillwynia retorta ssp. *retorta*	Heathy Parrot Pea
Pultenaea paleacea ssp. *paleacea*	Chaffy Bush Pea
Pultenaea villosa	Hairy Bush Pea
Xanthorrhoea macronema	
Persoonia linearis	Narrow-leaved Geebung
Dianella caerulea var. *producta*	Blue Flax Lily
Angophora costata	Smooth-barked Apple
Panicum simile	Two Colour Panic
Austrodanthonia sp.	
Joycea pallida	Red-anthered Wallaby Grass
Themeda australis	Kangaroo Grass
Hibbertia aspera	Rough Guinea Pea
Pultenaea euchila	
Lomandra obliqua	Fishbones
Entolasia stricta	Wiry Panic
Goodenia heterophylla	Variable-leaved Goodenia
Pultenaea villosa	
Pomax umbulata	Pomax

Number of species: 23

Transect 10

Community – Small-fruited Grey Gum/Tallowwood/Ironbark Open Forest

*AMG Reference. E - 414201 N – 6383740 to 414302 N - 6383780
*Length – 100m
*Aspect – Southerly
*Soils – Sandy loam

*Species Recorded

Dodonaea triquetra	Hop Bush
Pultenaea daphnoides	
Dianella caerulea var. *producta*	Blue Flax Lily
Allocasuarina littoralis	Black She-oak
Acacia falcata	Falcate Wattle
Entolasia marginata	Bordered Panic
Imperata cylindrica var. *major*	Blady Grass
Lomandra obliqua	Fishbones
Leptospermum laterale	Sword Sedge
Themeda australis	Kangaroo Grass
Eucalyptus propinqua	Small-fruited Grey Gum
Eustrephus latifolius	Wombat Berry
Entolasia stricta	Wiry Panic
Glycine clandestina sp. complex	Love Creeper
Lomandra longifolia	Spiny Mat Rush
Angophora costata	Smooth-barked Apple
Eucalyptus microcorys	Tallowwood
Pomax umbulata	Pomax
Breynia oblongifolia	Breynia
Persoonia linearis	Narrow-leaved Geebung
Monotoca elliptica	Tree Broom Heath
Pultenaea villosa	
Adiantum aethiopicum	Common Maidenhair Fern
Pandorea pandorana	Wonga Wonga Vine
Poa labillardieri	Tussock Grass
Hibbertia aspera	Rough Guinea Flower
Indigofera australis	Austral indigo

Number of species: 27

Transect 11

Community – Spotted Gum-Ironbark Open Forest

*AMG Reference. E - 414258 N – 6383970 to E - 414372 N – 6383981
*Length – 100m
*Aspect – Northerly
*Soils – Gravelly loam

*Species Recorded

Dodonaea triquetra	Hop Bush
Eucalyptus maculata	Spotted Gum
Pultenaea villosa	Hairy Bush Pea
Imperata cylindrica var. *major*	Blady Grass
Panicum simile	Two Colour Panic
Pultenaea euchila	
Leptospermum laterale	Sword Sedge
Allocasuarina torulosa	Forest Oak
Poa labillardieri	Tussock Grass
Eucalyptus paniculata	Grey Ironbark
Eustrephus latifolius	Wombat Berry
Pomax umbulata	Pomax
Eucalyptus microcorys	Tallowwood
Pultenaea daphnoides	Broad-leaved Bush Pea
Persoonia linearis	Narrow-leaved Geebung
Glycine clandestina sp. complex	Love Creeper
Hibbertia aspera	Rough Guinea Flower
Eucalyptus propinqua	Small-fruited Grey Gum
Kennedia rubicunda	Kennedia
Entolasia marginata	Bordered Panic
Dianella caerulea var. *producta*	Blue Flax Lily
Lomandra longifolia	Spiny Mat Rush
Pandorea pandorana	Wonga Wonga Vine
Breynia oblongifolia	Breynia

Number of species: 24

Transect 12

Community – Moist Riparian Forest

*AMG Reference. E - 414300 N – 6384040 to E - 414400 N – 6384010
*Length – 100m
*Aspect – within gully
*Soils – Sandy loam

*Species Recorded

Gahnia sieberiana	Sword Grass
Lomandra longifolia	Spiny Mat Rush
Melaleuca linearifolia	Snow in Summer
Lepidosperma elatius	
Adiantum aethiopicum	Common Maidenhair Fern
Callistemon salignus	Willow Bottlebrush
Blechnum cartilagineum	Gristle Fern
Entolasia marginata	Bordered Panic
Eustrephus latifolius	Wombat Berry
Glochidion ferdinandi var. *ferdinandi*	Cheese Tree
Leptospermum polygalifolium ssp. *polygalifolium*	Tea Tree
Dodonaea triquetra	Hop Bush
Melaleuca styphelioides	Prickly-leaved Paperbark
Livistona australis	Cabbage Tree Gum
Platycerium bifurcatum	Elk Horn
Sarcopetalum harveyanum	Pearl Vine
**Lantana camara*	Lantana
Dioscorea transversa	Native Yam
Cayratia clematidea	Slender Grape
Notelea longifolia	Mock Olive
Parsonsia straminea var. *straminea*	Common Silkpod
Mysine variabilis	Muttonwood
Doodea aspera	Rasp Fern
Breynia oblongifolia	Breynia
Pandorea pandorana	Wonga Wonga Vine

Number of species: 25

Transect 13

Community – Saltmarsh (Within Pig Station Creek)

*AMG Reference. E – 414285, N – 6384042 to E – 414285, N – 6384043
*Length – 100m
*Soils – Sandy loam (Salty)

*Species Recorded

Juncus kraussii	Sea Rush
Baumea juncea	
Phragmites australis	Australian Reed
Sporobolus virginicus	Sand Couch
Avicennia marina ssp. *australasica*	Grey Mangrove

Number of species: 5

2.0 QUADRAT METHODOLOGY

Thirteen quadrat-based vegetation surveys were undertaken within the bounds of the site to provide additional detail on the flora assemblages present (Figure A1). The quadrats were 20 × 20m in area. All species observed within the quadrat were recorded, with the dominant species in each stratum being duly noted. A modified Braun-Blanquet 6-point scale (Braun-Blanquet 1927, with selected modifications sourced from Poore 1955 and Austin *et al*. 2000) was used to estimate cover-abundances of all plant species within each quadrat. The cover-abundance categories are shown in Table A1.

Table A1: Modified Braun-Blanquet Crown Cover-abundance Scale

Class	Cover - Abundance	Notes
1	Few individuals (less than 5% cover)	Herbs, sedges and grasses: < 5 individuals Shrubs and small trees: 5 or more individuals
2	Many individuals (less than 5% cover)	Herbs, sedges and grasses: 5 or more individuals Medium-large over hanging tree
3	5 – < 20% cover	-
4	20 – < 50% cover	-
5	50 – < 75% cover	-
6	75 – 100% cover	-

Quadrat 1 - Swamp Mahogany – Paperbark Forest
Quadrat 2 - Swamp Mahogany – Paperbark Forest
Quadrat 3 - Smooth-barked Apple Heath
Quadrat 4 - Coastal Sand Blackbutt Forest
Quadrat 5 - Coastal Sand Blackbutt Forest
Quadrat 6 – Ironbark/Tallowwood Open Forest
Quadrat 7 – Ironbark/Tallowwood Open Forest
Quadrat 8 - Grey Gum/Tallowwood/Ironbark
Quadrat 9 – Spotted Gum – Ironbark Open Forest
Quadrat 10 - Smooth-barked Apple/Stringybark Open Forest
Quadrat 11 - Smooth-barked Apple/Stringybark Open Forest
Quadrat 12 - Moist Riparian Forest

Quadrat 1

***Community – Swamp Mahogany – Paperbark Forest**

*Aspect – flat
*Location North-east corner - E – 414201, N – 6383430

*Soils – sandy/silt

*Structural Components –

Canopy	(to 35m)	%coverage = 45%
Mid Layer	(to 5m)	%coverage = 20%
Shrub Layer	(to 2m)	%coverage = 10%
Ground Cover	(to 1m)	%coverage = 80%

*Species Recorded –

Canopy Dominants		
Eucalyptus robusta	Swamp Mahogany	2
Melaleuca quinquenervia	Broad-leaved Paperbark	2
Mid Layer Dominants		
Livistona australis	Cabbage Tree Palm	1
Shrub Layer Dominants		
Acacia longifolia	Sydney Golden Wattle	2
Glochidion ferdinandi	Cheese Tree	
Ground Cover Dominants		
Pteridium esculentum	Bracken Fern	3
Gahnia clarkei	Sword Grass	3
Additional Species Recorded		
Lomandra longifolia	Spiny Mat Rush	2
Dianella caerulea var. *producta*	Blue Flax Lily	2
Imperata cylindrica var. *major*	Blady Grass	2
Baloskion tetraphyllum ssp. *meiostachyum*		*2*
Calochlaena dubia	False Bracken Fern	1
Blechnum indicum	Blechnum	1

Quadrat 2

***Community – Swamp Mahogany – Paperbark Forest**

*Location North-east corner E-414049 N - 6383306

*Aspect – flat
*Soils – sandy/silt

*Structural Components –

Canopy	(to 30m)	%coverage = 35%
Mid Layer	(to 10m)	%coverage = 5%
Shrub Layer	(to 3m)	%coverage = 20%
Ground Cover	(to 1.5m)	%coverage = 70%

*Species Recorded –

Canopy Dominants		
Eucalyptus robusta	Swamp Mahogany	4
Mid Layer Dominants		
Melaleuca quinquenervia	Broad-leaved Paperbark	1
Glochidion ferdinandi	Cheese Tree	2
Shrub Layer Dominants		
Acacia longifolia	Sydney Golden Wattle	1
Ground Cover Dominants		
Baloskion tetraphyllum ssp. *meiostachyum*		4
Gahnia clarkei	Sword Grass	3
Pteridium esculentum	Bracken Fern	4
Additional Species Recorded		
Livistona australis	Cabbage Tree Palm	1
Blechnum indicum	Blechnum	3
Imperata cylindrica var. *major*	Blady Grass	2
**Chrysanthemoides monilifera* ssp. *monilifera*	Bitou Bush	1
Parsonsia straminea var. *straminea*	Common Silkpod	1
Calochlaena dubia	False Bracken Fern	3
Pomax umbulata	Pomax	2
Entolasia marginata	Bordered Panic	1
Hibbertia scandens	Climbing Guinea Flower	1
Pratia purpurascens	White Root	1
Lomandra longifolia	Spiny Mat Rush	1
Dianella caerulea var. *producta*	Blue Flax Lily	1

Quadrat 3

***Community – Smooth-barked Apple Heath Forest**

*AMG Reference. E - 414360 N - 6383640
*Aspect – flat
*Soils – sandy

*Structural Components –

Canopy	(to 35m)	%coverage = 45%
Mid Layer	(to 5m)	%coverage = 20%
Shrub Layer	(to 2m)	%coverage = 10%
Ground Cover	(to 1m)	%coverage = 80%

