

Appendix E

Biodiversity impact assessment



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Roads and Maritime Services

Alfords Point Road Upgrade Biodiversity Assessment

February 2013

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1. Introduction

GHD Pty Ltd (GHD) has been engaged by the Roads and Maritime Services (RMS) to undertake a review of Environmental Factors (REF) for the proposed upgrade of Alford's Point Road between Alford's Point Bridge and Brushwood Drive.

This Biodiversity Assessment has been prepared as a supporting document to the REF. It assesses the potential for impacts on ecological values at the site, with particular emphasis on threatened ecological communities, populations and species listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act) and *Fisheries Management Act 1994* (FM Act), and *Matters of National Environmental Significance* (MNES) listed under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act). Recommended mitigation measures to ameliorate potential impacts of the proposal are included in Section 6 of this report.

1.1 Proposal description

The existing Alford's Point Road is a dual carriageway with two 3.3 m lanes in both directions. It is proposed to widen approximately 2.1 km of the road between the southern abutment of Alford's Point Bridge to Brushwood Drive. This would upgrade the existing undivided 4-lane road to a 6 lane divided carriageway with a concrete barrier dividing the northbound and southbound lanes.

- Upgrade about 2.1 kilometres of Alford's Point Road from a four lane undivided carriageway to a six lane divided carriageway. Alford's Point Road would be widened on the eastern side to accommodate three lanes in each direction
- Install a continuous concrete type F median barrier from the southern abutment of Alford's Point Bridge to about 1.8 kilometres south to separate the northbound and southbound lanes
- Provide emergency vehicle access via an opening in the central median barrier at the southern abutment to Alford's Point Bridge
- Widen the Brushwood Drive northbound on ramp to accommodate the relocated bus bay
- Relocate the existing bus stop on the Brushwood Drive on ramp to about 80 metres south of the existing location
- Realign and extend the existing footpath to the new bus stop location. To provide pedestrian access to the realigned footpath the existing noise wall opening would be reorientated from its current north facing direction to a south facing direction (ie the opening would be repositioned seven metres south and current opening closed)
- Widen the single lane section of the Illawong/Alford's Point southbound off ramp to two lanes for a length of about 300 metres. This would provide additional vehicle storage capacity on approach to the roundabout intersection and prevent queuing onto Alford's Point Road southbound lanes
- Replace the temporary bitumen shared path with a permanent off-road shared path on the eastern side of Alford's Point Road. The shared path would extend the length of the proposal from Alford's Point Bridge to the roundabout at the end of the Illawong/Alford's Point off ramp. Where the grades are steep the shared path would be converted into separate cyclist and pedestrian paths for safety reasons. A concrete type F barrier would be installed along the western side of the shared path to separate it from the southbound carriageway



- ▶ Relocate and reinstate the existing pedestrian path between Maxwell Close and the shared path on the eastern side of Alfords Point Road
- ▶ Relocate the existing heavy vehicle inspection bay to a permanent location beneath Old Illawarra Road overbridge (900 metres south of Brushwood Drive on the southbound side of Alfords Point Road). This would include permanent boundary fencing, lockable gates and lighting
- ▶ Provide a vehicle breakdown bay on the southbound carriageway at the location of the existing heavy vehicle inspection bay. The breakdown bay would be an extension of the road pavement and be about 20 metres long and five metres wide
- ▶ Subject to an assessment of feasible and reasonable noise mitigation options:
 - Potentially extend the existing noise barrier on the western roadside edge of Alfords Point Road for about 700 metres
 - Potentially provide a noise barrier on the eastern side of Alfords Point Road for one kilometre between Maxwell Close and Brushwood Drive
- ▶ Relocate the existing variable message sign located at the existing heavy vehicle inspection bay to about 500 metres south of the existing location
- ▶ Adjust the pavement drainage along the eastern side of Alfords Point Road and within the median
- ▶ Construct a permanent swale drain and rock check dam at culvert outlets (300 metres and 1620 metres south of Alfords Point Bridge). Potentially construct a permanent water quality basin at 870 metres south of Alfords Point Bridge
- ▶ Relocate the optic fibre cables, light poles and underground electricity on the eastern and western sides of Alfords Point Road to the outside edge of the widened Alfords Point Road. Provide a new utility installation to supply power from Old Illawarra Road to the proposed heavy vehicle inspection bay.

The proposal footprint is shown in Figure 1. Refer to the main REF document for full details of the works to be undertaken.

1.1.1 Terms and definitions

The following terms are used throughout the report:

Proposal disturbance footprint: the area to be directly impacted by the proposal (see Figure 1). In this case it comprises the construction footprint, including the widened road, new truck inspection bay, and intersections, potential site compounds, batters, retaining walls and table drains.

Study area: the proposal footprint and any additional areas which are likely to be affected by the proposal, either directly or indirectly. In this study it includes the proposal footprint and immediately adjacent areas of native vegetation. Generally this is taken to be 30 metres from the proposal footprint boundary though a broader study area was assessed where native vegetation occurs downslope of the proposal footprint.

Locality: the area within a 10 km radius of the proposal.



1.2 Study Area

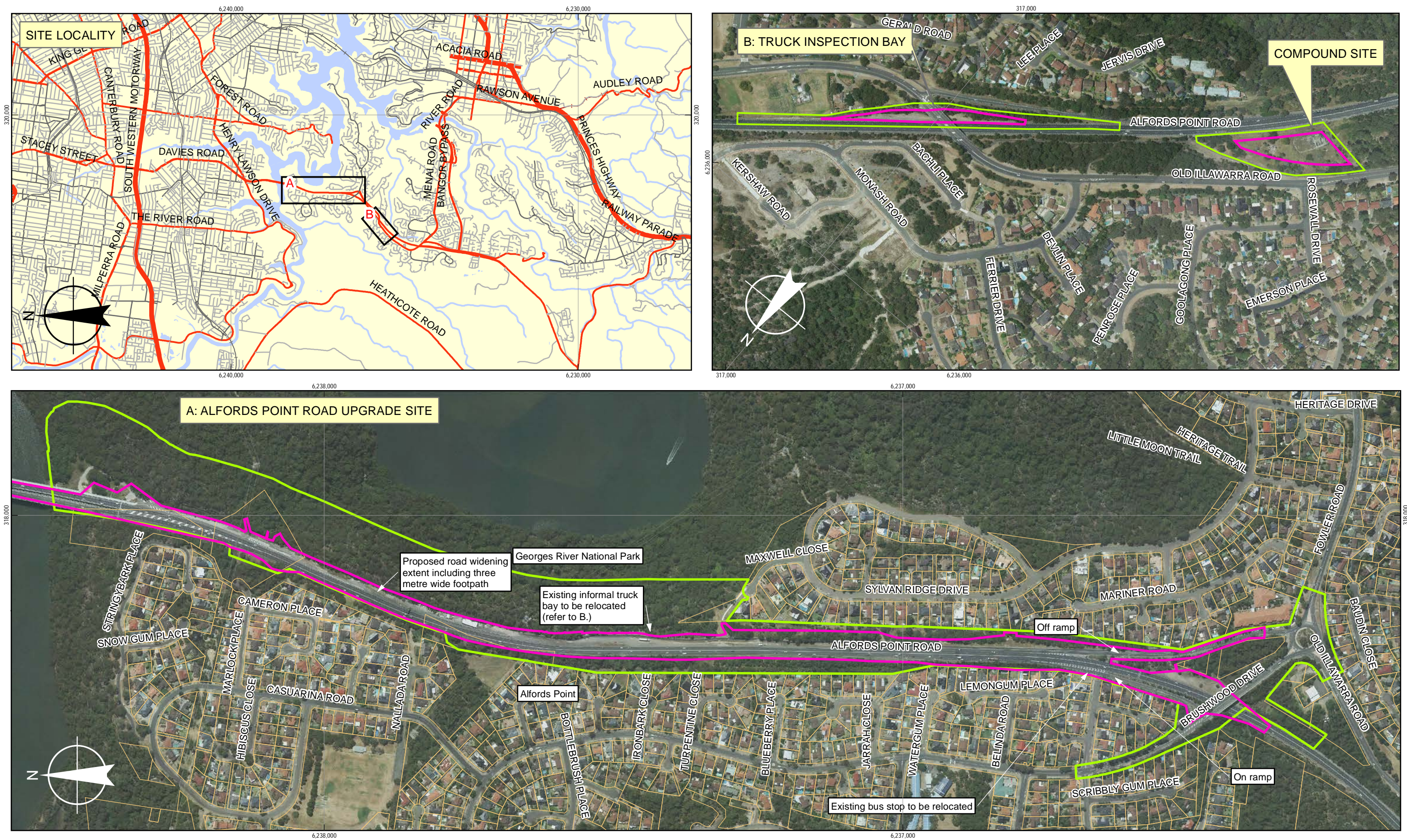
The proposal is located within the Sutherland local government area (LGA) in Sydney's south. The study area includes:

- ▶ Approximately 2.1 km of Alfords Point Road between the Alfords Point Bridge and Brushwood Drive
- ▶ The location of the proposed permanent truck inspection bay farther south on Alfords Point Road, beneath the Old Illawarra Road overbridge
- ▶ The location of the proposed construction site compound between Alfords Point Road and Old Illawarra Road, near the intersection with Rosewall Drive
- ▶ Areas of native vegetation and habitat adjacent to these locations that may be subject to secondary impacts of the proposal.

The study area includes the following land use areas (see Sutherland LEP 2006 for explanation of zoning):

- ▶ Private property (Zone 3 – Environmental Housing (Bushland)) to the west of Alfords Point Road, and Zone 20/ Zone 1 (Environmental Housing (Environmentally Sensitive Site)) along the eastern side of the road in the south of the study area.
- ▶ Georges River National Park (Zone 20 – National Park Reserve and recreation area) to the east of Alfords Point Road (excluding areas of private property).
- ▶ Alfords Point Road (Zone 22 – Arterial Road).

The study area is also mapped as a core part of the Sutherland Shire Council Greenweb program (SSC 2012), meaning it is considered to 'contain key habitat areas, key linkages and threatened species, or endangered ecological communities'. The Greenweb program aims to 'conserve and enhance Sutherland Shire's bushland by identifying and managing key areas of bushland habitat and establishing and maintaining interconnecting linkages and corridors'.





2. Legislative Context

2.1 Commonwealth legislation

2.1.1 *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*

The purpose of the EPBC Act is to ensure that actions likely to cause a significant impact on MNES undergo an assessment and approval process. Under the EPBC Act, an action includes a proposal, undertaking, proposal or activity. An action that 'has, will have or is likely to have a significant impact on a matter of national environmental significance' is deemed to be a 'controlled action' and may not be undertaken without prior approval from the Australian Government Minister for Sustainability, Environment, Water, Populations and Communities (the 'Minister').

The EPBC Act identifies MNES as:

- ▶ World heritage properties.
- ▶ National heritage places.
- ▶ Wetlands of international importance (Ramsar wetlands).
- ▶ Threatened species and ecological communities.
- ▶ Migratory species.
- ▶ Commonwealth marine areas.
- ▶ Nuclear actions (including uranium mining).

Potential impacts on any MNES must be subject to assessments of significance pursuant to the DSEWPac *Significant Impact Guidelines* (DEWHA 2009). If a significant impact is considered likely, a referral under the EPBC Act must be submitted to the Commonwealth Environment Minister. Assessments of significance for MNES considered to have the potential to occur at the site are included in Appendix D. These assessments concluded that a significant impact is not likely and no referral is required.

2.2 NSW legislation

2.2.1 *Environmental Planning and Assessment Act 1979 (EP&A Act)*

The EP&A Act forms the legal and policy platform for proposal assessment and approval in NSW and aims to, inter alia, 'encourage the proper management, proposal and conservation of natural and artificial resources'. All development in NSW is assessed in accordance with the provisions of the EP&A Act and EP&A Regulation 2000. The proposal, as an activity that does not require consent, is to be determined under Part 5 of the Act and Council is the 'determining authority' for the purposes of the Act.

Section 5A of the EP&A Act lists seven factors that must be taken into account in the determination of the significance of potential impacts of a proposed activity on threatened species, populations or ecological communities (or their habitats) listed under the TSC Act and the FM Act. 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.



2.2.2 *Threatened Species Conservation Act 1995 (TSC Act)*

The TSC Act provides legal status for biota of conservation significance in NSW. The Act aims to, inter alia, 'conserve biological diversity and promote ecologically sustainable proposal'. It contains schedules that list endangered, critically endangered and vulnerable species, populations, ecological communities, and key threatening processes in NSW. Potential impacts on any of these biota must be subject to an impact significance assessment ("7-part test) through the provisions of section 5A of the EP&A Act. Seven-part tests have been prepared for threatened biota listed under the TSC Act, and are presented in Appendix C.

If a significant impact on threatened biota is likely, a Species Impact Statement (SIS) must be completed and a licence obtained pursuant to Part 6 of the TSC Act. No significant impacts on threatened biota are anticipated from the proposal, and an SIS is not required.

2.2.3 *National Parks and Wildlife Act 1979*

The National Parks and Wildlife Act 1974 (NPW Act) provides the basis for the legal protection of native animals and plants in NSW. A wildlife licence is required under the NPW Act to harm or pick protected fauna and flora. All surveys were carried out under a Section 132C scientific licence (SL100146).

Georges River National Park lies to the east of the proposal footprint (Figure 1). The proposal has been located to avoid impacts on Georges River National Park. Mitigation measures to reduce indirect impacts to Georges River National Park are provided in Section 6.

2.2.4 *Fisheries Management Act 1994 (FM Act)*

The FM Act contains schedules that list endangered, critically endangered and vulnerable aquatic species, populations, ecological communities, and key threatening processes of relevance to aquatic environments. As for biota listed under the TSC Act, potential impacts on any of these species must be addressed through 7 part tests in accordance with section 5a of the EP&A Act. If a significant impact is likely, an SIS must be completed and a licence obtained pursuant to Part 7a of the FM Act. The proposal is considered unlikely to impact on any threatened biota listed under the FM Act (see Appendix B). The proposal infrastructure has been positioned so as to avoid sensitive aquatic habitats such as mangrove and saltmarsh vegetation beneath Alfords Point Bridge. The proposal does not involve any dredging or reclamation that would require specific consideration under the Act.

2.2.5 *Noxious Weeds Act 1993 (NW Act)*

The NW Act provides for the declaration of noxious weeds by the Minister for Primary Industries. Noxious weeds may be considered noxious on a National, State, Regional or Local scale. All private landowners, occupiers, public authorities and Councils are required to control noxious weeds on their land under Part 3 Division 1 of the NW Act. As such, if present, noxious weeds on the site should be assessed and controlled.

There are six noxious weed species present at the site, all of which would require control.



2.3 NSW policies and guidelines

2.3.1 SEPP 44 Koalas

State Environmental Planning Policy 44 Koala Habitat Protection (SEPP 44) aims to encourage the 'proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline'. SEPP 44 is not applicable to RMS as a public authority however its principles are still adopted as guide to the assessment of koala populations and their habitats. The koala is listed as a vulnerable species under the TSC Act and EPBC Act.

Schedule 1 of SEPP 44 lists the local government areas to which SEPP 44 applies. The site is within the Sutherland LGA which is listed under Schedule 1. SEPP 44 requires that before granting consent for development on land over 1 hectare in area, a consent authority must be satisfied as to whether or not the land is 'potential' and 'core' koala habitat. Potential koala habitat is defined as 'an area of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component'.

Core koala habitat, is defined as 'an area of land with a resident breeding population of koalas, evidenced by attributes such as breeding females and recent sightings and historical records of a population'. Where core koala habitat is found to occur, SEPP 44 requires that a site-specific Koala Plan of Management (KPoM) be prepared, unless a LGA-based KPoM exists. Sutherland Shire Council has not prepared a KPoM.

The proposal disturbance footprint does not contain any primary, secondary or supplementary Koala food trees identified for this region in the Koala Recovery Plan (DECC 2008). Whilst, there are 88 previous records of the Koala within a 10 kilometre radius of the site since 1985 (OEH, 2011a), the majority of these records are from the Holsworthy Military Area to the west of the study area and the Georges River National Park to the east. The proposal disturbance footprint is isolated from these areas of known habitat by residential development, Alford's Point Road and associated steep cuttings and batters. Given the absence of known food trees and the landscape context, Koalas are unlikely to occur in the proposal disturbance footprint and the habitat present would not support a resident local population.

Nevertheless, targeted pre-clearing surveys for Koalas and measures for the safe management of Koalas if detected will be incorporated into the Construction Environmental Management Plan (CEMP) to reduce the risk of injury or mortality in the unlikely event that an individual should happen to be present within the disturbance footprint at the time of construction.

2.3.2 Sutherland Shire Local Environment Plan 2006

Under the *Sutherland Shire Local Environmental Plan 2006* (LEP), the proposed works are located within Zone 22 – Arterial Road.

Under the LEP, the proposal is permissible without consent in this zone; however Clause 94 of the ISEPP permits development on any land for the purpose of a road or road infrastructure facilities to be carried out by or on behalf of a public authority without consent. The proposal is therefore permitted without consent from Council.

No other provisions of the Sutherland Shire LEP are specifically relevant to the proposal.



The general intent of the LEP to conserve and manage the natural environment of the Sutherland Shire have been addressed in this report by the due consideration of the potential for impacts on native biota and the local environment in Section 5, and through management recommendations provided in Section 7.



3. Methodology

3.1 Database searches

A desktop assessment was undertaken to identify threatened flora and fauna species, populations and ecological communities listed under the TSC Act and FM Act, and MNES listed under the EPBC Act that may be affected by the proposal. Database records pertaining to the study area and locality (i.e. within a 10 km radius of the study area) were reviewed and included:

- ▶ NSW Office of Environment and Heritage (OEH) Wildlife Atlas database for records of threatened species listed under the TSC Act (OEH 2012; data supplied by OEH on 29 February 2012).
- ▶ Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) Protected Matters Online Search Tool for MNES listed under the EPBC Act and predicted to occur in the locality (DSEWPaC 2012; database queried on 27 February 2012).
- ▶ Department of Primary Industries (DPI) Threatened Species Records Viewer (DPI 2012; database queried 27 February 2012) for threatened species listed under the FM Act and recorded within the Sydney Metropolitan catchment.
- ▶ Broad-scale vegetation mapping of south-east NSW to identify threatened ecological communities mapped as occurring within the locality of the site (Tozer *et al* 2010, SSC 2012).

The habitat resources present at the site (determined during the site inspection) were compared with the known habitat associations/requirements of the threatened and migratory biota highlighted by the desktop review. This was used to determine the likelihood of each threatened ecological community, endangered population and threatened or migratory species occurring within the study area. The results of this assessment are presented in Appendix B.

3.2 Field survey

Field surveys were conducted over two survey rounds:

- ▶ A three day two night flora and fauna survey, by two GHD ecologists, between 27- 29 February 2012 targetting the entire study area
- ▶ A supplementary site inspection, by one GHD senior ecologist, on 1 November 2012 targetting the construction site compound.

Survey techniques and effort were conducted with reference to DEC (2004) survey guidelines. The locations of survey sites are shown in Figure 2.

3.2.1 Terrestrial flora survey

The flora survey involved the following techniques, which are described in detail below:

- ▶ Flora sampling through quadrats, area searches and systematic traverses
- ▶ Vegetation mapping
- ▶ Targeted threatened flora surveys.

The locations of quadrats sampled during the flora survey are displayed in Figure 2.



Flora sampling

Four 20 x 20 metre quadrats were positioned randomly within identified vegetation communities to compile a flora species list for each community within the study area (see Figure 2). Survey effort was targeted using air photo interpretation and field habitat assessment. The majority of the proposal footprint comprised hardstand areas or highly modified, cleared vegetation adjacent to the existing Alfords Point Road. A systematic traverse was used in this area because a quadrat would not have effectively sampled the flora species present. Additional opportunistic observations of plant species were also undertaken, noting any species not detected in other surveys.

All vascular plants (ie not mosses, lichens or fungi) observed were recorded on proforma field data sheets. Each species list was accompanied by a detailed biophysical description, including vegetation structure, soils, geology and geomorphology, habitat and disturbance history. Plant specimens that could not be identified rapidly in the field were collected and subsequently identified using standard botanical texts and where required were compared with voucher specimens held in the National Herbarium of NSW Online Reference Collection.

Structural vegetation communities were described according to classifications made by Specht (1970). Plant identifications were made according to nomenclature in Harden (1990-93) and RBGT (2010). Plant specimens which were difficult to identify (either insufficient sample collected or buds/fruitlet bodies were not available at the time of the survey) were identified to genus level.

Vegetation mapping

Native vegetation within the study area was mapped based on observed species composition and vegetation structure according to the classification of Specht (1970). Intact native vegetation communities were defined using the map units of Tozer *et al.* (2010). Exotic or planted native vegetation was defined based on structure and species composition. All vegetation communities were then mapped using aerial photographic interpretation within a geographical information system (GIS) as guided by the field survey results.

Vegetation within the study area was assessed against identification criteria for State and Commonwealth listed threatened ecological communities (critically endangered ecological communities (CEECs), endangered ecological communities (EECs) and vulnerable ecological communities (VECs)). Vegetation and habitats was compared with descriptions provided in DEC (2005) and DSEWPC (2012b) profiles.

Targeted threatened flora surveys

Targeted surveys were undertaken for threatened flora species which could potentially occur within the study area given known distributions, previous records in the locality and habitat requirements for each species. Random meander transects, according to the methods of Cropper (1993), were focused in areas of proposed impact in potentially suitable habitat and within immediately adjoining vegetation.

3.2.2 Terrestrial fauna survey

A variety of techniques were used for fauna surveys within the study area to target threatened fauna species and assess habitat values. Detailed descriptions of survey techniques are outlined below. All observations were recorded on proforma field data sheets. Fauna survey locations are identified in Figure 2.



Fauna habitat assessment

General fauna habitat assessments were undertaken throughout the study area, including active searches for potential shelter, basking, roosting, nesting and/or foraging sites. Specific habitat features and resources such as water bodies, food trees, the density of understorey vegetation, the composition of ground cover, the soil type, presence of hollow-bearing trees, leaf litter and ground debris were noted.

Habitat quality was rated as 'good', 'medium' and 'low', based on the level of breeding, nesting, feeding and roosting resources available. Good quality habitat was considered to have high densities of habitat resources present, while low quality habitat was considered to have low densities of habitat resources.

Indicative habitat criteria for targeted threatened species (ie those determined as having the potential to occur within the study area following the desktop review) were identified prior to fieldwork. Habitat criteria were based on information provided in OEH and DSEWPC threatened species profiles, field guides, and the knowledge and experience of GHD field ecologists. Habitat assessment assists in the compilation of a comprehensive list of fauna that are predicted within the vicinity of the study area, rather than relying solely on single event surveys that are subject to seasonal limitations and may only represent a snapshot of assemblages present.

Habitat assessments included active searches for the following:

- Trees with bird nests or other potential fauna roosts.
- Rock outcrops or overhangs providing potential shelter sites for fauna.
- Burrows, dens and warrens.
- Distinctive scats or latrine sites (of particular relevance for the Spotted-tailed Quoll), owl white wash and regurgitated pellets under roost sites.
- Tracks or animal remains.
- Evidence of activity such as feeding scars, scratches and diggings.
- Specific food trees and evidence of foraging.

The locations and quantitative descriptions of significant habitat features were captured with a handheld GPS unit and photographed where appropriate.

Hollow-bearing tree assessments

Counts and mapping of hollow-bearing trees within the proposal disturbance footprint were undertaken within the study area. Counts and estimates of sizes of visible hollows were made, and hollows were checked for signs of use (eg visible chew marks). The locations of hollow-bearing trees were captured with a handheld GPS unit.

Diurnal bird surveys

Targeted surveys for diurnal birds were undertaken throughout the study area within two hours of dawn. Surveys followed the area search method, and birds were identified by observation with binoculars and/or call identification. Diurnal bird surveys also included searches for habitat features of relevance for particular threatened species, including searching for evidence of feeding (eg *Allocasuarina* chewed cones which are signs of Glossy Black-cockatoo (*Calyptorhynchus lathami*) foraging) and signs of bird presence, such as pellets, whitewash, nests etc.



Nocturnal amphibian surveys

Active searches for frogs were performed within the study area focussing on areas of suitable habitat, including small ponds and/or pools of standing water and the drainage line. Frogs were identified by sight and call. Call playback for threatened species was not used, given the lack of potential habitat for these species in the proposal disturbance footprint (see Appendix B).

Microchiropteran bat survey

Stationary Anabat recordings were undertaken in four locations (two on each night), in vegetation within Georges River National Park to the east of the proposal footprint and within the proposal footprint itself (Figure 2). Recording commenced at least half an hour before dusk and continued until the following morning.

Calls recorded during the field survey were identified using zero-crossing analysis and AnalookW software (version 3.8m, Chris Corben 2010) by visually comparing call traits. The analysis of all bat calls was undertaken by GHD ecologists. No reference calls were collected during the survey. Pennay *et al.* (2004) was used as a guide to call analysis. Due to the high level of variability and overlap in call characteristics, a conservative approach was taken when analysing calls.

A call (pass) was defined as a sequence of three or more consecutive pulses of similar frequency. Pulses separated from another sequence by a period of five seconds were considered to be separate passes. Scattered sequences, where intermittent pulses were not separated by more than five seconds, were recognised as a single pass. Where constant activity was recorded, a single pass was defined as 15 seconds (ie one full display screen comprising an Anabat sequence file). Although this method underestimates the number of bat passes when there is continuous activity, the standard unit of time remains consistent (Law *et al.* 1998; Law *et al.* 1999).

Stagwatches

Stagwatches of large, hollow-bearing trees were undertaken on both nights, with four trees surveyed (see Figure 2). Stagwatches began approximately half an hour before sunset and continued for one hour after sunset. Observers were positioned so that they could clearly see any fauna exiting the identified hollows. The trees and surrounding vegetation were sporadically scanned with spotlights.

Spotlighting

Spotlight searches were undertaken throughout the study area for nocturnally active mammals, birds and frogs, including dedicated listening periods for fauna vocalisations. Mammals and nocturnal birds were identified by observation under spotlight or by vocalisations heard whilst spotlighting. Transects were conducted on foot within the study area on both nights.

Call playback

Nocturnal call playback surveys were conducted for the Koala (*Phascolarctos cinereus*), Yellow-bellied Glider (*Petaurus australis*), Barking Owl (*Ninox connivens*), Powerful Owl (*N. strenua*), Masked Owl (*Tyto novaehollandiae*) and Sooty Owl (*T. tenebricosa*) on both nights. Surveys were conducted within vegetation in Georges River National Park (Figure 2). Surveys involved an initial listening period of five minutes, followed by call playing for five minutes, followed by a listening period of five minutes (undertaken separately for each species), with a final listening period of approximately 10 minutes. Calls were played through a portable MP3 player connected to a 45-watt megaphone. All potential roost sites in the immediate area were then scanned for 10 minutes using spotlights.



Koala Spot Assessment Technique (SAT)

There are no preferred Koala feed trees (listed under SEPP 44) or primary or secondary feed trees listed in the recovery plan (DECC 2008) within the study area, however searches were performed as there are known populations of the species in the locality, such as at the Holsworthy army base and Heathcote National Park. Koala spot assessments were conducted in two locations in the study area. These followed the technique of Phillips and Callaghan (1995), and involved scanning trees for Koalas before searching for scats at the base of the trees. At least 30 trees were searched at each location.

Opportunistic observations

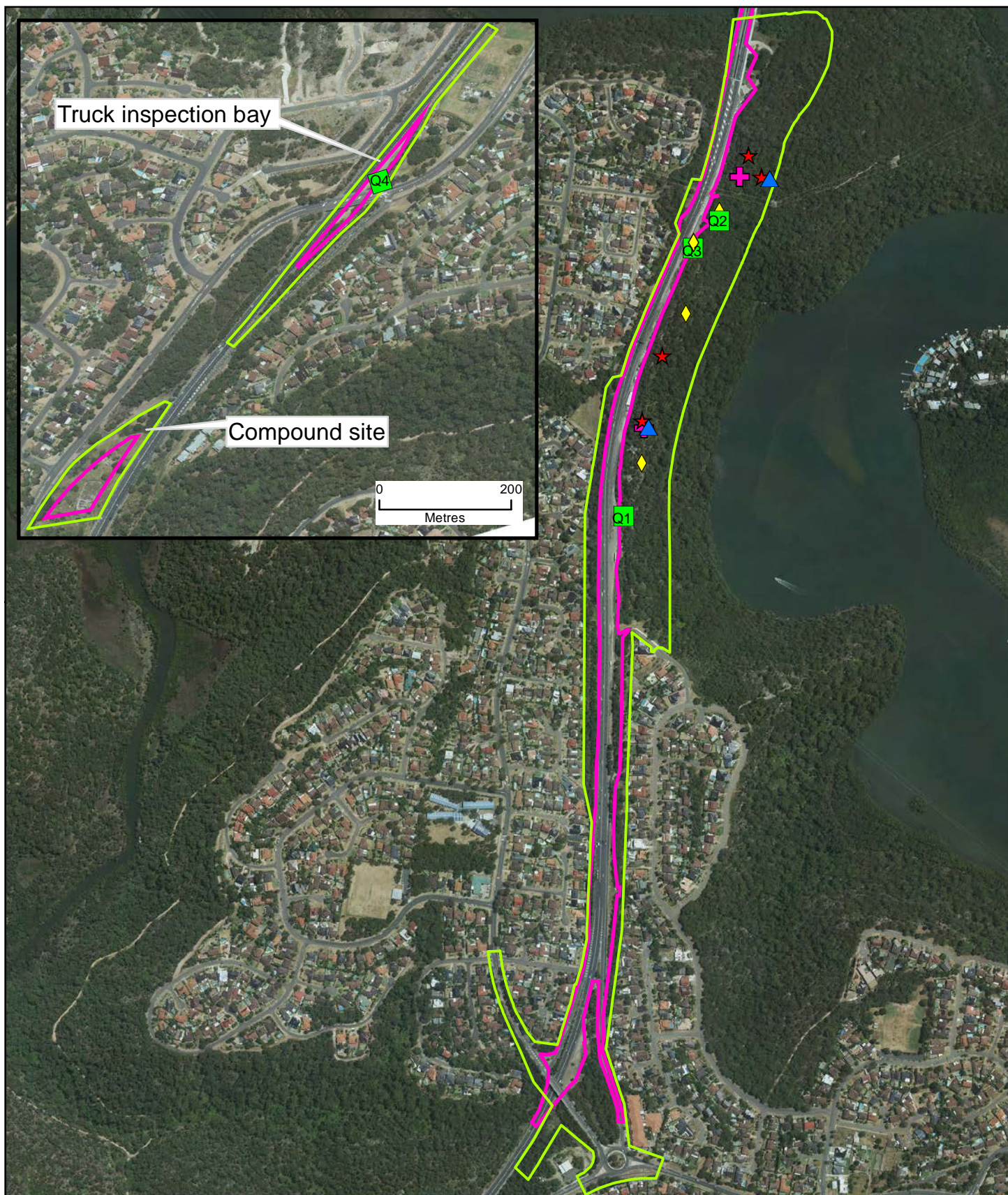
Opportunistic and incidental observations of fauna species were recorded at all times during field surveys. Survey effort was concentrated on suitable areas of habitat throughout the course of the flora survey, for instance fallen timber was scanned and/or turned for reptiles and mature trees and dams were scanned for roosting birds.

3.3 Survey Limitations

Given the duration and timing of the field surveys (late summer and mid spring) it is likely that some species that utilise the study area (permanently, seasonally or transiently) were not detected during the survey. These species are likely to include: flora species that flower at other times of year as well as annual, ephemeral or cryptic species; and frogs which call at other times of year or after heavy rainfall. Some fauna species are also mobile and transient in their use of resources and it is likely that not all species were recorded during the survey period.

The Anabat call recordings collected during the survey were limited, in terms of the number, duration and quality of calls. This may be a product of weather conditions during the survey, background noise and/or equipment failure.

The desktop assessment provided a list of the native flora and fauna and especially threatened biota that could potentially occur in the study area or be affected by the proposal (including seasonal, transient or cryptic species). The habitat assessment conducted for the site allows for identification of habitat resources for such species. As such, the survey was not designed to detect all species, rather to provide an overall assessment of the ecological values on site in order to predict potential impacts of the proposal, with particular emphasis on endangered ecological communities, threatened species and their habitats.

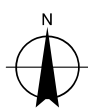


LEGEND

- ◆ Anabat
- ▲ Call Playback
- ✕ Koala SAT
- 20m x 20m Vegetation Quadrat
- ★ Stagwatch
- Study Area*
- Proposed Disturbance Footprint

Note:
*Targeted threatened plant searches, habitat assessment, vegetation mapping and opportunistic fauna observations were undertaken within the entire study area.

1:10,000 (at A4)
0 25 50 100 150 200
Metres
Geographic Coordinate System
Horizontal Datum: Geocentric Datum of Australia 1994



Roads and Maritime Services
Alfords Point Road REF

Job Number 21-21268
Revision E
Date 11 Feb 2013

Survey Effort

Figure 2

4. Existing environment

4.1 Landscape context

4.1.1 Geology, soils and topography

The study area is located near the top of a sandstone ridge. Much of the study area has been modified for construction of the existing road, with cuttings along the majority of the eastern side of the proposal footprint. Within Georges River National Park, to the east of the existing road, the land slopes steeply down to Great Moon Bay adjoining the Georges River. At the north of the study area, the land slopes moderately steeply to the Georges River under Alfords Point Bridge.

Review of the Soil Landscapes of the Sydney 1:100 000 map sheet (Chapman and Murphy 1989) indicates that the study area is associated with the following four landscapes:

- ▶ Lucas Heights landscape, which occurs in the southern part of the study area on relatively level ground on the ridgetop. This landscape typically occurs on gently undulating crests and ridges on plateau surfaces of the Mittagong geological formation, which comprised alternating bands of shale and fine grained sandstone. Soils are moderately deep sandy loams, and typically support eucalypt forest and open woodland.
- ▶ Lambert landscape, which occurs toward the northern end of the study area, also along the ridgetop. This landscape typically occurs on undulating to rolling low hills on Hawkesbury Sandstone in exposed areas and supports heathy vegetation with patches of low woodland. Soils are generally shallow, stony, very permeable sandy soils with low fertility.
- ▶ Hawkesbury landscape, which occurs on the steep slopes leading down to the Georges River. This landscape typically occurs on rolling to very steep hills, and supports shallow, discontinuous sandy soils with high permeability and low fertility. Vegetation is typically open woodland with patches of tall open forest.
- ▶ Mangrove Creek landscape which occurs in small pockets on the edge of the Georges River. This landscape typically occurs on tidal flats on Quaternary marine sediments, and may support mangroves, saltmarsh, herbland, sedgeland or low-open forest.

4.1.2 Hydrology

The study area is located on a ridgetop above the Georges River, a large estuarine river which flows into Botany Bay. There are no named creeks or rivers within the study area, but stormwater flows from the western side of Alfords Point Road in the vicinity of Marlock Place are discharged into a small drainage line running down from the study area into Great Moon Bay. This drainage line was running at the time of survey, with several semi-permanent pools.



4.1.3 Climate

The Lucas Heights (ANSTO) station is the nearest weather station, located approximately 8 kilometres to the south of the study area. Lucas Heights has a mild climate, with a daily mean maximum temperature of 21.4 degrees Celsius and a mean daily minimum temperature of 12.3 degrees Celsius (BOM 2012). Rainfall is generally weakly seasonal with higher rainfall months occurring in late summer and early autumn and lower rainfall months in late winter to early spring. The average annual rainfall for the Lucas Heights area is 1017 mm.

4.1.4 Landuse

The study area includes the following land use areas (see Sutherland LEP 2006 for explanation of zoning):

- ▶ Private property (Zone 3 – Environmental Housing (Bushland)) to the west of Alfords Point Road, and Zone 20/ Zone 1 (Environmental Housing (Environmentally Sensitive Site)) along the eastern side of the road in the south of the study area.
- ▶ Georges River National Park (Zone 20 – National Park Reserve and recreation area) to the east of Alfords Point Road (excluding areas of private property).
- ▶ Alfords Point Road (Zone 22 – Arterial Road).

