Appendix E

Biodiversity assessment

Transport Roads & Maritime Services

NSW GOVERNMENT

Biodiversity Assessment

BURRILL LAKE, NSW

FEBRUARY 2014

ngh environmental

Document Verification

Project Title: Biodiversity Assessment Burrill Lake, NSW

Project Number: 5299

Project File Name: Burrill Lake Biodiversity Assessment

Revision	Date	Prepared by (name)	Reviewed by (name)	Approved by (name)
Draft V1	12/12/13	Deb Frazer Dave Maynard	Brooke Marshall Raphael Morgan	Brooke Marshall
Final V1	8/1/14	Deb Frazer Dave Maynard	Raphael Morgan	Raphael Morgan
Final v1.1	12/2/14	Deb Frazer Dave Maynard	Raphael Morgan	Raphael Morgan

nghenvironmental is a registered trading name of NGH Environmental Pty Ltd; ACN: 124 444 622.
ABN: 31 124 444 622

suite 1, 216 carp st (po box 470) bega nsw 2550 australia t 61 2 6492 8333

www.nghenvironmental.com.au e ngh@nghenvironmental.com.au

room 15, 341 havannah st (po box 434)
bathurst nsw 2795 australia
0488 820 748

unit 18, level 3, 21 mary st
surry hills nsw 2010 australia
t (02) 8202 8333

suite 1, 39 fitzmaurice st (po box 5464)
wagga wagga nsw 2650 australia
t (02) 6971 9696

unit 17, 27 yallourn st (po box 1037)
fyshwick act 2609 australia
t (02) 6280 5053

37 peron ave (po box 1037)
dunsborough wa 6281 australia
(08) 9759 1985

EXECUTIVE SUMMARY

NSW Roads and Maritime Services (Roads and Maritime) is proposing to replace the Burrill Lake Bridge which is located over Burrill Lake on the Princes Highway south of Ulladulla, NSW. The structural integrity of the existing bridge is compromised due to the immersion of the bridge piles within the saline environment of Burrill Lake which has resulted in cracking and deterioration. This Biodiversity Assessment (BA) was undertaken to identify potential biodiversity constraints and recommend mitigation measures for the proposal. The proposal includes raising the approaches to the bridge and associated changes to local traffic conditions.

An initial constraints assessment was undertaken by GHD (2012) in which the existing landscape was characterised, vegetation communities mapped and general flora and fauna surveys undertaken to define the biodiversity constraints of the study area. This BA cites results presented in GHD (2012) and builds on existing information. It provides the results of the targeted surveys recommended by GHD and provides an impact assessment for the proposal.

Diurnal and nocturnal (day and night) surveys were undertaken by two **ngh**environmental ecologists between October and December 2013. Targeted surveys were undertaken for microchiropteran bats, Green and Golden Bell Frog (*Litoria aurea*), threatened shorebirds and migratory birds, and East Lynne Midge Orchid (*Genoplesium vernale*). Visual assessment and transect surveys of seagrass were undertaken to update the terrestrial and aquatic vegetation mapping completed by GHD (2012). The targeted surveys were primarily focused within the 'subject site'; however some vegetation mapping and orchid surveys were undertaken in additional areas adjacent to the works areas (the broader 'study area').

Four native vegetation communities occur within the study area and are detailed below, including their total extent of distribution within the study area:

1. Seagrass Meadows (4 hectares)
2. Estuarine Saltmarsh (0.5 hectares)
3. Coastal Sand Forest (4.8 hectares)
4. Estuarine Fringe Forest (1.7 hectares)

A total of 0.9 hectares of native vegetation (including seagrass) would be removed by the proposal. Of the four vegetation types identified in the study area, three are threatened ecological communities (TECs) listed under the NSW *Threatened Species Conservation Act* (TSC Act). Some areas of the Coastal Sand Forest constitute Bangalay Sand Forest; the Estuarine Saltmarsh constitutes Coastal Saltmarsh; and some areas of the Estuarine Fringe Forest constitute Swamp Oak Forest. The condition of these TECs is mostly poor to moderate, with the exception of the Coastal Saltmarsh and a patch of Bangalay Sand Forest in the north of the study area which are in good condition. No EECs listed under the Commonwealth *Environment Biodiversity Protection and Conservation Act* (EPBC Act) are present within the study area, or considered likely to occur.

Thirty-nine flora species were recorded across the study area and include:

- 24 native species
- 15 exotic species: one of these species was listed as a Class 4 noxious weeds by the Shoalhaven City Council (Blackberry, *Rubus fruticosus*)

No threatened flora species were observed during the surveys or are considered likely to occur within the proposed work areas.

Forty-two fauna species were detected within the study area and include:

- 35 bird species
- 2 frog species
- 5 fish species

One threatened fauna species listed under the TSC Act was recorded in the study area, the Pied Oystercatcher (*Haemotopus longirostris*). The EPBC Act listed Migratory Great Egret (*Ardea alba*) was also recorded. Habitat within Burrill Lake and its margins (seagrass and mudflats) supports some foraging habitat for shorebird species, however the remaining habitat within the study area is unsuitable for threatened fauna species.

Assessments of significance were undertaken for three TECs and eight fauna species with the potential to occur within the study area:

- Bangalay Sand Forest (TSC Act - EEC)
- Coastal Saltmarsh (TSC Act - EEC)
- Swamp Oak Floodplain Forest (TSC Act - EEC)
- White-fronted Chat (TSC Act – Vulnerable species)
- Sooty Oystercatcher (TSC Act – Vulnerable species)
- Pied Oystercatcher (TSC Act – Endangered species)
- Little Tern (TSC Act – Endangered species)
- Bar-tailed Godwit (EPBC Act – Migratory species)
- Double-banded Plover (EPBC Act – Migratory species)
- Eastern Curlew (EPBC Act – Migratory species)
- Great Egret (EPBC Act – Migratory species)

The proposal is considered unlikely to result in a significant impact on any NSW or Commonwealth listed species of flora or fauna, or TECs. Therefore a Species Impact Statement (SIS) or referral to the Commonwealth Department of Environment (DoE) is not required for the proposal.

The potential impacts from the proposal include:

- 0.9 hectares of direct loss of native vegetation (including seagrass) / habitat
- Injury and mortality to resident fauna
- Increase in weeds, pests and pathogens
- Changed hydrology and seagrass impacts within Burrill Lake
- Increase of key threatening processes
- Cumulative impacts

Measures required to mitigate the specific impacts of the proposal have been recommended in this report. These have been developed to prevent undue damage to the surrounding environment during replacement of the Burrill Lake bridge. Mitigation measures include strategies to prevent over-clearing, erosion and/or disturbance to Burrill Lake hydrology, manage noxious weeds, prevent excessive disturbance to habitat features, and revegetate areas of disturbance after construction activities.

CONTENTS

TABLES

FIGURES

ACRONYMS AND ABBREVIATIONS

BOM	Australian Bureau of Meteorology
CMA	Catchment Management Authority
Cwth	Commonwealth
DECCW	Refer to OEH
DoE	Federal Department of the Environment
DP&I	(NSW) Department of Planning and Infrastructure
EEC	Endangered ecological community – as defined under relevant law applying to the proposal
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999* (Cwth)
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
FM Act	*Fisheries Management Act 1994* (NSW)
ISEPP	*State Environmental Planning Policy (Infrastructure) 2007* (NSW)
KFH	Key Fish Habitat
LEP	Local Environment Plan
NES	Matters of National environmental significance under the EPBC Act (*c.f.*)
Noxious Weeds Act	*Noxious Weeds Act 1993* (NSW)
NPW Act	*National Parks And Wildlife Act 1974* (NSW)
NSW	New South Wales
NV Act	*Native Vegetation Act 2003* (NSW)
OEH	(NSW) Office of Environment and Heritage, formerly Department of Environment, Climate Change and Water
REF	Review of Environmental Factors
SEPP	State Environmental Planning Policy (NSW)
SIS	Species Impact Statement
sp/spp	Species/multiple species
TSC Act	*Threatened Species Conservation Act 1995* (NSW)

1 INTRODUCTION

Roads and Maritime Services (Roads and Maritime) propose to replace the existing Burrill Lake crossing on the Princes Highway, approximately 230 kilometres south of Sydney, and six kilometres south of Ulladulla, New South Wales. The proposal would include:

- Construction of a new simple plank bridge, about three metres higher that the existing deck, located to the east of the existing crossing.
- Construction of new bridge approaches.
- Construction of two new roundabouts:
    - A roundabout at the junction of the Princes Highway with Dolphin Point Road and Balmoral Road.
    - A roundabout at the junction of the Princes Highway with McDonald Parade and Princess Avenue South.
- Removal of the existing bridge and causeway.

Works are required to address deterioration of the existing crossing; upgrade or replacement in the next five to seven years is required to maintain a safe crossing at Burrill Lake.

For the purpose of this report, Roads and Maritime is the proponent and the determining authority under Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

1.1 BACKGROUND TO THIS ASSESSMENT

An Ecological Constraints Assessment was conducted by GHD (2012) to describe the natural environment at the site, identify resident flora, fauna and their habitats, determine the site's conservation significance and identify ecological constraints and opportunities for future replacement or upgrade of the bridge.

The Ecological Constraints Assessment identified the need for follow-up targeted surveys to further assess the impact of the proposal. This Biodiversity Assessment (BA) cites results presented in GHD (2012) and builds on existing information. It provides the results of the targeted surveys recommended by GHD and completes the impact assessment for the proposal works. Results from both GHD (2012) and this current assessment are presented in this report.

1.2 AIM OF THIS ASSESSMENT

This BA forms part of the environmental assessment required to fulfil the requirements of Part 5 of the *Environmental Planning and Assessment Act 1979*.

Specifically, the aims of this report are to:

- Describe the biodiversity values of the site and surrounding area including identifying protected and threatened flora and fauna species, populations and ecological communities and their habitats.
- Update existing ecological constraints mapping of areas that would be affected by the works.
- Identify the direct and indirect impacts of the possible options on flora and fauna species, populations, ecological communities and critical habitat.
- Address the requirements of relevant legislation including the Environmental Planning & Assessment Act 1979 (EP&A Act), the Threatened Species Conservation Act 1995 (TSC Act) and the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).
- Assess the significance of the impact of the proposal on species, ecological communities and populations listed under the TSC Act and EPBC Act.
- Propose environmental management measures to avoid, minimise, mitigate and, if necessary,

offset impacts.

1.3 NEED FOR THE PROJECT

The key driver for the proposal is the imminent maintenance requirement of the existing Burrill Lake crossing. Works are required to address deterioration of the existing crossing. Upgrade or replacement of the crossing is required in the next five to seven years. The primary objective is therefore to:

- Provide a safe and reliable crossing over Burrill Lake.

Secondary objectives of the proposal have been identified as:

- Extend the design life of the crossing by improving the overall reliability of the Princes Highway and reducing future crossing maintenance.
- Provide a lake crossing and road approaches designed above the predicted 1 : 100 ARI.
- Improve road safety and traffic efficiency by providing 3.5 metre lanes and 2.5 metre shoulders on the bridge as well as new connections between local roads and the Princes Highway.
- Provide a Higher Mass Limit (HML) compliant structure on the Princes Highway crossing of Burrill Lake.
- Provide the opportunity to improve pedestrian and cyclist access and safety.
- Maintain connectivity for local traffic, including to businesses that front Burrill Lake.
- Provide new infrastructure that is consistent with the future provision of a Milton Ulladulla Bypass.
- Minimise environmental impacts (including social impacts and removal of hazardous waste).
- Provide value for money.

1.4 PROJECT DESCRIPTION

The existing Burrill Lake crossing would be replaced with a new bridge and bridge approaches. Construction is expected to take between 15 to 18 months, and is anticipated to commence in early to mid-2015.

The proposal includes:

- Construction of a new bridge to the east of the existing crossing consisting of a simple plank 2-lane bridge about 290 metres in length and about three metres higher with concrete piers bored into the lake about 16 – 18 metres apart.
- Construction of new bridge approaches extending about 540 metres north and 260 metres south of the proposed new crossing; total length of works being about 1.09 kilometres.
- Construction of a new roundabout at the junction of the Princes Highway with Dolphin Point Road and Balmoral Road.
- Construction of a new roundabout at the junction of the Princes Highway with McDonald Parade and Princess Avenue South.
- Removal of the existing bridge and causeway will be undertaken using a combination of hand tools, excavator and crane. A small barge or floating platform may be required within the lake to locate discarded materials during removal.
- Other plant and equipment will include mulching plant and chipper, generators, bobcats, air compressors, road trucks, compactors, graders, multi-tyred vibratory rollers, asphalt paving plant, backhoes, rock crushers, jackhammers, and concrete saws.
- Three stockpile sites would be used during the construction stage for the storage of equipment and materials; two adjacent to the north and south abutments, and one at the junction of Princes Highway and Wheelbarrow Road, approximately two kilometres south of Burrill Lake.

For a full project description refer to *Burrill Lake Bridge Review of Environmental Factors*

(**ngh**environmental 2014).

1.4.1 Direct and Indirect Impacts

The following direct impacts on flora and fauna are anticipated from the proposal:

a) Clearing or thinning of native vegetation including seagrasses within the lake;
b) Earth works, including excavation of lake bed material for removal of existing bridge piers;
c) Potential sedimentation or contamination of Burrill Lake from disturbance to soils near and within the lake, or from spills during construction;
d) Potential changes in local hydrology within Burrill Lake during removal of the existing bridge and construction of the new bridge; and
e) Compaction of the soil within areas to be accessed by heavy machinery/vehicles.

The following indirect impacts on flora and fauna are anticipated from the proposal:

a) Potential increase in noise, light, and vehicle disturbance from resident use which may alter behaviour of fauna;
b) Microclimate changes to areas of vegetation to be retained arising from clearing of adjoining areas; and
c) Potential weed invasion into areas of native vegetation adjoining the disturbed areas.

1.5 ASSESSMENT TERMINOLOGY

The following definitions are used in this report:

Subject site: is the area directly affected by the development proposal, which comprises approximately 4.3 hectares of land (area of impact). Detailed investigations were undertaken within the subject site.

Study Area: further general field investigations were completed within an area defined as the study area (approximately 25 hectares) to determine the significance of surrounding vegetation and other habitat features (i.e. Burrill Lake) that may be indirectly affected by the proposal. The study area included the subject site and an adjoining area.

Locality: area within a 10 kilometres radius of the study area.

The boundaries of the subject site, study area, and locality are shown in Appendix I, Figure A.

1.6 LEGISLATIVE REQUIREMENTS

1.6.1 Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)

The purpose of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is to ensure that actions likely to cause a significant impact on Matters of National Environmental Significance (MNES) undergo an assessment and approval process. Approval by the Environment Minister is required if an action is likely to have a significant impact on a MNES listed under the Act.

These include:

- World heritage properties
- National heritage places
- Wetlands of international importance (listed under the Ramsar Convention)
- Listed threatened species and ecological communities
- Migratory species protected under international agreements

- Nuclear actions (including uranium mines)
- Commonwealth marine areas
- The Great Barrier Reef Marine Park
- A water resource, in relation to coal seam gas development and large coal mining development.

The EPBC MNES reporting tool was consulted to determine if any threatened biota or communities listed under the Act would be impacted by the proposal. This included a 10 kilometres search buffer from the centre of the subject site. The Significant Impact Guidelines for the EPBC Act set out criteria to assist in determining whether a proposed action is likely to have a 'significant impact' on any MNES. Assessments of significance have been completed for relevant threatened fauna that have potential to be affected by the proposal (refer Appendix H).

1.6.2 NSW Environmental Planning and Assessment Act 1979 (EP&A Act)

The *Environmental Planning and Assessment Act 1979* (EPA Act) is the principle planning legislation for NSW. The EP&A Act provides the framework for environmental planning and development approvals and includes provisions to ensure that the potential environmental impacts of a development are assessed and considered in the decision making process. This proposal is to be assessed under Part 5 of the EP&A Act.

The EP&A Act places a duty on the determining authority (in this case Roads and Maritime) to adequately address a range of environmental matters including the maintenance of biodiversity and the likely impact to threatened species, populations and communities listed under the TSC Act, FM Act and NPW Act.

Assessment of threatened species, populations and community considerations usually occurs under Section 5A of the EP&A Act relating to 7-Part Tests of Significance. The 7-part test is used to assist in the determination of whether a proposal is 'likely' to impose 'a significant effect' on threatened biota and thus whether a species impact statement (SIS) is required.

Seven-part tests have been completed for relevant threatened entities that have potential to be affected by the proposal (refer Appendix G).

1.6.3 NSW Threatened Species Conservation Act 1995 (TSC Act)

The *Threatened Species Conservation Act 1995* (TSC Act) aims to protect and encourage the recovery of threatened species, populations and communities listed under the Act. Obligations on determining authorities include the consideration of threatened species, populations, endangered communities and recovery plans in fulfilling their statutory responsibilities in the development approvals process under the EP&A Act.

The TSC Act has been addressed in the current assessment through identifying threatened biota and their habitats listed under the Act that could be potentially impacted by the proposal to which 7-part tests were completed in accordance with the EP&A Act (refer Section 5).

1.6.4 NSW Fisheries Management Act 1994 (FM Act)

The objects of the Fisheries Management Act 1994 (FM Act) are to conserve, develop and share the fishery resources of the State for the benefit of present and future generations.

The FM Act has been addressed in the current assessment through identifying threatened biota and their habitats listed under the Act that could be potentially impacted by the proposal to which 7-part tests were completed in accordance with the EP&A Act (refer Section 5).

One of the objectives of the FM Act is to conserve key fish habitats, which includes aquatic habitats that are important to the maintenance of fish populations generally and the survival and recovery of threatened aquatic species. Burrill Lake is mapped as key fish habitat (DPI 2013). To assist in the protection of key fish habitats, the Minister for Primary Industries has gazetted Fish Habitat Management Plan No 1 (DPI 1995), relating to works or activities that can impact on fish habitat.

Fish Habitat Management Plan No 1 applies to the following developments, works or activities, each of which can impact on fish habitat:

- Dredging or reclamation. Under clause 6.4 of Fish Habitat Management Plan No 1 and section 199 of the FM Act, the Minister is required to be consulted over any dredging or reclamation works carried out, or proposed to be authorised, by a public authority (other than a local government authority) (DPI 1995). The construction of the new bridge requires dredging or reclamation and the Minister must be consulted.
- Impeding fish passage. A permit may be required under section 219 of the FM Act for any works that could result in the temporary or permanent blockage of fish passage within a waterway. The construction of the new bridge is unlikely to impede fish passage.
- Damaging marine vegetation. A permit is required for any cutting, removal, damage or destruction of seagrasses, saltmarsh or macroalgae.
- De-snagging. Under clause 6.14 of the Fish Habitat Management Plan No 1, public authorities are required to notify the Minister of any proposal to remove or relocate snags, in particular fallen trees or rocks (DPI 1995). The removal of snags is not required for the construction of the new bridge.

The Minister for Primary Industries has also gazetted Fish Habitat Management Plan No 2 (DPI 1997), which deals with the protection of seagrasses. The primary objective of this Plan is to ensure there is no net loss of seagrasses within the coastal and estuarine waters of NSW.

In summary, The FM Act sets out provisions to protect marine vegetation (mangroves, seagrass, saltmarsh and seaweeds whether alive or dead) from 'harm'. 'Harm' under the FM Act means gather, cut, pull up, destroy, poison, dig up, remove, injure, prevent light from reaching or otherwise harm the marine vegetation, or any part of it. A permit under part 7 of the FM Act is required from NSW Department of Primary Industries (DPI) to harm marine vegetation.

1.6.5 NSW Native Vegetation Act 2003

The *Native Vegetation Act 2003* (NV Act) aims to regulate the clearing of native vegetation on all land in NSW. Exemption from obtaining Consent under the NV Act is achieved through Clause 25 of the Act, which provides exemptions for the following:

(a) any clearing that is, or is part of, an activity carried out by a determining authority within the meaning of Part 5 of the Environmental Planning & Assessment Act 1979 if the determining authority has complied with that Part

(b) any clearing that involves the removal or lopping of any tree or other vegetation in accordance with section 88 of the Roads Act 1993

(c) any clearing carried out in accordance with a consent under Division 3 of Part 9 of the Roads Act 1993

The proposal would be assessed as Part 5 development (under the EP&A Act) and the proposal would be carried out by Roads and Maritime, a determining authority as defined by the Act. Therefore the project is exempt from the requirements of the NV Act.

1.6.6 NSW Noxious Weeds Act 1993

This act aims to prevent the establishment, reduce the risk of spread and minimise the extent of noxious weeds. The *Noxious Weeds* (NW) *Act 1993* guides the management of declared noxious weeds within Local Government Areas (LGAs). The act distinguishes between five classes of noxious weeds, which are separated based on their distributions and the level of threat that each species poses to the environment, human health, or primary production (Table 1-1). Noxious weeds that are classified as Class 1, 2 or 5 are also considered 'notifiable weeds'. The Local Control Authority (e.g. Council) must be informed about the presence of the weed on land within 24 hours of becoming aware or suspecting that the weed is on the land. Declared noxious weeds in NSW are plants that have been proclaimed under the NW Act. The legislation requires that these species be controlled or eradicated.

One Class 4 weed, Blackberry (*Rubus fruticosus*), was identified during the field survey. Recommendations are made in this assessment to control this weed.

Table 1-1: Noxious weed classes and their characteristics as listed under the Noxious Weeds Act 1993.

Noxious Weed Class	Class Characteristics
Class 1 **State Prohibited Weeds**	Plants that pose a potentially serious threat to primary production or the environment and are not present in the State or are present only to a limited extent.
Class 2 **Regionally Prohibited Weeds**	Plants that pose a potentially serious threat to primary production or the environment of a region to which the order applies and are not present in the region or are present only to a limited extent.
Class 3 **Regionally Controlled Weeds**	Plants that pose a serious threat to primary production or the environment of an area to which the order applies, are not widely distributed in the area and are likely to spread in the area or to another area.
Class 4 **Locally Controlled Weeds**	Plants that pose a threat to primary production, the environment or human health, are widely distributed in an area to which the order applies and are likely to spread in the area or to another area.
Class 5 **Restricted Plants**	Plants that are likely, by their sale or the sale of their seeds or movement within the State or an area of the State, to spread in the State or outside the State.

1.6.7 NSW National Parks and Wildlife (NPW) Act 1974

This act aims to conserve nature, habitat, ecosystems, ecosystem processes and biological diversity at the community, species and genetic levels. Under this act all native fauna is protected, threatened or otherwise. Schedule 13 of the act lists protected plants which shall not be harmed or picked on any land either on or off National Park estate.

With regard to threatened species a person must not:

(a) harm any animal that is of, or is part of, a threatened species, an endangered population or an endangered ecological community, or

(b) use any substance, animal, firearm, explosive, net, trap, hunting device or instrument or means whatever for the purpose of harming any such animal.

Mitigation measures have been developed within this biological assessment to address risks to threatened species, endangered populations and endangered ecological communities.

Ecologically Sustainable Development Principles

The precautionary principle – This assessment has been prepared utilising the precautionary principle. That is, if threats are perceived as possibly leading to serious or irreversible environmental damage, then either the proposal would not occur, or the development would be modified to ensure that such threats are addressed.

Inter-generational equity – This assessment considers the potential for the three possible options to impact on natural or cultural features to a level that would compromise the health, diversity or productivity of the environment to a level that would impact on future generations.

Conservation of biological diversity and ecological integrity – The proposal considered in this BA would require vegetation removal. The assessment has considered potential to impact notably on the biological diversity and ecological integrity of the region.

Improved valuation of pricing of environmental resources – The assessment has been undertaken in recognition of the value of the environment.

Mitigation measures have been developed that would assist in protecting important habitat features at the site.

1.6.8 SEPP 14 – Coastal Wetlands

State Environmental Planning Policy 14 – Coastal Wetlands (SEPP 14) seeks to control development within coastal wetland areas for environmental and economic considerations. Any development within or near listed wetlands must be considered for the impact it might have on the environment, and whether or not the proposal is avoidable within these areas, before consent is granted.

No SEPP 14 coastal wetlands would be affected by the proposal. A number of SEPP 14 coastal wetlands are associated with Burrill Lake, but are located over four kilometres upstream of the study area. This report assesses the estuarine habitats associated with Burrill Lake and potential impacts of the proposal according to legislative requirements of the EP&A Act.

1.6.9 SEPP 44 – Koala Habitat Protection

The *State Environmental Planning Policy No. 44 – Koala Habitat Protection* (SEPP 44) applies to all LGAs listed on Schedule 1 of the policy, except land dedicated under the *National Parks and Wildlife Act 1974* or the *Forestry Act 1916*. The identification of an area of land as SEPP 44 Potential Koala Habitat is determined by the presence of Koala feed tree species listed within Schedule 2 of the policy.

Potential Koala Habitat is defined as areas where the tree species listed under Schedule 2 constitute at least 15 per cent of the total number of trees in the upper or lower strata of the tree component. An area of land to which the policy applies must be at least one hectare in area (and may include adjoining land in the same ownership). If Potential Koala Habitat is present then it must be further assessed to determine whether it represents Core Koala Habitat. There are specific matters to be taken into consideration before development consent may be granted if Core Koala Habitat is present.

The proposal is being assessed under Part 5 of the EP&A Act therefore this SEPP is not applicable. However, this SEPP been considered in this assessment according to the above requirements. Shoalhaven LGA is listed in Schedule 1 of SEPP No. 44. No tree species classified as potential Koala habitat as listed under schedule 2 or listed as preferred, secondary or supplementary feed species in the recovery plan

(DECC 2008) were recorded. The study area would therefore not be considered *core* or *potential Koala habitat.*

1.6.10 SEPP 71 – Coastal Protection

State Environmental Planning Policy 71 (SEPP 71) encourages the appropriate development of the NSW coastal zone by ensuring the use of consistent and strategic approach to coastal planning and management and a clear development assessment framework.

The proposal is being assessed under Part 5 of the EP&A Act therefore this SEPP is not applicable. However, this report assesses the estuarine habitats associated with Burrill Lake and potential impacts of the proposal according to legislative requirements of the EP&A Act.

1.6.11 Draft Shoalhaven LEP 2013

The Shoalhaven Local Environmental Plan (LEP) 1985 is being superseded by the Draft Shoalhaven LEP 2013, which had been submitted to Department of Planning and Infrastructure for finalisation in October 2013 at the time of writing. Therefore, the most recent land use zoning detailed in the Draft LEP 2013 has been referenced in this report.

The area of the existing Burrill Lake Bridge is zoned as SP2 - Infrastructure. The land surrounding Burrill Lake is zoned as RE1 - Public Recreation and a small area is zoned as SP3 - Tourist. Burrill Lake is zoned as W2 - Recreational Waterways. The zoning is aimed at maintaining the arterial road network both within and adjacent to the Princes Highway, while also promoting recreational use.

The provisions of the State Environmental Planning and Policy (Infrastructure) 2007 override the consent requirements of the draft LEP and development consent from Council would not be required in this instance as Roads and Maritime are the determining authority.

2 METHODOLOGY

2.1 LITERATURE REVIEW, SURVEY GUIDELINES AND DATABASE SEARCHES

Literature Review

Literature relevant to this assessment was reviewed and included:

- OEH Threatened Species Profiles
- Department of the Environment EPBC Act Species Profiles and Threats Database (SPRAT)
- Construction methodology and concept designs
- Aerial maps
- Burrill Lake Bridge Ecological Constraints Assessment (GHD, 2012). Survey effort and results of this assessment are summarised in Section 2 and 3 of this report.
- Native vegetation mapping for the area (Tozer *et al.* 2010)
- Shoalhaven City Council Endangered Ecological Community mapping

Survey Guidelines

Surveys were undertaken in accordance with relevant guidelines including DECC (2004) Draft Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities; DPI (2013) Policy and guidelines for fish habitat conservation and management; and a combination of NPWS (2003) Green and Golden Bell Frog Environmental Impact Assessment Guidelines and DEWHA (2009) EPBC Act significant impact guidelines for the Green and Golden Bell Frog.

Database Searches

Database searches undertaken for the purposes of this assessment included threatened species databases and noxious weed databases as listed in Table 2-1. The results of the database searches are provided in full in Appendix D. An evaluation of the likelihood of occurrence of threatened flora and fauna species and ecological communities within the study area is provided in full in Appendix E.

Table 2-1 Background searches undertaken for threatened entities and noxious weeds.

Resource	Target	Search Date	Search Area
OEH Wildlife Atlas Database	Threatened flora and fauna and populations.	08/10/13	10 kilometres radius of study area
EPBC Act Protected Matters Search Tool	Threatened flora and fauna, endangered populations and ecological communities and migratory species.	08/10/13	10 kilometres radius of study area
DPI Fishing and Aquaculture threatened and protected species records viewer	Threatened and protected species of fish and marine vegetation	08/10/13	Shoalhaven City Council
DPI Noxious Weed Database	Noxious weeds declared in the relevant LGA.	08/10/13	Shoalhaven City Council

2.2 FLORA METHODS

2.2.1 Survey undertaken by GHD (2012) during the Ecological Constraints Assessment

GHD (2012) undertook flora surveys during their Burrill Lake Bridge Ecological Constraints Assessment. These surveys are briefly summarised below and results are presented in Section 3 and Appendix B and C. The following surveys were completed:

- **Terrestrial vegetation mapping** was undertaken through random meander surveys to characterise vegetation type, structure and condition. Vegetation condition was assessed as poor, moderate, or good.
- **Random meander flora surveys** were undertaken within and around the study area to search for likely habitat of threatened plant species.
- **Seagrass mapping** by NSW Department of Primary Industries (DPI) was ground-truthed and seagrass extent and changes in cover and density were recorded within the study area.

2.2.2 Surveys undertaken by nghenvironmental November 2013

The aims of the flora surveys were to:

1. Review the vegetation mapping reported by GHD (2012) within the study area, as well as condition and extent of vegetation types and supplement survey effort for seagrass vegetation.
2. Carry out targeted survey for threatened flora species identified by GHD (2012) as having potential for impact including:
    - The Leafless Tongue Orchid (*Cryptostylis hunteriana*)
    - East Lynne Midge Orchid (*Genoplesium vernale*)
    - Tangled Bedstraw (*Galium australe*)

Random meander and targeted flora surveys

Floristics at the site were surveyed using the random meander method of Cropper (1993). Random meanders were undertaken within all areas supporting native vegetation across the study area. Highly disturbed or exotic dominated areas were not surveyed in detail. All identifiable species encountered were recorded for the purposes of characterising vegetation types and habitat values for threatened species and communities. The boundaries of vegetation types were recorded using a handheld GPS for later input into a GIS for mapping.

Areas supporting better quality and less disturbed vegetation were targeted and searched for the presence of threatened species and their habitats. Targeted search transects are shown Appendix I, Figure B. The early November timing of the survey was selected to coincide with the flowering of the East Lynne Midge Orchid. A known population of this species at East Lynne was visited on the morning of the survey to confirm that the species was identifiable and flowering at the time.

Supplementary seagrass survey

Ground-truthing of the seagrass community mapping reported by GHD (2012) was undertaken within the study area and in adjacent areas to the south where seagrass was more extensive. The purpose of extending the survey beyond the study area was to characterise areas of seagrass that are unlikely to be impacted by the proposal and provide a context to assess the extent of areas that would be impacted. Within the more extensive areas mapped on the south eastern side of the bridge, transects perpendicular

to the shore were conducted on foot initially at 10 metre spacing and then at 20 metre spacing once it was determined that variability parallel to the shore was generally low and would be adequately detected using a spacing of 20 metres. Ten detailed transects were completed. An additional two transects were also conducted to establish the eastern boundaries of varying cover and density. The locations of transects are shown on Appendix I, Figure B. At every five metres along each transect the following information was recorded:

- Water depth
- Seagrass species present
- Percent cover of each species (in increments of 10 per cent)
- Percent cover of epiphytes on seagrass leaves ((in increments of 10 per cent)
- Notes on general shifts in coverage or density

Transects were not completed on the north-eastern side of the bridge due to a high proportion of sediment within the bed of the estuary and the difficulty in traversing this area on foot. Instead a general survey of the area was conducted. Detailed transects were not considered to be warranted on the north or south-western sides of the bridge as the extent of seagrass from the shoreline was generally short. Transects were undertaken parallel to the shore and general characteristics on the coverage and density of seagrass noted.

GHD (2012) mapped seagrass extent and changes in coverage and density using the Braun-Blanquet (Cropper 1993) seagrass density matrix as outlined in **Table 2-2** below. This classification is also utilised in this report for ease of comparison.

Table 2-2 Braun-Blanquet seagrass density matrix (Cropper 1993)

Coverage / Density	1	2	3
	Single individual plants	Moderate individuals	Continuous mat
A Single stands	A1	A2	A3
B Patchy	B1	B2	B3
C Fairly continuous	C1	C2	C3
D Established beds	D1	D2	D3

2.2.3 Terrestrial Vegetation Condition

Condition assessment was applied to the terrestrial vegetation types within the study area[1]. General condition classes used in this assessment are based on structural characteristics, species richness and the ratio of native species to exotics as per below:

Poor Groundlayer dominated by exotics, native overstorey present OR native overstorey and understorey present however extensively modified due to disturbance resulting in low species diversity. Exotic species may be abundant.

Moderate Native overstorey present (if applicable to vegetation type), some exotics may be present in the groundlayer but mostly native dominated. Some disturbance is evident however, structural integrity is maintained and a moderate level of species diversity is present

[1] GHD (2012) also applied a three point condition assessment to some of the vegetation types within the study area however the condition classes were not well defined. As such, condition classes applied in this assessment may differ.

Good Groundlayer dominated by native species, few exotics present. Low levels of or no evidence of disturbance. Structural integrity is maintained and a high level of species diversity is present.

All of the above condition classes would be considered to be 'moderate to good condition' under the NSW OEH Biometric definitions where the percent overstorey cover exceed 15 per cent of the lower benchmark value for a given vegetation type or where the percent native groundcover is greater than 50 per cent.

2.2.4 Plant and Community Nomenclature

The plant and community nomenclature used in the GHD (2012) has been cited in this report for simplicity. Vegetation communities in the study area were categorised on the basis of their structure and formation using Specht (1970) classification, as well as the floristic composition of the site. Vegetation types are classified using the Southeast NSW Native Vegetation Classification and Mapping (SCIVI) communities for south-east NSW (Tozer *et al.* 2010). The equivalent Biometric vegetation types (OEH 2012) are also provided.

Botanical nomenclature follows Harden (1990-2002), with recent name changes provided by the Australian Plant Name Index of the Australian National Herbarium. In the body of this report, flora species are referred to by both their common and scientific names when first mentioned. Subsequent references to these species cite the common name only. Where a species does not have a generally accepted common name, the scientific name is used throughout the body of the report. Common and scientific names are included in the Appendices.

Noxious weeds are those declared for the Shoalhaven control area under the *Noxious Weeds Act 1993* (refer Appendix F).

2.3 FAUNA METHODS

2.3.1 Survey Effort Undertaken by GHD (2012) During the Ecological Constraints Assessment

GHD (2012) undertook several fauna surveys during their Burrill Lake Bridge Ecological Constraints Assessment. These surveys are briefly summarised below and the results are presented in Section 3 and Appendix B and C of this report. Surveys focused on the identification of suitable habitat and specific resources to determine the value of habitats for threatened and migratory species within the study area. The following surveys were completed:

- **General fauna habitat assessments** to record type of habitats present within the study area such as potential shelter, roosting, nesting or foraging sites and specific habitat features such as lake margins, food trees, understorey diversity and density, presence of hollow-bearing trees, ground-cover and soil types.
- **Diurnal bird surveys** to record all bird species present.
- **Microchiropteran bat survey** to target species potentially roosting under the Burrill Lake Bridge.
- **Opportunistic observations** of any fauna species seen or heard during other fauna surveys.

2.3.2 Survey Undertaken by nghenvironmental November 2013

The aims of the terrestrial fauna survey were to:

1. Review the extent of fauna habitat as reported by GHD (2012), particularly threatened species habitat, such as aquatic habitat within Burrill Lake and augment the existing survey effort where appropriate.
2. Carry out targeted survey for threatened species with potential for impact, particularly:
    a. Threatened microchiropteran bats.
    b. Green and Golden Bell Frog (*Litoria aurea*).
    c. Threatened shorebirds or migratory birds: Eastern Osprey (*Pandion cristatus*), Pied Oystercatcher (*Haemotopus longirostris*), Sooty Oystercatcher (*Haemotopus fuliginosus*), White-fronted Chat (*Epthianura albifrons*), Bar-tailed Godwit (*Limosa lapponica)*, Double-banded Plover (*Charadrius bicinctus*), Eastern Curlew (*Numenius madagascariensis*), Great Egret (*Ardea alba*), and White-bellied Sea-Eagle (*Haliaeetus leucogaster*).

Habitat assessment

A brief assessment of habitat types and their quality was conducted across the subject site to review the results of field surveys conducted by GHD (2012). Factors such as canopy resources, ground-layer resources, vegetation structure, connectivity and existing levels of disturbance were noted and compared to the results presented in 2012 by GHD.

Shorebird and migratory bird surveys

Four bird surveys were undertaken within the study area (Appendix I, Figure C). Surveys primarily focused on the subject site (i.e. shorebird habitat) as GHD (2012) completed general diurnal bird surveys. However, one survey was conducted within the adjacent parkland to Burrill Lake to survey for other diurnal migratory or threatened species. Each survey was undertaken between 45 minutes to 2 hours and all species seen or heard were recorded. The following variables were recorded: observation type, microhabitat type and number of individuals.

Surveys were conducted in the early morning or afternoon and where possible, were timed to coincide with low tide within Burrill Lake when mud flats would be most exposed to maximise detection of foraging shorebirds.

All opportunistic records of bird species observed during other fauna surveys were also recorded.