*Species Recorded –

Canopy Dominants		
Angophora costata	Smooth-barked Apple	3
Eucalyptus pilularis	Blackbutt	2
Mid Layer Dominants		
Banksia serrata	Old Man Banksia	1
Shrub Layer Dominants		
Acacia longifolia	Sydney Golden Wattle	2
Acacia suaveolens	Sweet-scented Wattle	1
Ground Cover Dominants		
Baloskion tetraphyllum ssp. *meiostachyum*		4
Pteridium esculentum	Bracken Fern	4
Additional Species Recorded		
Lomandra longifolia	Spiny Mat Rush	2
Dianella caerulea var. *producta*	Blue Flax Lily	2
Pomax umbulata	Pomax	2
Gonocarpus tetragynus	Raspwort	1
Glycine clandestina	Glycine	1
Correa reflexa	Correa	1
Platylobium formosum	Handsome Flat Pea	1
Endiandra sieberi	Corkwood	1
Acacia ulicifolia	Prickly Moses	1
Hibbertia linearis		1
Dodonaea triquetra	Hop Bush	1

Quadrat 4

***Community – Coastal Sand Blackbutt Forest**

*AMG Reference. E - 413090 N - 6383360
*Aspect – Relatively Flat
*Soils – Sandy

*Structural Components –

Canopy	(to 30m)	%coverage = 40%
Mid Layer	(to 10m)	%coverage = 5%
Shrub Layer	(to 3m)	%coverage = 10%
Ground Cover	(to 1m)	%coverage = 70%

*Species Recorded –

Canopy Dominants		
Eucalyptus pilularis	Blackbutt	3
Corymbia gummifera	Red Bloodwood	1
Mid Layer Dominants		
Banksia serrata	Old Man Banksia	1
Shrub Layer Dominants		
Oxylobium arborescens		1
1		
Ground Cover Dominants		
Imperata cylindrica var. *major*	Blady Grass	2
Pteridium esculentum	Bracken	4
Lomandra longifolia	Spiny Mat Rush	3
Themeda triandra	Kangaroo Grass	2
Additional Species Recorded		
Leucopogon margarodes		1
Gonocarpus teucrioides	Germander Raspwort	1
Glycine clandestina	Love Creeper	1
Breynia oblongifolia	Breynia	1
Acacia longifolia	Sydney Golden Wattle	1
Dianella caerulea var. *producta*	Blue Flax Lily	1
Dodonaea triquetra	Hop Bush	1
Pomax umbulata	Pomax	2
Calochlaena dubia	Soft Bracken Fern	1
Hardenbergia violacea	False Sarsaparilla	1

Quadrat 5 -

***Community – Coastal Sand Blackbutt Forest**

*Date – 23/02/11
*AMG Reference. E - 414041 N - 6383413
*Aspect – Relatively Flat
*Litter
*Soils – Sandy

*Structural Components –

Canopy	(to 35m)	%coverage = 60%
Mid Layer	(to 15m)	%coverage = 25%
Shrub Layer	(to 3m)	%coverage = 5%
Ground Cover	(to 1m)	%coverage = 20%

*Species Recorded –

Canopy Dominants		
Eucalyptus pilularis	Blackbutt	4
Mid Layer Dominants		
Endiandra sieberi	Corkwood	3
Shrub Layer Dominants		
Dodonaea triquetra	Hop Bush	2
Ground Cover Dominants		
Imperata cylindrica var. *major*	Blady Grass	3
Pteridium esculentum	Bracken	3
Additional Species Recorded		
Lomandra longifolia	Spiny Mat Rush	1
Themeda australis	Kangaroo Grass	2
Calochlaena dubia	Soft Bracken Fern	2
Leucopogon lanceolatus	Lance Beard Heath	1
Notelea longifolia	Mock Olive	2
Pomax umbulata	Pomax	3
Leucopogon margarodes		2
Dianella caerulea var. *producta*	Blue Flax Lily	2
Breynia oblongifolia	Breynia	2
Pandorea pandorana	Wonga Wonga Vine	2
Acacia longifolia	Sydney Golden Wattle	1
Smilax glyciphylla	Native Sarsaparilla	1
Platylobium formosum	Handsome Flat Pea	2
Acacia ulicifolia	Prickly Moses	2
Banksia serrata	Old Man Banksia	1
Smilax australis	Smilax	1
Lomandra longifolia	Spiny Mat Rush	1
Hibbertia scandens	Climbing Guinea Flower	1
Desmodium varians		1
Gonocarpus teucrioides	Germander Raspwort	2
Hibbertia linearis	Showy Guinea Flower	1
Corymbia gummifera	Red Bloodwood	1
Myrsine variabilis	Muttonwood	1
Glycine clandestina	Love Creeper	1
Xanthorrhoea macronema		
Acacia suaveolens	Sweet-scented Wattle	1

Quadrat 6

***Community – Ironbark/Tallowwood Open Forest**

*AMG Reference. E - 414130 N - 6383540
*Date – 24/02/11
*Aspect – Relatively Flat
*Soils – Sandy loam

*Structural Components –

Canopy	(to 30m)	%coverage = 45%
Mid Layer	(to 10m)	%coverage = 5%
Shrub Layer	(to 3m)	%coverage = 20%
Ground Cover	(to 1m)	%coverage = 50%

*Species Recorded –

Canopy Dominants		
Eucalyptus microcorys	Tallowwood	3
Corymbia gummifera	Red Bloodwood	1
Mid Layer Dominants		
Allocasuarina torulosa	Forest Oak	3
Shrub Layer Dominants		
Dodonaea triquetra	Hop Bush	3
Ground Cover Dominants		
Imperata cylindrica var. *major*	Blady Grass	3
Themeda australis	Kangaroo Grass	3
Additional Species Recorded		
Pandorea pandorana	Wonga Wonga Vine	2
Lepidosperma laterale	Sword Rush	2
Dichondra repens	Kidney Weed	2
**Lantana camara*	Lantana	1
Dianella caerulea var. *producta*	Blue Flax Lily	2
Livistona australis	Cabbage Tree Palm	1
Pultenaea villosa		2
Hibbertia riparia		2
Xanthorrhoea macronema		3
Goodenia heterophylla	Variable-leaved Goodenia	2
Notelea longifolia	Mock Olive	2
Polyscias sambucifolia	Elderberry Panax	2
Desmodium rhytidophyllum		1
Desmodium varians		1
Glycine clandestina	Glycine	1
Lomandra confertifolia		1
Breynia oblongifolia	Breynia	1
Leucopogon lanceolatus	Lance Beard Heath	1
Pomax umbulata	Pomax	2
Daviesia ulicifolia		1
Billardiera scandens	Apple Dumplings	1
Hibbertia linearis	Showy Guinea Flower	1
Geitonoplesium cymosum	Scrambling Lily	1
Entolasia marginata	Bordered Panic	2
Phyllanthus hirtellus	Thyme Spurge	1
Panicum simile	Two Colour Panic	2
Solanum prinophyllum	Forest Nightshade	1

Lomandra multiflora ssp. *multiflora*		1
Themeda australis	Kangaroo Grass	3
Pseuderanthemum variabile	Pastel Flower	2
Austrodanthonia sp.		1
Melaleuca styphelioides	Prickly-leaved Tea Tree	1
Persoonia linearis	Narrow-leaved Geebung	1
Pteridium esculentum	Bracken Fern	1
Alphitonia excelsa	Red Ash	1
Brachycome sp.		1
Gahnia aspera		1
Eustrephus latifolius	Wombat Berry	1
Pultenaea retusa		1

Quadrat 7

***Community – Ironbark/Tallowwood Open Forest**

*AMG Reference North-east corner . E - 414990 N - 6383530
*Aspect – Southerly
*Soils – Course Sediment

*Structural Components –

Canopy	(to 35m)	%coverage = 45%
Mid Layer	(to 15m)	%coverage = 20%
Shrub Layer	(to 2m)	%coverage = 5%
Ground Cover	(to 1m)	%coverage = 25%

*Species Recorded –

Canopy Dominants		
Eucalyptus siderophloia	Ironbark	4
Eucalyptus microcorys	Tallowwood	1
Mid Layer Dominants		
Allocasuarina torulosa	Forest Oak	3
Shrub Layer Dominants		
Juvenile Eucalypts		1
**Lantana camara*	Lantana	1
Ground Cover Dominants		
Lomandra longifolia	Spiny Mat Rush	2
Dianella caerulea var. *producta*	Blue Flax Lily	2
Imperata cylindrica var. *major*	Blady Grass	2
Additional Species Recorded		
Acianthus fornicatus	Pixie Orchid	1
Oplismenus aemulus	Basket Grass	1
Gahnia aspera	Rough Guinea Flower	1
Eustrephus latifolius	Wombat Berry	1
Pterostylis nutans	Nodding Greenhood	1
Notelaea longifolia	Mock Olive	1
Dodonaea triquetra	Common Hop Bush	1
Breynia oblongifolia	Breynia	1
Goodenia heterophylla	Variable-leaved Goodenia	1

Quadrat 8

***Community – Small-fruited Grey Gum/Tallowwood/Ironbark Open Forest**

*GDA-94 Reference. E - 414231 N - 6383780

*Aspect – Southerly
*Soils – Course Sediment

*Structural Components –

Canopy	(to 20m)	%coverage = 35%
Shrub Layer	(to 2m)	%coverage = 10%
Ground Cover	(to 1m)	%coverage = 60%

*Species Recorded –

Canopy Dominants		
Eucalyptus propinqua	Small-fruited Grey Gum	3
Eucalyptus siderophloia	Ironbark	1
Shrub Layer Dominants		
Persoonia linearis	Narrow-leaved Geebung	2
Pultenaea villosa		*2*
Ground Cover Dominants		
Poa labillardieri	Tussock Grass	2
Lomandra longifolia	Spiny Mat Rush	2
Additional Species Recorded		
Dianella caerulea var. *producta*	Blue Flax Lily	1
Hardenbergia violacea	Hardenbergia	1
Pomax umbulata	Pomax	1
Goodenia heterophylla		1

Quadrat 9

***Community – Spotted Gum - Ironbark**

*GDA-94 Reference. E - 414310 N - 6383011
*Aspect – Southerly

*Structural Components –

Canopy	(to 25m)	%coverage = 35%
Mid Layer	(to 10m)	%coverage = 5%
Shrub Layer	(to 2m)	%coverage = 5%
Ground Cover	(to 1m)	%coverage = 70%

*Species Recorded –

Canopy Dominants

Corymbia maculata	Spotted Gum	3
Eucalyptus microcorys	Tallowwood	1

Mid Layer Dominants

Juvenile Eucalypts

Shrub Layer Dominants

Persoonia linearis	Narrow-leaved Geebung	2
Pultenaea villosa		3
Dodonaea triquetra	Common Hop Bush	3

Ground Cover Dominants

Lomandra longifolia	Spiny Mat Rush	2
Dianella caerulea var. *producta*	Blue Flax Lily	2
Imperata cylindrica var. *major*	Blady Grass	2