4.1.5 Habitat connectivity

Vegetation in the Georges River National Park, directly adjacent to the proposal footprint, is mapped as a core part of the Sutherland Shire Council Greenweb program (SSC 2012), meaning it is considered to 'contain key habitat areas, key linkages and threatened species, or endangered ecological communities'. The Greenweb program aims to 'conserve and enhance Sutherland Shire's bushland by identifying and managing key areas of bushland habitat and establishing and maintaining interconnecting linkages and corridors'.

To the east, native vegetation in the Georges River National Park is contiguous with native vegetation stretching along the Georges River, eventually connecting to vegetation bordering the Woronora River. To the west, it connects with extensive areas of native vegetation along Mill Creek, in to the Holsworthy Military Reserve and eventually into Heathcote National Park. This vegetation therefore provides an important movement corridor for native fauna, allowing them to move throughout the landscape.

The proposal footprint is located on the edge of this patch of habitat and does not, in itself, comprise an important connecting linkage. The majority of the proposal footprint is hardstand or low, exotic vegetation that would have very little value as fauna movement habitat. Alfords Point Road immediately adjoins the proposal footprint. It is a busy, dual carriageway at least four lanes wide and would comprise a 'hostile gap' separating patches of habitat as defined in the BioBanking assessment methodology (DECC, 2008). Fauna movement, pollination and seed fall of plants and other ecological processes would occur around, rather than through, the proposal footprint. In this context, the proposal would not have an adverse effect on fauna movement or habitat connectivity as described in Section 5.2.1.

4.2 Flora

4.2.1 Flora species

One-hundred and fifty-two species of flora from 51 families were recorded within the study area, comprising 101 native and 51 exotic species. The Poaceae (grasses, 27 species), Proteaceae (15 species, all native) and Asteraceae (daisies, 12 species, all exotic) were the most diverse families recorded. No threatened flora species were recorded. The full list of species recorded is presented in Appendix A. Species recorded are discussed below in relation to the vegetation communities occurring within the study area.

4.2.2 Vegetation communities

Vegetation communities mapped within the study area are shown on Figure 3 and described below. The proposal footprint contains mainly hardstand areas and exotic weed species. There is a thin strip of remnant native vegetation along the eastern edge of the study area, which is contiguous with an extensive patch of native vegetation within the Georges River National Park. Native vegetation within the proposal footprint contains moderate weed infestation attributable to disturbance and edge effects from the construction of Alfords Point Road and the associated road shoulders and bicycle track. Away from these disturbed areas the native vegetation is generally in very good condition. Vegetation communities were described according to NSW *Vegetation Types Database* (DECCW, 2012) where applicable and are summarised in Table 1 below.

Table 1 Summary of vegetation communities recorded within the study area

Vegetation Community (Tozer, 2010)	NSW Vegetation Type (DECCW, 2012)	Status	Percent cleared (DECCW, 2012) ¹
Coastal Sandstone Ridgetop Woodland	Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux, Sydney Basin	Native	25
Hinterland Sandstone Gully Forest	Smooth-barked Apple - Red Bloodwood - Sydney Peppermint heathy open forest in sandstone gullies of western Sydney, Sydney Basin	EEC TSC Act ²	20
Exotic Shrubland	n/a	Exotic	n/a
Planted Native Vegetation	n/a	Exotic	n/a

1 = Percentage of the estimated pre-European extent of the vegetation type that has been cleared within the Hawkesbury Nepean CMA region.

2 = Only a small portion of this vegetation community type within the study area is classified as EEC, described in Section 4.4.1.

Table 2 Description of vegetation communities

Coastal Sandstone Ridgetop Woodland	
Extent and distribution within proposal disturbance footprint	A narrow linear strip (2.567 hectares in total) along the eastern and western edges of the proposal disturbance footprint (either side of Alford's Point Road) which is continuous with an extensive patch off site to the east in Georges River National Park. This community also occurs as thin linear strips adjoining Alford's Point Road adjacent to the proposed truck inspection bay and construction site compound. It occurs on Hawkesbury Sandstone derived soils, on a ridge top and upper slopes, with frequent rock outcrop, slight cross-slopes and partially impeded drainage.
Survey effort	Three 20m x 20m vegetation quadrats (Q1, Q2 and Q4) and one systematic traverse (area search 3 adjacent to the construction site compound; refer to Appendix A)
Description	<p>This community has a woodland structure (Specht, 1970) with a diverse sclerophyll shrub layer and a groundcover of sedges, grasses and herbs. Dominant canopy species include Smooth-barked Apple (<i>Angophora costata</i>), Sydney Peppermint (<i>Eucalyptus piperita</i>) and Red Bloodwood (<i>Corymbia gummifera</i>). In patches, there is a dense small tree layer of Black She Oak (<i>Allocasuarina littoralis</i>), Lemon-scented Tea-tree (<i>Leptospermum polygalifolium</i>) or Old-man Banksia (<i>Banksia serrata</i>).</p> <p>The shrub layer is dense and species rich and includes Pink Spider Flower (<i>Grevillea sericea</i>), Sunshine Wattle (<i>Acacia terminalis</i> subsp. <i>angustifolia</i>), Sweet Wattle (<i>Acacia suaveolens</i>), Hairpin Banksia (<i>Banksia spinulosa</i>), <i>Platysace linearifolia</i>, Large-leaf Bush pea (<i>Pultenaea daphnoides</i>) and Needlebush (<i>Hakea sericea</i>).</p> <p>The groundcover is very dense, species rich and variable and includes: sedges such as <i>Lepidosperma laterale</i>; grasses such as Kangaroo Grass (<i>Themeda australis</i>), Wiry Panic (<i>Entolasia stricta</i>) and Blady Grass (<i>Imperata cylindrica</i>); along with other forbs such as <i>Lomandra multiflora</i>, Flax Lily (<i>Dianella caerulea</i> var. <i>producta</i>), <i>Lomandra obliqua</i>; and herbs such as <i>Pomax umbellata</i> and Lesser Flannel Flower (<i>Actinotus minor</i>).</p>
Condition	Very good – intact vegetation structure, high native plant species richness, generally low exotic plant cover. Localised moderate exotic plant cover along the western edge of the extent of the vegetation community, including within the proposal disturbance footprint.
Threatened species of plant?	None within the proposal disturbance footprint.
Threatened ecological community?	No

Hinterland Sandstone Gully Forest

Extent and distribution within proposal disturbance footprint	A short, narrow strip (0.148 ha in area) in the eastern edge of the proposal disturbance footprint which is continuous within an extensive patch off site to the east. It occurs on Hawkesbury Sandstone derived soils, on mid and lower slopes, with frequent rock outcrop, slight cross-slopes and free drainage. The portion of the community adjoining the proposal disturbance footprint is associated with sideslopes above a gully that contains a small drainage line which flows to the east. A small portion (0.017 ha) of vegetation classified as Hinterland Sandstone Gully Forest is classified as Southern Sydney Sheltered Forest EEC, and occurs within the proposal disturbance footprint, refer to Figure 3a.
Survey effort	One 20m x 20m vegetation quadrat (Q3; refer to Figure 2)
Description	<p>This community has a forest form (Specht, 1970) with an open shrub and small tree layer and a dense understorey of ferns, sedges and grasses. The canopy is dominated by Smooth-barked Apple (<i>Angophora costata</i>) and Sydney Peppermint (<i>Eucalyptus piperita</i>). On side slopes there is an open small tree layer of Old Man Banksia (<i>Banksia serrata</i>), Cheese Tree (<i>Glochidion ferdinandii</i>) and Christmas Bush (<i>Ceratopetalum gummiferum</i>). On lower slopes and gullies there is a dense small tree layer of Coachwood (<i>C. apetalum</i>) and Grey Myrtle (<i>Backhousia myrtifolia</i>). There is an open, diverse and variable shrub layer of species such as Narrow-leaved Geebung (<i>Persoonia linearis</i>), Spiny-leaf Podocarp (<i>Podocarpus spinulosa</i>).</p> <p>There is diverse and variable understorey, including: grasses such as Weeping Grass (<i>Microlaena stipoides</i>), Wiry Panic (<i>Entolasia stricta</i>) and Kangaroo Grass (<i>Themeda australis</i>); ferns such as Bracken (<i>Pteridium esculentum</i>), Common Maidenhair (<i>Adiantum aethiopicum</i>) and Rainbow Fern (<i>Calochlaena dubia</i>); forbs such as Burrawang (<i>Macrozamia communis</i>), Flax Lily (<i>Dianella caerulea</i> var. <i>producta</i>). There are large numbers of scramblers and climbers such as Sweet Sarsparilla (<i>Smilax glycyphylla</i>), Wonga Wonga Vine (<i>Pandorea pandorana</i>) and Hairy Apple Berry (<i>Billardiera scandens</i>).</p> <p>There is localised severe infestation with Crofton Weed (<i>Ageratina adenophora</i>*) and African Love Grass (<i>Eragrostis curvula</i>*).</p>
Condition	Good – intact vegetation structure, high native plant species richness, generally low exotic plant cover. Localised high exotic plant cover in the western portion of the vegetation community, including within the proposal disturbance footprint.
Threatened species of plant?	None within the proposal disturbance footprint.
Threatened ecological community?	A small (0.508 ha) area in the upper reaches of a gully (including approximately 0.017 ha within the proposal disturbance footprint) comprises 'Southern Sydney sheltered forest on transitional sandstone soils in the Sydney Basin Bioregion'. There is 0.017 ha of EEC vegetation within the proposal disturbance footprint.

Exotic shrubland

Extent and distribution within proposal disturbance footprint	A linear strip of 3.376 ha adjoining Alford's Point Road associated with disturbed land. It occurs on flat land at the edge of the road and adjoining table drains and cuttings. This community also occurs within the entire 6000 m ² construction site compound. Soils and landforms would originally have been associated with ridge tops on Hawkesbury Sandstone but have been extensively modified.
Survey effort	Two systematic traverses (area search 1 adjacent to Alford's Point Road and area search 2 within the construction site compound; refer to Appendix A).
Description	<p>This community has a variable structure including areas of open and closed shrubland and tussock grassland (Specht, 1970). It is dominated by exotic species, including noxious and environmental weeds with occasional remnant or opportunistic native plants associated with the two native communities described above.</p> <p>There are occasional, isolated sub-mature native trees including Smooth-barked Apple (<i>Angophora costata</i>), Sydney Peppermint (<i>Eucalyptus piperita</i>) and Coastal Banksia (<i>Banksia integrifolia</i>). The construction site compound also contains a single mature Forest Red Gum (<i>Eucalyptus tereticornis</i>), a number of exotic ornamental trees, including Pines (<i>Pinus</i>* spp.) and Desert Ash (<i>Fraxinus angustifolia</i> subsp. <i>angustifolia</i>) and the environmental weed Coral Tree (<i>Erythrina x sykesii</i>).</p> <p>The shrub layer, where present, is dominated by Lantana (<i>Lantana camara</i>) and Bitou Bush (<i>Chrysanthemoides monilifera</i> subsp. <i>Rotundata</i>*). There is locally dense cover of tall forbs such as Fleabane (<i>Conyza bonariensis</i>*) and Purpletop (<i>Verbena bonariensis</i>*) and the tussock grass African Love Grass (<i>Eragrostis curvula</i>*). Throughout, there is a very high cover of a diverse mix of exotic grasses, scramblers and herbs including noxious and environmental weeds. There are occasional native shrubs, herbs and grasses associated with the two native communities described above, though always at low cover abundances.</p> <p>The mapped extent of this community also includes gravel tracks, hardstand areas and other infrastructure with occasional plants associated with cracks or shallow soil deposits.</p>
Condition	Poor – >70% exotic plant cover and does not qualify as native vegetation. No intact vegetation structure, moderate native plant species richness but very low cover.
Threatened species of plant?	None in proposal disturbance footprint.
Threatened community?	No.

Planted native vegetation

Extent and distribution within proposal disturbance footprint	Short linear strips within a total area of 0.586 ha associated with shoulders and median strips in Alfords Point Road. It occurs on flat land at the edge of the road and adjoining table drains and cuttings. Soils and landforms would originally have been associated with ridge tops on Hawkesbury Sandstone but have been extensively modified.
Survey effort	One systematic traverse (area search 1; refer to Appendix A)
Description	<p>This community has a variable structure including areas of scrub and tussock grassland (Specht, 1970). It is dominated by a small number of planted native species broadly associated with the two native communities described above along with occasional noxious and environmental weeds.</p> <p>One patch consists of a linear strip of the small tree Black She-Oak (<i>Casuarina littoralis</i>). Another consists of densely planted Spiny-headed Mat-rush (<i>Lomandra longifolia</i>).</p>
Condition	Moderate – >50% native plant cover, but does not contain original soil profiles and genetic provenance of plants is unknown, so would not qualify as native vegetation. No intact vegetation structure, low native plant species richness and moderate cover.
Threatened species of plant?	None in proposal disturbance footprint.
Threatened community?	No.

4.2.3 Groundwater dependant ecosystems

The proposal disturbance footprint is in a high rainfall area (1017 mm average annual rainfall – BOM, 2012) and so native vegetation would not rely on groundwater to achieve a forest or woodland structure. There are no swamps or wetlands within the proposal disturbance footprint or other evidence of a shallow water table. The proposal disturbance footprint is on a ridge with greater than 100 m elevation above the Georges River and so it is likely that depths to groundwater are considerable and that terrestrial vegetation would rely on surface water.

The proposal will not extract or intercept groundwater. The proposal will affect surface water flows but this would have a minor effect on the contribution of surface water to regional groundwater flows given the relatively small area of the proposal disturbance footprint and the extensive existing modification to surface water flows in the locality for existing roads and suburban development.

Based on the above considerations the proposal is unlikely to affect any groundwater dependant ecosystems and so they are not considered further in this assessment.

4.2.4 Noxious and environmental weeds

The *Noxious Weeds Act 1993* provides for the declaration of noxious weeds in local government areas. Landowners and occupiers must control noxious weeds according to the control category specified in the Act. Public authorities must control noxious weeds according to the control category to the extent necessary to prevent their spread to adjoining land.

The proposal disturbance footprint contains six species declared as noxious weeds in the Sutherland Local Government Area (LGA), as shown in Table 3 below. These noxious species occurred in generally low numbers throughout the exotic shrubland in disturbed areas of the proposal disturbance footprint. There is a localised severe infestation with the noxious weeds Lantana (*Lantana camara**) and Bitou Bush (*Chrysanthemoides monilifera* subspecies *rotundata**) in the north of the proposal disturbance footprint, which extends off site to the north in the vicinity of the Alford's Point Bridge.

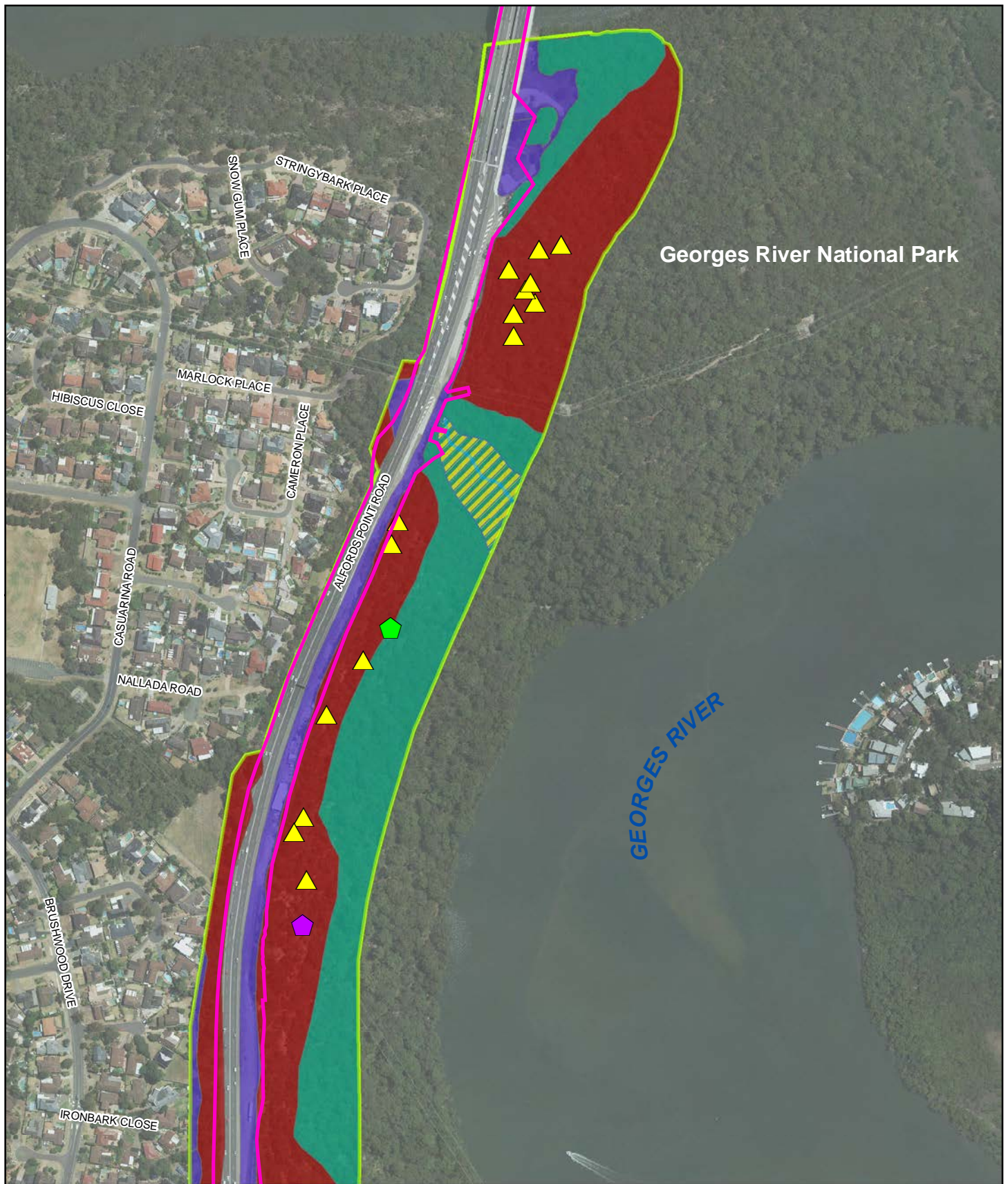
Table 3 Declared noxious weeds of the Sutherland LGA recorded during the field survey.

Scientific Name	Common Name	Control category	Legal Requirements
<i>Lantana camara</i> *	Lantana	4	The growth of the plant must be managed in a manner that reduces its numbers, spread and incidence and continuously inhibits its reproduction
<i>Chrysanthemoides monilifera</i> subspecies <i>rotundata</i> *	Bitou bush	4	The growth of the plant must be managed in a manner that reduces its numbers, spread and incidence and continuously inhibits its reproduction
<i>Ricinus communis</i>	Castor oil plant	4	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction
<i>Cestrum parqui</i> *	Green Cestrum	3	Green Cestrum The plant must be fully and continuously suppressed and destroyed
<i>Ligustrum lucidum</i> *	Privet (Broad-leaf)	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
<i>Ligustrum sinense</i> *	Privet (Narrow-leaf/Chinese)	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



These noxious weeds are interspersed with severe infestations of environmental weeds throughout the study area. The exotic grasses Paspalum (*Paspalum dilatatum**), African Love Grass (*Eragrostis curvula**), Narrow-leaved Carpet Grass (*Axonopus fissifolius**) and Kikuyu Grass (*Pennisetum clandestinum**) are abundant in the road reserve adjoining Alford's Point Road. There is also localised severe infestation with Crofton Weed (*Ageratina adenophora**) in a gully which extends eastwards from the subject.

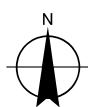
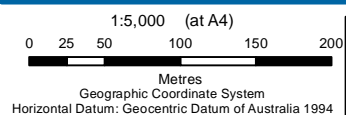
The distribution of noxious and environmental weeds in the study area is closely tied to disturbance, with road verges, drainage works and other recently cleared environments dominated by exotic plant species. Surface water and potentially also nutrient flows from hard stand areas would be contributing to the observed weed infestation. Adjoining areas of native vegetation are relatively free of weeds as is typical of exposed positions on Hawkesbury Sandstone substrates. These environments are relatively dry and nutrient-poor which means that native vegetation is less susceptible to weed infestation (pers. obs.).



LEGEND

- | | | | | | |
|--|---|--|--------------------------------|--|--------------------------------------|
| | Yellow-bellied Sheathtail Bat (<i>Saccolaimus flaviventris</i>) | | Proposal Disturbance Footprint | | Southern Sydney Sheltered Forest EEC |
| | Large-eared Pied bat (<i>Chalinolobus dwyeri</i>) | | Study Area | | Coastal Sandstone Ridgetop Woodland |
| | Hollow-bearing Tree | | | | Hinterland Sandstone Gully Forest |
| | Drainage Line | | | | Planted Natives |
| | | | | | Exotic Shrubland |

Note: Grey-headed Flying-fox (*Pteropus poliocephalus*) observed flying over at multiple locations



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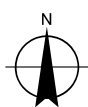
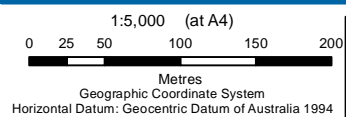
Figure 3a



LEGEND

- Yellow-bellied Sheathtail Bat (*Saccolaimus flaviventris*)
- Large-eared Pied bat (*Chalinolobus dwyeri*)
- Hollow-bearing Tree
- Drainage Line
- Proposal Disturbance Footprint
- Study Area
- Southern Sydney Sheltered Forest EEC
- Coastal Sandstone Ridgetop Woodland
- Hinterland Sandstone Gully Forest
- Planted Natives
- Exotic Shrubland

Note: Grey-headed Flying-fox (*Pteropus poliocephalus*) observed flying over at multiple locations

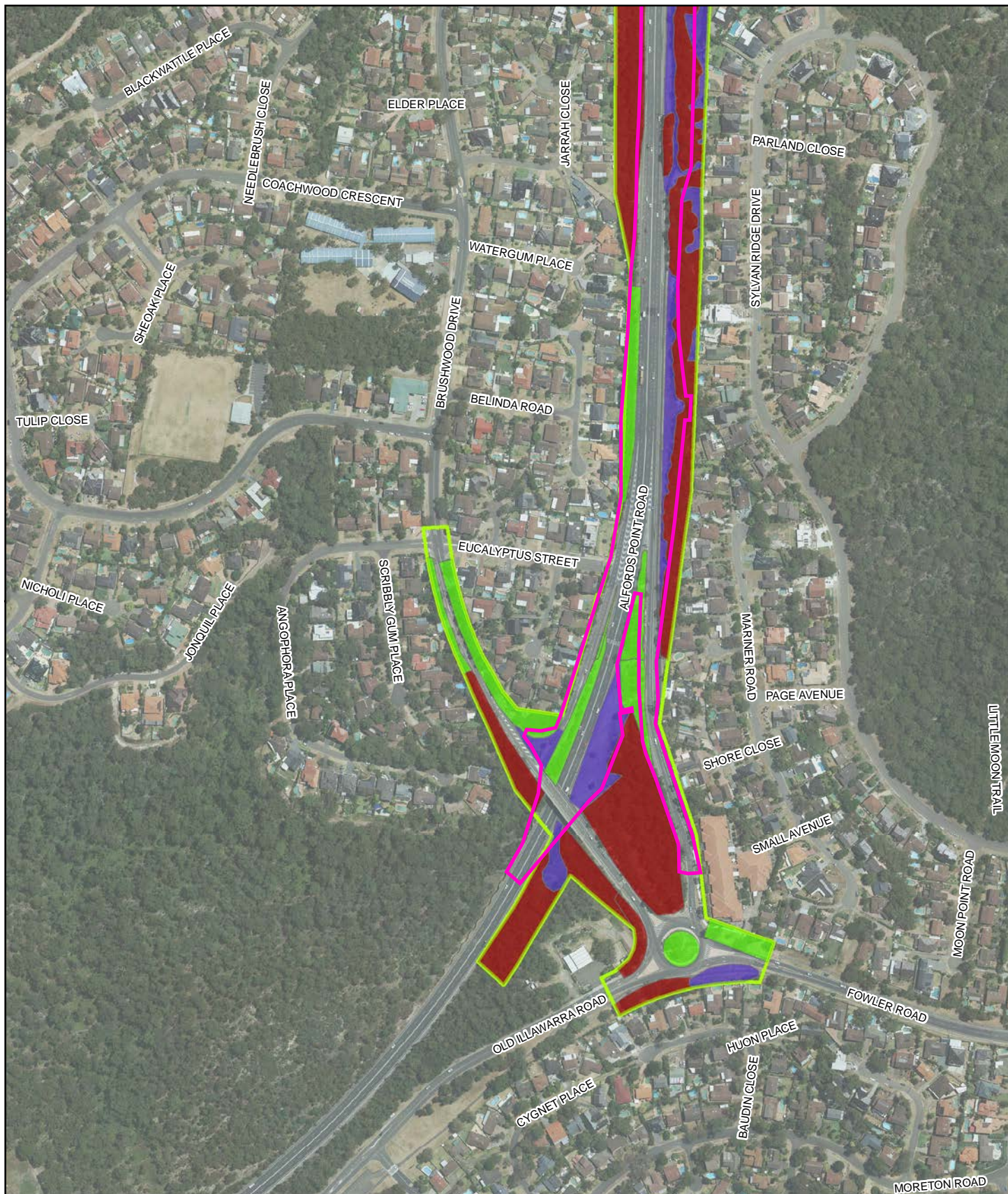


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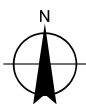
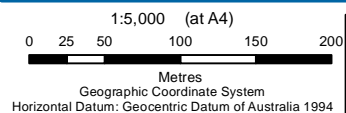
Figure 3b



LEGEND

- | | | | | | |
|--|---|--|--------------------------------|--|--------------------------------------|
| | Yellow-bellied Sheathtail Bat (<i>Saccolaimus flaviventris</i>) | | Proposal Disturbance Footprint | | Southern Sydney Sheltered Forest EEC |
| | Large-eared Pied bat (<i>Chalinolobus dwyeri</i>) | | Study Area | | Coastal Sandstone Ridgetop Woodland |
| | Hollow-bearing Tree | | | | Hinterland Sandstone Gully Forest |
| | Drainage Line | | | | Planted Natives |
| | | | | | Exotic Shrubland |

Note: Grey-headed Flying-fox (*Pteropus poliocephalus*) observed flying over at multiple locations



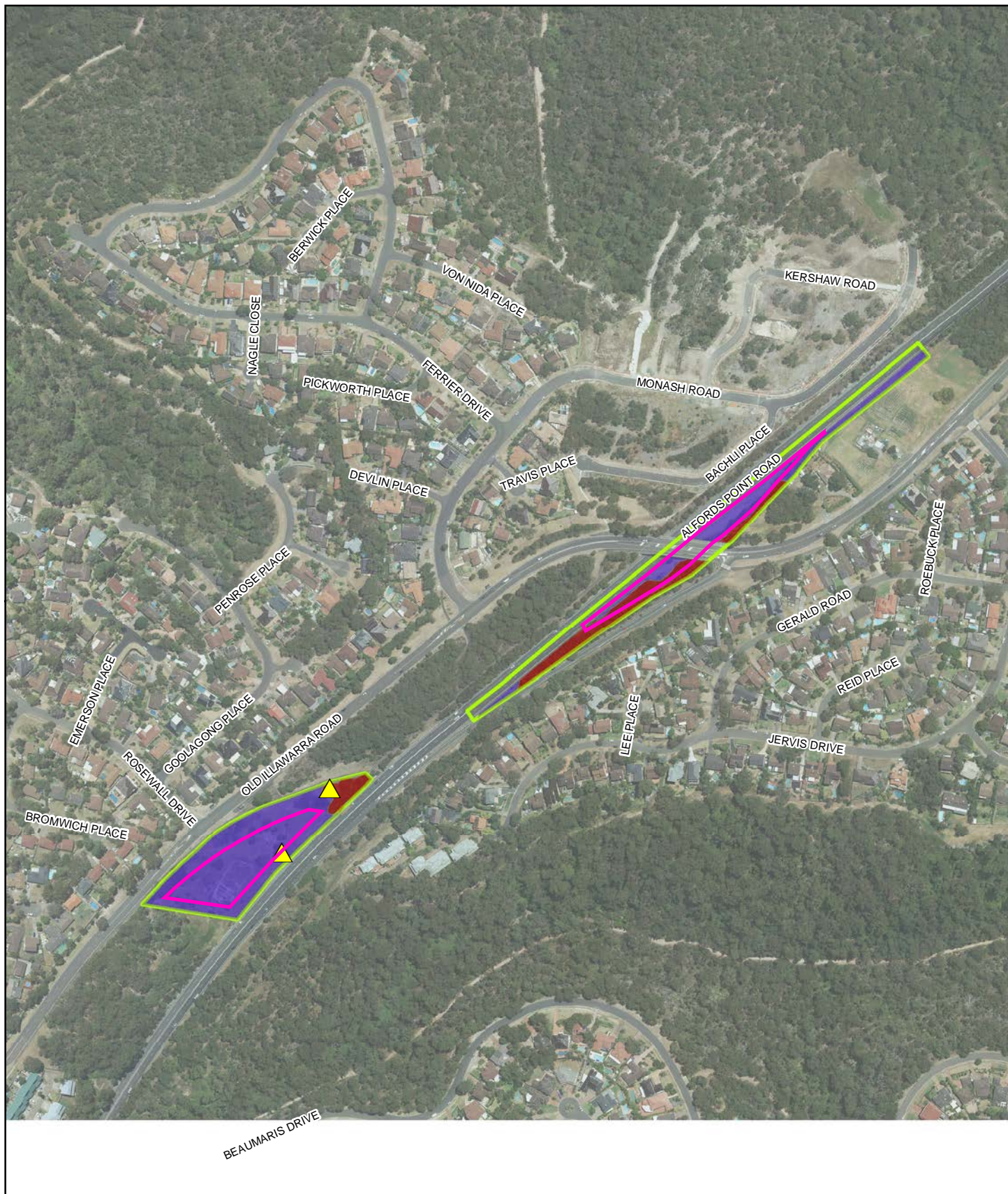
CLIENTS | PEOPLE | PERFORMANCE

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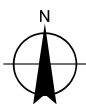
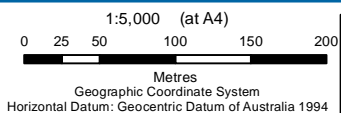
Figure 3c



LEGEND

- | | | | | | |
|--|---|--|--------------------------------|--|--------------------------------------|
| | Yellow-bellied Sheathtail Bat (<i>Saccolaimus flaviventris</i>) | | Proposal Disturbance Footprint | | Southern Sydney Sheltered Forest EEC |
| | Large-eared Pied bat (<i>Chalinobus dwyeri</i>) | | Study Area | | Coastal Sandstone Ridgetop Woodland |
| | Hollow-bearing Tree | | | | Hinterland Sandstone Gully Forest |
| | Drainage Line | | | | Planted Natives |
| | | | | | Exotic Shrubland |

Note: Grey-headed Flying-fox (*Pteropus poliocephalus*) observed flying over at multiple locations



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Biota and Habitat Features

Figure 3d



4.3 Fauna

4.3.1 Fauna species

A total of 52 species of native fauna and one exotic bird species were recorded during the field surveys, comprising three frog species, 37 bird species, eight mammal species and four reptile species (see Appendix A). One threatened species, the Grey-headed Flying-fox (*Pteropus poliocephalus*), and two species listed as migratory under the EPBC Act were recorded (see Section 4.4). Two additional threatened species, the Large-eared Pied Bat (*Chalinolobus dwyeri*) and Yellow-bellied Sheath-tail-bat (*Saccolaimus flaviventris*), are potentially present based on 'probable' Anabat call recordings.

Birds

Of the 37 bird species recorded, the majority were common woodland bird species often seen in semi-urban bush remnants around Sydney. Bird species diversity and abundance were higher within relatively intact vegetation to the east of the proposal footprint: habitats along the road are subject to high noise levels from the busy road and contain few habitat resources of relevance to most native species.

Bird species observed included:

- ▶ Large, generalist birds common in urban areas, including Sulphur-crested Cockatoos (*Cacatua galerita*), Australian Magpie (*Cracticus tibicen*), Australian Raven (*Corvus coronoides*) and Rainbow Lorikeets (*Trichoglossus haematodus*).
- ▶ Small woodland birds, including Thornbills (*Acanthiza* spp.), Red-browed Finch (*Neochmia temporalis*), Fairy-wrens (*Malurus* spp.), Fantails (*Rhipidura* spp.), Eastern Spinebill (*Acanthorhynchus tenuirostris*) and Eastern Yellow Robins (*Eopsaltria australis*).
- ▶ Two large raptors, the White-bellied Sea-eagle (*Haliaeetus leucogaster*), seen overflying the site only, and the Brown Goshawk (*Accipiter fasciatus*) which was perched in vegetation on the west side of Alford's Point Road.
- ▶ Two nocturnal bird species, the Australian Owlet Nightjar (*Aegotheles cristatus*) and Southern Boobook (*Ninox novaeseelandiae*).

The full list of species observed is included in Appendix A.

Mammals

The Grey-headed Flying-fox was recorded overflying the study area during nocturnal surveys, but was not recorded landing or foraging within vegetation. This species is listed as vulnerable under both the TSC and EPBC Acts and is discussed in Section 4.4.

Anabat call analysis revealed two 'definite' identifications of microbat species: the White-striped Freetail-bat (*Tadarida australis*) and the Gould's Wattled Bat (*Chalinolobus gouldii*). The White-striped Freetail-bat was also heard foraging in vegetation above the road cuttings on the eastern side of Alford's Point, and several microbats were also observed foraging throughout the study area but could not be identified.

Anabat recording files were of very poor – moderate quality resulting in the majority of bat calls being probable or belonging to a species group or multiple species. The majority of bat calls only consisted of short sequences with poor – moderate quality pulses making positive call identification difficult.



Two threatened species, Large-eared Pied Bat (*Chalinolobus dwyerii*, listed as a vulnerable species on the TSC and EPBC Acts) and Yellow-bellied Sheath-tail-bat (*Saccolaimus flaviventris*), listed as a vulnerable species on the TSC Act) were both 'probably' recorded from one call each. The duration and quality of call prevented definite identification. For the purposes of this assessment both threatened species are assumed to be present in the study area.

Detailed Anabat call analysis results are presented in Appendix B.

A Red-necked Wallaby (*Macropus rufogriseus*) was observed in Georges River National Park during morning bird surveys, and several other macropods were heard or glimpsed throughout the field surveys but could not be identified.

Common Ringtail Possums (*Pseudocheirus peregrinus*) were observed foraging in the study area and it is likely that other common arboreal mammal species would occur.

Frogs and reptiles

Due to recent rain, drains and areas of grassland along the road and on access tracks through the national park supported small pools of standing water, from which Common Eastern Froglets (*Crinia signifera*) and Brown-striped Frogs (*Limnodynastes peronei*) were heard calling. Common Eastern Froglets and Smooth Toadlets (*Uperoleia laevis*) were also seen and heard calling from a pond on the ridge-top in the north-east of the study area, in what appears to be a former excavation pit.

Pale- and Dark-flecked Garden Sunskinks (*Lampropholis delicata* and *L. guichenoti*) were abundant throughout the study area, and were observed foraging and basking in leaf litter and along rock outcrops. A Copper-tailed Skink (*Ctenotus taeniolatus*) was observed foraging in leaf litter and debris at the base of the existing road cutting, and an Eastern Blue-tongue (*Tiliqua scincoides*) was recorded basking in exotic grasses on the verge of the existing road.

4.3.2 Fauna habitats

Three broad fauna habitat types were recorded within the study area:

- ▶ Exotic shrubland and cleared areas.
- ▶ Native woodland and forest.
- ▶ Drainage line and wetland habitats.

The suitability of these habitats for native fauna are discussed below, with particular emphasis on habitat resources of relevance to threatened fauna.