Microchiropteran Anabat surveys

Microbats were surveyed using a ground mounted stationary Anabat detector (passive survey) on the 24th October and 14th of November 2013 (Appendix I, Figure C). The primary aim of the survey was to determine if microbats were roosting under the Burrill Lake Bridge. One Anabat was set-up at the southern side of the bridge on two separate occasions. The Anabat were set to record calls from approximately 30 minutes before sunset to daybreak the following morning. Surveys targeted nights of no or little wind to maximise the chance of calls being recorded.

Green and Golden Bell Frog surveys

Targeted Green and Golden Bell Frog surveys were undertaken within a drain supporting potential habitat on the south side of the Burrill Lake (south side of Dolphin Point Road). The site was surveyed according to the NSW NPWS (2003) survey guidelines and EPBC Act (DEWHA 2009) survey guidelines for this species and included: active diurnal search for basking animals, call playback for up to 5 minutes,

listening for vocalisations for the species for up to 15 minutes, and spotlighting for up to 40 minutes, totalling a duration of one hour per survey. Surveys were undertaken during the breeding season of the species in warm temperatures conducive to detecting the species, with two surveys undertaken after significant rainfall events. Surveys were undertaken over four separate nights to increase the chance of detecting the species.

Table 2-2 and Appendix I - Figure C detail the survey effort completed.

2.4 SURVEY EFFORT AND CONDITIONS

Table 2-3 details the survey effort and Table 2-4 details the weather conditions recorded during the field survey. Overall, conditions during the survey period were considered appropriate for detecting the target species.

Table 2-3 Survey effort completed by nghevironmental 2013

Date	Method	Survey Effort	Target Species
Flora			
14 November 2013	Random meander and targeted searches	3.5 person hours	All species East Lynne Midge Orchid
14 November 2013	Supplementary seagrass surveys	3 person hours	All seagrass species
Habitat			
9 Oct 2013	Habitat inspection	1.5 hours	All species
Birds			
9th and 24th Oct 2013; 20th and 26th Nov 2013	Diurnal bird survey	45 minute to 2 hours (4.50 person hours)	All species, but primarily threatened shorebirds
Microbats			
24th Oct 2013 and 14th Nov 2013	Anabat Survey	Two overnight surveys	Threatened Microbats
Green and Golden Bell Frog			
14th, 20th, 26th November 2013; 6th December 2013	Nocturnal survey	Four surveys at 1 hour each (4 person hours)	Green and Golden Bell Frog

Table 2-4 Weather conditions recorded during the field surveys

Date	Temperature min (°C)	Temperature max (°C)	Temperature at time of frog survey (°C)	Rain (mm)	Wind
9 Oct 2013	9.4	28.6	N/A	Nil	Slight breeze
24th Oct 2013	14.3	21.2	N/A	Nil	Slight breeze
14th Nov 2013	14.2	22.6	18	Nil (however rain 2-days prior)	Slight breeze

Date	Temperature min (°C)	Temperature max (°C)	Temperature at time of frog survey (°C)	Rain (mm)	Wind
20th Nov 2013	14.1	23	17	Nil	Slight breeze
26th Nov 2013	13.6	20	15	Nil (however rain leading up to survey)	Slight breeze
6th Dec 2013	9.5	20.4	15	Nil (however rain leading up to survey)	Moderate breeze

2.5 LIMITATIONS

Most living flora species encountered at the site were able to be identified, enabling vegetation types and condition to be clearly defined. The late spring timing of the survey was considered appropriate for detecting a high species diversity within the study area however, it is possible that some summer flowering species, and species difficult to identify in their vegetative state, may have been overlooked. Summer flowering orchids (such as the Leafless Tongue Orchid) would not have been detectable.

To account for the potential for species of conservation significance to be overlooked due to the survey timing, habitat evaluation has been utilised to determine the likelihood of threatened species to occur and be impacted by the proposed development (refer to Appendix E).

Some of the seagrass beds within the study area were in the early stages of growth at the time of the survey (the seagrass species within the study area dieback over winter and regrow in the summer) dominated by juvenile plants. This resulted in the coverage in these areas appearing lower then what would be the case if and/or when the seagrass had matured.

Hand-held Garmin GPS units were used to record features during the survey. Data were plotted over aerial imagery (sourced from Roads and Maritime) using ESRI's ArcGIS software for mapping, planning and presentation. Sea-grass vegetation boundaries were extrapolated from field data. All map references are based on the GDA 94 datum.

Using CAD data of each option, provided by Roads and Maritime, the subject site boundaries were digitised using ArcGIS to determine the impact area. During the digitising process, it was not always possible to precisely align the construction footprint polygons with the CAD boundary due to some inherent compatibility issues between the two formats. As such, there may be small discrepancies (< 1 metre) at a few discrete locations. The significance of this error to the impact assessment conclusions is considered to be minor.

3 EXISTING ENVIRONMENT

3.1 LANDSCAPE CONTEXT

The landscape character of the South Coast region is dominated by the natural environment. Extensive areas of bushland and rural land are common. The landform is variable, generally undulating to hilly. The locality is characterised by low density settlement, farm land, state forests, coastal waterways and national parks; Meroo National Park borders the western side of the Princes Highway.

Current land uses at the proposal site include:

- Low density residential properties on either side of the lake,
- Businesses and community services associated with Burrill Lake township along the existing highway alignment, and
- Tourism including caravan parks to the north and south of the lake, recreation open areas including Lions Park on the western approach, and Burrill Lake and holiday rentals.

The proposal site crosses Burrill Lake which is a barrier-type estuary. It is classified as an intermittently closed and opened lake or lagoon which is generally open to the sea, however, displays very little tidal fluctuation. Burrill Lake provides Class 1 major key fish habitat (DPI 2013).

3.2 DATABASE AND LITERATURE REVIEW

Appendix D provides a list of threatened species that have been recorded from database searches within a 10 kilometre radius of the study area. In Appendix E, the habitat characteristics of these species or communities have been evaluated to determine their likelihood to occur within the study area. Those species identified from the field survey or considered likely to occur require further assessment according to Section 5A of the EPA Act and the EPBC Act and have been identified in Section 3.3.3 for flora and Section 3.4.3 for fauna. Further assessment of these species is presented in Appendix G – Assessment of Significance (AoS).

3.3 FLORA FIELD SURVEY RESULTS

3.3.1 Vegetation Communities

GHD (2012) identified four native vegetation communities within the study area, the condition and extent of which were confirmed during surveys by **ngh**environmental. These are summarised in **Table 3-1** and discussed in more detail below. A species list identifying the species recorded during the 2012 and 2013 surveys is included in Appendix B.

Table 3-1 Vegetation communities in the study area (from GHD, 2012)

Vegetation Community (GHD, 2012)	Location within the study area
Seagrass Meadows (Zostera) (SL e70)	Shallow areas of Burrill Lake, on either side of Burrill Lake Bridge.
Estuarine Saltmarsh	Narrow strips along the edges of Burrill Lake, on the north-east, south-

Vegetation Community (GHD, 2012)	Location within the study area
(SL p509)	east and south-west sides of the bridge.
Coastal Sand Forest (DSF p64)	Small patches in the west of the study area, adjacent to the Princes Highway (both to the north and south) and in the east of the study area, particularly to the south of the Princes Highway.
Estuarine Fringe Forest (FOW p106)	Small patches adjacent to Princes Highway on the approaches to the bridge and along the shore of Burrill lake inlet in the south-west of the study area. Additional areas extend further south outside of the study area.

All of the native terrestrial vegetation types within the study area would be considered to be in moderate to good condition according to the NSW OEH Biometric definitions as the percent overstorey cover exceeds 15 per cent of the lower benchmark value for Coastal Sand Forest and Estuarine Fringe Forest and the percent native groundcover is greater than 50 per cent within the Estuarine Saltmarsh.

Seagrass Meadows

Seagrass meadows (dominated almost entirely by *Zostera muelleri* subsp*. capricorni*) occur extensively on all stable sand bars within Burrill Lake. Investigation by GHD (2012) revealed that the occurrence of seagrass is far more prevalent than indicated on existing mapping by DPI (2002) and Tozer et al (2010), particularly on the sand bar located to the south of the bridge and east of the channel. This area was mapped as a bare sand bar, however seagrass has colonised this area extensively. The distribution and density and/or cover of seagrass varies across the study area from single stands to patchy or fairly continuous beds of moderate to high densities. The distribution of this variation is illustrated on the vegetation mapping in Appendix I – Figure D. The mapped distribution of seagrass in 2013 is somewhat different to the 2012 mapping (GHD 2012), demonstrating the dynamic nature of seagrass beds. Seagrass beds can be seasonally variable as some seagrasses (such as *Zostera muelleri* subsp*. capricorni*) die back during winter and re-establish in summer (DPI 2007).

Figure 3-1 Examples of varying seagrass coverage and densities across the study area

Investigations by GHD (2012) suggested that tidal fluctuations in Burrill Lake appear to be limited to about 10 centimetres difference between low and high tide. Seagrass was not observed to be exposed during the 2012 surveys, and given the limited fluctuation, it was considered that it is likely to only rarely be exposed, if at all. Surveys in 2013 were conducted at low tide with the depth of water in some areas as

low as 5 centimetres which resulted in some degree of exposure of the seagrass as can be seen in Figure 3-1.

The characteristics of this community are summarised in Table 3-2 below.

Table 3-2 Summary of Seagrass Meadows vegetation community

Seagrass Meadows	
Approximate extent within study area	There are about 4 hectares of this community in the study area.
Area to be impacted	Approximately 0.2 hectares will be impacted by the proposal.
Description	Canopy: NA Understorey: NA Groundcover: Varying densities and distribution (scattered plants to fairly continuous beds) of *Zostera muelleri* subsp. *capricorni* with scattered occurrences of macroalgae
Condition	Good.
Conservation Status	This vegetation community is not listed as an Endangered Ecological Community (EEC) under either the TSC or EPBC Acts. Seagrass communities are however, protected under the *Fisheries Management Act 1994* (FM Act). The NSW DPI has management responsibility for fish and marine vegetation, including seagrasses, under the FM act. Any development or activity that may harm seagrass requires a permit to harm under Part 7 of the FM Act.
Threatened plant species habitat	Within the study area, this community does not provide habitat for threatened flora species, all of which are considered unlikely to occur.
Threatened fauna species habitat	Seagrasses provide important habitat for juvenile and adult fish. Many commercially and recreationally important fish species such as bream, luderick, leatherjackets, snapper and sea mullet live in seagrass habitats for all or part of their life cycle. Seagrass beds are also used by fish to spawn and as shelter from predators (NSW DPI 2007). Shorebirds that could forage within seagrasses and nearby mudflats include Sooty Oystercatcher, Pied Oystercatcher and Migratory species of Bar-tailed Godwit, Eastern Curlew, Double-banded Plover and Great Egret.
Equivalent vegetation types	The Biometric vegetation types database does not have any closely matching community for the vegetation on site.
Example	**Figure 3-1 Examples of varying seagrass coverage and densities across the study area**

Estuarine Saltmarsh

Estuarine Saltmarsh occurs in the intertidal zone on the shores of Burrill Lake (**Figure 3-2**). It is present in the location identified in the DPI (2002) mapping (north-east bank adjacent to the bridge) and also occurs on two additional banks (south-east and south-west), in lesser extent. In these additional occurrences the extent of saltmarsh landward is restricted by copper post and rail retaining fences delineating the boundaries of maintained open space / parkland. Saltmarsh location and extent in the study area is

displayed in Appendix D. Saltmarsh communities also occur outside the study area, however mapping of the entire saltmarsh extent at Burrill Lake as not undertaken for this assessment.

Figure 3-2 Examples of Estuarine Saltmarsh within the study area

A total of 15 saltmarsh-associated flora species were recorded at the three locations investigated by GHD in 2012, being the north-east, south-east and south-west banks (refer to Appendix B). On the south-east and south-west banks a narrow band of low saltmarsh vegetation is present. The extent of saltmarsh landward at these locations is restricted by copper post and rail retaining fences delineating the boundaries of maintained open space / parkland adjacent to the lake.

The characteristics of this community are summarised in Table 3-3 below.

Table 3-3 Summary of Estuarine Saltmarsh vegetation community

Estuarine Saltmarsh	
Approximate extent within study area	There are about 4.7 hectares of this community in the study area.
Area to be impacted	Approximately 0.04 hectares will be impacted by the proposal.
Description	Canopy: NA Understorey: Scattered young Swamp Oak recruits Groundcover: Dominated by reeds and sedges particularly *Cyperus laevigatus* closer to the waters edge and Sea Rush (*Juncus kraussii* subsp. *australiensis*) within upper levels. Other key species include Beaded Glasswort (*Sarcocornia quinqueflora*), Creeping Brookweed (*Samolus repens*), Austral Seablite (*Suaeda australis*), Streaked Arrow Grass (*Triglochin striata*), Saltwater Couch (*Sporobolus virginicus*) and Sea Club-rush (*Bolboschoenus caldwellii*)
Condition	Moderate to good. Varying levels of minor disturbance from people walking through the community. **Hydrocotyle bonariensis* is a common weed throughout the majority of the upper saltmarsh levels throughout the study area.

Estuarine Saltmarsh	
Conservation Status	This community is equivalent to the endangered ecological community (EEC) *Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions*, listed under the TSC Act. Saltmarsh is considered marine vegetation under the FM Act and will require a permit to harm under Part 7 of the FM Act.
Threatened plant species habitat	Within the study area, this community does not provide habitat for threatened flora species, all of which are considered unlikely to occur.
Threatened fauna species habitat	Within the study area, this community does not provide particularly important habitat for threatened fauna species; however those species that forage within the seagrasses could conceivably occur in this habitat type occasionally (refer Table 3-2).
Equivalent vegetation types	This community is listed as Saltmarsh in estuaries of the Sydney Basin and South East Corner (SR614) within the Biometric vegetation types database
Example	Figure 3-2 Examples of Estuarine Saltmarsh within the study area

Coastal Sand Forest

Coastal Sand Forest occurs as a patch in the south-west of the study area adjacent to the Princes Highway, as well as near Burrill Lake Tourist Park in the east of the study area. To the west of the bridge on the southern side of the Princes Highway, the vegetation is more intact, with an established understorey however, weed invasion and the exclusion of natural processes such as fire have severely degraded the community in this location. In more open areas, the groundcover is almost entirely dominated by exotic grasses while towards the centre of the patch, dense growth of Rough-fruited and Sweet Pittosporum (*Pittosporum revolutum* and *P. undulatum*) has resulted in a general absence of a native groundcover due to high levels of shading (Figure 3-3). To the north of the Princes Highway, the community has been extensively modified due to the development of tourist accommodation with only scattered overstorey Bangalay (*Eucalyptus botryoides*) trees (in combination with exotic Pines) remaining.

To the east of the bridge the community is also highly disturbed. Only scattered Bangalay trees remain along the frontage to the Burrill Lake Tourist Park with isolated clumps of understorey shrubs occurring further east, mostly around remaining mature trees (Figure 3-4). The groundcover in this area is maintained by mowing and has resulted in large open areas which appear to have been colonised by exotic grasses.

The characteristics of this community are summarised in Table 3-4 below.

Figure 3-3 Coastal Sand Forest in the west of the study area

Figure 3-4 Coastal Sand Forest in the east of the study area

Table 3-4 Summary of Coastal Sand Forest vegetation community

Coastal Sand Forest	
Approximate extent within study area	There are about 4.8 hectares of this community in the study area.
Area to be impacted	Approximately 0.5 hectares will be impacted by the proposal.

Coastal Sand Forest	
Description	Canopy: Dominated by Bangalay (*Eucalyptus botryoides*) with scattered Blackbutt (*E. pilularis*) in the south-west. Understorey: Rough-fruited Pittosporum, Sweet Pittosporum, Tree Broom-heath (*Monotoca elliptica*), Coastal Wattle (*Acacia longifolia* var. *sophorae*), Swamp Oak (*Casuarina glauca*) and Coast Banksia (*Banksia integrifolia*). Groundcover: Mostly exotic grasses including Kikuyu (**Pennisetum clandestinum*), Sweet Vernal Grass (**Anthoxanthum odoratum*) and Yorkshire Fog (**Holcus lanatus*). Asparagus Fern (**Asparagus aethiopicus*) forming extensive mats in more shaded areas in the south-west. Spiny-headed Matt-rush (*Lomandra longifolia*) occasional in un-mown areas east of the bridge.
Condition	Poor to moderate. Most areas heavily invaded by exotics in the understorey and would be considered to be in poor condition. Some areas in the south-west where exotics are less prevalent and moderate native species diversity occurs but generally coincides with heavily shaded areas where the general abundance of individuals is low.
Conservation Status	This community is equivalent to the EEC *Bangalay Sand Forest of the Sydney Basin and South East Corner bioregions*, listed under the TSC Act
Threatened plant species habitat	Given the high levels of invasion by exotic grasses, extensive shading in other areas and additional disturbances such as mowing, this community is not considered to provide habitat for threatened flora species, all of which are considered unlikely to occur.
Threatened fauna species habitat	This community does not provide any unique or important habitat for any threatened species. No hollows are present in the areas of the proposal and foraging resources are limited due to the disturbed nature of the area.
Equivalent vegetation types	This community is listed as Bangalay - Old-man Banksia open forest on coastal sands, Sydney Basin and South East Corner (SR512) within the Biometric vegetation types database.
Example	Figure 3-3 Coastal Sand Forest in the west of the study area. Figure 3-4 Coastal Sand Forest in the east of the study area.

Estuarine Fringe Forest

Regrowth Estuarine Fringe Forest occurs in small patches near the edges of Burrill Lake south of the Highway and around Burrill Inlet. This community was not identified as occurring in the study area by Tozer et al (2010). One patch is located immediately adjacent to the Princes Highway, just south-east of the bridge (**Figure 3-5**). In this area the community consists of a narrow band of overstorey trees with a highly modified and presumably predominately exotic understorey. The area appears to be regularly mown.

Figure 3-5 Estuarine Fringe Forest in the south-west of the study area

Another patch is associated with a drainage line adjacent to the Princes Highway, just south-west of the bridge (**Figure 3-6**). In this area a narrow band of predominately young regrowth trees occurs, expanding slightly closer to Burrill Lake. On the southern side, the community adjoins predominately exotic mown parkland and as such native species are restricted to the drainage line itself and immediate edges, Exotic species are common and extensive becoming less so as sedges begin to dominate closer to Burrill Lake. Two small isolated patches of overstorey trees also occur within the parkland, which are likely remnants from past clearing (**Figure 3-6**). No native understorey or groundcover occurs in these areas.

The characteristics of this community are summarised in Table 3-5.

Figure 3-6 Estuarine Fringe Forest in the south-east of the study area

Table 3-5 Summary of Estuarine Fringe Forest vegetation community

Estuarine Fringe Forest	
Approximate extent within study area	There are about 1.7 hectares of this community in the study area.
Area to be impacted	Approximately 0.2 hectares will be impacted by the proposal.

Estuarine Fringe Forest	
Description	Overstorey: Scattered mature and predominately regrowth Swamp Oak (Ca*suarina glauca*) Understorey: Coastal Wattle occurs as isolated individuals within the drainage line west of the bridge. Groundcover: New Zealand Spinach (**Tetragonia tetragonoides*) is common within this community. To the west of the bridge, Sea Rush, *Baumea juncea* and Common Reed (*Phragmites australis*) occur closer to Burrill Lake. Exotic species are extensive including Cobblers Pegs (**Bidens pilosa*), Asparagus Fern, Fleabane (**Conyza bonariensis*), *Hydrocotyle bonariensis,* Cat's Ear (**Hypochaeris radicata*) and Plantain (**Plantago lanceolata*). Grasses are entirely exotic.
Condition	Poor. The structure of the community within the study area has been extensively modified and weed invasion is extensive.
Conservation Status	This community is equivalent to the EEC *Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions*, listed under the TSC Act.
Threatened plant species habitat	Given the high levels of invasion by exotic species, and high levels of disturbance, this community is not considered to provide habitat for threatened flora species, all of which are considered unlikely to occur.
Threatened fauna species habitat	This community does not provide any unique or important habitat for any threatened species. No hollows are present in this community and Swamp Oak is not known as an important feed tree for any fauna species. There is very limited habitat in this community due to its modified structure.
Equivalent vegetation types	This community is listed as Swamp Oak swamp forest fringing estuaries, Sydney Basin and South East Corner (SR650) within the Biometric vegetation types database.
Example	Figure 3-5 Estuarine Fringe Forest in the south-west of the study area. Figure 3-6 Estuarine Fringe Forest in the south-east of the study area.

3.3.2 Endangered Ecological Communities and Marine Vegetation

Of the four vegetation types identified in the study area (Section 3.3.1, Table 3-1), three are threatened ecological communities listed under the TSC Act. These include Bangalay Sand Forest, Coastal Saltmarsh and Swamp Oak Floodplain Forest (Table 3-6). The two highly modified areas of Coastal Sand Forest where only scattered overstorey trees remain are not considered to comprise the Bangalay Sand Forest EEC as these areas are not representative of the listed community and have little if any chance of recovery. Similarly, areas of Estuarine Fringe Forest where the understorey has been highly modified and maintained as parkland are also not considered to comprise the Swamp Oak Floodplain Forest EEC.

Two types of marine vegetation protected under the FM Act are present in the study area. These are detailed in Table 3-6 below.

Table 3-6 Endangered ecological communities and marine vegetation identified within the study area

Vegetation Community (GHD, 2012)	Endangered Ecological Community and/or protected marine vegetation	Status
Seagrass Meadows (Zostera) (SL e70)	Marine Vegetation	FM Act
Estuarine Saltmarsh (SL p509)	Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions Marine Vegetation	EEC – TSC Act FM Act
Coastal Sand Forest (DSF p64)	Bangalay Sand Forest of the Sydney Basin and South East Corner bioregions (EEC- TSC Act)	EEC – TSC Act
Estuarine Fringe Forest (FOW p106)	Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions	EEC – TSC Act

3.3.3 Threatened Flora Species

Background database searches produced a total of eight threatened flora species with potential to occur in the study area, with the NSW Wildlife Atlas Database identifying four species and the Commonwealth Protected Matters Search Tool identifying seven species. Habitat evaluation by GHD (2012) identified the potential for three threatened flora species to occur within the study area as outlined in Table 3-7. Targeted surveys were recommended for these species if works were to impact on the Bangalay Sand Forest in the south of the study area.

Following detailed survey by **ngh**environmental in 2013, the potential for these species to occur has been revised. The threatened species habitat evaluations (presented in full in Appendix E) determined that no threatened flora species are likely to occur within the study area due to the:

1. Absence of required abiotic habitat features
2. High levels of disturbance
3. Absence of associated vegetation communities or flora species
4. Lack of nearby (within 10 kilometres) records of the species

Further explanation is provided in Table 3-7 for these species.

Table 3-7 Threatened species with potential to occur in the proposal area

Species	TSC Act	EPBC Act	Likelihood of occurrence (GHD 2012)	Likelihood of occurrence (nghenvironmental 2013)	Assessment of Significance required (TSC Act). Y/N?
Cryptostylis hunteriana Leafless Tongue Orchid	V	V	**High.** Potential habitat present in Bangalay Sand Forest in the west and east of the study area. Targeted surveys during the summer flowering period (November - February) may be required if road works are likely to impact Bangalay Sand Forest in the south of the study area.	**Low**. No habitat present in the study area.	**No.** This species is known to occur within a wide range of vegetation communities including Coastal Sand Forest, and commonly prefers relatively open areas within these communities (Clarke *et al.* 2004). Open areas within the Coastal Sand Forest within the study area west and north-east of the bridge are either heavily infested with tall exotic grasses or highly disturbed by activities such as mowing. Groundcover species with which the Leafless Tongue Orchid is usually associated with are absent. South-east of the bridge (in the existing road verge south of the Princes Highway), habitat that would be impacted by the proposal contains dense native midstorey regrowth which does not provide the open areas preferred by this species. Habitat within the study area is not representative of the habitat in which nearby records occur which has not suffered the same levels of disturbance. It is considered unlikely that the Leafless Tongue Orchid would occur within the habitats within the study area.
Gailum australe Tangled Bedstraw	E		**High.** Potential habitat present in Bangalay Sand Forest in the west and east of the study area. Targeted surveys during the summer flowering period may be required if road works are likely to impact woodland in the south of the study area.	**Low.** No habitat present in the study area.	**No.** This species is known to occur within a wide range of vegetation communities including Coastal Sand Forest (OEH 2013). It has been recorded in a number of habitats including a valley floor, alluvial soil beside a creek, heathland in a rocky gully, and the top of an escarpment above a creek (NSW SC 2004) and appears to be generally associated with moist environments. The habitats within the study area are generally not moist and are highly disturbed. Weed invasion is prevalent west of the bridge. Weed invasion and inappropriate fire regimes are recognised as a threat to this species (NSW SC 2004). Based on the dense colonisation of Pittosporum within the understorey to the west of the bridge, it is considered unlikely that the vegetation has been subject to natural fire regimes for some time. Furthermore, the nearest record of Tangled Bedstraw is approximately 10kilometres south-west of the study area. Based on the above factors, it is considered unlikely that this species would occur within the study area.
Genoplesium		V	**High.** Potential habitat	**Low.** No habitat present in	**No.** The East Lynne Midge Orchid grows in 'poorer' dry sclerophyll

Species	TSC Act	EPBC Act	Likelihood of occurrence (GHD 2012)	Likelihood of occurrence (nghenvironmental 2013)	Assessment of Significance required (TSC Act). Y/N?
vernale East Lynne Midge-Orchid			present in Bangalay Sand Forest in the west and east of the study area. Targeted surveys during the spring flowering period (mid November – late December) may be required if road works are likely to impact woodland in the south of the study area.	the study area.	woodland and forest on the south coast of New South Wales between Mogo and Ulladulla. It is confined to areas with good drainage and shallow, low fertility soils (OEH 2013). It has not been recorded within Coastal Sand Forest. The nearest records for this species are approximately 15 kilometres north-west and south-west of the study area in habitats that are not represented by that within the study area. A known population at East Lynne was investigated on the day of the November survey which confirmed flowering of the species (Figure 3-7). The targeted transect shown on Appendix I – Map B was conducted while surveying the available habitats within the Coastal Sand Forest in the west of the site which did not detect this species. Given the lack of available habitat, the proximity of nearest records and that the species was not detected during the survey (despite the suitable timing), it is considered highly unlikely that the East Lynne Midge Orchid occurs within the study area.

Figure 3-7 East Lynne Midge Orchid in flower at a known location prior to the survey

3.3.4 Common Flora Species

The Burrill Lake Bridge Ecological Constraints Assessment (GHD, 2012) identified a total of 39 flora species within the study area. These included 24 native species and 15 introduced species. The surveys conducted in 2013 identified a further 23 native species and 17 introduced species. The species that were identified in the GHD assessment are provided in Appendix C of the Burrill Lake Ecological Constraints Assessment report (GHD, 2012). A full species list of all flora species recorded from both surveys is provided in Appendix B of this report.

3.3.5 Weeds and Disturbance

The field surveys undertaken as part of the Burrill Lake Bridge Ecological Constraints Assessment (GHD, 2012) did not identify any noxious weeds within the study area. Surveys conducted during 2013 identified a large patch of Blackberry (*Rubus fruticosus* aggregate spp.) just to the west of the Coastal Sand Forest in the west of the study area (Figure 3-8). Several smaller plants were widespread throughout the Coastal Sand Forest in this area. Blackberry is listed as a Class 4 noxious weed within the Shoalhaven Local Control area. The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction.

Blackberry is also a listed Weed of National Significance (WONS). Asparagus Fern, although not listed as noxious within the Shoalhaven local control area, is also a listed WONS. This species was recorded during the 2012 surveys by GHD and was observed to be widespread during the 2013 surveys, particularly in the Coastal Sand Forest west of the bridge (**Figure 3-8**).

Figure 3-8 Blackberry and Asparagus Fern adjacent to and within the Coastal Sand forest west of the bridge

3.4 FAUNA FIELD SURVEY RESULTS

3.4.1 Fauna Habitats

The Burrill Lake Bridge Ecological Constraints Assessment (GHD, 2012) identified five broad fauna habitats within the study area including 1) Burrill Lake and lake margins; 2) Burrill Lake Bridge; 3) open parkland; 4) woodland and forest patches; and 5) drains and drainage lines. The following descriptions have been adapted from GHD (2012).

Burrill Lake and lake margins

Burrill Lake is an estuarine lake, with expanses of seagrass beds present. The margins of Burrill Lake in the study area are dominated by reeds and sedges. In some areas a narrow band of low saltmarsh vegetation is also present. A rocky foreshore is present around the abutments of the existing bridge which occurs in generally shallow (<30 cm deep) water. Small areas of sandflats are present downstream of the bridge, adjacent to the park. Reedy areas and saltmarsh provide habitat for a range of waterbirds.

However, limited habitat is present for many shorebirds, especially threatened species, due to the lack of wide mudflats and sandflats; this is due to the minor tidal fluctuations at Burrill Lake which limit the extent of mudflats that are exposed at low tide. Nesting or breeding habitat is not available for shorebirds or waders, but foraging habitat is available on lake margins during high tide and within seagrass beds and exposed mudflats during low tide. Waterbirds that were commonly recorded during field surveys included Black Swan (*Cygnus atratus*), Chestnut Teal (*Anas castanea*), Masked Lapwing (*Vanellus miles*) White-faced Heron (*Egretta novaehollandiae*), Australasian Darter (*Anhinga novaehollandiae*), Little Pied Cormorant (*Microcarbo melanoleucos*), Silver Gull (*Chroicocephalus novaehollandiae*) and Australian Pelican (*Pelecanus conspicillatus*). The Pied Oystercatcher (*Haematopus longirostris*) which is listed as endangered under the TSC Act was observed on one occasion within the study area, but outside the subject site, foraging in exposed mudflats at low tide.

Habitat is also limited for migratory shorebirds for the same reasons stated above, although the Eastern Great Egret (*Ardea modesta*) was recorded in the study area. There is potential for a number of migratory shorebirds species to utilise seagrass beds and saltmarsh for foraging, although it is considered these species would not rely on the site on a permanent basis. These include the migratory Bar-tailed Godwit (*Limosa lapponica*), Double-banded Plover (*Charadrius bicinctus*), and Eastern Curlew (*Numenius madagascariensis*) which could occur in the study area on occasion.

The seagrass community in Burrill Lake are valuable as nursery, feeding and shelter areas for many aquatic animals, including commercially and recreationally important fish, mollusc and crustacean species. Burrill Lake is mapped as Key Fish Habitat (DPI 2007).

GHD (2012) observed two ray species, reporting one to be the IUCN Vulnerable Estuary Stingray (*Dasyatis fluviorum*) after the identification of the species from a photograph by a fish expert within the Australian Museum. The presence of the Estuary Stingray was confirmed by **ngh**environmental staff during this assessment (during seagrass mapping surveys). This species is uncommon in NSW with Forster considered to be the current official southern limit (Kyne et al. 1993); however it was recently recorded on the NSW south coast (GHD 2012).

Burrill Lake Bridge

There is the potential for threatened microbats such as the Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*) and the Large-footed Myotis (*Myotis macropus*) to roost on occasion under the Burrill Lake Bridge; however these species were not detected via Anabat during the three nights surveyed (one night by GHD, and two nights by **ngh**environmental). There are few crevices in the bridge, and roosts would only be temporary in nature. There is no breeding habitat for these species in the study area. The existing bridge is not considered an important roost site for threatened bats.

Open parkland

Open parkland is present to the east of the Princes Highway south and north of Burrill Lake Bridge. Open grassland provides limited habitat for fauna and is most likely primarily used for foraging by common or invasive bird species. There is limited habitat for mammals, reptiles and frogs in these areas. There is minimal potential habitat for threatened species in the existing parkland due to the cleared nature of much of the area which is subject to repeated slashing from park maintenance activities. Ongoing disturbances to fauna are also present due to recreation use of the area by the local community, with dog walking being a common activity. Additionally, Dolphin Point Road fragments the parkland on the southern side of the bridge exposing fauna to low levels of traffic flow.

Woodland and forest

Small, generally isolated patches of woodland are present in the study area. A stand of degraded Swamp Oak Floodplain Forest is located to the east of the Princes Highway north of the bridge, near the margin of the lake. A narrow band of Swamp Oak Floodplain Forest is present alongside a drainage ditch adjacent to the Princes Highway south of the bridge, and a larger remnant is present around the inlet nearby the pedestrian bridge within the south-eastern section of the study area. These areas are dominated primarily by one species, Swamp Oak (*Casuarina glauca*), rendering the forest as poor quality supporting low diversity. Common diurnal birds, such as the Yellow Thornbills (*Acanthiza nana*) and Little Wattlebirds (*Anthochaera chrysoptera*) were observed foraging in these trees by GHD (2012).

Areas of Bangalay Sand Forest are present in the south of the study area and to the east of the study area within parkland. These areas included a number of eucalypt and banksia species, which would provide some limited foraging habitat for various birds. A range of common birds were recorded, however there is limited habitat present for threatened and migratory terrestrial species. There are no hollow-bearing trees present in the woodland and forest in the study area, further limiting the potential for many threatened species to occur. As for the Open Parkland habitat, the Bangalay Sand Forest is exposed to disturbances associated with recreational use of the parkland and fragmentation from proximity to roads.

Drains and drainage lines

Drains and drainage lines are present in the parkland. These have a variety of in-stream flora present, including species of Juncus and Eleocharis. Potential habitat for amphibian species is represented by the presence of ephemeral waterbodies, basking areas and emergent vegetation in the drains and drainage lines. This area of habitat is not considered optimal habitat for amphibians as they are small isolated areas, dense with Lomandra grass in the drain, and lack permanent freshwater; these drains exist in a highly disturbed environment (surrounded by parkland) and are isolated from other freshwater habitats.

3.4.2 Fauna Species

A combined total of 42 species were recorded within the study area from this current survey and surveys undertaken by GHD (2012). The species recorded included 35 bird species, two frog species and five fish species (Appendix C). Of the 35 bird species recorded during the field surveys, 15 species were waterbirds. Section 3.4.1 details the common species observed.

The Burrill Lake Ecological Constraints Assessment (GHD, 2012) reports that no threatened fauna species were observed within the study area during their field surveys, despite undertaking targeted bird surveys and one microchiropteran bat survey; however two individuals of the threatened Pied Oystercatcher were observed by **ngh**environmental during the current assessment.

One migratory species listed under the EPBC Act was recorded by GHD (2012) and by **ngh**environmental during this current assessment, the Eastern Great Egret (*Ardea modesta*).

Green and Golden Bell Frog results

Targeted surveys were undertaken as there was an unsubstantiated anecdotal record of Green and Golden Bell Frogs (*Litoria aurea*) in the parkland, as reported in GHD (2012). However, there are no records of this species in the immediate area of the proposal; the nearest records are at Ulladulla (~ 4.8 kilometres north) and Meroo Lake (~12.5 kilometres south). Additionally, surveys for the species have previously been undertaken to the south-west of the study area in larger wetlands areas for a proposed developed, although no Green and Golden Bell Frogs were identified (BES 2006).

No Green and Golden Bell Frogs were recorded during the targeted surveys and the habitat surveyed is considered unlikely habitat for this species. The species prefers permanent, unshaded water bodies containing emergent vegetation which is not available within the study area. The available habitat is characterised as a man-made drain with no permanent water. Vegetation within the drain is dense and compact and prevents water pooling at the bottom of the drain. A road and parkland surround the available habitat; the parkland area is subject to ongoing disturbances including slashing, recreational use, dog-walking and fragmentation from roads. The available habitat is isolated from other freshwater habitats and limited to a discrete area as it is bounded by Dolphin Point Road to the north and east, housing to the south and Princes Highway to the west. Habitat corridors for movement of this species are therefore not present within the subject site. Additionally, the location of the drain on the edge of the subject site and the potential habitat is supports will not be directly affected by the proposal.

Anabat results

No microbat species were recorded during the Anabat survey. There are no breeding or maternity sites for threatened microbats within the surrounding vegetation and limited roost sites within the existing bridge. There is potential for microbats to forage within the study area but the proposal will not prevent any species from continuing to forage within the area. Refer to Section 3.4.3, Table 3-8 for more detail.

3.4.3 Threatened Fauna Species

Background database searches produced a total of 80 threatened fauna species with potential to occur in the study area, with the NSW Wildlife Atlas Database identifying 43 species (22 bird species, 17 mammal, 1 reptile and 3 amphibian species). The Commonwealth Protected Matters Search Tool identifying 50 species (24 bird, 5 reptile, 5 amphibian, 11 mammal, 2 fish and 3 shark species).

Within non-marine habitats including woodland, forest and parkland areas, there is no unique habitat or resources for threatened arboreal mammals and woodland fauna. The forests are generally highly disturbed and support no hollow-bearing trees. Isolated remnants or scattered trees remain and parkland areas are maintained by mowing resulting in large open areas which are dominated by exotic grassland. As a result no threatened species will be impacted by the proposal in these habitats. Other ongoing disturbances (residential housing, dog walking, noise and vibrations from traffic on the Princes Highway) would prevent many threatened species from permanently using the area.

As a result there is little habitat for threatened species in the study area, although some have the potential to occur on occasion to forage; however, no breeding habitat exists within the study area for any threatened species. Species considered to have a moderate or high likelihood of occurrence, based on the existence of records in the locality and the presence of potential habitat in the study area, as assessed in Appendix E are provided in Table 3-8 below.

For many of the species identified in Table 3-8 the proposal are considered to have a negligible impact. According to the 'likelihood of occurrence' definitions detailed in the threatened species evaluation in Appendix E, species that could utilise the site on occasion or fly over the study area on foraging bouts can result in a moderate to high likelihood of occurrence; however, in reality these species are unlikely to rely on habitat of the study area (particularly for breeding), are highly mobile, forage over extensive areas, large areas of suitable foraging habitat is available in the locality, and clearance of potential habitat for these species is minor. These species are therefore highly unlikely to be affected by the proposal and an Assessment of Significance (AoS) was not completed. Further explanation is provided in Table 3-8 for these species.