Additional Species Recorded

Goodenia heterophylla	Variable-leaved Goodenia	1

Quadrat 10

***Community – Smooth-barked Apple/Stringybark Open Forest**

*GDA-94 Reference. E - 414070 N - 6383830
*Aspect – Southerly
*Soils – Course Sediment

*Structural Components –

Canopy	(to 15m)	%coverage = 30%
Shrub Layer	(to 2m)	%coverage = 30%
Ground Cover	(to 1m)	%coverage = 60%

*Species Recorded –

Canopy Dominants

Eucalyptus agglomerata	Stringybark	3
Angophora costata	Smooth-barked Apple	2

Shrub Layer Dominants

Pultenaea euchila		
Dodonaea triquetra	Common Hop Bush	3

Ground Cover Dominants

Joycea pallida	Joycea	2

Additional Species Recorded

Goodenia heterophylla	Variable-leaved Goodenia	1
Pomax umbulata	Pomax	1
Dianella caerulea var. *producta*	Blue Flax Lily	2
Phyllanthus hirtellus	Thyme Spurge	1
Patersonia sericea	Purple Flag	2
Pultenaea villosa		*2*
Lomandra obliqua	Fishbones	1
Comesperma ericinum	Matchheads	1
Hardenbergia violacea	Hardenbergia	1
Pultenaea palacea var. *palacea*		

Quadrat 11

***Community – Smooth-barked Apple/Stringybark Open Forest**

*GDA-94 Reference. E - 414640 N - 6383305

*Aspect – Southerly
*Soils – Course Sediment

*Structural Components –

Canopy	(to 15m)	%coverage = 30%
Shrub Layer	(to 2m)	%coverage = 30%
Ground Cover	(to 1m)	%coverage = 60%

*Species Recorded –

Canopy Dominants

Eucalyptus agglomerata	Stringybark	3
Angophora costata	Smooth-barked Apple	2
Corymbia gummifera	Red Bloodwood	1

Shrub Layer Dominants

Boronia pinnata		1
Leptospermum polygalifolium	Lemon Scented Tea-tree	1

Ground Cover Dominants

Themeda triandra	Kangaroo Grass	2

Additional Species Recorded

Dianella caerulea var. *producta*	Blue Flax Lily	1
Patersonia sericea	Purple Flag	2
Comesperma ericinum	Matchheads	1
Hardenbergia violacea	Hardenbergia	1
Pultenaea palacea var. *palacea*		
Stylidium graminifolium	Trigger Plant	1
Goodenia heterophylla		1

Quadrat 12

***Community – Moist Riparian Forest**

*Aspect – In gully
*GDA-94 Reference. E - 414331 N - 6384040
*Soil – Sandy loam
*Structural Components –

Canopy	(to 20m)	%coverage = 30%
Shrub Layer	(to 2m)	%coverage = 30%
Ground Cover	(to 1m)	%coverage = 60%

*Species Recorded –

Canopy Dominants		
Eucalyptus propinqua	Small-leaved Grey Gum	3
Mid Layer Dominants		
Melaleuca styphelioides	Prickly-leaved Paperbark	1
Melaleuca linearifolia	Snow in Summer	1
Shrub Layer Dominants		
Callistemon salignus	Weeping Bottlebrush	1
Melaleuca linearifolia	Snow in Summer	1
Ground Cover Dominants		
Lomandra longifolia	Spiny Mat Rush	4
Additional Species Recorded		
Dianella caerulea var. *producta*	Blue Flax Lily	2
Goodenia ovata		1

APPENDIX D:
FAUNA LIST FOR THE STUDY AREA

FAUNA LIST

Family sequencing and taxonomy follow for each fauna class:

Birds - Pizzey and Knight (1997).

Herpetofauna - Cogger (2000), Ehmann (Ed) (1997) and Barker, Grigg and Tyler (1995).

Mammals - Van Dyck & Strahan (Ed) (2008) and Churchill (2008).

- Species observed or indicated by scats, tracks etc. on site during this investigation.

#(?) - Indicates a species identified without certainty or to a Genus level only.

* - Indicates an introduced species.

The following symbols are used to indicate species recorded during previous surveys.
@ - Previous record (Wildthing Environmental Consultants, 2002)
$ - Previous record (Wildthing Environmental Consultants, 2008a)

Threatened species addressed within this assessment appear in **bold** font.

Observation Type

O - Observed (sighted)	**R** – Road Kill	**F** – Tracks, scratching
W - Heard call	**D** – Dog Kill	**Z** – In raptor/owl Pellet
X - In scat	**C** – Cat Kill	**M** - Miscellaneous
P – Scat	**V** – Fox Kill	**E** – Nest or roost
T - Trapped or netted	**K** – Dead	**B** - Burnt
H - Hair or feathers	**S** – Shot	**Y** – Bones or teeth
A - Stranded/Beached	**I** – Fossil/subfossil	**N** – Not located

Vegetation Community Types within study area

Within Lot 2:

1. Swamp Mahogany – Paperbark Forest
2. Smooth-barked Apple Swamp Forest
3. Coastal Sand Blackbutt Open Forest
4. Ironbark/Tallowwood Open Forest
5. Grey Gum/Tallowwood/Ironbark
6. Spotted Gum/Ironbark Forest
7. Smooth-barked Apple/Stringybark Open Forest
8. Moist Riparian Forest
9. Cleared Modified
10. Aquatic Dam

Outside Lot 2:

11. Intertidal Mudflat/Mangrove
12. Foreshore
13. Saltmarsh
14. Swamp Oak Forest

Scientific Name	Common Name	Legal Status	Observation Type	Vegetation Community
AMPHIBIANS				
Family Myobatrachidae - 'Southern Frogs'				
Crinia signifera	Common Eastern Froglet		W	10
Crinia tinnula	Wallum Froglet	**TSC - V**	W	1
Limnodynastes peronii	Striped Marsh Frog		W	10
Paracrinia haswelli	Haswell's Froglet		W	1
Pseudophryne bibronii	Brown Toadlet		W,O	1
Pseudophryne coriacea	Red-backed Toadlet		W,O	4
Uperoleia laevigata	Smooth Toadlet		W	3
Family Hylidae - Tree Frogs				
Litoria fallax	Dwarf Tree Frog		W,O	1
Litoria jervisensis	Jervis Bay Tree Frog		W	1
Litoria peronii	Peron's Tree Frog		W	1
Litoria tyleri	Tyler's Tree Frog		W	1
REPTILES				
Family Varanidae - Monitors				
Varanus varius	Lace Monitor		T,O	1,3,4
Family Scinidae - Skinks				
Egernia major	Land Mullet		T,O	1,3
Lampropholis delicata	Grass Skink		O	3,4,5,6,7
Saiphos equalis	Three-toed Skink		O	3
Family Boidae - Pythons				
Morelia spilota ssp. *spilota*	Diamond Python		O	3
Family Elapidae - Venomous Snakes				
Pseudechis porphyriacus	Red-bellied Black Snake		T,O	4

Scientific Name	Common Name	Legal Status	Observation Type	Vegetation Community
BIRDS				
Family Scolopacidae				
Numenius madagascariensis	Eastern Curlew	**EPBC - Migratory**	O	11
Numenius phaeopus	Whimbrel	**EPBC - Migratory**	O	11
Family Procellariidae – Shearwaters, Petrels, Prions.				
Puffinus tenuirostris	Short-tailed Shearwater	**EPBC - Migratory**	K	12
Family Anatidae - Ducks, Swans and Geese				
Anas superciliosa	Pacific Black Duck		O	11
Cygnus atratus	Black Swan		O	11
Family Ardeidae - Herons, Egrets and Bitterns				
Egretta novaehollandiae	White-faced Heron		O	11
Butorides striatus	Striated Heron		O	11
Family Threskiornithidae - Ibises and Spoonbills				
Threskiornis molucca	Sacred Ibis		O	11
Family Accipitridae - Osprey, Hawks, Eagles and Harriers				
Haliaeetus leucogaster	White-breasted Sea-Eagle	**EPBC - Migratory**	O	3
Haliastur sphenurus	Whistling Kite		O	3
Family Charadriidae - Plovers, Dotterels and Lapwings				
Vanellus miles	Masked Lapwing		O	9
Family Columbidae - Pigeons, Doves				
Leucosarcia melanoleuca	Wonga Pigeon		W	4

Scientific Name	Common Name	Legal Status	Observation Type	Vegetation Community
Family Cacatuidae - Cockatoos and Corellas				
Cacatua galerita	Sulphur-crested Cockatoo		O	3
Cacatua roseicapilla	Galah		O	3
Calyptorhyncus funereus	Yellow-tailed Black-Cockatoo		O	3,4
Family Psittacidae - Parrots, Rosellas and Lorikeets				
Alisterus scapularis	King Parrot		O	3,4
Glossopsitta pusilla	Little Lorikeet	**TSC-V**	O	3
Platycercus eximius	Eastern Rosella		O	1,3,4,5
Trichoglossus chlorolepidotus	Scaly-breasted Lorikeet		O	1,3,4
Trichoglossus haematodus	Rainbow Lorikeet		O	1,3,4,5,6
Family Cuculidae - Cuckoos				
Cuculus pallidus	Pallid Cuckoo		O	4
Cacomantis flabelliformis	Fan-tailed Cuckoo		O	4
Eudynamys scolopacea	Common Koel		O,W	1
Scythrops novaehollandiae	Channel-billed Cuckoo		O,W	1,2
Family Strigidae - Hawk-Owls				
Ninox boobook	Southern Boobook		W	3
Family Podargidae - Frogmouths				
Podargus strigoides	Tawny Frogmouth		O,W	3,4
Family Caprimulgidae - Nightjars				
Eurostopodus mystacalis	White-throated Nightjar		W	3,4
Family Halcyonidae - Tree Kingfishers				
Dacelo novaeguineae	Laughing Kookaburra		O	1,2,3,4,5
Todiramphus sancta	Sacred Kingfisher		O,W	1,2,3,4,5,7
Family Coraciidae - Rollers				
Eurystomus orientalis	Dollarbird		O,W	1,3,4

Scientific Name	Common Name	Legal Status	Observation Type	Vegetation Community
Family Climacteridae - Treecreepers				
Cormobates leucophaea	White-throated Treecreeper		O,W	3,4,5
Family Maluridae - Fairy-Wrens and Emu-Wrens				
Malurus assimilis	Variegated Fairy-Wren		O	2
Malurus cyaneus	Superb Fairy-Wren		O	1,3,4,5
Family Pardalotidae - Pardalotes, Gerygones, Scrubwrens, Heathwrens and Thornbills				
Acanthiza nana	Yellow Thornbill		O	3,4
Acanthiza pusilla	Brown Thornbill		O	1,3,4,8
Gerygone mouki	Brown Gerygone		O	1,8
Gerygone olivacea	White-throated Gerygone		O	3,4,5,7
Pardalotus punctatus	Spotted Pardalote		O	1,2,3,4,5,6,7
Pardalotus striatus	Striated Pardalote		O	4
Sericornis frontalis	White-browed Scrubwren		O	1, 3
Family Meliphagidae - Honeyeaters				
Acanthorhynchus tenuirostris	Eastern Spinebill		O	1,3,4
Anthrochaera chrysoptera	Brush Wattlebird		O	3
Lichenostomus chrysops	Yellow-faced Honeyeater		O	1,3
Manorina melanocephala	Noisy Miner		O	1,2,3,4,5,6,7,8
Meliphaga lewinii	Lewin's Honeyeater		O	3
Philemon corniculatus	Noisy Friarbird		O	1,3,4
Phylidonyris nigra	White-cheeked Honeyeater		O	1,2,3
Family Petroicidae - Robins and Jacky Winter				
Eopsaltria australis	Eastern Yellow Robin		O	4
Microeca leucophaea	Jacky Winter		O	3
Family Cinclosomatidae - Whipbird and Quail-thrushes				
Psophodes olivaceus	Eastern Whipbird		O,W	1