The proposal disturbance footprint is dominated by exotic shrubland and cleared areas (including around 3.376 hectares of exotic vegetation and 0.586 hectares of planted native vegetation). The proposal disturbance footprint intersects about 2.715 hectares of native woodland and forest vegetation communities as shown on Figure 3. Georges River is located to the north and east of the study area. The proposal disturbance footprint will also impact on the upper portion of a small gully that runs east from Alford's Point Road towards the Georges River (see Figure 3). Vegetation within this location coincides with the EEC Southern Sydney Sheltered Forest, which is typically associated with gently sloping geomorphic settings, with sheltered aspects. The drainage line present within the study area is described in detail later in this section.



Exotic shrubland and cleared areas

These areas occur along the verge of Alford's Point Road and the existing cycleway, as well as around residential developments in the southern part of the study area. As discussed in Section 4.2.2, these areas would have historically supported native woodland vegetation but have been extensively modified by previous developments.

These areas have limited habitat value for native fauna. Regrowth trees and shrubs would provide some foraging resources for native birds such as Thornbills and Red-browed Finches which were observed in these areas during the survey. Several species of native reptiles were also observed foraging and basking in areas of exotic grassland. Most of these species would use these areas as an adjunct to the higher quality, more extensive areas of suitable habitat available to the east in the Georges River National Park and it is unlikely that any species or individuals of native fauna would be reliant on these habitats for their survival. The habitat value of these exotic shrubland areas is further reduced by the high degree of noise, light and air pollution generated by Alford's Point Road, which is a busy arterial road with continuous traffic flow at most times of day and night.

These areas contain no habitat features of relevance to threatened fauna. Several species of threatened birds and microbats would be considered likely to occur in adjacent habitats within Georges River National Park (see below) but would be unlikely to occur within areas of exotic shrubland or cleared areas.

Native woodland and forest

Native woodland and forest in the broader study area adjacent to the proposal footprint within Georges River National Park provides good quality fauna habitats. These habitats include: extensive rock outcrops, plateaus and overhangs; abundant woody debris and leaf litter; patches of dense understorey shrubs; hollow-bearing trees and a range of fruiting and flowering trees and shrubs. As discussed in Section 4.1.5, this vegetation also has good connectivity with native vegetation along the Georges River and Mill Creek and eventually with large protected areas and conservation reserves such as the Holsworthy Military Area and Heathcote National Park. There is some noise and light disturbance, particularly in areas directly adjacent to the existing road, however this is quickly attenuated as the land slopes steeply away from the top of the existing cutting down towards the Georges River. Based on these attributes this vegetation would be expected to support a large suite of native fauna, including a number of threatened species.

The extensive rock landforms, fallen woody debris and leaf litter within the study area would provide habitat for a range of native reptiles and small mammals. In addition to the reptile species recorded, a range of native skinks, dragons and geckos would be expected to occur such as the Eastern Water Dragon (*Physignathus lesueurii*) and Leaf-tailed Gecko (*Phyllurus platurus*). A small nest was also found in sandstone honeycombing in an overhanging, which was thought to be from a Bush Rat (*Rattus fuscipes*). Sandstone overhangs, honeycombing and crevices may provide roosting habitat for threatened microbats such as the Large-eared Pied Bat (*Chalinolobus dwyeri*) or Eastern Bentwing-bat (*Miniopterus australis*).

A total of 16 habitat trees, including hollow-bearing trees, were recorded in the study area as shown on Figure 3. The proposed construction site compound contains a single mature, hollow-bearing Forest Red Gum (*Eucalyptus tereticornis*). The construction site compound would be laid out so as to avoid impacts on this tree. There are no other hollow-bearing trees in the proposal disturbance footprint. Hollow-bearing trees within the study area supported a range of different sized hollows, from less than 5 centimetre



diameter to over 20. These hollows would provide roosting and potentially breeding for arboreal mammals, bats and birds such as the Common Ringtail Possum (*Pseudocheirus peregrinus*), White-striped Freetail-bat (*Tadarida australis*) and Rainbow Lorikeet (*Trichoglossus haematodus*), all of which were observed at the site. These hollows would also provide potential habitat for threatened hollow-dependant fauna such as the Yellow-bellied Sheath-tail-bat (*Saccolaimus flaviventris*), Yellow-bellied Glider (*Petaurus australis*) and Eastern Freetail-bat (*Mormopterus norfolkensis*).

Eucalypts in the study area represent known or preferred feed trees for a number of fauna species, including threatened birds and the Grey-headed Flying-fox. Red Bloodwood is a keystone nectar feed tree (DEC 2008) and is a known feed tree for the threatened Grey-headed Flying-fox, Swift Parrot (*Lathamus discolor*) and Yellow-bellied Glider. None of the eucalypts recorded are winter-flowering species, however, winter-flowering banksias and acacias at the site would help provide year-round foraging resources for a range of native birds, bats and mammals. None of the tree species are Koala food trees listed under Schedule 2 of SEPP 44 or are regional primary, secondary or supplementary food trees identified in the Koala Recovery Plan.

There is also a thin strip of native vegetation within the southern half of the study area which is located between the existing road and residential properties. Vegetation in this area has a highly modified understorey, is less than 50 metres wide and would have generally low value for native fauna, but does provide connectivity between habitat areas to the north and south.

Drainage line and wetland habitats

There is a small, first order drainage line running through the study area to the east of the proposal disturbance footprint. It has been modified during construction and maintenance of the existing Alford's Point Road. The upper 20 metres of the drainage line comprises a concrete channel, its banks are artificial and comprise stacked oversize sandstone and its source is a stormwater drain discharging from beneath Alford's Point Road. It is assumed that any drainage works required for the proposal would be restricted to the disturbed portions of the drainage line.

Downstream to the east the drainage line runs down a steep gully and is mostly bedrock confined, with defined banks. It is in good condition with intact geomorphology, intact riparian vegetation and apparently good water quality. It contained moderate contamination with coarse particulates (i.e. rubbish) and moderate weed infestation.

The drainage line contained pools of surface water up to 30 cm deep and was flowing rapidly. Given the steep slope and porous soil and geology, the creek is likely to be intermittent with scattered semi-permanent pools of water. This type of drainage line would provide breeding habitat for a number of stream breeding frogs, potentially including the Brown-striped Frog, Lesueur's Frog (*Litoria lesueuri*). The drainage line is not suitable habitat for any of the threatened frogs with the potential to occur in the locality.

The remainder of the study area has little in the way of wetland habitats. As mentioned in Section 4.3.1, there were a number of flooded grassy depressions observed due to the recent rain, and a small pond in what appeared to be a former excavation. These areas supported common, generalist frogs such as the Common Eastern Froglet and Smooth Toadlet, and would also be likely to provide habitat for reptiles such as the Eastern Water Skink (*Eulamprus quoyii*) and Red-bellied Black-snake (*Pseudechis porphyriacus*).



4.4 Conservation significance

Based on the desktop assessment the following threatened biota and MNES have the potential to occur in the locality:

- ▶ 18 threatened ecological communities (TECs)
- ▶ 32 threatened flora species
- ▶ 51 threatened fauna species
- ▶ One endangered population
- ▶ 13 migratory species
- ▶ One National Heritage Place
- ▶ One Ramsar wetland

This list does not include marine threatened and migratory species such as the Dugong (*Dugong dugon*), Green Turtle (*Chelonia mydas*) or shorebirds which were highlighted by the database searches.

The status of these threatened biota and MNES within the proposal disturbance footprint is described below.

4.4.1 Threatened biota (TSC Act and FM Act)

The database searches identified 31 threatened flora species, one endangered flora population and 50 threatened fauna species listed under the TSC Act as having been previously recorded or predicted to occur in the locality (see Appendix C). Seventeen threatened ecological communities (TECs) listed under the TSC Act have been mapped in the locality (Tozer *et al.* 2010).

No threatened biota listed under the FM Act have been previously recorded or are predicted to occur in the locality of the study area (see Appendix C).

Threatened ecological communities

One endangered ecological community (EEC) listed under the TSC Act, Southern Sydney Sheltered Forest, occurs within the study area and 0.017 ha of this community occurs within the proposed disturbance footprint. This community occurs along a gully that runs east from Alford's Point Road towards the Georges River (see Figure 3). The EEC coincides with the Hinterland Sandstone Gully Forest vegetation community, however only a portion of this vegetation type within the study area qualifies as Southern Sydney Sheltered Forest. Southern Sydney Sheltered Forest is associated with gently sloping geomorphic settings, with sheltered aspects on sandstone-derived soils that show evidence of enrichment from shale-derived substrates upslope. The area of EEC mapped on Figure 3 was identified based on geomorphic position, sheltered (east facing) aspect, characteristic flora species and heavier (i.e. clay-enriched) soil. The remainder of the Hinterland Sandstone Gully Forest in the study area is associated with steeper slopes and sandy soils, where contribution of shale-derived material from upslope would be minimal, and hence, is not included within the EEC criteria. Southern Sydney Sheltered Forest is likely to occur elsewhere in the locality surrounding the study area that was directly observed and mapped during the field survey.

No other threatened ecological communities are present in the study area.



Threatened flora species

No threatened flora species were recorded during the field surveys. Of the 31 threatened flora species previously recorded in the locality, 11 can be discounted as having nil chance of occurring in the study area or being affected by the proposal. These species are associated with specific habitat types that are not present in the study area, as described in Appendix B. Notably there are a number of plant species associated with shale or tertiary gravel habitats of the Cumberland Plain which are present within the locality but can be reliably excluded from occurring in Hawkesbury Sandstone habitats within the study area.

There is broadly suitable habitat for the remaining 20 species within the study area; however they can be reliably discounted as occurring based on known distributions and/or the field survey effort undertaken. None of the species with known habitat preferences similar to habitats within the study area are cryptic or require seasonal surveys and so it is unlikely that they would not have been detected if they were present.

Habitat within the proposal footprint has been heavily modified by construction of Alford's Point Road, particularly the excavation of cuttings to accommodate the existing road corridor. Soil material within the proposal disturbance footprint consists of subsoil that has been exposed by excavations and is well below the original soil surface or recently deposited sediments on exposed Hawkesbury sandstone substrate. This habitat is dominated by exotic grasses and herbs with some regrowth of opportunistic native species. It is highly unlikely that any threatened flora species persist in the soil seed bank within the proposal footprint. It is also unlikely that any threatened plant species would colonise this area in the future since no threatened plants were observed in the study area and these threatened plants would not be opportunistic and able to spread considerable distances into disturbed habitats.

Vegetation within the Georges River National Park outside of the study area contains potential habitat for a number of these species of threatened flora. Given the mitigation measures proposed in Section 6 and standard RMS management practices it is highly unlikely that the proposal would affect any threatened plants or their habitats beyond the study area.

Threatened fauna

The Grey-headed Flying-fox, which is listed as vulnerable under both the TSC and EPBC Acts, was recorded flying over the study area during nocturnal surveys and would be expected to forage within the study area on an occasional basis. There is no roosting or breeding habitat for this species within the study area: this species roosts and breeds within communal camps with up to several thousands of individuals roosting together. The locations of such camps are relatively well known: the closest continuously occupied camp to the site is at Kareela, some 6.5 km to the south-east; while there is an occasionally occupied camp at Menai, approximately 3 km to the south-west.

Two threatened microbat species were tentatively recorded based on 'probable' Anabat recordings: the Yellow-bellied Shearwater Bat and Large-eared Pied Bat. There are no potential roost sites for either species in the proposal disturbance footprint. They may use aerial foraging habitat through and above the proposal disturbance footprint on occasion.

There are 88 previous records of the Koala within a 10 kilometre radius of the site since 1985 (OEH, 2011a). The majority of these records are from the Holsworthy Military Area to the west of the study area and the Georges River National Park to the east. The proposal disturbance footprint is isolated from these areas of known habitat by residential development, Alford's Point Road and associated steep cuttings and batters. The proposal disturbance footprint does not contain any Koala food tree species.



identified on Schedule 2 of SEPP 44 or any primary, secondary or supplementary Koala food trees identified for this region in the Koala Recovery Plan (DECC 2008). Given the absence of known food trees and the landscape context, Koalas are unlikely to occur in the proposal disturbance footprint and the habitat present would not support a resident local population.

As discussed in Section 4.3.2, the proposal footprint is highly modified and contains no habitat resources of relevance to any other threatened fauna species. The footprint supports some juvenile and sub-mature eucalypts which would provide limited nectar and pollen for nectivorous species. Given the context of these trees at the base of a steep cutting, directly adjacent to a busy arterial road they are unlikely to be utilised by any threatened fauna. These species would be more likely to use the extensive areas of alternative, better quality habitats within Georges River National Park and other conservation reserves in the locality.

A range of threatened fauna would be expected to occur within Georges River National Park immediately to the east of the proposal, and aerial threatened fauna such as microbats and birds may fly over the proposal footprint while foraging or moving through the landscape. There are no recent local records or specific habitat resources that suggest that permanent local populations of any of these threatened biota are present in the study area. Some individual threatened fauna may utilise habitat in the proposal footprint and/or study area on a transitory or opportunistic basis. The following mobile threatened fauna species are identified as 'possibly' occurring in the study area on occasion and potentially being affected by the proposal: Gang Gang Cockatoo; Masked Owl; Glossy Black Cockatoo; Powerful Owl; Eastern Freetail-bat; Greater Broad-nosed Bat and Eastern Bentwing Bat.

4.4.2 EPBC Act MNES

The database searches identified five threatened ecological communities, 25 threatened flora species, 19 threatened fauna species and 13 migratory species listed under the EPBC Act as potentially occurring in the study area (see Appendix B). Two additional MNES, a National Heritage Place and a Ramsar wetland, were also identified as occurring within the locality. No World Heritage Properties or Commonwealth Marine Areas were identified.

Threatened ecological communities

No threatened ecological communities listed under the EPBC Act occur within the study area.

Threatened flora

No threatened flora species listed under the EPBC Act were recorded within the study area. As discussed in Section 4.4.1, no threatened flora species would be likely to occur within the highly modified habitats within the proposal footprint and secondary effects on threatened plants potentially present within Georges River National Park are highly unlikely.

Threatened fauna

The Grey-headed Flying-fox was recorded flying over the study area. The Large-eared Pied Bat was tentatively recorded based on 'probable' Anabat recordings. Both of these species are listed as 'vulnerable species' under the EPBC Act and are also listed under the TSC Act and discussed in Section 4.4.1 above. As for threatened fauna listed under the TSC Act, a range of threatened fauna would be expected to occur within habitats in Georges River National Park, but these species would be highly unlikely to use habitats within the proposal footprint given the highly modified nature of these habitats and their position next to a busy arterial road. As noted above, the Koala is unlikely to occur in the



proposal disturbance footprint given an absence of known food trees and the isolation of the site from areas of known habitat in the wider locality by residential development, Alford's Point Road and associated steep cuttings and batters.

Migratory and marine fauna

Three marine bird species, four wetland birds (two of which are also listed as marine species) and seven 'terrestrial' bird species were identified by the EPBC Online Protected Matters Search Tool results (DSEWPaC 2012a), comprising:

- ▶ Wetland species:
 - Great Egret (*Ardea alba*; also listed as marine)
 - Cattle Egret (*Ardea ibis*; also listed as marine)
 - Latham's Snipe (*Gallinago hardwickii*)
 - Painted Snipe (*Rostratula benghalensis*)
- ▶ 'Terrestrial' species
 - White-bellied Sea-eagle (*Haliaeetus leucogaster*)
 - White-throated Needletail (*Hirundapus caudacutus*)
 - Rainbow Bee-eater (*Merops ornatus*)
 - Black-faced Monarch (*Monarcha melanopsis*)
 - Satin Flycatcher (*Myiagra cyanoleuca*)
 - Rufous Fantail (*Rhipidura rufifrons*)
 - Regent Honeyeater (*Xanthomyza phrygia*)
- ▶ 'Marine' species
 - Fork-tailed Swift (*Apus pacificus*)

Two of these migratory bird species were observed during field surveys: the White-bellied Sea-eagle (*Haliaeetus leucogaster*) soaring overhead and above the Georges River; and the Rufous Fantail (*Rhipidura rufifrons*) foraging in native vegetation to the east of the study area.

The proposal footprint would have little value any of these migratory species, as it comprises highly modified residential and cleared areas. As for threatened fauna, migratory fauna species occurring within Georges River National Park would be unlikely to utilise habitats within the proposal footprint given the highly modified nature of these habitats and their position next to a busy arterial road.

Vegetation within Georges River National Park is in excellent condition with connectivity to extensive areas of good quality native vegetation including the Holsworthy Military reserve and Heathcote National Park. Several Rufous Fantails were observed within this vegetation, and other 'terrestrial' migratory species would also be likely to occur in these habitats. The White-bellied Sea-eagle was observed flying over the site and would be likely to forage over the Georges River adjacent to the study area. The EPBC Act lists migratory species listed under international agreements, as well as families of birds (such as ducks and eagles and hawks) that are also known to be migratory but are not listed under international agreements. Other seasonally migratory or nomadic species would also be likely to utilise habitats within the Georges River National Park on occasion.

There is no suitable wetland habitat within the study that would provide breeding, shelter or foraging habitat for wetland migratory species.



Additional MNES

The protected matters search (DSEWPC 2012a) also identified two further MNES within the locality. The Royal National Park and Garrawarra State Conservation Area are listed as national heritage places. These areas occur over 6 km to the south west of the proposal. Towra Point Nature Reserve, which occurs downstream of the study area on the Kurnell peninsula, is listed as a Wetland of International Significance (Ramsar wetland).

5. Potential Impacts

5.1 Direct impacts

5.1.1 Vegetation clearing and habitat removal

The proposal would result in the removal or modification of about 6.68 hectares of vegetation, including 2.715 hectares of native vegetation communities as shown on Figure 3. This includes clearing for the permanent infrastructure components of the proposal as shown on Figure 1 i.e. the additional lanes adjoining Alfords Point Road and associated shoulders, concrete barriers and batters, the relocated pedestrian and cycle path, the noise wall and the re-located truck inspection bay. It is assumed that construction site compounds, temporary sediment basins, permanent drainage works, noise mitigation structures and any other ancillary structures would be included in the proposal disturbance footprint. This disturbance footprint would require 6.68 hectares of vegetation removal though areas of temporary disturbance such as compound sites can be revegetated once works are completed. For the purposes of impact assessment calculations however, the precautionary principal has been applied and it is assumed that there would be permanent removal of vegetation and habitat within the entire proposal disturbance footprint.

The extent of clearing of vegetation and habitats within the proposal is summarised in Table 4 below.

2.567 hectares of Coastal Sandstone Ridgetop Woodland would be removed, which is approximately 0.07% of the total estimated area of that vegetation community in the locality (around 3923.97 hectares, based on Tozer (2010) vegetation mapping). This minor reduction in extent would not threaten the viability or persistence of the vegetation community in the locality or the region. An additional 0.148 hectares of vegetation comprising Hinterland Sandstone Gully Forest (including 0.017 hectares of Southern Sydney Sheltered Forest EEC) would also be cleared. Approximately 0.400% of the total estimated area of the Hinterland Sandstone Gully Forest community in the locality would be removed; Tozer (2010) notes 3694.39 ha remaining, and approximately 0.002% of the total estimated area of Southern Sydney Sheltered Forest EEC community in the locality would be removed; Tozer (2010) notes 728.63 ha remaining. Reductions of this size are unlikely to threaten the viability or persistence of the vegetation communities within the locality.

Appendix D provides a detailed assessment of significance of removal of 0.017 hectares of Southern Sydney Sheltered Forest EEC. The results of the assessment indicate that removal of this small area of the EEC from the disturbed edge of its occurrence in the study area is unlikely to result in a significant impact to the community. As such, a species impact statement is not required.

The clearing of 2.715 hectares of native vegetation would involve removal of a moderately diverse range of non-threatened native plants, including a small number of mature trees. Mature trees have value within plant populations as sources of pollen and seed. There are extensive areas of these vegetation communities and species in the locality, including extensive areas of older growth vegetation under secure tenure in Georges River National Park. The total area of native vegetation to be removed (2.715 hectares) is around 0.02% of the estimated area of native vegetation in the locality (around 12573.363 hectares, based on Tozer (2010) vegetation mapping). This very minor reduction in the extent of native vegetation would not threaten the persistence of local populations of native plants. Flora populations would persist within adjoining areas of alternative habitat beyond the study area.

The majority of the disturbance footprint is disturbed, cleared land containing exotic pasture species or environmental weeds. These areas contain little native vegetation cover and have limited habitat value for native plants. Any vegetation clearing required in these areas would remove a small number of individuals of non-threatened native plants and noxious and environmental weeds. Provided the weed management measures proposed in Section 6 are adopted the proposal may result in positive impacts on retained native vegetation by reducing the area of exotic vegetation in the study area. This would remove a source of weed propagules that are currently threatening adjoining areas of intact native vegetation.

Table 4 Vegetation clearing within the proposal disturbance footprint

Vegetation Community (Tozer, 2010)	TSC Act Status	EPBC Act Status	Area within proposal disturbance footprint (hectares)	Area within locality ¹ (hectares)	Percentage in locality to be cleared
Coastal Sandstone Ridgetop Woodland	Not listed	Not listed	2.567	3923.970	0.07%
Hinterland Sandstone Gully Forest	EEC ³	Not listed	0.148	3694.390	0.400%
Exotic Shrubland	Not listed	Not listed	3.376	n/a	n/a
Planted Native Vegetation	Not listed	Not listed	0.586	n/a	n/a
Total Native Vegetation			2.715	12573.360²	0.020%
Total All Vegetation			6.680	n/a	n/a

1 = based on Tozer (2010) vegetation mapping.

2 = total of all native vegetation in the locality.

3 = 0.017 ha of vegetation within this community is comensurate with the EEC Southern Sydney Sheltered Forest. The remaining 0.131 ha is not classified as an EEC.

The vegetation that would be removed provides limited habitat resources for native fauna species. Fauna habitat resources that would be removed include foraging and shelter resources for opportunistic native fauna including common and widespread birds (such as the Noisy Miner, Australian Magpie and Rainbow Lorikeet), opportunistic frogs (such as the Common Eastern Froglet and Striped Marsh Frog) and opportunistic reptiles (such as the Eastern Blue-tongue Lizard and Garden Sun-skink). The proposal would remove known foraging habitat for one threatened species, the Grey-headed Flying-fox. The proposal may also remove aerial foraging or travelling habitat for two threatened microbats, the Yellow-bellied Sheath-tail Bat and Large-eared Pied Bat. The proposal disturbance footprint is a narrow strip of exotic weeds and regrowth native vegetation adjoining a major road and over much of its length partially



isolated by road barriers, existing noise walls, steep cuttings, batters and houses. In this context, the proposal disturbance footprint would not contain habitat resources for woodland and forest birds, forest owls, terrestrial or arboreal mammals or the majority of native frogs and reptiles. The proposal footprint does not contain any known or potential roosting habitat for the Grey-headed Flying-fox (which favours tall, closed forest close to permanent water), the Yellow-bellied Sheath-tail Bat (which requires hollow-bearing trees) or Large-eared Pied Bat (which requires caves).

The clearing of 2.715 hectares of native vegetation would involve removal of a small number of mature trees. Mature trees have value for fauna populations as sources of foraging resources such as nectar, sap or seed. Myrtaceous trees within this area may be used as foraging resources by the Grey-headed Flying Fox. The proposal would remove a very small proportion of available foraging resources for local populations of the Grey-headed Flying Fox and other native fauna: 0.02% of the extent of vegetation map units likely to contain Myrtaceous trees in the locality (around 11961.33 hectares based on Tozer, 2010 vegetation mapping). Foraging resources in the proposal disturbance footprint would have even less value than this area suggests, as native fauna are more likely to favour resources that are not immediately adjacent to major roads.

The proposal disturbance footprint is unlikely to contain any important breeding, roosting or nesting habitat. No hollow-bearing trees, wetlands, rock outcrops, woody debris or any other important habitat resources would be removed. There are a number of hollow bearing trees located directly adjacent to the proposal disturbance footprint that could be at risk from overclearing through inappropriate delineation of works boundary or miscommunication, poor machinery operation, or if damaged in the felling of adjacent trees.

5.1.2 Aquatic habitats

The proposal would not directly affect any riparian and aquatic habitats.

There are potential sensitive receptors for indirect impacts on aquatic habitats in the study area including a small drainage line, a portion of which is located in the east of the proposal disturbance footprint, and the catchment for the Georges River. Potential impacts that could cause the decline in aquatic habitat value include:

- ▶ Alterations to riparian and floodplain geomorphology
- ▶ Alterations to catchment hydrology
- ▶ Reduced water quality through hydrocarbon contamination or through increased nutrient or sediment inputs.

The hydrology of the study area is already substantially modified by engineering works for Alfords Point Road and surrounding suburban development. The proposal would result in a minor increase in the proportion of hardstand surfaces in the study area and may also modify drainage through drains and other engineered structures. The drainage line adjacent to the proposal disturbance footprint has also been modified and its source is a stormwater drain discharging from beneath Alfords Point Road. It is assumed that any additional structural works required for the proposal would be restricted to the disturbed portions of the drainage line. Given the extent of existing modifications to the local catchment the proposal would comprise a minor change to hydrology and would be highly unlikely to adversely affect any aquatic habitats.



The potential for hydrocarbon contamination or increased nutrient or sediment inputs can be avoided or minimised through the implementation of appropriate mitigation measures as outlined in Section 6.

5.1.3 Fauna injury and mortality

As described above, the proposal disturbance footprint provides limited habitat resources for native fauna species and would only contain foraging and shelter resources for opportunistic native fauna. Construction may result in the injury or mortality of small terrestrial fauna that may be sheltering in vegetation within the proposal disturbance footprint, such as the opportunistic frogs and reptiles described above. These species are widespread and abundant and so the potential injury or mortality of individuals within a maximum of 6.68 hectares of habitat (comprising all vegetation, including native and exotic, to be removed), is highly unlikely to affect an ecologically significant proportion of any local populations. More mobile native fauna such as native birds, the Grey-headed Flying Fox, terrestrial and arboreal mammals are highly unlikely to be affected by construction activities.

Pre-clearing fauna surveys will be undertaken as part of the Construction Environmental Management Plan (CEMP) to reduce the risk of injury or mortality to native fauna. These surveys will involve the inspection of trees for Koalas as a precautionary measure, should an individual happen to be present within the disturbance footprint or adjoining areas. The CEMP will also contain measures for the safe management of Koalas and other native fauna if detected on site during construction (see Section 6). The proposal would increase the width of Alford's Point Road and may result in a minor increase in the volume of traffic. This would have a negligible effect on the risk of vehicle collisions with native fauna given the existing volume of traffic on Alford's Point Road and because the proposal disturbance footprint does not intersect any fauna movement corridors (refer Section 4.1.5).

5.2 Indirect impacts

5.2.1 Habitat fragmentation

The proposal would involve widening an existing gap in habitat and so vegetation clearing for the proposal will not directly isolate or fragment any areas of habitat.

Vegetation in the Georges River National Park, directly adjacent to the proposal footprint, is recognised as an important habitat corridor as described in Section 4.1.5. The proposal footprint is located on the edge of this patch of habitat and does not, in itself, comprise an important connecting linkage. The majority of the proposal footprint is hardstand or low, exotic vegetation that would have very little value as fauna movement habitat. The entire edge of the proposal disturbance footprint that adjoins native vegetation is at the bottom of a steep cutting and/or is already fenced. Fauna movement, pollination and seed fall of plants and other ecological processes would occur around, rather than through, the proposal footprint.

The proposal involves construction of structures that may obstruct movement of fauna attempting to cross Alford's Point Road. In addition to the road, potential obstructions include concrete barriers, cycle path and the existing noise walls. Alford's Point Road is a busy, dual carriageway at least four lanes wide and would comprise a 'hostile gap' separating patches of habitat as defined in the BioBanking assessment methodology (DECC, 2008). All of the above listed barriers would be parallel to existing, equivalent barriers, including large rock cuttings, and would not significantly increase the degree to which fauna movement is disrupted.



In this context, the proposal would not have an adverse effect on fauna movement or habitat connectivity.

5.2.2 Weed invasion and edge effects

'Edge effects' refers to increased noise and light or erosion and sedimentation at the interface of intact vegetation and cleared areas. Edge effects may result in impacts such as changes to vegetation type and structure, increased growth of exotic plants, increased predation of native fauna or avoidance of habitat by native fauna. Edge effects would result from construction activities and then continue to affect vegetation and habitats adjoining the proposal disturbance footprint during operation of the proposal.

Construction may increase the degree of weed infestation through dispersal of weed propagules (seeds, stems and flowers) into areas of native vegetation via erosion (wind and water) and via workers shoes and clothing and through construction vehicles. The risk of introduction of weeds would continue during operation of the road.

The proposal involves widening an existing road and would therefore not constitute a novel impact. Weed invasion and edge effects are already present at the site, notably within the drainage line containing Southern Sydney Sheltered Forest EEC vegetation, beneath the Alford's Point Bridge and within cleared areas of the proposal disturbance footprint.

Within the majority of the study area the potential for edge effects and weed invasion would be limited by the presence of existing disturbance. The entire western edge of the proposal disturbance footprint adjoins cleared, hardstand areas. Further, around half of the eastern edge of the proposal disturbance footprint contains steep sandstone cuttings. Vegetation on the top of these cuttings shows little sign of weed invasion and would be highly unlikely to be affected by edge effects arising from the proposal since water, sediment and weed propagules would not travel up slope. Areas vulnerable to edge effects include those downslope of the proposal disturbance footprint where it adjoins batters rather than cuttings, comprising:

- The northern end of the study area, including the area under Alford's Point Bridge leading down to the Georges River (noting that this area is already extensively disturbed and dominated by noxious weeds)
- The vicinity of the drainage line downslope and to the east, including areas of Southern Sydney Sheltered Forest EEC vegetation
- The narrow strip of vegetation to the east of the southern half of the proposal disturbance footprint.

A Vegetation Management Plan is recommended for the proposal, which would contain measures to avoid direct and indirect impacts on native vegetation adjoining the proposal disturbance footprint (refer Section 6). Given these mitigation measures and the extent of existing weed infestation and disturbance in the study area the proposal would result in a minor increase in weed infestation and other edge effects.

5.2.3 Pests and pathogens

Construction activities within the proposal disturbance footprint have the potential to introduce or spread pathogens such as Phytophthora (*Phytophthora cinnamomi*), Myrtle Rust (*Uredo rangeli*) and Chytrid fungus (*Batrachochytrium dendrobatidis*) throughout the study area through vegetation disturbance and increased visitation. There is little available information about the distribution of these pathogens within



the locality, and no evidence of these pathogens was observed during surveys. Phytophthora and Myrtle Rust may result in the dieback or modification of native vegetation and damage to fauna habitats. Chytrid fungus affects both tadpoles and adult frogs and can wipe out entire populations once introduced into an area.

The potential for impacts associated with these pathogens is low, given the disturbed nature and high visitation rates to the proposal disturbance footprint, and lack of intact native vegetation along most of the route. As a precautionary measure a 'clean on entry, clean on exit' policy should be implemented during construction activities as outlined under the Construction Environment Management Plan (detailed further in Section 6) to prevent the introduction or spread of these pathogens.

5.3 Operational impacts

5.3.1 Noise, light and vibration

The proposal footprint is located directly adjacent to a busy arterial road (Alfords Point Road) with high traffic volumes, particularly in peak hour times. Habitats adjacent to the proposal footprint therefore already experience high noise, light and vibration disturbance. In approximately half of the study area these effects are attenuated by the presence of noise mitigation structures or the existing road cutting and steeply sloping landform. Although the proposal may increase traffic flow due to the additional lanes, this is likely to have a minor impact given the current disturbances experienced at the site and the presence of the existing barriers.

5.4 Cumulative impacts

The proposal is an upgrade to an existing road and the majority of the proposal disturbance footprint falls within land which is extensively modified by existing, approved developments. The entire proposal disturbance footprint is located adjacent to Alfords Point Road. It contains very little native vegetation, minimal habitat resources for native fauna and has negligible value as a movement corridor. Impacts on native flora and fauna are substantially less than would be associated with an undisturbed 'green field' site. Nonetheless the proposal would still result in cumulative impacts and exacerbate the negative effects associated with Alfords Point Road and other development in the study area.

Potential cumulative impacts arising from the proposal include:

- ▶ An increase in the degree of vegetation clearing in the study area and associated fragmentation of habitat
- ▶ An increase in the magnitude of edge effects on remnant native vegetation and the imposition of novel edge effects on some areas of vegetation
- ▶ An increase in the risk of vehicle collisions due to increased vehicle traffic and increased width of the road surface.

Mitigation measures are proposed to ameliorate each of these potential cumulative impacts and are included as Section 6. Notably pre-construction treatment of weed infestations, vegetation management during construction and post-construction monitoring of native vegetation and treatment of weeds are proposed to mitigate against additional degradation of intact native vegetation in Georges River National Park.

The proposal would be located entirely within the existing Alford's Point Road corridor and would comprise a relatively minor increase in the degree of habitat fragmentation or indirect effects. Alford's Point Road already comprises a 'hostile gap' separating patches of habitat as defined in the BioBanking assessment methodology (DECC, 2008). The proposed upgrade from two to four lanes is unlikely to result in a significant cumulative increase in impacts compared to, for instance, an upgrade from a two-lane road to a four-lane dual carriageway. Cumulative impacts arising from the proposal are unlikely to cross any critical threshold for impacts that would have a significant adverse effect on local populations of any native biota.

5.5 Key threatening processes

A key threatening process (KTP) is defined in the TSC Act (OEH 2011c) as an action, activity or proposal that:

- Adversely affects two or more threatened species, populations or ecological communities.
- Could cause species, populations or ecological communities that are not currently threatened to become threatened.

There are currently 36 KTPs listed under the TSC Act, seven listed under the FM Act and 19 under the EPBC Act. A number of KTPs are listed under more than one Act. Those potentially relevant to this proposal are discussed in Table 5 below. Mitigation measures to limit the impacts of these KTPs are discussed in Section 6.

Table 5 Key threatening processes

KTP	Status	Comment
Clearing of native vegetation	TSC Act; EPBC Act	Clearing of native vegetation has occurred historically within and around the study area. The proposal would result in the clearing of 2.715 hectares of native vegetation, including 0.017 hectares of vegetation which constitutes an EEC, from within the proposal disturbance footprint. The vegetation to be removed is in moderate to low condition due to weed infestation and other edge effects. The clearing of this vegetation is not likely to significantly affect any threatened biota. The implementation of a Vegetation Management Plan is recommended to limit impacts on native vegetation.
Clearing of hollow-bearing trees	TSC Act	16 hollow-bearing trees were recorded within the study area, though none were recorded in the proposal disturbance footprint. The proposal would not increase the operation of this KTP.
Removal of dead wood and dead trees	TSC Act	There are good quantities of dead wood and dead trees scattered throughout the study area that would provide habitat resources for native fauna. There is no woody debris of any note within the proposal disturbance footprint. The proposal would not increase the operation of this KTP.
Invasion of plant communities by	TSC Act	The entire disturbance footprint features moderate to

KTP	Status	Comment
perennial exotic grasses		severe infestation with perennial exotic grasses. Adjoining areas of native vegetation also feature localised moderate infestation. There is the potential for perennial exotic grasses to further invade native vegetation through disturbance during construction of the proposal and a shift of the disturbance corridor east into intact native vegetation. A Vegetation Management Plan is recommended, which would include measures to limit the spread of weeds. These mitigation measures are likely to effectively limit the operation of this KTP.
Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands	TSC Act; FM Act	The hydrology of the study area is already substantially modified by engineering works for Alford's Point Road and surrounding suburban development. The proposal is unlikely to increase the operation of this KTP.
Infection of native plants by <i>Phytophthora cinnamomi</i>	TSC Act; EPBC Act	Construction activities have the potential to introduce the root-rot fungus <i>Phytophthora cinnamomi</i> into the study area, which could lead to dieback of vegetation. The implementation of a Vegetation Management Plan is recommended to limit impacts on native vegetation. The proposal is unlikely to increase the operation of this KTP.
Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae	TSC Act	Construction activities have the potential to introduce Myrtle Rust to the study area. The implementation of a Vegetation Management Plan is recommended to limit impacts on native vegetation. The proposal is unlikely to increase the operation of this KTP.
Infection of frogs by amphibian chytrid causing the disease chytridiomycosis	TSC Act; EPBC Act	Construction activities have the potential to introduce amphibian chytrid to the study area, which could lead to death of local frogs. The implementation of a Fauna Management Plan is recommended to limit impacts on fauna and their habitats. The proposal is unlikely to increase the operation of this KTP.