Habitat evaluation by GHD (2012) identified the potential for the Green and Golden Bell Frog to occur within the study area. Following the field survey by **ngh**environmental in 2013, the potential for this species to occur has been revised to a 'low likelihood of occurrence' and is therefore not included in Table 3-8. The Green and Golden Bell Frog would not be adversely affected by the proposal and the species has not been considered further for detailed assessment within an AoS. This conclusion is based on the results presented in Section 3.4.2.

Table 3-8 Threatened species with potential to occur in the proposal area

Species	TSC Act	EPBC Act	Likelihood of occurrence (GHD 2012)	Likelihood of occurrence (nghenvironmental 2013)	Assessment of Significance required (TSC Act). Y/N?
Diurnal Birds					
Callocephalon fimbriatum Gang-gang Cockatoo	V		**Moderate**. May forage on occasion in the study area. No breeding habitat present.	**Moderate**. Marginal foraging habitat, but may forage on occasion in the study area. No breeding habitat present.	**No. T**he study area supports marginal foraging habitat, but no nesting habitat for the Gang-gang Cockatoo. This species would be more likely to utilise more intact habitat within the nearby Morton National Park over the disturbed habitat within the study area. While the species could feasibly occur within the study area, that is it could fly over the area on a foraging bout or temporarily land within the forest and forage briefly while moving through the area it would not utilise the area on a permanent basis. If this species were to occur on site it would utilise habitat within the Bangalay Sand Forest (eucalypt and acacias) for foraging and only a minor area of this habitat will be affected by the proposal. Clearing will occur only on the edges of the forest. Removal of a minor amount of already disturbed Bangalay Sand Forest will not limit foraging resources within the wider area for this species. As this species is highly mobile it will not be affected by the proposal and an assessment of significance is not required.
Epthianura albifrons White-fronted Chat	V		**High.** May forage on occasion along the Burill Lake Bridge embankment and saltmarsh	**Moderate**. May forage on occasion along the Burrill Lake Bridge embankment and in saltmarsh.	**Yes.** There is potential for the proposal to directly affect habitat of this species given impacts predominantly affect Burrill Lake habitat including Coastal Saltmarsh habitat utilised by this species.
Raptors					
Lophoictinia isura Square-tailed Kite	V		**Moderate.** Minimal foraging and breeding habitat present in the study area.	**Moderate.** Minimal foraging and breeding habitat present in the study area, may fly over area during foraging bouts.	**No.** The study area contains potential foraging habitat, but no potential nesting habitat. This species has a large home range and forages over a very large area. This species is regularly known within the Shoalhaven region and its foraging habitat is common and widespread in the locality. As this species is highly mobile and its foraging habitat is generalised throughout the locality, it is feasible the species could pass

Species	TSC Act	EPBC Act	Likelihood of occurrence (GHD 2012)	Likelihood of occurrence (nghenvironmental 2013)	Assessment of Significance required (TSC Act). Y/N?
					through the area on foraging bouts but is unlikely to rely on the habitat within the study area; the study area does not support any unique or important foraging habitat that is critical to the survival of this species that cannot be obtained within the locality. Due to the disturbances within the study area, it is expected the species would forage in areas with better-quality habitat or higher densities of prey species. The proposal will not have an adverse effect on this species and an assessment of significance is not required.
Pandion cristatus Eastern Osprey	V	M	**High.** Likely to forage over Burrill Lake.	**Moderate.** Could forage over Burrill Lake. Ospreys are known to nest in a communications tower in Ulladulla.	**No.** As for Square-tailed Kite.
Shorebirds					
Haemotopus fuliginosus Sooty Oystercatcher	V		**High.** May forage on occasion along the Burrill Lake Bridge embankments and in saltmarsh.	**Moderate.** May forage on occasion along edge of lake or within exposed mud flats during low tide.	**Yes.** There is potential for the proposal to directly affect habitat of this species given impacts predominantly affect Burrill Lake habitat.
Haemotopus longirostris Pied Oystercatcher	E		**High.** May forage on occasion along the Burrill Lake Bridge embankments and in saltmarsh.	**Present.** Recorded during ngh 2013 surveys. Observed foraging along edge of lake during low tide.	**Yes.** There is potential for the proposal to directly affect habitat of this species given impacts predominantly affect Burrill Lake habitat.
Sternula albifrons Little Tern	E	M	**Moderate.** Minimal foraging and breeding habitat present in study area.	**Moderate**. Small area of potential foraging habitat present in study area.	**Yes.** There is potential for the proposal to directly affect habitat of this species given impacts predominantly affect Burrill Lake habitat.
Microbats					

Species	TSC Act	EPBC Act	Likelihood of occurrence (GHD 2012)	Likelihood of occurrence (nghenvironmental 2013)	Assessment of Significance required (TSC Act). Y/N?
Falsistrellus tasmaniensis Eastern False Pipistrelle	V		**Moderate.** Limited foraging habitat and no breeding habitat present in the study area.	**Moderate.** Limited foraging habitat and no breeding habitat present in the study area.	**No.** Most of these species forage for insects above or below the tree canopy, within or at the edges of forested environments, or nearby water bodies. In particular, the Southern Myotis requires water for foraging as they forage over streams and pools whereby they rake their feet across the water surface to catch their prey. Each bat species detailed above is dependent on tree hollows or other similar cavities, such as caves for roosting and breeding. The Eastern False Pipistrelle, Eastern Freetail Bat and Greater Broad-nosed Bat are largely dependent on hollow-bearing trees for roosting, while the Eastern Bent-wing Bat and Southern Myotis will roost in caves, or similar structures, but can also roost in hollows. No bat species were identified from Anabat surveys and the existing bridge is not considered to be an important roosting site for bat species. The study area provides foraging habitat for microchiropteran bat species through the presence of forest trees, temporary and small waterbodies that pool after rainfall events, but no breeding or maternity roost resources. These microbat species are commonly found within the Shoalhaven region and any open area can conceivably be considered potential foraging habitat for these species in the region. For this reason, the proposal will impact a limited area of potential foraging resources in the form of canopy trees that are located on the edge of cleared parkland, but the habitat to be removed is not considered important or unique to the survival of these species given it is common habitat found throughout the region. Better-quality habitat is available within the nearby national parks that are more suited to threatened microbat species. The proposal will not prevent movement of bat species through the locality. As these species are highly mobile, forage over an extensive area and large areas of better quality foraging habitat is available in the locality the proposal will not have an adverse effect on these species. An assessment of significance is not required.
Miniopterus schreibersii oceanensis Eastern Bentwing-bat	V		**High.** Could forage in study area on occasion. Limited roosting habitat.	**Moderate.** Could forage in study area on occasion. Minimal roosting habitat present.	
Mormopterus norfolkensis Eastern Freetail-bat	V		**Moderate.** Limited foraging habitat and no breeding habitat present in the study area.	**Moderate.** Limited foraging habitat and no breeding habitat present in the study area.	
Myotis macropus Southern Myotis	V		**High.** May forage over Burrill Lake. Minimal roosting habitat present.	**Moderate.** Limited foraging habitat and no breeding habitat present in the study area.	
Scoteanax rueppellii Greater Broad-nosed Bat	V		**Moderate.** Limited foraging habitat and no breeding habitat present in the study area.	**Moderate.** Limited foraging habitat and no breeding habitat present in the study area.	

Species	TSC Act	EPBC Act	Likelihood of occurrence (GHD 2012)	Likelihood of occurrence (nghenvironmental 2013)	Assessment of Significance required (TSC Act). Y/N?
Pteropus poliocephalus Grey-headed Flying-fox	V	V	**Moderate.** Some foraging habitat and no breeding habitat present in the study area.	**Moderate.** Some foraging habitat and no breeding habitat present in the study area.	**No.** The site provides marginal and limited foraging habitat for the species through the nectar and pollen of flowering eucalypts, although not high quality foraging resources due to the limited number of larger trees which produce large amounts of nectar or soft fruits. As this species is highly mobile, forages over an extensive area and large areas of better quality foraging habitat is available in the locality the proposal will not have an adverse effect on this species. An assessment of significance is not required.

KEY: V: Vulnerable; E: Endangered; M: Migratory.

Threatened and protected fish and marine vegetation

A search of the DPI Fishing and Aquaculture threatened and protected species records viewer identified eight records of the threatened Australian Grayling within the Shoalhaven local government area (refer to Appendix D). All records were from Yalwal Creek and the Clyde River which are over 20 kilometres south of the proposal site.

Members of the Syngnathidae (seahorses, pipefish, seadragons) are protected under the FM Act and the EPBC Act. Syngnathidae are known to occur in various habitats, including seagrass habitat, and have the potential to occur on site.

3.4.4 Migratory Species

The EPBC Act protected matters search tool revealed 49 migratory species listed under the EPBC Act as potentially occurring within 10 kilometres of the subject site (see Appendix D). Many of these species are marine and/or pelagic (e.g. albatrosses and whales) and are unlikely to occur in the study area. There are no known migratory fish species listed for Burrill Lake.

There is little habitat for migratory species in the study area, although some have the potential to occur on occasion, as assessed in Appendix E. These migratory species are provided in Table 3-9 below.

The Eastern Great Egret (*Ardea modesta*) was recorded by GHD (2012) during the field surveys and during this current assessment.

Table 3-9 Migratory species with the potential to occur within the proposal area (from GHD, 2012).

Species	EPBC Act	Likelihood of occurrence (GHD 2012 & nghenvironmental 2013)	Assessment of Significance required(EPBC Act). Y/N?
Limosa lapponica Bar-tailed Godwit	M	**High.** May forage around saltmarsh and seagrass in the study area.	**Yes.** There is potential for the proposal to directly affect foraging habitat of this species given impacts predominantly affect Burrill Lake habitat.
Charadrius bicinctus Double-banded Plover	M	**High.** May forage around saltmarsh and seagrass in the study area.	
Numenius madagascariensis Eastern Curlew	M	**High.** May forage around saltmarsh and seagrass in the study area.	
Ardea modesta Great Egret	M	**Present.** Recorded foraging on edges of Burrill Lake.	
Haliaeetus leucogaster White-bellied Sea-Eagle	M	**High.** Likely to regularly forage over Burrill Lake.	**No.** This species is regularly known within the Shoalhaven region and its foraging habitat is common and widespread in the locality. As this species is highly mobile and its foraging habitat is generalised throughout the locality, it is feasible the species could pass through the area on foraging bouts but is unlikely to rely on the habitat within the study area; the study area does not support any unique or important foraging habitat that is critical to the survival of this species that cannot be obtained within the

Species	EPBC Act	Likelihood of occurrence (GHD 2012 & nghenvironmental 2013)	Assessment of Significance required(EPBC Act). Y/N?
			locality. Due to the disturbances within the study area, it is expected the species would forage in areas with better-quality habitat or higher densities of prey species. The proposal will not have an adverse effect on this species and an assessment of significance is not required.

KEY: M: Migratory.

3.5 CRITICAL HABITAT

The study area does not contain any areas that have been declared as critical habitat under either the TSC Act or EPBC Act.

3.6 WILDLIFE CONNECTIVITY CORRIDORS

Wildlife corridors are generally defined as a link of habitat between two or more larger areas of wildlife habitat. Corridors are critical for the maintenance of ecological processes. They allow for the movement of animals and the continuation of viable populations. For example, they may facilitate genetic exchange between local populations and thereby protect populations from inbreeding or events, such as disease, bushfire, or other events that could threaten an isolated population with extinction. The width and structure of corridors is specific to the species utilising them. Corridors are less important for wide-ranging, highly mobile species; and more important for species such as frogs, reptiles and small mammals.

Vegetation within the Burrill Lake study area provides limited connectivity to other areas of habitat as cleared residential land is prevalent throughout the surrounding landscape and the proposal are adjacent the Princes Highway. The works will only affect the edges of remnant vegetation and will not contribute to fragmentation of the area. Species that would currently use the corridor are those already likely to be tolerant of a level of fragmentation and are more likely to be highly mobile, wide ranging species.

Burrill Lake itself provides an aquatic corridor for marine or aquatic species. The new bridge will not create a barrier to movement of aquatic fauna beyond those already known for the existing bridge and marine fauna or shorebirds that utilise the lake will be able to continue to move through the area, both under and over the bridge.

4 CONSTRAINTS ASSESSMENT

4.1.1 Assessment of Ecological Constraints

GHD (2012) defined ecological constraints for the study area which were categorised into three classes based on the conservation significance of the vegetation or habitat resource. After completion of targeted surveys in 2013, the constraints mapping has been updated. The constraints mapping demonstrates higher value areas where mitigation measures should be focused.

For consistency, this report utilises the same constraint classes but has reviewed the level of constraint based on results of the targeted surveys undertaken during this assessment. The description of constraint classes are defined in Table 4-1.

The ecological constraints for the study area, as determined from this current assessment, are defined in detail below and mapped in Appendix I – Figure E.

Table 4-1 Constraint classes (adopted from GHD 2012)

Constraint Class	Description
Low	No constraints identified. Highly modified/cleared areas, typically dominated by exotic grasses or turf. Some planted street trees or shrubs. Minimal habitat value for native flora and fauna.
Medium	Non-threatened ecological communities with potential habitat for threatened species, or specific potential habitat for threatened species.
High	Threatened ecological communities or marine vegetation, good quality habitat for threatened or migratory species.

Low constraint areas

The parkland areas surrounding the lake which support areas of exotic grassland or planted trees and shrubs are considered to be of low ecological constraint. Much of the immediate area around the lake has been cleared for parkland and is used for recreation by the public. Burrill Lake Tourist Park occupies land directly north of the bridge and a community area including toilet facilities and picnic tables are located in cleared land in the south of the study area. These areas are low in biodiversity value and offer no habitat for threatened flora or fauna species.

Medium constraint areas

No areas of medium constraint are identified for the study area. GHD (2012) previously identified two medium constraint areas which consisted of an isolated area supporting a drain that was potential habitat for the Green and Golden Bell Frog, as well as the Burrill Lake bridge which was considered potential roosting habitat for threatened microbats. These fauna species were not detected during targeted surveys and the areas are now downgraded to a low constraint.

High constraint areas

GHD (2012) identified all areas of Seagrass meadows, Saltmarsh (Coastal Saltmarsh EEC), Estuarine Forest (Swamp Oak Floodplain Forest EEC) and Coastal Sand Forest (Bangalay Sand Forest EEC) to be of high

ecological constraint. These areas remain as a high constraint after review of these vegetation types this assessment, with the exception of two areas of EEC which are highly modified and no longer viable communities. One area consists of highly modified Bangalay Sand Forest located on the very southern extent of the study area, the other area consists of highly disturbed Swamp Oak Floodplain Forest within the south-eastern boundary of the study area (refer Appendix I – Map D).

The areas designated as high constraint are limited by flora values and the presence of EECs, but are not constraining for fauna values. The study area does not support unique or important habitat for fauna and no areas have been designated high constraint for threatened fauna species.

5 POTENTIAL IMPACTS

The replacement of Burrill Lake Bridge will have some impact on the biodiversity values of the study area. The potential impacts identified include:

- Direct loss of vegetation / habitat
- Potential injury and mortality to resident fauna
- Potential increase of weeds, pests and pathogens
- Changed hydrology and seagrass impacts within Burrill Lake
- Water quality impacts from accidental spills
- Increase of key threatening processes
- Cumulative impacts

These impacts are discussed below with reference to the proposal.

5.1 LOSS OF VEGETATION/HABITAT

Direct impacts on vegetation are outlined below, although there is also potential for indirect impacts. For terrestrial and marine vegetation this is discussed in Section 5.1.1 and Section 5.1.2, respectively below.

5.1.1 Terrestrial Vegetation/habitat

The extent and estimated direct loss of habitat within the subject site is summarised in Table 5-1 for each vegetation type recorded in the study area. Direct loss of terrestrial habitats will occur as a result of clearing of native vegetation. No hollow-bearing trees will be removed as part of the proposal.

Within terrestrial habitats including woodland, forest and parkland areas, there is no unique habitat or resources for threatened arboreal mammals and woodland fauna. The Coastal Sand Forest and Estuarine Fringe Forest lack important foraging resources and support no hollow-bearing trees. Isolated remnants or scattered Bangalay trees remain within the areas of Coastal Sand Forest and the groundcover is maintained by mowing and has resulted in large open areas which have been colonised by exotic grasses. The Estuarine Fringe Forest is regrowth vegetation that consists of isolated patches of trees with a primarily exotic understorey. As a result it is unlikely that any threatened species would be impacted by the proposal in these habitats. Other ongoing disturbances such as recreational pursuits, dog walking, noise and vibrations from traffic on the Princes Highway would prevent many threatened species from permanently using the area.

The upgrade of the bridge is unlikely to substantially alter the available habitat for shorebirds given their mobility and the extent of similar habitat that will remain within the locality.

5.1.2 Aquatic Vegetation/habitat

Direct loss of marine habitat such as seagrass meadows, will result from clearing for the establishment of footings within Burrill Lake (reclamation). Indirect loss of seagrass is also expected immediately under the deck of the new bridge as a result of shading. Accidentals impacts may also occur from use of boats/barges in shallow areas (the propellers could damage the seagrass as well as the use of anchors in seagrass beds). It is estimated that around 0.2 hectares of seagrass would be impacted as a result of the proposal. The distribution and abundance of seagrass may also be effected following construction of the new bridge and the removal of the existing bridge and causeway. The removal of the existing bridge and

causeway will provide new areas of shallow water habitat (approximately 0.17 hectares). Zostera is abundant within existing seagrass beds and is likely to colonise these new areas. However, as discussed in section 4.5, localised changes in hydrology may have some minor impacts on the distribution of seagrass which cannot be quantified at this stage.

Due to the extensive amount of seagrass habitat at the site and in adjacent areas, the proposal is unlikely to have more than a minor impact on habitat availability for aquatic species.

Table 5-1 Extent and estimated loss of vegetation communities within the study area.

Vegetation community	Threatened Ecological Community and/or protected marine vegetation?	Condition	Area of vegetation estimated to be removed (hectares)
Seagrass Meadows	Yes (marine vegetation)	Variable	0.23 (although 0.17 hectares of habitat may be created)
Estuarine Saltmarsh	Yes	Moderate to good	0.04
Coastal Sand Forest	Yes	Good	0.15
Coastal Sand Forest	Yes	Poor to moderate	0.07
Coastal Sand Forest	Yes	Poor	0.17
Coastal Sand Forest (highly modified)	No	Poor	0.06
Estuarine Fringe Forest	Yes	Poor	0.13
Estuarine Fringe Forest (highly modified)	No	Poor	0.09
Exotic Grassland and Planted Trees	No	NA	1.7
		TOTAL (hectares)	0.94 hectares native vegetation; 1.7 hectares exotic vegetation

5.2 WILDLIFE CONNECTIVITY AND HABITAT FRAGMENTATION

The remnants within the Princes Highway road reserve near Burrill Lake are not densely treed, apart from the northern section of the study area north of Burrill Lake Tourist Park; however, minimal clearance of vegetation is required in this area. The area south of the proposal generally supports cleared areas, patches of low quality or exotic-dominated vegetation.

It is likely that native mammals and birds utilise this roadside vegetation to move through the landscape in a northerly or southerly direction, but less likely in an easterly or westerly direction given the proximity of the Lake and residential area both sides of the Princes Highway. The proposal will not affect any movement corridors for ground-dwelling wildlife as the area of direct works is already fragmented and existing corridors are not present. Species that would currently use the corridor would already be tolerant of a level of fragmentation and are more likely to be highly mobile, wide ranging species.

The implementation of the new bridge in the proposed location (east of the existing bridge) will not prevent marine fauna or shorebirds utilising the lake or passing under/over the bridge. Approximately

thirteen piers will be constructed in discrete locations, as the Lake at the area of the proposal is approximately 205 metres wide, the new bridge will not create a barrier to movement of aquatic fauna.

The removal of 0.9 hectares of native vegetation (including seagrass) from the study area would not substantially fragment the remnant vegetation in the local landscape. As such, the removal of habitat within the study area is unlikely to significantly isolate or fragment the site from other areas of habitat to the extent that species currently using the corridor would be adversely affected.

The planting of locally-occurring native species in the proposed road reserve would ideally take place as close as practical to the proposed road shoulders and would incorporate the use of overstorey species; this would eventually be able to replace any lost habitat within the study area. This is included as a mitigation measure in Section 7 of this report.

5.3 INJURY AND MORTALITY

The removal of the existing bridge has the potential to remove habitat and disturb roosting Welcome Swallows and potentially microbats. While no microbats were observed in current studies, mitigation measures have been recommended to minimise impacts to any fauna that may be utilising the existing bridge. However, the current assessment suggests that no threatened species will be adversely affected by the proposal given that no threatened species were observed, apart from the Pied Oystercatcher. The Pied Oystercatcher is a mobile species that would likely avoid the area during construction activities and is highly unlikely to be injured during the works.

Injury or mortality to other common fauna species is considered to be minor and unlikely given the location of the proposal in an already disturbed parkland environment that supports no important habitat features such as hollow-bearing trees. However, many smaller and more common species such as skinks and frogs are difficult to locate or remove during pre-clearing surveys. It is likely there will be some loss of individuals from these common populations.

The proposal has the potential to cause injury and mortality to sessile aquatic fauna species, in particular those slow moving or attached invertebrates located within the sediment, seagrass or attached to boulders around the causeway. These impacts are likely to occur during the removal of the causeway and construction of the new bridge, in particular during piling activities. Invertebrates species would be common and found in high abundance in these types of habitat and any injury or mortality would only have a minor impact on their abundance in the locality. More mobile aquatic species such as stingray and other fish species could potentially vacate the immediate area during construction due to vibration and noise impacts and other impacts to habitat. Due to the availability of similar aquatic habitats in surrounding areas, impacts are likely to be minor and temporary, with species moving back to the area following works.

5.4 WEEDS, PESTS AND PATHOGENS

Spread of the one Class 4 noxious weed species (Blackberry) and two WONS (Blackberry and Asparagus Fern) observed in the study area may occur during vegetation removal and movement of vehicles and machinery into or out of the site. Weeds are easily transported as seeds and propagules on machinery brought to the site. Equally, they can be carried away to other areas from the site or spread within it. Generally within the site, the greater the area of soil disturbance and the longer it is left without vegetative cover, the more susceptible an area is to weed infestations, particularly by noxious weeds or WONS which are already established.

Appropriate measures according to Guide 6 (Weed Management) of the Roads and Maritime Biodiversity Guidelines (RTA 2011) would be required to ensure weeds are not spread within or out of the subject site. Each species of weed requires particular treatment and follow-up management in order to successfully minimise any impacts on biodiversity, and much of this information can be sought from the *Noxious and Environmental Weed Control Handbook* (DPI 2011). All noxious weeds present within the subject site would be treated according to the requirements of both the NW Act (requiring reference to the Shoalhaven City Council weed control plan for each weed) and Guide 6 (Weed Management) of the Roads and Maritime Biodiversity Guidelines (RTA 2011). Rehabilitation of disturbed areas and ongoing weed management after the completion of construction activities would limit the establishment and spread of weed species during operation. Section 7 of this report recommends weed management measures.

Several pathogens in NSW have the potential to impact on the environment and biodiversity. These may be introduced and spread during the construction of road projects and roadside maintenance works. Pathogens that have the potential to be introduced and spread during the proposal include but are not limited to:

- Phytophthora (*Phytophthora cinnamomi*).
- Myrtle rust (*Uredo rangelli*).
- Fusarium wilt/Panama disease (*Fusarium oxysporum*)

Phytophthora is listed as a Key Threatening Processes (KTPs) under both the TSC Act and EPBC Act, and myrtle rust is listed under the TSC Act. The likelihood of encountering Myrtle rust in the southern coastal areas of NSW has increased over the past two years, with the distribution of the pathogen spreading south of the Shoalhaven LGA in 2011. This fungus affects plants in the Myrtaceae family, and there is a large number of known host species (DPI 2012). Of the known host species, two were recorded within the Coastal Sand Forest in the south-west section study area in low densities, namely Blackbutt (*Eucalyptus pilularis*) and Kanooka (*Tristaniopsis laurina*). No infestations were noticed during the survey. As Myrtle rust is known from the region, it is possible that construction activities within the study are could introduce or contribute to the spread of the pathogen. If implemented, any work should follow the best practice hygiene guidelines in the Roads and Maritime Biodiversity Guidelines (Guide 7: Pathogen Management) to prevent their introduction or spread. Mitigation measures have been included in Section 7 to prevent the introduction and/or spread of any pathogens within the study area.

These risks are highly manageable with the effective implementation of safeguards, particularly considering the low densities of known hosts and apparent absence of the pathogen within the study area.

5.5 CHANGED HYDROLOGY AND SEAGRASS IMPACTS WITHIN BURRILL LAKE

The Burrill Lake catchment covers an area of 78 square kilometres (Shoalhaven City Council 2002). Burrill Lake has a surface area of approximately four square kilometres. It is connected to the ocean by a three kilometre long entrance channel. The entrance to the sea is located between a rock platform at Dolphin Point and the Burrill Beach shoal resulting in a highly constricted mouth. The lake has one major tributary, Stoney Creek at the northern end of the lake. A number of SEPP 14 coastal wetlands are associated with Burrill Lake. The closest is located over four kilometres upstream of the study area and would not be affected by the proposal.

Burrill Lake is a barrier-type estuary. It is classified as an intermittently closed and opened lake or lagoon which is generally open to the sea, however, displays very little tidal fluctuation. Burrill Lake is generally open to the sea and has sufficient tidal exchange to maintain good water quality periods (Shoalhaven City Council 2002).

With the exception of the proposed stock pile site at the junction of the Princes Highway and Wheelbarrow Road (about two kilometres south of Burrill Lake), all construction and demolition works proposed, including ancillary facilities, would be located within the 1:10 year flood level.

The construction of the new bridge has the potential to disrupt local flow temporarily, primarily through the installation of temporary rock working platforms within the waterway; however these structures would not prevent blockage of Burrill Lake to the coast and would not contribute to flooding in significant rainfall events (BMT WBM 2013). As Burrill Lake displays little tidal fluctuation naturally, the construction activities are not expected to alter flow velocities, increase water turbulence, or realign the existing waterways to any substantial degree.

A Burrill Bridge Upgrade Options Investigation was undertaken by BMT WBM (2013). This study was an assessment of the impacts of the concept designs on the flow conditions with the Burrill Inlet and broader estuary. It was concluded the construction of the proposal would have minimal impact on the existing tidal flow exchange of Burrill Lake. No substantial changes in local hydrology are expected from the proposal.

Increased sedimentation and turbidity of the lake is likely to result during removal of the existing bridge and excavation activities. Potential mismanagement of stockpile sites could also affect water quality. Sedimentation of seagrass beds could impact this habitat as well as temporary increases in turbidity, which could prevent light penetration to the bed and reduce growth and/or lead to die back. However, the likelihood of lack of light being of concern is low considering how shallow the waters are at the site. Environmental safeguards are required as part of the proposal to implement standard best practice erosion and sedimentation controls. Environmental safeguards for the proposal are prescribed in Section 7 and further detailed in the Burrill Lake REF (**ngh**environmental 2013). Sediment controls such as silt curtains, have the potential to harm seagrass beds if they are used improperly (e.g. dragged along the bottom).

Effects on seagrass meadows from altered hydrology

Although no substantial changes in overall local hydrology are expected, the BMT WBM (2013) report states that the proposed removal of the causeway represents a noteworthy change from existing conditions in terms of both flood and tidal flow distributions and that these impacts are confined to the near vicinity of the causeway. The more extensive areas of seagrass within the study area are immediately south of the causeway and given their close proximity are potentially susceptible to changes in flood and tidal flows and associated movements of sediment.

The local distribution of seagrass is largely dependent on the availability of sunlight (DPI 2007b). This is generally a function of depth and water quality. As stated in **ngh**environmental (2013) the water quality for Burrill Lake is generally good despite high rainfall during summer, which can stir up sediments and wash pollutants into the lake from upper catchment areas. Therefore, depth is likely to be a major determining factor for the distribution of seagrass within Burrill Lake.

The BMT WBM (2013) report acknowledges that removal of the causeway would provide for increases in current speeds on the eastern side of the channel upstream and downstream of the causeway. Increases in flow velocity over the existing shoals (particularly during flood events) may scour some of the finer

siltation in this area (that has accumulated due to the presence of the existing causeway) as the channel adjusts to a new equilibrium. Any scouring that occurs could have an impact on the existing seagrass meadows either from destabilisation of existing plants or causing an increase in depth within the area. Additionally the scoured sediment will move elsewhere and may smother surrounding seagrass beds or create new intertidal areas as sediments accumulate

At the time of the 2013 survey, the larger area of seagrass on the south-east side of the bridge was observed to occur at depths generally ranging from 5 – 35cm at low tide with the majority of the area generally shallow (5 – 20cm), then dropping quickly in to the main channel to the west. This would suggest that significant scouring would need to occur over a relatively large area to increase the depth of the shoals in this area to that which would be unsuitable for seagrass. Scouring to this extent is considered unlikely and as such changes to seagrass distribution within the study area beyond the direct impacts of the proposal are also considered unlikely.

In regards to the relocation of sediments that may occur and smother seagrass habitat, the locations that would receive the scoured sediment and the quantity of sediments that would be relocated are currently unknown. It is therefore not possible at this stage to quantify the area of seagrass that would be impacted or how its distribution and/or cover would be modified and whether there will be a net loss or gain as a result of the proposal. However, based on existing information including the likely localised impact of the proposal on hydrology and sediment movements and the creation of new potential seagrass habitat as a result of the removal of the causeway, the effect on the distribution and abundance is likely to be minor.

5.6 IMPACT ON RELEVANT KEY THREATENING PROCESSES

Six key threatening processes have been identified as relevant to the proposal and are outlined below.

Table 5-2 Relevant key threatening processes

Key Threatening Processes (KTPs)			
TSC Act	**EPBC Act**	**FM Act**	**Relevance**
Clearing of native vegetation	Land clearance	The degradation of native riparian vegetation along New South Wales water courses	Native vegetation would be removed as part of the proposal. Given the area is already degraded and a small area will be cleared (up to 0.9 hectares), the proposal is not considered to contribute to this KTP.
Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands			Proposal for construction and removal of the bridge are required in Lake Burrill and have the potential to alter the local hydrology. Studies of flow velocities and impacts to sediment transport were undertaken (BMT WBM 2013) and concluded no significant impacts were expected from the works. The proposal is not considered to contribute to this KTP.

Key Threatening Processes (KTPs)			
TSC Act	**EPBC Act**	**FM Act**	**Relevance**
Infection of native plants by *Phytophthora cinnamomi*	Dieback caused by the root-rot fungus (*Phytophthora cinnamomi*)		The pathogen is well established in higher rainfall areas. The level of threat and its distribution can increase if human activities alter site conditions to favour the spread and intensification of the species. Guide 7 (*Pathogen management*) of the Roads and Maritime *Biodiversity Guidelines* (RTA 2011) have been recommended to prevent the spread of infected material.
Invasion of native plant communities by exotic perennial grasses			A number of exotic perennial grasses (Appendix B) were recorded across the site, and can become dominant in the landscape due to disturbance. Weed management at the site has been recommended to prevent these species from spreading further.
Introduction and establishment of exotic rust fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae			No evidence of Myrtle Rust was observed during the field survey but two host trees are present in the south west of the study area; therefore, there is the potential for its introduction. With adherence to Roads and Maritime *Biodiversity Guidelines* Guide 7 (Pathogen Management) it is considered unlikely that the proposal would contribute to this KTP.
		Instream structures and other mechanisms that alter natural flow	The establishment of the new bridge will contribute to the alteration of natural flow, however, the removal of the existing bridge is likely to reinstate a more natural flow regime than currently exists. The proposal would not contribute to this KTP.

5.7 CUMULATIVE IMPACTS

As the study area is located in a residential regional area with agriculture, national parks and nature reserves as dominant land uses, the number of developments occurring is relatively low. There are no known Roads and Maritime projects, major projects, or other large scale developments occurring in the region that are considered relevant to the upgrade. The clearing of native vegetation, which is a key threatening process at both State and Commonwealth level, is considered a major factor in the loss of biological diversity. At least 61 per cent of the native vegetation in NSW has been cleared or highly modified since European settlement, and the removal of vegetation for this upgrade is contributing to this process, although that contribution is relatively minor (0.9 hectares).

The Burrill Lake Bridge is seen as important transport infrastructure along the south coast given its location on the Princes Highway; the upgrade of the bridge is necessary to maintain road access in this area. Given minor clearance is associated with the proposal and the new bridge will be located adjacent

the existing bridge in a predominantly cleared area, the proposal is not considered to add to cumulative impacts in the local region.

6 ASSESSMENTS OF SIGNIFICANCE

6.1 TSC ACT ASSESSMENT OF SIGNIFICANCE (AOS)

An Assessment of Significance (AoS) was conducted for threatened species or communities considered to have moderate to high likelihood of utilising areas that would be directly impacted by the proposal. These species included:

- Bangalay Sand Forest
- Coastal Saltmarsh
- Swamp Oak Floodplain Forest
- White-fronted Chat
- Sooty Oystercatcher
- Pied Oystercatcher
- Little Tern

The assessments were conducted to characterise the significance of potential impacts on these species and determine whether impacts could be mitigated sufficiently or whether a Species Impact Statement (SIS) and further assessment may be required. The results of the assessment are summarised below, in Flora Assessments of Significance.

6.1.1 Flora Assessments of Significance

Bangalay Sand Forest

The proposal would remove approximately 0.4 hectares of Bangalay Sand Forest which is highly disturbed and generally in poor condition. Weeds are already prevalent within the community and the proposal is unlikely to exacerbate this. The proposal would not cause further fragmentation or isolation and the habitat to be removed is not considered important to the community's survival in the locality. A significant impact to the Bangalay Sand Forest EEC is considered unlikely.

Costal Saltmarsh

The proposal would remove 0.04 hectares of Costal Saltmarsh which is considered a very minor amount in the context of the occurrence of the community around Burrill Lake. The increase in fragmentation would be negligible and would not result in any additional isolation. The potential to introduce weeds is considered to be low and highly manageable. The habitat to be removed is not considered important to the long-term survival of the community in the locality. A significant impact to the Coastal Saltmarsh EEC is considered unlikely however, it is considered protected marine vegetation and will require a permit under the FM Act to harm.

Swamp Oak Floodplain Forest

The proposal would remove approximately 0.13 hectares of Swamp Oak Floodplain Forest which is highly disturbed and generally in poor condition and already fragmented from other remnant habitats. This community is highly fragmented and restricted within the locality and remaining remnants are considered to be of high conservation significance. The existing high levels of disturbance within a parkland environment however, severely compromises the viability of this community within the areas to be impacted. The community in these areas has been highly cleared leaving only small patches that are

heavily weed infested or maintained as parkland trees over a mown exotic understorey. It is not considered to be viable in the long-term. The habitat to be impacted is not considered important to the long-term survival of the community in the locality given the area affected is already highly modified (i.e. Swamp Oak is the dominant species remaining and the community is otherwise dominated by exotic species). Areas of Swamp Oak Floodplain Forest occur within the study area around Burrill Inlet which will not be impacted by the proposal which will maintain the local occurrence of the community. A significant impact to the Swamp Oak Floodplain Forest is considered unlikely.

6.1.2 Fauna Assessments of Significance

The threatened fauna species assessed are highly mobile and are most likely to utilise the site for foraging only. The AoS concluded the works would incur minor or negligible impacts on these species.

White-fronted Chat

The proposal will affect 0.04 hectares of potential foraging habitat (Coastal Saltmarsh) within Burrill Lake, but no nesting habitat. As the White-fronted Chat is easily observed and not detected during field surveys it is not considered to be a permanent resident of the area. Additionally, the extent of habitat to be removed is considered a relatively small impact in the context of the available resources remaining within Burrill Lake within the study area and other habitats within the locality. Given the species absence during surveys, its mobility to move through the landscape and the minor clearing to Saltmarsh within an already disturbed environment, it is considered unlikely that the proposal will result in significant impacts to the White-fronted Chat.

Shorebirds (Sooty Oystercatcher, Pied Oystercatcher, and Little Tern)

The proposal will affect 0.5 hectares of potential foraging habitat within Burrill Lake for the Pied and Sooty Oystercatcher and 2 hectares for the Little Tern, but no nesting habitat. The extent of habitat to be removed is considered a relatively small impact in the context of the available resources remaining within Burrill Lake within the study area and other habitats within the locality. The construction of the new bridge will not substantially affect habitat connectivity, nor increase fragmentation as these species are highly mobile, forage over larger distances, and contiguous habitat within Burrill Lake will remain available.

Based on the assessment provided above, it is considered unlikely that the proposal will result in significant impacts to the Pied Oystercatcher, Sooty Oystercatcher or the Little Tern.

Table 6-1 Summary of Assessments of Significance (AoS)

TSC Act significance assessments								
Threatened species, or communities	**Significance assessment question[1]**							**Likely significant impact?**
	a	b	c	d	e	f	g	
Bangalay Sand Forest	NA	NA	N	N	NA	NA	N	N
Coastal Saltmarsh	NA	NA	N	N	NA	NA	N	N
Swamp Oak Floodplain Forest	NA	NA	N	N	NA	NA	N	N
White-fronted Chat	N	NA	NA	N	NA	N	N	N
Sooty Oystercatcher	N	NA	NA	N	NA	N	N	N
Pied Oystercatcher	N	NA	NA	N	NA	N	N	N
Little Tern	N	NA	NA	N	NA	N	N	N

Notes: Y= Yes (negative impact), N= No (no or positive impact), NA= not applicable, ?= unknown impact.