Scientific Name	Common Name	Legal Status	Observation Type	Vegetation Community
Family Pachycephalidae - Whistlers, Shrike-tit and Shrike-thrushes				
Colluricincla harmonica	Grey Shrike-thrush		O	3,4
Pachycephala pectoralis	Golden Whistler		O	4
Family Dicruridae - Monarchs, Flycatchers, Fantails, Drongo and Magpie-Lark				
Myiagra inquieta	Restless Flycatcher		O	**4**
Rhipidura fuliginosa	Grey Fantail		O	3,4
Rhipidura leucophrys	Willie Wagtail		O	9
Rhipidura rufifrons	Rufous Fantail	**EPBC - Migratory**	O	4
Grallina cyanoleuca	Magpie-lark		O	1
Family Campephagidae - Cuckoo-shrikes and Trillers				
Coracina novaehollandiae	Black-faced Cuckoo-shrike		O	1,2,3,4,5,6
Family Artamidae - Wood-swallows, Butcherbirds, Magpie and Currawongs				
Cracticus nigrogularis	Pied Butcherbird		O	1,4
Cracticus torquatus	Grey Butcherbird		O	1
Gymnorhina tibicen	Australian Magpie		O	1,3,4,5,9
Strepera graculina	Pied Currawong		O	3,4
Family Corvidae - Crows, Raven				
Corvus coronoides	Australian Raven		O	3,4
Family Passeridae - Sparrows, Grassfinches, Mannikins				
Neochmia temporalis	Red-browed Finch		O	1,2,3,4
Family Hirundinidae - Swallows and Martins				
Hirundo neoxena	Welcome Swallow		O	10

Scientific Name	Common Name	Legal Status	Observation Type	Vegetation Community
Family Zosteropidae - White-eyes				
Zosterops lateralis	Silvereye		O	3
MAMMALS				
Family Tachyglossidae - Echidna				
Tachyglossus aculeatus	Echidna		F	4
Family Dasyuridae - Dasyurids				
Antechinus stuartii	Brown Antechinus		T	1,3,4
Family Peramelidae - Bandicoots				
Isoodon macrourus	Northern Brown Bandicoot		F	1,3
Perameles nasuta	Long-nosed Bandicoot		F	1,3
Family Phascolarctidae - Koala				
Phascolarctos cinereus	Koala	**TSC-V**	P,F	1
Family Pseudocheiridae - Ringtail Possums and Greater Glider				
Pseudocheirus peregrinus	Common Ringtail Possum		O	3
Family Phalangeridae - Brushtail Possums				
Trichosurus vulpecula	Common Brushtail Possum		O	1,3,4,5
Family Macropodidae - Kangaroos, Wallabies				
Macropus giganteus	Eastern Grey Kangaroo		O	3,4,9
Macropus rufogriseus	Red-necked Wallaby		O	3,4
Family Pteropodidae - Fruit Bats				
Pteropus poliocephalus	Grey-headed Flying-fox	**TSC-V, EPBC - V**	O,W	1,4
Family Molossidae - Freetail-bats				
Mormopterus sp. 2	Freetail-bat sp.		T,W	1
Nyctinomus australis	White-striped Freetail-bat		W	4

Scientific Name	Common Name	Legal Status	Observation Type	Vegetation Community
Family Vespertilionidae - Plain-nosed Bats				
Chalinolobus gouldii	Gould's Wattled bat		T,W	1,3
Chalinolobus morio	Chocolate Wattled Bat		T,W	1,3
Miniopterus australis	Little Bentwing-bat	**TSC-V**	T,W	1,3
Nyctophilus geoffroyi	Lesser Long-eared Bat		T	1,3
Nyctophilus gouldi	Gould's Long-eared Bat		T	1,3
Scoteanax rueppellii	Greater Broad-nosed Bat	**TSC-V**	T,W	1,3
Vespaledus vulturnus	Little Forest Bat		T	1,3
Family Muridae - Rodents				
Rattus fuscipes	Southern Bush Rat		T	1,3,4
**Rattus rattus*	Black Rat		T	1
Family Canidae				
**Canis familiaris*	Dog		O	9

APPENDIX E

HABITAT TREES WITHIN PROXIMITY OF PROPOSAL

Habitat Tree Data Key for Table E1.

- **DBH** – Diameter at Breast Height. Tree trunk diameter measured at breast height (1.4 metres above ground level). Fabric diameter tape used which assumes a circular cross section.
- **Tree Height** – Estimated with the use of an inclinometer and rangefinder (metres).
- **Coordinates - GDA - 1994**
- **Habitat/Hollows** –

  Class 1 – large sized hollow openings (i.e. >15cm) suitable for species such as Owls

  Class 2 – medium sized hollow-openings (i.e. 5-15cm) suitable for species such as Gliders and Possums

  Class 3 – small sized hollow openings (i.e. <5cm) suitable for species such as microchiropteran bats.

Spout: Hollow opening towards sky offering little protection from the weather.

Location of Habitat Tree within the Vicinity of the proposal are shown in Figure E1.

Figure E1: Habitat (Hollow-bearing) trees within proximity to development.

Table E1: Details of habitat trees.

Tree No.	Species	COORDINATES GDA - 94	DBH (M)	Height (M)	Habitat Tree Hollows Comments
1	*Eucalyptus pilularis* (Blackbutt)	414094 6383363	1.3	35	3 x Class 2 4 x Class 3 Very large tree
2	*Angophora costata* (Smooth-barked Apple)	414104 6383368	1	35	1 x Class 1 2 x Class 3 Large tree
3	*Eucalyptus robusta* (Swamp Mahogany)	414117 6383359	1.3	30	3 x Class 2 3 x Class 3 Very large Swamp Mahogany. One Koala scat found.
4	*Melaleuca quinquenervia* (Broad-leafed Paperbark)	414132 6383347	0.9	20	1 x Class 2
5	*M. quinquenervia*	414124 6383350	1	20	2 x Class 3 Knobbly Tree
6	*M. quinquenervia*	414151 6383360	0.9	25	1 x Class 3 Scar scarf on tree
7	*E. robusta*	414175 6383350	0.8	20	1 x Class 3
8	*M. quinquenervia*	414183 6383353	0.7	25	1 x Class 2 1 x Class 3
9	*E. robusta*	414168 6383371	0.6	20	1 x Class 3
10	*A. costata*	414183 6383379	0.9	25	2 x Class 3
11	*A. costata*	414191 6383380	0.9	30	2 x Class 2 3 x Class 3
12	*E. robusta*	414200 6383383	0.7	18	1 x Class 3 Hollow base suitable for microchiropteran bats
13	*M. quinquenervia*	414189 6383393	0.9	20	1 x Class 2 1 x Class 3
14	*M. quinquenervia*	414216 6383405	0.9	20	1 x Class 2 1 x Class 3
15	*M. quinquenervia*	414234 6383420	1.1	20	2 x Class 2 3 x Class 3

Tree No.	Species	COORDINATES GDA - 94	DBH (M)	Height (M)	Habitat Tree Hollows Comments
16	Dead Stag	414165 6383379	0.4	10	1 x Class 2 1 x Class 3
17	*E. pilularis*	414144 6383414	3.0	35	3 x Class 1 2 x Class 2 5 x Class 3 Very large tree
18	*E. pilularis*	414083 6383393	1.5	35	3 x Class 3
19	Dead Stag	414079 6383388	1.1	20	2 x Class 2 2 x Class 3
20	Dead Stag	414082 6383379	0.8	17	2 x Class 1 – Spout
21	*E. pilularis*	414072 6383379	1.0	35	1 x Class 3
22	*E. pilularis*	414067 6383372	1.8	35	2 x Class 2 3 x Class 3
23	*E. pilularis*	414045 6383354	2.0	35	2 x Class 1 6 x Class 2 2 x Class 3 Very large tree
24	Dead Stag	414068 6383381	0.9	20	2 x Class 1 – Spout 1 x Class 3
25	*Corymbia gummifera* (Red Bloodwood)	414036 6383352	0.55	18	1 x Class 3
26	*E. pilularis*	414032 6383343	2.0	30	5 x Class 2 4 x Class 3 Very large tree, leaning over
27	*E. pilularis*	414026 6383343	1.1	20	3 x Class 2 2 x Class 3
28	*E. pilularis*	414017 6383359	1.9	35	1 x Class 1 10 x Class 2 7 x Class 3 Large tree
32	*E. pilularis*	414005 6383386	0.8	30	1 x Class 3

Tree No.	Species	COORDINATES GDA - 94	DBH (M)	Height (M)	Habitat Tree Hollows Comments
33	*E. pilularis*	414018 6383384	1.0	35	1 x Class 2
34	*E. pilularis*	414028 6383377	1.1	35	1 x Class 3
35	Dead Stag	414039 6383406	0.5	18	2 x Class 3
36	*E. pilularis*	414042 6383406	1.8	35	2 x Class 2 5 x Class 3 Forked trunk
37	*C. gummifera*	414034 6383411	0.6	20	1 x Class 3
38	*A. costata*	414075 6383418	2.2	35	5 x Class 2 7 x Class 3 Very large tree
39	*E. pilularis*	414091 6383405	1.1	25	1 x Class 2 2 x Class 3
40	*E. pilularis*	414097 6383405	1.1	20	2 x Class 3
41	*E. pilularis*	414072 6383402	1.3	30	4 x Class 2 4 x Class 3
42	*E. pilularis*	414055 6383431	1.2	35	4 x Class 3
43	*Allocasuarina torulosa* (Forest Oak)	414051 6383422	0.5	18	Tall thin opening in trunk suitable for bats and frogs
44	*E. pilularis*	414063 6383448	1.8	35	4 x Class 3
45	*C. gummifera*	414019 6383423	1.2	18	3 x Class 2
46	Dead Stag	414095 6383449	1.1	20	1 x Class 1 2 x Class 2 3 x Class 3
47	Dead Stag	414099 6383472	0.35	15	1 x Class 3
48	*Eucalyptus resinifera* (Red Mahogany)	414109 6383483	1.1	30	2 x Class 2 2 x Class 3