6. Mitigation Measures

The mitigation of adverse effects arising from the proposal has been presented according to the hierarchy of avoidance, mitigation and offsetting of impacts, consistent with the approach outlined in the RMS (2011) *Environmental Impact Assessment Practice Note - Biodiversity Assessment guidelines*.

The proposal would result in direct impacts on native biota and their habitats within the surface disturbance area. There is also the potential for impacts on habitat outside the disturbance area during the longer-term operational phase of the proposal. Specific mitigation measures are recommended to minimise such impacts on the natural environment.

The proposal would result in some unavoidable residual adverse impacts imposed upon some elements of the natural environment, including removal of native vegetation and imposition of edge effects on adjoining areas of native vegetation. These residual impacts are not expected to impose a significant negative effect on any local populations of native biota, including threatened species, EECs and their habitats, which occur in the study area or in adjoining habitats.

Biodiversity offsets in the form of targeted weed management and bush regeneration may be appropriate to address these residual adverse impacts to achieve an overall 'maintain or improve' outcome for biodiversity conservation.

The following sections detail the avoidance of impacts, mitigation measures and offset contributions recommended for the proposal.

6.1 Avoidance of impacts

The proposal is an upgrade to an existing road and so its location is fundamentally limited by the location of that road. The majority of the proposal disturbance footprint falls within land which is extensively modified by existing, approved developments. Impacts on native flora and fauna are substantially less than would be associated with an undisturbed 'green field' site.

There was some flexibility with the selection of the location of the truck inspection bay. A site has been selected which contains predominantly cleared land containing noxious and environmental weeds and a small amount of regrowth native vegetation. This location is between Alford's Point Road and a steep, 10 metre high cutting and is overshadowed by an overpass. It would contain minimal habitat resources for native fauna and have negligible value as a movement corridor. The proposal has successfully avoided impacts on native biota by selecting a site with limited conservation value.

6.2 Mitigation of impacts

6.2.1 Pre construction phase

Detailed Design Phase

During the detailed design process, the impact of the proposal on areas with high biodiversity values should be minimised wherever possible by:

- ▶ Minimising the area of native vegetation and especially Southern Sydney Sheltered Forest to be cleared



- ▶ Avoidance of identified hollow-bearing trees wherever possible
- ▶ 'Minimising scour protection requirements wherever possible.

Construction Environmental Management Plan

A Construction Environmental Management Plan (CEMP) would be required for the construction phase of the project. The CEMP would include, as a minimum, industry-standard measures for the management of soil, surface water, weeds and pollutants, as well as site-specific measures including the procedures outlined below. The CEMP should be prepared and implemented by the contractor with reference to the RMS *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA Environment Branch 2011).

The CEMP would be required to address the following as a minimum:

- ▶ An erosion and sediment control plan, which would require:
 - Installation of erosion and sediment control measures prior to construction
 - Regular inspection of erosion and sediment control measures, particularly following rainfall events, to ensure their ongoing functionality
 - Stockpiles to be restricted to identified construction compounds, and managed in accordance with RMS Stockpile Site Management Guideline, *RTA Environmental Protection (Management System) QA Specification G36 and RTA Vegetation QA Specification R178*
- ▶ A vegetation management plan (VMP), which should include (but not be limited to) the following:
 - Delineation and protection of exclusion zones around native vegetation to be retained
 - Communication with construction personnel of the conservation value of surrounding habitats and their responsibilities with regards to protecting these habitats during construction
 - Hygiene procedures to prevent the introduction and spread of pathogens such as *Phytophthora* and *Myrtle Rust* in areas of native vegetation. These would include exclusion zones around retained areas of native vegetation and/or provision of machine and footwear washdown stations for all equipment and personnel working in areas of native vegetation
- ▶ A weed management plan, including a description of:
 - Communication with construction personnel with regards to their responsibility to abide by all procedures in the plan
 - Type and location of weeds of concern (including noxious weeds) within the proposal disturbance footprint
 - Sensitive receivers (such as native vegetation and waterways) within or adjacent to the proposal disturbance footprint
 - Measures to prevent the spread of weeds, including hygiene procedures for equipment, footwear and clothing
 - Proposed weed control methods and targeted areas
 - Weed disposal protocols
- ▶ A landscaping program to reinstate vegetation cover and prevent weed establishment on disturbed areas. This should include:
 - Progressive landscaping of disturbed areas during construction to prevent weed establishment

- Use of native flora species of local provenance where possible
- ▮ A fauna management plan, including (but not limited to) the following:
 - Clearing of mature trees should be minimised where possible
 - A fauna management protocol including pre-clearing surveys for nests or sheltering terrestrial fauna and rescue and salvage of fauna where possible
 - Habitat features such as mature tree trunks and rock fragments within the proposal disturbance footprint should be salvaged and replaced within revegetation areas as far as is practicable.
 - Protocols to prevent introduction or spread of chytrid fungus should be implemented following OEH Hygiene protocol for the control of disease in frogs (DECCW, 2008c).
- ▮ Separate Work Method Statements (WMS) should be prepared for all works within 10 m of a waterway and submitted to RMS environment staff prior to commencement of works. WMS should include/address:
 - A map of the area of works
 - A description and timeline of all works to be undertaken
 - Avoiding/ minimising duration of any in stream works
 - Avoiding peak flows and flood events
 - Appropriate environmental controls (including sediment and erosion control)
 - Hygiene protocols to avoid introduction and/or spread of weeds, pests and pathogens
 - Progressive rehabilitation of aquatic and riparian vegetation and stream banks

Pre-clearance surveys

Pre-clearance surveys should be undertaken by a qualified ecologist, and the required methodology and targeted species should be developed as part of the CEMP. Surveys should include:

- ▮ Clear marking/erection of exclusion fencing around protected vegetation areas and delineation of 'no-go' areas
- ▮ Targeted pre-clearing surveys for the Koala
- ▮ Inspections of native vegetation for other resident fauna and/or nests or other signs of fauna occupancy
- ▮ Deferral of vegetation removal and associated construction activity in areas occupied by more mobile threatened fauna until the fauna has vacated the proposal disturbance footprint
- ▮ Capture and relocation or captive rearing of less mobile fauna (such as Koalas or nestling birds) by a trained fauna handler and with assistance from Wildlife Information Rescue and Education Service (WIRES) as required
- ▮ Inspection and and identification / marking of hollow-bearing trees adjacent to construction footprints to help ensure against accidental impacts.

6.2.2 Construction phase

The following principals should be followed throughout the construction phase:

- ▮ All works should be undertaken in accordance with the CEMP and the RMS *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA Environment Branch, 2011)



- ▶ Clearing surveys must be undertaken by a suitably qualified ecologist during any construction stages that involve removal of native vegetation. Clearing methods and presence/fate of any resident fauna must be documented
- ▶ Wildlife should not be handled wherever possible. Construction staff should only handle wildlife in an emergency situation. Uninjured wildlife should be gently encouraged to leave the site by the ecologist/ wildlife specialist. Injured wildlife would be taken to a local WIRES carer or veterinarian for treatment and care if necessary
- ▶ All equipment must be refuelled at least 20 metres away from drainage lines and all fuel and chemical storages should be bunded.

6.3 Offsetting of impacts

The proposal would result in some residual impacts on native biota including:

- ▶ The removal or modification of about 6.68 hectares of vegetation, including 2.715 hectares of native vegetation communities and associated habitat resources
- ▶ Potential injury or mortality of small terrestrial fauna within the proposal disturbance footprint
- ▶ Potential increase in the degree of edge effects in the study area and imposition of novel edge effects on native vegetation adjoining the proposal disturbance footprint.

The RMS Guideline for Biodiversity Offsetting (RMS 2011) sets vegetation clearing thresholds that trigger the need for offsets. In this instance, clearing is under the threshold, which is set at 5 hectares for native vegetation (that is not of high conservation significance) that contains potential habitat for threatened species. RMS (2011) sets the threshold for native vegetation of high conservation significance (including threatened ecological communities in moderate to good condition, or vegetation types more than 70% cleared in NSW) at 1 hectare.

Given the proposal will require the clearing of only 0.017 hectares of an EEC, and 2.715 hectares of native vegetation overall, the need for offsets is not triggered. Any potential further degradation of the surrounding vegetation could be addressed by targeting infestations surrounding the disturbance footprint including consideration for treatment of the;

- ▶ Crofton Weed and African Love Grass infestations in the vicinity of the Southern Sydney Sheltered Forest EEC
- ▶ Severe Lantana and Bitou Bush infestations in the northern portion of the study area around Alford's Point Bridge and revegetation of this area with plant species representative of the Hinterland Sandstone Gully Forest vegetation type.

7. Assessments of Significance

7.1 Identification of affected threatened biota

The desktop assessment, field surveys and habitat assessments described above have been used to identify the suite of threatened biota that may be affected by the proposal, through either direct or indirect impacts. If threatened biota is potentially affected by a proposed activity then the significance of impacts must be assessed through Section 5A of the EPA Act (the seven part test) and/or the *Matters of National Environmental Significance – Assessment of significance guidelines* (DEWHA, 2009).

The DECC (2007) *Threatened species assessment guidelines - the assessment of significance and* DEWHA (2009) guidelines require proponents to compile a list of threatened biota which may be affected by the proposal and which require an assessment of significance. Threatened biota do not have to be considered as part of the assessment of significance if adequate surveys or studies have been carried out that clearly show that the species (DECC, 2007):

- Does not occur in the study area, or
- Will not use on-site habitats, even on occasion, or
- Will not be influenced by off-site impacts of the proposal.

The suite of threatened biota potentially relevant to this assessment is presented in Appendix C, along with the nature of any previous records in the locality and an assessment of the likelihood of occurrence in the study area. Based on the targeted surveys and habitat assessments undertaken, the majority of the threatened biota presented in Appendix C do not occur in the study area. Further, given the existing disturbance associated with Alford's Point Road and poor quality of habitat resources in the proposal disturbance footprint the majority of threatened biota would not use on-site habitats, even on occasion. Given the limited scale and magnitude of impacts arising from the proposal and impact mitigation and environmental management measures described in Section 6, no additional threatened biota outside of the study area are likely to be affected by off-site impacts of the proposal.

Based on the above, the following endangered ecological community and threatened fauna species are known or likely to be present in the study area and are considered affected threatened biota for the proposal which require specific assessments of significance of impacts:

- Southern Sydney Sheltered Forest, listed as an EEC on the TSC Act. The proposal will require removal of 0.017 hectares of this vegetation type. An additional 0.491 hectares of this community occurs directly adjacent to the proposal disturbance footprint
- Grey-headed Flying Fox, listed as a vulnerable species on the TSC Act and the EPBC Act and which was observed flying over the study area and may forage in the proposal disturbance footprint on occasion
- The Large-eared Pied Bat, listed as a vulnerable species on the TSC Act and the EPBC Act and which was tentatively recorded within the study area and may forage in the proposal disturbance footprint on occasion
- The Yellow-bellied Freetail Bat, listed as a vulnerable species on the TSC Act which was tentatively recorded within the study area and may forage in the proposal disturbance footprint on occasion.



Based on the habitat assessments undertaken a number of additional species may be present in the study area:

- ▶ Gang-gang Cockatoo
- ▶ Masked Owl
- ▶ Powerful Owl
- ▶ Glossy Black-cockatoo
- ▶ East coast Freetail Bat
- ▶ Greater Broad-nosed Bat
- ▶ Eastern bentwing Bat.

There are no specific records or habitat resources that suggest that local populations of these species are present however they may utilise habitats in the study area on a transitory or occasional basis and so specific assessments of significance of impacts have been performed.

An assessment of the likely significance of impacts of the proposal on the Koala has been prepared taking a precautionary approach given the known population in the wider locality. However, the Koala is considered unlikely to occur in the proposal disturbance footprint given the absence of food trees and the physical isolation of the site from areas of known habitat in Georges River National Park and the Holsworthy Military Area by Alford's Point Road and associated steep cuttings and batters and residential areas.

Targeted pre-clearing surveys for Koalas will be undertaken as part of the Construction Environmental Management Plan (CEMP). Measures will be incorporated for the safe management of Koalas to reduce the risk of injury or mortality of individuals in the unlikely event that they happen to be present within the disturbance footprint during construction (see Section 6).

The results of the assessments of significance for affected threatened biota are summarised in Table 6 and described below.

7.1.1 Threatened ecological communities

One endangered ecological community (EEC) listed under the TSC Act, Southern Sydney Sheltered Forest, occurs along a gully that runs east from Alford's Point Road towards the Georges River (see Figure 3). It occurs within the proposal footprint and there is the potential for indirect impacts arising from edge effects, sedimentation, noise, light or increased risk of vehicle collisions. Therefore a seven part test has been performed and is included in Appendix D.

The EEC coincides with the Hinterland Sandstone Gully Forest vegetation community, however only the area mapped on Figure 3 qualifies as the EEC based on geomorphic position and soil type. Southern Sydney Sheltered Forest would occur elsewhere in the locality, however given the scale and magnitude of impacts arising from the proposal, indirect impacts on any other patches of the EEC are unlikely. An assessment of significance of impacts on the local occurrence of this EEC has been prepared and is included in Appendix D. The outcome of this assessment of significance is that the proposal is not likely to have a significant impact on the local populations of Southern Sydney Sheltered Forest.

No other threatened ecological communities are present in the study area. A number of threatened ecological communities would be present in the locality, notably EECs of coastal floodplains which would



be present on the floodplain of the Georges River. Given the limited scale and magnitude of impacts arising from the proposal and impact mitigation and environmental management measures described in Section 6, no additional TECs outside of the study area are likely to be affected by off-site impacts of the proposal.

7.1.2 Threatened flora species

There is broadly suitable habitat for up to 20 threatened species of plant within the study area; however they can be reliably discounted as occurring based on known distributions and/or the field survey effort undertaken. None of the species with known habitat preferences similar to habitats within the study area are cryptic or require seasonal surveys and so it is unlikely that they would not have been detected if they were present.

Habitat within the proposal footprint has been heavily modified by construction of Alford's Point Road and consists of exposed subsoil or recent sediments without the topsoil, soil seed bank and associated soil organisms that would comprise habitat for threatened plants. The proposal footprint is dominated by exotic grasses and herbs with some regrowth of opportunistic native species. It is highly unlikely that any threatened flora species persist in the soil seed bank within the proposal footprint or would colonise this area in the future.

Vegetation within the Georges River National Park outside of the study area contains potential habitat for a number of these species of threatened flora. Given the mitigation measures proposed in Section 6 and standard RMS management practices it is highly unlikely that the proposal would affect any threatened plants or their habitats beyond the study area.

7.1.3 Threatened fauna

The Grey-headed Flying-fox, which is listed as vulnerable under both the TSC and EPBC Acts, was recorded overflying the study area during nocturnal surveys and would be expected to forage within the study area on an occasional basis. The proposal would remove a small quantity of foraging resources for the species.

The Large-eared Pied Bat, listed as a vulnerable species on the TSC Act and the EPBC Act was tentatively recorded within the study area based on 'probable' Anabat call identification. This species is cave roosting. There are no suitable breeding or diurnal roost sites within the proposal disturbance footprint though there are potentially suitable sites in sandstone cliffs and overhangs within the broader study area. The Large-eared Pied Bat may forage in the proposal disturbance footprint on occasion.

The Yellow-bellied Freetail Bat, listed as a vulnerable species on the TSC Act was tentatively recorded within the study area based on 'probable' Anabat call identification. This species roosts in large, hollow-bearing trees and occasionally buildings. There are no suitable breeding or diurnal roost sites within the proposal disturbance footprint though there are potentially suitable sites in hollow-bearing trees within the broader study area. The Yellow-bellied Freetail Bat may forage in the proposal disturbance footprint on occasion.

Assessments of significance of impacts on local populations of these three threatened species have been prepared. A seven part test for each species is included in Appendix D and an EPBC Act assessment of significance for a vulnerable species is included for the Large-eared Pied Bat and Grey-headed Flying-fox in Appendix E. The outcome of these assessments of significance is that the proposal is not likely to have a significant impact on local populations of these threatened fauna species.

As discussed in Section 4, habitats adjacent to the proposal footprint within Georges River National Park may occasionally support a range of threatened fauna based on the habitat resources observed. The following species are identified as 'possibly' occurring in the study area and being affected by the proposal in Appendix C: Gang Gang Cockatoo; Masked Owl; Glossy Black Cockatoo; Powerful Owl; Eastern Freetail-bat; Greater Broad-nosed Bat and Eastern Bentwing Bat.

Assessments of significance of impacts on potential local populations of these threatened species have been prepared and are included in Appendix D. The outcome of these assessments of significance is that the proposal is not likely to have a significant impact on any local populations of these threatened fauna species, should they occur.

Whilst known from the wider locality, the Koala is considered unlikely to occur in the proposal disturbance footprint given the absence of food trees and the physical isolation of the site from areas of known habitat in Georges River National Park and the Holsworthy Military Area by Alford's Point Road and associated steep cuttings and batters and residential areas. Nevertheless, an assessment of the likely significance of impacts of the proposal on the Koala has been prepared taking a precautionary approach given the known population in the wider locality (Appendix D). The outcome of this assessment of significance is that the proposal is not likely to have a significant impact on a local population of the Koala, should it occur.

The proposal disturbance footprint contains no habitat of relevance to any additional threatened fauna listed under the TSC, FM or EPBC Acts. The proposal would therefore have no direct impact on habitat for any other threatened fauna species.

7.1.4 Migratory fauna

Two migratory bird species were observed during field surveys: the White-bellied Sea-eagle and the Rufous Fantail. Other seasonally migratory or nomadic species would also be likely to utilise habitats within the Georges River National Park on occasion.

The EPBC Act requires an assessment of the significance of potential impacts of a proposal on migratory species with reference to the criteria specified in the *Matters of National Environmental Significance – Assessment of significance guidelines* (DEWHA 2009).

An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will (DEWHA, 2009):

- ▶ Substantially modify, destroy or isolate an area of important habitat for a migratory species

An area of 'important habitat' for a migratory species is: habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species, and/or; habitat that is of critical importance to the species at particular life-cycle stages, and/or; habitat utilised by a migratory species which is at the limit of the species range, and/or; habitat within an area where the species is declining (DEWHA, 2009).

As described in Section 4.4.2 the proposal disturbance footprint would have little value for migratory species and does not comprise 'important habitat'. Impacts would be restricted to the proposal disturbance footprint and its immediate vicinity and so the proposal would not substantially modify any important habitat.

- ▶ 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



As described above the proposal disturbance footprint does not comprise 'important habitat'. Impacts would be restricted to the the proposal disturbance footprint and its immediate vicinity and so the proposal would not result in an invasive species becoming established in important habitat.

- ▶ Seriously disrupt the lifecycle of an ecologically significant proportion of the population of a migratory species.

Only a small number of individuals of the the White-bellied Sea-eagle, Rufous Fantail or any other migratory species would ever occupy habitat within or near the proposal disturbance footprint. The risk of injury or mortality of any of these individuals is very slight. The proposal disturbance footprint does not contain any habitat resources that are likely to be significant to any migratory species. As described in Section 5.2.1, the proposal would not significantly increase the degree of fragmentation or isolation of habitat in the locality. Therefore the proposal would not seriously disrupt the lifecycle of an ecologically significant proportion of the population of any migratory species.

Based on the consideration of the criteria contained in the *Matters of National Environmental Significance –Assessment of significance guidelines* (DEWHA 2009), the proposal would not be likely to have a significant impact on any migratory species.

7.2 Summary of assessments of significance

Assessments of significance for affected threatened biota are included as Appendix D and E. The outcome of these assessments is that the proposal is not likely to have a significant adverse impact on any threatened biota.

The application of the various assessment criteria to each of the affected threatened biota is summarised in Table 6 below.

Table 6 Summary of assessment of significance results

Affected threatened biota	Significance assessment criteria ¹							Likely significant impact?
	a	b	c	d	e	f	g	
Southern Sydney Sheltered Forest	X	X	N	N	X	Y	Y	No
Grey-headed Flying Fox	N	X	X	Y	N	Y	Y	No
Large-eared Pied Bat	N	X	X	Y	N	X	Y	No
Yellow-bellied Freetail Bat	N	X	X	Y	N	X	Y	No
Gang-gang Cockatoo	N	X	X	Y	N	X	Y	No
Masked Owl	N	X	X	Y	N	N	Y	No
Powerful Owl	N	X	X	Y	N	N	Y	No
Glossy Black-cockatoo	N	X	X	Y	N	X	Y	No
East coast Freetail Bat	N	X	X	Y	N	X	Y	No
Greater Broad-nosed Bat	N	X	X	Y	N	X	Y	No
Eastern bentwing Bat.	N	X	X	Y	N	X	Y	No
Koala	N	X	X	N	N	N	Y	No
Threatened species, or communities	Important population ²							Likely significant impact?
Grey-headed Flying Fox	Yes							No
Large-eared Pied Bat	No							No
Migratory Species	Important habitat ³							Likely significant impact?
Rufous Fantail, White-bellied Sea-Eagle, various migratory waders potentially present in the locality	No							No

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

1. 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.
2. Important Population as determined by the EPBC Act, is one that for a vulnerable species:
 - a is likely to be key source populations either for breeding or dispersal
 - b is likely to be necessary for maintaining genetic diversity
 - c is at or near the limit of the species range.
 3. Important habitat habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species, and/or; habitat that is of critical importance to the species at particular life-cycle stages, and/or; habitat utilised by a migratory species which is at the limit of the species range, and/or; habitat within an area where the species is declining (DEWHA, 2009).

7.3 Additional MNES

The proposal would be highly unlikely to have any effect on either of the two additional MNES identified by the desktop review, given the physical separation between the study area and these MNES. Towra Point Nature Reserve Ramsar wetland is over 10 km downstream of the study area and separated from it by the expanse of Botany Bay, while the Royal National Park and Garrawarra State Conservation Area occur over 6 km to the south west of the proposal and are separated by multiple major roads, train lines and water bodies. No assessment of significance under the EPBC Act has therefore been prepared for these MNES.

8. Conclusion

The proposal disturbance footprint contains mainly hardstand areas and exotic weed species. There is a thin strip of remnant native vegetation along the eastern edge of the study area, which is contiguous with an extensive patch of native vegetation within the Georges River National Park. Native vegetation within the proposal footprint contains moderate weed infestation attributable to disturbance and edge effects from the construction of Alford's Point Road and the associated road shoulders and bicycle track. Away from these disturbed areas the native vegetation is generally in very good condition.

Based on the desktop assessment, field surveys and habitat assessments undertaken the following affected threatened biota for the proposal were identified:

- ▶ Southern Sydney Sheltered Forest, listed as an EEC on the TSC Act; 0.017 hectares of this community will be removed from within the proposal disturbance footprint as a result of the proposal
- ▶ Grey-headed Flying Fox, listed as a vulnerable species on the TSC Act and the EPBC Act and which was observed flying over the study area and may forage in the proposal disturbance footprint on occasion
- ▶ The Large-eared Pied Bat, listed as a vulnerable species on the TSC Act and the EPBC Act and which was tentatively recorded within the study area and may forage in the proposal disturbance footprint on occasion
- ▶ The Yellow-bellied Freetail Bat, listed as a vulnerable species on the TSC Act which was tentatively recorded within the study area and may forage in the proposal disturbance footprint on occasion.

Native vegetation adjacent to the proposal footprint within Georges River National Park would provide potential habitat for additional threatened fauna based on the habitat resources observed. The following species are identified as 'possibly' occurring in the study area and being affected by the proposal: Gang Gang Cockatoo; Masked Owl; Glossy Black Cockatoo; Powerful Owl; Eastern Freetail-bat; Greater Broad-nosed Bat and Eastern Bentwing Bat.

The extent of habitat in the study area for each of these mobile and wide-ranging threatened fauna species is limited. The species may forage on occasion within the study area, but would not rely on these habitats for their conservation in the locality.

Whilst known from the wider locality, the Koala is considered unlikely to occur in the study area given the absence of food trees and the physical isolation of the study area from areas of known habitat by Alford's Point Road and associated steep cuttings and batters and residential areas. Targeted pre-clearing surveys for Koalas and measures for the safe management of Koalas if detected will be incorporated into the Construction Environmental Management Plan (CEMP) to reduce the risk of injury or mortality in the unlikely event that an individual should happen to be present within the disturbance footprint at the time of construction.

The proposal would result in impacts on native biota and their habitats including:

- ▶ The removal or modification of about 6.68 hectares of vegetation, including 2.715 hectares of native vegetation communities (of which 0.017 hectares is classified as EEC) and associated habitat resources within the surface disturbance area
- ▶ Potential injury or mortality of small terrestrial fauna within the proposal disturbance footprint



- ▶ Potential increase in the degree of edge effects in the study area and imposition of novel edge effects on native vegetation adjoining the proposal disturbance footprint.

There is also the potential for impacts on habitat outside the disturbance area during the longer-term operational phase of the proposal. Specific mitigation measures are recommended to minimise such impacts on the natural environment, including:

- ▶ Erosion and sediment control measures should be established prior to construction and regularly inspected to ensure their ongoing functionality
- ▶ Restriction of access into adjacent remnant vegetation during construction and machinery hygiene protocols, washing of vehicles and erection of appropriate barriers to reduce the risk of transmission of weeds, contaminants or pathogens
- ▶ Management of noxious and environmental weeds.

The proposal would result in some unavoidable residual adverse impacts imposed upon some elements of the natural environment, including removal of native vegetation and imposition of edge effects on adjoining areas of native vegetation. These residual impacts are not expected to impose a significant negative effect on any local populations of native biota, including threatened species, EECs and their habitats, which occur in the study area or in adjoining habitats.

Ongoing weed management should be considered to address these residual adverse impacts to achieve an overall 'maintain or improve' outcome for biodiversity conservation.



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Appendix A

Species Lists



Flora species list

Family	Exotic	Scientific Name	Common Name	TSC Status	EPBC Status	Cover Abundance/Survey Area ¹							
						Q1	Q1 Assoc	Q2	Q3	Q4	AS1	AS2	AS3
Adiantaceae		<i>Adiantum aethiopicum</i>	Common Maidenhair					1					
		<i>Cheilanthes sieberi</i>	Rock Fern			1							
Amaranthaceae		<i>Gomphrena spp.</i>		0	0							1	
Apiaceae		<i>Actinotus helianthi</i>	Flannel Flower			2			2		1		
	*	<i>Foeniculum vulgare</i>	Fennel		0							2	
		<i>Platysace linearifolia</i>				3			2				
		<i>Xanthosia pilosa</i>	Woolly Xanthosia			1			1		1		
Apocynaceae	*	<i>Araujia sericifera</i>	Moth Vine		0							1	
Araucariaceae	*	<i>Araucaria spp.</i>		0	0							3	
Asparagaceae	*	<i>Asparagus aethiopicus</i>	Asparagus Fern					1				1	
	*	<i>Asparagus asparagoides</i>	Bridal Creeper		0							2	2
Asphodelaceae	*	<i>Aloe maculata</i>	Common Soap Aloe		0							2	
	*	<i>Asphodelus fistulosus</i>	Onion Weed							x			
Asteraceae	*	<i>Ageratina adenophora</i>	Crofton Weed							x	3	1	
	*	<i>Bidens pilosa</i>	Cobbler's Pegs			1				x	3	2	
		<i>Chrysanthemoides monilifera subsp. rotundata</i>	Bitou Bush								2		
	*	<i>Cirsium vulgare</i>	Spear Thistle								2		
	*	<i>Conyza bonariensis</i>	Flaxleaf Fleabane							x	2	2	
	*	<i>Coreopsis lanceolata</i>	Coreopsis							x	3		2
	*	<i>Dimorphotheca ecklonis</i>	Cape Daisy								1		
	*	<i>Hypochaeris radicata</i>	Catsear			2							
	*	<i>Osteospermum ecklonis</i>	Cape Daisy		0							2	



Cover Abundance/Survey Area ¹													
Family	Exotic	Scientific Name	Common Name	TSC Status	EPBC Status	Q1	Q1 Assoc	Q2	Q3	Q4	AS1	AS2	AS3
		<i>Senecio hispidulus</i>	Hill Fireweed	0									1
	*	<i>Senecio madagascariensis</i>	Fireweed	0									2
	*	<i>Sonchus oleraceus</i>	Common Sowthistle							x			2
Bignoniaceae		<i>Pandorea jasminoides</i>	Bower Vine	0									1
		<i>Pandorea pandorana</i>	Wonga Wonga Vine					1	1				
Cactaceae	*	<i>Opuntia spp.</i>		0	0								2
Campanulaceae		<i>Wahlenbergia gracilis</i>	Sprawling Bluebell			1				x			
Casuarinaceae		<i>Allocasuarina littoralis</i>	Black She-Oak			3		1	3	x	2		3
Crassulaceae	*	<i>Bryophyllum delagoense</i>	Mother of millions	0									2
Cunoniaceae		<i>Ceratopetalum gummiferum</i>	Christmas Bush				x	3					
Cyperaceae	*	<i>Cyperus eragrostis</i>	Umbrella Sedge								2		
		<i>Lepidosperma laterale</i>	Variable Sword-sedge				x	1					
Dennstaedtiaceae		<i>Pteridium esculentum</i>	Bracken			2		2	2		2		
Dicksoniaceae		<i>Calochlaena dubia</i>	Rainbow Fern					3					
Dilleniaceae		<i>Hibbertia dentata</i>	Twining Guinea Flower						1				
Elaeocarpaceae		<i>Elaeocarpus reticulatus</i>	Blueberry Ash			1						1	
Ericaceae		<i>Monotoca scoparia</i>				1			2				
Euphorbiaceae	*	<i>Ricinus communis</i>	Castor Oil Plant								1		
Fabaceae	*	<i>Trifolium subterraneum</i>	Subterranean Clover							x			
Fabaceae (Faboideae)		<i>Desmodium rhytidophyllum</i>							1				
		<i>Dillwynia retorta</i>				2							
	*	<i>Erythrina sykesii</i>	Coral Tree	0									3



Family	Exotic	Scientific Name	Common Name	TSC Status	EPBC Status	Cover Abundance/Survey Area ¹							
						Q1	Q1 Assoc	Q2	Q3	Q4	AS1	AS2	AS3
		<i>Hardenbergia violacea</i>	False Sarsaparilla			1			1				
		<i>Jacksonia scoparia</i>	Dogwood						1				
		<i>Kennedia rubicunda</i>	Dusky Coral Pea								1		
	*	<i>Lotus spp.</i>		0	0							2	
		<i>Pultenaea daphnoides</i>	Large-leaf Bush-pea						2				
	*	<i>Trifolium sp.</i>	A Clover								3		
		<i>Acacia baileyana</i>	Cootamundra Wattle	0								2	
		<i>Acacia decurrens</i>	Black Wattle	0								1	
		<i>Acacia falcata</i>								x	1		1
		<i>Acacia linifolia</i>	White Wattle			1					2		
		<i>Acacia longifolia</i>		0	0							2	
		<i>Acacia myrtifolia</i>	Red-stemmed Wattle							x			2
		<i>Acacia suaveolens</i>	Sweet Wattle			2							1
		<i>Acacia terminalis</i>	Sunshine Wattle			2				x	3		1
		<i>Acacia ulicifolia</i>	Prickly Moses			1							
Geraniaceae	*	<i>Pelargonium spp.</i>		0	0							1	
Goodeniaceae		<i>Goodenia hederacea</i>	Ivy Goodenia						1				
			Germander										
Haloragaceae		<i>Gonocarpus teucrioides</i>	Raspwort				x						
Juncaceae		<i>Juncus usitatus</i>		0	0							2	
Lomandraceae		<i>Lomandra confertifolia</i>											
		<i>subsp. rubiginosa</i>				2							
		<i>Lomandra filiformis</i>											
		<i>subsp. filiformis</i>				2							
		<i>Lomandra longifolia</i>	Spiny-headed Mat-rush			2		1	2	x			2
		<i>Lomandra multiflora</i>	Many-flowered Mat-rush			2			2				



				Cover Abundance/Survey Area ¹									
Family	Exotic	Scientific Name	Common Name	TSC Status	EPBC Status	Q1	Q1 Assoc	Q2	Q3	Q4	AS1	AS2	AS3
		<i>Lomandra obliqua</i>				2			2				
Malvaceae	*	<i>Modiola caroliniana</i>	Red-flowered Mallow							x	2		
Malvaceae	*	<i>Sida rhombifolia</i>	Paddy's Lucerne							x	2	2	
Monimiaceae		<i>Wilkiea huegeliana</i>	Veiny Wilkiea					2					
Myrsinaceae	*	<i>Anagallis arvensis</i>	Scarlet Pimpernel									2	
Myrsinaceae		<i>Myrsine variabilis</i>						2	1				
Myrtaceae		<i>Angophora costata</i>	Sydney Red Gum			3		4	4		3		3
		<i>Backhousia myrtifolia</i>	Grey Myrtle					4					
		<i>Corymbia gummifera</i>	Red Bloodwood			3			3	x			
		<i>Eucalyptus haemastoma</i>	Broad-leaved Scribbly Gum										3
		<i>Eucalyptus oblonga</i>											3
		<i>Eucalyptus piperita</i>	Sydney Peppermint			3		3					
		<i>Eucalyptus resinifera</i>	Red Mahogany						3				
		<i>Eucalyptus tereticornis</i>	Forest Red Gum									1	
		<i>Kunzea ambigua</i>	Tick Bush				x		2	x	1	3	3
		<i>Leptospermum polygalifolium</i>	Tantoon			2			3				
		<i>Leptospermum trinervium</i>	Slender Tea-tree						3				
Oleaceae	*	<i>Fraxinus angustifolia subsp. angustifolia</i>	Desert Ash									3	
	*	<i>Ligustrum lucidum</i>	Large-leaved Privet								1		
Phormiaceae		<i>Dianella caerulea var. producta</i>				1		2	1				
		<i>Dianella revoluta</i>	Blueberry Lily			2			2				2
Phyllanthaceae		<i>Breynia oblongifolia</i>	Coffee Bush				x	1					
		<i>Glochidion ferdinandi</i>	Cheese Tree					1					



Family	Exotic	Scientific Name	Common Name	TSC Status	EPBC Status	Cover Abundance/Survey Area ¹							
						Q1	Q1 Assoc	Q2	Q3	Q4	AS1	AS2	AS3
		<i>Phyllanthus hirtellus</i>	Thyme Spurge			2			2				
Pinaceae	*	<i>Cedrus spp.</i>										3	
Pinaceae	*	<i>Pinus spp.</i>										3	2
Pittosporaceae		<i>Billardiera scandens</i>	Hairy Apple Berry					1					1
		<i>Bursaria spinosa</i>	Native Blackthorn					2					
Plantaginaceae	*	<i>Plantago lanceolata</i>	Lamb's Tongues							x		2	2
Poaceae	*	<i>Andropogon virginicus</i>	Whisky Grass									3	
		<i>Anisopogon avenaceus</i>	Oat Speargrass			1							
		<i>Austrodanthonia sp.</i>	A Wallaby Grass						1				
		<i>Austrodanthonia tenuior</i>	A Wallaby Grass						1				
	*	<i>Avena fatua</i>	Wild Oats									2	2
	*	<i>Axonopus fissifolius</i>	Narrow-leafed Carpet Grass							x			
	*	<i>Briza maxima</i>	Quaking Grass									3	
	*	<i>Briza subaristata</i>											
		<i>Cymbopogon refractus</i>	Barbed Wire Grass			2							
		<i>Cynodon dactylon</i>	Common Couch							x	3	2	3
		<i>Dichelachne micrantha</i>	Shorthair Plumegrass			2							
		<i>Digitaria parviflora</i>	Small-flowered Finger Grass			2			2				
	*	<i>Eleusine indica</i>	Crowsfoot Grass							x			
		<i>Entolasia marginata</i>	Bordered Panic					2		x			
		<i>Entolasia stricta</i>	Wiry Panic			2			2		1		1
		<i>Eragrostis benthamii</i>				1							
	*	<i>Eragrostis curvula</i>	African Lovegrass							x	3	3	3



Family	Exotic	Scientific Name	Common Name	TSC Status	EPBC Status	Cover Abundance/Survey Area ¹							
						Q1	Q1 Assoc	Q2	Q3	Q4	AS1	AS2	AS3
		<i>Imperata cylindrica</i>	Blady Grass			1		1	1			2	
	*	<i>Lolium perenne</i>	Perennial Ryegrass									2	
		<i>Microlaena stipoides</i>	Weeping Grass			2		2					
		<i>Panicum effusum</i>	Hairy Panic						1				
	*	<i>Paspalum dilatatum</i>	Paspalum			1				x	3		1
		<i>Pennisetum clandestinum</i>	Kikuyu Grass							x	3	4	3
	*	<i>Poa sp.</i>								x			
	*	<i>Setaria parviflora</i>								x			
		<i>Setaria pumila</i>								x			
		<i>Themeda australis</i>	Kangaroo Grass			1			2				
Podocarpaceae		<i>Podocarpus spinulosus</i>	Spiny-leaf Podocarp				x	2	1				
Proteaceae		<i>Banksia integrifolia</i>	Coast Banksia				x	1		2			
Proteaceae		<i>Banksia oblongifolia</i>	Fern-leaved Banksia							x			2
		<i>Banksia serrata</i>	Old-man Banksia				x						
		<i>Banksia spinulosa</i>	Hairpin Banksia			1							
		<i>Grevillea mucronulata</i>					x		1				
		<i>Grevillea sericea</i>	Pink Spider Flower			2			2	x	2		2
		<i>Hakea dactyloides</i>	Finger Hakea									1	
		<i>Hakea salicifolia</i>	Willow-leaved Hakea									2	
		<i>Hakea Sericea</i>	Needlebush							x		1	2
		<i>Lambertia formosa</i>	Mountain Devil				x						
		<i>Lomatia silaifolia</i>	Crinkle Bush				x						
		<i>Persoonia lanceolata</i>	Lance Leaf Geebung										1
		<i>Persoonia levis</i>	Broad-leaved Geebung				x		1				



						Cover Abundance/Survey Area ¹							
Family	Exotic	Scientific Name	Common Name	TSC Status	EPBC Status	Q1	Q1 Assoc	Q2	Q3	Q4	AS1	AS2	AS3
		<i>Persoonia linearis</i>	Narrow-leaved Geebung				x		2				
		<i>Xylomelum pyriforme</i>	Woody Pear				x		1				
Rosaceae	*	<i>Rosa spp.</i>										1	
Rubiaceae		<i>Pomax umbellata</i>	Pomax			2			2		1		
Rutaceae		<i>Correa reflexa</i>	Native Fuschia			1			1				
		<i>Zieria pilosa</i>	Pilose-leaved Zieria			2							
Sapindaceae		<i>Dodonaea triquetra</i>	Large-leaf Hop-bush							x			2
Smilacaceae		<i>Smilax glycyphylla</i>	Sweet Sarsparilla			2		1	1				
Solanaceae	*	<i>Solanum nigrum</i>	Black-berry Nightshade							x		2	
Verbenaceae	*	<i>Lantana camara</i>	Lantana								1	3	2
	*	<i>Verbena bonariensis</i>	Purpletop							x	3	2	2
Xanthorrhoeaceae		<i>Xanthorrhoea media</i>							1				
		<i>Xanthorrhoea sp.</i>				1							
Zamiaceae		<i>Macrozamia communis</i>	Burrawang			1		2	2			1	
		<i>Eucalyptus consideniana</i>	Yertchuk										1

1 – Cover abundance rankings within each survey area: **1** Foliage sparsely or very sparsely present, cover less than 5%; **2** 1-5% Plentiful, foliage cover 1-5 %; **3** 5-25% foliage cover; **4** 26-50% foliage cover; **5** 51-75% foliage cover; **6** 76-100% foliage cover; **x** – opportunistic record, relative abundance not recorded.