Significance Assessment Questions as set out in the *Threatened Species Conservation Act 1995/ Environmental Planning and Assessment Act 1979.*

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,

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,

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,

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,

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

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

6.2 EPBC ACT SIGNIFICANT IMPACT CRITERIA

A review of significant impact criteria for migratory species was undertaken for species with high potential to occur within the study area that would be directly impacted by the proposal. These included:

- Little Tern
- Bar-tailed Godwit
- Double-banded Plover
- Eastern Curlew
- Great Egret

The assessments were conducted to characterise the significance of potential impacts on these species and determine whether impacts could be mitigated sufficiently or whether an EPBC referral was required. The results of the assessment are summarised below and provided in full in Appendix H.

Little Tern, Bar-tailed Godwit, Double-banded Plover, Eastern Curlew, and Great Egret

The Bar-tailed Godwit, Eastern Curlew and Double-banded Plover do not breed in Australia. The major Australian breeding populations for the Little Tern are not known near Burrill Lake, however, the species will nest on sandy beaches and this habitat type is not available for this species within the study area. The Great Egret will breed within Australia and is widespread but no breeding habitat is available for this species within the study area.

Burrill Lake is not known as a site of international importance for these species and is not known to support an ecological significant proportion of a population of any of these migratory species. The study area supports foraging habitat only for these species; 2 hectares of habitat will be temporarily disturbed for the Little Tern and 0.5 hectares will be affected for the Bar-tailed Godwit, Double-banded Plover, Eastern Curlew and Great Egret. As these birds are highly mobile, widespread (apart from the Little Tern), can forage over large distances and similar habitat is available within the locality the proposal is not expected to disrupt the lifecycle of these species.

7 MANAGING POTENTIAL IMPACTS UPON BIODIVERSITY

7.1 MITIGATION MEASURES

To ensure that the potential impacts identified in this assessment are adequately managed (that impacts are avoided, or minimised wherever possible), it is recommended that the proposal follow the Roads and Maritime *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011). These guidelines and the mitigation measures below (Table 7-1) would assist in minimising potential impacts on biodiversity during any construction and bridge or road maintenance works.

Permits will be required from NSW DPI to harm protected marine vegetation (seagrass and saltmarsh). Additional mitigations measures may be included in conditions prescribed by these permits.

Table 7-1 Mitigation measures designed to minimise environmental damage during construction.

Impact	Mitigation measures	Responsibility	Timing
Clearing	• Prior to the commencement of work, a physical vegetation clearing boundary at the approved clearing limit is to be demarcated and implemented. The delineation of such a boundary may include the use of temporary fencing, flagging tape, parawebbing or similar. • Trees designated for clearing would be removed in such a way as not to cause damage to surrounding vegetation. This would ensure groundcover disturbance would be kept to a minimum. • Where possible, trees to be removed would be mulched on-site and re-used to stabilise disturbed areas, or for erosion and sediment control (if required). • Where trees are to be retained, an adequate protection zone would be provided around each tree for the duration of construction. The radius of this zone is calculated by multiplying the diameter of the tree at breast height (1.4 m) by 12, and is a minimum of 2 m and a maximum of 12 m. • Where possible, work would not encroach into the drip line of trees to be retained. This zone is defined as the Tree Protection Zone (TPZ). • All vegetation removal would be in accordance with the Roads and Maritime *Biodiversity Guidelines – Protecting and Managing Biodiversity on RTA Projects* (RTA 2011a). • A permit under Part 7 of the Fisheries Management Act to harm saltmarsh would be required.	Contractor	Pre-construction and construction
Erosion and/or disturbance to	• The saltmarsh along the foreshore of the lake but outside the works footprint would be a designated	Roads and Maritime,	Pre-construction

Impact	Mitigation measures	Responsibility	Timing
Burrill Lake and lake margins	no go area for any construction plant and construction personnel. • A site-specific Erosion and Sediment Control Plan, as well as a Soil and Water management Plan are required as an environmental safeguard for the proposal and are specified in detail in the Burrill Lake REF (**ngh**environmental 2013). • The primary safeguards for erosion control would include: ○ Measures to ensure that the site is adequately protected when rain is forecast. ○ Erosion controls would be put in place on the upslope of works to prevent soil and debris travelling downslope, especially to prevent sedimentation of Burrill Lake. ○ Steps to prevent mixing of different soils (e.g. subsoils and topsoils) and ensure that they are replaced in their natural configuration to assist revegetation. ○ Measures to minimise the area of disturbance and the amount of disturbance (traffic or compaction from material laydown) over areas that would, on completion, be retained as vegetated areas. ○ Measures to protect drainage lines from disturbance or the entry of polluted run-off. ○ Measures to contain sediments near water (e.g. silt curtain). • Stockpiles would be managed in accordance with the *Stockpile Site Management Guideline* (RTA 2011b). • Stockpile and compound sites have been located in consultation with the Roads and Maritime Regional Environment Officer, using the following criteria: ○ Within 1:10 year flood zone ○ Within the road reserve ○ On primarily level and cleared ground	contractor	and construction
Damage to native vegetation outside of impact zone	• Stockpiling materials and equipment and parking vehicles would be avoided within the dripline (extent of foliage cover) of any tree.	Contractor	Construction
Introduction and spread of noxious weeds and pathogens	• A Weed Management Plan would be developed for the sites to prevent/minimise the spread of weeds in and between sites, in accordance with *Guide 6 (Weed Management)* in the Roads and Maritime *Biodiversity Guidelines* (RTA 2011a) and Shoalhaven City Council control plan for each noxious weed. • Declared noxious weeds would be managed according to the requirements stipulated by the *Noxious Weeds Act 1993*, and any weed removal	Contractor	Construction

Impact	Mitigation measures	Responsibility	Timing
	activities would be in accordance with *Guide 6 (Weed Management)* in the Roads and Maritime *Biodiversity Guidelines* (RTA 2011a). • Regular targeted control of noxious and environmental weeds would take place during construction to manage noxious weeds. • Construction machinery (bulldozers, excavators, trucks, loaders and graders) would be cleaned using a high-pressure washer (or other suitable device) prior to entering and exiting work sites. • All plant material containing seed heads, weeds that have allopathic properties, and weeds that are able to reproduce vegetatively (e.g. Wandering Jew and Willows), including topsoil containing weed propagules, would be disposed of at an appropriate waste management facility or otherwise properly treated to prevent weed growth. • Weed-free fill would be used for on-site earthworks. • All pesticides would be used in accordance with the requirements on the label. Any person undertaking pesticide (including herbicide) application would be trained to do so and have the proper certificate of completion/competency or statement of attainment issued by a registered training organisation. • Any occurrences of pathogens such as Myrtle Rust and Phytophthora will be monitored and treated as per *Guide 7 (Pathogen Management)* of the Roads and Maritime *Biodiversity Guidelines* (RTA 2011a).		
Disturbance to seagrass meadows	• A permit under Part 7 of the Fisheries Management Act to harm seagrass would be required. • If used, silt curtains would be placed at strategic locations to prevent any sedimentation of seagrass. Care would be taken when installing the silt curtain to ensure it does not directly impact any seagrass. Silt curtains would not be installed such that they block fish passage (e.g. across the channel) • The use of boats and barges in seagrass beds would be minimised where possible. • Boats and barges would not enter seagrass beds at low tide or when water levels are low enough that there is a risk of propellers striking seagrass (dictated by draft of the vessel). • Anchoring would not occur within seagrass beds. Support vessels would be moored to the barge to prevent any damage to seagrass beds.	Roads and Maritime, contractor	Construction, Post-construction

Impact	Mitigation measures	Responsibility	Timing
	• To determine the degree of impact to seagrass, monitoring would be conducted twice prior construction and twice following construction and once the stabilisation of sediments has occurred. Monitoring would follow a Before After Construction Impact (BACI) design to allow impacts to be quantified and to determine any potential compensatory measures required should a net loss have occurred as a result of the proposal. Monitoring would also be used to determine if seagrass was colonising areas where old infrastructure has been removed.		
Disturbance to fallen timber, dead wood and bush rock	• Any fallen timber, dead wood and bush rock (if present) encountered on site would be left in situ or relocated to a suitable place nearby. Rock would be removed with suitable machinery so as not to damage the underlying rock or result in excessive soil disturbance (refer to *Guide 5 Re-use of woody debris and bushrock* of the Roads and Maritime *Biodiversity Guidelines* (RTA 2011a) for guidance).	Contractor	Construction
Removal and replacement of native vegetation and/or fauna habitat	• A 'Clearing and Grubbing Plan' would be developed in accordance with *Guide 4 (clearing of vegetation)* of the Roads and Maritime *Biodiversity Guidelines* (RTA 2011a). This will include best practice methods for the removal of woody vegetation and non-woody vegetation. • A pre-clearing process and unexpected threatened species finds procedure would be implemented before clearing begins according to Guide 1 of the *Roads and Maritime Biodiversity Guidelines* (RTA 2011a). This would include checking bridge piers and infrastructure for microbats prior to any construction works. • Revegetation of any bare soil or cleared areas with locally-occurring native flora species typical of the original habitat types should occur (refer to flora species list in Appendix B for guidance).	Roads and Maritime, contractor	Construction and post-construction

7.2 OFFSETS

7.2.1 Roads and Maritime Guideline for Biodiversity Offsets

The Guideline for Biodiversity Offsets is an internal Roads and Maritime document. It is designed to assist in deciding whether biodiversity offsets are required for a project and to guide the implementation of offsets if they are required. The offsets should be considered depending on the conservation value of the habitat (very high, high etc.). Vegetation of *very high conservation value* is defined as including:

- A vegetation type that is more than 90 per cent cleared in NSW where the patch size of the impacted vegetation is greater than 4 hectares
- Areas where any removal would likely result in local extinctions of communities or species

- Type 1 or Type 2 sensitive key fish habitat (as identified by NSW Fisheries) where the impact cannot be otherwise mitigated.

The guideline states that offsets should be considered for any clearing of these vegetation types

Estuarine Fringe Forest (Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions EEC) is more than 90 per cent cleared (OEH 2012) The proposal will result in the total clearing of approximately 0.13 hectares of this community, however, as none of the patches to be impacted are greater than 4 hectares, it is therefore not classified as vegetation of *very high conservation value.* The proposal is unlikely to result in local extinctions of communities or species.

The proposal will impact on Type 1 highly sensitive key fish habitat in the form of *Zostera* seagrass beds >5m^2 in area and Coastal Saltmarsh > 5m^2 in area. Rehabilitation and/or compensation measures in line with DPI (2013) should be considered for these areas. These measures may be determined by DPI as part of permit conditions.

It is currently not possible to quantify whether there will be a net loss or gain of seagrass following construction. Compensatory measures, if a net loss occurs, would be informed by monitoring pre and post construction which would account for areas where old infrastructure has been removed and habitat provided and also potential changes in the location of shoals due to sediment movement following the removal of the causeway. As a general rule, DPI has a 2:1 habitat replacement policy, meaning that if a habitat is harmed, damaged or removed, then compensation must be provided for double the amount that originally occurred.

Vegetation of *high conservation value* is defined as including:

- A vegetation type more than 70 per cent cleared in NSW
- Threatened Ecological Communities in moderate to good condition

All of the native vegetation types within the subject site are listed Threatened Ecological Communities and would be considered to be in moderate to good condition under the Biometric guidelines. High conservation vegetation would include the Bangalay Sand forest and Swamp Oak Floodplain Forest EECs within the study area. According to the guideline, offsets should be considered for these vegetation types where clearing exceeds 1 hectare. The proposal would result in the clearing of approximately 0.4 hectares of Bangalay Sand Forest and approximately 0.13 hectares of Swamp Oak Floodplain Forest. Offsets are not required for these communities according to the guideline.

8 CONCLUSION

8.1 FLORA

Impacts associated with the proposal to replace Burrill Lake Bridge include clearance of the threatened ecological communities:

- Coastal Saltmarsh on the margins of the lake (0.04 hectares),
- Swamp Oak Floodplain Forest in patches adjacent to the Princes Highway (0.39 hectares), and
- Bangalay Sand Forest at the southern and northern ends of the study area (0.13 hectares).

Impacts to these communities were not considered to be significant. Coastal Saltmarsh is abundant around the shores of Burrill Lake and only a very small area (0.04 hectares) will be impacted by the proposal. Areas of Swamp Oak Floodplain Forest to be impacted are highly disturbed and fragmented and not considered viable for the long-term. Areas of Bangalay Sand Forest to be impacted are also highly disturbed and not considered important to the long-term survival of the community.

It is considered highly unlikely that any threatened flora species would occur within the study area.

There would be direct and indirect impacts to seagrass beds in Burrill Lake. As noted earlier, seagrass beds are extensive within the portion of Burill Lake that is located within the study area and immediate vicinity. DPI has management responsibility for fish and marine vegetation, including seagrasses, under the FM Act. Any development or activity that may harm seagrass must be referred to DPI and requires a permit.

The Roads and Maritime guidelines for Biodiversity Offsets should be considered to determine offsets and/or rehabilitation and other compensatory measures for type 1 or type 2 sensitive key fish habitat, which include seagrass and saltmarsh, where the impact cannot be otherwise mitigated. Any compensatory measures may be determined by DPI as part of permit conditions.

8.2 FAUNA

Potential habitat for a range of threatened and migratory fauna, mostly shorebirds, bridge-roosting microbats and the Green and Golden bell Frog were investigated through targeted surveys during this current 2013 assessment. This assessment followed on from field surveys undertaken by GHD (2012).

The Green and Golden Bell Frog was not detected during targeted surveys undertaken during its breeding season and the proposal is unlikely to impact this species. The potential habitat surveyed during this assessment is considered marginal and subject to ongoing disturbances such as permanent hard surfaces (roads) creating barriers to movement, as well as slashing of parkland in the immediate vicinity. The potential habitat also lacks permanent fresh water and basking sites for this species.

No microbats were detected during Anabat surveys. The existing bridge was considered a potential roost site in the GHD (2012) constraints assessment, however Anabat results indicate it is not a preferred or regularly used roost site. Microbats are not expected to rely on the area for roosting due to the lack of roosting sites (hollows) within the existing vegetation types.

Within terrestrial habitats including woodland, forest and parkland areas, there is no unique habitat or resources for threatened arboreal mammals and woodland fauna. The upgrade of the bridge is unlikely to substantially alter the available habitat for shorebirds given their mobility and the extent of similar

habitat that will remain within the locality. The proposal is unlikely to have more than a minor effect on other aquatic species (i.e. fish) considering extent of similar habitat that will remain; however, appropriate mitigation measures are required to minimise the potential for indirect impacts of sedimentation and turbidity in the study area and downstream habitats for aquatic species.

An AoS was conducted for threatened species or communities considered to have moderate to high likelihood of utilising areas that would be directly impacted by the proposal. As a result of the assessment, no species or community was considered to be significantly affected by the proposal.

9 REFERENCES

BES (2006). Flora and Fauna Assessment: Proposed Mixed Use, Residential, Commercial and Recreational Development (Stages 2, 3 and 5) Lot 1 DP 1045990 Princes Highway Dolphin Point Shoalhaven. Bushfire and Environmental Services.

Braun-Blanquet, J. (1932). (Translated, revised and edited by Fuller, G.D. & Conrad, H.S. in 1983) *Plant sociology: the study of plant communities* (Koeltz Scientific Books: Germany).

BMT WBM Pty Ltd (2013). *Burrill Bridge Upgrade Design Impact Assessment*, BMT WBM Pty Ltd, Broadmeadow.

Clarke , S., deLacey, C. and Chamberlain, S. (2004) Using environmental variables and multivariate analysis to delineate preferred habitat for *Cryptostylis hunteriana*, the Leafless Tongue Orchid, in the Shoalhaven Local Government Area, NSW. *Cunninghamia* 8(4): 467-476.

Creese, R., Glasby, T., West, G. & Gallen, C. (2009). Mapping the habitats of NSW. Fisheries Final Report Series No. 113, Department of Primary Industries. Accessed online at: http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0004/306625/AE_2009_Output-1575_Creese-et-al_Habitat-Mapping-Final-Report-113_REPORT.pdf

Cropper, S.C. (1993) *Management of Endangered Plants*. CSIRO, East Melbourne, Victoria.

DECC (2004) Draft Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities. NSW Department of Environment and Climate Change, November 2004

DEWHA (2009). *EPBC Act Policy Statement 3.19. Significant Impact Guidelines for the vulnerable green and golden bell frog* Litoria aurea. Department of the Environment, Water, Heritage and the Arts, Canberra.

DPI (1995) Fish Habitat Protection Plan No 1. Department of Primary Industries (Fisheries). Accessed online at: http://www.dpi.nsw.gov.au/fisheries/habitat/protecting-habitats/toolkit

DPI (2002). Mapping estuarine habitats: Narrawallee Inlet, Mollymook Creek, Ulladulla and Burrill Lake. Accessed online at: http://www.dpi.nsw.gov.au/research/areas/aquatic-ecosystems/estuarine-habitats-maps/IINSW_EstMac_map51.pdf

DPI (2007a).Key Fish Habitat Management Plan No. 2. Department of Primary Industries. Accessed online athttp://www.dpi.nsw.gov.au/fisheries/habitat/protecting-habitats/toolkit

DPI (2007b) NSW DPI Primefact 629 – Seagrasses. NSW Department of Primary Industries, September 2007.

DPI (2012) Field hosts of Myrtle rust recorded in NSW. NSW Department of Primary Industries, May 2012. Accessed online at: http://www.dpi.nsw.gov.au/biosecurity/plant/myrtle-rust/hosts

DPI (2011) Noxious and environmental weed control handbook: a guide to weed control in non-crop, aquatic and bushland situations. Department of Primary Industries

DPI (2013) Threatened and protected species records viewer. Department of Primary Industries. Accessed online at: http://www.dpi.nsw.gov.au/fisheries/species-protection/records

GHD (2012). *Burrill Lake Bridge Preliminary Environmental Assessment*, 21/21478/181987, GHD, Sydney. Crows Nest, NSW.

Harden, G. (Ed). (1992-2002). *Flora of New South Wales*. Vols 1,2,3 and 4. NSW University Press, Kensington, NSW.

Kyne, P.M., Pollard, D.A. & Bennett, M.B. (2003). *Dasyatis fluviorum*. In: IUCN 2011. IUCN Red List of Threatened Species. http://www.iucnredlist.org/apps/redlist/details/41797/0

nghenvironmental (2014). Burrill Lake Bridge Review of Environmental Factors, prepared for Roads and Maritime Services. **ngh**environmental, Bega, NSW.

NSW SC (2004) Final Determination – Galium australe (a herb) – endangered species listing. NSW Scientific Committee.

OEH (2012) Biometric Vegetation Types Database. NSW Office of Environment and Heritage, May 2012.

OEH (2013) Threatened Species Profile Database. NSW Office of Environment and Heritage. Accessed online at: http://www.environment.nsw.gov.au/threatenedspecies/index.htm

Pizzey, G.; Knight, F. (2012) *The field guide to the birds of Australia* 9th Ed (Editor S. Pizzey). HarperCollins Publishers (Australia) Pty Ltd.

RTA (2011a) Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects. NSW Roads and Traffic Authority.

RTA (2011b) Stockpile Site Management Guideline. NSW Roads and Traffic Authority.

Shoalhaven City Council (2002). Burrill Lake Estuary and Catchment Management Plan, accessed 18 November 2013, from: http://www.shoalhaven.nsw.gov.au/Portals/WebDataStore/Indexed/d11_115630.PDF

Shoalhaven City Council LEP (2013). Draft Shoalhaven Local Environmental Plan. Accessed online at: http://slep2013.shoalhaven.nsw.gov.au/sites/slep2013.shoalhaven.nsw.gov.au/files/draftslep2013_exhibitioninstrument_0.pdf

Specht, R.L. (1970) *Vegetation in the Australian environment*. G.W. Leeper Ed., Fourth edition. CSIRO, Melbourne.

Tozer, M.G.; Turner, K.; Keith, D.A.; Tindall, D.; Pennay, C.; Simpson, C.; MacKenzie, B.; Beukers, P.; and Cox, S. (2010) Native Vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands. *Cunninghamia* 11(3): 359-406.

APPENDIX A ASSESSMENT PERSONNEL

APPENDIX B FLORA SPECIES RECORDED

APPENDIX C FAUNA SPECIES RECORDED

APPENDIX D DATABASE SEACH RESULTS

APPENDIX E THREATENED SPECIES EVALUATIONS

APPENDIX F NOXIOUS WEEDS

APPENDIX G NSW TSC ACT ASSESSMENT OF SIGNIFICANCE

APPENDIX H EPBC ACT SIGNIFICANT IMPACT CRITERIA

APPENDIX I MAPS

APPENDIX A ASSESSMENT PERSONNEL

Deb Frazer holds a bachelor degree in Applied Science (Biodiversity Management Hons). Deb has over 9 years' experience as an ecologist and within biodiversity assessment, including several large infrastructure projects. Deb's positions have included management and senior roles, as well as educational and research assistant positions. Deb has experience in impact assessment and fauna survey projects throughout southern NSW and South Australia. Deb has also conducted biodiversity and environmental impact assessments for wind farms, powerline, road infrastructure and commercial and residential developments. Deb has extensive experience in fauna assessment and survey planning and design. In particular, Deb is skilled in interpretation and application of legislation and statutory controls; stakeholder, contractor, and client consultation; design and execution of field work; and reporting (verbal and written).

Dave Maynard completed a BSc (Ecology Hons 1) at the University of New South Wales in 2004. His honours research was conducted in conjunction with the Royal Botanic Gardens, Sydney. Dave specialises in flora assessment. Dave has been involved in a range of projects including constraint and biodiversity impact assessment for large infrastructure projects including solar, wind, sewerage, powerline, communications, road infrastructure and commercial and residential developments. Dave has extensive experience in GIS mapping and analysis, as well as floristic survey planning and design incorporating methodologies such as rapid site assessment, transects, random meanders, standardised quadrats, Biometric plots and OEH's Grassy Ecosystem Assessment methodology. Dave has conducted numerous targeted surveys for threatened flora species listed under state and federal legislation in a wide range of habitats.

APPENDIX B FLORA SPECIES RECORDED

B.1 FLORA SPECIES LIST

Relative abundance is given by a cover abundance scale (modified Braun-Blanquet):

1	1 to a few individuals present, less than 5% cover
2	many individuals present, but still less than 5% cover
3	5 - < 20% cover
4	20 - < 50% cover
5	50 - < 75% cover
6	75 - 100% cover

Cover/abundance scores relate to the general abundance within vegetation types not to representative quadrats. Vegetation types are abbreviated as follows:

BSF	Bangalay Sand Forest
SOF	Swamp Oak Forest
CSM	Coastal Salt Marsh
SGB	Seagrass beds

Where cover/abundance varied markedly, a range of values is givens. For the GHD (2012) survey, cover/abundance was not provided and the presence of species is indicated by an 'X'.

*Introduced species are preceded by an asterisk. Weeds declared as noxious within the Shoalhaven local control area or Weeds of National Significance (WONS) are denoted by a triangle (△). Where it was not possible to identify a species to specific level, the genus is listed followed by 'sp.' (species). Where uncertainty exists, the taxon is preceded by a question mark '?'. Botanical nomenclature follows G.J. Harden (ed) (1990-2002) Flora of New South Wales, UNSW Press, except where recent changes have occurred.

Scientific name	Common name	Family	GHD (2012) (presence only)	NGH (2013)			
				BSF	SOF	CSM	SGB
TREES							
Acacia implexa	Hickory Wattle	Fabaceae (Mimosoideae)		0-2			
Acacia mearnsii	Black Wattle	Fabaceae (Mimosoideae)		1			
Acmena smithii	Lilly Pilly	Myrtaceae		1			
Banksia integrifolia	Coast Banksia	Proteaceae		1			
Casuarina glauca	Swamp Oak	Casuarinaceae	X	1	2-3	0-2	
Eucalyptus botryoides	Bangalay	Myrtaceae		3			
Eucalyptus pilularis	Blackbutt	Myrtaceae		1			
Pittosporum revolutum	Rough-fruited Pittosporum	Pittosporaceae		1-6			
Pittosporum undulatum	Sweet Pittosporum	Pittosporaceae	X	2			
Tristaniopsis laurina	Kanooka	Myrtaceae	X	1			
SHRUBS/SUB-SHRUBS							
Acacia longifolia var. *sophorae*	Coastal Wattle	Fabaceae (Faboideae)	X	2	1		
Homalanthus populifolius	Native Poplar	Euphorbiaceae	X	1			
Monotoca elliptica	Tree Broom-heath	Ericaceae		2			
△*Rubus fruticosus* (spp. aggregate)	Blackberry	Rosaceae		1-5			
Rubus parvifolius	Native Raspberry	Rosaceae		1			
VINES/TWINERS							
Clematis aristata	Old Man's Beard	Ranunculaceae		1			
Eustrephus latifolius	Wombat Berry	Luzuriagaceae		1			
Marsdenia rostrata	Milk Vine	Apocynaceae		1			
Stephania japonica var. *discolor*	Snake Vine	Menispermaceae		1			
FORBS							

Scientific name	Common name	Family	GHD (2012) (presence only)	NGH (2013)			
				BSF	SOF	CSM	SGB
**Agapanthus praecox*	African Lily	Alliaceae		1			
**Anagallis arvensis*	Scarlet Pimpernel	Myrsinaceae	X	2			
Apium prostratum subsp. *prostratum* var. *filiforme*		Apiaceae	X	2			
Apium sp.		Apiaceae	X		2		
△**Asparagus aethiopicus*	Asparagus Fern	Asparagaceae	X	2-4	2		
Atriplex australasica		Chenopodiaceae	X			0-2	
Atriplex sp.	A Saltbush	Chenopodiaceae	X				
**Bidens pilosa*	Cobbler's Pegs	Asteraceae	X	2	1		
**Cakile edentula*	American Sea Rocket	Brassicaceae	X	1	1		
**Cirsium vulgare*	Black Thistle	Asteraceae		2			
**Conyza bonariensis*	Flaxleaf Fleabane	Asteraceae	X	2	2		
**Cotula coronopifolia*	Water Buttons	Asteraceae	X			2	
Dichondra repens	Kidney Weed	Convolvulaceae		0-2			
**Gamochaeta* sp.	Cudweed	Asteraceae			1		
Geranium solanderi	Native Geranium	Geraniaceae		1			
**Hydrocotyle bonariensis*		Apiaceae	X	0-2	2-3	2-3	
Hydrocotyle laxiflora	Stinking Pennywort	Apiaceae		1			
**Hypochaeris radicata*	Cat's Ear	Asteraceae		2	2		
**Lilium formosanum*	Formosan Lily	Liliaceae		2			
Lobelia anceps		Lobeliaceae	X		1	0-2	
**Pelargonium ?asperum*	Rose Geranium	Geraniaceae		0-2			
Persicaria decipiens	Tall Knotweed	Polygonaceae			0-2		
Persicaria lapathifolia	Pale Knotweed	Polygonaceae	X				
**Plantago lanceolata*	Lamb's Tongues	Plantaginaceae	X	2			

Scientific name	Common name	Family	GHD (2012) (presence only)	NGH (2013)			
				BSF	SOF	CSM	SGB
Pteridium esculentum	Bracken	Dennstaedtiaceae		0-2			
**Rumex crispus*	Curled Dock	Polygonaceae			1		
Samolus repens	Creeping Brookweed	Primulaceae	X			2	
Sarcocornia quinqueflora		Chenopodiaceae	X			0-2	
Selliera radicans	Swamp Weed	Goodeniaceae			2		
**Solanum nigrum*	Black-berry Nightshade	Solanaceae	X	1			
**Soliva sessilis*	Bindyi	Asteraceae	X				
**Sonchus oleraceus*	Common Sowthistle	Asteraceae	X	2			
**Stellaria media*	Common Chickweed	Caryophyllaceae	X	2	2		
Suaeda australis		Chenopodiaceae	X			2-3	
Tetragonia tetragonioides	New Zealand Spinach	Aizoaceae	X		2		
**Trifolium dubium*	Yellow Suckling Clover	Fabaceae (Faboideae)					
**Trifolium repens*	White Clover	Fabaceae (Faboideae)					
**Trifolium subterraneum*	Subterranean Clover	Fabaceae (Faboideae)	X	2			
Triglochin striata	Streaked Arrowgrass	Juncaginaceae	X			0-2	
**Verbena bonariensis*	Purpletop	Verbenaceae	X	2			
GRASSES							
**Anthoxanthum odoratum*	Sweet Vernal Grass	Poaceae		0-4	3		
**Briza maxima*	Quaking Grass	Poaceae		0-3			
Cynodon dactylon	Couch	Poaceae		0-3			
**Cynosurus* sp.	Dogstail Grass	Poaceae		2			
**Dactylis glomerata*	Cocksfoot	Poaceae		0-3			
**Holcus lanatus*	Yorkshire Fog	Poaceae		0-4			
Microlaena stipoides	Weeping Grass	Poaceae		0-2			
**Paspalum dilatatum*	Paspalum	Poaceae	X	2			

Scientific name	Common name	Family	GHD (2012) (presence only)	NGH (2013)			
				BSF	SOF	CSM	SGB
**Pennisetum clandestinum*	Kikuyu Grass	Poaceae	X	2-6	3		
Phragmites australis	Common Reed	Poaceae	X	0-3			
Sporobolus virginicus	Paspalum	Poaceae	X			0-3	
**Thinopyrum ponticum*	Tall Wheat Grass	Poaceae			2		
Zostera muelleri subsp. *capricorni*	Seagrass	Zosteracea	X				2-6
SEDGES							
Baumea juncea		Cyperaceae	X		0-4		
Bolboschoenus caldwellii		Cyperaceae	X			0-1	
**Cyperus eragrostis*	Umbrella Sedge	Cyperaceae			0-2		
Cyperus laevigatus		Cyperaceae	X			3-5	
Cyperus polystachyos		Cyperaceae	X		1		
Gahnia filum	Chaffy Sword-sedge	Cyperaceae	X			2	
Juncus kraussii subsp. *australiensis*	Sea Rush	Juncaceae	X		0-4	2-4	
Lomandra longifolia	Spiny-headed Mat-rush	Lomandraceae		2			

APPENDIX C FAUNA SPECIES RECORDED

Species listed on Schedule 2 of the TSC Act are noted in **bold**.

Family	Scientific name	Common name	Status	Survey	
				GHD (2012)	NGH (2013)
Birds					
Accipitriformes	Haliastur sphenurus	Whistling Kite		Y	
Anseriformes	*Chenonetta jubata*	Australian Wood Duck		Y	Y
Anseriformes	*Cygnus atratus*	Black Swan		Y	
Anseriformes	*Anas castanea*	Chestnut Teal		Y	Y
Charadriiformes	*Vanellus miles*	Masked Lapwing		Y	Y
Charadriiformes	*Chroicocephalus novaehollandiae*	Silver Gull		Y	Y
Charadriiformes	*Sterna* sp.	A tern		Y	
Ciconiiformes	*Pelecanus conspicillatus*	Australian Pelican		Y	Y
Ciconiiformes	*Threskiornis molucca*	Australian White Ibis		Y	Y
Ciconiiformes	*Ardea modesta*	Eastern Great Egret	Mi	Y	Y
Ciconiiformes	*Ardea intermedia*	Intermediate Egret		Y	Y
Ciconiiformes	*Platalea regia*	Royal Spoonbill		Y	Y
Ciconiiformes	*Egretta novaehollandiae*	White-faced Heron		Y	Y
Columbiformes	*Ocyphaps lophotes*	Crested Pigeon		Y	Y
Columbiformes	*Columba leucomela*	White-headed Pigeon		Y	
Haematopodidae	***Haematopus longirostris***	**Pied Oystercatcher**			**Y**
Passeriformes	*Malurus cyaneus*	Superb Fairy-wren		Y	Y
Passeriformes	*Acanthiza nana*	Yellow Thornbill		Y	Y
Passeriformes	*Anthochaera chrysoptera*	Little Wattlebird		Y	Y
Passeriformes	*Philemon corniculatus*	Noisy Friarbird		Y	
Passeriformes	*Cracticus torquatus*	Grey Butcherbird		Y	
Passeriformes	*Cracticus tibicen*	Australian Magpie		Y	Y
Passeriformes	*Rhipidura leucophrys*	Willie Wagtail		Y	Y
Passeriformes	*Corvus coronoides*	Australian Raven		Y	Y
Passeriformes	*Grallina cyanoleuca*	Magpie-lark		Y	Y
Passeriformes	*Hirundo neoxena*	Welcome Swallow		Y	Y
Passeriformes	*Passer domesticus**	House Sparrow		Y	Y
Phalacrocoraciformes	*Anhinga novaehollandiae*	Australasian Darter		Y	Y
Phalacrocoraciformes	*Phalacrocorax sulcirostris*	Little Black Comorant			Y
Phalacrocoraciformes	*Microcarbo melanoleucos*	Little Pied Cormorant		Y	Y
Psittaciformes	*Platycercus elegans*	Crimson Rosella		Y	Y

Family	Scientific name	Common name	Status	Survey	
				GHD (2012)	NGH (2013)
Psittaciformes	*Platycercus eximius*	Eastern Rosella			Y
Psittaciformes	*Eolophus roseicapillus*	Galah		Y	Y
Psittaciformes	*Trichoglossus haematodus*	Rainbow Lorikeet		Y	Y
Psittaciformes	*Calyptorhynchus funereus*	Yellow-tailed Black-Cockatoo		Y	Y
Frogs					
Myobatrachidae	*Crinia signifera*	Common Eastern Froglet		Y	Y
Lymnodynastidae	*Limnodynastes tasmaniensis*	Spotted Grass Frog			Y
Fish					
	Platycephalidae sp.	A flathead		Y	
	Mugil cephalus	Sea Mullet		Y	
	Tetractenos glaber	Smooth Toadfish		Y	
Rays					
	Dasyatis brevicaudatus	Smooth Stingray		Y	
	Dasyatis fluviorum	Estuary Stingray		Y	Y

APPENDIX D DATABASE SEARCH RESULTS

OEH Bionet Wildlife Atlas and EPBC Protected Matters Search tool

OEH Bionet Wildlife Atlas: Lists records of threatened species on the schedule of the TSC Act within 10 km of the study area

EPBC Protected Matters Search tool: Lists items/species on the Schedules of the EPBC Act with the potential to occur within 10 km of the study area

Acronyms

TSC	Threatened Species Conservation Act
TSC-V	Listed as Vulnerable under the Threatened Species Conservation Act
TSC-E	Listed as Endangered under the Threatened Species Conservation Act
TSC-EEC	Listed as an Endangered Ecological Community under the Threatened Species Conservation Act
TSC-EP	Listed as an Endangered Population under the Threatened Species Conservation Act
EPBC	Environment Protection and Biodiversity Conservation Act
EPBC-V	Listed as Vulnerable under the Environment Protection and Biodiversity Conservation Act
EPBC-E	Listed as Endangered under the Environment Protection and Biodiversity Conservation Act
EPBC-Mi	Listed as Migratory under the Environment Protection and Biodiversity Conservation Act
EPBC-EEC	Listed as an Endangered Ecological Community under the Environment Protection and Biodiversity Conservation Act
EPBC-CEEC	Listed as a Critically Endangered Ecological Community under the Environment Protection and Biodiversity Conservation Act

Species	Common Name	OEH Wildlife Atlas 10 km search (08/10/2013)	EPBC Protected Matters 10 km search (08/10/2013)
FAUNA			
Amphibians			
Heleioporus australiacus	Giant Burrowing Frog	TSC-V	EPBC-V
Litoria aurea	Green and Golden Bell Frog	TSC- E	EPBC-V
Litoria littlejohni	Littlejohn's Tree Frog		EPBC-V
Mixophytes balbus	Stuttering Frog	TSC-E	EPBC-V
Mixophytes iteratus	Giant Barred Frog		EPBC-E
Birds			
Anthochaera phrygia	Regent Honeyeater	TSC-CE	EPBC-E, Mi
Callocephalon fimbriatum	Gang-gang Cockatoo	TSC-V	
Calyptorhynchus lathami	Glossy Black-Cockatoo	TSC-V	
Dasyornis brachypterus	Eastern Bristlebird	TSC-E	EPBC-E
Diomedea epomophora epomorphora	Southern Royal Albatross		EPBC-V, Mi
Diomedea epomophora sanfordi	Northern Royal Albatross		EPBC-E, Mi
Diomedea exulans antipodensis	Antipodean Albatross		EPBC-V, Mi
Diomedea exulans exulans	Tristan Albatross		EPBC-E, Mi
Diomedea exulans gibsoni	Gibson's Albatross		EPBC-V, Mi
Diomedea exulans (sensu lato)	Wandering Albatross	TSC-E	EPBC-V, Mi
Epthianura albifrons	White-fronted Chat	TSC-V	
Erythrotriorchis radiatus	Red Goshawk		EPBC-V
Fregetta grallaria grallaria	White-bellied Storm-petrel		EPBC-V
Haemotopus fuliginosus	Sooty Oystercatcher	TSC-V	
Haemotopus longirostris	Pied Oystercatcher	TSC-E	
Hieraaetus morphnoides	Little Eagle	TSC-V	
Lathamus discolour	Swift Parrot	TSC-E	EPBC-E
Lophoictinia isura	Square-tailed Kite	TSC-V	
Macronectes giganteus	Southern Giant Petrel	TSC-E	EPBC-E, Mi
Macronectes halli	Northern-Giant-Petrel		EPBC-V, Mi

Species	Common Name	OEH Wildlife Atlas 10 km search (08/10/2013)	EPBC Protected Matters 10 km search (08/10/2013)
Neophema chrysogaster	Orange-bellied Parrot	TSC-CE	
Ninox strenua	Powerful Owl	TSC-V	
Pandion cristatus	Eastern Osprey	TSC-V	
Petroica boodang	Scarlet Robin	TSC-V	
Petroica phoenicea	Flame Robbin	TSC-V	
Pezoporus wallicus wallicus	Eastern Ground Parrot	TSC-V	
Pterodroma neglecta neglecta	Kermadec Petrel (Western)		EPBC-V
Ptilinopus superbus	Superb Fruit-Dove	TSC-V	
Rostratula australis	Australian Painted Snipe	TSC-E	EPBC-V, Mi
Sternula albifrons	Little Tern	TSC-E	Mi
Sternula nereis nereis	Australian Fairy Tern		EPBC-V
Thalassarche bulleri	Buller's Albatross		EPBC-V, Mi
Thalassarche cauta cauta	Shy Albatross	TSC-V	EPBC-V, Mi
Thalassarche cauta salvini	Salvin's Albatross		EPBC-V, Mi
Thalassarche cauta steadi	White-capped Albatross		EPBC-V, Mi
Thalassarche eremita	Chatham Albatross		EPBC-E, Mi
Thalassarche melanophris	Black-browed Albatross	TSC-V	EPBC-V, Mi
Thalassarche melanophris impavida	Campbell Albatross		EPBC-V, Mi
Thinornis rubricollis	Hooded Plover	TSC-E	
Tyto novaehollandiae	Masked Owl	TSC-V	
Tyto tenebricosa	Sooty Owl	TSC-V	
Fish			
Epinephelus daemelii	Black Rockcod		EPBC-V
Prototroctes maraena	Australian Grayling		EPBC-V
Mammals			
Arctocephalus pusillus	Australian Fur-seal	TSC-V	
Balaenoptera musculus	Blue Whale		EPBC-E
Cercartetus nanus	Eastern Pygmy-possum	TSC-V	
Chalinolobus dwyeri	Large-eared Pied Bat	TSC-V	EPBC-V
Dasyurus maculatus	Spotted-tailed Quoll	TSC-V	EPBC-E
Eubalaena australis	Southern Right Whale		EPBC-E

Species	Common Name	OEH Wildlife Atlas 10 km search (08/10/2013)	EPBC Protected Matters 10 km search (08/10/2013)
Falsistrellus tasmaniensis	Eastern False Pipistrelle	TSC-V	
Isoodon obesulus obesulus	Southern Brown Bandicoot (eastern)	TSC-E	EPBC-E
Kerivoula papuensis	Golden-tipped Bat	TSC-V	
Megaptera novaeangliae	Humpback Whale		EPBC-V
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	TSC-V	
Mormopterus norfolksensis	Eastern Freetail-bat	TSC-V	
Myotis macropus	Southern Myotis	TSC-V	
Petaurus australis	Yellow-bellied Glider	TSC-V	
Petaurus norfolcensis	Squirrel Glider	TSC-V	
Petrogale penicillata	Brush-tailed Rock-wallaby	TSC-E	EPBC-V
Phascolarctos cinereus	Koala	TSC-V	EPBC-V
Physeter macrocephalus	Sperm Whale	TSC-V	
Potorous tridactylus tridactylus	Long-nosed Potoroo	TSC-V	EPBC-V
Pseudomys novaehollandiae	New Holland Mouse		EPBC-V
Pteropus poliocephalus	Grey-headed Flying-fox	TSC-V	EPBC-V
Scoteanax rueppellii	Greater Broad-nosed Bat	TSC-V	
Sminthopsis leucopus	White-footed Dunnart	TSC-V	
Vespadelus troughtoni	Eastern Cave Bat	TSC-V	
Reptiles			
Caretta caretta	Loggerhead Turtle		EPBC-E, Mi
Chelonia mydas	Green Turtle	TSC-V	EPBC-V, Mi
Dermochelys coriacea	Leatherback Turtle		EPBC-E, Mi
Eretmochelys imbricata	Hawksbill Turtle		EPBC-V, Mi
Natator depressus	Flatback Turtle		EPBC-V, Mi
Sharks			
Carcharius taurus	Grey Nurse Shark		EPBC-CE
Carcharodon carcharias	Great White Shark		EPBC-V, Mi
Rhincodon typus	Whale Shark		EPBC-V, Mi
FLORA			
Plantae			
Caladenia tessellata	Thick-lipped Spider-orchid	TSC-E	EPBC-V

Species	Common Name	OEH Wildlife Atlas 10 km search (08/10/2013)	EPBC Protected Matters 10 km search (08/10/2013)
Cryptostylis hunteriana	Leafless Tongue-orchid	TSC-V	EPBC-V
Galium australe	Tangled Bedstraw	TSC-E	
Genoplesium vernale	East Lynne Midge Orchid		EPBC-V
Melaleuca biconvexa	Biconvex Paperbark		EPBC-V
Pterostylis gibbosa	Illawarra Greenhood		EPBC-E
Streblus pendulinus	Siah's Backbone		EPBC-E
Thesium australe	Austral Toadflax	TSC-V	EPBC-V
THREATENED ECOLOGICAL COMMUNITIES			
Bangalay Sand Forest of the Sydney Basin and South East Corner bioregions		TSC-EEC	
Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions		TSC-EEC	
Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions		TSC-EEC	
Littoral Rainforest and Coastal Vine Thickets of Eastern Australia			EPBC-CEEC
Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions		TSC-EEC	
Lowland Grassy Woodland in the South East Corner Bioregion			EPBC-CEEC
Milton Ulladulla Subtropical Rainforest in the Sydney Basin Bioregion		TSC-EEC	
River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions		TSC-EEC	
Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions		TSC-EEC	
Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions		TSC-EEC	
Themeda grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South East Corner Bioregions		TSC-EEC	
MIGRATORY SPECIES			
Migratory Marine Birds			
Apus pacificus	Fork-tailed Swift		Species or species habitat likely to occur within area.