Tree No.	Species	COORDINATES GDA - 94	DBH (M)	Height (M)	Habitat Tree Hollows Comments
49	*E. resinifera*	414141 6383485	0.7	15	1 x Class 2
50	*E. resinifera*	414155 6383479	1	25	1 x Class 2 1 x Class 3
51	Dead Stag	414226 6383493	1	18	1 x Class 1 Spout 1 x Class 1 1 x Class 2 2 x Class 3
52	Ironbark	414245 6383541	0.6	20	2 x Class 3
53	Ironbark	414243 6383554	1.2	35	1 x Class 2 2 x Class 3
54	*E. robusta*	414267 6383554	0.8	25	1 x Class 2
55	*E. pilularis*	414248 6383605	4.0	35	6 x Class 1 6 x Class 2 7 x Class 3 Very large tree with huge opening in base and hollow through the middle.
56	*E. robusta*	414209 6383607	1.3	25	3 x Class 2 1 x Class 3 + 2 hollows under tree.
57	*M. quinquenervia*	414212 6383599	1.1	30	1 x Class 2 1 x Class 3
58	Dead Stag	414195 6383593	1.0	25	1 x Class 2 3 x Class 3
59	Dead Stag	414181 6383604	2.0	20	2 x Class 1 spouts 5 x Class 2 5 x Class 3
60	*Eucalyptus microcorys* (Tallowwood)	414157 6383600	2.5	35	4 x Class 2 5 x Class 3
61	Ironbark	414149 6383591	0.7	15	1 x Class 2 1 x Class 3
62	Dead Stag	414147 6383615	0.6	15	4 x Class 2 3 x Class 3
63	*Eucalyptus umbra* (Broad-leaved White Mahogany)	414121 6383601	1.3	20	3 x Class 2 4 x Class 3

Tree No.	Species	COORDINATES GDA - 94	DBH (M)	Height (M)	Habitat Tree Hollows Comments
64	Dead Stag	414102 6383594	0.55	8	1 x Class 2 1 x Class 3
65	*E. microcorys*	414094 6383586	1.3	30	2 x Class 2 3 x Class 3
66	*C. gummifera*	414080 6383598	0.9	30	2 x Class 2 1 x Class 3
67	*E. microcorys*	414076 6383602	1.2	35	3 x Class 2 4 x Class 3
68	Dead Trunk	414070 6383591	0.8	7	1 x Class 1 spout – possibly full of dirt.
69	*E. umbra*	414075 6383582	1	25	3 x Class 3
70	*E. umbra*	414074 6383575	1	30	2 x Class 2 2 x Class 3 Opening at base
71	Dead Stag	414060 6383552	0.7	18	5 x Class 2 2 x Class 3
72	Ironbark	414064 6383547	0.9	25	2 x Class 2 7 *Dendrobium aemulum* (Ironbark Orchid) observed on trunk.
73	Dead Stag	414064 6383531	0.4	25	1 x Class 3
74	*E. umbra*	414065 6383519	0.6	25	1 x Class 2
75	*E. umbra*	414046 6383509	0.4	20	1 x Class 3
76	*E. microcorys*	414030 6383517	1.3	35	1 x Class 1 (Hollow trunk) 4 x Class 2 3 x Class 3 .
77	*E. umbra*	414010 6383511	1	30	2 x Class 3
78	Dead Stag	414005 6383514	0.6	13	1 x Class 2 1 x Class 3
79	Dead Stag	413996 6383512	0.3	15	1 x Class 3

Tree No.	Species	COORDINATES GDA - 94	DBH (M)	Height (M)	Habitat Tree Hollows Comments
80	Dead Stag	413985 6383525	1	20	15 x Class 3
81	Ironbark	413977 6383536	1	20	1 x Class 3
82	*E. microcorys*	413980 6383570	2	35	1 x Class 1 2 x Class 2 7 x Class 3 Very large tree
83	Dead Stag	414055 6383568	1	30	1 x Class 2 3 x Class 3
84	*C. gummifera*	414008 6383596	1	25	3 x Class 3
85	Dead Stag	414017 6383619	1.1	18	3 x Class 2 8 x Class 3
86	*A. costata*	414031 6383597	0.6	25	1 x Class 2
87	*C. gummifera*	413984 6383598	0.7	25	1 x Class 2 1 x Class 3 Arboreal termite nest suitable for Kingfishers and Kookaburras
88	Dead Stag	413979 6383621	1	25	2 x Class 2 6 x Class 3
89	*E. microcorys*	413960 6383612	0.7	20	2 x Class 3
90	*E. microcorys*	413936 6383677	2	35	3 x Class 1 5 x Class 2 Owl pellet found at base, scratch marks probably from Lace Monitor
91	*E. umbra*	413931 6383649	0.7	25	1 x Class 1
92	*C. gummifera*	413935 6383603	0.9	30	1 x Class 2 2 x Class 3
93	*C. gummifera*	413928 6383586	0.9	30	2 x Class 3
94	*E. umbra*	413929 6383585	0.4	18	1 x Class 2 1 x Class 3 Hollows low in tree.

Tree No.	Species	COORDINATES GDA - 94	DBH (M)	Height (M)	Habitat Tree Hollows Comments
95	Dead Stag	413918 6383575	1.7	25	1 x Class 1 (Spout) 1 x Class 2 3 x Class 3
96	*C. gummifera*	413915 6383591	0.8	20	1 x Class 2 Tree leaning over track.
97	*E. umbra*	413938 6383576	1.1	25	2 x Class 2 *Cymbidium suave* (Snake Flower) in tree.
98	*C. gummifera*	413959 6383569	0.6	20	2 x Class 3
99	Dead Stag	413968 6383527	0.6	10	4 x Class 2 1 x Class 3
100	Dead Stag	413949 6383505	0.9	18	3 x Class 2 2 x Class 3
101	*E. pilularis*	414184 6383453	1.3	35	4 x Class 2 3 x Class 3
102	*E. microcorys*	414166 6383453	1.9	35	4 x Class 2 4 x Class 3
103	*E. microcorys*	414171 6383482	1.8	30	1 x Class 1 3 x Class 2 7 x Class 3 Forked trunk (1m DBH)
104	Dead Stag	414151 6383501	1	30	4 x Class 3
105	Ironbark	414150 6383500	1	30	1 x Class 3 *Dendrobium aemulum* (Ironbark Orchid) observed on trunk.
106	*E. microcorys*	414140 6383519	0.8	30	1 x Class 3
107	*E. microcorys*	414130 6383508	0.8	25	1 x Class 3
108	*A. costata*	414118 6383504	0.35	18	1 x Class 3
109	*E. microcorys*	414108 6383510	1.2	30	2 x Class 3
110	Dead Stag	414108 6383526	0.45	12	4 x Class 3 Hollow at base

Tree No.	Species	COORDINATES GDA - 94	DBH (M)	Height (M)	Habitat Tree Hollows Comments
111	Dead Stag	414113 6383533	1	18	1 x Class 1 4 x Class 2 4 x Class 3
112	Dead Stag	414123 6383542	0.5	9	2 x Class 2 2 x Class 3
113	Dead Stag (Ironbark)	414156 6383549	0.8	12	2 x Class 2
114	Ironbark	414159 6383564	0.7	30	1 x Class 3 Arboreal termite nest suitable for Kingfishers and Kookaburras
115	Dead Stag	414161 6383569	0.5	15	2 x Class 3
116	*E. resinifera*	414087 6383515	0.8	25	1 x Class 2 2 x Class 3
117	*E. resinifera*	414091 6383495	1	30	1 x Class 2 3 x Class 3
118	Dead Stag	414076 6383473	1.1	25	2 x Class 2 3 x Class 3
119	*E. microcorys*	414026 6383472	2.3	35	2 x Class 1 8 x Class 2 8 x Class 3 Very large tree
120	Dead Stag	414004 6383489	0.9	10	1 x Class 1 (Spout)
121	*E. microcorys*	413945 6383476	1.2	35	9 x Class 3
122	*E. umbra*	413955 6383455	0.7	25	3 x Class 3 Arboreal termite nest suitable for Kingfishers and Kookaburras
123	*E. umbra*	413942 6383447	0.8	20	1 x Class 3
124	*E. umbra*	413925 6383454	1	20	2 x Class 2
125	*E. microcorys*	414048 6383439	1.1	35	1 x Class 2
126	*A. torulosa*	414117 6383430	0.4	8	1 x Class 3

Tree No.	Species	COORDINATES GDA - 94	DBH (M)	Height (M)	Habitat Tree Hollows Comments
127	Dead Stag	414166 6383122	2.2	20	3 x Class 1 7 x Class 2 4 x Class 3 Very large stag.
128	*E. pilularis*	414151 6383107	0.75	10	2 x Class 3
129	*E. pilularis*	414142 6383114	0.8	13	1 x Class 2 3 x Class 3
130	*E. pilularis*	414137 6383113	1.1	25	5 x Class 2 4 x Class 3
131	*E. pilularis*	414123 6383100	1.2	25	3 x Class 2 5 x Class 3
132	*E. robusta*	414129 6383123	1	18	1 x Class 3 Scratches on bark probably from Koala or Lace Monitor.
133	Dead Stag	414151 6383123	0.9	7	1 x Class 1 (Spout) 1 x Class 2
134	Dead Trunk	414151 6383131	1.2	7	1 x Class 1 (Spout)
135	*E. pilularis*	414069 6383140	2.9	35	3 x Class 1 3 x Class 2 4 x Class 3 Very large tree.
136	*E. pilularis*	414049 6383158	1.7	30	14 x Class 2 5 x Class 3 Large tree. Large *Cymbidium suave* (Snake Flower) and/or *Lomandra longifolia* (Spiny Mat Rush) high in tree.
137	*E. robusta*	414050 6383169	1.2	25	2 x Class 3
138	*E. pilularis*	414057 6383182	1	25	1 x Class 3
139	*E. pilularis*	414066 6383183	0.8	25	1 x Class 2 2 x Class 3
140	*E. pilularis*	414071 6383182	1.8	35-40	5 x Class 2 2 x Class 3 Very large tree. *Cymbidium suave* (Snake Flower) high in tree.