Fauna species list

Family	Scientific Name	Common Name	TSC Status	EPBC Status
Frogs				
Myobatrachidae	<i>Crinia signifera</i>	Common Eastern Froglet		
	<i>Limnodynastes peronii</i>	Brown-striped Frog		
	<i>Uperoleia laevisgata</i>	Smooth Toadlet		
Birds				
Acanthizidae	<i>Acanthiza lineata</i>	Striated Thornbill		
	<i>Acanthiza nana</i>	Yellow Thornbill		
	<i>Acanthiza pusilla</i>	Brown Thornbill		
	<i>Sericornis frontalis</i>	White-browed Scrubwren		
Accipitridae	<i>Accipiter fasciatus</i>	Brown Goshawk		
Accipitridae	<i>Haliaeetus leucogaster</i>	White-bellied Sea-eagle		M
Aegothelidae	<i>Aegothales cristatus</i>	Australian Owlet-nightjar		
Alcedinidae	<i>Dacelo novaeguineae</i>	Laughing Kookaburra		
	<i>Todiramphus sanctus</i>	Sacred Kingfisher		
Artamidae	<i>Cracticus tibicen</i>	Australian Magpie		
	<i>Cracticus torquatus</i>	Grey Butcherbird		
	<i>Strepera graculina</i>	Pied Currawong		
Cacatuidae	<i>Cacatua galerita</i>	Sulphur-crested Cockatoo		
	<i>Eolophus roseicapillus</i>	Galah		
Campephagidae	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike		
Charadriidae	<i>Vanellus miles</i>	Masked Lapwing		
Climacteridae	<i>Cormobates leucophaea</i>	White-throated Treecreeper		
Corvidae	<i>Corvus coronoides</i>	Australian Raven		
Dicruridae	<i>Dicrurus bracteatus</i>	Spangled Drongo		
Estrildidae	<i>Neochmia temporalis</i>	Red-browed Finch		
Maluridae	<i>Malurus cyaneus</i>	Superb Fairy-wren		
	<i>Malurus lamberti</i>	Variegated Fairy-wren		



Family	Scientific Name	Common Name	TSC Status	EPBC Status
Meliphagidae	<i>Acanthorhynchus tenuirostris</i>	Eastern Spinebill		
	<i>Manorina melanocephala</i>	Noisy Miner		
	<i>Philemon corniculatus</i>	Noisy Friarbird		
Monarchidae	<i>Grallina cyanoleuca</i>	Magpie-lark		
Pachycephalidae	<i>Pachycephala pectoralis</i>	Golden Whistler		
Pardalotidae	<i>Pardalotus punctatus</i>	Spotted Pardalote		
Petroicidae	<i>Eopsaltria australis</i>	Eastern Yellow Robin		
Psittacidae	<i>Platycercus elegans</i>	Crimson Rosella		
	<i>Trichoglossus haematodus</i>	Rainbow Lorikeet		
Psophodidae	<i>Psophodes olivaceus</i>	Eastern Whipbird		
Pycnonotidae	* <i>Pycnonotus jocosus</i>	Red-whiskered Bulbul		
Rhipiduridae	<i>Rhipidura albiscapa</i>	Grey Fantail		
	<i>Rhipidura rufifrons</i>	Rufous Fantail		M
Strigidae	<i>Ninox novaeseelandiae</i>	Southern Boobook		
Timaliidae	<i>Zosterops lateralis</i>	Silvereye		
Mammals				
Emballonuridae	<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat (Probable)	V	
Macropodidae	<i>Macropus rufogriseus</i>	Red-necked Wallaby		
Molossidae	<i>Tadarida australis</i>	White-striped Freetail-bat		
Molossidae	Mormopterus "Species 2"	Undescribed Freetail Bat (Probable)		
Pseudocheiridae	<i>Pseudocheirus peregrinus</i>	Common Ringtail Possum		
Pteropodidae	<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	V
Vespertilionidae	<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat (Probable)	V	V
Vespertilionidae	<i>Chalinolobus gouldii</i>	Gould's Wattled Bat		
Reptiles				
Scincidae	<i>Ctenotus taeniolatus</i>	Copper-tailed Skink		
	<i>Lampropholis guichenoti</i>	Pale-flecked Garden Sunskink		
	<i>Lampropholis delicata</i>	Dark-flecked Garden		



Family	Scientific Name	Common Name	TSC Status	EPBC Status
		Sunskink		
	<i>Tiliqua scincoides</i>	Eastern Blue-tongue		



Appendix B

Anabat Call Analysis Results



Analysis Method

Calls collected during the field surveys were identified using zero-crossing analysis and AnalookW software by visually comparing call traits / parameters (version 3.8s, Chris Corben 2011). Craig Grabham (GHD) undertook analysis of all bat calls. No reference calls were collected during the survey. The *Bat calls of NSW: Region based guide to the echolocation calls of microchiropteran bats* (Pennay et al. 2004) was used as a guide to call analysis. Due to the high level of variability and overlap in call characteristics, a conservative approach was taken when analysing the calls.

A call (pass) was defined as a sequence of three or more consecutive pulses of similar frequency. Pulses separated from another sequence by a period of five seconds were considered to be separate passes. Scattered sequences, where intermittent pulses were not separated by more than five seconds, were recognised as a single pass. Where constant activity was recorded, a single pass was defined as 15 seconds (i.e. one full display screen comprising as Anabat sequence file) (Law et al., 1998; Law et al., 1999).

Due to variability in the quality of calls and the difficulty in distinguishing some species the identification of each call was assigned a confidence rating (see Mills et al. 1996 & Duffy et al. 2000) as summarised in Table 1.

Table 1 Confidence ratings applied to calls

Identification	Description
D - Definite	Species identification not in doubt.
PR - Probable	Call most likely to represent a particular species, but there exists a low probability of confusion with species of similar call type or call lacks sufficient detail.
PO - Possible	Call characteristics are comparable with the species, but there exists a reasonable probability of confusion with one or more species of similar call types or quality or length of call prohibits a confident identification.
Species Group	<p>Call made by one of two or more species. Call characteristics overlap making it too difficult to distinguish between species e.g.</p> <p><i>Chalinolobus gouldii</i> / <i>M. Mormopterus sp 2</i>.</p> <p><i>Chalinolobus gouldii</i> / <i>Scotorepens orion</i> / <i>Scoteanax rueppellii</i></p> <p><i>Scotorepens orion</i> / <i>Scoteanax rueppellii</i> / <i>Falsistrellus tasmaniensis</i></p> <p><i>Vespadelus spp.</i> (<i>V. darlingtoni</i> / <i>V. regulus</i>)</p> <p><i>Vespadelus sp.</i> / <i>Miniopterus schreibersii oceanensis</i></p> <p><i>Vespadelus vulturnus</i> / <i>C. morio</i></p> <p><i>Nyctophilus spp.</i> The calls of <i>Nyctophilus geoffroyi</i> and <i>N. gouldi</i> cannot be distinguished during the analysis process and are therefore lumped together.</p>



Results

Files were of very poor – moderate quality resulting in the majority of bat calls being probable or belonging to a species group or multiple species. The majority of bat calls only consisted of short sequences with poor – moderate quality pulses making positive call identification difficult.

Two threatened species *Chalinolobus dwyeri* and *Saccolaimus flaviventris* were both probably recorded from one call each. The duration and quality of call prevented definite identification.

Table 2 summaries the results from the Anabat analysis.

Table 2 Summary of Anabat analysis

Species (TSC Act Status/EPBC Act Status)	Unit and Date				TOTAL
	Grey 5/3/12	Grey 6/3/12	Brown 5/3/12	Brown 6/3/12	
<i>Tadarida australis</i>	-	-	D (7)	D (8)	15
<i>Saccolaimus flaviventris</i> (v)	-	-	Pr (1)	-	1
<i>Chalinolobus dwyeri</i> (v/V)	-	-	Pr (1)	Pr (1)	2
<i>Chalinolobus gouldii</i>	D (7) Pr (2)	-	D (11) Pr (8)	D (2) Pr (14)	20 24
<i>D. dwyeri</i> / <i>C. gouldii</i>	-	-	-	✓ (2)	2
<i>Mormopterus sp.2</i>	Pr (3)	-	Pr (1)	-	4
<i>Chalinolobus gouldii</i> <i>/Mormopterus sp.2</i>	✓ (18)	-	✓ (9)	✓ (2)	29
<i>C. gouldii</i> / <i>Scotorepens orion</i> / <i>Scoteanax rueppellii</i>	✓ (1)	-	✓ (1)	✓ (4)	6
<i>Scotorepens orion</i> / <i>Scoteanax rueppellii</i>	-	-	✓ (1)	-	1
<i>S. orion</i> / <i>S. rueppellii</i> / <i>Falsistrellus tasmaniensis</i>	✓ (1)	-	-	-	1
<i>Vespadelus darlingtoni/regulus</i>	✓ (1)	-	✓ (2)	-	3
<i>Vespadelus sp.</i> / <i>M. schreibersii oceanensis</i> (v)	✓ (1)	-	-	-	1
<hr/>					
# sequence files	150	2	78	115	345
# bat calls	39	-	54	59	152
Other	111	2	24	56	193
Approx. survey effort	11 hrs	0 hrs	11 hrs	11 hrs	33 hrs
Start – finish time	Clock error	Clock error	1929-0826	1933-0802	n/a
Bat activity	-	-	1954-	1950-	n/a



Species (TSC Act Status/EPBC Act Status)	Unit and Date				TOTAL
	Grey	Grey	Brown	Brown	
	5/3/12	6/3/12	5/3/12	6/3/12	
			0623	0601	
Total D species	1	0	2	2	2
Total PR species	1	0	2	1	2

Notes:

Nomenclature follows Pennay, M, Law., B, and Lunney., D (2011), then Strahan and Van Dyck (2008).

Numbers in brackets represent the number of calls allocated to a species or species group for that site

✓ = species group was recorded for that site.

- = not recorded.

ce (critically endangered) e (endangered), v (vulnerable) - species listed under the *NSW Threatened Species Conservation Act 1996*.

CE (critically endangered), E (endangered), V (vulnerable) – species listed under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999*.

Anabat sequence files: total number of Anabat sequence files recorded for survey period.

bat calls: approximate number of Anabat sequence files identified as a bat call of some description (includes all definite, probably, possible, species group, multiple species calls in the same sequence file and other bat calls). Note possible bat calls not included in species counts but are included in total number of bat calls.

Other – number of other Anabat sequence files with other types of ultrasound (e.g. insect activity, miscellaneous non-bat noise)

Survey effort: estimate of time between sunset and sunrise for a successful night of Anabat detection.

Start – finish: approximate time detector recorded first ultrasound and last ultrasound (e.g. bat or insect noise).

Bat activity: approximate time of first identified bat call and last identified bat call for that survey period.

Total number of species recorded for each site is based on definite (D) identification only.



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Appendix C

Threatened and Migratory Biota



Threatened biota known or predicted from the locality, habitat association and suitable habitat present at the proposal disturbance footprint

Notes:

Marine and littoral threatened species (particularly shorebirds) which are restricted to coastal or estuarine environments were excluded from the threatened biota table.

Wildlife Atlas records: only records from 1980 or later were considered. The date of the last record is included for any species which have not been recorded within the last 20 years.

A search of the DPI online records viewer (DPI 2012a) and OEH Bionet websites revealed no records of threatened fish species within the Sydney Metropolitan catchment.

Name	TSC Act	EPBC Act	Habitat Association	Nature of Record	Presence within proposal footprint
EECs					
Agnes Banks Woodland in the Sydney Basin	EEC	-	Most remnants occur near Agnes Banks in Penrith LGA, on eastern bank of the Hawkesbury River. Occurs on aeolian sands overlaying Tertiary alluviums. Structure varies from low woodland on higher ridges to sedgeland in low-lying depressions. Characteristic species include <i>Eucalyptus sclerophylla</i> , <i>Angophora bakeri</i> and <i>Banksia serrata</i> .	Mapped as occurring within 10km (Tozer <i>et al</i> 2010)	Does not occur
Bangalay Sand Forest in the Sydney Basin and South East Corner bioregions	EEC	-	Associated with coastal sand plains on deep, freely draining to damp sandy soils on flat to moderate slopes within a few km of the sea and below 100 m asl. Known from Sutherland south to Bega Valley LGA. Variable structure with a dense to open tree canopy from 5 - 20 m tall, dependant on exposure and disturbance history. Characteristic species include <i>Eucalyptus botryoides</i> and <i>Banksia integrifolia</i> subsp. <i>integrifolia</i> over an open sclerophyllous or mesophyllous shrub stratum, with an understorey of grasses, forbs and/or sedges.	Mapped as occurring within 10km (Tozer <i>et al</i> 2010)	Does not occur



Name	TSC Act	EPBC Act	Habitat Association	Nature of Record	Presence within proposal footprint
Blue Gum High Forest	CEEC	CEEC	Occurs on the Hornsby Plateau, north eastern edge of the Cumberland Plain with most remnants in Hornsby, Ku-ring-gai and Baulkham Hills LGAs. Typically occurs in high rainfall areas on fertile soils derived from Wianamatta shale. Grades into Sydney Turpentine-Ironbark Forest at lower rainfall areas. Moist, tall open forest characterised by <i>Eucalyptus saligna</i> and <i>E. pilularis</i> . Usually has small tree layer of <i>Pittosporum undulatum</i> , <i>Elaeocarpus reticulatus</i> and <i>Allocasuarina torulosa</i> over a low, open shrub layer and an understorey of grasses, herbs and ferns.	Mapped as occurring within 10km (Tozer <i>et al</i> 2010)	Does not occur
Castlereagh Scribbly Gum Woodland	VEC	-	Occurs almost exclusively on soils derived from Tertiary alluvium, or on sites located on adjoining shale or Holocene alluvium, with known occurrences in the Bankstown, Blacktown, Campbelltown, Hawkesbury, Liverpool and Penrith LGAs. Typically on sandy soils and on slightly higher ground than Castlereagh Ironbark Forest or Shale Gravel Transition Forest (Tozer 2003). Dominated by <i>Eucalyptus parramattensis</i> subsp. <i>parramattensis</i> , <i>Angophora bakeri</i> and <i>E. sclerophylla</i> . A small tree stratum of <i>Melaleuca decora</i> is sometimes present, generally in areas with poorer drainage. It has a well-developed sclerophyllous shrub stratum over a diverse range of forbs.	Mapped as occurring within 10km (Tozer <i>et al</i> 2010)	Does not occur
Castlereagh Swamp Forest	EEC	-	Occurs Castlereagh and Holsworthy areas on the Cumberland Plain on alluvial soils, often in poorly drained depressions. Low woodland characterised by dense stands of <i>Melaleuca decora</i> along with other canopy trees, such as <i>Eucalyptus parramattensis</i> ssp <i>parramattensis</i> . Poorly developed shrub layer of juvenile Melaleucas over waterlogging tolerant groundcover species such as <i>Centella asiatica</i> , <i>Juncus usitatus</i> and <i>Goodenia paniculata</i> .	Mapped as occurring within 10km (Tozer <i>et al</i> 2010)	Does not occur
Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner bioregions	EEC	-	Occurs on landward side of mangrove stands in intertidal zones along the shores of estuaries and lagoons that are permanently or intermittently open to the sea. Characterised by <i>Baumea juncea</i> , <i>Juncus kraussii</i> , <i>Sarcocornia quinqueflora</i> , <i>Sporobolus virginicus</i> , <i>Triglochin striata</i> , <i>Isolepis nodosa</i> , <i>Samolus repens</i> , <i>Selliera radicans</i> , <i>Suaeda australis</i> and <i>Zoysia macrantha</i> , with occasional scattered mangroves occurring throughout the saltmarsh. Saltpans and tall reeds may also occur.	Mapped as occurring within 10km (Tozer <i>et al</i> 2010)	Does not occur



Name	TSC Act	EPBC Act	Habitat Association	Nature of Record	Presence within proposal footprint
Cooks River – Castlereagh Ironbark Forest	EEC	-	Occurs on the Cumberland Plain with the most extensive stands in Castlereagh and Holsworthy areas. Smaller remnants in Kemps Creek area and eastern section of the Cumberland Plain. Ranges from open forest to low woodland, with a canopy dominated by <i>Eucalyptus fibrosa</i> and <i>Melaleuca decora</i> along with other species of eucalypt. Dense shrubby understorey of <i>Melaleuca nodosa</i> , <i>Lissanthe strigosa</i> and <i>Fabaceae</i> sp over sparse ground layer of grasses and herbs.	Mapped as occurring within 10km (Tozer <i>et al</i> 2010)	Does not occur
Cumberland Plain Woodland (NSW listing)	EEC	See below	Grassy woodland/forest endemic to the hills and plains of the Cumberland Plain. Canopy typically dominated by <i>Eucalyptus moluccana</i> , and <i>E. tereticornis</i> , with <i>E. crebra</i> , <i>Corymbia maculata</i> and <i>E. eugenoides</i> occurring less frequently. Shrub layer dominated by <i>Bursaria spinosa</i> , and grasses such as <i>Themeda australis</i> and <i>Microlaena stipoides</i> var <i>stipoides</i> .	Mapped as occurring within 10km (Tozer <i>et al</i> 2010)	Does not occur
Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest (federal listing)	Compon CEEC ent EECs listed separately		Grassy woodlands and forests of the shale hills and plains of the Cumberland Plain and associated transitional communities on shale-gravel soils. Canopy typically dominated by <i>Eucalyptus moluccana</i> , <i>E. tereticornis</i> and/or <i>E. fibrosa</i> . Sparse small tree stratum of young eucalypts and Acacia species and/or shrub layer dominated by <i>Bursaria spinosa</i> may be present. Understorey comprises perennial native grasses, grasslike and non-woody plants.	Mapped as occurring within 10km (Tozer <i>et al</i> 2010) Predicted to occur within 10km (DSEWPac 2012a)	Does not occur
Freshwater Wetlands on Coastal Floodplains	EEC	-	Occurs in coastal areas subject to periodic flooding with standing fresh water for at least part of the year. Typically on silts, muds or humic loams below 20 m elevation in low-lying parts of floodplains, alluvial flats, depressions, drainage lines, backswamps, lagoons and lakes. Structure and composition varies spatially and temporally depending on the water regime, though is usually dominated by herbaceous plants and has few woody species.	Mapped as occurring within 10km (Tozer <i>et al</i> 2010)	Does not occur



Name	TSC Act	EPBC Act	Habitat Association	Nature of Record	Presence within proposal footprint
Littoral Rainforest in the NSW North Coast, Sydney Basin and SE Corner Bioregions	EEC	CEEC	Occurs along the NSW coast, usually within 2 km of the ocean on a variety of substrates. Variable structure and composition, typically with closed canopy. Generally rainforest species with vines a major component.	Mapped as occurring within 10km (Tozer <i>et al</i> 2010) Predicted to occur within 10km (DSEWPac 2012a)	Does not occur
River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions	EEC	-	Occurs on flats, drainage lines and river terraces of coastal floodplains where flooding is periodic and soils generally rich in silt, lack deep humic layers and have little or no saline (salt) influence. Occurs south from Port Stephens in the NSW North Coast, Sydney Basin and South East Corner bioregions. Characterised by a tall open canopy layer of eucalypts with variable species composition.	Mapped as occurring within 10km (Tozer <i>et al</i> 2010)	Does not occur
Shale/Gravel Transition Forest	EEC	Listed with land Cumber Plain Woodla nd (see above)	Primarily in the northern section of the Cumberland Plain, also found in Liverpool/;Holsworthy, Bankstown, Yennora, Villawood and Kemps Creek areas. Occurs primarily where shallow deposits from ancient river systems overlay shale soils, but also associated with localised concentrations of iron-hardened gravel. Open forest with canopy dominated by <i>Eucalyptus fibrosa</i> , <i>E. moluccana</i> and <i>E. tereticornis</i> , often with small tree layer of <i>Melaleuca decora</i> over a sparse shrub layer. Grades into Cumberland Plain Woodland where the influence of gravel soil declines, and into Cooks River/Castlereagh Ironbark Forest or Castlereagh Scribbly Gum Woodland where gravel deposits are thick.	Mapped as occurring within 10km (Tozer <i>et al</i> 2010)	Does not occur



Name	TSC Act	EPBC Act	Habitat Association	Nature of Record	Presence within proposal footprint
Shale-sandstone Transition Forest	EEC	EEC	Occurs on the edges of the Cumberland Plain where clay soils on shale intergrade with sandstone soils, or where shale caps overlay sandstone. Species composition variable depending on soil influences. Dominant tree species include <i>Eucalyptus tereticornis</i> , <i>E. punctata</i> , <i>E. globoidea</i> , <i>E. eugenioides</i> , <i>E. fibrosa</i> and <i>E. crebra</i> . Areas with a low sandstone influence have an understorey closer to Cumberland Plain Woodland.	Mapped as occurring within 10km (Tozer <i>et al</i> 2010) Predicted to occur within 10km (DSEWPac 2012a)	Does not occur
Southern Sydney Sheltered Forest	EEC	-	Restricted to sheltered heads and upper slopes of gullies on transitional zones where sandstone outcrops may exist, but where soils are influenced by lateral movement of moisture, nutrients and sediment from more fertile substrates in an area bounded by Hurstville, Carss Park, Bundeena, Otford, Stanwell Tops, Darkes Forest, Punchbowl Creek and Menai. Open forest dominated by Angophora costata, <i>Eucalyptus piperita</i> and occasional <i>E. pilularis</i> over scattered subcanopy trees, a diverse shrub layer and well-developed groundcover of ferns, forbs, grasses and graminoids. Variable species composition.	Mapped as occurring within 10km (Tozer <i>et al</i> 2010)	Present. 0.017 ha occurs within eastern section of footprint, along drainage line level with Marlock Place. Distribution extends into study area, east of the proposed footprint.
Swamp Oak Floodplain forest of the NSW North Coast, Sydney basin and South East Corner Bioregions	EEC	-	Typically occurs below 20m asl on waterlogged or periodically inundated flats, drainage lines, lake margins and estuarine fringes on coastal floodplains of NSW. Associated with grey-black clay-loams and sandy loams, saline or sub-saline groundwater. Structure variable from open forests to scrubs or reedlands with scattered trees. Canopy dominated by <i>Casuarina glauca</i> (north of Bermagui) or <i>Melaleuca ericifolia</i> (south of Bermagui). Understorey characterised by frequent occurrences of vines, a sparse cover of shrubs, and a continuous groundcover of forbs, sedges, grasses and leaf litter.	Mapped as occurring within 10km (Tozer <i>et al</i> 2010)	Does not occur



Name	TSC Act	EPBC Act	Habitat Association	Nature of Record	Presence within proposal footprint
Swamp Sclerophyll forest on Coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions	EEC	-	Usually occurs below 20m asl (sometimes up to 50m). Associated with humic clay loams and sandy loams, on waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains. Characterised by open to dense tree layer of eucalypts and paperbarks, with trees up to or higher than 25 m. Includes areas of fern land and tall reed or sedge land, where trees are sparse or absent.	Mapped as occurring within 10km (Tozer <i>et al</i> 2010)	Does not occur
Sydney Turpentine-Ironbark Forest	EEC	CEEC	Occurs on the Cumberland Plain , with most remnants in Baulkham Hills, Hawkesbury, Hornsby, Ku-ring-gai, Parramatta, Ryde, Sutherland and Wollondilly LGAs. Open forest characterised by <i>Syncarpia glomulifera</i> , <i>Eucalyptus punctata</i> , <i>Eucalyptus paniculata</i> and <i>E. eugenoides</i> . In areas of high rainfall (over 1050 mm per annum) <i>E. saligna</i> is more dominant. Sparse shrub stratum of <i>Pittosporum undulatum</i> and <i>Polyscias sambucifolia</i> .	Mapped as occurring within 10km (Tozer <i>et al</i> 2010) Predicted to occur within 10km (DSEWPac 2012a)	Does not occur



Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of occurrence
FLORA						
<i>Acacia bynoeana</i>	Bynoe's Wattle	E	V	Endemic to central eastern NSW, currently known from only 34 locations, many of only 1-5 plants. Grows mainly in heath/ dry sclerophyll forest on sandy soils, prefers open, sometimes slightly disturbed proposal disturbance footprints such as trail margins, road edges, and in recently burnt open patches. Flowers September to March, and fruit matures in November.	Predicted to occur within 10km (DSEWPaC 2012a)	Unlikely. Broadly suitable habitat present but site is outside of known distribution.
<i>Acacia prominens</i>	Gosford Wattle	EP (Hurstville and Kogarah)	-	Occurs at a few sites along the railway line at Penshurst, at Carss Bush Park, Carss Park and there is an unconfirmed siting at Oatley Park, Oatley. Grows in open situations on clayey or sandy soils. Habitats mostly cleared and occurs as isolated or small groups of trees.	3 records within 10km (OEI 2012a)	Unlikely. Broadly suitable habitat present but site is outside of known distribution.
<i>Acacia pubescens</i>	Downy Wattle	V	V	Occurs mainly in Bankstown-Fairfield-Rookwood and Pitt Town areas, with outliers at Barden Ridge, Oakdale and Mountain Lagoon. Grows on alluviums, shales and shale/sandstone intergrades. Soils characteristically gravely, often with ironstone. Occurs in open woodland and forest, in communities including Cooks River/ Castlereagh Ironbark Forest, Shale/ Gravel Transition Forest and Cumberland Plain Woodland. Flowers August to October.	99 records within 10km (OEI 2012a) Predicted to occur within 10km (DSEWPaC 2012a)	Nil. Suitable clay and tertiary alluvium substrates not present.



Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of occurrence
<i>Acacia terminalis subsp. terminalis</i>	Sunshine Wattle	E	E	Occurs in near-coastal areas from northern shores of Sydney Harbour south to the northern and western shores of Botany Bay. Occurs on sandy soil on creek banks, hillslopes in shallow soil in rock crevices and sandstone platforms on cliffs. Grows in scrub and open eucalypt woodland or forest (Bremner and Goeth 2010).	2 records within 10km (OEH 2012a)	Unlikely. Broadly suitable habitat present but large and obvious species that would have been detected during field surveys.
<i>Allocasuarina glauca</i>		E	E	Primarily restricted to small populations in and around Castlereagh NR (NW Cumberland Plain), but with an outlier population at Voyager Point, Liverpool. Also reported from Holsworthy Military Area. Grows on tertiary alluvial gravels, with yellow clayey subsoil and lateritic soil. Occurs in Castlereagh open woodland.	1 record within 10km (OEH 2012a)	Nil. Suitable tertiary alluvium substrates not present.
<i>Asterolasia elegans</i>		E	E	Occurs north of Sydney, in the Baulkham Hills, Hawkesbury and Hornsby LGAs, may also occur in the western part of Gosford LGA. 7 known populations. Occurs on Hawkesbury sandstone, commonly amongst rocky outcrops and boulders in sheltered forests on mid- to lower slopes and valleys.	Predicted to occur within 10km (DSEWPac 2012a)	Unlikely. Broadly suitable habitat present but site is outside of known distribution.
<i>Astrotricha crassifolia</i>	Thick-leaf Star-hair	V	V	Occurs near Patonga (Gosford LGA), and in Royal NP and on the Woronora Plateau (Sutherland and Campbelltown LGAs). There is also a record from near Glen Davis (Lithgow LGA). Grows on dry ridgetops to 300 m altitude, associated with very rich heath, or dry sclerophyll woodland on sandstone.	Predicted to occur within 10km (DSEWPac 2012a)	Unlikely. Broadly suitable habitat present but site is outside of known distribution.



Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of occurrence
<i>Caesia parviflora</i> var. <i>minor</i>	Small Pale Grass Lily	E	-	Occurs uncommonly in Tasmania, southern Victoria and south-east South Australia with an outlying population in NSW, in Barcoongere State Forest, between Grafton and Coffs Harbour. Found in damp places in open forest on sandstone.	1 record within 10km (OEH 2012a)	Unlikely. Broadly suitable habitat present but site is outside of known distribution. Local record would appear dubious.
<i>Caladenia tessellata</i>		E	V	Occurs from Central Coast NSW to southern VIC. Mostly coastal but extends inland to Braidwood in southern NSW. In NSW grows in grassy dry sclerophyll woodland on clay loam or sandy soils, and less commonly in heathland on sandy loam soils (Duncan 2010).	1 record within 10km (OEH 2012a) Predicted to occur within 10km (DSEWPac 2012a)	Unlikely. No suitable grassy woodland habitats in study area.
<i>Callistemon linearifolius</i>	Netted Bottlebrush	V	-	Recorded from the Georges to Hawkesbury Rivers in Sydney, and north to Nelson Bay. There is also a recent record from the northern Illawarra. In Sydney, recent records are limited to the Hornsby Plateau area near the Hawkesbury River. Grows in dry sclerophyll forest on the coast and adjacent ranges.	1 record within 10km (OEH 2012a)	Unlikely. Broadly suitable habitat present but large and obvious species that would have been detected during field surveys.



Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of occurrence
<i>Cryptostylis hunteriana</i>	Leafless Tongue V Orchid	V		Occurs in coastal areas from East Gippsland to southern Queensland. Habitat preferences not well defined. Grows mostly in coastal heathlands, margins of coastal swamps and sedgelands, coastal forest, dry woodland, and lowland forest. Prefers open areas in the understorey and is often found in association with <i>Cryptostylis subulata</i> and <i>Cryptostylis erecta</i> . Soils include moist sands, moist to dry clay loam and occasionally in accumulated eucalypt leaves. Flowers November-February.	Predicted to occur within 10km (DSEWPaC 2012a)	Unlikely. No suitable coastal or lowland forest present.
<i>Deyeuxia appressa</i>		E	E	Known only from two pre-1942 records in Sydney, at Saltpan Creek and Killara. May be extinct in the wild. Thought to occur in moist conditions.	Predicted to occur within 10km (DSEWPaC 2012a)	Unlikely. No suitable moist habitats present.
<i>Dillwynia tenuifolia</i>		V	V	Occurs in western Sydney, predominately the Cumberland Plain as well as the Lower Blue Mountains and north to Yengo. Grows in scrubby/dry heath areas of Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays, and associated transitional communities including Castlereagh Scribbly Gum Woodland.	2 records within 10km (OEI 2012a)	Nil. No suitable tertiary clay or gravel communities present.
<i>Epacris purpurascens</i> var. <i>purpurascens</i>		V	-	Occurs from Gosford in the north, Narrabeen in the east, Silverdale in the west and Avon Dam vicinity in the South. Grows in a range of habitat types, most of which have a strong shale soil influence.	6 records within 10km (OEI 2012a)	Unlikely. Broadly suitable habitat present but relatively large and obvious species that would have been detected during field surveys.



Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of occurrence
<i>Eucalyptus camfieldii</i>	Camfield's Stringybark	V	V	Occurs from Raymond Terrace to Waterfall, with populations at Norah Head (Tuggerah Lakes), Peats Ridge, Mt Colah, Elvina Bay Trail (West Head), Terrey Hills, Killara, North Head, Menai and the Royal NP. Occurs in exposed situations on sandstone plateaus, ridges and slopes near the coast, often on the boundary of tall coastal heaths or low open woodland. It grows in shallow sandy soils overlying Hawkesbury sandstone.	5 records within 10km (OEH 2012a) Predicted to occur within 10km (DSEWPaC 2012a)	Unlikely. Broadly suitable habitat present but a large and obvious species that would have been detected during field surveys.
<i>Grevillea parviflora</i> subsp. <i>parviflora</i>	Small-flower Grevillea	V	V	Occurs between Moss Vale/Bargo and lower Hunter Valley, with most occurrences in Appin, Wedderburn, Picton and Bargo. Broad habitat range including heath, shrubby woodland and open forest on light clay or sandy soils, and often in disturbed areas such as on the fringes of tracks.	2 records within 10km (OEH 2012a) Predicted to occur within 10km (DSEWPaC 2012a)	Unlikely. Broadly suitable habitat present but relatively obvious species that would have been detected during field surveys.
<i>Hibbertia</i> subsp. <i>Bankstown</i>		CE	CE	Known only from Bankstown airport. Habitat is very heavily modified, lacks canopy species and is currently a low grass/shrub association with many pasture grasses and other introduced herbaceous weeds. Soil at the site is a sandy (Tertiary) alluvium with a high silt content.	1 record within 10km (OEH 2012a) Predicted to occur within 10km (DSEWPaC 2012a)	Nil. No suitable alluvial soils present and outside of known distribution.



Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of occurrence
<i>Hibbertia</i> sp. nov. 'Menai'		E	-	Two known populations: one either side of the Woronora River gorge including the Menai-Bangor, Alfords Point and Illawong areas in the north and Maandowie Reserve, Loftus on the southern side; and west and southwest of Nowra. Occurs in dry sclerophyll forest and woodland. Northern metapopulation occurs on upper slopes and above the Woronora escarpment, at or near the interface of Hawkesbury sandstone and the Lucas Heights soil landscape. Southern population appears to occur in sandy soils on sandstone, with one record from gravelly clay soil.	3 records within 10km (OEH 2012a)	Unlikely. Broadly suitable habitat present but relatively obvious species that would have been detected during field surveys.
<i>Meleleuca biconvexa</i>	Biconvex Paperbark	V	V	Scattered, disjunct populations in coastal areas from Jervis Bay to Port Macquarie, with most populations in the Gosford-Wyong areas. Grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects.	Predicted to occur within 10km (DSEWPac 2012a)	Nil. No suitable moist alluvial soils present.
<i>Melaleuca deanei</i>	Deane's Paperbark	V	V	Occurs from Nowra- St Albans and west to the Blue Mountains, with most records in Ku-ring-gai / Berowra and Holsworthy/Wedderburn areas. Mostly grows on broad flat ridgetops, dry ridges and slopes and strongly associated with low nutrient sandy loam soils, sometimes with ironstone. Grows in heath- open forest, often in sandstone ridgetop woodland communities.	20 records within 10km (OEH 2012a) Predicted to occur within 10km (DSEWPac 2012a)	Unlikely. Broadly suitable habitat present but relatively obvious species that would have been detected during field surveys.



Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of occurrence
<i>Persoonia hirsuta</i>	Hairy Geebung	E	E	Occurs within the Blue Mountains, Southern Highlands and Sydney coastal regions from Hilltop to Glen Davis and Royal NP to Gosford. Population within the Hills Shire particularly important due to high density of plants. Grows on sandy soils in dry sclerophyll open forest, woodland and heath on sandstone up to 600m above sea level.	4 records within 10km (OEH 2012a)	Unlikely. Broadly suitable habitat present but relatively obvious species that would have been detected during field surveys.
<i>Persoonia nutans</i>	Nodding Geebung	E	E	Occurs from Richmond to Macquarie Fields on the Cumberland Plain. Grows only on aeolian and alluvial sediments in sclerophyll forest and woodland vegetation communities. Largest populations occur in Agnes Banks Woodland or Castlereagh Scribbly Gum Woodland.	9 records within 10km (OEH 2012a) Predicted to occur within 10km (DSEWPaC 2012a)	Nil. No suitable aeolian or alluvial sediments present.
<i>Pimelea curviflora</i> var. <i>curviflora</i>	Pimelea curviflora var. curviflora	V	V	Confined to area between north Sydney in the south and Maroota in the north-west. Former range extended to Parramatta River including Five Dock, Bellevue Hill and Manly. Grows on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands. Often grows amongst dense grasses and sedges. Flowers October to May.	Predicted to occur within 10km (DSEWPaC 2012a)	Unlikely. Broadly suitable habitat but outside of known distribution.



Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of occurrence
<i>Pimelea spicata</i>	Spiked Rice Flower	E	E	Disjunct populations within the Cumberland Plain (from Mount Annan and Narellan Vale to Freemans Reach and Penrith to Georges Hall) and Illawarra (from Mt Warrigal to Gerroa) (DEC 2005). In the Cumberland Plain region, restricted to areas which support or historically supported Cumberland Plain Woodland. Grows on well-structured clay soils derived from Wianamatta Shale. In the Illawarra, grows on variable soils in close proximity to the coast on hills or coastal headlands. Inhabits coastal woodland or grassland with emergent shrubs (DEC 2005).	16 records within 10km (OEH 2012a) Predicted to occur within 10km (DSEWPaC 2012a)	Nil. No suitable shale-derived clay soils present.
<i>Pomaderris prunifolia</i>		EP (Parramatta, Auburn, Strathfield and Bankstown LGAs)	-	Known from only 3 sites within population range: at Rydalmere, within Rookwood Cemetery and at The Crest of Bankstown. At Rydalmere occurs along a road reserve near a creek, among grass species on sandstone. At Rookwood Cemetery occurs in small gully of degraded Cooks River / Castlereagh Ironbark Forest on shale soils.	2 records within 10km (OEH 2012a)	Nil. Suitable clay soils not present and outside of known distribution.
<i>Pterostylis gibbosa</i>	Illawarra Greenhood	E	E	Known from a small number of populations in the Illawarra, Nowra and Hunter regions. First collected in western Sydney. Only visible above the ground between late summer and spring, and only when soil moisture levels can sustain its growth. Grows in open forest or woodland, on flat or gently sloping land with poor drainage.	Predicted to occur within 10km (DSEWPaC 2012a)	Unlikely. Outside known distribution.
<i>Pterostylis saxicola</i>	Sydney Plains Greenhood	E	E	Occurs in western Sydney between Picton and Freemans Reach. Grows in small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines. Associated vegetation above these rock shelves is sclerophyll forest or woodland on shale or shale/sandstone transition soils.	4 records within 10km (OEH 2012a) Predicted to occur within 10km (DSEWPaC 2012a)	Unlikely. Broadly suitable habitat but outside of known distribution.



Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of occurrence
<i>Pultenaea parviflora</i>		E	V	Occurs on the Cumberland Plain, with core distribution from Windsor to Penrith and east to Dean Park, and outliers in Kemps Creek and Wilberforce. Grows in dry sclerophyll woodlands, forest or in grasslands on Wianamatta Shale, laterite or Tertiary alluvium, on infertile sandy to clay soils. Associated communities include Castlereagh Ironbark Forest, Shale Gravel transition Forest and intergrade with Castlereagh Scribbly Gum Woodland.	2 records within 10km (OEH 2012a)	Nil. Suitable tertiary alluvium or shale-derived soils not present.
<i>Pultenaea pedunculata</i>	Matted Bush-pea	E	-	3 disjunct populations in NSW: in the Cumberland Plains in Sydney, the coast between Tathra and Bermagui and the Windellama area south of Goulburn (where it is locally abundant). NSW populations typically among woodland vegetation but also found on road batters and coastal cliffs. In Windellama it is largely confined to loamy soils in dry gullies.	2 records within 10km (OEH 2012a)	Nil. Suitable tertiary alluvium or shale-derived soils not present.
<i>Syzygium paniculatum</i>	Magenta Lilly Pilly	V	V	Occurs in narrow coastal strip from Bulahdelah to Conjola State Forest. Grows in rainforest on sandy soils or stabilised Quaternary sand dunes at low altitudes in coastal areas, often in remnant littoral or gallery rainforests.	1 record from 1987 within 10km (OEH 2012a)	Nil. No suitable rainforest on dune sands present.
<i>Thelymitra sp. Kangaloon</i>	Sun-orchid	-	CE	Only known from three locations near Robertson in the Southern Highlands. Grows in seasonally swampy sedgeland on grey silty clay loam at 600–700 m above sea level. Flowers in late October and early November.	Predicted to occur within 10km (DSEWPac 2012a)	Nil. No suitable swampy habitat on heavy soils present and outside of known distribution.



Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of occurrence
<i>Thesium australe</i>	Austral Toadflax	V	V	Found in small, scattered populations along the east coast, northern and southern tablelands. Occurs in grassland or grassy woodland, and is often found in association with <i>Themeda australis</i> .	Predicted to occur within 10km (DSEWPac 2012a)	Unlikely. No suitable grassland or grassy woodland present.
<i>Wilsonia backhousei</i>	Narrow-leaved Wilsonia	V	-	In NSW it is scattered along the coast with a northern limit of Wamberal, N of Sydney. Most extensive stands at Jervis Bay. Grows on the margins of saltmarshes and lakes.	2 records within 10km (OEH 2012a)	Nil. No suitable lakeside or saltmarsh vegetation present.



Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of occurrence within proposal footprint
FAUNA						
Birds						
<i>Botaurus poiciloptilus</i>	Australasian Bittern	E	E	Widespread but uncommon over most NSW except the northwest. Favours permanent freshwater wetlands with tall dense reedbeds particularly <i>Typha</i> spp. and <i>Eleocharis</i> spp., with adjacent shallow, open water for foraging. Roosts during the day amongst dense reeds or rushes and feeds mainly at night on frogs, fish, yabbies, spiders, insects and snails.	Predicted to occur within 10km (DSEWPaC 2012a)	Unlikely. No suitable habitat.
<i>Ixobrychus flavicollis</i>	Black Bittern	V	-	Occurs from southern NSW to Cape York and the Kimberley, and southwest WA. Inhabits terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. May occur in flooded grassland, forest, woodland, rainforest and mangroves as long as there is permanent water. Roosts by day in trees or within reeds on the ground. Nests in branches overhanging water and breeds from December to March.	1 record within 10km (OEH 2012a)	Unlikely. No suitable habitat.
<i>Melithreptus gularis</i>	Black-chinned Honeyeater	V	-	Widespread in NSW, but rarely recorded east of Great Dividing Range except in Richmond and Clarence River areas and scattered sites in the Hunter, Central Coast and Illawarra regions. Mostly in upper levels of drier open forests /woodlands dominated by box and ironbark eucalypts, or less commonly smooth-barked gums, stringybarks and tea-treas. Forage over home range of >5 ha. Tend to occur within largest woodland patches in the landscape. They forage for insects, nectar and honeydew. The nest is hidden by foliage high in the crown of a tree.	4 records within 10km (OEH 2012a)	Unlikely. Outside core distribution, preferred box/ironbark woodlands not present.



Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of occurrence within proposal footprint
<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork	E	-	Primarily inhabits permanent freshwater wetlands and surrounding vegetation including swamps, floodplains, watercourses and billabongs, freshwater meadows, wet heathland, farm dams and shallow floodwaters. Will also forage in inter-tidal shorelines, mangrove margins and estuaries. Feeds in shallow, still water. This species breeds during summer, nesting in or near a freshwater swamp	1 record within 10km (OEH 2012a)	Unlikely. No suitable habitat.
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper	V	-	Occurs from Corowa, Wagga Wagga, Temora, Forbes, Dubbo and Inverell to the east coast, in areas such as the Snowy River Valley, Cumberland Plain, Hunter Valley and parts of the Richmond and Clarence Valleys. Most common on the inland slopes and plains. Inhabits eucalypt woodlands and dry open forest, usually dominated by stringybarks or rough-barked species with open grassy understorey. Fallen timber is important foraging habitat. Nests in hollows in standing trees or stumps.	1 record within 10km (OEH 2012a)	Unlikely. Preferred open grassy woodlands not present.
<i>Burhinus grallarius</i>	Bush Stone-curlew	E	-	Scattered distribution across NSW. The nearest known population to the site is in Pittwater (DEC 2006). Inhabits lowland grassy woodland and open forest and, in coastal areas, Casuarina and Melaleuca woodlands, saltmarsh and mangroves. Requires a low, sparse groundcover, some fallen timber and leaf litter, and a general lack of a shrubby understory (DEC 2006).	2 records within 10km (OEH 2012a)	Unlikely. No suitable habitat.
<i>Dasyornis brachypterus</i>	Eastern Bristlebird	E	E	Occurs in three disjunct areas of south-eastern Australia: southern Queensland/northern NSW, the Illawarra Region and in the vicinity of the NSW/Victorian border. Illawarra population comprises an estimated 1600 birds, mainly from Barren Grounds Nature Reserve, Budderoo National Park and the Jervis Bay area. Habitat characterised by dense, low vegetation including heath and open woodland with a heathy understorey. The fire history of habitat is important, and the Illawarra and southern populations reach maximum densities in habitat that have not been burnt for over 15 years.	Predicted to occur within 10km (DSEWPac 2012a)	Unlikely. Outside known distribution, no suitable habitat.



Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of occurrence within proposal footprint
<i>Pandion haliaetus</i>	Eastern Osprey	V	M	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.	6 records within 10km (OEH 2012a)	Unlikely. Preferred foraging and breeding habitat not present. May fly over/ rest within study area on occasion.
<i>Petroica phoenicea</i>	Flame Robin	V	-	Breeds in upland moist eucalypt forests and woodlands, often on ridges and slopes, in areas of open understorey. Migrates in winter to more open lowland habitats such as grassland with scattered trees and open woodland on the inland slopes and plains. Forages from low perches, feeding on invertebrates taken from the ground, tree trunks, logs and other coarse woody debris. Fallen logs and coarse woody debris are important habitat components. Open cup nest of plant fibres and cobweb is often built near the ground in a sheltered niche, ledge or shallow cavity in a tree, stump or bank.	2 records within 10km (OEH 2012a)	Unlikely. Preferred breeding and wintering habitats not present.
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	V	-	Restricted to SE coast and highlands south from the Hunter Valley. Spends summer in tall mountain forests and woodlands, usually heavily timbered and mature wet sclerophyll forests. Winters at lower altitudes in drier more open eucalypt forest and woodlands, particularly in coastal areas. Nests in summer in large tree hollows, often close to water, usually in tall mature sclerophyll forests with a dense understorey, and occasionally in coastal forests. Feeds on seeds, particularly Eucalyptus and Acacia, also berries, fruit and insects (Higgins 1999).	5 records within 10km (OEH 2012a)	Possible. No suitable breeding habitat. May forage in regrowth eucalypts on opportunistic basis



Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of occurrence within proposal footprint
<i>Calyptorhynchus lathamii</i>	Glossy Black-Cockatoo	V	-	Widespread but uncommon from coast to southern tablelands and central western plains. Feeds almost exclusively on the seeds of <i>Allocasuarina</i> species. Prefers woodland and open forests, rarely away from <i>Allocasuarina</i> . Roost in leafy canopy trees, preferably eucalypts, usually <1 km from feeding site. Nests in large (approx. 20 cm) hollows in trees, stumps or limbs, usually in Eucalypts (Higgins 1999).	1 record within 10km (OEH 2012a)	Possible. No suitable breeding habitat. May forage in <i>Allocasuarina</i> on occasion.
<i>Hieraaetus morphnoides</i>	Little Eagle	V	-	Occurs throughout NSW except most densely forested parts of the Dividing Range escarpment. Occupies habitats rich in prey within open eucalypt forest, woodland or open woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW are also used. For nest sites it requires a tall living tree within a remnant patch, where pairs build a large stick nest in winter and lay in early spring.	4 records within 10km (OEH 2012a)	Unlikely. Preferred breeding/foraging habitats not present.
<i>Glossopsitta pusilla</i>	Little Lorikeet	V	-	Occurs from coast to western slopes of the Great Dividing Range. Inhabits dry, open eucalypt forests and woodlands. Feed primarily on profusely-flowering eucalypts and a variety of other species including melaleucas and mistletoes. On the western slopes and tablelands <i>Eucalyptus albens</i> and <i>E. melliodora</i> are particularly important food sources for pollen and nectar respectively. Mostly nests in small (opening approx. 3cm) hollows in living, smooth-barked eucalypts, especially <i>Eucalyptus viminalis</i> , <i>E. blakelyi</i> and <i>E. dealbata</i> .	4 records within 10km (OEH 2012a)	Unlikely. No suitable breeding habitat. Preferred foraging habitat not present.
<i>Cacatua leadbeateri</i>	Major Mitchell's Cockatoo	V	-	Occurs in arid and semi-arid NSW, regularly as far east as Bourke and Griffith and occasionally further east as vagrants. Inhabits a range of treed and treeless inland habitats within easy reach of water. Nests in tree hollows.	3 records within 10km (OEH 2012a)	Unlikely. Outside core distribution.



Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of occurrence within proposal footprint
<i>Tyto novaehollandiae</i>	Masked Owl	V	-	Occurs across NSW except NW corner. Most common on the coast. Inhabits dry eucalypt woodlands from sea level to 1100 m. Roosts and breeds in large (>40cm) hollows and sometime caves in moist eucalypt forested gullies. Hunts along the edges of forests and roadsides. Home range between 500 ha and 1000 ha. Prey mostly terrestrial mammals but arboreal species may also be taken.	1 record within 10km (OEH 2012a)	Possible. No suitable breeding habitat. May forage within broader study area.
<i>Neophema chrysogaster</i>	Orange-bellied Parrot	CE	CE	Breeds in Tasmania and migrates in winter to SE South Australia and southern Victoria. There are occasional reports from NSW, including Shellharbour, Maroubra and the Shoalhaven. In winter, usually found within 3 km of the coast in saltmarsh and strandline/ foredune vegetation. May also occur on golf-courses and other grassy areas, including improved pasture.	Predicted to occur within 10km (DSEWPaC 2012a)	Unlikely. Outside core distribution, no suitable habitat.
<i>Rostratula benghalensis</i>	Painted Snipe (was Australian Painted Snipe)	E	V, M	Normally found in permanent or ephemeral shallow inland wetlands, either freshwater or brackish. Nests on the ground amongst tall reed-like vegetation near water. Feeds on mudflats and the water's edge taking insects, worm and seeds. Prefers fringes of swamps, dams and nearby marshy areas with cover of grasses, lignum, low scrub or open timber.	Predicted to occur within 10km (DSEWPaC 2012a)	Unlikely. No suitable habitat.
<i>Petroica rodinogaster</i>	Pink Robin	V	-	In NSW occurs mainly in the South Coast and Southern Tablelands regions. It is vagrant in the Sydney and Illawarra areas, with generally only individual birds recorded in these areas. It prefers a dense shrub layer in damp or wet forests or rainforests. It generally breeds in wet gullies. It forages for insects on the ground or in low undergrowth. It may be partly migratory or dispersive in autumn and winter. It is generally seen in pairs, occasionally small flocks.	1 record from 1987 within 10km (OEH 2012a)	Unlikely. May occur as a vagrant on occasion. Preferred habitats not present.



Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of occurrence within proposal footprint
<i>Ninox strenua</i>	Powerful Owl	V	-	Occurs from the coast to the western slopes. Solitary and sedentary species. Inhabits a range of habitats from woodland and open sclerophyll forest to tall open wet forest and rainforest. Prefers large tracts of vegetation. Nests in large tree hollows (> 0.5 m deep), in large eucalypts (dbh 80-240 cm) that are at least 150 years old. Pairs have high fidelity to a small number of hollow-bearing nest trees and defend a large home range of 400 - 1,450 ha. Forages within open and closed woodlands as well as open areas.	886 records within 10km (OEH 2012a)	Possible. No suitable breeding habitat. May forage within broader study area.
<i>Anthochaera phrygia</i>	Regent Honeyeater	CE	E	In NSW confined to two known breeding areas: the Capertee Valley and Bundarra-Barraba region. Non-breeding flocks occasionally seen in coastal areas foraging in flowering Spotted Gum and Swamp Mahogany forests, presumably in response to drought. Inhabits dry open forest and woodlands, particularly Box-Ironbark woodland and riparian forests of River Sheoak, with an abundance of mature trees, high canopy cover and abundance of mistletoes.	6 records within 10km (OEH 2012a)	Unlikely. Outside breeding areas and core distribution. Preferred drought habitats not present.
<i>Petroica boodang</i>	Scarlet Robin	V	-	In NSW occurs from coast to inland slopes. Breeds in drier eucalypt forests and temperate woodlands, often on ridges and slopes, within open understorey of shrubs and grasses and sometimes in open areas. In autumn and winter it migrates to more open habitats such as grassy open woodland or paddocks with scattered trees. Abundant logs and coarse woody debris are important habitat components.	3 records within 10km (OEH 2012a)	Unlikely. No suitable breeding/ foraging habitat.



Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of occurrence within proposal footprint
<i>Tyto tenebricosa</i>	Sooty Owl	V	-	Occurs in the coastal, escarpment and tablelands regions of NSW. More common in the north and absent from the western tablelands and further west. Inhabits tall, moist eucalypt forests and rainforests, and are strongly associated with sheltered gullies, particularly those with tall rainforest understorey. Roosts in tree hollows, amongst dense foliage in gullies or in caves, recesses or ledges of cliffs or banks. Nest in large (>40cm wide, 100cm deep) tree hollows in unlogged/unburnt gullies within 100m of streams or in caves.	17 records within 10km (OEH 2012a)	Unlikely. No suitable habitat.
<i>Lophoictinia isura</i>	Square-tailed Kite	V	-	Occurs across NSW, resident in North, northeast and along west-flowing rivers. Summer breeding migrant to southeast of state. Inhabits a variety of habitats including woodlands and open forests, with preference for timbered watercourses. Favours productive forests on the coastal plain, box-ironbark-gum woodlands on the inland slopes, and Coolibah/River Red Gum on the inland plains. In Sydney area nests in mature living trees within 100m of ephemeral/permanent watercourse. Large home range > 100 km ² .	5 records within 10km (OEH 2012a)	Unlikely. No suitable breeding/foraging habitat.
<i>Ptilinopus superbus</i>	Superb Fruit-dove	V	M	A small pigeon that inhabits rainforest and similar closed forests where it forages high in the canopy. It may also forage in eucalypt or acacia woodland where there are fruit-bearing trees. Occurs principally in NE Qld to NE NSW, becoming much less common further south and is largely confined to pockets of suitable habitat as far south as Moruya, with vagrants as far south as Tasmania.	2 records within 10km (OEH 2012a)	Unlikely. No suitable habitat.
<i>Lathamus discolor</i>	Swift Parrot	E	E	Migratory, travelling to the mainland from March to October. Breeds in Tasmania from September to January. On the mainland, it mostly occurs in the southeast foraging on winter flowering eucalypts and lerps, with records of the species between Adelaide and Brisbane. Principal over-winter habitat is box-ironbark communities on the inland slopes and plains. <i>Eucalyptus robusta</i> , <i>Corymbia maculata</i> and <i>C. gummifera</i> dominated coastal forests are also important habitat.	6 records within 10km (OEH 2012a) Predicted to occur within 10km (DSEWPaC 2012a)	Unlikely. Outside breeding distribution. Preferred foraging habitats not present.



Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of occurrence within proposal footprint
<i>Daphoenositta chrysoptera</i>	Varied Sittella	V	-	Sedentary, occurs across NSW from the coast to the far west. Inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. Sensitive to habitat isolation and loss of structural complexity, and adversely affected by dominance of Noisy Miners. Cleared agricultural land is potentially a barrier to movement. Builds a cup-shaped nest of plant fibres and cobwebs in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years.	15 records within 10km (OEH 2012a)	Unlikely. No suitable breeding/foraging habitat
<i>Epthianura albifrons</i>	White-fronted Chat	V, EP (Sydney Metro CMA)	-	This species occurs from southern Queensland to Western Australia and down to Tasmania, mostly in temperate to arid climates and very rarely in sub-tropical areas. 2 isolated sub-populations in the Sydney Metropolitan CMA: at Newington Nature Reserve and at Towra Point NR. Inhabits damp open habitats, particularly wetlands containing saltmarsh areas that are bordered by open grasslands. Along the coast they are found in estuarine and marshy habitats with vegetation <1m tall, and in open grasslands and areas bordering wetlands. Inland, they are often observed in grassy plains, saltlakes and salt pans along waterway margins.	4 records within 10km (OEH 2012a)	Unlikely. No suitable habitat.

Mammals



Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of occurrence within proposal footprint
<i>Petrogale pencillata</i>	Brush-tailed Rock-wallaby	E	V	Occurs from the Shoalhaven north to the Queensland border. Now mostly extinct west of the Great Dividing Range, except in the Warrumbungles and Mt Kaputar. Occurs on rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges facing north. Diet consists of vegetation in adjacent to rocky areas eating grasses and forbs as well as the foliage and fruits of shrubs and trees.	1 record within 10km (OEH 2012a) Predicted to occur within 10km (DSEWPaC 2012a)	Unlikely. No suitable habitat.
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat	V	-	Generally occurs east of the Great Dividing Range along NSW coast (Churchill 2008). Inhabits various habitats from open grasslands to woodlands, wet and dry sclerophyll forests and rainforest. Essentially a cave bat but may also roost in road culverts, stormwater tunnels and other man-made structures. Only 4 known maternity caves in NSW, near Wee Jasper, Bungonia, Kempsey and Texas. Females may travel hundreds of kilometres to the nearest maternal colony (Churchill 2008).	16 records within 10km (OEH 2012a)	Possible. No suitable breeding/roosting habitat. May forage along edge of road on occasion.
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V	-	Occurs on southeast coast and ranges. Prefers tall (>20m) and wet forest with dense understorey. Absent from small remnants, preferring continuous forest but can move through cleared landscapes and may forage in open areas. Roosts in hollow trunks of Eucalypts, underneath bark or in buildings. Forages in gaps and spaces within forest, with large foraging range (12km foraging movements recorded) (Churchill 2008, Law et al 2008).	2 records within 10km (OEH 2012a)	Unlikely. Preferred habitats absent.



Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of occurrence within proposal footprint
<i>Mormopterus norfolkensis</i>	Eastern Freetail- bat	V	-	Occurs in dry sclerophyll forest and woodland east of the Great Dividing Range. Forages in natural and artificial openings in vegetation, typically within a few kilometres of its roost. Roosts primarily in tree hollows but also recorded from man-made structures or under bark (Churchill 2008).	5 records within 10km (OEH 2012a)	Possible. No suitable breeding/roosting habitat. May forage along edge of road on occasion.
<i>Cercartetus nanus</i>	Eastern Pygmy-possum	V	-	Occurs along the east coast of NSW, and inland to the Pillaga, Dubbo, Parkes and Wagga Wagga. Inhabits range of habitats from coastal heath and woodland through open and closed forests, subalpine heath and rainforest (Tulloch and Dickman 1995). Inhabits rainforest, sclerophyll forests and heath. Banksia spp. and myrtaceous shrubs and trees are favoured food sources and nesting proposal disturbance footprints in drier habitats. Diet mostly pollen and nectar from Banksia spp., Eucalyptus spp., Callistemon spp. and insects (Ward and Turner 2008). Nests in hollows in trees, under the bark of Eucalypts, forks of tea-trees, abandoned bird nests and Xanthorrhoea bases (Ward and Turner 2008, Tulloch and Dickman 2006).	2 records within 10km (OEH 2012a)	Unlikely. No suitable habitat
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V	-	Occurs on the east coast and Great Dividing Range. Inhabits a variety of habitats from woodland to wet and dry sclerophyll forests and rainforest, also remnant paddock trees and timber-lined creeks, typically below 500m asl. Forages in relatively uncluttered areas, using natural or man-made openings in denser habitats. Usually roosts in tree hollows or fissures but also under exfoliating bark or in the roofs of old buildings. Females congregate in maternal roosts in suitable hollow trees (Hoye and Richards 2008, Churchill 2008).	5 records within 10km (OEH 2012a)	Possible. No suitable breeding/roosting habitat. May forage along edge of road on occasion.



Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of occurrence within proposal footprint
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	V	Roosts in camps within 20 km of a regular food source, typically in gullies, close to water and in vegetation with a dense canopy. Forages in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths, swamps and street trees, particularly in eucalypts, melaleucas and banksias. Highly mobile with movements largely determined by food availability (Eby and Law 2008). Will also forage in urban gardens and cultivated fruit crops.	81 records within 10km (OEH 2012a) Predicted to occur within 10km (DSEWPaC 2012a)	Present. Recorded flying over the site. No suitable breeding/roosting habitat. May forage along edge of road on occasion.
<i>Phascolarctos cinereus</i>	Koala	V	V	Occurs from coast to inland slopes and plains. Restricted to areas of preferred feed trees in eucalypt woodlands and forests. Home range varies depending on habitat quality, from < 2 to several hundred hectares.	88 records within 10km (OEH 2012a)	Unlikely. No food trees present. Proposal footprint isolated from known populations by Alford's Point road and associated cuttings and batters.
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	Occurs from the coast to the western slopes of the divide. Largest numbers of records from sandstone escarpment country in the Sydney Basin and Hunter Valley (Hoye and Schulz 2008). Roosts in caves and mines and most commonly recorded from dry sclerophyll forests and woodlands. An insectivorous species that flies over the canopy or along creek beds (Churchill 2008). In southern Sydney appears to be largely restricted to the interface between sandstone escarpments and fertile valleys.	Predicted to occur within 10km (DSEWPaC 2012a)	Possible. 'Probable' Anabat call recordings. No suitable breeding/roosting habitat.



Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of occurrence within proposal footprint
<i>Myotis macropus</i>	Large-footed Myotis	V	-	Mainly coastal but may occur inland along large river systems. Usually associated with permanent waterways at low elevations in flat/undulating country, usually in vegetated areas. Forages over streams and watercourses feeding on fish and insects from the water surface. Roosts in a variety of habitats including caves, mine shafts, hollow-bearing trees, stormwater channels, buildings, under bridges and in dense foliage, typically in close proximity to water (Campbell 2011). Breeds November or December (Churchill 2008).	3 records within 10km (OEH 2012a)	Unlikely. No suitable breeding/roosting/foraging habitat.
<i>Potorous tridactylus</i>	Long-Nosed Potoroo	V	V	Restricted to east of the Great Dividing Range, with annual rainfall >760 mm. Inhabits coastal heath and dry and wet sclerophyll forests. Requires relatively thick ground cover and appears restricted to areas of light and sandy soil (Johnston 2008). Feeds on fungi, roots, tubers, insects and their larvae, and other soft-bodied animals in the soil.	Predicted to occur within 10km (DSEWPaC 2012a)	Unlikely. No suitable habitat.
<i>Pseudomys novaehollandiae</i>	New Holland Mouse	-	V	Occurs in disjunct, coastal populations from Tasmania to Queensland. In NSW inhabits a variety of coastal habitats including heathland, woodland, dry sclerophyll forest with a dense shrub layer and vegetated sand dunes (Wilson and Bradtke 1999). Populations may recolonise/ increase in size in regenerating native vegetation after wildfire, clearing and sandmining. Presence strongly correlated with understorey vegetation density, and high floristic diversity in regenerating heath (Lock and Wilson 1999).	Predicted to occur within 10km (DSEWPaC 2012a)	Unlikely. No suitable habitat.



Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of occurrence within proposal footprint
<i>Isoodon obesulus</i>	Southern Brown Bandicoot	E	E	Occurs mainly in 2 areas: Ku-ring-gai Chase and Garigal National Parks N of Sydney, and far SE NSW including Ben Boyd National Park, East Boyd State Forest, Nadgee Nature Reserve, Nadgee State Forest, South East Forest and Yambulla State Forest but also occurs between these areas. Inhabits scrubby vegetation, including heath, shrubland, and heathy forest and woodland. Often associated with well-drained soils and dry heathland communities, and prefers periodically burnt areas as this increases insect abundance.	Predicted to occur within 10km (DSEWPaC 2012a)	Unlikely. Outside known distribution.
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	V	E	Inhabits a range of environments including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Den proposal disturbance footprints are in hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces. Females occupy home ranges of up to 750 ha and males up to 3,500 ha, which are usually traversed along densely vegetated creek lines.	3 records within 10km (OEH 2012a) Predicted to occur within 10km (DSEWPaC 2012a)	Unlikely. No suitable habitat.
<i>Petaurus australis</i>	Yellow-Bellied Glider	V	-	Occurs along the east coast to the western slopes of the Great Dividing Range. Inhabits a variety of forest types but prefers tall mature eucalypt forest with high rainfall and rich soils. Relies on large hollow-bearing trees for shelter and nesting, with family groups of 2-6 typically denning together. In southern NSW its preferred habitat at low altitudes is moist gullies and creek flats in mature coastal forests. Mostly feeds on sap, nectar and honeydew.	1 record within 10km (OEH 2012a)	Unlikely. No suitable habitat.



Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of occurrence within proposal footprint
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheathtail-bat	V	-	Migrates from tropics to SE Aus in summer. Forages across a range of habitats including those with and without trees, from wet and dry sclerophyll forest, open woodland, Acacia shrubland, mallee, grasslands and desert. Roosts communally in large tree hollows and buildings (Churchill 2008).	3 records within 10km (OEH 2012a)	Possible. ‘Probable’ Anabat call recordings. No suitable breeding/roosting habitat. No suitable breeding/roosting habitat. May forage along edge of road on occasion.
Reptiles						
<i>Hoplocephalus bungaroides</i>	Broad-Headed Snake	E	V	Nocturnal, sheltering in rock crevices and under flat sandstone rocks on exposed cliff edges during autumn, winter, and spring, moving to shelters in hollows of large trees within 200m of escarpments in summer. Feeds mostly on geckos and small skinks, and occasionally on frogs and small mammals.	1 record within 10km (OEH 2012a) Predicted to occur within 10km (DSEWPaC 2012a)	Unlikely. No suitable habitat
<i>Varanus rosenbergi</i>	Rosenberg's Goanna	V	-	In NSW mainly occurs on the mid coast from Wollemi NP to Nowra; the ACT and Goulburn regions and the South-west Slopes. Inhabits coastal heathlands, wet and dry sclerophyll forests, woodlands and mallee. Termite mounds are important: eggs are laid in the mounds in summer and incubate till spring, when the young dig themselves out. Young may return to the mound as a refuge for some months, while adults shelter in burrows dug under rocks or logs, or in rock crevices, hollow logs or even rabbit burrows (Sass 2008).	5 records within 10km (OEH 2012a)	Unlikely. No suitable habitat



Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of occurrence within proposal footprint
Frogs						
<i>Heleioporus australiacus</i>	Giant Burrowing Frog	V	V	Occurs along the coast and eastern slopes of the Great Dividing Range south from Wollemi National Park. Appears to exist as 2 populations with a 100km gap in records between Jervis Bay and Eden. Northern population occurs on sandy soils supporting heath, woodland or open forest. Breeds in ephemeral to intermittent streams with persistent pools. Only infrequently moves to breeding sites, most commonly found on ridges away from creeks, several hundred metres from water.	3 records within 10km (OEH 2012a) Predicted to occur within 10km (DSEWPaC 2012a)	Unlikely. No suitable habitat.
<i>Litoria aurea</i>	Green and Golden Bell Frog	E	V	Formerly occurred from Brunswick Heads to Victoria, but >80% populations now extinct. Inhabits marshes, natural and artificial freshwater to brackish wetlands, dams and in stream wetlands. Prefers sites containing cumbungi (<i>Typha</i> spp.) or spike rushes (<i>Eleocharis</i> spp.), which are unshaded and have a grassy area and/or rubble as shelter/refuge habitat nearby. <i>Gambusia holbrooki</i> is a key threat as they feed on green and Golden Bell Frog eggs and tadpoles.	63 records within 10km (OEH 2012a) Predicted to occur within 10km (DSEWPaC 2012a)	Unlikely. No suitable habitat.
<i>Litoria raniformis</i>	Southern Bell Frog	E	V	In NSW, the species is now known to exist only in isolated populations in the Coleambally Irrigation Area, the Lowbidgee floodplain and around Lake Victoria. A few yet unconfirmed records have also been made in the Murray Irrigation Area in recent years. It is usually found in or around permanent or ephemeral Black Box/Lignum/Nitre Goosefoot swamps, Lignum/Typha swamps and River Red Gum swamps or billabongs. They are also found in irrigated rice crops. Tadpoles require standing water for at least 4 months but can take 12 months to develop.	Predicted to occur within 10km (DSEWPaC 2012a)	Unlikely. Outside core distribution, no suitable habitat.
<i>Litoria littlejohni</i>	Littlejohns Treefrog	V	V	Occurs on plateaus and eastern slopes of the Great Dividing Range south from Watagan State Forest. Occurs along permanent rocky streams with thick fringing vegetation associated with eucalypt woodlands and heaths among sandstone outcrops, hunting either in shrubs or on the ground.	Predicted to occur within 10km (DSEWPaC 2012a)	Unlikely. No suitable habitat.