Species	Common Name	OEH Wildlife Atlas 10 km search (08/10/2013)	EPBC Protected Matters 10 km search (08/10/2013)
Diomedea antipodensis	Antipodean Albatross		Species or species habitat likely to occur within area.
Diomedea dabbenea	Tristan Albatross		Species or species habitat likely to occur within area.
Doimedea epomophora (sensu stricto)	Southern Royal Albatross		Species or species habitat likely to occur within area.
Diomedea exulans (sensu lato)	Wandering Albatross		Species or species habitat likely to occur within area.
Diomedea gibsoni	Gibson's Albatross		Species or species habitat likely to occur within area.
Diomedea sanfordi	Northern Royal Albatross		Species or species habitat likely to occur within area.
Macronectes giganteus	Southern Giant-Petrel		Species or species habitat likely to occur within area.
Macronectes halli	Northern Giant-Petrel		Species or species habitat likely to occur within area.
Puffinus carneipes	Flesh-footed Shearwater		Species or species habitat likely to occur within area.
Sterna albifrons	Little Tern		Species or species habitat likely to occur within area.
Thalassarche bulleri	Buller's Albatross		Species or species habitat likely to occur within area.
Thalassarche cauta cauta	Shy Albatross		Species or species habitat likely to occur within area.
Thalassarche eremita	Chatham Albatross		Species or species habitat likely to occur within area.
Thalassarche melanophris impavida	Campbell Albatross		Species or species habitat likely to occur within area.
Thalassarche melanophris	Black-browed Albatross		Species or species habitat likely to occur within area.
Thalassarche cauta salvini	Salvin's Albatross		Species or species habitat likely to occur within area.
Thalassarche cauta steadi	White-capped Albatross		Species or species habitat likely to occur within area.
Migratory Marine Mammals			
Balaenoptera edeni	Bryde's Whale		Species or species habitat likely to occur within area.
Balaenoptera musculus	Blue Whale		Species or species habitat likely to occur within area.

Species	Common Name	OEH Wildlife Atlas 10 km search (08/10/2013)	EPBC Protected Matters 10 km search (08/10/2013)
Capera marginata	Pygmy Right Whale		Species or species habitat likely to occur within area.
Carcharodon carcharias	Great White Shark		Species or species habitat likely to occur within area.
Caretta caretta	Loggerhead Turtle		Species or species habitat likely to occur within area.
Chelonia mydas	Green Turtle		Species or species habitat likely to occur within area.
Dermochelys coriacea	Leatherback Turtle		Species or species habitat likely to occur within area.
Eretmochelys imbricate	Hawksbill Turtle		Species or species habitat likely to occur within area.
Eubalaena australis	Southern Right Whale		Species or species habitat likely to occur within area.
Lagenorhynchus obscurus	Dusky Dolphin		Species or species habitat likely to occur within area.
Lamna nasus	Porbeagle, Mackerel Shark		Species or species habitat likely to occur within area.
Megaptera novaeangliae	Humpback Whale		Species or species habitat likely to occur within area.
Natator depressus	Flatback Turtle		Species or species habitat likely to occur within area.
Orcinus orca	Killer Whale, Orca		Species or species habitat likely to occur within area.
Rhincodon typus	Whale Shark		Species or species habitat likely to occur within area.
Migratory Wetland Species			
Ardea alba	Great Egret		Species or species habitat likely to occur within area
Ardea ibis	Cattle Egret		Species or species habitat likely to occur within area
Charadrius bicinctus	Double-banded Plover		Species or species habitat likely to occur within area.
Gallinago hardwickii	Latham's Snipe		Species or species habitat may occur within area
Limosa lapponica	Bar-tailed Godwit		Species or species habitat likely to occur within area.
Numenius madagascariensis	Eastern Curlew		Species or species habitat likely to occur within area.

Species	Common Name	OEH Wildlife Atlas 10 km search (08/10/2013)	EPBC Protected Matters 10 km search (08/10/2013)
Rostratula benghalensis	Painted Snipe		Species or species habitat may occur within area
Migratory Terrestrial Species			
Haliaeetus leucogaster	White-bellied Sea-Eagle		Species or species habitat known to occur within area
Hirundapus caudacutus	White-throated Needletail		Species or species habitat known to occur within area
Merops ornatus	Rainbow Bee-eater		Species or species habitat may occur within area
Monarcha melanopsis	Black-faced Monarch		Species or species habitat known to occur within area
Monarcha trivirgatus	Spectacled Monarch		Species or species habitat may occur within area
Myiagra cyanoleuca	Satin Flycatcher		Species or species habitat known to occur within area
Neophema chrysogaster	Orange-bellied Parrot		Species or species habitat likely to occur within area.
Rhipidura rufifrons	Rufous Fantail		Species or species habitat known to occur within area
Xanthomyza phrygia	Regent Honeyeater		Species or species habitat likely to occur within area.

APPENDIX E THREATENED SPECIES EVALUATIONS

An evaluation of presence of habitat and likelihood of occurrence of threatened flora and fauna recorded within a 10 km radius of the subject site is presented overleaf. Records are from a search of the OEH Wildlife Atlas and the EPBC Environmental Reporting Tool for the Department of the Sustainability, Environment, Water, Population and Communities (DSEWPC). Ecology information has been obtained from the Threatened Species Profiles on the NSW OEH website (www.threatenedspecies.environment.nsw.gov.au) unless otherwise referenced.

LIKELIHOOD OF OCCURRENCE

Nil:	Known not to occur at the site.
Low:	Species / community unlikely to occur at the site.
Moderate:	Species could occur and proposal site may provide suitable conditions.
High:	Species was recorded or is highly likely to occur at the site.

ACRONYMS

TSC	Threatened Species Conservation Act
TSC-V	Listed as Vulnerable under the Threatened Species Conservation Act
TSC-E	Listed as Endangered under the Threatened Species Conservation Act
TSC-EEC	Listed as an Endangered Ecological Community under the Threatened Species Conservation Act
TSC-EP	Listed as an Endangered Population under the Threatened Species Conservation Act
EPBC	Environment Protection and Biodiversity Conservation Act
EPBC-V	Listed as Vulnerable under the Environment Protection and Biodiversity Conservation Act
EPBC-E	Listed as Endangered under the Environment Protection and Biodiversity Conservation Act
EPBC-Mi	Listed as Migratory under the Environment Protection and Biodiversity Conservation Act
EPBC-EEC	Listed as an Endangered Ecological Community under the Environment Protection and Biodiversity Conservation Act
EPBC-CEEC	Listed as a Critically Endangered Ecological Community under the Environment Protection and Biodiversity Conservation Act

Species	TSC Act/FM Act	EPBC Act	Habitat requirements	Number of records (NSW Wildlife Atlas)	Likelihood of occurrence
FLORA					
Plantae					
Caladenia tessellata Thick-lipped Spider-orchid	E	V	The Tessellated Spider Orchid is from a group of orchids characterised by five long spreading petals and sepals around a broad down-curled labellum ('lip'). Known from the Sydney area (old records), Wyong, Ulladulla and Braidwood in NSW. Populations in Kiama and Queanbeyan are presumed extinct. It was also recorded in the Huskisson area in the 1930s. In NSW current populations occur in Morton NP, Munmorah State Recreation Area, Braidwood (private property), South Pacific Heathland Reserve, Wyrrabalong NP, and Porter Creek Wetland Reserve. The species occurs on the coast in Victoria from east of Melbourne to almost the NSW border. Generally found in grassy sclerophyll woodland on clay loam or sandy soils, though the population near Braidwood is in low woodland with stony soil. The single leaf regrows each year. Flowers appear between September and November (but apparently generally late September or early October in extant southern populations).	1	**Low**. No habitat present in the study area.
Cryptostylis hunteriana Leafless Tongue-orchid	V	V	The Leafless Tongue Orchid has no leaf. It produces an upright flower-stem to 45 cm tall, bearing five to 10 flowers between November and February. This species has inconsistent flowering, with individuals not always flowering each season. The species occurs mostly in coastal heathlands, margins of coastal swamps and sedgelands, coastal forest, dry woodland, and lowland forest. It prefers open areas in the understorey of forested communities. The soils include moist sands, moist to dry clay loam and occasionally in accumulated eucalypt leaves. The larger populations typically occur in woodland dominated by Scribbly Gum (*Eucalyptus sclerophylla*), Silvertop Ash (*E. sieberi*), Red Bloodwood (*Corymbia gummifera*) and Black Sheoak (*Allocasuarina littoralis*); appears to prefer open areas in the understorey of this community and is often found in association with the Large Tongue Orchid (*C. subulata*) and the Tartan Tongue Orchid (*C. erecta*).	28	**Low**. No habitat present in the study area.
Galium australe Tangled Bedstraw	E		Tangled Bedstraw is a straggling and inter-twining herb with weak, hairy stems to 60 cm long. Widespread in Victoria and is also found in South Australia and Tasmania. Once regarded as presumed extinct in NSW, this species is now known from the Towamba Valley near Bega, Lake Yarrunga near Kangaroo Valley, Cullendulla Creek Nature Reserve near Batemans Bay, Conjola National Park, Swan Lake near	3	**Low**. No habitat present in the study area.

Species	TSC Act/FM Act	EPBC Act	Habitat requirements	Number of records (NSW Wildlife Atlas)	Likelihood of occurrence
			Swanhaven, and the Big Hole in Deua National Park. It was recorded historically from the Clyde River near Batemans Bay and the Mongarlowe area near Braidwood. The species also occurs beside Lake Windemere in the Australian Capital Territory at Jervis Bay. There is also an outlying record to the north from near Byabarra on the north coast. Most flowering collections have been made in late spring to early autumn. In NSW Tangled Bedstraw has been found in moist gullies of tall forest, *Eucalyptus tereticornis* forest, coastal Banksia shrubland, and *Allocasuarina nana* heathland. In other States the species is found in a range of near-coastal habitats, including sand dunes, sand spits, shrubland and woodland.		
Genoplesium vernale East Lynne Midge Orchid	V	V	Has 10 to 25 flowers densely crowded onto a spike less than 4 cm long, on a stem less than 25 cm tall. Currently known from only a narrow belt, approximately 12 km wide, of predominantly Dry Sclerophyll Forest from 17 km south of Batemans Bay to 24 km north of Ulladulla. Grows in 'poorer' dry sclerophyll woodland and forest on the south coast of New South Wales between Mogo and Ulladulla. It is confined to areas with good drainage and shallow, low fertility soils. Most sites have a 'sandy-clay' soil, usually with associated quartzite gravel. Individuals are usually found where the groundcover is sparse and there is little competition for light. Sites are usually dominated by Yertchuk (*Eucalyptus consideniana*), Sydney Peppermint (*E. piperita*), White Stringybark (*E. globoidea*), Silvertop Ash (*E. sieberi*), and Red Bloodwood (*Corymbia gummifera*) which is present in the majority of sites, and Blue-leaved Stringybark (*E. agglomerata*) and Large-fruited Red Mahogany (*E. scias*), with a reliable indicator species being the Sedge/Grass (*Cyathochaeta diandra).* The plant exists only as a dormant tuber for part of the year, dying back after flowering and fruiting in mid November to late December. Has an ability to re-colonise previously disturbed sites.	0	**Low**. No habitat present in the study area.
Melaleuca biconvexa Biconvex Paperbark		V	This species occurs in damps areas often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects. The flowering period for this species is short with flowering taking place over a 3 – 4 week period during September and October. This species is conspicuous and could be easily identified outside the flowering period.	0	**Low.** Conspicuous species not detected during surveys
Pterostylis gibbosa Illawarra Greenhood	E	E	A ground-dwelling orchid with a flower stem up to 45cm high. Known from a small number of populations in the Hunter region (Milbrodale), the Illawarra region (Albion Park and Yallah) and the Shoalhaven region (near Nowra). It is apparently extinct in	0	**Low.** No habitat present in the study area.

Species	TSC Act/FM Act	EPBC Act	Habitat requirements	Number of records (NSW Wildlife Atlas)	Likelihood of occurrence
			western Sydney which is the area where it was first collected (1803). All known populations grow in open forest or woodland, on flat or gently sloping land with poor drainage. In the Illawarra region, the species grows in woodland dominated by Forest Red Gum *Eucalyptus tereticornis*, Woollybutt *E. longifolia* and White Feather Honey-myrtle *Melaleuca decora*. Near Nowra, the species grows in an open forest of Spotted Gum *Corymbia maculata*, Forest Red Gum and Grey Ironbark *E. paniculata*. In the Hunter region, the species grows in open woodland dominated by Narrow-leaved Ironbark *E. crebra*, Forest Red Gum and Black Cypress Pine *Callitris endlicheri*. The Illawarra Greenhood is a deciduous orchid that is only visible above the ground between late summer and spring, and only when soil moisture levels can sustain its growth. The leaf rosette grows from an underground tuber in late summer, followed by the flower stem in winter. After a spring flowering, the plant begins to die back and seed capsules form (if pollination has taken place).		
Streblus pendulinus Siah's Backbone		E	A tree or large shrub that grows to 6 m in height. Occurs from Cape York Peninsula to Milton, south-east New South Wales (NSW), as well as Norfolk Island. On the Australian mainland, 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. Siah's Backbone is dioecious (plants are either male or female) (DNP 2010) with fruit ripe in January–April.	0	**Low.** No habitat present in the study area.
Thesium australe Austral Toadflax		V	An erect perennial herb to 40 cm high. Found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. It is also found in Tasmania and Queensland and in eastern Asia. Occurs in grassland or grassy woodland, often found in damp sites in association with Kangaroo Grass (*Themeda australis*). A root parasite that takes water and some nutrients from other plants, especially Kangaroo Grass. Flowering is predominantly in spring and summer.	1	**Low.** No habitat present in the study area.
Endangered Ecological Communities					
Bangalay Sand Forest of the Sydney Basin and South East Corner bioregions	EEC		Bangalay Sand Forest of the Sydney Basin and South East Corner bioregions typically has a dense to open tree canopy, approximately 5 - 20 m tall, depending on exposure and disturbance history. The most common tree species include *Eucalyptus botryoides* (Bangalay) and *Banksia integrifolia* subsp. *integrifolia* (Coast Banksia), while *Eucalyptus pilularis* (Blackbutt) and *Acmena smithii* (Lilly Pilly) may occur in	NA	**High.** Present in the south and north of the study area.

Species	TSC Act/FM Act	EPBC Act	Habitat requirements	Number of records (NSW Wildlife Atlas)	Likelihood of occurrence
			more sheltered situations, and *Casuarina glauca* (Swamp Oak) may occur on dunes exposed to salt-bearing sea breezes or where Bangalay Sand Forest adjoins Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions, as listed under the Threatened Species Conservation Act 1995. The open shrub stratum may be dominated by sclerophyllous species, such as *Banksia serrata* (Old Man Banksia), *Leptospermum laevigatum* (Coast Teatree) and *Monotoca elliptica*, or mesophyllous, species, such as *Breynia oblongifolia* (Coffee Bush) and *Pittosporum undulatum* (Sweet Pittosporum), or a combination of both. Shrubs may vary in height from one to ten m tall. The groundcover varies from open to dense, and may be sparse where the tree canopy is dense or where there is a thick litter of leaves and branches. Dominant species include *Dianella* spp. (Blue Flax Lilies), *Lepidosperma concavum*, *Lomandra longifolia* (Spiny-headed Matrush), *Pteridium esculentum* (Bracken), and the grasses *Imperata cylindrica var. major* (Blady Grass), *Microlaena stipoides var. stipoides* (Weeping Grass) and *Themeda australis* (Kangaroo Grass), while herbs, such as *Desmodium gunnii*, *Dichondra repens* (Kidney Weed), *Pratia purpurascens* (Whiteroot) and *Viola hederacea* (Ivy-leaved Violet), are scattered amongst the larger plants. Vines of *Glycine clandestina*, *Hardenbergia violacea* (False Sarsparilla), *Kennedia rubicunda* (Running Postman), *Marsdenia rostrata* (Common Milk Vine) and *Stephania japonica var. discolor* (Snake Vine) scramble through the groundcover and occasionally over shrubs or tree trunks. Bangalay Sand Forest of the Sydney Basin and South East Corner bioregions is currently known from parts of the Local Government Areas of Sutherland, Wollongong, Shellharbour, Kiama, Shoalhaven, Eurobodalla and Bega Valley but may occur elsewhere in these bioregions.		
Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	EEC		Coastal Saltmarsh occurs in the intertidal zone along the NSW coast on the shores of estuaries and lagoons that are permanently or intermittently open to the sea. It is frequently found as a zone on the landward side of mangrove stands. Characteristic plants include *Baumea juncea*, *Juncus krausii*, *Sarcocornia quinqueflora*, *Sporobolus virginicus*, *Triglochin striata*, *Isolepis nodosa*, *Samolus repens*, *Selliera radicans*, *Suaeda australis* and *Zoysia macrantha*. Occasionally mangroves are scattered through the saltmarsh. Tall reeds may also occur, as well as salt pan. Species composition varies with elevation and latitude, with Saltmarsh in southern NSW being generally more species-rich than further north. The sediment surface may support a diversity of seaweed species. Species restricted to coastal saltmarshes include	NA	**High.** Present along margins of Burrill Lake

Species	TSC Act/FM Act	EPBC Act	Habitat requirements	Number of records (NSW Wildlife Atlas)	Likelihood of occurrence
			Distichlis distichophylla (endangered), *Halosarcia pergranulata subsp. pergranulata*, *Wilsonia backhousei* (vulnerable) and *Wilsonia rotundifolia* (endangered). Coastal Saltmarsh occurs in a number of conservation reserves including the Ramsar listed sites at Towra Point and Kooragang Island Nature Reserves, and at Sydney Olympic Park.		
Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	EEC		Associated with coastal areas subject to periodic flooding and in which standing fresh water persists for at least part of the year in most years. Typically occurs on silts, muds or humic loams in low-lying parts of floodplains, alluvial flats, depressions, drainage lines, backswamps, lagoons and lakes but may also occur in backbarrier landforms where floodplains adjoin coastal sandplains. Generally occur below 20 m elevation on level areas. They are dominated by herbaceous plants and have very few woody species. The structure and composition of the community varies both spatially and temporally depending on the water regime: Those that lack standing water most of the time are usually dominated by dense grassland or sedgeland vegetation, often forming a turf less than 0.5 metre tall and dominated by amphibious plants including *Paspalum distichum* (water couch), *Leersia hexandra* (swamp rice-grass), *Pseudoraphis spinescens* (mud grass) and *Carex appressa* (tussock sedge). Where they are subject to regular inundation and drying the vegetation may include large emergent sedges over 1 metre tall, such as *Baumea articulata*, *Eleocharis equisetina* and *Lepironia articulata*, as well as emergent or floating herbs such as *Hydrocharis dubia* (frogbit), *Philydrum lanuginosum* (frogsmouth), *Ludwigia peploides* subsp. *montevidensis* (water primrose), *Marsilea mutica* (nardoo) and *Myriophyllum* spp. (milfoils). As standing water becomes deeper or more permanent, amphibious and emergent plants become less abundant, while floating and submerged aquatic herbs become more abundant. These latter species include *Azolla filiculoides* var. *rubra*, *Ceratophyllum demersum* (hornwort), *Hydrilla verticillata* (water thyme), *Lemna* spp. (duckweeds), *Nymphaea gigantea* (giant waterlily), *Nymphoides indica* (water snowflake), *Ottelia ovalifolia* (swamp lily) and *Potamageton* spp. (pondweeds). The threatened aquatic plants, *Aldrovanda vesiculosa* and *Najas marina*, also occur within this community. Known from along the majority of the NSW coast. However, it is distinct from Sydney Freshwater Wetlands which are associated with sandplains in the Sydney Basin bioregion. Extensively cleared and modified. In the 1990s the extent remaining were: 3% in the NSW North Coast bioregion, 66% in the lower Hunter – Central coast region, 40% on the Cumberland Plain, 70% in the Sydney – South Coast	NA	**Nil.** Does not occur

Species	TSC Act/FM Act	EPBC Act	Habitat requirements	Number of records (NSW Wildlife Atlas)	Likelihood of occurrence
			region, and 30% in the Eden region. There is less than 150 ha remaining on the Tweed lowlands (estimate in 1985); about 10,600 ha on the lower Clarence floodplain (in 1982); about 11,200 ha on the lower Macleay floodplain (in 1983); about 3,500 ha in the lower Hunter – Central Hunter region (in 1990s); less than 2,700 ha on the NSW south coast from Sydney to Moruya (in the mid 1990s), including about 660 ha on the Cumberland Plain (in 1998) and about 100 ha on the Illawarra Plain (in 2001); and less than 1000 ha in the Eden region (in 1990). Poorly reserved, known to occur in Ukerebagh, Tuckean, Tabbimoble Swamp, Hexham Swamp, Pambalong and Pitt Town Nature Reserves and Bungawalbin, Scheyville and Seven Mile Beach National Parks.		
Littoral Rainforest and Coastal Vine Thickets of Eastern Australia		CEEC	Generally a closed forest, the structure and composition of which is strongly influenced by its proximity to the ocean. The plant species of this community are predominantly rainforest species. Several species have compound leaves, and vines may be a major component of the canopy. These features differentiate littoral rainforest from forest or scrub, but while the canopy is dominated by rainforest species, scattered emergent individuals of sclerophyll species, such as *Angophora costata*, *Banksia integrifolia*, *Eucalyptus botryoides* and *Eucalyptus tereticornis* occur in many stands. Littoral Rainforest occurs only on the coast and is found at locations in the NSW North Coast Bioregion, Sydney Basin Bioregion and South East Corner Bioregion. Littoral Rainforest is very rare and occurs in many small stands. In total, it comprises less than one percent of the total area of rainforest in NSW. The largest known stand occurs in Iluka Nature Reserve, which is about 136 hectares in size. Occurs on sand dunes and on soil derived from underlying rocks. Stands on headlands exposed to strong wind-action may take the form of dense, wind-pruned thickets. Stands are generally taller in sheltered sites such as hind dunes, although wind-pruning may still occur on their windward sides. Most stands occur within two kilometres of the sea, though are occasionally found further inland within reach of the maritime influence. A number of species characteristic of Littoral Rainforest in NSW reach their southern limits at various places along the coast; a number of temperate species are restricted to the south coast; the total Littoral Rainforest flora declines from north to south. The species composition (flora and fauna) of a site will be influenced by its geographic location, the size of the site, its degree of exposure and rainfall, its disturbance history (including fire) and, if previously disturbed, the stage of regeneration.	NA	**Nil.** Does not occur

Species	TSC Act/FM Act	EPBC Act	Habitat requirements	Number of records (NSW Wildlife Atlas)	Likelihood of occurrence
Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	EEC		Generally a closed forest, the structure and composition of which is strongly influenced by its proximity to the ocean. The plant species of this community are predominantly rainforest species. Several species have compound leaves, and vines may be a major component of the canopy. These features differentiate littoral rainforest from forest or scrub, but while the canopy is dominated by rainforest species, scattered emergent individuals of sclerophyll species, such as *Angophora costata*, *Banksia integrifolia*, *Eucalyptus botryoides* and *Eucalyptus tereticornis* occur in many stands. Littoral Rainforest occurs only on the coast and is found at locations in the NSW North Coast Bioregion, Sydney Basin Bioregion and South East Corner Bioregion. Littoral Rainforest is very rare and occurs in many small stands. In total, it comprises less than one percent of the total area of rainforest in NSW. The largest known stand occurs in Iluka Nature Reserve, which is about 136 hectares in size. Occurs on sand dunes and on soil derived from underlying rocks. Stands on headlands exposed to strong wind-action may take the form of dense, wind-pruned thickets. Stands are generally taller in sheltered sites such as hind dunes, although wind-pruning may still occur on their windward sides. Most stands occur within two kilometres of the sea, though are occasionally found further inland within reach of the maritime influence. A number of species characteristic of Littoral Rainforest in NSW reach their southern limits at various places along the coast; a number of temperate species are restricted to the south coast; the total Littoral Rainforest flora declines from north to south. The species composition (flora and fauna) of a site will be influenced by its geographic location, the size of the site, its degree of exposure and rainfall, its disturbance history (including fire) and, if previously disturbed, the stage of regeneration.	NA	**Nil.** Does not occur
Lowland Grassy Woodland in the South East Corner Bioregion		CEEC	Associated with rainshadow areas of the south coast and hinterland of New South Wales. Typically the community comprises an open tree canopy, a near-continuous groundcover dominated by grasses and herbs, sometimes with layers of shrubs and/or small trees. Undisturbed stands of the community may have a woodland or forest structure. Small trees or saplings may dominate the community in relatively high densities after partial or total clearing. The community also includes 'derived' native grasslands which result from removal of the woody strata from the woodlands and forests. This community is currently known to occur within the Bega Valley, Eurobodalla and Palerang Local Government Areas, but may occur elsewhere in the bioregion. Major occurrences are found to the west of Batemans Bay, around	NA	**Nil.** Does not occur

Species	TSC Act/FM Act	EPBC Act	Habitat requirements	Number of records (NSW Wildlife Atlas)	Likelihood of occurrence
			Moruya, in the Araluen valley, in the Cobargo - Bega – Candelo area, the Towamba Valley and near Tanja. Located in rainshadow areas receiving less rainfall than more elevated terrain that partially surrounds them, with mean annual rainfall typically in the range of 700-1100 mm. The community typically occurs in undulating terrain up to 500 m in elevation on granitic substrates (e.g. adamellites, granites, granodiorites, gabbros, etc.) but may also occur on locally steep sites and on acid volcanic, alluvial and fine-grained sedimentary substrates. Contemporary tree-dominated stands of the community are largely relics or regrowth of originally taller forests and woodlands, which are likely to have had scattered shrubs and a largely continuous grassy groundcover. At some sites, mature trees may exceed 40 m, although regrowth stands may be shorter than 10 m.		
Milton Ulladulla Subtropical Rainforest in the Sydney Basin Bioregion	EEC		A dense forest up to 15 m tall with an emergent tree layer to 25 m tall. It is characterised by a fairly diverse canopy layer including *Claoxylon australe*, *Acmena smithii*, *Dendrocnide excelsa*, several *Ficus* species, *Syzygium australe*, *Streblus brunonianus*, *Baloghia inophylla* and *Toona ciliata*. The shrub and ground layers are generally sparse. The most common shrub species is *Citriobatus pauciflorus*. The ferns *Adiantum flabellifolium* and *Pellaea falcata* may also be present. Vines and lianas are common and include *Malaisia scandens*, *Smilax australis* and *Cissus hypoglauca*. Milton Ulladulla Subtropical Rainforest is confined to the Milton region on the South Coast of NSW. It occurs roughly between Yatte Yattah in the north, Milton in the east, Croobyar Creek in the west and the upper reaches of Burrill Lake in the south. Recorded from the local government area of Shoalhaven and may occur elsewhere in the Sydney Basin Bioregion. Confined to soils derived entirely or partially from the Milton Monzonite. The largest remnant occurs within a steep gully on Currowar Creek; however, much smaller remnants closer to the town of Milton indicate that this community would have been widespread on rolling hills throughout the area. A large proportion of this community has been cleared for agricultural development; one remnant is protected within a nature reserve and most other remnants occur on private land or roadsides and are frequently very small. Provides habitat for threatened fauna species including the Grey-headed Flying Fox (Pteropus poliocephalus) and the Powerful Owl (Ninox strenua).	NA	**Nil.** Does not occur
River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North	EEC		This EEC is found on the river flats of the coastal floodplains. It has a tall open tree layer of eucalypts, which may exceed 40 m in height. While the composition of the tree stratum varies considerably, the most widespread and abundant dominant trees	NA	**Nil.** Does not occur

Species	TSC Act/FM Act	EPBC Act	Habitat requirements	Number of records (NSW Wildlife Atlas)	Likelihood of occurrence
Coast, Sydney Basin and South East Corner Bioregions			include *Eucalyptus tereticornis (forest red gum)*, *E. amplifolia* (cabbage gum), *Angophora floribunda* (rough-barked apple) and *A. subvelutina* (broad-leaved apple). *Eucalyptus baueriana* (blue box), *E. botryoides* (bangalay) and *E. elata* (river peppermint) south from Sydney. A layer of small trees may be present, including *Melaleuca decora, M. styphelioides* (prickly-leaved teatree), *Backhousia myrtifolia* (grey myrtle), *Melia azaderach* (white cedar), *Casuarina cunninghamiana* (river oak) and *C. glauca* (swamp oak). Scattered shrubs include *Bursaria spinosa* , *Solanum prinophyllum, Rubus parvifolius, Breynia oblongifolia, Ozothamnus diosmifolius, Hymenanthera dentata, Acacia floribunda* and *Phyllanthus gunnii* .The groundcover is composed of abundant forbs, scramblers and grasses including *Microlaena stipoides, Dichondra repens, Glycine clandestina, Oplismenus aemulus, Desmodium gunnii, Pratia purpurascens, Entolasia marginata, Oxalis perennans* and *Veronica plebeia* . The composition and structure of the understorey is influenced by grazing and fire history, changes to hydrology and soil salinity and other disturbance, and may have a substantial component of exotic shrubs, grasses, vines and forbs. Associated with silts, clay-loams and sandy loams, on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains. Generally occurs below 50 m elevation, but may occur on localised river flats up to 250 m above sea level. The structure of the community may vary from tall open forests to woodlands, although partial clearing may have reduced the canopy to scattered trees. Typically form mosaics with other floodplain forest communities and treeless wetlands, and often fringe treeless floodplain lagoons or wetlands with semi-permanent standing water. Given its habitat, the community has an important role in maintaining river ecosystems and riverbank stability.		
Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	EEC		This community is found on the coastal floodplains of NSW. It has a dense to sparse tree layer in which *Casuarina glauca* (Swamp Oak) is the dominant species northwards from Bermagui. Other trees including *Acmena smithii* (Lilly Pilly), *Glochidion* spp. (Cheese Trees) and *Melaleuca* spp. (Paperbarks) may be present as subordinate species, and are found most frequently in stands of the community northwards from Gosford. Tree diversity decreases with latitude, and *Melaleuca ericifolia* is the only abundant tree in this community south of Bermagui. Known from parts of the Local Government Areas of Tweed, Byron, Lismore, Ballina, Richmond Valley, Clarence Valley, Coffs Harbour, Bellingen, Nambucca, Kempsey, Hastings, Greater Taree, Great Lakes, Port Stephens, Maitland, Newcastle, Cessnock, Lake	NA	**High.** Present in the south and north of the study area.