Tree No.	Species	COORDINATES GDA - 94	DBH (M)	Height (M)	Habitat Tree Hollows Comments
					Large opening in base of tree.
141	*E. pilularis*	414072 6383164	1.1	35	3 x Class 2 3 x Class 3
142	*E. pilularis*	414088 6383164	2.4	35	4 x Class 1 5 x Class 2 Very large tree. 3 large clumps of *Cymbidium suave* (Snake Flower) high in tree.
143	*E. pilularis*	414103 6383178	1.4	35	1 x Class 2 3 x Class 3
144	Dead Trunk	414111 6383191	2.5	8	1 x Class 1 (Very large spout)
145	*E. robusta*	414095 6383216	1	20	1 x Class 2 2 x Class 3 Scratches on bark probably from Koala or Lace Monitor.
146	*E. robusta*	414066 6383202	0.9	25	2 x Class 3
147	*E. robusta*	414068 6383233	0.7	30	1 x Class 2 Arboreal termite nest suitable for Kingfishers and Kookaburras
148	*E. robusta*	414044 6383238	0.6	10	1 x Class 3
149	*E. robusta*	414025 6383248	0.8	10	2 x Class 3
150	*E. robusta*	414030 6383261	0.7	25	3 x Class 3
151	*E. robusta*	414070 6383264	0.9	20	1 x Class 2 3 x Class 3 *Cymbidium suave* (Snake Flower) in tree.
152	*E. robusta*	414080 6383261	0.75	20	2 x Class 3
153	*E. robusta*	414087 6383261	1.1	25	1 x Class 2 3 x Class 3
154	Dead Stag	414039 6383271	0.65	20	1 x Class 3
155	*E. robusta*	414013 6383268	0.9	20	1 x Class 1 1 x Class 2 2 x Class 3

Tree No.	Species	COORDINATES GDA - 94	DBH (M)	Height (M)	Habitat Tree Hollows Comments
156	Dead Stag	414012 6383272	0.8	5	1 x Class 1 Hollow filled with dirt. *Cymbidium suave* (Snake Flower) in tree.
157	*E. robusta*	414016 6383275	0.4	13	1 x Class 2
158	*E. robusta*	414014 6383281	1.1	18	1 x Class 1 (Spout) 1 x Class 2
159	*E. pilularis*	414025 6383310	1.2	30	1 x Class 2 3 x Class 3
160	Dead Stag	414038 6383314	0.6	20	2 x Class 3 1 small *Cymbidium suave* (Snake Flower) in tree.
161	*E. pilularis*	414193 6383444	1.1	40	2 x Class 3
162	*M. quinquenervia*	414176 6383436	1.2	30	2 x Class 3 Large Paperbark
163	Dead Stag	414039 6383328	0.7	20	1 x Class 2 3 x Class 3
164	*E. robusta*	414061 6383323	0.5	20	1 x Class 2 (long hollow in trunk) 3 x Class 3
165	*C. gummifera*	414154 6383325	0.7	14	2 x Class 3
166	*M. quinquenervia*	414076 6383327	0.8	20	3 x Class 3 (some fauna scratches)
167	*E. robusta*	414075 6383338	0.8	25	1 x Class 1 1 x Class 2 Tree half burnt
168	*C. gummifera*	414081 6383349	0.75	20	2 x Class 2 Tree leaning to side
169	Dead Stag	414118 6383334	0.4	8	1 x Class 1 (spout)
170	*M. quinquenervia*	414120 6383325	1.2	30	1 x Class 2 2 x Class 3
171	*M. quinquenervia*	414120 6383296	1.0	25	1 x Class 1 (spout) 1 x Class 2 2 x Class 3
172	*M. quinquenervia*	414123 6383285	1.1	20	3 x Class 3

Tree No.	Species	COORDINATES GDA - 94	DBH (M)	Height (M)	Habitat Tree Hollows Comments
173	*M. quinquenervia*	414132 6383275	1.0	30	Koala scratches & scats
174	*M. quinquenervia*	414140 6383290	0.9	18	1 x Class 1 (spout) 1 x Class 3
175	*A. torulosa*	414133 6383419	0.35	13	1 x Class 2 (in trunk)
176	*M. quinquenervia*	414198 6383457	0.9	30	2 x Class 3?
177	*E. robusta*	414221 6383431	0.8	25	2 x Class 3 (hollow at base of tree) Koala scratches & scats
178	*E. robusta*	414208 6383442	0.35	20	Koala scat at base of tree
179	*M. quinquenervia*	414216 6383450	1.0	20	3 x Class 2 2 x Class 3
180	*M. quinquenervia*	414232 6383452	0.9	30	1 x Class 2
181	*M. quinquenervia*	414246 6383497	1.0	30	3 x Class 3
182	*A. costata*	414367 6383724	0.5	20	1 x Class 2
183	*A. costata*	414329 6383681	0.90	25	1 x Class 1 (spout)
184	*A. costata*	414330 6383680	0.8	25	1 x Class 2 2 x Class 3
185	Stag	414329 6383650	1.1	7	2 x Class 1 (spout & opening 5m up)
186	*A. costata*	414327 6383640	1.1	35	2 x Class 2 3 x Class 3
187	*M. quinquenervia*	414305 6383542	1.2	30	1 x Class 1 (wide opening along trunk) 2 x Class 2 1 x Class 3
188	*A. costata*	414296 6383555	0.9	35	1 x Class 2 1 x Class 3
189	*E. robusta*	414326 6383571	0.6	8	2 x Class 3

Tree No.	Species	COORDINATES GDA - 94	DBH (M)	Height (M)	Habitat Tree Hollows Comments
190	Stag	414327 6383584	1.1	14	1 x Class 1 (spout)
191	*A. costata*	414336 6383577	0.8	12	2 x Class 3
192	*A. costata*	414354 6383617	1.1	30	1 x Class 1 3 x Class 2 2 x Class 3
193	*A. costata*	414357 6383626	1.0	14	1 x Class 1 (spout)
194	*E. microcorys*	414332 6383648	0.6	16	1 x Class 2

APPENDIX F

TREES REQUIRED TO BE REMOVED

Habitat Tree Data Key for Table F1.

- **DBH** – Diameter at Breast Height. Tree trunk diameter measured at breast height (1.4 metres above ground level). Fabric diameter tape used which assumes a circular cross section.
- **Tree Height** – Estimated with the use of an inclinometer and rangefinder (metres).
- **Coordinates - GDA - 1994**
- **Habitat/Hollows** –

  Class 1 – large sized hollow openings (i.e. >15cm) suitable for species such as Owls

  Class 2 – medium sized hollow-openings (i.e. 5-15cm) suitable for species such as Gliders and Possums

  Class 3 – small sized hollow openings (i.e. <5cm) suitable for species such as microchiropteran bats.

Spout: Hollow opening towards sky offering little protection from the weather.

Table F1: Details of trees to be removed.

Tree No.	Species	COORDINATES GDA - 94	DBH (M)	Height (M)	Habitat Tree Hollows Comments
1	*Eucalyptus microcorys* (Tallowwood)	414080 6383460	0.4	35	
2	*E. microcorys*	414081 6383457	0.25	25	
3	*Eucalyptus pilularis* (Blackbutt)	414081 6383456	0.15	10	
4	*E. microcorys*	4141084 6383451	0.70	34	
5	*E. microcorys*	414085 6383446	0.85	35	
6	*Allocasuarina torulosa* (Forest Oak)	414084 6383442	0.25	12	
7	*E. microcorys*	4141088 6383442	0.25	20	
8	Dead Stag	414096 6383443	0.90	25	Habitat Tree No. 46. 1 x Class 1 2 x Class 2 3 x Class 3
9	*Eucalyptus siderophloia* (Northern Grey Ironbark)	414106 6383444	0.60	25	
10	*E. siderophloia*	414116 6383437	0.90	35	
11	*Angophora costata* (Smooth-barked Apple)	414116 6383438	0.20	15	
12	*E. microcorys*	414122 6383439	0.25	20	Forked Tree
13	*E. microcorys*	414121 6383438	0.18	15	
14	*A. torulosa*	414121 6383435	0.4	8	Habitat Tree No. 126 1 x Class 3
15	*A. costata*	414116 6383431	0.18	12	
16	*E. siderophloia*	414115 6383428	0.22	1410	

Tree No.	Species	COORDINATES GDA - 94	DBH (M)	Height (M)	Habitat Tree Hollows Comments
17	*E. pilularis*	414114 6383424	0.75	35	
18	*E. microcorys*	414105 6383419	0.40	25	
19	*E. microcorys*	414105 6383415	0.25	20	
20	*E. microcorys*	414103 6383411	0.25	20	
21	*E. pilularis*	414102 6383409	0.45	30	
22	*E. pilularis*	414088 6383420	1.10	35	Large Tree
23	*E. pilularis*	414085 6383422	0.90	30	
24	*E. microcorys*	414089 6383427	0.60	30	
25	*E. microcorys*	414099 6383434	0.50	40	
26	*E. microcorys*	414103 6383438	0.25	25	
27	*E. microcorys*	414078 6383433	0.55	40	
28	*E. pilularis*	414074 6383430	0.18	15	
29	*E. pilularis*	414074 6383430	0.30	25	
30	*E. microcorys*	414074 316383431	0.18	12	
31	*E. microcorys*	414072 6383443	0.35	30	
32	*E. microcorys*	414071 6383443			
33	*E. microcorys*	414109 6383488	0.90	40	
34	*A. torulosa*	414111 6383488	0.18	8	

Tree No.	Species	COORDINATES GDA - 94	DBH (M)	Height (M)	Habitat Tree Hollows Comments
35	*E. siderophloia*	414113 6383406	0.14	10	
36	*E. microcorys*	414112 6383492	0.40	25	
37	*E. microcorys*	414113 6383499	0.12	12	
38	*E. microcorys*	414112 6383502	0.30	25	
39	*E. microcorys*	414113 6383502	0.18	20	
40	*Angophora costata*	414117 6383506	0.30	20	
41	*A. torulosa*	414142 6383502	0.22	8	
42	*E. siderophloia*	414144 6383508	0.95	30	Habitat Tree No. 105. 1 x Class 3 *Dendrobium aemulum* (Ironbark Orchid) observed on trunk.
43	Dead Stag	414146 6383509	0.65	25	Habitat Tree No. 104. 4 x Class 3
44	*E. siderophloia*	414149 6383507	0.45	20	
45	*E. siderophloia*	414154 6383506	0.35	20	
46	*E. siderophloia*	414162 6383505	0.30	20	
47	*E. siderophloia*	414163 6383505	0.50	30	
48	*A. torulosa*	414157 6383497	0.15	8	
49	*E. microcorys*	414157 6383497	0.20	15	
50	*E. microcorys*	414154 6383495	0.35	25	
51	Stringybark	414148 6383495	0.35	20	

Tree No.	**Species**	**COORDINATES GDA - 94**	**DBH (M)**	**Height (M)**	**Habitat Tree Hollows Comments**
52	Stringybark	414145 6383493	0.25	20	
53	*E. siderophloia*	414241 6383518	0.50	12	
54	*E. siderophloia*	414242 6383515	0.45	30	
55	*E. siderophloia*	414242 6383513	0.60	30	
56	*E. siderophloia*	414240 6383511	0.20	12	
57	*E. siderophloia*	414242 6383505	0.45	20	
58	*E. siderophloia*	414241 6383505	0.25	20	
59	*E. siderophloia*	414242 6383499	0.30	20	
60	*E. siderophloia*	414240 6383501	0.25	20	
61	*E. siderophloia*	414236 6383492	0.30	25	
62	*E. siderophloia*	414231 6383505	0.30	25	
63	*E. siderophloia*	414236 6383511	0.50	35	
64	*E. siderophloia*	414226 6383519	0.20	30	
65	*E. siderophloia*	414215 6383538	0.50	30	

APPENDIX G

Matters of National Environmental Significance Report

Australian Government

Department of Sustainability, Environment, Water, Population and Communities

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information about the EPBC Act including significance guidelines, forms and application process details can be found at http://www.environment.gov.au/epbc/assessmentsapprovals/index.html