Scientific Name	Common Name	TSC/FM Act	EPBC Act	Habitat Association	Nature of Record	Likelihood of occurrence within proposal footprint
<i>Pseudophryne australis</i>	Red-crowned Toadlet	V	-	Restricted to Sydney Basin, from Nowra to Pokolbin and west to Mt Victoria. Inhabits heathland and open woodland on Hawkesbury and Narrabeen Sandstones, within 100 m of ridgelines. Breeds in ephemeral feeder creeks or flooded depressions, requiring unpolluted water between 5.5 and 6.5 pH. Shelters under rocks, amongst masses of dense vegetation or leaf litter. Populations restricted to immediate vicinity of breeding areas.	13 records within 10km (OEH 2012a)	Unlikely. No suitable habitat.
<i>Mixophyes balbus</i>	Stuttering Frog	E	V	Occurs along the east coast of Australia. Found in rainforest and wet, tall, open forest. Shelter in deep leaf litter and thick understorey vegetation on the forest floor. Feeds on insects and smaller frogs, breeding in streams during summer after heavy rain. Within Sydney Basin the species is now confined to populations in the Watagan Mountains, the southern Blue Mountains and Macquarie Pass (White 2008a). The species does not occur in areas where the riparian vegetation has been disturbed or where there have been significant upstream human impacts (Mahony et al 1997).	Predicted to occur within 10km (DSEWPaC 2012a)	Unlikely. No suitable habitat.

All information in this table is taken from NSW OEH and Commonwealth DSEWPaC Threatened Species profiles (DEC 2005, DSEWPaC 2012b) unless otherwise stated. The codes used in this table are: CE – Critically Endangered; E – Endangered; V – Vulnerable; EP – Endangered Population; CEEC – Critically Endangered Ecological Community; EEC – Endangered Ecological Community.

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Appendix D

TSC Act Assessments of Significance



Assessment of Significance for Southern Sydney Sheltered Forest (Endangered Ecological Community)

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 to this EEC.

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 to this EEC.

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

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

The proposal will result in the removal of 0.017 hectares of vegetation that constitutes the EEC Southern Sydney Sheltered Forest. Tozer (2010) estimates that approximately 728.63 hectares of this community exists within the locality, which represents a loss of 0.002% of the occurrence within the locality. A total of 0.508 hectares of this community occurs within the study area.

A Vegetation Management Plan is recommended for the proposal, which would contain measures to avoid direct and indirect impacts on native vegetation adjoining the proposal disturbance footprint, including this EEC. Given these mitigation measures and the extent of existing weed infestation and disturbance in the study area, the proposal would result in a minor increase in weed infestation and other edge effects. The likely magnitude of edge effects or other indirect effects would not 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) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

The proposal would result in the removal of 0.017 hectares of Southern Sydney Sheltered Forest vegetation, from the disturbed edge of its occurrence in the study area. This represents a loss of approximately 0.002% from within the locality (Tozer (2010) estimates that 728.63 hectares of this community exists within the locality) and a reduction of 3.276% from within the study area (0.508 hectares was mapped within the study area). 0.491 hectares of this EEC will be retained within the study area, and extensive patches of this EEC occur in areas surrounding the study area. Extensive areas of the floristically similar vegetation type Hinterland Sandstone Gully Forest occurs within the locality (Tozer (2010) estimates 3694.39 hectares), and study area, which will ensure continued species recruitment.

As it occurs within the study area, the EEC is in poor condition, with numerous exotic species in the understorey. The proximity of the existing roadway and nearby urban areas has resulted in ongoing edge effects, weed infestation, rubbish dumping and vehicle impacts associated with Alford's Point Road. Both the construction and operational phase of the proposal is likely to result in the continuation of the indirect impacts listed above, as well as fauna mortality. Standard environmental management measures are likely to mitigate against any substantial effects on the local occurrence of the EEC outside of the immediate disturbance footprint.



Assessment of Significance for Southern Sydney Sheltered Forest (Endangered Ecological Community)

Given the above considerations of the extensive areas of the EEC elsewhere in the locality and study area, the presence of the similar Hinterland Sandstone Gully Forest vegetation, and the disturbed nature of the area to be impacted, the vegetation to be removed is unlikely to contribute substantially to the composition of the EEC. As such, the proposed activity is not likely to remove, modify or fragment a significant proportion of the habitat for this EEC in the locality such that any component species would become locally extinct (refer *part d*).

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

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

The proposal will require the removal of 0.017 hectares of this community. Vegetation to be removed comprises disturbed portions of the community at the edge of its occurrence in the study area (adjacent to Alford's Point Road). A total of 0.508 hectares of this community was mapped within the study area, of which 0.491 hectares will be retained.

During the operational phase, the proposal could further modify habitat for the EEC through edge effects, weed infestation or fauna mortalities, however given the community exists in a disturbed state, any such impacts are likely to be minimal. The proposed impact mitigation and environmental management measures are likely to mitigate against any substantial effects on the local population of the EEC outside of the immediate disturbance footprint.

(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

The proposal would require the removal of a small portion (0.017 hectares) of this community from its westernmost occurrence in the study area. The vegetation to be removed is disturbed in nature as a result of ongoing edge impacts and proximity to Alford's Point Road), and the presence of Alford's Point Road represents an existing barrier to the community. It is unlikely that the proposal will directly fragment or isolate any additional habitat for the EEC, as the vegetation to be removed is located at the edge of the patch of the community, and the remainder of the community will remain linked to other vegetation outside of the proposal disturbance footprint. The proposal would contribute to the existing barrier to movement or recruitment of native species that are part of the EEC but which may occur in environments to the west. The proposal disturbance footprint is parallel to the existing gap in habitat caused by Alford's Point Road. The increase in the barrier as a result of the proposal would comprise a relatively minor increase in the risk or energy costs of traversing the gap in habitat, compared to the existing required expenditure. As such, the proposal is unlikely to result in significant increases to the fragmentation or isolation of the community.

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

The proposal would result in the removal of 0.017 hectares of vegetation which constitutes this EEC. This habitat would be permanently cleared of the community. Tozer (2010) notes that 728.63 hectares of the community exists within the locality, meaning the proposal will result in the removal of 0.002% of the community from the locality. 0.491 hectares of the EEC mapped within the study area will be retained. As such, the removal of a very small, disturbed (located on the edge of the patch, with evidence of ongoing impacts resulting from dumping, vehicles, weed infestation and edge effects) and isolated portion from



Assessment of Significance for Southern Sydney Sheltered Forest (Endangered Ecological Community)

within the proposal disturbance footprint is not considered to be 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),

There is no critical habitat listed for this EEC.

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

There is no recovery plan for this EEC. OEH identifies a number of priority actions intended to abate threats to this EEC and ensure its long term conservation (OEH, 2011b), including the protection of habitat by minimising further clearing of the community. The removal of 0.017 hectares of this community from the proposal disturbance footprint is inconsistent with identified priority actions but is unlikely to substantially affect the recovery of the community in the locality given the small area and modified nature of the vegetation to be removed.

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 would directly contribute to the operation of the KTP 'Clearing of native vegetation' through the removal of 2.715 hectares of native vegetation. The total area of native vegetation to be removed is around 0.02% of the estimated area of native vegetation in the locality (around 12573.36 hectares, based on Tozer (2010) vegetation mapping, much of which is conserved in national parks) and thus comprises a very minor increase in the operation of the KTP.

The proposal also has the potential to indirectly cause or increase the operation of the following KTPs that are of potential relevance to this ecological community:

- Invasion of plant communities by perennial exotic grasses – the proposal would create disturbed edges through native vegetation and potentially transfer exotic grass propagules
- Infection of native plants by *Phytophthora cinnamomi* - the proposal would disturb soil within and adjoining native vegetation and potentially transfer fungi spores
- Infection of frogs by amphibian chytrid causing the disease chytridiomycosis - the proposal would disturb soil within and adjoining native vegetation and periodically flooded depressions and potentially transfer fungi spores.

The proposal would include environmental management measures including specific consideration of potential impacts on soil, water and native vegetation. These measures would mitigate against the operation of these KTPs.

Conclusion of Assessment of Significance

Based on consideration of the above criteria, the proposal is unlikely to have a significant effect on the local occurrence of Southern Sydney Sheltered Forest.



Grey-headed Flying-fox (vulnerable)

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,

Grey-headed Flying-foxes roost and breed in large colonies (camps). All the flying-fox camps in eastern Australia are linked into one population and numbers in any one camp are influenced by food availability and the requirements of mating and raising young. Fluctuations in the size of a camp can vary week by week, month by month or in some cases from one night to the next, and reflect the nomadic nature of Grey-headed Flying-foxes (KBCS 2011).

No Grey-headed Flying-fox camps are present in the study area. The locations of such camps are relatively well known: the closest continuously occupied camp to the site is at Kareela, some 6.5 km to the south-east; while there is an occasionally occupied camp at Menai, approximately 3 km to the south-west, which is well beyond the range of any indirect effects potentially arising from the proposal.

The species may forage within the study area on occasion, but as stated in *part d)* the species is highly unlikely to depend on the resources that would be removed by the proposal. The proposal would not cause any barrier to movement between roost sites and potential foraging habitat.

The proposal is therefore unlikely to adversely affect the lifecycle of the species such that a viable local population is 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,

Not applicable to this threatened fauna 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

Not applicable to this threatened fauna species

(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 to this threatened fauna species

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

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

The primary food source for Grey-headed Flying-foxes is blossom from *Eucalyptus* species and other Myrtaceous species but in some areas it also utilises a wide range of rainforest fruits (Eby 1998). The Grey-headed Flying-fox is a highly mobile species which regularly travels up to 50 kilometres in a night to forage, and has been shown to make migratory movements of almost 1000 kilometres within a year (Churchill 2008, Webb and Tidemann 1996). The species was seen flying over the study area and so forest and woodland within the study area comprises potential foraging habitat for the species. About



Grey-headed Flying-fox (vulnerable)

2.715 hectares of potential foraging habitat for the species, comprising native woodland and forest with Myrtaceous tree species, would be removed as a result of this proposal. The total area of native vegetation to be removed is around 0.02% of the estimated area of native vegetation in the locality (around 12573.36 hectares, based on Tozer (2010) vegetation mapping, much of which is conserved in national parks).

As stated in *part a)* no known or potential roosting habitat for the species would be removed or modified by the proposal.

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

The proposal would involve widening an existing gap in habitat and so vegetation clearing for the proposal will not directly isolate or fragment any areas of habitat.

The proposal involves construction of structures that may obstruct movement of fauna attempting to cross Alford's Point Road. These potential obstructions include F type concrete barriers, noise mitigation structures and the roadway and cycle paths themselves. The Grey-headed Flying Fox would easily traverse these obstructions as it is known to routinely travel up to 50 km in a night to forage (Churchill 2008). Further, all of the above listed barriers would be parallel to existing, equivalent barriers and would not significantly increase the energy costs of flying over the proposal disturbance footprint or otherwise increase the degree to which fauna movement is already disrupted.

(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,

At least two eucalypt species known to be highly productive species (productivity scores >0.91) occur in the study area: Red Bloodwood and Sydney Peppermint. These trees would not necessarily provide annually reliable resources (Eby and Law, 2008). Grey-headed Flying-foxes may feed occasionally in the proposal disturbance footprint, but would not depend solely on these foraging resources. The proposal would remove a very small proportion of available foraging resources for local populations of the Grey-headed Flying Fox: 0.0049% % of the extent of vegetation map units likely to contain Myrtaceous trees in the locality (around 11961.33 hectares based on Tozer, 2010 vegetation mapping). Foraging resources in the proposal disturbance footprint would have even less value than this area suggests, as the species is more likely to favour resources that are not immediately adjacent to major roads and affected by noise, light and the risk of vehicle collisions.

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

The draft national recovery plan (DECCW 2009) states that foraging habitat that meets at least one of the following criteria qualifies as critical habitat:

- ▶ productive during winter and spring, when food bottlenecks have been identified.
 - ▶ known to support populations of > 30 000 individuals within an area of 50 kilometre radius (the maximum foraging distance of an adult).
 - ▶ productive during the final weeks of gestation, and during the weeks of birth, lactation and conception (September to May).
 - ▶ productive during the final stages of fruit proposal and ripening in commercial crops affected by Grey-
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Grey-headed Flying-fox (vulnerable)

headed Flying-foxes (months vary between regions).

- known to support a continuously occupied camp.

Vegetation at the site does not support a continuously occupied roost camp, and is not in a region with significant commercial fruit crops. The proposal disturbance footprint would not support a population of more than 30 000 individuals, but would contribute to foraging habitat for some individuals of the population. While there would be some productivity of foraging resources during winter and spring, the resources present in the study area are limited in comparison to available foraging resources in nearby areas, such as Georges River National Park. The small area of foraging habitat to be removed and the large tracts of other vegetation in the locality mean that the site is unlikely to represent habitat critical to the survival of a local population of the species.

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

The draft recovery plan for the Grey-headed Flying-fox (DECCW, 2009) identifies the following recovery objectives of relevance to the removal of foraging habitat for the species:

- Objective 1. To identify and protect foraging habitat critical to the survival of Grey-headed Flying-foxes throughout their range

The study area does not support a breeding camp or populations of >30,000 individuals. While trees are present that flower during winter and spring (during food bottlenecks) and summer and autumn (during the breeding season), these trees are not considered to be productive enough to support the local population.

- Objective 2. To protect and increase the extent of key winter and spring foraging habitat of Grey-headed Flying-foxes

Out of the native vegetation to be removed, a proportion are winter/spring flowering trees. Foraging resources in the study area are not considered to be key foraging habitat for the Grey-headed Flying-fox, although the species may forage in the study area on occasion during these seasons. Therefore the proposal would result in a reduction of up to 2.715 hectares of potential foraging habitat for the species.

The proposed action is therefore not entirely consistent with the draft recovery plan for the 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 would directly contribute to the operation of the KTP 'Clearing of native vegetation' through the removal of 2.715 hectares of native vegetation. The total area of native vegetation to be removed is around 0.02% of the estimated area of native vegetation in the locality (around 12573.36 hectares, based on Tozer (2010) vegetation mapping, much of which is conserved in national parks) and thus comprises a very minor increase in the operation of the KTP.

The proposal would not affect the operation of any other KTPs of relevance to this threatened species.

Conclusion of Assessment of Significance

On consideration of the above criteria, the proposal is unlikely to have a significant negative effect on the local population of the Grey-headed Flying-fox.



Grey-headed Flying-fox (vulnerable)

Large-eared Pied Bat (vulnerable)

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 Large-eared Pied Bat occurs from the coast to the western slopes of the divide with the largest numbers of records from sandstone escarpment country in the Sydney Basin and Hunter Valley (Hoye and Schulz 2008). It roosts in caves and mines and is most commonly recorded from dry sclerophyll forests and woodlands. It is an insectivorous species that flies over the canopy or along creek beds (Churchill 2008). In southern Sydney, it appears to be largely restricted to the interface between sandstone escarpments and fertile valleys. The factors that could potentially disrupt the life cycle of the Large-eared Pied Bat are loss of roost sites in suitable caves or fissures and/or loss of significant areas of foraging habitat.

There are no caves, overhangs or fissures in the proposal disturbance footprint that could comprise potential roost sites for the species. The proposal is highly unlikely to adversely affect any such roost sites that would be present elsewhere in the study area.

The species may forage within the study area on occasion, but as stated in *part d)* the species is highly unlikely to depend on the resources that would be removed by the proposal. The proposal is therefore unlikely to adversely affect the lifecycle of the species such that a viable local population is 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,

Not applicable to this threatened fauna 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

Not applicable to this threatened fauna species

(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 to this threatened fauna species

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



Grey-headed Flying-fox (vulnerable)

The species was recorded in the study area and so forest and woodland within the study area comprises potential foraging habitat for the species. About 2.715 hectares of potential foraging habitat for the species, comprising native woodland and forest, would be removed as a result of this proposal.

As stated in *part a)* no known or potential roosting habitat for the species would be removed or modified by the proposal.

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

The proposal would involve widening an existing gap in habitat and so vegetation clearing for the proposal will not directly isolate or fragment any areas of habitat.

The proposal involves construction of structures that may obstruct movement of fauna attempting to cross Alford's Point Road. These potential obstructions include F type concrete barriers, noise mitigation structures and the roadway and cycle paths themselves. The Large-eared Pied Bat forages at high speed above the canopy (Churchill, 2008) and so would easily traverse these structures by flying over or around them. Further, all of the above listed barriers would be parallel to existing, equivalent barriers and would not significantly increase the energy costs of flying over the proposal disturbance footprint or otherwise increase the degree to which fauna movement is already disrupted.

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

The total area of habitat to be removed (2.715 hectares) is around 0.02% of the estimated area of potentially suitable habitat in native vegetation in the locality (around 12573.36 hectares, based on Tozer (2010) vegetation mapping, much of which is conserved in national parks). The small area of vegetated habitat to be removed would have very limited value to the local population of the species. Habitat in the proposal disturbance footprint would have even less value than this area suggests as it is regrowth vegetation and is adjacent to a major road and subject to noise and light impacts and the risk of vehicle collision.

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

There is no critical habitat identified for recovery plan for this species.

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

There is no recovery plan for this species. The OEH (2011b) has identified a number of priority actions for this species which generally relate to protection of roosting habitat. No priority actions are particularly relevant to the proposal. The proposal is therefore not inconsistent with the priority actions for this species.

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



Large-eared Pied Bat (vulnerable)

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 Large-eared Pied Bat occurs from the coast to the western slopes of the divide with the largest numbers of records from sandstone escarpment country in the Sydney Basin and Hunter Valley (Hoye and Schulz 2008). It roosts in caves and mines and is most commonly recorded from dry sclerophyll forests and woodlands. It is an insectivorous species that flies over the canopy or along creek beds (Churchill 2008). In southern Sydney, it appears to be largely restricted to the interface between sandstone escarpments and fertile valleys. The factors that could potentially disrupt the life cycle of the Large-eared Pied Bat are loss of roost sites in suitable caves or fissures and/or loss of significant areas of foraging habitat.

There are no caves, overhangs or fissures in the proposal disturbance footprint that could comprise potential roost sites for the species. The proposal is highly unlikely to adversely affect any such roost sites that would be present elsewhere in the study area.

The species may forage within the study area on occasion, but as stated in *part d)* the species is highly unlikely to depend on the resources that would be removed by the proposal. The proposal is therefore unlikely to adversely affect the lifecycle of the species such that a viable local population is 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,

Not applicable to this threatened fauna 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

Not applicable to this threatened fauna species

(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 to this threatened fauna species

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

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

The species was recorded in the study area and so forest and woodland within the study area comprises potential foraging habitat for the species. About 2.715 hectares of potential foraging habitat for the species, comprising native woodland and forest, would be removed as a result of this proposal.

As stated in *part a)* no known or potential roosting habitat for the species would be removed or modified by the proposal.



Large-eared Pied Bat (vulnerable)

(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

The proposal would involve widening an existing gap in habitat and so vegetation clearing for the proposal will not directly isolate or fragment any areas of habitat.

The proposal involves construction of structures that may obstruct movement of fauna attempting to cross Alford's Point Road. These potential obstructions include F type concrete barriers, noise mitigation structures and the roadway and cycle paths themselves. The Large-eared Pied Bat forages at high speed above the canopy (Churchill, 2008) and so would easily traverse these structures by flying over or around them. Further, all of the above listed barriers would be parallel to existing, equivalent barriers and would not significantly increase the energy costs of flying over the proposal disturbance footprint or otherwise increase the degree to which fauna movement is already disrupted.

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

The total area of habitat to be removed (2.715 hectares) is around 0.02% of the estimated area of potentially suitable habitat in native vegetation in the locality (around 12573.36 hectares, based on Tozer (2010) vegetation mapping, much of which is conserved in national parks). The small area of vegetated habitat to be removed would have very limited value to the local population of the species. Habitat in the proposal disturbance footprint would have even less value than this area suggests as it is regrowth vegetation and is adjacent to a major road and subject to noise and light impacts and the risk of vehicle collision.

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

There is no critical habitat identified for recovery plan for this species.

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

There is no recovery plan for this species. The OEH (2011b) has identified a number of priority actions for this species which generally relate to protection of roosting habitat. No priority actions are particularly relevant to the proposal. The proposal is therefore not inconsistent with the priority actions for this species.

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

The proposal would directly contribute to the operation of the KTP 'Clearing of native vegetation' through the removal of 2.715 hectares of native vegetation. The total area of native vegetation to be removed is around 0.02% of the estimated area of native vegetation in the locality (around 12573.36 hectares, based on Tozer (2010) vegetation mapping, much of which is conserved in national parks) and thus comprises a very minor increase in the operation of the KTP.

The proposal would not affect the operation of any other KTPs of relevance to this threatened species.

Conclusion of Assessment of Significance

On consideration of the above criteria, the proposal is unlikely to have a significant negative effect on the



Large-eared Pied Bat (vulnerable)

local population of the Large-eared Pied Bat.

Yellow-bellied Sheathtail Bat (vulnerable)

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 Yellow-bellied Sheathtail Bat migrates from the tropics to southeast Australia in summer and forages across a range of habitats, including those with and without trees, from wet and dry sclerophyll forest, open woodland, Acacia shrubland, mallee, grasslands and desert. It roosts communally in large tree hollows and buildings (Churchill, 2008). The factors that could potentially disrupt the life cycle of the Yellow-bellied Sheathtail Bat are loss of roost trees and/or loss of significant areas of foraging habitat.

The local population of the Yellow-bellied Sheathtail Bat may utilise tree hollows in the study area as diurnal roosts or maternity roosts. The proposal would not remove any hollow-bearing trees and is highly unlikely to prevent the species from using roost trees in the broader study area through indirect effects.

The species may forage within the study area on occasion, but as stated in *part d)* the species is highly unlikely to depend on the resources that would be removed by the proposal. The proposal is therefore unlikely to adversely affect the lifecycle of the species such that a viable local population is 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,

Not applicable to this threatened fauna 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

Not applicable to this threatened fauna species

(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 to this threatened fauna species

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

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

The species was recorded in the study area and so forest and woodland within the study area comprises potential foraging habitat for the species. About 2.715 hectares of potential foraging habitat for the



Yellow-bellied Sheath-tail Bat (vulnerable)

species, comprising native woodland and forest, would be removed as a result of this proposal.

As stated in *part a)* no known or potential roosting habitat for the species would be removed or modified by the proposal.

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

The proposal would involve widening an existing gap in habitat and so vegetation clearing for the proposal will not directly isolate or fragment any areas of habitat.

The proposal involves construction of structures that may obstruct movement of fauna attempting to cross Alfords Point Road. These potential obstructions include F type concrete barriers, noise mitigation structures and the roadway and cycle paths themselves. The Large-eared Pied Bat migrates long distances (Churchill 2008) and would easily traverse these structures by flying over or around them. Further, all of the above listed barriers would be parallel to existing, equivalent barriers and would not significantly increase the energy costs of flying over the proposal disturbance footprint or otherwise increase the degree to which fauna movement is already disrupted.

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

The total area of habitat to be removed (2.715 hectares) is around 0.02% of the estimated area of potentially suitable habitat in native vegetation in the locality (around 12573.36 hectares, based on Tozer (2010) vegetation mapping, much of which is conserved in national parks). The small area of vegetated habitat to be removed would have very limited value to the local population of the species. Habitat in the proposal disturbance footprint would have even less value than this area suggests as it is regrowth vegetation and is adjacent to a major road and subject to noise and light impacts and the risk of vehicle collision.

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

There is no critical habitat identified for recovery plan for this species.

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

There is no recovery plan for this species. The OEH (2011b) has identified a number of priority actions for this species which generally relate to protection of roosting habitat. No priority actions are particularly relevant to the proposal. The proposal is therefore not inconsistent with the priority actions for this species.

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

The proposal would directly contribute to the operation of the KTP 'Clearing of native vegetation' through the removal of 2.715 hectares of native vegetation. The total area of native vegetation to be removed is around 0.02% of the estimated area of native vegetation in the locality (around 12573.36 hectares, based on Tozer (2010) vegetation mapping, much of which is conserved in national parks) and thus comprises a very minor increase in the operation of the KTP.

The proposal would not affect the operation of any other KTPs of relevance to this threatened species.



Yellow-bellied Sheath-tail Bat (vulnerable)

Conclusion of Assessment of Significance

On consideration of the above criteria, the proposal is unlikely to have a significant negative effect on the local population of the Yellow-bellied Sheath-tail Bat

Koala (vulnerable)

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,

There are 88 previous records of the Koala within a 10 kilometre radius of the site since 1985 (OEH, 2011a). The majority of these records are from the Holsworthy Military Area to the west of the study area and the Georges River National Park to the east. The proposal disturbance footprint is isolated from these areas of known habitat by Alfords Point Road and associated steep cuttings and batters and high density urban development. The proposal disturbance footprint does not contain any Koala food tree species identified on Schedule 2 of SEPP 44 or any primary, secondary or supplementary Koala food trees identified in the Koala Recovery Plan (DECC 2008). Given the absence of known food trees and the landscape context, Koalas are unlikely to occur in the proposal disturbance footprint and the habitat present would not support a resident local population.

The proposal would involve widening an existing gap in habitat and so vegetation clearing for the proposal will not directly isolate or fragment any areas of habitat.

Vegetation in the Georges River National Park, directly adjacent to the proposal footprint, is recognised as an important habitat corridor as described in Section 4.1.5. The proposal footprint is located on the edge of this patch of habitat and does not, in itself, comprise an important connecting linkage. The majority of the proposal footprint is hardstand or low, exotic vegetation that would have very little value as fauna movement habitat. The entire edge of the proposal disturbance footprint that adjoins native vegetation is at the bottom of a steep cutting and/or is already fenced. Fauna movement, pollination and seed fall of plants and other ecological processes would occur around, rather than through, the proposal footprint.

The proposal involves construction of structures that may obstruct movement of fauna attempting to cross Alfords Point Road. In addition to the road, potential obstructions include concrete barriers, cycle path and the existing noise walls. Alfords Point Road is a busy, dual carriageway at least four lanes wide and would comprise a 'hostile gap' separating patches of habitat as defined in the BioBanking assessment methodology (DECC, 2008). All of the above listed barriers would be parallel to existing, equivalent barriers, including large rock cuttings, and would not significantly increase the degree to which fauna movement opportunities are already disrupted.

In this context, the proposal would not have an adverse effect on fauna movement or habitat connectivity.

Based on the above considerations, the proposal is therefore unlikely to adversely affect the lifecycle of the Koala such that a viable local population is placed at risk of extinction.

b) in the case of an endangered population, whether the action proposed is likely to have an



Koala (vulnerable)

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 to this threatened fauna 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

Not applicable to this threatened fauna species

(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 to this threatened fauna species

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

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

The total area of native vegetation to be removed is around 0.02% of the estimated area of native vegetation in the locality (around 12573.36 hectares, based on Tozer (2010) vegetation mapping) much of which is conserved in national parks. This vegetation is not expected to comprise habitat for the Koala. The proposal footprint does not contain food tree species identified on Schedule 2 of SEPP 44 or within the Koala Recovery Plan and no evidence of the Koala (eg droppings or scratches on trees) was detected during the field surveys. The vegetation to be removed is unlikely to comprise a movement corridor for the Koala given it's isolation from other areas of known habitat in the wider locality by Alfords Point Road and associated steep batters and cuttings and high density urban development.

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

The proposal would involve widening an existing gap in habitat and so vegetation clearing for the proposal will not directly isolate or fragment any areas of habitat. The vegetation to be removed in the disturbance footprint does not contain foraging habitat for the Koala and is unlikely to form part of a movement corridor for this species. Alfords Point Road represents a significant existing barrier to the movement of terrestrial fauna. The road is a busy, dual carriageway at least four lanes wide and would comprise a 'hostile gap' separating patches of habitat as defined in the BioBanking assessment methodology (DECC, 2008). The proposal involves construction of additional F type concrete barriers, noise mitigation structures and the roadway and cycle paths themselves. However, all of these structures would be parallel to existing, equivalent barriers and would not significantly increase the degree to which fauna movement is already disrupted.

Vegetation in the Georges River National Park, directly adjacent to the proposal footprint, is recognised as an important habitat corridor as described in Section 4.1.5. The proposal footprint is located on the edge of this patch of habitat and does not, in itself, comprise an important connecting linkage. The majority of the proposal footprint is hardstand or low, exotic vegetation that would have very little value as fauna movement habitat. The entire edge of the proposal disturbance footprint that adjoins native vegetation is at the bottom of a steep cutting and/or is already fenced. As such, fauna movement would



Koala (vulnerable)

occur around, rather than through, the proposal footprint.

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

The proposal will not involve the removal, modification or fragmentation of any known habitat for the Koala and the vegetation to be removed is highly unlikely to be important for the long-term survival of the species in the locality.

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

The proposal footprint does not contain Koala food trees identified in the recovery plan (DECCW 2008), will not fragment or isolate any areas of known habitat for the Koala or create a novel barrier to Koala movements in the locality. Given these considerations, the Proposal is unlikely to have an adverse direct or indirect effect on habitat critical for the long-term survival of a population in the wider locality.

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

As noted in *part e)* above, the proposal footprint does not contain Koala food trees identified in the recovery plan (DECCW 2008), will not fragment or isolate any areas of known habitat for the Koala or create a novel barrier to Koala movements in the locality.

The proposal involves the construction of roads and associated infrastructure which are recognised in the recovery plan as a threat to Koala populations (DECCW 2008). Alfords Point Road is a busy, dual carriageway at least four lanes wide. The proposal footprint would be parallel to existing, equivalent road infrastructure and would not significantly increase the degree to which Alfords Point Road may affect local and regional Koala populations.

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 would directly contribute to the operation of the KTP 'Clearing of native vegetation' through the removal of 2.715 hectares of native vegetation. The total area of native vegetation to be removed is around 0.02% of the estimated area of native vegetation in the locality (around 12573.36 hectares, based on Tozer (2010) vegetation mapping, much of which is conserved in national parks) and thus comprises a very minor increase in the operation of the KTP.

The vegetation to be removed does not contain Koala food trees identified on Schedule 2 of SEPP 44 or primary, secondary or supplementary regional Koala food trees identified in the Recovery Plan for this species (DECC 2008). The vegetation is also unlikely to form part of a movement corridor for the Koala given its isolation from more extensive areas of known Koala habitat in the wider locality by the existing Alfords Point Road and associated steep cuttings and batters and extensive residential development.

The proposal would not affect the operation of any other KTPs of relevance to this threatened species.

Conclusion of Assessment of Significance

On consideration of the above criteria, the proposal is unlikely to have a significant negative effect on the local population of the Koala.



Assessment of Significance for Hollow-dependent Cockatoos

Gang-gang Cockatoo

Glossy Black-cockatoo

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,

Gang-gang Cockatoos nest in hollow-bearing trees close to water with breeding taking place between October and January. Breeding usually occurs in tall mature sclerophyll forests that have a dense understorey. The species requires nesting hollows with specific attributes (hollow shape, position and structure) and individual pairs show high fidelity to selected hollows (DECC, 2008).

There are no hollow bearing trees that could provide roost sites within the subject site. Construction and operation of the proposal is highly unlikely to affect availability or usage of roost sites in the broader study area because: environmental management measures are likely to restrict direct impacts to the subject site; and indirect impacts such as noise, light spill and the risk of vehicle collisions would be equivalent to those impacts currently associated with Alford's Point road.

The species may forage within the study area on occasion, but as stated in *part d)* the species is highly unlikely to depend on the resources that would be removed by the proposal. The proposal would not cause any barrier to movement between roost sites and potential foraging habitat.

The proposal is therefore unlikely to adversely affect the lifecycle of the species such that a viable local population is placed at risk of extinction.

Glossy Black-cockatoos require suitable hollows in large, old eucalypt trees (living or dead) for nesting. There is a tendency for Glossy Black-cockatoos to nest in the same areas as other nesting pairs, sometimes even sharing the same nest tree (NPWS, 1999a). Roost sites are usually within 1 kilometre of a reliable water source and, during the breeding season, tend to be within 30 metres of a nesting tree (Garnett et al., 1999). The species is gregarious, usually recorded in family parties of up to 10. Locally nomadic, small flocks roam in search of feeding areas (NPWS, 1999b).

There are no hollow bearing trees that could provide roost sites within the subject site. Construction and operation of the proposal is highly unlikely to affect availability or usage of roost sites in the broader study area because: environmental management measures are likely to restrict direct impacts to the subject site; and indirect impacts such as noise, light spill and the risk of vehicle collisions would be equivalent to those impacts currently associated with Alford's Point road.

The species may forage within the study area on occasion, but as stated in *part d)* the species is highly unlikely to depend on the resources that would be removed by the proposal. The proposal would not cause any barrier to movement between roost sites and potential foraging habitat.

The proposal is therefore unlikely to adversely affect the lifecycle of the species such that a viable local population is 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,

Not applicable to these threatened fauna species

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



Gang-gang Cockatoo

Glossy Black-cockatoo

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

Not applicable to these threatened fauna species

(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 to these threatened fauna species

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

The Gang-gang Cockatoo feeds on seeds obtained in trees and shrubs, mostly from eucalypts and acacias, though it eats some seeds of introduced trees and shrubs around human settlements in winter, and also insect larvae (DECC, 2008).

Glossy Black-cockatoos are highly specialised, feeding almost exclusively on the seeds extracted from the wooden cones of species of *Allocasuarina* and *Casuarina* (DECCW 2011). The cockatoos are highly selective with respect to both the trees and the cones on which they choose to forage, often showing fidelity to particular trees. Glossy Black-cockatoos prefer trees carrying a large number of cones (Pepper *et al.* 2000), in part because they appear to select feeding trees primarily on the basis of optimizing kernel intake (Crowley and Garnett, 2006).

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

About 2.715 hectares of potential foraging habitat for the species, comprising native woodland and forest with Myrtaceous tree species and *Acacia* species, would be removed as a result of this proposal. The total area of native vegetation to be removed is around 0.02% of the estimated area of native vegetation in the locality (around 12573.36 hectares, based on Tozer (2010) vegetation mapping, much of which is conserved in national parks).

As stated in *part a*) no known or potential roosting habitat for the species would be removed or modified by the proposal.

Only a portion of the native woodland and forest in the subject site contains any *Casuarina* species and would comprise foraging habitat for the species. There are no dense stands of *Casuarinas* or particularly large and productive trees in the subject site. Less than 2.715 hectares of potential foraging habitat for the species would be removed as a result of this proposal. The total area of native vegetation to be removed is around 0.02% of the estimated area of native vegetation in the locality (around 12573.36 hectares, based on Tozer (2010) vegetation mapping, much of which is conserved in national parks).

As stated in *part a*) no known or potential roosting habitat for the species would be removed or modified by the proposal.

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



Gang-gang Cockatoo

Glossy Black-cockatoo

Impacts of the proposal on fragmentation or isolation of habitat are equivalent for these species.

The proposal would involve widening an existing gap in habitat and so vegetation clearing for the proposal will not directly isolate or fragment any areas of habitat.

The proposal involves construction of structures that may obstruct movement of fauna attempting to cross Alfords Point Road. These potential obstructions include F type concrete barriers, noise mitigation structures and the roadway and cycle paths themselves. These large, mobile bird species would easily traverse these obstructions. Further, all of the above listed barriers would be parallel to existing, equivalent barriers and would not significantly increase the energy costs of flying over the proposal disturbance footprint or otherwise increase the degree to which fauna movement is already disrupted.

(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,

There is some foraging habitat for Gang-gang Cockatoos in the subject site but it is highly unlikely that the local population of the species would depend on these foraging resources. The proposal would remove a very small proportion of available foraging resources for local populations of the Gang-gang Cockatoo: 0.023% % of the extent of vegetation map units likely to contain Myrtaceous trees and *Acacia* spp. in the locality (around 11961.33 hectares based on Tozer, 2010 vegetation mapping). Foraging resources in the proposal disturbance footprint would have even less value than this area suggests, as the species is more likely to favour resources that are not immediately adjacent to major roads and affected by noise, light and the risk of vehicle collisions.

There is some foraging habitat for Glossy Black-cockatoos in the subject site but it is highly unlikely that the local population of the species would depend on these foraging resources. There are no dense stands of *Casuarinas* or particularly large and productive trees in the subject site. The proposal would remove a very small proportion of available foraging resources for local populations of the Glossy Black-cockatoo: less than 0.023% % of the extent of vegetation map units likely to contain *Casuarina* species in the locality (around 11961.33 hectares based on Tozer, 2010 vegetation mapping). Foraging resources in the proposal disturbance footprint would have even less value than this area suggests, as the species is more likely to favour resources that are not immediately adjacent to major roads and affected by noise, light and the risk of vehicle collisions.