Species	TSC Act/FM Act	EPBC Act	Habitat requirements	Number of records (NSW Wildlife Atlas)	Likelihood of occurrence
			Macquarie, Wyong, Gosford, Pittwater, Warringah, Hawkesbury, Baulkham Hills, Hornsby, Lane Cove, Blacktown, Auburn, Parramatta, Canada Bay, Rockdale, Kogarah, Sutherland, Penrith, Fairfield, Liverpool, Bankstown, Wollondilly, Camden, Campbelltown, Wollongong, Shellharbour, Kiama, Shoalhaven, Eurobodalla and Bega Valley but may occur elsewhere in these bioregions. Major examples once occurred on the floodplains of the Clarence, Macleay, Hastings, Manning, Hunter, Hawkesbury, Shoalhaven and Moruya Rivers. Small areas of Swamp Oak Floodplain Forest are contained within existing conservation reserves, including Stotts Island, Ukerebagh, Tuckean, Pambalong, Wamberal, Towra Point and Cullendulla Creek Nature Reserves and Bongil Bongil, Myall Lakes and Conjola National Parks. Associated with grey-black clay-loams and sandy loams, where the groundwater is saline or sub-saline, on waterlogged or periodically inundated flats, drainage lines, lake margins and estuarine fringes associated with coastal floodplains. Generally occurs below 20 m (rarely above 10 m) elevation. The structure of the community may vary from open forests to low woodlands, scrubs or reedlands with scattered trees. Often fringes treeless floodplain lagoons or wetlands with semi-permanent standing water.		
Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	EEC		Usually an open to closed forest with a shrubby or reedy/ferny understorey. Has an open to dense tree layer of eucalypts and paperbarks although some remnants now only have scattered trees as a result of partial clearing. The trees may exceed 25 m in height, but can be considerably shorter in regrowth stands or under conditions of lower site quality where the tree stratum is low and dense. For example, stands dominated by *Melaleuca ericifolia* typically do not exceed 8 m in height. The community also includes some areas of fernland and tall reedland or sedgeland, where trees are very sparse or absent. The most widespread and abundant dominant trees include *Eucalyptus robusta* (Swamp Mahogany), *Melaleuca quinquenervia* (Paperbark) and, south from Sydney, *Eucalyptus botryoides* (Bangalay) and *Eucalyptus longifolia* (Woollybut). This community is known from parts of the Local Government Areas of Tweed, Byron, Lismore, Ballina, Richmond Valley, Clarence Valley, Coffs Harbour, Bellingen, Nambucca, Kempsey, Hastings, Greater Taree, Great Lakes and Port Stephens, Lake Macquarie, Wyong, Gosford, Hornsby, Pittwater, Warringah, Manly, Liverpool, Rockdale, Botany Bay, Randwick, Sutherland, Wollongong, Shellharbour, Kiama and Shoalhaven but may occur elsewhere in these bioregions. The exact amount of its original extent is unknown but it is much less than 30%. There are less than 350 ha of native vegetation attributable to this community on the Tweed	NA	**Nil.** Does not occur

Species	TSC Act/FM Act	EPBC Act	Habitat requirements	Number of records (NSW Wildlife Atlas)	Likelihood of occurrence
			lowlands, less than 2,500 ha on the Clarence floodplain, less than 700 ha on the Macleay floodplain, up to 7,000 ha in the lower Hunter – central coast district, and less than 1,000 ha in the Sydney – South Coast region. Small areas of Swamp Sclerophyll Forest on Coastal Floodplains are contained within existing conservation reserves, including Bungawalbin, Tuckean and Moonee Beach Nature Reserves, and Hat Head, Crowdy Bay, Wallingat, Myall Lakes and Garigal National Parks. Associated with humic clay loams and sandy loams, on waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains. Generally occurs below 20 m (though sometimes up to 50 m) elevation. The composition of the community is primarily determined by the frequency and duration of waterlogging and the texture, salinity nutrient and moisture content of the soil, and latitude. The understorey may have a substantial component of exotic grasses, vines and forbs. Often fringes treeless floodplain lagoons or wetlands with semi-permanent standing water.		
Themeda grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South East Corner Bioregions	EEC		The structure of the community is typically closed tussock grassland, but may be open shrubland or open heath with a grassy matrix between the shrubs. *Themeda australis* is the dominant species in this ecological commmunity. *Themeda australis* is an extremely widespread species, but in this community it may have a distinctive appearance, being prostrate and having glaucous leaves. These features are retained in cultivation and the form is believed to be genetically distinct. Scattered shrubs occur in many stands, most frequently *Pimelea linifolia, Banksia integrifolia* and *Westringia fruticosa*. These and other woody species often have dwarf growth forms. A number of threatened species occur in some stands of the community, including *Diuris* sp. aff. *chrysantha, Pultenaea maritima, Rutidosus heterogama, Thesium australe* and *Zieria prostrata*. Themeda Grassland on seacliffs and coastal headlands is found on a range of substrates in the NSW North Coast, Sydney Basin and South East Corner bioregions. Stands on sandstone are infrequent and small. Larger stands are found on old sand dunes above cliffs, as for example at Cape Banks and Henry Head in Botany Bay National Park, and on basalt headlands, as for example at Damerals Head in Moonee Beach National Park. Individual stands of the community are often very small, a few square metres, but at some sites larger stands of up to several hectares or tens of hectares occur. Overall, the community has a highly restricted geographic distribution comprising small, but widely scattered patches.	NA	**Nil.** Does not occur

Species	TSC Act/FM Act	EPBC Act	Habitat requirements	Number of records (NSW Wildlife Atlas)	Likelihood of occurrence in study area.
FAUNA					
Diurnal Birds					
Anthochaera phrygia Regent Honeyeater	CE	E, Mi	The Regent Honeyeater mainly inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. Birds are also found in drier coastal woodlands and forests in some years. There are only three known key breeding regions remaining: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley and the Bundarra-Barraba region. The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River She-oak. Regent Honeyeaters inhabit woodlands that support a significantly high abundance and species richness of bird species. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. Birds are occasionally seen on the south coast. The Regent Honeyeater is a generalist forager, which mainly feeds on the nectar from a wide range of eucalypts and mistletoes. Key eucalypt species include Mugga Ironbark, Yellow Box, Blakely's Red Gum, White Box and Swamp Mahogany. Also utilises *E. microcarpa, E. punctata, E. polyanthemos, E. mollucana, Corymbia robusta, E. crebra, E. caleyi, Corymbia maculata, E. mckieana, E. macrorhyncha, E. laevopinea,* and *Angophora floribunda*. Nectar and fruit from the mistletoes *A. miquelii, A. pendula* and *A. cambagei* are also eaten during the breeding season.		**Low.** Unlikely foraging habitat and no breeding habitat present in the study area.
Callocephalon fimbriatum Gang-gang Cockatoo	V		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 south-west slopes. It occurs regularly in the Australian Capital Territory. In summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter, may occur at lower altitudes in drier more open eucalypt forests and woodlands, and often found in urban areas. May also occur in sub-alpine Snow Gum Eucalyptus pauciflora woodland and occasionally in temperate rainforests. Favours old growth attributes for nesting and roosting. Feed mainly on seeds of native and introduced trees and shrubs, with a preference for eucalypts, wattles and introduced hawthorns. They will also eat berries, fruits, nuts and insects and their larvae.		**Moderate**. May forage on occasion in the study area. No breeding habitat present.

Species	TSC Act/FM Act	EPBC Act	Habitat requirements	Number of records (NSW Wildlife Atlas)	Likelihood of occurrence in study area.
Calyptorhynchus lathami Glossy Black-Cockatoo	V		The species is uncommon although widespread throughout suitable forest and woodland habitats, from the central Queensland coast to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW, with a small population in the Riverina. An isolated population exists on Kangaroo Island, South Australia. Dependent on large hollow-bearing eucalypts for nest sites. One or two eggs are laid between March and August. Inhabits open forest and woodlands of the coast and the Great Dividing Range up to 1000 m in which stands of she-oak species, particularly Black She-oak (*Allocasuarina littoralis*), Forest She-oak (*A. torulosa*) or Drooping She-oak (*A. verticillata*) occur. In the Riverina area, inhabits open woodlands dominated by Belah (*Casuarina cristata*). Feeds almost exclusively on the seeds of several species of she-oak (Casuarina and Allocasuarina species), shredding the cones with the massive bill.		**Low**. No foraging or breeding habitat present in the study area.
Dasyornis brachypterus Eastern Bristlebird	E	E	The distribution of the Eastern Bristlebird has contracted to three disjunct areas of south-eastern Australia: southern Queensland/northern NSW, the Illawarra Region and in the vicinity of the NSW/Victorian border. There are now only four populations in the southern Queensland/northern NSW area with a total of 35 birds. The Illawarra population comprises an estimated 1600 birds, mainly from Barren Grounds Nature Reserve, Budderoo National Park and the Jervis Bay area. 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; all of these vegetation types are fire prone. Age of habitat since fires (fire-age) is of paramount importance to this species; Illawarra and southern populations reach maximum densities in habitat that has not been burnt for at least 15 years; however, in the northern NSW population a lack of fire in grassy forest may be detrimental as grassy tussock nesting habitat becomes unsuitable after long periods without fire; northern NSW birds are usually found in habitats burnt five to 10 years previously.		**Nil**. No heathy habitat present in the study area.
Epthianura albifrons White-fronted Chat	V		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.		**Moderate**. May forage on occasion along the Burrill Lake Bridge embankment and in saltmarsh.

Species	TSC Act/FM Act	EPBC Act	Habitat requirements	Number of records (NSW Wildlife Atlas)	Likelihood of occurrence in study area.
Lathamus discolour Swift Parrot	E	E	Breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. In NSW mostly occurs on the coast and south west slopes. On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany *Eucalyptus robusta*, Spotted Gum *Corymbia maculata*, Red Bloodwood *C. gummifera*, Mugga Ironbark *E. sideroxylon*, and White Box *E. albens*. Commonly used lerp infested trees include Grey Box *E. microcarpa*, Grey Box *E. moluccana* and Blackbutt *E. pilularis*. Return to home foraging sites on a cyclic basis depending on food availability.		**Low.** Unlikely foraging habitat and no breeding habitat present in the study area.
Neophema chrysogaster Orange-bellied Parrot	CE		Breeds in the south-west of Tasmania and migrates in autumn to spend the winter on the mainland coast of south-eastern South Australia and southern Victoria. There are occasional reports from NSW, with the most recent records from Shellharbour and Maroubra in May 2003. It is expected that NSW habitats may be being more frequently utilised than observations suggest. Typical winter habitat is saltmarsh and strandline/foredune vegetation communities either on coastlines or coastal lagoons. Spits and islands are favoured but they will turn up anywhere within these coastal regions. The species can be found foraging in weedy areas associated with these coastal habitats or even in totally modified landscapes such as pastures, seed crops and golf courses. On the mainland, the Orange-bellied Parrot spends winter mostly within 3 km of the coast in sheltered coastal habitats including bays, lagoons, estuaries, coastal dunes and saltmarshes. The species also inhabits small islands and peninsulas and occasionally saltworks and golf courses. Birds forage in low samphire herbland or taller coastal shrubland. Diet mainly comprises seeds and fruits of sedges and salt-tolerant coastal and saltmarsh plants. Occasionally, flowers and stems are eaten. Orange-bellied Parrots are known to forage among flocks of Blue-winged Parrots. Recent records from unexpected places, including Shellharbour and Maroubra suggest that the species may be expanding their selection of habitats and foraging plant species. Birds seen in NSW in 2003 were foraging on weed species several hundred metres from the coast.		**Nil.** No foraging habitat and no breeding habitat present in the study area.
Petroica boodang Scarlet Robin	V		Found from SE Queensland to SE South Australia and also in Tasmania and SW Western Australia. In NSW, it occurs from the coast to the inland slopes. After breeding, some Scarlet Robins disperse to the lower valleys and plains of the tablelands and slopes. Some birds may appear as far west as the eastern edges of the		**Low**. Unlikely habitat due to lack of structural diversity and lack of ground habitat (no logs, timber). No breeding habitat present.

Species	TSC Act/FM Act	EPBC Act	Habitat requirements	Number of records (NSW Wildlife Atlas)	Likelihood of occurrence in study area.
			inland plains in autumn and winter. Lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. This species lives in both mature and regrowth vegetation. It occasionally occurs in mallee or wet forest communities, or in wetlands and tea-tree swamps. Scarlet Robin habitat usually contains abundant logs and fallen timber: these are important components of its habitat. Breeds on ridges, hills and foothills of the western slopes, the Great Dividing Range and eastern coastal regions; this species is occasionally found up to 1000 metres in altitude. Primarily a resident in forests and woodlands, but some adults and young birds disperse to more open habitats after breeding. In autumn and winter many Scarlet Robins live in open grassy woodlands, and grasslands or grazed paddocks with scattered trees.		
Petroica phoenicea Flame Robin	V		Endemic to SE Australia, and ranges from near the Queensland border to SE South Australia and also in Tasmania. In NSW, it breeds in upland areas and in winter, many birds move to the inland slopes and plains. It is likely that there are two separate populations in NSW, one in the Northern Tablelands, and another ranging from the Central to Southern Tablelands. Breeds in upland tall moist eucalypt forests and woodlands, often on ridges and slopes. Prefers clearings or areas with open understoreys. The groundlayer of the breeding habitat is dominated by native grasses and the shrub layer may be either sparse or dense. Occasionally occurs in temperate rainforest, and also in herbfields, heathlands, shrublands and sedgelands at high altitudes. In winter, birds migrate to drier more open habitats in the lowlands (i.e. valleys below the ranges, and to the western slopes and plains). Often occurs in recently burnt areas; however, habitat becomes unsuitable as vegetation closes up following regeneration. In winter lives in dry forests, open woodlands and in pastures and native grasslands, with or without scattered trees. In winter, occasionally seen in heathland or other shrublands in coastal areas.		**Low**. Unlikely habitat due to lack of structural diversity and lack native grass ground layer. No breeding habitat present.
Pezoporus wallicus wallicus Eastern Ground Parrot	V		Occurs in high rainfall coastal and near coastal low heathlands and sedgelands, generally below one metre in height and very dense (up to 90% projected foliage cover). These habitats provide a high abundance and diversity of food, adequate cover and suitable roosting and nesting opportunities for the Ground Parrot, which spends most of its time on or near the ground. The coastal and subcoastal heathland and sedgeland habitats of the Ground Parrot are particularly fire-prone. Ground Parrots feed mostly on seeds from a large range of plant species, which varies seasonally. An individual bird may consume in the order of 8000 seeds per day from as many as 60 plant species.		**Nil.** No heath habitat present in the study area.

Species	TSC Act/FM Act	EPBC Act	Habitat requirements	Number of records (NSW Wildlife Atlas)	Likelihood of occurrence in study area.
Ptilinopus superbus Superb Fruit-Dove	V		Inhabits rainforest and similar closed forests where it forages high in the canopy, eating the fruits of many tree species such as figs and palms. It may also forage in eucalypt or acacia woodland where there are fruit-bearing trees. Part of the population is migratory or nomadic. There are records of single birds flying into lighted windows and lighthouses, indicating that birds travel at night. At least some of the population, particularly young birds, moves south through Sydney, especially in autumn. Breeding takes place from September to January.		**Low.** Marginal and unlikely foraging and breeding habitat present in the study area.
Rostratula australis Australian Painted Snipe	E	V, Mi	Little is known of the ecology, habitat requirements and reproductive biology of Australian Painted Snipe. They feed in shallow water or at the waters' edge and on mudflats, taking seeds and invertebrates such as insects, worms, molluscs and crustaceans. Most records of Australian Painted Snipe are from temporary or infrequently filled freshwater wetlands. Primarily occurs along the east coast from north Queensland (excluding Cape York) to the Eyre Peninsula in South Australia, including the majority of Victoria and NSW. In NSW, this species has been recorded at the Paroo wetlands, Lake Cowell, Macquarie Marshes and Hexham Swamp. Most common in the Murray-Darling Basin. Inhabits inland and coastal shallow freshwater wetlands. The species occurs in both ephemeral and permanent wetlands, particularly where there is a cover of vegetation, including grasses, Lignum and Samphire. Individuals have also been known to use artificial habitats, such as sewage ponds, dams and waterlogged grassland.		**Low.** Marginal and unlikely foraging and breeding habitat present in the study area.
Raptors					
Erythrotriorchis radiates Red Goshawk		V	This unique Australian endemic raptor is distributed sparsely through northern and eastern Australia, from the western Kimberley Division of northern Western Australia to north-eastern Queensland and south to far north-eastern NSW, and with scattered records in central Australia. The species is very rare in NSW, extending south to about 30°S, with most records north of this, in the Clarence River Catchment, and a few around the lower Richmond and Tweed Rivers. Formerly, it was at least occasionally reported as far south as Port Stephens. Red Goshawks inhabit open woodland and forest, preferring a mosaic of vegetation types, a large population of birds as a source of food, and permanent water, and are often found in riparian habitats along or near watercourses or wetlands. In NSW, preferred habitats include mixed subtropical rainforest, *Melaleuca* swamp forest and riparian *Eucalyptus* forest of coastal rivers.		**Low**. Unlikely to occur as not known from the south coast area. Species is known within the Coffs Harbour area and further north.
Hieraaetus morphnoides Little Eagle	V		The Little Eagle is a medium-sized bird of prey that is found throughout the Australian mainland excepting the most densely forested parts of the Dividing Range		**Low.** Unlikely foraging habitat and no breeding habitat present

Species	TSC Act/FM Act	EPBC Act	Habitat requirements	Number of records (NSW Wildlife Atlas)	Likelihood of occurrence in study area.
			escarpment. It occurs as a single population throughout NSW. Occupies open eucalypt forest, woodland or open woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW are also used.		in the study area.
Lophoictinia isura Square-tailed Kite	V		The Square-tailed Kite ranges along coastal and subcoastal areas from south-western to northern Australia, Queensland, NSW and Victoria. In NSW, scattered records of the species throughout the state indicate that the species is a regular resident in the north, north-east and along the major west-flowing river systems. It is a summer breeding migrant to the south-east, including the NSW south coast, arriving in September and leaving by March. Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses. In NSW it is commonly associated with ridge or gully forests dominated by Woollybutt, Spotted Gum, or Peppermint Gum. Is a specialist hunter of passerines, especially honeyeaters, and most particularly nestlings, and insects in the tree canopy, picking most prey items from the outer foliage. Appears to occupy large hunting ranges of more than 100km^2.		**Moderate.** Minimal foraging and breeding habitat present in the study area, may fly over area during foraging bouts.
Threatened Owls					
Ninox strenua Powerful Owl	V		Endemic to eastern and south-eastern Australia, mainly on the coastal side of the Great Dividing Range from Mackay to south-western Victoria. In NSW the Powerful Owl lives in forests and woodlands occurring in the coastal, escarpment, tablelands and western slopes environments. Specific habitat requirements include eucalypt forests and woodlands on productive sites on gentle terrain; a mosaic of moist and dry types, with mesic gullies and permanent streams; presence of leafy sub-canopy trees or tall shrubs for roosting; presence of large old trees to provide nest hollows. Optimal habitat includes a tall shrub layer and abundant hollows supporting high densities of arboreal marsupials. Roosts in groves of dense mid-canopy trees or tall shrubs in sheltered gullies, typically on wide creek flats and at the heads of minor drainage lines, but also adjacent to cliff faces and below dry waterfalls. Species commonly used for roosting include the She-oaks *Allocasuarina* spp., rainforest species such as Coachwood *Ceratopetalum apetalum*, Lilly Pilly *Acmena smithii* and Sassafras *Doryphora sassafras*, Black Wattle *Acacia melanoxylon*, Turpentine *Syncarpia glomulifera* and eucalypts. Roosting sites are commonly among small groves of up to 2 ha of similar-sized trees with dense foliage in the height range 3-15 m.		**Low.** Unlikely to occur. Very marginal foraging habitat and no breeding habitat present in the study area.

Species	TSC Act/FM Act	EPBC Act	Habitat requirements	Number of records (NSW Wildlife Atlas)	Likelihood of occurrence in study area.
Tyto novaehollandiae Masked Owl	V		Extends from the coast where it is most abundant to the western plains. Lives in dry eucalypt forests and woodlands from sea level to 1100 m. Habitat for this species is also widespread throughout the dry eucalypt forests of the tablelands, western slopes and the undulating wet-dry forests of the coast. Optimal habitat includes an open understorey and a mosaic of sparse (grassy) and dense (shrubby) ground cover on gentle terrain. Roosts in hollows in live or occasionally dead eucalypts; dense foliage in gullies; and caves. Nest in old hollow eucalypts, live or dead, in a variety of topographic positions, with hollows greater than 40 cm wide and greater than 100 cm deep. Hollow entrances are at least 3 m above ground, in trees of at least 90 cm diameter at breast height. A specialist predator of terrestrial mammals, particularly native rodents. Home range has been estimated as 400-1000 ha according to habitat productivity.		**Low.** Unlikley to occur. Very marginal foraging habitat and no breeding habitat present in the study area.
Tyto tenebricosa Sooty Owl	V		Habitat is limited mainly to the moist eucalypt forests and rainforests of the coastal, escarpment and eastern tablelands regions of NSW. Sooty Owls occur in both steep and undulating country but are strongly associated with sheltered gullies, particularly those with a tall, rainforest understorey. Hollows in live or occasionally dead trees, eucalypt or rainforest species, in moist forest; among dense foliage in rainforest gullies; caves, recesses or ledges in cliffs or banks. Roost sites are in the darkest and most secluded or sheltered positions in the forest. Foliage roosts are typically in narrow, gloomy side-gullies near creek junctions or below dry waterfalls, less than 10 m from drainage lines. Foliage roosts used are rainforest species, tree ferns and vine tangles. Hollows used are usually less than 100 m from streams. Nests in old hollow trees in unlogged, unburnt gullies and lower slopes within 100 m of streams, with hollows greater than 40 cm wide and greater than 100 cm deep; surrounded by canopy trees. Also nests in caves. Hollow entrances are at least 16 m above ground, in trees of at least 120 cm diameter at breast height. The Sooty Owl is a generalist predator taking almost all arboreal, scansorial and small terrestrial mammals occurring within its more specialised habitat.		**Low.** Unlikely to occur. Very marginal foraging habitat and no breeding habitat present in the study area.
Marine / Shorebirds					
Diomedea epomophora epomorphora Southern Royal Albatross		V, Mi	The Southern Royal Albatross is marine and pelagic. It occurs in subantarctic, subtropical and occasionally Antarctic waters.		**Nil**. This is a marine species, unlikely to occur within Burrill Lake.

Species	TSC Act/FM Act	EPBC Act	Habitat requirements	Number of records (NSW Wildlife Atlas)	Likelihood of occurrence in study area.
Diomedea epomophora sanfordi Northern Royal Albatross		E, Mi	The Northern Royal Albatross is marine, pelagic and aerial. Its habitat includes subantarctic, subtropical, and occasionally Antarctic waters.		**Nil**. This is a marine species, unlikely to occur within Burrill Lake.
Diomedea exulans antipodensis Antipodean Albatross		V, Mi	The Antipodean Albatross is endemic to New Zealand, however forages widely in open water in the south-west Pacific Ocean, Southern Ocean and the Tasman Sea, notably off the coast of NSW. It is marine, pelagic and aerial. The Antipodean Albatross breeds on the New Zealand islands of Antipodes Island, Campbell Island, Pitt Island and the Auckland Islands.		**Nil**. This is a marine species, unlikely to occur within Burrill Lake.
Diomedea exulans exulans Tristan Albatross		E, Mi	The Tristan Albatross occurs in a single population which breeds on Inaccessible Island and Gough Island in the Atlantic Ocean. There is currently only one definitive record of the Tristan Albatross from Australian waters. A bird banded as a chick on Gough Island was recaptured four years later off Wollongong.		**Nil**. This is a marine species, unlikely to occur within Burrill Lake.
Diomedea exulans gibsoni Gibson's Albatross		V, Mi	There are no breeding colonies of Gibson's Albatross in Australian territory. This albatross visits Australian waters while foraging and during the non-breeding season. In Australian territory, Gibson's Albatross has been recorded foraging between Coffs Harbour, NSW, and Wilson's Promontory, Victoria. Gibson's Albatross is marine, pelagic and aerial.		**Nil**. This is a marine species, unlikely to occur within Burrill Lake.
Diomedea exulans (sensu lato) Wandering Albatross		V, Mi	The Wandering Albatross breeds on Macquarie Island. It feeds in Australian portions of the Southern Ocean. In the Australasian region, it occurs inshore, offshore and in pelagic waters.		**Nil**. This is a marine species, unlikely to occur within Burrill Lake.
Fregetta gallaria gallaria White-bellied Storm-petrel		V	The White-bellied Storm-Petrel (Tasman Sea) breeds on small offshore islets and rocks in the Lord Howe Island group. In the non-breeding season, it reaches and forages over near-shore waters along the continental shelf of mainland Australia.		**Nil**. This is a marine species unlikely to occur within Burrill Lake.
Haemotopus fuliginosus Sooty Oystercatcher	V		Evenly distributed along NSW coast, including offshore islands. Favours rocky headlands, rocky shelves, and exposed reefs with rock pools, beaches and muddy estuaries. Forages on exposed rock or coral at low tide. Breeds almost exclusively on offshore islands, and occasionally on isolated promontories.		**Moderate.** May forage on occasion along edge of lake or within exposed mud flats during low tide.
Haemotopus longirostris Pied Oystercatcher	E		Scattered along NSW coast. Favours intertidal flats of inlets and bays, open beaches and sandbanks. Forages on exposed sand, mud and rock at low tide. Nests mostly on coastal or estuarine beaches; occasionally saltmarsh or grassy areas.		**High.** Recorded during ngh 2013 surveys. Observed foraging along edge of lake during low tide.
Macronectes giganteus Southern Giant Petrel	E	E, Mi	The Southern Giant-Petrel breeds on six subantarctic and Antarctic islands in Australian territory. The winter dispersal is circumpolar, extending north to the		**Nil**. This is a marine species, unlikely to occur within Burrill

Species	TSC Act/FM Act	EPBC Act	Habitat requirements	Number of records (NSW Wildlife Atlas)	Likelihood of occurrence in study area.
			Tropic of Capricorn and sometimes beyond. The waters off southeastern Australia may be particularly important wintering grounds.		Lake.
Macronectes halli Northern-Giant Petrel		V, Mi	The Northern Giant Petrel breeds in the sub-Antarctic, and visits areas off the Australian mainland mainly during the winter months (May-October). Immature and some adult birds are commonly seen during this period in offshore and inshore waters from around Fremantle to around Sydney.		**Nil**. This is a marine species, unlikely to occur within Burrill Lake.
Pandion cristatus Eastern Osprey	V		Favours coastal areas, especially the mouths of large rivers, lagoons and lakes. They feed on fish over clear, open water. Breeding takes place from July to September in NSW, with nests being built high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea.		**Moderate.** Could forage over Burrill Lake. Ospreys are known to nest in a communications tower in Ulladulla.
Pterodroma neglecta neglecta Kermadec Petrel (Western)		V	The Kermadec Petrel (western) is a pelagic seabird that occurs in tropical, subtropical and temperate waters of the Pacific Ocean. It breeds on islands, atolls and islets in the southern Pacific Ocean.		**Nil**. This is a marine species unlikely to occur within Burrill Lake.
Sternula albifrons Little Tern	E	Mi	In NSW occurs mainly north of Sydney, with smaller numbers south to VIC. Almost exclusively coastal, preferring sheltered environments; may occur several kilometres from the sea in harbours, inlets and rivers. Nests in low dunes or sandy beaches just above high tide mark near estuary mouths/ adjacent to coastal lakes and islands. Forage in shallow waters of estuaries, coastal lagoons and lakes, also along open coasts, less often at sea, and usually within 50 m of shore.		**Moderate**. Small area of potential foraging habitat present in study area.
Sternula nereis nereis Australian Fairy Tern		V	Occurs along NSW coast. Inhabit offshore, estuarine or lake islands, wetlands, beaches and spits. Nests on coral shingle on continental islands or coral cays, on sandy islands and beaches inside estuaries and on open sandy beaches.		**Low**. Small area of potential foraging habitat present in study area.
Thalassarche bulleri Buller's Albatross		V, Mi	Buller's Albatross breed in New Zealand, but are regular visitors to Australian waters. They are frequently seen off the coast from Coffs Harbour, south to Tasmania and west to Eyre Peninsula. Buller's Albatross are marine and pelagic.		**Nil**. This is a marine species unlikely to occur within Burrill Lake.
Thalassarche cauta cauta Shy Albatross		V, Mi	Most adult Shy Albatrosses remain in the waters off southeast Australia all year round, and seldom venture more than 600km from the breeding colony. Breeding occurs on Albatross Island, Bass Strait, and Mewstone and Pedra Branca, off southern Tasmania.		**Nil**. This is a marine species unlikely to occur within Burrill Lake.
Thalassarche cauta salvini Salvin's Albatross		V, Mi	Salvin's Albatross breeds on islands off New Zealand. It ranges widely through the south Pacific.		**Nil**. This is a marine species unlikely to occur within Burrill Lake.

Species	TSC Act/FM Act	EPBC Act	Habitat requirements	Number of records (NSW Wildlife Atlas)	Likelihood of occurrence in study area.
Thalassarche cauta steadi White-capped Albatross		V, Mi	The White-capped Albatross is probably common off the coast of south-east Australia throughout the year. Breeding colonies occur on islands south of New Zealand. The species occurs both inshore and offshore and enters harbours and bays. The species is scarce in pelagic waters.		**Low.** Unlikley to occur. Very marginal foraging habitat and no breeding habitat present in the study area. Not known for the locality.
Thalassarche eremita Chatham Albatross		E, Mi	The Chatham Albatross is a marine species. It occurs in subantarctic and subtropical waters reaching the tropics in the cool Humboldt Current off South America. The species nests on level or gently sloping ledges, summits, slopes and caves of rocky islets and stacks. It is usually in broken terrain with little soil and vegetation.		**Nil**. This is a marine species unlikely to occur within Burrill Lake.
Thalassarche melanophris Black-browed Albatross	V	V, Mi	Black-browed Albatross are found over Antarctic, subantarctic and sub-tropical waters. They breed on subantarctic and Antarctic islands such as Iles Kerguelen, Heard Island and the McDonald Islands, and Macquarie Island. The species is common in the non-breeding period at the continental shelf and shelf-break of South Australia, Victoria, Tasmania, western and eastern Bass Strait and NSW. It obtains most of its food while settled on the surface of the water by reaching down to seize a food item in the bill. It regularly trails fishing vessels to collect discarded items.		**Nil**. This is a marine species unlikely to occur within Burrill Lake.
Thalassarche melanophris impavida Campbell Albatross		V, Mi	Campbell Albatross breed only on the northern and western coastline of Campbell Island and the tiny offshore islet, Jeanette Marie, New Zealand. Its non-breeding range is confined to southern Australian waters, the Tasman Sea and the south Pacific Ocean. It feed by surface-seizing and is probably capable of shallow dives.		**Nil**. This is a marine species unlikely to occur within Burrill Lake.
Thinornis rubricollis Hooded Plover	E		The Hooded Plover is endemic to southern Australia and is nowadays found mainly along the coast from south of Jervis Bay. Hooded Plovers prefer sandy ocean beaches backed by sparsely vegetated sand-dunes for shelter and nesting. Hooded Plovers display high nest site fidelity and nest solitarily. Occasionally Hooded Plovers are found on tidal bays and estuaries, rock platforms and rocky or sand-covered reefs near sandy beaches, and small beaches in lines of cliffs.		**Low.** Unlikely habitat given lack of areas of nest sites. Hooded Plover populations are monitored for the South Coast and are not known for Burrill Lake.
Additional Migratoy Bird Species					
Apus pacificus Fork-tailed Swift		Mi	This species breeds in the north-east and mid-east Asia and winters in Australia and southern New Guinea. It is a visitor to most parts of Western Australia, beginning to arrive in the Kimberley in late September, in the Pilbara and Eucla in November and in the south-west land division in mid-December, and leaving by late April. It is common in the Kimberley, uncommon to moderately common near north-west, west and southeast coasts and rare to scarce elsewhere. They never settle voluntarily on		**Low.** May forage above the study area on occasion but would not be affected by the proposed works as this species is primarily an aerial species.

Species	TSC Act/FM Act	EPBC Act	Habitat requirements	Number of records (NSW Wildlife Atlas)	Likelihood of occurrence in study area.
			the ground and spend most of their lives in the air, living on the insects they catch in their beaks.		
Puffinus carneipes Flesh-footed Shearwater		Mi	The Flesh-footed Shearwater mainly occurs in the subtropics over continental shelves and slopes and occasionally inshore waters. Individuals also pass through the tropics and over deeper waters when on migration. The Flesh-footed Shearwater does not occur in any of the threatened ecological communities listed under the EPBC Act.		**Nil**. This is a marine species unlikely to occur within Burrill Lake.
Ardea alba Great Egret		Mi	The Eastern Great Egret has been reported in a wide range of wetland habitats (for example inland and coastal, freshwater and saline, permanent and ephemeral, open and vegetated, large and small, natural and artificial). These include swamps and marshes; margins of rivers and lakes; damp or flooded grasslands, pastures or agricultural lands; reservoirs; sewage treatment ponds; drainage channels; salt pans and salt lakes; salt marshes; estuarine mudflats, tidal streams; mangrove swamps; coastal lagoons; and offshore reefs. The species usually frequents shallow waters. Eastern Great Egrets usually nest in colonies and rarely as solitary pairs. In Australia, breeding sites are located in wooded and shrubby swamps including mangrove forests (the main habitat of the species in the Top End), *Melaleuca* swamps (on the eastern coast of Australia and south-western Western Australia) and mixed eucalypt/acacia/lignum swamps (in the Channel Country and Murray-Darling Basin). The Eastern Great Egret has a diverse diet that includes fish, insects, crustaceans, molluscs, frogs, lizards, snakes and small birds and mammal.		**High.** Recorded foraging on edges of Burrill Lake.
Ardea ibis Cattle Egret		Mi	The Cattle Egret is found in grasslands, woodlands and wetlands, and is not common in arid areas. It also uses pastures and croplands, especially where drainage is poor. Will also forage at garbage dumps, and is often seen with cattle and other stock. The Cattle Egret is partially migratory, moving during winter.		**Low.** Unlikely to occur in saline environment of study area, would occur inland in more frewshwater evnrionments or within cattle country.
Charadrius bicinctus Double-banded Plover		Mi	The Double-banded Plover can be found in both coastal and inland areas. During the non-breeding season, it is common in eastern and southern Australia. Lake Bathurst in NSW is a site of international importance for this species. The Double-banded Plover is found on littoral, estuarine and fresh or saline terrestrial wetlands and also saltmarsh, grasslands and pasture. It occurs on muddy, sandy, shingled or sometimes rocky beaches, bays and inlets, harbours and margins of fresh or saline terrestrial wetlands such as lakes, lagoons and swamps, shallow estuaries and rivers. The species is sometimes associated with coastal lagoons, inland saltlakes and saltworks. It is also found on seagrass beds, especially Zostera.		**Moderate.** May forage around saltmarsh and mudflats within the foreshore of the study area.

Species	TSC Act/FM Act	EPBC Act	Habitat requirements	Number of records (NSW Wildlife Atlas)	Likelihood of occurrence in study area.
Gallinago hardwickii Latham's Snipe		Mi	In Australia, Latham's Snipe occurs in permanent and ephemeral wetlands up to 2000 m above sea-level. They usually inhabit open, freshwater wetlands with low, dense vegetation (e.g. swamps, flooded grasslands or heathlands, around bogs and other water bodies). However, they can also occur in habitats with saline or brackish water, in modified or artificial habitats, and in habitats located close to humans or human activity. Latham's Snipe does not breed within Australian jurisdiction. Latham's Snipe is an omnivorous species that feeds on seeds and other plant material (mainly from species in families such as Cyperaceae, Poaceae, Juncaceae, Polygonaceae, Ranunculaceae and Fabaceae), and on invertebrates including insects (mainly flies and beetles), earthworms and spiders and occasionally molluscs, isopods and centipedes.		**Low.** Species does not breed in Australia. Study area provides unlikely foraging habitat and was not detected during bird surveys.
Limosa lapponica Bar-tailed Godwit		Mi	The Bar-tailed Godwit breeds in the north of Scandinavia, Russia and north-west Alaska. It has been recorded in the coastal areas of all Australian states. It is widespread along the east coast of NSW, including the offshore islands. There are a few inland records from NSW. The Hunter Estuary is a site of international importance for this species. The Bar-tailed Godwit is found mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. It is found often around beds of seagrass and, sometimes, in nearby saltmarsh. It has been sighted in coastal sewage farms and saltworks, saltlakes and brackish wetlands near coasts, sandy ocean beaches, rock platforms, and coral reef-flats.		**High.** May forage around saltmarsh and seagrass in the study area.
Numenius madagascariensis Eastern Curlew		Mi	The Eastern Curlew breeds in Russia and north-eastern China. Within Australia, the Eastern Curlew has a primarily coastal distribution. Port Stephens in NSW is a site of international importance for this species. The Eastern Curlew mainly forages on soft sheltered intertidal sandflats or mudflats, open and without vegetation or covered with seagrass, often near mangroves, on saltflats and in saltmarsh, rockpools and among rubble on coral reefs, and on ocean beaches near the tideline. The birds are rarely seen on near-coastal lakes and in grassy areas.		**High.** May forage around saltmarsh and seagrass and in sandflats in the study area.
Haliaeetus leucogaster White-bellied Sea-Eagle		Mi	White-bellied Sea-Eagles are a common sight in coastal and near coastal areas of Australia. Birds form permanent pairs that inhabit territories throughout the year. Their loud "goose-like" honking call is a familiar sound, particularly during the breeding season. Birds are normally seen, perched high in a tree, or soaring over waterways and adjacent land. In addition to Australia, the species is found in New Guinea, Indonesia, China, south-east Asia and India. The White-bellied Sea-Eagle feeds mainly off aquatic animals, such as fish, turtles and sea snakes, but it takes		**High**. Likely to regularly forage over Burrill Lake.

Species	TSC Act/FM Act	EPBC Act	Habitat requirements	Number of records (NSW Wildlife Atlas)	Likelihood of occurrence in study area.
			birds and mammals as well. It is a skilled hunter, and will attack prey up to the size of a swan. Sea-Eagles also feed on carrion (dead prey) such as sheep and fish along the waterline. They harass smaller birds, forcing them to drop any food that they are carrying. Sea-Eagles feed alone, in pairs or in family groups. White-bellied Sea-Eagles build a large stick nest, which is used for many seasons in succession. The nest can be located in a tree up to 30m above the ground, but may be also be placed on the ground or on rocks, where there are no suitable trees. At the start of the breeding season (May to October), the nest is lined with fresh green leaves and twigs. The female carries out most of the incubation of the two white eggs, but the male performs this duty from time to time.		
Hirundapus caudacutus White-throated Needletail		Mi	White-throated Needletails often occur in large numbers over eastern and northern Australia. They arrive in Australia from their breeding grounds in the northern hemisphere in about October each year and leave somewhere between May and August. They are aerial birds and for a time it was commonly believed that they did not land while in Australia. It has now been observed that birds will roost in trees, and radio-tracking has since confirmed that this is a regular activity. The White-throated Needletail feeds on flying insects, such as termites, ants, beetles and flies. They catch the insects in flight in their wide gaping beaks. Birds usually feed in rising thermal currents associated with storm fronts and bushfires and they are commonly seen moving with wind fronts. White-throated Needletails are non-breeding migrants in Australia.		**Low.** May forage on occasion over the study area, but are primarily an aerial species and unlikely habitat is present in the study area.
Merops ornatus Rainbow Bee-eater		Mi	The Rainbow Bee-eater is found throughout mainland Australia, as well as eastern Indonesia, New Guinea and, rarely, the Solomon Islands. In Australia it is widespread, except in desert areas, and breeds throughout most of its range, although southern birds move north to breed. The Rainbow Bee-eater is most often found in open forests, woodlands and shrublands, and cleared areas, usually near water. It will be found on farmland with remnant vegetation and in orchards and vineyards. It will use disturbed sites such as quarries, cuttings and mines to build its nesting tunnels. Southern populations move north, often in huge flocks, during winter; northern populations are present year round. Rainbow Bee-eaters eat insects, mainly catching bees and wasps, as well as dragonflies, beetles, butterflies and moths. They catch flying insects on the wing and carry them back to a perch to beat them against it before swallowing them. Bees and wasps are rubbed against the perch to remove the stings and venom glands.		**Low.** May forage in the study area on occasion. Limited breeding habitat present.