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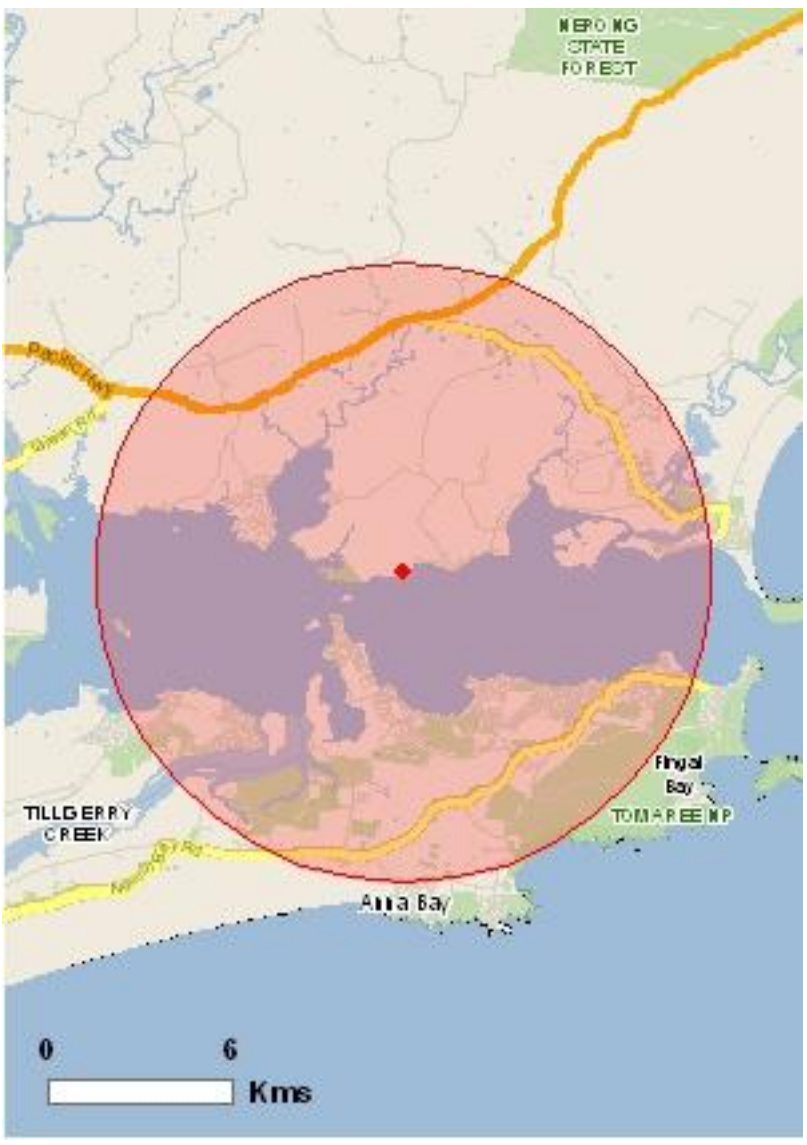

Coordinates

Buffer: 10.0Km

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance - see http://www.environment.gov.au/epbc/assessmentsapprovals/guidelines/index.html

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Threatened Ecological Communities:	None
Threatened Species:	42
Migratory Species:	61

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage/index.html

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species. Information on EPBC Act permit requirements and application forms can be found at http://www.environment.gov.

Commonwealth Lands:	4
Commonwealth Heritage Places:	None
Listed Marine Species:	80
Whales and Other Cetaceans:	12
Critical Habitats:	None
Commonwealth Reserves:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

Place on the RNE:	14
State and Territory Reserves:	11
Regional Forest Agreements:	1
Invasive Species:	16
Nationally Important Wetlands:	1

Details

Matters of National Environmental Significance

Wetlands of International Significance (RAMSAR)	[Resource Information]
Name	Proximity
Myall lakes	Within Ramsar site

Threatened Species		[Resource Information]
Name	Status	Type of Presence
BIRDS		
Anthochaera phrygia		
Regent Honeyeater [82338]	Endangered	Species or species

Name	Status	Type of Presence
		habitat may occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Dasyornis brachypterus Eastern Bristlebird [533]	Endangered	Species or species habitat likely to occur within area
Diomedea exulans antipodensis Antipodean Albatross [82269]	Vulnerable	Species or species habitat may occur within area
Diomedea exulans gibsoni Gibson's Albatross [82271]	Vulnerable	Species or species habitat may occur within area
Fregetta grallaria grallaria White-bellied Storm-Petrel (Tasman Sea), White-bellied Storm-Petrel (Australasian) [64438]	Vulnerable	Species or species habitat likely to occur within area
Lathamus discolor Swift Parrot [744]	Endangered	Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant-Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant-Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Pterodroma neglecta neglecta Kermadec Petrel (western) [64450]	Vulnerable	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Vulnerable	Species or species habitat may occur within area
Thalassarche bulleri Buller's Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta cauta Shy Albatross, Tasmanian Shy Albatross [82345]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta salvini Salvin's Albatross [82343]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta steadi White-capped Albatross [82344]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris impavida Campbell Albatross [82449]	Vulnerable	Species or species habitat may occur within area
FROGS		
Litoria aurea Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat may occur within area
Mixophyes balbus Stuttering Frog, Southern Barred Frog (in Victoria) [1942]	Vulnerable	Species or species habitat likely to occur within area
MAMMALS		

Name	Status	Type of Presence
Chalinolobus dwyeri		
Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat may occur within area
Dasyurus maculatus maculatus (SE mainland population)		
Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat may occur within area
Eubalaena australis		
Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Megaptera novaeangliae		
Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Petrogale penicillata		
Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat likely to occur within area
Potorous tridactylus tridactylus		
Long-nosed Potoroo (SE mainland) [66645]	Vulnerable	Species or species habitat may occur within area
Pseudomys novaehollandiae		
New Holland Mouse [96]	Vulnerable	Species or species habitat known to occur within area
Pteropus poliocephalus		
Grey-headed Flying-fox [186]	Vulnerable	Roosting known to occur within area
PLANTS		
Allocasuarina defungens		
Dwarf Heath Casuarina [21924]	Endangered	Species or species habitat likely to occur within area
Cryptostylis hunteriana		
Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat may occur within area
Diuris praecox		
Newcastle Doubletail [55086]	Vulnerable	Species or species habitat likely to occur within area
Eucalyptus parramattensis subsp. decadens		
Earp's Gum, Earp's Dirty Gum [56148]	Vulnerable	Species or species habitat likely to occur within area
Melaleuca biconvexa		
Biconvex Paperbark [5583]	Vulnerable	Species or species habitat may occur within area
Prostanthera densa		
Villous Mintbush [12233]	Vulnerable	Species or species habitat likely to occur within area
Tetratheca juncea		
Black-eyed Susan [21407]	Vulnerable	Species or species habitat known to occur within area
REPTILES		
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Eretmochelys imbricata		
Hawksbill Turtle [1766]	Vulnerable	Species or species habitat likely to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Species or species habitat likely to occur within area
SHARKS		
Carcharias taurus (east coast population)		
Grey Nurse Shark (east coast population) [68751]	Critically Endangered	Species or species habitat may occur within area
Carcharodon carcharias		
Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Pristis zijsron		
Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat may occur within area
Rhincodon typus		
Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat may occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Calonectris leucomelas		
Streaked Shearwater [1077]		Species or species habitat may occur within area
Diomedea antipodensis		
Antipodean Albatross [64458]	Vulnerable*	Species or species habitat may occur within area
Diomedea gibsoni		
Gibson's Albatross [64466]	Vulnerable*	Species or species habitat may occur within area
Macronectes giganteus		
Southern Giant-Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli		
Northern Giant-Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Puffinus leucomelas		
Streaked Shearwater [66541]		Species or species habitat may occur within area
Sterna albifrons		
Little Tern [813]		Breeding may occur within area
Thalassarche bulleri		
Buller's Albatross [64460]	Vulnerable	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Thalassarche cauta (sensu stricto)		
Shy Albatross, Tasmanian Shy Albatross [64697]	Vulnerable*	Species or species habitat may occur within area
Thalassarche impavida		
Campbell Albatross [64459]	Vulnerable*	Species or species habitat may occur within area
Thalassarche salvini		
Salvin's Albatross [64463]	Vulnerable*	Species or species habitat may occur within area
Thalassarche steadi		
White-capped Albatross [64462]	Vulnerable*	Species or species habitat may occur within area
Migratory Marine Species		
Balaenoptera edeni		
Bryde's Whale [35]		Species or species habitat may occur within area
Caperea marginata		
Pygmy Right Whale [39]		Species or species habitat may occur within area
Carcharodon carcharias		
Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Dugong dugon		
Dugong [28]		Species or species habitat may occur within area
Eretmochelys imbricata		
Hawksbill Turtle [1766]	Vulnerable	Species or species habitat likely to occur within area
Eubalaena australis		
Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Lagenorhynchus obscurus		
Dusky Dolphin [43]		Species or species habitat may occur within area
Lamna nasus		
Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area
Megaptera novaeangliae		
Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Species or species habitat likely to occur within area
Orcinus orca		
Killer Whale, Orca [46]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Migratory Terrestrial Species		
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Breeding may occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Breeding likely to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Breeding likely to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Breeding may occur within area
Xanthomyza phrygia Regent Honeyeater [430]	Endangered*	Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Roosting known to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Arenaria interpres Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]		Roosting known to occur within area
Calidris ferruginea Curlew Sandpiper [856]		Roosting known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]		Roosting known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]		Roosting known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Roosting may occur within area

Name	Threatened	Type of Presence
Heteroscelus brevipes Grey-tailed Tattler [59311]		Roosting known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Roosting known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Numenius madagascariensis Eastern Curlew [847]		Roosting known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting likely to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Rostratula benghalensis s. lat. Painted Snipe [889]	Vulnerable*	Species or species habitat may occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Lands [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -
Commonwealth Land - Australian Telecommunications Commission
Commonwealth Land - Defence Housing Authority
Commonwealth Land - Telstra Corporation Limited

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Roosting known to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat may occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Arenaria interpres Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]		Roosting known to occur within area
Calidris ferruginea Curlew Sandpiper [856]		Roosting known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Roosting known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]		Roosting known to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat may occur within area
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]		Roosting known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Roosting known to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable*	Species or species habitat may occur within area
Diomedea gibsoni Gibson's Albatross [64466]	Vulnerable*	Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Roosting may occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]		Roosting known to occur within area
Himantopus himantopus Black-winged Stilt [870]		Roosting known to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat may occur within area
Lathamus discolor Swift Parrot [744]	Endangered	Species or species habitat likely to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Roosting known to occur within area