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

No area of critical habitat has been listed for these species.

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

No recovery plan has yet been prepared for this species. The OEH (2011b) has identified 11 priority actions, which are primarily concerned with research, habitat management and protection, and monitoring. The proposal will remove a small area of potential foraging habitat for this species compared with the local and regional extent of potential habitat and will not remove breeding habitat. On this basis, the proposal is unlikely to interfere with the recovery of this species.

No recovery plan has yet been prepared for this species. The OEH (2011b) has identified 9 priority actions, which are primarily concerned with research, habitat management and protection, coordinating ex-situ conservation and the proposal of a recovery plan. The proposal will remove a small area of potential foraging habitat for this species compared with the local and regional extent of potential habitat and will not remove breeding habitat. On this basis, the proposal is unlikely to interfere with the recovery of this species.



Gang-gang Cockatoo

Glossy Black-cockatoo

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.

Impacts of the proposal on the operation of KTPs are equivalent for these species.

The proposal would directly contribute to the operation of the KTP 'Clearing of native vegetation' through the removal of 2.715 hectares of native vegetation. The total area of native vegetation to be removed is around 0.02% of the estimated area of native vegetation in the locality (around 12573.36 hectares, based on Tozer (2010) vegetation mapping, much of which is conserved in national parks) and thus comprises a very minor increase in the operation of the KTP.

The proposal would not affect the operation of any other KTPs of relevance to these threatened species

Conclusion of Assessment of Significance

On consideration of the above criteria, the proposal is unlikely to have a significant effect on any local population of the Gang-gang Cockatoo or Glossy Black-cockatoo, should a local population be present in the study area.

Masked Owl

Powerful Owl

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,



Masked Owl	Powerful Owl
<p>Masked Owls are sparsely distributed and have a home range covering between 500 hectares and 1000 hectares. The Masked Owl roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting (Higgins, 1999).</p> <p>The subject site would make up only a small proportion of the home range of individuals within the local population of the Masked Owl (if present). There are no hollow bearing trees that could provide roost sites within the subject site. There may be suitable roost trees down slope to the east of the subject site associated with gullies containing tall, moist forest. Construction and operation of the proposal is highly unlikely to affect availability or usage of roost sites in the broader study area because: environmental management measures are likely to restrict direct impacts to the subject site; and indirect impacts such as noise, light spill and the risk of vehicle collisions would be equivalent to those impacts currently associated with Alford's Point road.</p> <p>The species may forage within the study area on occasion, but as stated in <i>part d</i>) the species is highly unlikely to depend on the resources that would be removed by the proposal. The proposal would not cause any barrier to movement between roost sites and potential foraging habitat.</p> <p>Given the large area of protected habitat present in the locality, and the large home range of the species, the proposal is unlikely to impact the lifecycle of the species such that a viable local population is placed at risk of extinction.</p>	<p>Powerful Owls are nocturnal, solitary and sedentary. Powerful Owls nest in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old with breeding taking place from late summer to late autumn. Pairs of Powerful Owls are believed to have high fidelity to a small number of hollow-bearing nest trees and will defend a large home range of 400 - 1,450 hectares (Higgins, 1999).</p> <p>The subject site would make up only a small proportion of the home range of individuals within the local population of the Powerful Owl (if present). There are no hollow bearing trees that could provide roost sites within the subject site. There may be suitable roost trees down slope to the east of the subject site associated with gullies containing tall, moist forest. Construction and operation of the proposal is highly unlikely to affect availability or usage of roost sites in the broader study area because: environmental management measures are likely to restrict direct impacts to the subject site; and indirect impacts such as noise, light spill and the risk of vehicle collisions would be equivalent to those impacts currently associated with Alford's Point road.</p> <p>The species may forage within the study area on occasion, but as stated in <i>part d</i>) the species is highly unlikely to depend on the resources that would be removed by the proposal. The proposal would not cause any barrier to movement between roost sites and potential foraging habitat.</p> <p>Given the large area of protected habitat present in the locality, and the large home range of the species, the proposal is unlikely to impact the lifecycle of the species such that a viable local population is placed at risk of extinction.</p>
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 to these threatened fauna 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	
Not applicable to these threatened fauna species	



Masked Owl	Powerful Owl
(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 to these threatened fauna species	
d) in relation to the habitat of a threatened species, population or ecological community:	
This species occurs in dry eucalypt woodlands at altitudes from sea level to 1100 m and roosts and breeds in hollows and sometime caves in moist eucalypt forested gullies. It hunts along the edges of forests and roadsides. Prey for this species are principally terrestrial mammals but arboreal species may also be taken (Higgins, 1999).	Powerful Owls occur in a number of vegetation types ranging from woodland and open sclerophyll forest to tall open wet forest and rainforest. However, this species does prefer large tracts of vegetation. Preferred prey species are arboreal mammals (Higgins, 1999).
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and	
Potential impacts on habitat resources for these two forest owl species are equivalent. About 2.715 hectares of potential foraging habitat for the Masked Owl and Powerful Owl, comprising native woodland and forest would be removed as a result of this proposal. The total area of native vegetation to be removed is around 0.02% of the estimated area of native vegetation in the locality (around 12573.36 hectares, based on Tozer (2010) vegetation mapping, much of which is conserved in national parks). As stated in <i>part a)</i> no known or potential roosting habitat for these species would be removed or modified by the proposal.	
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and	
The proposal would involve widening an existing gap in habitat and so vegetation clearing for the proposal will not directly isolate or fragment any areas of habitat. The proposal involves construction of structures that may obstruct movement of fauna attempting to cross Alford's Point Road. These potential obstructions include F type concrete barriers, noise mitigation structures and the roadway and cycle paths themselves. These large, mobile forest owl species would easily traverse these barriers. Further, all of the above listed barriers would be parallel to existing, equivalent barriers and would not significantly increase the energy costs of flying over the proposal disturbance footprint or otherwise increase the degree to which fauna movement is already disrupted.	
(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,	



Masked Owl

Powerful Owl

These forest owl species have very large home ranges, of which the subject site would only be a very small proportion. Habitat for these species is present throughout Georges River National Park and other native vegetation in the locality. Foraging habitat for these owls is present in forested areas of the subject site, and it is possible that these species would forage occasionally in the subject site but would not depend solely on these foraging resources. The proposal would remove a very small proportion of available foraging resources for local populations of these forest owls: 0.02% of the estimated area of native vegetation in the locality (around 12573.36 hectares, based on Tozer (2010) vegetation mapping, much of which is conserved in national parks). Foraging resources in the proposal disturbance footprint would have even less value than this area suggests, as forest owls would be more likely to favour resources that are not immediately adjacent to major roads and affected by noise and light.

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

No area of critical habitat has been listed for these species.

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

A Recovery Plan has been prepared for the large forest owls (Masked, Sooty and Powerful Owls). The overall objective of the NSW Large Forest Owl recovery plan is to ensure that viable populations of the three species continue in the wild in NSW in each region where they presently occur (DEC, 2006). Relevant specific objectives include:

- Ensure the impacts on large forest owls and their habitats are adequately assessed during planning and environmental assessment processes.

Impacts to these species have been assessed in this report. The proposal is therefore consistent with this recovery objective.

The proposal will remove a small area of potential foraging habitat for these species compared with the local and regional extent of potential habitat and will not remove roosting or breeding habitat. On this basis, the proposal is unlikely to interfere with the recovery of either 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.

Impacts of the proposal on the operation of KTPs are equivalent for these species.

The proposal would directly contribute to the operation of the KTP 'Clearing of native vegetation' through the removal of 2.715 hectares of native vegetation. The total area of native vegetation to be removed is around 0.02% of the estimated area of native vegetation in the locality (around 12573.36 hectares, based on Tozer (2010) vegetation mapping, much of which is conserved in national parks) and thus comprises a very minor increase in the operation of the KTP.

The proposal would not affect the operation of any other KTPs of relevance to these threatened species



Masked Owl

Powerful Owl

Conclusion of Assessment of Significance

On consideration of the above criteria, the proposal is unlikely to have a significant effect on any local population of the Masked Owl or Powerful Owl, should a local population be present in the study area.

Assessment of Significance for Hollow-roosting Bats

Greater Broad-nosed Bat

East Coast Freetail Bat

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 Greater Broad-nosed Bat inhabits tall, wet forests and roosts in hollow trunks of eucalypts, and occasionally in caves and buildings (Churchill, 2008). Hollow-dependent bats such as the Greater Broad-nosed Bat are likely to require multiple roost trees, generally in close proximity. Roost sites used on consecutive nights are typically within a few hundred metres of one another (Parnaby and Hamilton-Smith, 2004).

A local population of the Greater Broad-nosed Bat may utilise tree hollows in the study area as diurnal roosts or maternity roosts. The proposal would not remove any hollow-bearing trees and is highly unlikely to prevent the species from using roost trees in the broader study area through indirect effects.

The species may forage within the study area on occasion, but as stated in *part d*) the species is highly unlikely to depend on the resources that would be removed by the proposal. The proposal is therefore unlikely to adversely affect the lifecycle of the species such that a viable local population is placed at risk of extinction.

Female East Coast Freetail Bats give birth in late November/early December and lactate until late January. East Coast Freetail Bats roost in tree hollows (generally spouts of large mature trees). They have also been recorded roosting in buildings and under exfoliating bark (Churchill, 2008). Hollow-dependent bats such as the East Coast Freetail Bat are likely to require multiple roost trees, generally in close proximity. Roost sites used on consecutive nights are typically within a few hundred metres of one another (Parnaby and Hamilton-Smith, 2004).

A local population of the East Coast Freetail Bat may utilise tree hollows in the study area as diurnal roosts or maternity roosts. The proposal would not remove any hollow-bearing trees and is highly unlikely to prevent the species from using roost trees in the broader study area through indirect effects.

The species may forage within the study area on occasion, but as stated in *part d*) the species is highly unlikely to depend on the resources that would be removed by the proposal. The proposal is therefore unlikely to adversely affect the lifecycle of the species such that a viable local population is 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,

Not applicable to these species



Greater Broad-nosed Bat	East Coast Freetail Bat
c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:	
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or	
Not applicable to these species	
(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 to these threatened fauna species	
d) in relation to the habitat of a threatened species, population or ecological community:	
The Greater Broad-nosed Bat inhabits tall wet forests with a dense understorey. The species prefers continuous forest, and is generally absent from small patches of remnant forest. Diet consists of moths, beetles and other insects (Churchill, 2008).	East Coast Freetail Bats occur in dry forests and woodlands. They show a preference for foraging in open spaces in these habitats, as well as over waterways (Churchill, 2008).
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and	
Impacts on habitat for the Greater Broad-nosed Bat and East Coast Freetail Bat are equivalent.	
Forest and woodland within the study area comprises potential foraging habitat for these species. About 2.715 hectares of potential foraging habitat for the species would be removed as a result of this proposal.	
As stated in <i>part a)</i> no known or potential roosting habitat for the species would be removed or modified by the proposal.	
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and	
The proposal would involve widening an existing gap in habitat and so vegetation clearing for the proposal will not directly isolate or fragment any areas of habitat.	
The proposal involves construction of structures that may obstruct movement of fauna attempting to cross Alford's Point Road. These potential obstructions include F type concrete barriers, noise mitigation structures and the roadway and cycle paths themselves. Microbats would easily traverse these structures by flying over or around them. Further, all of the above listed barriers would be parallel to existing, equivalent barriers and would not significantly increase the energy costs of flying over the proposal disturbance footprint or otherwise increase the degree to which fauna movement is already disrupted.	



Greater Broad-nosed Bat

East Coast Freetail Bat

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

The total area of habitat to be removed (2.715 hectares) is around 0.02% of the estimated area of potentially suitable habitat in native vegetation in the locality (around 12573.36 hectares, based on Tozer (2010) vegetation mapping, much of which is conserved in national parks). The small area of vegetated habitat to be removed would have very limited value to any local populations of these species. Habitat in the proposal disturbance footprint would have even less value than this area suggests as it is regrowth vegetation and is adjacent to a major road and subject to noise and light impacts and the risk of vehicle collision.

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

No area of critical habitat has been listed for these species.

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

There is no recovery plan for this species. The OEH (2011b) has identified a number of priority actions for this species which generally relate to protection of roosting habitat. As stated in *part a)* the proposal would not remove any roosting habitat. The proposal will remove a small area of potential foraging habitat for this species compared with the local and regional extent of potential habitat. Based on these considerations, the proposal is unlikely to interfere with the recovery of this species.

There is no recovery plan for this species. The OEH (2011b) has identified a number of priority actions for this species which generally relate to protection of roosting habitat. As stated in *part a)* the proposal would not remove any roosting habitat. The proposal will remove a small area of potential foraging habitat for this species compared with the local and regional extent of potential habitat. Based on these considerations, the proposal is unlikely to interfere with 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.

Impacts of the proposal on the operation of KTPs are equivalent for these species.

The proposal would directly contribute to the operation of the KTP 'Clearing of native vegetation' through the removal of 2.715 hectares of native vegetation. The total area of native vegetation to be removed is around 0.02% of the estimated area of native vegetation in the locality (around 12573.36 hectares, based on Tozer (2010) vegetation mapping, much of which is conserved in national parks) and thus comprises a very minor increase in the operation of the KTP.

The proposal would not affect the operation of any other KTPs of relevance to these threatened species

Conclusion of Assessment of Significance

On consideration of the above criteria, the proposal is unlikely to have a significant effect on any local population of the Greater Broad-nosed Bat or East Coast Freetail Bat, should a local population be present in the study area.



Eastern Bentwing Bat

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

The Eastern Bentwing Bat is essentially a cave bat, but also utilises man-made habitats such as road culverts, storm-water tunnels and other man-made structures outside the breeding season. Breeding takes place from October to April in a number of maternity caves that host up to 100,000 females (Churchill, 2008). Maternity colonies are known from Wee Jasper, Bungonia, Willi-Willi, and Riverton (OEH, 2011).

No maternity caves are present in the study area. A local population of the Eastern Bentwing Bat may forage throughout the subject site, including over open areas on occasion, but as stated in *part d)* the species is highly unlikely to depend on the resources that would be removed by the proposal. The proposal is therefore unlikely to adversely affect the lifecycle of the species such that a viable local population is 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,

Not applicable to 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

Not applicable to this species

(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 to this threatened fauna species

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

The Eastern Bentwing Bat is known from a variety of habitats along the east coast including rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grasslands. In forested areas, it flies above the canopy to hunt, while in open grassland areas, flight may be within 6 metres of the ground. Moths form the major component of their diet (Churchill 2008).

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



Eastern Bentwing Bat

Forest and woodland within the study area comprises potential foraging habitat for the species. About 2.715 hectares of potential foraging habitat for the species, comprising native woodland and forest, would be removed as a result of this proposal.

As stated in *part a*) no known or potential roosting habitat for the species would be removed or modified by the proposal.

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

The proposal would involve widening an existing gap in habitat and so vegetation clearing for the proposal will not directly isolate or fragment any areas of habitat.

The proposal involves construction of structures that may obstruct movement of fauna attempting to cross Alford's Point Road. These potential obstructions include F type concrete barriers, noise mitigation structures and the roadway and cycle paths themselves. The Eastern Bentwing Bat would easily traverse these structures by flying over or around them. Further, all of the above listed barriers would be parallel to existing, equivalent barriers and would not significantly increase the energy costs of flying over the proposal disturbance footprint or otherwise increase the degree to which fauna movement is already disrupted.

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

The total area of habitat to be removed (2.715 hectares) is around 0.02% of the estimated area of potentially suitable habitat in native vegetation in the locality (around 12573.36 hectares, based on Tozer (2010) vegetation mapping, much of which is conserved in national parks). The small area of vegetated habitat to be removed would have very limited value to the local population of the species. Habitat in the proposal disturbance footprint would have even less value than this area suggests as it is regrowth vegetation and is adjacent to a major road and subject to noise and light impacts and the risk of vehicle collision.

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

- ▶ No area of critical habitat has been listed for this species

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

There is no recovery plan for this species. The OEH (2011b) has identified a number of priority actions for this species which generally relate to maternity caves and roost habitat. The proposal will remove a small area of potential foraging habitat for this species compared with the local and regional extent of potential habitat. Based on these considerations, the proposal is unlikely to interfere with 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.



Eastern Bentwing Bat

The proposal would directly contribute to the operation of the KTP 'Clearing of native vegetation' through the removal of 2.715 hectares of native vegetation. The total area of native vegetation to be removed is around 0.02% of the estimated area of native vegetation in the locality (around 12573.36 hectares, based on Tozer (2010) vegetation mapping, much of which is conserved in national parks) and thus comprises a very minor increase in the operation of the KTP.

The proposal would not affect the operation of any other KTPs of relevance to this threatened species.

Conclusion of Assessment of Significance

On consideration of the above criteria, the proposal is unlikely to have a significant effect on a local population of the Eastern Bentwing Bat, should it be present within the study area.



Appendix E

EPBC Act Assessments of Significance



According to the DEWHA (2009) 'significant impact criteria' for vulnerable species, an action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

i). Lead to a long term decrease in the size of an important population

The Grey-headed Flying-fox is a highly mobile species which regularly travels up to 50km in a night to forage, and has been shown to make migratory movements of almost 1000 km within a year (Churchill 2008, Webb and Tidemann 1996). The subsequent mixing of populations means that genetically the species can be treated as one population across its entire range in eastern Australia (Webb and Tidemann 1996), and the numbers in any one camp are influenced by food availability and the requirements of mating and raising young (KBCS 2011). This population is therefore considered an important population.

No Grey-headed Flying-fox camps are present in the study area. The locations of such camps are relatively well known: the closest continuously occupied camp to the site is at Kareela, some 6.5 km to the south-east; while there is an occasionally occupied camp at Menai, approximately 3 km to the south-west, which is well beyond the range of any indirect effects potentially arising from the proposal.

The species may forage within the study area on occasion, but as stated in criteria iv) the species is highly unlikely to depend on the resources that would be removed by the proposal.

Construction would not occur at night, when the species would potentially be foraging in the study area and so there is negligible risk of direct injury or mortality of any individuals.

The proposal is therefore unlikely to lead to a long term decrease in the size of the NSW population of the Grey-headed Flying-fox.

ii). Reduce the area of occupancy of the species

The Grey-headed Flying-fox occurs along the east coast of NSW, as well as in inland areas. The proposal would not reduce the area of occupancy of the species.

iii). Fragment an existing important population into two or more populations

The proposal would involve widening an existing gap in habitat and so vegetation clearing for the proposal will not directly isolate or fragment any areas of habitat.

The proposal involves construction of structures that may obstruct movement of fauna attempting to cross Alfords Point Road. These potential obstructions include F type concrete barriers, noise mitigation structures and the roadway and cycle paths themselves. The Grey-headed Flying Fox would easily traverse these obstructions as it is known to routinely travel up to 50 km in a night to forage (Churchill 2008). Further, all of the above listed barriers would be parallel to existing, equivalent barriers and would not significantly increase the energy costs of flying over the proposal disturbance footprint or otherwise increase the degree to which fauna movement is already disrupted.

**iv). Adversely affect habitat critical to the survival of the species**

The draft national recovery plan (DECCW 2009) states that foraging habitat that meets at least one of the following criteria qualifies as critical habitat:

- *productive during winter and spring, when food bottlenecks have been identified.*
- *known to support populations of > 30 000 individuals within an area of 50 kilometre radius (the maximum foraging distance of an adult).*
- *productive during the final weeks of gestation, and during the weeks of birth, lactation and conception (September to May).*
- *productive during the final stages of fruit proposal and ripening in commercial crops affected by Grey-headed Flying-foxes (months vary between regions).*
- *known to support a continuously occupied camp.*

Vegetation at the site does not support a continuously occupied roost camp, and is not in a region with significant commercial fruit crops. The proposal disturbance footprint would not support a population of more than 30 000 individuals, but would contribute to foraging habitat for some individuals of the population. While there would be some productivity of foraging resources during winter and spring, the resources present in the study area are limited in comparison to available foraging resources in nearby areas, such as Georges River National Park. The small area of foraging habitat to be removed and the large tracts of other vegetation in the locality mean that the site is unlikely to represent habitat critical to the survival of a local population of the species.

v). Disrupt the breeding cycle of an important population

There are no roost camps in the study area. No local roosting and breeding habitat would be affected by the proposal. Grey-headed Flying-foxes would forage on the site in eucalypts and other Myrtaceous species as well as fruiting trees on an occasional basis. Flowering of eucalypts would take place intermittently through the year. Trees productive in winter and spring are important during food bottlenecks for this species, and trees productive in summer and autumn are important during the weeks of birth, lactation and conception. The proposal would not cause any barrier to movement between roost sites and potential foraging habitat.

Large areas of similar (and better quality) native vegetation are present throughout locality, including within Georges River National Park. Given the mobility of the species and the presence of these alternative habitats, the removal of 2.715 hectares of foraging habitat is highly unlikely to cause any disruption in the breeding cycle of local populations.

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



EPBC Act - Assessment of Significance

Grey-headed Flying-fox (vulnerable)

Two eucalypt species known to be highly productive species (productivity scores >0.91) occur in the study area: Red Bloodwood, and Sydney Peppermint. These trees do not necessarily, however, provide annually reliable resources (Eby and Law 2008). Grey-headed Flying-foxes may also feed on Coastal Banksia and fruiting rainforest trees within the study area.

Given the high mobility of this species and the proximity of large areas of native vegetation in the locality (eg Georges River National Park), the removal of 2.715 hectares of foraging habitat would be very unlikely to have a significant effect on the long-term survival of a local population of the Grey-headed Flying-fox. The proposal would remove a very small proportion of available foraging resources for local populations of the Grey-headed Flying Fox: 0.02% of the extent of vegetation map units likely to contain Myrtaceous trees in the locality (around 11961.33 hectares based on Tozer (2010) vegetation mapping). Foraging resources in the proposal disturbance footprint would have even less value than this area suggests, as the species is more likely to favour resources that are not immediately adjacent to major roads and affected by noise, light and the risk of vehicle collisions, and better quality habitat is available close by.

vii). Result in invasive species that are harmful to the vulnerable species becoming established in the vulnerable species' habitat

No invasive species that may cause the Grey-headed Flying-fox to decline are likely to become established in the study area as a result of the proposal.

viii). Introduce disease that may cause the species to decline

No animal diseases that may cause the Grey-headed Flying-fox to decline are likely to become established in the study area as a result of the proposal since the proposal will not transport any animals or animal materials and no construction activities are likely to directly affect any Grey-headed Flying Foxes. The plant diseases Phytophthora or Myrtle Rust could potentially cause the species to decline by reducing the extent of foraging resources associated with affected tree species within foraging ranges. Specific mitigation measures are proposed to prevent the transmission of plant diseases in the study area as a result of construction works.

ix). Interfere with the recovery of the species



EPBC Act - Assessment of Significance

Grey-headed Flying-fox (vulnerable)

The draft recovery plan for the Grey-headed Flying-fox identifies the following recovery objectives of relevance to the removal of foraging habitat for the species:

- ▶ *Objective 1. To identify and protect foraging habitat critical to the survival of Grey-headed Flying-foxes throughout their range*
 - ▶ The study area does not support a breeding camp or populations of >30,000 individuals. While trees are present that flower during winter and spring (during food bottlenecks) and summer and autumn (during the breeding season), these trees are not considered to be productive enough to support the local population in isolation. As discussed above, the area of potential foraging habitat to be removed does not qualify as critical habitat for the species. Therefore the proposed action is not inconsistent with this objective.
- ▶ *Objective 2. To protect and increase the extent of key winter and spring foraging habitat of Grey-headed Flying-foxes*
 - ▶ Winter flowering eucalypts such as Spotted Gum are present in the study area. Foraging resources in the study area are not considered to be key foraging habitat for the Grey-headed Flying-fox, although the species may forage in the study area on occasion during these seasons. Some replacement plantings would be undertaken, including the planting of foraging plants for this species.

The proposal is not likely, therefore, to interfere with the recovery of this species.

▶ **Conclusion of Assessment of Significance:**

Based on consideration of the above criteria, the proposal is not 'likely' to have a 'significant impact' on the Grey-headed Flying-fox.



According to the DEWHA (2009) 'significant impact criteria' for vulnerable species, an action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

i). Lead to a long term decrease in the size of an important population

There are 88 previous records of the Koala within a 10 kilometre radius of the site since 1985 (OEH, 2011a). The majority of these records are from the Holsworthy Military Area to the west of the study area and the Georges River National Park to the east. The proposal disturbance footprint is isolated from these areas of known habitat by Alford's Point Road and associated steep cuttings and batters and high density urban development. The proposal disturbance footprint does not contain any Koala food tree species identified on Schedule 2 of SEPP 44 or any primary, secondary or supplementary Koala food trees identified in the Koala Recovery Plan (DECC 2008). Given the absence of known food trees and the landscape context, Koalas are unlikely to occur in the proposal disturbance footprint and the habitat present would not support an important population.

The proposal would involve widening an existing gap in habitat and so vegetation clearing for the proposal will not directly isolate or fragment any areas of habitat. The proposal involves construction of structures that may obstruct movement of fauna attempting to cross Alford's Point Road. In addition to the road, potential obstructions include concrete barriers, cycle path and the existing noise walls. Alford's Point Road is a busy, dual carriageway at least four lanes wide and would comprise a 'hostile gap' separating patches of habitat as defined in the BioBanking assessment methodology (DECC, 2008). All of the above listed barriers would be parallel to existing, equivalent barriers, including large rock cuttings, and would not significantly increase the degree to which fauna movement is disrupted.

In this context, the proposal would not have an adverse effect on fauna movement or habitat connectivity for an important Koala population in the region surrounding the proposal footprint.

The proposal is therefore unlikely to lead to a long term decrease in the size of an important population of the Koala.

ii). Reduce the area of occupancy of the species

The Koala occurs along the east coast of NSW, as well as in inland areas.

The vegetation to be removed within the Proposal footprint does not contain foraging habitat for the Koala. The trees present are not food trees identified on Schedule 2 of SEPP 44 or primary, secondary or supplementary regional Koala food trees identified in the Recovery Plan for this species (DECC 2008).

The vegetation is also unlikely to form part of an important movement corridor for the Koala given its landscape context.

The proposal would not reduce the area of occupancy of the species.

iii). Fragment an existing important population into two or more populations

The proposal disturbance footprint is isolated from areas of known Koala habitat by Alford's Point Road and associated steep cuttings and batters and high density urban development. Alford's Point Road is a busy, dual carriageway at least four lanes wide and would comprise a 'hostile gap' separating patches of habitat as defined in the BioBanking assessment methodology (DECC, 2008). The proposal footprint would be parallel to existing, equivalent barriers, including large rock cuttings, and would not significantly

**EPBC Act - Assessment of Significance****Koala (vulnerable)**

increase the degree to which fauna movement is disrupted.

The proposal would involve widening an existing gap in habitat and so vegetation clearing for the proposal will not directly isolate or fragment any areas of habitat.

iv). Adversely affect habitat critical to the survival of the species

Vegetation within the disturbance footprint does not contain foraging habitat for the Koala and is highly unlikely to be used as a movement corridor for the local population given its landscape context and existing barriers to terrestrial fauna movements. As such the site is unlikely to represent habitat critical to the survival of the species.

v). Disrupt the breeding cycle of an important population

Vegetation within the disturbance footprint does not contain foraging habitat for the Koala and is highly unlikely to be used as a movement corridor for the local population given its landscape context and existing barriers to terrestrial fauna movements. As such the site is unlikely to disrupt the breeding cycle of the species.

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

Vegetation within the disturbance footprint does not contain foraging habitat for the Koala and is highly unlikely to be used as a movement corridor for the local population given its landscape context and existing barriers to terrestrial fauna movements. The removal of 2.715 hectares of low quality habitat would be very unlikely to have a significant effect on the long-term survival of the Koala. The proposal would remove a very small proportion of available habitat resources for local populations of the Koala: 0.02% of the extent of vegetation map units likely to contain Myrtaceous trees in the locality (around 11961.33 hectares based on Tozer (2010) vegetation mapping). Foraging resources in the proposal disturbance footprint would have even less value than this area suggests, as the species is more likely to favour habitat that contains known feed tree.

vii). Result in invasive species that are harmful to the vulnerable species becoming established in the vulnerable species' habitat

No invasive species that may cause the Koala to decline are likely to become established in the study area as a result of the proposal.

viii). Introduce disease that may cause the species to decline

The proposal will not involve the transport or introduction of any animals and so would not introduce any animal disease that may cause the Koala to decline.

The plant diseases Phytophthora or Myrtle Rust could potentially cause the species to decline by reducing the extent of foraging resources associated with affected tree species within foraging ranges. The proposal disturbance footprint and adjoining study area are unlikely to comprise Koala habitat as described above. Specific mitigation measures are proposed to prevent the transmission of plant diseases in the study area as a result of construction works and so it is highly unlikely that the proposal would introduce plant disease into Koala habitat in the broader locality.



EPBC Act - Assessment of Significance

Koala (vulnerable)

ix). Interfere with the recovery of the species

The proposal footprint does not contain Koala food trees identified in the recovery plan (DECCW 2008), will not fragment or isolate any areas of known habitat for the Koala or create a novel barrier to Koala movements in the locality.

The proposal involves the construction of roads and associated infrastructure which are recognised in the recovery plan as a threat to Koala populations (DECCW 2008). Alfords Point Road is a busy, dual carriageway at least four lanes wide. The proposal footprint would be parallel to existing, equivalent road infrastructure and would not significantly increase the degree to which Alfords Point Road may affect local and regional Koala populations.

The proposal is not likely, therefore, to interfere with the recovery of the Koala.

► Conclusion of Assessment of Significance:

Based on consideration of the above criteria, the proposal is not likely to have a significant impact on the Koala or its habitat.



According to the DEWHA (2009) 'significant impact criteria' for vulnerable species, an action is likely to have a significant impact on an vulnerable species if there is a real chance or possibility that it will:

i). Lead to a long term decrease in the size of an important population

The Large-eared Pied Bat occurs from the coast to the western slopes of the divide with the largest numbers of records from sandstone escarpment country in the Sydney Basin and Hunter Valley (Hoye and Schulz 2008). It roosts in caves and mines and is most commonly recorded from dry sclerophyll forests and woodlands. It is an insectivorous species that flies over the canopy or along creek beds (Churchill 2008). In southern Sydney, it appears to be largely restricted to the interface between sandstone escarpments and fertile valleys. The factors that could potentially disrupt the life cycle of the Large-eared Pied Bat are loss of roost sites in suitable caves or fissures and/or loss of significant areas of foraging habitat.

There are no caves, overhangs or fissures in the proposal disturbance footprint that could comprise potential roost sites for the species. The proposal is highly unlikely to adversely affect any such roost sites that would be present elsewhere in the study area.

The species may forage within the study area on occasion, but as stated in *criteria iv)* the species is highly unlikely to depend on the resources that would be removed by the proposal.

Construction would not occur at night, when the species would potentially be foraging in the study area and so there is negligible risk of direct injury or mortality of any individuals.

The proposal is therefore unlikely to lead to a long term decrease in the size of the NSW population of the Large-eared Pied Bat.

ii). Reduce the area of occupancy of the species

The Large-eared Pied Bat occurs along the east coast of NSW, as well as in the dividing range. The proposal would not reduce the area of occupancy of the species.

iii). Fragment an existing important population into two or more populations

The proposal would involve widening an existing gap in habitat and so vegetation clearing for the proposal will not directly isolate or fragment any areas of habitat.

The proposal involves construction of structures that may obstruct movement of fauna attempting to cross Alford's Point Road. These potential obstructions include F type concrete barriers, noise mitigation structures and the roadway and cycle paths themselves. The Large-eared Pied Bat forages at high speed above the canopy (Churchill, 2008) and so would easily traverse these structures by flying over or around them. Further, all of the above listed barriers would be parallel to existing, equivalent barriers and would not significantly increase the energy costs of flying over the proposal disturbance footprint or otherwise increase the degree to which fauna movement is already disrupted.

iv). Adversely affect habitat critical to the survival of the species

The species was recorded in the study area and so forest and woodland within the study area comprises potential foraging habitat for the species. About 2.715 hectares of potential foraging habitat for the species, comprising native woodland and forest, would be removed as a result of this proposal.

There are no caves, overhangs or fissures in the proposal disturbance footprint that could comprise



EPBC Act - Assessment of Significance

Large-eared Pied Bat (vulnerable)

potential roost sites for the species. The proposal is highly unlikely to adversely affect any such roost sites that would be present elsewhere in the study area.

The proposal would involve widening an existing gap in habitat and so vegetation clearing for the proposal will not directly isolate or fragment any areas of critical habitat that may be present in the locality.

The total area of habitat to be removed (2.715 hectares) is around 0.02% of the estimated area of potentially suitable habitat in native vegetation in the locality (around 12573.36 hectares, based on Tozer (2010) vegetation mapping, of which much is conserved in national parks). Habitat in the proposal disturbance footprint would have even less value than this area suggests as it is regrowth vegetation and is adjacent to a major road and subject to noise and light impacts and the risk of vehicle collision.

Based on the above considerations the proposal would not adversely affect habitat critical to the survival of the species.

v). Disrupt the breeding cycle of an important population

There are no caves, overhangs or fissures in the proposal disturbance footprint that could comprise potential roost sites for the species. The proposal is highly unlikely to adversely affect any such roost sites that would be present elsewhere in the study area.

The Large-eared Pied Bat forages at high speed above the canopy (Churchill, 2008) and would easily traverse the proposal disturbance footprint so the proposal would not isolate any portions of the breeding population or affect migration, dispersal or recruitment activities.

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

The species was recorded in the study area and so forest and woodland within the study area comprises potential foraging habitat for the species. About 2.715 hectares of potential foraging habitat for the species, comprising native woodland and forest, would be removed as a result of this proposal.

No known or potential roosting habitat for the species would be removed or modified by the proposal.

The proposal would involve widening an existing gap in habitat and so vegetation clearing for the proposal will not directly isolate or fragment any areas of habitat.

The total area of habitat to be removed (2.715 hectares) is around 0.02% of the estimated area of potentially suitable habitat in native vegetation in the locality (around 12573.36 hectares, based on Tozer (2010) vegetation mapping, of which much is conserved in national parks). The small area of vegetated habitat to be removed would have very limited value to the local population of the species. Habitat in the proposal disturbance footprint would have even less value than this area suggests as it is regrowth vegetation and is adjacent to a major road and subject to noise and light impacts and the risk of vehicle collision.

The magnitude of impacts on habitat described above would not cause the species to decline.

vii). Result in invasive species that are harmful to the vulnerable species becoming established in the vulnerable species' habitat

No invasive species that may cause the Large-eared Pied Bat to decline are likely to become established



EPBC Act - Assessment of Significance

Large-eared Pied Bat (vulnerable)

in the study area as a result of the proposal.

viii). Introduce disease that may cause the species to decline

No animal diseases that may cause the Large-eared Pied Bat to decline are likely to become established in the study area as a result of the proposal since the proposal will not transport any animals or animal materials and no construction activities are likely to directly affect any Grey-headed Flying Foxes. The plant diseases Phytophthora or Myrtle Rust could potentially cause the species to decline by reducing the extent of foraging habitat associated with affected native vegetation. Specific mitigation measures are proposed to prevent the transmission of plant diseases in the study area as a result of construction works.

► Conclusion of Assessment of Significance:

Based on consideration of the above criteria, the proposal is not 'likely' to have a 'significant impact' on the Large-eared Pied Bat.



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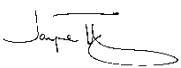
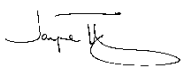
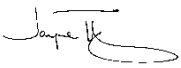
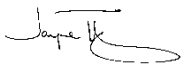
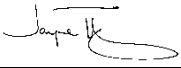
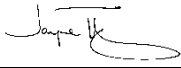
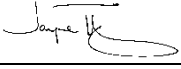
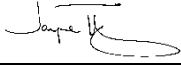
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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	R Hamer B Harrington	J Tipping		J Tipping		13/04/12
1	B Harrington	J Tipping		J Tipping		31/8/12
2	B Harrington	J Tipping		J Tipping		06/11/12
3	B Harrington/ K Chesnut	J Tipping		J Tipping		13/02/13