Species	TSC Act/FM Act	EPBC Act	Habitat requirements	Number of records (NSW Wildlife Atlas)	Likelihood of occurrence in study area.
Monarcha melanopsis Black-faced Monarch		Mi	The Black-faced Monarch is found along the coast of eastern Australia, becoming less common further south. The Black-faced Monarch is found in rainforests, eucalypt woodlands, coastal scrub and damp gullies. It may be found in more open woodland when migrating. Resident in the north of its range, but is a summer breeding migrant to coastal south-eastern Australia, arriving in September and returning northwards in March. The Black-faced Monarch forages for insects among foliage, or catches flying insects on the wing.		**Low.** Unlikely habitat present.
Monarcha trivirgatus Spectacled Monarch		Mi	Has a very large range. Populate the north-east and east coast of Australia during their breeding season. In winter the southern races migrate northwards. During the breeding season race "gouldii" is found along the east coast and the eastern slopes of the ranges from the Hunter estuary in NSW up to about the Whitsundays, QLD. Spectacled Monarchs can usually be found in wet forest and mangroves.		**Nil.** Unlikely habitat present in the study area.
Myiagra cyanoleuca Satin Flycatcher		Mi	The Satin Flycatcher is found along the east coast of Australia from far northern Queensland to Tasmania, including south-eastern South Australia. It is also found in New Guinea. The Satin Flycatcher is not a commonly seen species, especially in the far south of its range, where it is a summer breeding migrant. The Satin Flycatcher is found in tall forests, preferring wetter habitats such as heavily forested gullies, but not rainforests. The Satin Flycatcher is a migratory species, moving northwards in winter to northern Queensland and Papua New Guinea, returning south to breed in spring. The Satin Flycatcher takes insects on the wing, foraging actively from perches in the mid to upper canopy.		**Low.** Unlikely habitat present in the study area.
Rhipidura rufifrons Rufous Fantail		Mi	The Rufous Fantail is a summer breeding migrant to southeastern Australia. It is found in northern and eastern coastal Australia, being more common in the north. The Rufous Fantail is found in rainforest, dense wet forests, swamp woodlands and mangroves, preferring deep shade, and is often seen close to the ground. Strongly migratory in the south of its range, it moves northwards in winter, and virtually disappears from Victoria and New South Wales at this time. The Rufous Fantail feeds on insects, which it gleans from the middle and lower levels of the canopy.		**Low.** Unlikely habitat present in study area and no breeding habitat present.
Mammals (excluding microbats)					
Cercartetus nanus Eastern Pygmy-possum	V		Found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred, except in north-eastern NSW where they are most frequently encountered in rainforest. Feeds largely on nectar and pollen collected from		**Low**. No heathy habitat present in the study area.

Species	TSC Act/FM Act	EPBC Act	Habitat requirements	Number of records (NSW Wildlife Atlas)	Likelihood of occurrence in study area.
			banksias, eucalypts and bottlebrushes; an important pollinator of heathland plants such as banksias; soft fruits are eaten when flowers are unavailable. Also feeds on insects throughout the year; this feed source may be more important in habitats where flowers are less abundant such as wet forests. Shelters in tree hollows, rotten stumps, holes in the ground, abandoned bird-nests, Ringtail Possum (*Pseudocheirus peregrinus*) dreys or thickets of vegetation, (eg. grass-tree skirts).		
Dasyurus maculatus Spotted-tailed Quoll	V	E	Found on the east coast of NSW, Tasmania, eastern Victoria and north-eastern Queensland. Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites. Mostly nocturnal, although will hunt during the day; spends most of the time on the ground. The home-range of this species is unknown, but estimates are between 800ha and 20km^2. Usually traverse their ranges along densely vegetated creeklines. They need suitable den sites and abundant food, requiring large areas of intact vegetation for foraging. Use 'latrine sites', often on flat rocks among boulder fields and rocky cliff-faces; latrine sites can be recognised by the accumulation of the sometimes characteristic 'twisty-shaped' faeces deposited by animals. Consumes a variety of prey, including gliders, possums, small wallabies, rats, birds, bandicoots, rabbits and insects; also eats carrion and takes domestic fowl.		**Low.** Unlikely foraging habitat and no breeding habitat present in the study area.
Isoodon obesulus obesulus Southern Brown Bandicoot	E	E	The Southern Brown Bandicoot has a patchy distribution. It is found in south-eastern NSW, east of the Great Dividing Range south from the Hawkesbury River, southern coastal Victoria and the Grampian Ranges, south-eastern South Australia, south-west Western Australia and the northern tip of Queensland. Southern Brown Bandicoots are largely crepuscular (active mainly after dusk and/or before dawn). They are generally only found in heath or open forest with a heathy understorey on sandy or friable soils.		**Nil.** No habitat present in study area.
Petaurus australis Yellow-bellied Glider	V		Distribution is mostly continuous from about 50 kilometres east of Melbourne in Victoria, to Sarina near Mackay in central Queensland. In NSW, distribution of the Yellow-bellied Glider is essentially coastal, extending inland to adjacent ranges. It typically occurs in tall, mature eucalypt forest in regions of high rainfall, but is also known to occur in drier areas. It inhabits a wide range of forest types but prefers resource rich forests where mature trees provide nesting hollows and tree species composition provides year-round continuity of food resources. Preferred Yellow-bellied Glider habitat is often characterised by a mosaic of tree species associations		**Low.** Marginal foraging habitat given disturbed nature of site. No evidence of sap feed trees from field survey. No breeding habitat present in the study area.

Species	TSC Act/FM Act	EPBC Act	Habitat requirements	Number of records (NSW Wildlife Atlas)	Likelihood of occurrence in study area.
			likely to provide a continuous, year-round food supply. Forest type preferences vary with latitude and elevation; mixed coastal forests to dry escarpment forests in the north; moist coastal gullies and creek flats to tall montane forests in the south. In NSW, the tree species utilised as sap trees are mostly eucalypts (Eucalyptus and Corymbia species).		
Petaurus norfolcensis Squirrel Glider	V		The Squirrel Glider is sparsely distributed along the east coast and immediate inland districts from western Victoria to north Queensland. The species is found inland as far as the Grampians in Victoria and the Pilliga and the Coonabarabran areas of NSW. Inhabits dry sclerophyll forest and woodland and is generally absent from rainforest and closed forest. In NSW, potential habitat includes Box-Ironbark forests and woodlands in the west, the River Red Gum forests of the Murray Valley and the eucalypt forests of the northeast. Requires abundant hollow-bearing trees and a mix of eucalypts, acacias and banksias. Nightly movements are estimated at between 300 and 500 m. Squirrel Glider's forage in the upper and lower forest canopies and in the shrub understorey.		**Low.** Development to occur in disturbed area and unlikely habitat for this species. No breeding habitat present in the study area.
Petrogale penicillata Brush-tailed Rock-wallaby	E	V	The range of the Brush-tailed Rock-wallaby extends from south-east Queensland to the Grampians in western Victoria, roughly following the line of the Great Dividing Range. The species' range is now fragmented, particularly in the south where they are now mostly found as small isolated populations dotted across their former range. In NSW they occur from the Queensland border in the north to the Shoalhaven in the south, with the population in the Warrumbungle Ranges being the western limit. Occupy rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges facing north. Throughout their range, Brush-tailed Rock-wallabies feed on a wide variety of grasses and shrubs, and have flexible dietary requirements. Shelter or bask during the day in rock crevices, caves and overhangs and are most active at night.		**Nil.** No habitat present in study area.
Phascolarctos cinereus Koala	V	V	Occurs in eastern Australia, from north-eastern Queensland to south-eastern South Australia and to the west of the Great Dividing Range. In NSW it mainly occurs on the central and north coasts with some populations in the western region. It was historically abundant on the south coast of NSW, but now occurs in sparse and possibly disjunct populations. The koala inhabits a range of eucalypt forest and woodland communities, including coastal forests, the woodlands of the tablelands and western slopes, and the riparian communities of the western plains. Examples of important shelter trees are cypress pine and brush box. The quality of forest and woodland communities as habitat for koalas is influenced by a range of factors, such		**Nil.** No habitat present in study area.

Species	TSC Act/FM Act	EPBC Act	Habitat requirements	Number of records (NSW Wildlife Atlas)	Likelihood of occurrence in study area.
			as; species and size of trees present; structural diversity of the vegetation; soil nutrients; climate and rainfall; size and disturbance history of the habitat patch.Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. Home range size varies with quality of habitat, ranging from less than two ha to several hundred hectares in size. Breeding season for the koala peaks between September and February.		
Potorous tridactylus tridactylus Long-nosed Potoroo	V	V	In NSW it is generally restricted to the east of the Great Dividing Range, with an annual rainfall exceeding 760 mm. 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. A sandy loam soil is also a common feature. The main habitat requirements would appear to be access to some form of dense vegetation for shelter and the presence of an abundant supply of fungi for food. 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. 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.		**Nil.** No habitat present in study area.
Pseudomys novaehollandiae New Holland Mouse		V	The New Holland Mouse has a fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. Known to inhabit open heathlands, open woodlands with a heathland understorey and vegetated sand dunes. Lives predominantly in burrows shared with other individuals. The home range of the New Holland Mouse ranges from 0.44 ha to 1.4 ha. Breeding typically occurs between August and January, but can extend into autumn. The species peaks in abundance during early to mid stages of vegetation succession typically induced by fire. Nocturnal and omnivorous, feeding on seeds, insects, leaves, flowers and fungi, and is therefore likely to play an important role in seed dispersal and fungal spore dispersal.		**Nil.** No habitat present in study area.
Sminthopsis leucopus White-footed Dunnart	V		The Shoalhaven area is the species' northern-most limit. It has not been recorded west of the coastal escarpment with the western-most record being from Coolangubra State Forest, approximately 10 km south-east of Bombala. The White-footed Dunnart is found in a range of different habitats across its distribution, including coastal dune vegetation, coastal forest, tussock grassland and sedgeland, heathland, woodland and forest. In NSW, the species seems to favour vegetation communities with an open understorey structure (contrasting with populations in		**Low.** Due to prior disturbance structural diversity of habitat is poor for this species. Distubrances associated with a residential area and presences of dogs are ongoing in the study area.

Species	TSC Act/FM Act	EPBC Act	Habitat requirements	Number of records (NSW Wildlife Atlas)	Likelihood of occurrence in study area.
			Victoria which apparently prefer dense shrub and ground layers). It is patchily distributed across these habitats and, where present, typically occurs at low densities. Breeding populations have been recorded in logged forest shortly after disturbance, but these usually do not persist as regeneration proceeds and a dense ground cover of vegetation establishes.		
Microbats					
Kerivoula papuensis Golden-tipped Bat	V		Found in rainforest and adjacent wet and dry sclerophyll forest up to 1000m. Also recorded in tall open forest, *Casuarina*-dominated riparian forest and coastal *Melaleuca* forests. However, thiss species is often caught over streams within rainforest. Roost 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.		**Low.** Unlikely foraging habitat and no breeding habitat present in the study area.
Falsistrellus tasmaniensis Eastern False Pipistrelle	V		The Eastern False Pipistrelle is found on the south-east coast and ranges of Australia, from southern Queensland to Victoria and Tasmania. Prefers moist habitats, with trees taller than 20 m. Generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings.		**Moderate.** Limited foraging habitat and no breeding habitat present in the study area.
Chalinolobus dwyeri Large-eared Pied Bat	V	V	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. Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (*Hirundo arie*l), frequenting low to mid-elevation dry open forest and woodland close to these features. Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves. Found in well-timbered areas containing gullies. This species probably forages for small, flying insects below the forest canopy. Likely to hibernate through the coolest months. It is uncertain whether mating occurs early in winter or in spring.		**Low.** Limited foraging habitat and no breeding habitat present in the study area. Unlikely to occur.
Miniopterus schreibersii oceanensis Eastern Bentwing-bat	V		Eastern Bent-wing Bats occur along the east and north-west coasts of Australia. Associated with a range of habitats such as rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grassland Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young.		**Moderate.** Could forage in study area on occasion. Limited roosting habitat present.

Species	TSC Act/FM Act	EPBC Act	Habitat requirements	Number of records (NSW Wildlife Atlas)	Likelihood of occurrence in study area.
			Maternity caves have very specific temperature and humidity regimes. At other times of the year, populations disperse within about 300 km range of maternity caves.		
Mormopterus norfolksensis Eastern Freetail-bat	V		The East Coast Freetail bat is found along the east coast from south Queensland to southern NSW. Occur in dry sclerophyll forest and woodland east of the Great Dividing Range. Roost mainly in tree hollows but will also roost under bark or in man-made structures. Usually solitary but also recorded roosting communally, probably insectivorous.		**Moderate.** Limited foraging habitat and no breeding habitat present in the study area.
Myotis macropus Southern Myotis	V		The Large-footed Myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. It is rarely found more than 100 km inland, except along major rivers. Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools catching insects and small fish by raking their feet across the water surface.		**Moderate.** Limited foraging habitat and no breeding habitat present in the study area.
Scoteanax rueppellii Greater Broad-nosed Bat	V		The Greater Broad-nosed Bat is found mainly in the gullies and river systems that drain the Great Dividing Range, from north-eastern Victoria to the Atherton Tableland. It extends to the coast over much of its range. In NSW it is widespread on the New England Tablelands, however does not occur at altitudes above 500 m. Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. Although this species usually roosts in tree hollows, it has also been found in buildings. Forages after sunset, flying slowly and directly along creek and river corridors at an altitude of 3 - 6 m. Open woodland habitat and dry open forest suits the direct flight of this species as it searches for beetles and other large, slow-flying insects; this species has been known to eat other bat species. Little is known of its reproductive cycle, however a single young is born in January; prior to birth, females congregate at maternity sites located in suitable trees, where they appear to exclude males during the birth and raising of the single young.		**Moderate.** Limited foraging habitat and no breeding habitat present in the study area.
Pteropus poliocephalus Grey-headed Flying-fox	V	V	Grey-headed Flying-foxes are found within 200 km of the eastern coast of Australia, from Bundaberg in Queensland to Melbourne in Victoria. Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source, often in stands of riparian rainforest, Paperbark or Casuarina forest, and are commonly found in gullies, close to water, or in vegetation with a dense canopy. Forage on the nectar and pollen of native trees, in		**Moderate.** Some foraging habitat and no breeding habitat present in the study area.

Species	TSC Act/FM Act	EPBC Act	Habitat requirements	Number of records (NSW Wildlife Atlas)	Likelihood of occurrence in study area.
			particular *Eucalyptus*, *Melaleuca* and *Banksia,* and fruits of rainforest trees and vines. Travel up to 50 km to forage. Annual mating commences in January and a single young is born each October or November. Site fidelity to camps is high with some camps being used for over a century.		
Vespadelus troughtoni Eastern Cave Bat	V		This species inhabits tropical mixed woodland and wet sclerophyll forest on the coast and the dividing range but extend into the drier forest of the western slopes and inland areas. Has been found roosting in sandstone overhand caves, boulder piles, mine tunnels and occasionally in buildings.		**Low.** Unlikely; foraging habitat and no breeding habitat present.
Reptiles					
Caretta caretta Loggerhead Turtle		E, Mi	In Australia, the Loggerhead Turtle occurs in the waters of coral and rocky reefs, seagrass beds and muddy bays throughout eastern, northern and western Australia. Nesting populations are known from southern Queensland and Western Australia. Loggerhead Turtles are carnivorous, feeding primarily on benthic invertebrates in habitat ranging from nearshore to 55 m.		**Low**. Primarily marine species and nests on sandy beaches. Habitat not available within the study area.
Chelonia mydas Green Turtle	V	V, Mi	Green Turtles nest, forage and migrate across tropical northern Australia. Green Turtles are found in tropical and subtropical waters throughout the world. They usually remain within the 20°C isotherms, although individuals may also stray into temperate waters.		**Nil**. This is a marine species, unlikely to occur within Burrill Lake.
Dermochelys coriacea Leatherback Turtle		E, Mi	This species in inshore and offshore marine waters, and rarely breeds in Australia although they are known to nest occasionally on a short stretch of the Qld central coast (Cogger 1996). A number of sightings in southern waters along the eastern seaboard suggest this species actively seeks temperate feeding grounds, rather than occurring only as stray vagrants.		**Nil**. This is a marine species, unlikely to occur within Burrill Lake.
Eretmochelys imbricate Hawksbill Turtle		V, Mi	Major nesting of Hawksbill Turtles in Australia occurs in Western Australia, Queensland and the Northern Territory. Hawksbill Turtles have been seen in temperate regions as far south as northern NSW.		**Nil**. This is a marine species, unlikely to occur within Burrill Lake.
Natator depressus Flatback Turtle		V, Mi	Adults inhabit soft bottom habitat over the continental shelf of northern Australia, extending into Papua New Guinea and Irian Jaya. Nesting habitat includes sandy beaches in the tropics and subtropics with sand temperatures between 25 °C and 33 °C at nest depth.		**Nil**. This is a marine species, unlikely to occur within Burrill Lake.
Amphibians					

Species	TSC Act/FM Act	EPBC Act	Habitat requirements	Number of records (NSW Wildlife Atlas)	Likelihood of occurrence in study area.
Heleioporus australiacus Giant Burrowing Frog	V	V	The Giant Burrowing Frog occurs from the NSW Central Coast to eastern Victoria, but is most common on the Sydney sandstone. It has been found from the coast to the Great Dividing Range. Forages in woodlands, wet heath, dry and wet sclerophyll forest (Ehmann 1997). Associated with semi-permanent to ephemeral sand or rock based streams (Ehmann 1997), where the soil is soft and sandy so that burrows can be constructed (Environment Australia 2000).		**Low.** Unlikely foraging habitat and no breeding habitat present in the study area.
Litoria aurea Green and Golden Bell Frog	E	V	Its former distribution was predominantly coastal but extended inland to the central and southern tablelands, including Bathurst in the west. It was known from the northern coastal part of NSW from around Brunswick Heads south along the entire NSW coast extending into the north-eastern portion of Victoria. There are presently 43 identified remaining key populations, most of which have a small fragmented distribution of mainly near coastal locations. Large populations in NSW are located around the metropolitan areas of Sydney, Shoalhaven and mid north coast. There is only one known population on the NSW Southern Tablelands. Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (Typha spp.) or spikerushes (Eleocharis spp.). Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (Gambusia holbrooki), have a grassy area nearby and diurnal sheltering sites available. Some sites, particularly in the Greater Sydney region occur in highly disturbed areas. The species is active by day and usually breeds in summer when conditions are warm and wet. Tadpoles feed on algae and other plant-matter; adults eat mainly insects, but also other frogs. Preyed upon by various wading birds and snakes.		**Low.** Not detected during targeted surveys undertaken in known breeding season. Unlikely habitat available within the study area.
Litoria littlejohni Littlejohn's Tree Frog	V	V	Occurs in scattered locations between the Watagan Mountains in eastern New South Wales and Buchan in north-east Victoria. It occurs within the Hunter-Central Rivers, Southern Rivers (NSW) and East Gippsland (Victoria) Natural Resource Management Regions. Inhabits forest, coastal woodland and heath from 100 to 950 m above sea level, but is not associated with any specific vegetation types. This species breeds in the upper reaches of permanent streams and in perched swamps. Non-breeding habitat is heath based forests and woodlands where it shelters under leaf litter and low vegetation, and hunts for invertebrate prey either in shrubs or on the ground. Breeding is triggered by heavy rain and can potentially occur all year, but is usually from late summer to early spring. Eggs and tadpoles are mostly found in still or slow flowing pools that receive extended exposure to sunlight, but will also use temporary isolated pools.		**Nil.** No habitat present in study area.

Species	TSC Act/FM Act	EPBC Act	Habitat requirements	Number of records (NSW Wildlife Atlas)	Likelihood of occurrence in study area.
Mixophyes balbus Stuttering Frog	E	V	Stuttering Barred Frogs occur along the east coast of Australia from southern Queensland to the north-eastern Victoria. The species has suffered a marked decline in distribution and abundance, particularly in south-east NSW. It is the only *Mixophyes* species that occurs in south-east NSW and in recent surveys it has only been recorded at three locations south of Sydney. Found in rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range. Outside the breeding season adults live in deep leaf litter and thick understorey vegetation on the forest floor. Feed on insects and smaller frogs. Breed in streams during summer after heavy rain. Eggs are laid on rock shelves or shallow riffles in small, flowing streams. As the tadpoles grow they move to deep permanent pools and take approximately 12 months to metamorphose.		**Nil.** No habitat present in study area.
Mixophyes iteratus Giant Barred Frog	E	E	Distributed along coast and ranges from south-eastern Queensland to the Hawkesbury River in NSW. North-eastern NSW, particularly the Coffs Harbour-Dorrigo area, is now a stronghold. Giant Barred Frogs forage and live amongst deep, damp leaf litter in rainforests, moist eucalypt forest and nearby dry eucalypt forest, at elevations below 1000 m.		**Nil.** No habitat present in study area.
Fish					
Epinephelus daemeli Black Rockcod		V	The Black Rockcod is a common New South Wales species but is rarely seen due to its secretive nature usually found hiding in caves and under ledges. It is found on coastal reefs, estuaries and deep offshore.		**Low.** Unlikely habitat present within the lake. Adults live in rocky reefs and juveniles prefer rock pools or rocky intertidal areas. The deep channel within Burrill Lake does not include rocky reefs and would therefore not provide habitat for adults.
Prototroctes maraena Australian Grayling		V	This species of migratory fish inhabits estuarine waters and coastal seas as larvae/juveniles, and freshwater rivers and streams as adults. It occurs in coastal rivers and streams from the Shoalhaven River in South East New South Wales into Victoria and Tasmania. Most of their lives are spent in freshwater rivers and streams in cool, clear waters with a gravel substrate and alternating pool and riffle zones, however can also occur in turbid water. The species can penetrate well inland, being recorded over 100 km inland from the sea. Larvae and juveniles inhabit estuaries and coastal seas, with an apparent obligatory marine stage (Backhouse et al 2008).		**Low**. Unlikely habitat present within the lake. No freshwater available or pools with gravel substrate available.

Species	TSC Act/FM Act	EPBC Act	Habitat requirements	Number of records (NSW Wildlife Atlas)	Likelihood of occurrence in study area.
Marine Mammals					
Arctocephalus pusillus Australian Fur-Seal	V		Reported from New South Wales to South Australia. Breeds at ten known locations in Bass Strait, may have historically bred at Seal Rocks. Haul out sites are present along the NSW coast, notably Montague Island, Steamers Beach and Green Cape. Uses flat or sloping rocky sites for breeding and haul out sites. Preys on squid, school fish and bottom-dwelling fish, octopus and crustaceans.		**Low.** Unlikley habitat present, water levels generally too low for species and never observed within the area.
Balaenoptera edeni Bryde's Whale			Bryde's Whales occur in temperate to tropical waters, both oceanic and inshore, bounded by latitudes 40° N and 40° S. Insufficient information exists as to how Australian Bryde's Whales use their habitat, as no specific feeding or breeding grounds have been discovered off Australia.		**Nil**. This is a marine species, unlikely to occur within Burrill Lake.
Balaenoptera musculus Blue Whale			Much of the Australian continental shelf and coastal waters have no particular significance to Blue Whales and are used only for migration and opportunistic feeding. The only known areas of significance to Blue Whales are feeding areas around the southern continental shelf, notably the Perth Canyon, in Western Australia, and the Bonney Upwelling and adjacent upwelling areas of South Australia and Victoria.		**Nil**. This is a marine species, unlikely to occur within Burrill Lake.
Capera marginate Pygmy Right Whale			Pygmy Right Whales have primarily been recorded in areas associated with upwellings and with high zooplankton abundance. Records of Pygmy Right Whales in Australian waters are distributed between 32° S and 47° S, but are not uniformly spread around the coast. Few or no records are available for NSW, eastern Victoria, and the northern part of the Great Australian Bight.		**Nil**. This is a marine species, unlikely to occur within Burrill Lake.
Carcharius Taurus Grey Nurse Shark		CE	The Grey Nurse Shark (east coast population) has been regularly reported from southern Queensland and around south-east Australia. In NSW, aggregations of Grey Nurse Sharks can be found at reefs off the following locations: Byron Bay, Brooms Head, Solitary Islands, South West Rocks, Laurieton, Forster, Seal Rocks, Port Stephens, Sydney, Bateman's Bay and Narooma.		**Low.** Unlikely to occur in Burrill Lake.
Carcharodon carcharias Great White Shark			Great White Sharks have been recorded from central Queensland around the south coast to north-west Western Australia. Juveniles appear to aggregate seasonally in certain key areas including the coastal region between Newcastle and Forster in NSW. Great White Sharks can be found from close inshore around rocky reefs, surf beaches and shallow coastal bays to outer continental shelf and slope areas.		**Low.** Unlikely to occur in Burrill Lake.

Species	TSC Act/FM Act	EPBC Act	Habitat requirements	Number of records (NSW Wildlife Atlas)	Likelihood of occurrence in study area.
Lagenorhynchus obscurus Dusky Dolphin			In Australia, Dusky Dolphins are known from only 13 reports since 1828, with two sightings in the early 1980s (DEW 2007). They occur across southern Australia from Western Australia to Tasmania. Given the lack of understanding of the species' distribution in Australian waters, no key localities have yet been identified.		**Nil**. Outside normal distribution. Does not occur in estuarine areas.
Lamna nasus Porbeagle, Mackerel Shark			The Porbeagle is a wide-ranging, coastal and oceanic shark. Mackerel sharks feed mainly on pelagic schoolers such as herring, sardines and mackerels.		**Nil**. This is a marine species, unlikely to occur within Burrill Lake.
Orcinus orca Killer Whale, Orca			Killer Whales occur throughout all oceans and contiguous seas, from equatorial regions to the polar packice zones, and may even ascend rivers. However, they are most numerous in coastal waters and cooler regions where productivity is high. In Australia, Killer Whales are recorded from all states, with concentrations reported around Tasmania.		**Nil**. This is a marine species, unlikely to occur within Burrill Lake.
Physeter macrocephalus Sperm Whale	V		Females and young male Sperm Whales are restricted to warmer waters, generally north of approximately 45° S, while older males travel to and from colder waters and to the edge of the Antarctic pack-ice.		**Nil**. This is a marine species, unlikely to occur within Burrill Lake.
Rhincodon typus Whale Shark			The Whale Shark is most commonly seen in waters off northern Western Australia, Northern Territory and Queensland. The Whale Shark is an oceanic and coastal, tropical to warm-temperate pelagic shark. It is often seen far offshore, but also comes close inshore and sometimes enters lagoons of coral atolls.		**Nil**. This is a marine species, unlikely to occur within Burrill Lake.

APPENDIX F NOXIOUS WEEDS

F.1.1 Noxious weed declarations for Shoalhaven City Council

The following weeds are declared noxious in the control area of Shoalhaven City Council:

Weed	Class	Legal requirements
African boxthorn [*Lycium ferocissimum*] A Weed of National Significance	4	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction
African feathergrass [*Pennisetum macrourum*]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
African lovegrass [*Eragrostis curvula*]	4	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction
African turnip weed [*Sisymbrium runcinatum*]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
African turnip weed [*Sisymbrium thellungii*]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Alligator weed [*Alternanthera philoxeroides*] A Weed of National Significance	2	The plant must be eradicated from the land and the land must be kept free of the plant
Anchored water hyacinth [*Eichhornia azurea*]	1	The plant must be eradicated from the land and the land must be kept free of the plant. This is an All of NSW declaration
Annual ragweed [*Ambrosia artemisiifolia*]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Arrowhead [*Sagittaria montevidensis*]	4	The plant must not be sold propagated or knowingly distributed This is an All of NSW declaration
Artichoke thistle [*Cynara cardunculus*]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Athel pine [*Tamarix aphylla*] A Weed of National Significance	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Bathurst/Noogoora/Hunter/South American/Californian/cockle burr [*Xanthium* species]	4	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction
Bear-skin fescue [*Festuca gautieri*]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Bitou bush [*Chrysanthemoides monilifera* subspecies *rotundata*] A Weed of National Significance	4	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction

Weed	Class	Legal requirements
Black knapweed [*Centaurea nigra*]	1	The plant must be eradicated from the land and the land must be kept free of the plant. This is an All of NSW declaration
Blackberry [*Rubus fruticosus* aggregate species] except cultivars Black satin Chehalem Chester Thornless Dirksen Thornless Loch Ness Murrindindi Silvan Smooth stem Thornfree	4	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction and the plant must not be sold propagated or knowingly distributed This is an All of NSW declaration
Boneseed [*Chrysanthemoides monilifera* subspecies *monilifera*] A Weed of National Significance	2	The plant must be eradicated from the land and the land must be kept free of the plant
Bridal creeper [*Asparagus asparagoides*] A Weed of National Significance	4	The plant must not be sold propagated or knowingly distributed
Broomrapes [*Orobanche* species] Includes all Orobanche species except the native *O. cernua* variety *australiana* and *O. minor*	1	The plant must be eradicated from the land and the land must be kept free of the plant. This is an All of NSW declaration
Burr ragweed [*Ambrosia confertiflora*]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Cabomba [*Cabomba* species] Includes all Cabomba species except *C. furcata* A Weed of National Significance	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Cayenne snakeweed [*Stachytarpheta cayennensis*]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Chilean needle grass [*Nassella neesiana*] A Weed of National Significance	4	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction and the plant must not be sold propagated or knowingly distributed
Chinese violet [*Asystasia gangetica* subspecies *micrantha*]	1	The plant must be eradicated from the land and the land must be kept free of the plant. This is an All of NSW declaration
Clockweed [*Gaura parviflora*]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Corn sowthistle [*Sonchus arvensis*]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Crofton weed [*Ageratina adenophora*]	4	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction
Dodder [*Cuscuta* species] Includes All Cuscuta species except the native species C. australis, C. tasmanica and C. victoriana	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
East Indian hygrophila [*Hygrophila polysperma*]	4	The plant must not be sold propagated or knowingly distributed
English broom [*Cytisus scoparius*]		See Scotch broom

Weed	Class	Legal requirements
Espartillo [*Amelichloa brachychaeta, Amelichloa caudata*]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Eurasian water milfoil [*Myriophyllum spicatum*]	1	The plant must be eradicated from the land and the land must be kept free of the plant. This is an All of NSW declaration
Fine-bristled burr grass [*Cenchrus brownii*]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Fireweed [*Senecio madagascariensis*] A Weed of National Significance	4	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction
Fountain grass [*Pennisetum setaceum*]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Gallon's curse [*Cenchrus biflorus*]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Giant Parramatta grass [*Sporobolus fertilis*]	3	The plant must be fully and continuously suppressed and destroyed
Glaucous starthistle [*Carthamus glaucus*]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Golden dodder [*Cuscuta campestris*]	4	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction
Golden thistle [*Scolymus hispanicus*]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Gorse [*Ulex europaeus*] A Weed of National Significance	3	The plant must be fully and continuously suppressed and destroyed
Green cestrum [*Cestrum parqui*]	3	The plant must be fully and continuously suppressed and destroyed
Groundsel bush [*Baccharis halimifolia*]	3	The plant must be fully and continuously suppressed and destroyed
Harrisia cactus [*Harrisia* species]	4	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction and the plant must not be sold propagated or knowingly distributed This is an All of NSW declaration
Hawkweed [*Hieracium* species]	1	The plant must be eradicated from the land and the land must be kept free of the plant. This is an All of NSW declaration
Heteranthera [*Heteranthera reniformis*]	1	The plant must be eradicated from the land and the land must be kept free of the plant. This is an All of NSW declaration
Horsetail [*Equisetum species*]	1	The plant must be eradicated from the land and the land must be kept free of the plant. This is an All of NSW declaration
Hydrocotyl [*Hydrocotyl ranunculoides*]	1	The plant must be eradicated from the land and the land must be kept free of the plant. This is an All of NSW declaration

Weed	Class	Legal requirements
Hygro [*Hygrophila polysperma*]		See East Indian hygrophila
Hymenachne [*Hymenachne amplexicaulis* and hybrids] A Weed of National Significance	1	The plant must be eradicated from the land and the land must be kept free of the plant. This is an All of NSW declaration
Karroo thorn [*Acacia karroo*]	1	The plant must be eradicated from the land and the land must be kept free of the plant. This is an All of NSW declaration
Kochia [*Bassia scoparia*] except Bassia scoparia subspecies trichophylla	1	The plant must be eradicated from the land and the land must be kept free of the plant. This is an All of NSW declaration
Koster's curse [*Clidemia hirta*]	1	The plant must be eradicated from the land and the land must be kept free of the plant. This is an All of NSW declaration
Lagarosiphon [*Lagarosiphon major*]	1	The plant must be eradicated from the land and the land must be kept free of the plant. This is an All of NSW declaration
Lantana [*Lantana* species] A Weed of National Significance	4	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction and the plant must not be sold propagated or knowingly distributed
Leafy elodea [*Egeria densa*]	4	The plant must not be sold propagated or knowingly distributed This is an All of NSW declaration
Lippia [*Phyla canescens*]	4	The plant must not be sold propagated or knowingly distributed by any person other than a person involved in hay or lucerne production and the growth of the plant must be managed in a manner that reduces its spread and continuously inhibits its reproduct This is an All of NSW declaration
Long-leaf willow primrose [*Ludwigia longifolia*]	4	The plant must not be sold propagated or knowingly distributed
Mexican feather grass [*Nassella tenuissima*]	1	The plant must be eradicated from the land and the land must be kept free of the plant. This is an All of NSW declaration
Mexican poppy [*Argemone mexicana*]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Miconia [*Miconia* species]	1	The plant must be eradicated from the land and the land must be kept free of the plant. This is an All of NSW declaration
Mikania [*Mikania micrantha*]	1	The plant must be eradicated from the land and the land must be kept free of the plant. This is an All of NSW declaration
Mimosa [*Mimosa pigra*] A Weed of National Significance	1	The plant must be eradicated from the land and the land must be kept free of the plant. This is an All of NSW declaration
Mistflower [*Ageratina riparia*]	4	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction and the plant must not be sold propagated or knowingly distributed

Weed	Class	Legal requirements
Mossman River grass [*Cenchrus echinatus*]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Nodding thistle [*Carduus nutans*]	4	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction
Noogoora burr [*Xanthium* species]		See Bathurst/Noogoora/Hunter/South American/Californian/cockle burr
Pampas grass [*Cortaderia species*]	4	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction
Parthenium weed [*Parthenium hysterophorus*] A Weed of National Significance	1	The plant must be eradicated from the land and the land must be kept free of the plant. This is an All of NSW declaration
Pond apple [*Annona glabra*] A Weed of National Significance	1	The plant must be eradicated from the land and the land must be kept free of the plant. This is an All of NSW declaration
Prickly acacia [*Acacia nilotica*] A Weed of National Significance	1	The plant must be eradicated from the land and the land must be kept free of the plant. This is an All of NSW declaration
Prickly pear [*Cylindropuntia* species] A Weed of National Significance	4	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction and the plant must not be sold propagated or knowingly distributed This is an All of NSW declaration
Prickly pear [*Opuntia* species] Includes all *Opuntia* species except *O. ficus-indica* A Weed of National Significance	4	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction and the plant must not be sold propagated or knowingly distributed This is an All of NSW declaration
Privet (Broad-leaf) [*Ligustrum lucidum*]	4	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its flowering and reproduction
Privet (Narrow-leaf/Chinese) [*Ligustrum sinense*]	4	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its flowering and reproduction
Red rice [*Oryza rufipogon*]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Rhus tree [*Toxicodendron succedaneum*]	4	The growth of the plant must be managed in a manner that prevents any above ground part the plant from encroaching within 2 metres of the property boundary and the plant must not be sold propagated or knowingly distributed This is an All of NSW declaration
Rubber vine [*Cryptostegia grandiflora*] A Weed of National Significance	1	The plant must be eradicated from the land and the land must be kept free of the plant. This is an All of NSW declaration
Sagittaria [*Sagittaria platyphylla*] A Weed of National Significance	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Salvinia [*Salvinia molesta*] A Weed of National Significance	2	The plant must be eradicated from the land and the land must be kept free of the plant

Weed	Class	Legal requirements
Scotch broom [*Cytisus scoparius*] A Weed of National Significance	4	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction
Senegal tea plant [*Gymnocoronis spilanthoides*]	1	The plant must be eradicated from the land and the land must be kept free of the plant. This is an All of NSW declaration
Serrated tussock [*Nassella trichotoma*] A Weed of National Significance	4	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction and the plant must not be sold propagated or knowingly distributed
Siam weed [*Chromolaena odorata*]	1	The plant must be eradicated from the land and the land must be kept free of the plant. This is an All of NSW declaration
Smooth-stemmed turnip [*Brassica barrelieri* subspecies *oxyrrhina*]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Soldier thistle [*Picnomon acarna*]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Spotted knapweed [*Centaurea stoebe* subspecies *micranthos*]	1	The plant must be eradicated from the land and the land must be kept free of the plant. This is an All of NSW declaration
St. John's wort [*Hypericum perforatum*]	3	The plant must be fully and continuously suppressed and destroyed
Texas blueweed [*Helianthus ciliaris*]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Tropical soda apple [*Solanum viarum*]	2	The plant must be eradicated from the land and the land must be kept free of the plant
Water caltrop [*Trapa* species]	1	The plant must be eradicated from the land and the land must be kept free of the plant. This is an All of NSW declaration
Water hyacinth [*Eichhornia crassipes*] A Weed of National Significance	3	The plant must be fully and continuously suppressed and destroyed
Water lettuce [*Pistia stratiotes*]	1	The plant must be eradicated from the land and the land must be kept free of the plant. This is an All of NSW declaration
Water soldier [*Stratiotes aloides*]	1	The plant must be eradicated from the land and the land must be kept free of the plant. This is an All of NSW declaration
Willows [*Salix* species] Includes all Salix species except S. babylonica, S. x reichardtii, S. x calodendron	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration
Witchweed [*Striga* species] Striga species except the native *Striga parviflora*	1	The plant must be eradicated from the land and the land must be kept free of the plant. This is an All of NSW declaration
Yellow burrhead [*Limnocharis flava*]	1	The plant must be eradicated from the land and the land must be kept free of the plant. This is an All of NSW declaration

Weed	Class	Legal requirements
Yellow nutgrass [*Cyperus esculentus*]	5	The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with This is an All of NSW declaration

APPENDIX G NSW TSC ACT ASSESSMENT OF SIGNIFICANCE

The Assessment of Significance (7-part test) is applied to species, populations and ecological communities listed on Schedules 1, 1A and 2 of the TSC Act and Schedules 4, 4A and 5 of the Fisheries Management Act. The assessment sets out seven factors, which when considered, allow proponents to undertake a qualitative analysis of the likely impacts of an action and to determine whether further assessment is required via a Species Impact Statement (SIS). All factors must be considered and an overall conclusion made based on all factors in combination. An SIS is required if, through application of the 7-part test, an action is considered likely to have a significant impact on a threatened species, population or ecological community.