Name	Threatened	Type of Presence
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Macronectes giganteus Southern Giant-Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant-Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Breeding may occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Breeding likely to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Breeding likely to occur within area
Numenius madagascariensis Eastern Curlew [847]		Roosting known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting likely to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Roosting known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Breeding may occur within area
Rostratula benghalensis s. lat. Painted Snipe [889]	Vulnerable*	Species or species habitat may occur within area
Sterna albifrons Little Tern [813]		Breeding may occur within area
Thalassarche bulleri Buller's Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta (sensu stricto) Shy Albatross, Tasmanian Shy Albatross [64697]	Vulnerable*	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross [64459]	Vulnerable*	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable*	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area
Fish		
Acentronura tentaculata Shortpouch Pygmy Pipehorse [66187]		Species or species habitat may occur within area
Festucalex cinctus Girdled Pipefish [66214]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus abdominalis Bigbelly Seahorse, Eastern Potbelly Seahorse, New Zealand Potbelly Seahorse [66233]		Species or species habitat may occur within area
Hippocampus whitei White's Seahorse, Crowned Seahorse, Sydney Seahorse [66240]		Species or species habitat may occur within area
Histiogamphelus briggsii Crested Pipefish, Briggs' Crested Pipefish, Briggs' Pipefish [66242]		Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Notiocampus ruber Red Pipefish [66265]		Species or species habitat may occur within area
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
Solegnathus spinosissimus Spiny Pipehorse, Australian Spiny Pipehorse [66275]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Solenostomus paegnius Rough-snout Ghost Pipefish [68425]		Species or species habitat may occur within area
Solenostomus paradoxus Ornate Ghostpipefish, Harlequin Ghost Pipefish, Ornate Ghost Pipefish [66184]		Species or species habitat may occur within area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish [66276]		Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Mammals		
Arctocephalus forsteri New Zealand Fur-seal [20]		Species or species habitat may occur within area
Arctocephalus pusillus Australian Fur-seal, Australo-African Fur-seal [21]		Species or species habitat may occur within area
Dugong dugon Dugong [28]		Species or species habitat may occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat likely to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans		[Resource Information]
Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area

Name	Status	Type of Presence
Caperea marginata Pygmy Right Whale [39]		Species or species habitat may occur within area
Delphinus delphis Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Extra Information

Places on the RNE [Resource Information]

Note that not all Indigenous sites may be listed.

Name	State	Status
Natural		
Newcastle Bight Coastal Area	NSW	Indicative Place
Tea Gardens Wetland	NSW	Indicative Place
Tilligerry Creek Area	NSW	Indicative Place
Corrie Island	NSW	Registered
Fly Point, Halifax Park Aquatic Reserve	NSW	Registered
Port Stephens Estuary	NSW	Registered
Snapper Island Nature Reserve	NSW	Registered
Tomaree National Park	NSW	Registered
Historic		
Nelson Head Inner Lighthouse, Cottage and Reserve	NSW	Indicative Place
Port Stephens	NSW	Indicative Place
Carrington Cemetery	NSW	Registered
Tahlee House Grounds, Structures and Outbuildings	NSW	Registered
Tahlee House Group	NSW	Registered
Tahlee House Reception and Ballroom Wing	NSW	Registered

State and Territory Reserves [Resource Information]

Name	State
Bushy Island	NSW

Name	State
Corrie Island	NSW
Gir-um-bit	NSW
Karuah	NSW
Myall Lakes	NSW
One Tree Island	NSW
Port Stephens - Great Lakes	NSW
Snapper Island	NSW
Tilligerry	NSW
Tomaree	NSW
Worimi	NSW

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
North East NSW RFA	New South Wales

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit,

Name	Status	Type of Presence
Frogs		
Bufo marinus Cane Toad [1772]		Species or species habitat likely to occur within area
Mammals		
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Alternanthera philoxeroides Alligator Weed [11620]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat may occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtiji Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area

Nationally Important Wetlands	[Resource Information]
Name	State
Port Stephens Estuary	NSW

Coordinates

-32.68611 152.0833

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World Heritage and Register of National Estate properties, Wetlands of International Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Department of Environment, Climate Change and Water, New South Wales
-Department of Sustainability and Environment, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment and Natural Resources, South Australia
-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts
-Environmental and Resource Management, Queensland
-Department of Environment and Conservation, Western Australia
-Department of the Environment, Climate Change, Energy and Water
-Birds Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-SA Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
-State Forests of NSW
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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APPENDIX H

EXPERIENCE AND QUALIFICATIONS

Since its inception in 1993, **Wildthing Environmental Consultants** have undertaken a diverse range of studies over a wide geographic range from southern Sydney through to south-eastern Queensland and the western plains of New South Wales. All of these studies have satisfied the relevant Local Council, State Government and Commonwealth Government legislation and assessment guidelines in accordance with the project specifications.

Curriculum Vitae

Name: Daryl Harman

Position: Senior Ecologist

Qualifications:

Bachelor of Applied Science, (Environmental Science). Charles Sturt University Wagga Wagga. 1994-1997.

Certificate II in Bushland Regeneration, North Wagga TAFE, 1998.

Certificate II in Bushland Weed Control, North Wagga TAFE, 1998.

Wildlife Management – A subject through Charles Sturt University, Thurgoona Campus, Albury NSW. Summer Break 1997.

Fields of Competence:

- Flora and Fauna Impact Assessments
- Field Surveys involving Flora, Fauna and Habitat identification
- Ecological Constraints Assessments
- Environmental Management Plans
- Bushfire Protection and Attack Assessments
- Habitat Tree Identification and Clearance Supervision
- Nest Box Management Plans, Installation and Monitoring
- Geographic Information System Mapping
- Aquatic Fauna Surveys
- Plant identification.
- Fauna identification including invertebrates

Licences and other

- Scientific Investigation Licence, NSW National Parks and Wildlife Service.
- NSW Drivers Licence, Class C.
- Current with Lyssa virus injections.
- Current Greencard to work on construction sites.

PROFESSIONAL EMPLOYMENT AND EXPERIENCE

Wildthing Environmental Consultants, Newcastle (2002–Present) -Ecologist

Details of work carried out:

- Assessments on Flora and Fauna including invertebrates
- Species Impact Statements - Fieldwork
  - Report Writing
- Seven Part Test Assessments for Flora and Fauna.
- Environmental Management Plans.

- Environmental Mine Monitoring.
- Bushfire Protection and Attack Assessments.
- Habitat Tree Felling Supervision
- Nest Box installation, monitoring & maintenance.
- Aquatic Fauna Surveys
- Plant identification.
- Fauna identification.

Total Earth Care Pty. Ltd Warriewood NSW (2001 – 2002) - Full time Bush Regenerator. Working around various sites in the Greater Sydney area.

Johnstone Centre, Charles Sturt University, Wagga Wagga, NSW - August & October 2001 Casual Technician (Flora and fauna surveys).

Charles Sturt University, Wagga Wagga NSW, Science and Technology (April 1999 – March 2001) Casual Technical Officer.

NSW Department of Agriculture, Wagga Wagga - Casual Regulatory Officer/Casual Farm Assistant (1998).

Greening Australia, Wagga Wagga, NSW (November/ December 1998) Casual Technical Officer (Roadside Flora Surveys).

Charles Sturt University, Wagga Wagga NSW, Science and Technology (November/ December 1997) - Casual Technical Officer

Australian Army (1992 – 1997) - Infantry Soldier, Ready Reserve Scheme

Certificates/Short Courses

- Eucalypts of the Sydney Region. Eucalypt identification workshop with Van Klaphake. CECAL Hall, Earlwood. (10 & 11 July 2010).
- HLTFA301B Apply First Aid (17 September 2009).
- Safe Working at Heights Statement of Attainment (August 2008) Combined Safety Services, Adamstown NSW. BCPRF2001A.
- Sedges and Rushes of Sydney and the Blue Mountains –Van Klaphake. Marrickville, Sydney. (21 & 22 May 2005).
- Workshop on the Translocation of Threatened Plants. June 2004 - Royal Botanic Gardens Sydney.
- Community Greening Volunteer. – Newcastle City Council. 30 August 2003 - Induction Training Module.
- 25 March 2002 – Occupational Health and Safety, Induction Training for Construction Work. General course under the Occupational Health and Safety Regulation 2001. Work Cover NSW. Course completed to work on worksites.
- Identification of Coleoptera from the Australo-Pacific Region - CSIRO Canberra. (10 - 16 December 2001):

Memberships

- Australian Association of Bush Regenerators.
- Ecological Consultants Association of NSW.

Curriculum Vitae

Name: Luke Pickett

Position: Ecologist

Qualifications / Memberships:
B. Env. Sc. (Env. Mgt.) – University of Newcastle 2002-2004
Master Wildlife Management (Habitat) – Macquarie University 2006-2008.

NPWS Scientific Licence
OH&S Induction Training (Green Card)
NSW Driver's Licence (Class C)
HLTFA301B – Apply First Aid Certificate
BCPRF2001A – Work Safely at Heights Certificate

Fields of Competence:

- Flora and Fauna Impact Assessments
- Field Surveys involving Flora, Fauna and Habitat identification
- Ecological Constraints Assessments
- Vegetation Management Plans
- Bushfire Protection and Attack Assessments
- Habitat Tree Identification and Clearance Supervision
- SEPP 14 Coastal Wetlands Boundary Definition
- Nest Box Management Plans, Installation and Monitoring
- Geographic Information System Mapping
- Detailed understanding of environmental legislation and threatened species issues.

Experience:

2005 – 2011	Ecologist Wildthing, Wallsend NSW
2001 – 2004	Nursery Hand The Clivia Farm, Medowie NSW

Curriculum Vitae: Mungo Worth

Position: Manager

Fields of Competence:
• Flora and Fauna Impact Assessments
• Field Surveys involving Flora, Fauna and Habitat identification
• Ecological Constraints Assessments
• Environmental Management Plans
• Bushfire Protection and Attack Assessments
• Habitat Tree Identification and Clearance Supervision
• Nest Box Management Plans, Installation and Monitoring
• Plant identification
• Fauna identification

Licences and other:
• Scientific Investigation Licence, NSW National Parks and Wildlife Service
• NSW Drivers Licence, Class C
• Current with Lyssa virus injections
• Current Greencard to work on construction sites

Professional Employment and Experience:
Wildthing Environmental Consultants:
• Salt Ash, NSW (1995 – 2001, 2003 – 2004)
• Burleigh Heads, QLD (2002 – 2003)
• Wallsend, NSW (2005 – Present)

(1995 – Present) – Bat call analyst

(1995 – 1997) – Technical Assistant / Junior Ecologist

(1997 – 2004) - Ecologist

(1999 – 2001) – Training Officer

(2002 – 2003) – Queensland Projects Manager

(2004) –IT officer

(2005 – Present) – Manager / Ecologist

Details of work carried out:
• Assessments on Threatened Flora and Fauna
• Species Impact Statements – Fieldwork, Report Writing
• Seven Part Test Assessments for Flora and Fauna
• Environmental Management Plans
• Environmental monitoring
• Bushfire Protection and Attack Assessments
• Habitat tree clearance supervision and fauna rescue
• Nest Box installation, monitoring & maintenance
• Plant identification
• Fauna identification

Certificates/Short Courses:
• HLTFA301B Apply First Aid (17 September 2009).

• Safe Working at Heights Statement of Attainment (August 2008) Combined Safety Services, Adamstown NSW. BCPRF2001A.
• 25 March 2002 – Occupational Health and Safety, Induction Training for Construction Work. General course under the Occupational Health and Safety Regulation 2001. Work Cover NSW. Course completed to work on worksites.

Memberships:
• Australasian Bat Society.