Threatened species, populations and ecological communities which may be directly or indirectly affected by the current proposal include:

FLORA:

- Bangalay Sand Forest of the Sydney Basin and South East Corner bioregions
- Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
- Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions

FAUNA:

- White-fronted Chat (*Epthianura albifrons*)
- Sooty Oystercatcher (*Haemotopus fuliginosus*)Pied Oystercatcher (*Haemotopus longirostris*)
- Little Tern (*Sternula albifrons*)

Bangalay Sand Forest of the Sydney Basin and South East Corner bioregions

Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions

Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions

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.

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

Bangalay Sand Forest

i. The proposal will reduce the extent of the community by approximately 0.4 ha where it currently abuts the Princes Highway. Areas of the community to the south will be retained and contiguous areas of the community extend further south of the study area. Based on existing vegetation mapping (Tozer *et al.* 2010) over 900 ha of this community occurs within the locality. The proposal is unlikely 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

ii. The Bangalay Sand Forest within the study area has previously been subject to relatively high levels of disturbance from past clearing and invasion by exotic species including noxious weeds and weeds of national significance. Measures are recommended within this biodiversity assessment to treat existing weed infestations and prevent further introduction and spread. It is considered unlikely that the proposal would further adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Costal Saltmarsh

i. The proposal will reduce the extent of the community by approximately 0.04 ha where it currently abuts the existing bridge to the south. This community is common around the foreshores of Burrill Lake and is contiguous to the south of the study area. Based on existing vegetation mapping (Tozer *et al.* 2010) approximately 26 ha of this community occurs within

the locality. The proposal is unlikely 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

ii. The Coastal Salt Marsh within the study area is relatively weed free particularly in lower lying areas where salinity levels are higher. Minor weeds occur within the higher areas where salinity is lower. Given the generally high salinity environment of Coastal Saltmarsh within the study area and the general absence of salt tolerant weed species, the risk of weed invasion is considered to be low. Measures have been recommended within this biodiversity assessment to prevent the introduction and spread of weeds. It is considered unlikely that the proposal would adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

<u>Swamp Oak Floodplain Forest</u>

i. The proposal will reduce the extent of the community by effectively removing the patch of the community that occurs immediately to the west of the Burrill Lake Bridge (0.13 ha). Larger areas of the community in similar condition occur south of Burrill Inlet (at least another 1.5 ha). Within the locality this community is highly fragmented and restricted in its distribution which makes remaining remnants particlularly important, however, a patch must be viable to contribute to the long-term survival of the community. The patch of the community to be removed has been extensively affected by clearing and weed invasion and abuts highly modified environments such as the Princes Highway or maintained parkland. It has no potential for expansion and little chance of recovery. Further degradation over time is considered likely. Given these factors, the long-term viability of the occurrence within the study area is likely to be low. As the larger area in the south-west of the study area will not be impacted by the proposal, the local occurrence of the community would not be placed at risk of extinction.

ii. The Swamp Oak Floodplain Forest within the study area has previously been subject to relatively high levels of disturbance and invasion by exotic species including weeds of national significance. Measures are in place to treat existing weed infestations and prevent further introduction and spread. It is considered unlikely that the proposal would further adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

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

<u>Bangalay Sand Forest</u>

i. The proposal will reduce the extent of the community by approximately 0.4 ha. This area would be completely removed.

ii. The community is already highly fragmented except for the occurrence in the far east of the study area which is contiguous with adjacent vegetation extending towards the coast. The proposal would only slightly increase in the clearing of vegetation that abuts the southern

boundary of the Princes Highway with residential development to the north. The proposal would not further fragment or isolate habitat.

iii. The habitat to be removed by the proposal has already suffered high levels of disturbance and weed invasion and is considered to be degraded. Extensive areas (over 900 ha) of this community occur within reserves within the locality which are protected. The habitat to be impacted is not considered important to the long-term survival of the community in the locality.

Costal Saltmarsh

i. The proposal will reduce the extent of the community by approximately 0.04 ha. This area would be completely removed.

ii. The community occurs as continuous stretches around the foreshore of Burrill Lake. The stretches to be impacted by the proposal are currently fragmented by the existing bridge and causeway on the eastern side and by the bridge and residential development on the west. The proposal would increase the existing fragmentation by approximately 30m. This is considered to be minor and unlikely to further isolate existing habitats.

iii. Coastal Saltmarsh in similar condition is widespread around the shores of Burrill Lake (approximately 25 ha within the study area). In this context, the small amount to be removed by the proposal (0.04 ha) is considered to be negligible. The habitat to be impacted is not considered important to the long-term survival of the community in the locality.

Swamp Oak Floodplain Forest

i. The proposal will reduce the extent of the community by approximately 0.13 ha. This area would be completely removed.

ii. The community is already highly fragmented in the locality with only a small number of small, isolated patches. The small areas to be removed by the proposal may further contribute to this fragmentation however existing vegetation mapping (Tozer *et al.* 2010) suggests that there are no occurrences of this community further east and only small patches occurring approximately 1 km to the west and 4.5 km to the south-west within the locality. These patches would not be more isolated more than they already are as a result of the proposal.

iii. The habitat to be removed by the proposal has already suffered high levels of disturbance and weed invasion and is considered to be degraded. It is highly fragmented and given the high levels of disturbance not considered to be viable in the long-term. The habitat to be impacted is not considered important to the long-term survival of the community in the locality.

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

Not applicable.

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 currently exist for Bangalay Sand Forest, Coastal Saltmarsh or Swamp Oak Floodplain Forest

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

Four key threatening processes are considered relevant to impacts on Endangered Ecological Communities:

Clearing of native vegetation.

Native vegetation within EECs would be removed as part of the proposed works (up to 0.6 ha). Given the area is already degraded and a small area will be cleared, the proposal is not considered to contribute significantly to this KTP.

Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands

Proposed works for construction and removal of the bridge are required in Burrill Lake and have the potential to alter the local hydrology. Coastal Saltmarsh could be susceptible to changes in water levels within Burrill Lake. Studies of flow velocities and impacts to sediment transport were undertaken (BMT WBM 2013) and concluded no significant alterations to these factors were expected from the works. This study also concluded that, no alterations to tidal regimes are expected. It is considered unlikely that any changes to water levels of sediment distribution would occur that would affect Coastal Saltmarsh within the study area. The proposal is not considered to contribute significantly to this KTP.

Invasion of native plant communities by exotic perennial grasses.

A number of exotic perennial grasses (Appendix B) were recorded across the site, and can become dominant in the landscape due to disturbance. Restoration planting and weed management at the site have been recommended as part of this assessment to prevent these species from spreading further.

Introduction and establishment of exotic rust fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae.

No evidence of Myrtle Rust was observed during the field survey but two host trees are present in the south west of the study area; therefore, there is the potential for its introduction. With adherence to Roads and Maritime *Biodiversity Guidelines* Guide 7 (Pathogen Management) it is considered unlikely that the proposal would contribute to this KTP. This has been recommended by this assessment.

Conclusion

Bangalay Sand Forest

The proposal would remove approximately 0.4 ha of Bangalay Sand Forest which is highly disturbed and generally in poor condition. Weeds are already prevalent within the community and the proposal is unlikely to exacerbate this. The proposal would not cause further fragmentation or isolation and the habitat to be removed is not considered important to the community's survival in the locality. A significant impact to the Bangalay Sand Forest EEC is considered unlikely

Costal Saltmarsh

The proposal would remove 0.04 ha of Costal Saltmarsh which is considered a very minor amount in the context of the occurrence of the community around Burrill Lake. The increase in fragmentation would be negligible and would not result in any additional isolation. The potential to introduce weeds is considered to be low and highly manageable. The habitat to be removed is not considered important to the long-term survival of the community in the locality. A significant impact to the Coastal Saltmarsh EEC is considered unlikely.

Swamp Oak Floodplain Forest

The proposal would remove approximately 0.13 ha of Swamp Oak Floodplain Forest which is highly disturbed and generally in poor condition and already fragmented from other remnant habitats. The existing level of disturbance within a parkland environment severely compromises the viability of this community and it is not considered to be viable in the long-term. The habitat to be impacted is not considered important to the long-term survival of the community in the locality given the area affected is already highly modified (i.e. Swamp Oak is the dominant species remaining and the community is otherwise dominated by exotic species). A significant impact to the Swamp Oak Floodplain Forest is considered unlikely.

White-fronted Chat

The White-fronted Chat is found across the southern half of Australia, from southernmost Queensland to southern Tasmania, and across to Western Australia as far north as Carnarvon. Found mostly in temperate to arid climates and very rarely sub-tropical areas, it occupies foothills and lowlands up to 1000 m above sea level. In NSW, it occurs mostly in the southern half of the state, in damp open habitats along the coast, and near waterways in the western part of the state. Along the coastline, it is found predominantly in saltmarsh vegetation with vegetation less than 1 m tall. The species is usually found foraging on bare or grassy ground in wetland areas, singly or in pairs. They are insectivorous, feeding mainly on flies and beetles caught from or close to the ground. The species has been observed breeding from late July through to early March, with 'open-cup' nests built in low vegetation. The species is sensitive to human disturbance and is generally not found in built-up areas. They are insectivorous, with flies and beetles being the major components of their diet, feeding from the ground or catching flying insects close to the ground.

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 White-fronted Chat was not observed during this assessment. The species has not been recorded within the study area and the closest records of the species are known just south of Ulladulla and further south near Termeil Point along the coast. The study area provides marginal foraging habitat in the form of Coastal Saltmarsh on the margins of Burrill Lake, but unlikely breeding habitat. The available habitat borders the foreshore of the Lake and consists predominantly of low-lying vegetation and is therefore considered potential habitat for this species, although much of the vegetation is at ground level and flora diversity is limited within the impact area reducing insect diversity for prey species. The vegetation quality of the saltmarsh increases further east towards the Burrill Inlet.

The species is easily observed and gregarious and if the species utilised the area it is expected it would have been detected during field surveys. As the species was not observed during assessments, no prior records are known for the study area and the proposal will result in the loss of a limited area of potential foraging habitat (0.04 ha) but no breeding habitat, the proposal is not expected to have an adverse effect on the life cycle of the species such that a viable local population is likely to 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.

No endangered populations listed in *Schedule 1 - Part 2* of the *Threatened Species Conservation Act 1995* are found in the study area for this species.

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

i. The proposal will reduce the extent of potential foraging habitat by approximately 0.04 ha

ii. As the proposed works is limited to a discrete area nearby the existing bridge in an already disturbed environment the proposal is not considered to fragment habitat such that it would prevent the Whit-fronted Chat from utilising the area, if it were to occur. Coastal Saltmarsh is contiguous along the foreshore of the lake and outside the study area. Therefore, habitat will remain within the locality that will not be fragmented or isolated from each other. The species is highly mobile and would be able to continue to move through the locality.

iii. As the species was not observed during the assessments and is not known for the study area the habitat is not considered to be used on a permanent basis and is therefore not considered important to the long-term survival of this species. It is possible the species could pass through the area, but as the expanse of saltmarsh is limited to the lake margins and cleared land in the form of parklands neighbours the available habitat, the value of this potential habitat to this species is already compromised. It is expected the species would utilise larger wetland / saltmarsh areas that provide breeding habitat further south (i.e. near Lake Termeil). It is therefore considered the proposal will not affect habitat important for the long-term survival of any of these species in the locality.

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

No areas listed as critical habitat under the TSC Act occur in the study area, therefore the action proposed will not adversely affect critical habitat.

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

A recovery plan has not been produced for the White-fronted Chat, however Office of Environment and Heritage (OEH) (2013) have detailed three recovery actions to help recover this species including: liaising with planning authorities to minimise loss of habitat; supporting CMA initiatives aimed at maintaining or restoring natural river flows to catchments; and implementing feral animal control at priority sites. The proposal will not increase feral animals within the area as the study area is already disturbed and domestic animals are present in the area. The proposal is not considered to adversely affect the recovery of 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 proposal will remove or modify a minor amount of Coastal Saltmarsh (0.04 ha). This is potential habitat for the White-fronted Chat and constitutes the Key Threatening Process: '*Clearing of native vegetation*'.

This contribution to a key threatening process is not considered to be of a significant magnitude to impact on the species due to the small size of the area to be affected. Additionally, the vegetation affected by the proposal is not intact remnant vegetation and has been modified through prior disturbance.

Conclusion

The proposal will affect 0.04 ha of potential foraging habitat (Coastal Saltmarsh) within Burrill Lake, but no nesting habitat. As the White-fronted Chat is easily observed and was not detected during field surveys, it is not considered to be a permanent resident of the area. Additionally, the extent of potential habitat to be removed is considered a relatively small impact in the context of the available resources remaining within the study area and locality. Given the species absence during surveys, its mobility to move through the landscape and the minor clearing to Saltmarsh within an already disturbed environment, it is considered unlikely that the proposal will result in significant impacts to the White-fronted Chat.

Shorebirds (Pied Oystercatcher, Sooty Oystercatcher, and Little Tern)

The Pied Oystercatcher is distributed around the entire Australian coastline, although it is most common in coastal Tasmania and parts of Victoria, such as Corner Inlet. In NSW the species is thinly scattered along the entire coast, with fewer than 200 breeding pairs estimated to occur in the State. The species favours intertidal flats of inlets and bays, open beaches and sandbanks. The species forages on exposed sand, mud and rock at low tide, for molluscs, worms, crabs and small fish. The chisel-like bill is used to pry open or break into shells of oysters and other shellfish. The species nests mostly on coastal or estuarine beaches although occasionally they use saltmarsh or grassy areas. Nests are shallow scrapes in sand above the high tide mark, often amongst seaweed, shells and small stones.

The Sooty Oystercatcher is found around the entire Australian coast, including offshore islands, being most common in Bass Strait. Small numbers of the species are evenly distributed along the NSW coast. The availability of suitable nesting sites may limit populations. The species favours rocky headlands, rocky shelves, and exposed reefs with rock pools, beaches and muddy estuaries. The species primarily forages on exposed rock or coral at low tide for foods such as limpets and mussels. The Sooty Oystercatcher breeds in spring and summer, almost exclusively on offshore islands, and occasionally on isolated promontories. The nest is a shallow scrape on the ground, or small mounds of pebbles, shells or seaweed when nesting among rocks.

The Little Tern migrates from eastern Asia and is found on the north, east and south-east Australian coasts, from Shark Bay in Western Australia to the Gulf of St Vincent in South Australia. In NSW, it arrives from September to November, occurring mainly north of Sydney, with smaller numbers found south to Victoria. It breeds in spring and summer along the entire east coast from Tasmania to northern Queensland, and is seen until May, with only occasional birds seen in winter months. The species is almost exclusively coastal, preferring sheltered environments; however may occur several kilometres from the sea in harbours, inlets and rivers (with occasional offshore islands or coral cay records). It nests in small, scattered colonies in low dunes or on sandy beaches just above high tide mark near estuary mouths or adjacent to coastal lakes and islands. The species is often seen feeding in flocks, foraging for small fish, crustaceans, insects, annelids and molluscs by plunging in the shallow water of channels and estuaries, and in the surf on beaches, or skipping over the water surface with a swallow-like flight.

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.

Pied Oystercatcher

Two individuals of the Pied Oystercatcher were observed in November 2013 within the study area. Records of the species are common within and around Burrill Lake, as well as on the coast and further south at Lake Tabourie. The species was observed foraging on exposed mud of Burrill Lake within the study area at low tide during this assessment. The study area provides suitable foraging habitat for this species in the form of mud flats within the lake margins and exposed seagrasses at low tide, but no nesting habitat. The extent of foraging habitat has been conservatively defined as the exposed areas on the northern and southern edges of the lake during low-tide. Of this available habitat, the area to be impacted is approximately 50 m in length along the foreshore and 50 m in width as it extends from the foreshore into the lake, totalling 0.25 ha per edge and 0.5 ha in total. The foraging habitat is contiguous around the foreshore of Burrill Lake and is widely available within the locality. This species can also occur in a variety of habitats, as it primarily favours intertidal flats of inlets and bays, open beaches and sandbanks; therefore other habitats exists for this species within the locality. The proposal will result in the loss of a limited area of foraging habitat on the lake margins (0.5 ha), but will not prevent the species

from foraging in the general area within the immediate or long-term future. As this species is regularly recorded within the locality and no nesting resources will be impacted, the proposal is not expected to have an adverse effect on the life cycle of the species such that a viable local population is likely to be placed at risk of extinction.

Sooty Oystercatcher

The Sooty Oystercatcher was not observed during this assessment; the closest records of the species are known at Burrill inlet along the coast near the township of Dolphin Point. This species is also commonly recorded along the coastline in the locality, with records further north at Ulladulla and Mollymook as well as further south at Lake Tabourie. If the Sooty Oystercatcher utilised the area it would occur in the same habitat as the Pied Oystercatcher, which includes mud flats within the lake margins and exposed seagrasses at low tide (0.5 ha); however no nesting habitat is present. The habitat is considered unlikely for this species as it favours rocky headlands, rocky shelves, and exposed reefs with rock pools, beaches and muddy estuaries and primarily forages on exposed rock or coral. The study area does not support rocky habitat preferred for foraging by this species and is therefore not considered optimal foraging habitat.

The species could pass through the area on foraging bouts, but it is unlikely to rely on habitat within the study area on a permanent basis. Records indicate that better quality habitat is located outside the study area and further afield within the locality, but primarily along the headlands and rocky bays of the coastline.

The proposal will result in the loss of a limited area of marginal foraging habitat; therefore, the proposal is not expected to have an adverse effect on the life cycle of the species such that a viable local population is likely to be placed at risk of extinction.

Little Tern

The Little Tern was not was not observed during this assessment. Records of this species are not as common as the Oystercatchers however, the species is known near the Burrill inlet and is observed along the coastline on nearby beaches (Mollymook Beach, Dolphin Point). The study area provides marginal potential foraging habitat within Burrill Lake, but no nesting habitat. It is considered there is potential for the species to forage for small fish, crustaceans, insects, annelids and molluscs by diving into Burrill Lake on foraging bouts. However, the species is almost exclusively coastal, preferring sheltered environments and is known to occur closer to the coast within the locality.

As the species is a mobile forager and can take prey from a vast area (i.e. the coast and estuaries), the proposal will not prevent the species from foraging within the area. The proposed works will temporarily reduce the extent of available foraging habitat across a discrete area of Burrill Lake (2 ha) while construction works are in progress due to disturbance of habitat within the subject site as well as noise impacts, but the species would continue to forage in other areas of the lake during construction. Therefore, the proposal is not expected to have an adverse effect on the life cycle of the species such that a viable local population is likely to 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.

No endangered populations listed in *Schedule 1 - Part 2* of the *Threatened Species Conservation Act 1995* are found in the study area for these species.

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

i. The proposal will reduce the extent of foraging (and potential) habitat by approximately 0.5 ha for the Pied and Sooty Oystercatchers and by 2 ha for the Little Tern.

ii. As the proposed works is limited to a discrete area nearby the existing bridge in an already disturbed environment the proposal is not considered to fragment habitat beyond that already occurring within the subject site. The potential habitat is associated with the expanse of Burrill Lake in regard to mudflats, seagrasses and foreshore habitat for the Oystercatchers, and the entire lake for the Little Tern. Therefore a large amount of habitat will remain within the locality that will not be fragmented or isolated from each other.

iii. The study area was not noted to support particularly important feeding resources for the Sooty Oystercatcher or Little Tern. The foraging habitat is more typical for the Pied Oystercatcher; however this species forages over a wider area (i.e. intertidal flats of inlets and bays, open beaches and sandbanks) and these habitats will not be isolated from each other, particularly given the mobility of this species. It is therefore considered the proposal will not affect habitat important for the long-term survival of any of these species in the locality.

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

No areas listed as critical habitat under the TSC Act occur in the study area, therefore the action proposed will not adversely affect critical habitat.

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 Little Tern (NPWS 2003), but not for the Pied Oystercatcher or the Sooty Oystercatcher. The objectives and actions of this plan has been reviewed and the proposal is not considered to adversely affect the recovery of this species. The Office of Environment and Heritage (OEH) (2013) have detailed recovery actions to help recover these species. Recovery actions for all three species focus on:

- Undertaking fox, feral cat and Australian Raven control programs;
- Assessing the appropriateness of dog and cat ownership in new subdivisions;
- Managing estuaries and the surrounding landscape to ensure the natural hydrological regimes are maintained;
- Installing interpretive signs at major nesting sites;
- Protecting and maintain known or potential habitat, including the implementation of protection zones around known habitat sites and sites of recent records; and
- Limiting visitor movements through sites.

The proposal will not affect the implementation of these recovery actions as the study area is not known as a major nest site for any of these species and is already highly disturbed, with domestic pets common to the area. Of most importance is the maintainance of the natural hydrological regime of Burrill Lake during construction works and in the long-term. The proposal was not considered to significantly alter the hydrological flows of the lake in the long-term (BMT WBM 2013) and mitigation measures are required to manage short term impacts such as limiting clearing to designated areas, ensuring stockpile sites and removal of lake bed sediments are controlled to prevent irreversible contamination of the lake.

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 (KTP)

The proposed works will result in the KTP 'Clearing of native vegetation'. Native vegetation of most relevance to these species is seagrass. While seagrass is not listed under the TSC Act as and EEC, it is protected under the FM Act. Seagrass provides some foraging habitat for these species in the prey species it would harbour however, this KTP is not considered a major KTP for these species as the loss of seagrass is not primary habitat as most of these species forage within different habitats (i.e. along the mudflats of the Burrill Lake foreshore or over the waters of the lake). In total, 0.2 ha of seagrass will be directly impacted, with 3.8 ha remaining within the study area.

The proposal also has the potential to result in the KTP 'Alteration of the natural flow regimes of rivers and streams and their floodplains and wetlands' during the removal of the existing bridge and construction of the new bridge. However, flood and hydrology studies concluded that the works would not have a significant effect on the flow velocities and regime of the lake (BMT WBM 2013).

Conclusion

The proposal will affect 0.5 ha of foraging habitat within Burrill Lake for the Pied Oystercatcher, 0.5 ha of potential foraging habitat for the Sooty Oystercatcher and up to 2 ha of potential foraging habitat for the Little Tern, but no nesting habitat for any of these species. The extent of habitat to be removed is considered a relatively small impact in the context of the available resources remaining within Burrill Lake within the study area and other habitats within the locality. The construction of the new bridge will not substantially affect habitat connectivity, nor increase fragmentation as these species are highly mobile, forage over larger distances, and contiguous habitat within Burrill Lake will remain available.

Based on the assessment provided above, it is considered unlikely that the proposal will result in significant impacts to the Pied Oystercatcher, Sooty Oystercatcher or the Little Tern.

APPENDIX H EPBC ACT SIGNIFICANT IMPACT CRITERIA

The EPBC Act Administrative Guidelines on Significance set out 'Significant Impact Criteria' that are to be used to assist in determining whether a proposed action is likely to have a significant impact on matters of national environmental significance. Matters listed under the EPBC Act as being of national environmental significance include:

- World heritage properties
- National heritage places
- Wetlands of international importance (listed under the Ramsar Convention)
- Listed threatened species and ecological communities
- Migratory species protected under international agreements
- Nuclear actions (including uranium mines)
- Commonwealth marine areas
- The Great Barrier Reef Marine Park
- A water resource, in relation to coal seam gas development and large coal mining development.

Specific 'Significant Impact Criteria' are provided for each matter of national environmental significance except for threatened species and ecological communities in which case separate criteria are provided for species listed as endangered and vulnerable under the EPBC Act.

One endangered and five migratory species were considered to be potentially affected by the current proposal and include:

- Little Tern
- Bar-tailed Godwit
- Double-banded Plover
- Eastern Curlew
- Great Egret

Endangered Species (Little Tern)

**Please note: Little Tern is assessed above under the listing of TSC Act and this EPBC Act assessment summarises the above information.*

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

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

The study area provides marginal potential foraging habitat within Burrill Lake, but no nesting habitat. It is considered there is potential for the species to forage for small fish, crustaceans, insects, annelids and molluscs by diving into Burrill Lake on foraging bouts. The proposal will temporarily reduce the amount of potential foraging habitat available to the species within Burrill Lake, but will not contribute to the decrease in the size of a population. The major Australian breeding populations for the Little Tern are not known near Burrill Lake; the species will nest on sandy beaches and this habitat type is not available for this species within the study area.

b) Reduce the area of occupancy of the species

The proposal will affect 2 ha of potential foraging habitat (i.e. the area of direct impact to Burrill Lake) while construction works are in progress. However, this species would forage over the entire Burrill Lake if it utilises the area and is expected to be able to continue to forage in other areas of the lake during construction. This habitat is also considered marginal habitat in the context of other more suitable nearby habitat (i.e. coastal environments) and is not considered to reduce the area of occupancy for this species.

c) Fragment an existing population into two or more populations

The proposed works will not increase the fragmentation of any populations. The species is highly mobile and the nearest records to the area of direct impact are known for Burrill Inlet and the proposed works will not affect this area.

d) Adversely affect habitat critical to the survival of a species

No habitat on site is considered to be critical to the survival of these species.

e) Disrupt the breeding cycle of a population

The proposed works will not affect any breeding habitat for the Little Tern.

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

The proposed works will temporarily reduce the extent of potential foraging habitat within Burrill Lake (2 ha); this is considered to be a small impact in the context of the available resources remaining within the lake and the locality for this highly mobile species.

g) Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat

The proposal will not increase the risk from invasive species. No invasive species critical to the survival of this species will become established or increase as the result of the proposal.

h) Introduce disease that may cause the species to decline, or

The proposal is not expected to introduce disease that may cause the species to decline. The area to be impacted does not support a permanent population nor does it support breeding habitat; therefore the

proposed works are not proposed in a core breeding area and will not contribute to species decline through introduced disease.

i) Interfere with the recovery of the species.

As the proposal is not considered to decrease or fragment existing populations, the recovery of the species will not be substantially impacted.

Migratory Species (Little Tern, Bar-tailed Godwit, Double-banded Plover, Eastern Curlew and Great Egret)

**Please note: Little Tern is assessed above under the listing of Vulnerable and is not assessed again despite the fact it is a migratory species.*

a) 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

The area of the proposed works supports potential foraging habitat for the Bar-tailed Godwit, Double-banded Plover, Eastern Curlew and Great Egret. Only the Great Egret was observed within the study area by GHD (2012) and by **ngh**environmental in 2013. The potential foraging habitat includes seagrasses and mudflats within Burrill Lake for all species. The extent of foraging habitat has been defined as the exposed areas on the northern and southern edges of the lake during low-tide. Of this available habitat, the area to be impacted is approximately 50 m in length along the foreshore and 50 m in width as it extends from the foreshore into the lake, totalling 0.25 ha per edge and 0.5 ha in total. Burrill Lake is not known as a site of international importance for these species and is not known as an important breeding site.

The proposal would result in local temporary changes to hydrological flows but is not expected to result in any long-term significant changes to local flow velocities that would affect the foraging behaviours of these species. Approximately 0.2 ha of seagrass would be directly impacted by the proposal, but not all of this would have been available as habitat for the species given much of the seagrass still remains engulfed by water during low tide. During low tide segrasses are exposed nearby the foreshore on the northern side of the lake and shorebirds in general were mostly observed foraging in this area rather than the southern margin of the lake, this area is approximately 0.5 ha in extent. At the time of the 2013 survey, the larger area of seagrass on the south-east side of the bridge was observed to occur at depths generally ranging from 5 – 35cm at low tide with the majority of the area generally shallow (5 – 20cm), then dropping quickly in to the main channel to the west. This would suggest that significant scouring would need to occur over a relatively large area to increase the depth of the shoals in this area to that which would be unsuitable for seagrass. Scouring to this extent is considered unlikely and as such changes to seagrass distribution within the study area beyond the direct impacts of the proposal are also considered unlikely.

The proposal is not considered to substantially modify, destroy or isolate an area of important habitat given that these species are not expected to rely on the habitat within the area to be impacted and similar habitat will remain within the study area and locality.

b) 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

The proposal will not increase the risk from invasive species. No invasive species critical to the survival of this species will become established or increase as the result of the proposal.

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

The Bar-tailed Godwit, Eastern Curlew and Double-banded Plover do not breed in Australia. The major Australian breeding populations for the Little Tern are not known near Burrill Lake, however, the species

will nest on sandy beaches and this habitat type is not available for this species within the study area. The Great Egret will breed within Australia and is widespread but no breeding habitat is available for this species within the study area.

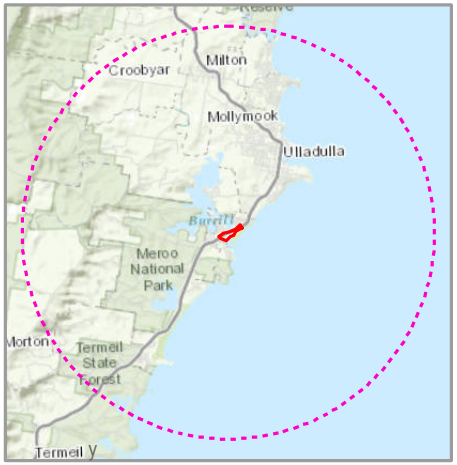
Burrill Lake is not known to support an ecological significant proportion of a population of any of these migratory species. The study area supports foraging habitat but only a small area of available habitat (0.5 ha) will be affected by the proposal. As these birds are highly mobile, can forage over large distances and similar habitat is available within the locality the proposal is not expected to disrupt the lifecycle of these species.

APPENDIX I MAPS

PROPOSED WORKS AND LOCALITY

Burrill Lake Bridge

Study area (nghenvironmental 2013)
Impact extent
Design and impact footprint
Compound/stockpile
Inset map:
Burrill Lake Bridge 10km locality



0 25 50 100 Metres

A4 @ 1:5500
Ref: 5299 BA v1.0
Author:SP

ngh environmental

www.nghenvironmental.com.au

FLORA AND SEAGRASS SURVEY EFFORT

Burrill Lake Bridge

Seagrass survey transect

Flora survey

Notes:
- Data collected by nghenvironmental (2013)
- Base map Copyright © Esri and its data suppliers.

0 25 50 100 Metres

A4 @ 1:4000
Ref: 5299 BA v1.0
Author: SP

ngh environmental

www.nghenvironmental.com.au

FAUNA SURVEY EFFORT AND RESULTS

Burrill Lake Bridge

- Anabat survey location
- Great Egret (*Ardea alba*)
- Pied Oystercatcher (*Haematopus longirostris*)
- Bird survey transect
- Green and Golden Bell Frog survey location

Notes:
- Data collected by nghenvironmental (Oct-Dec 2013)
- Other data courtesy of RMS, received 2013

0 25 50 100 Metres

A4 @ 1:3000
Ref: 5299 BA v1.0
Author: SP

ngh environmental

www.nghenvironmental.com.au

VEGETATION TYPE AND CONDITION
Burrill Lake Bridge

Study area

Seagrass meadows

- A2 - Single stands, Moderate individuals
- A3 - Single stands, Continuous mat
- B1 - Patchy, Single individual plants
- B2 - Patchy, Moderate individuals
- C2 - Fairly continuous, Moderate individuals
- C3 - Fairly continuous, Continuous mat

Terrestrial vegetation, condition

- Exotic grassland and planted trees
- Highly modified Coastal Sand Forest (not EEC)
- Coastal Sand Forest (Bangalay Sand Forest EEC), Poor
- Coastal Sand Forest (Bangalay Sand Forest EEC), Poor to Moderate
- Coastal Sand Forest (Bangalay Sand Forest EEC), Good
- Highly disturbed Estuarine Fringe Forest (not EEC)
- Estuarine Fringe Forest (Swamp Oak Fringe Forest EEC), Poor
- Saltmarsh (Coastal Saltmarsh EEC), Moderate to Good

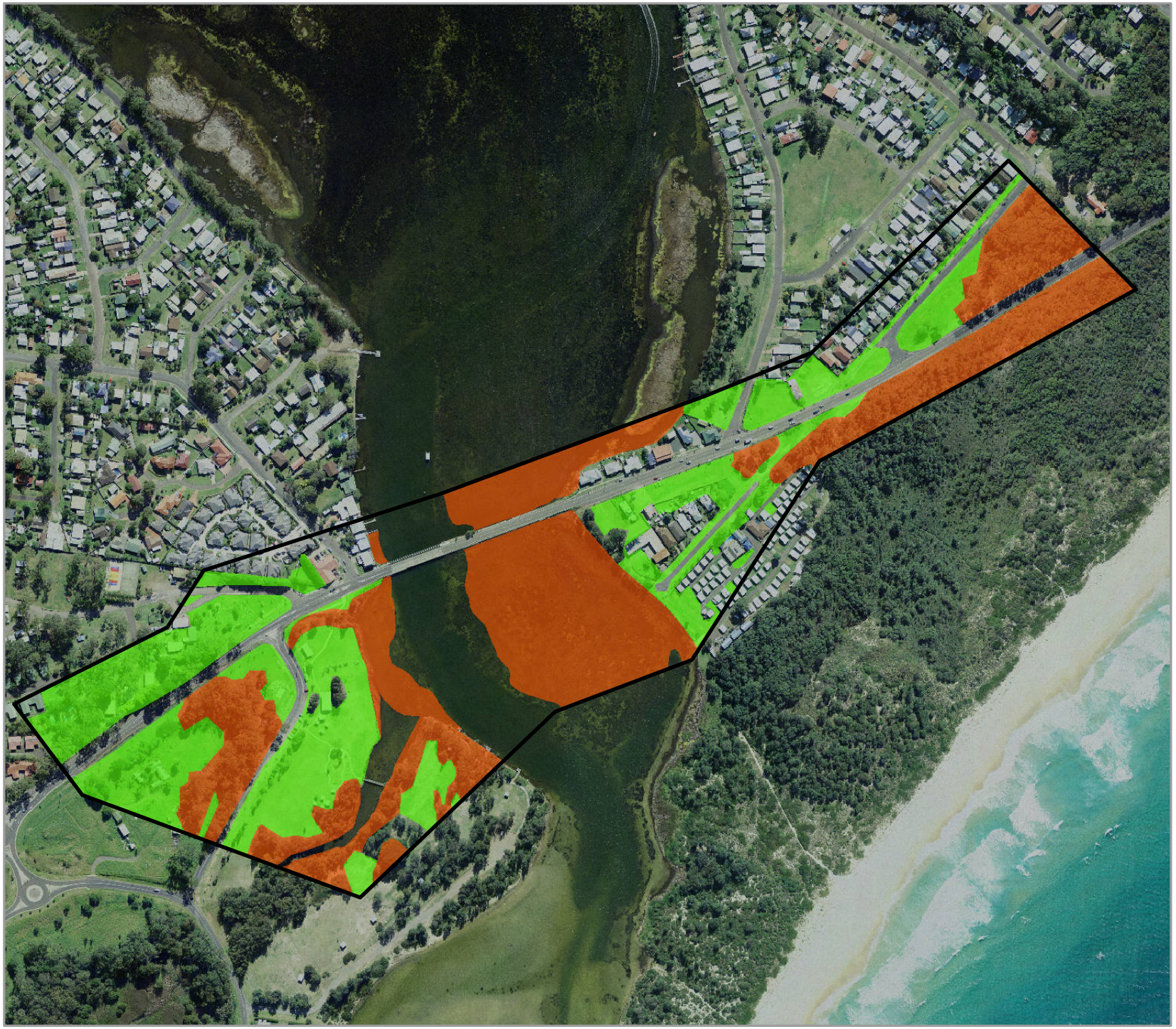
Notes:
- Data collected by nghenvironmental (Oct-Dec 2013)
- Other layers from RMS, received 2013

0 50 100 200 Metres

A4 @ 1:5500
Ref: 5299 veg
Author: SP

ngh environmental

www.nghenvironmental.com.au



CONSTRAINTS MAP
Burrill Lake Bridge

Study area

Constraint

Low

High

Notes:
- Data collected by nghenvironmental (Oct-Dec 2013)
- Other layers from RMS, received 2013

0 50 100 200 Metres

A4 @ 1:5500
Ref: 5299 constraints
Author: SP

ngh environmental

www.nghenvironmental.com.au