New Intercity Fleet Maintenance Facility

EPBC Act Referral

March 2016 | Version: 1

Referral of proposed action

Project title: New Intercity Fleet Maintenance Facility Kangy Angy NSW

1 Summary of proposed action

1.1 **Short description**

Transport for NSW (TfNSW) proposes to construct and operate a new train maintenance facility at a site in Kangy Angy on the Central Coast of NSW to support the introduction of a new fleet of passenger trains (the 'New Intercity Fleet').

1.2

Latitudes and longitudes bounding the project footprint are listed below.

Location Point	Latitude			Longitude		
	Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
1	-33	20	39	151	23	5
2	-33	20	10	151	23	29
3	-33	19	56	151	23	26
4	-33	19	35	151	24	5
5	-33	19	51	151	24	15
6	-33	19	58	151	24	2
7	-33	20	21	151	23	23
8	-33	20	38	151	23	8

1.3 **Locality and property description**

The subject site is located in the suburb of Kangy Angy, within the Wyong Shire local government area on the New South Wales Central Coast.

The site is generally bordered by the Main North Rail Line rail corridor to the south, and Orchard Road to the north west. Residential receivers on rural properties generally surround the site to the north, south and west, with industrial precincts to the south east and north-east (on the opposite side of the rail corridor to the site).

The M1 Pacific Motorway is located approximately 0.85km to the north west, and Tuggerah Lake is approximately 3.5 km to the east of the site. Chittaway Creek crosses the project at the southern end and Ourimbah Creek is to the north of the site.

The location and preliminary layout of the proposed facility is shown in Attachment 1 and Attachment 2 respectively.

1.4	**Size of the development footprint or work area (hectares)**	Approximately 48 hectares.
1.5	**Street address of the site**	53-55 Orchard Road Kangy Angy
1.6	**Lot description**	Lot 34-41 DP 2877 Lot 32 DP 1033784 Lot 121 DP 874787 (partial) Lot 1 DP 656505 (partial) Lot 82 DP 737040 (partial)
1.7	**Local Government Area and Council contact (if known)**	Wyong Shire Council – Steve Mann – Property Manager Ph: 02 4350 1397 Email: SJMann@wyong.nsw.gov.au The project is not subject to local council approval.
1.8	**Time frame**	Early works (utilities diversions, roadworks and other enabling works) are anticipated to commence in early 2017, with full construction to follow in mid 2017. Operation of the facility is scheduled to commence in mid 2020.

1.9	**Alternatives to proposed action** Were any feasible alternatives to taking the proposed action (including not taking the action) considered but are not proposed?		No
		X	Yes, you must also complete section 2.2
1.10	**Alternative time frames etc** Does the proposed action include alternative time frames, locations or activities?	X	No
			Yes, you must also complete Section 2.3. For each alternative, location, time frame, or activity identified, you must also complete details in Sections 1.2-1.9, 2.4-2.7 and 3.3 (where relevant).
1.11	**State assessment** Is the action subject to a state or territory environmental impact assessment?		No
		X	Yes, you must also complete Section 2.5
1.12	**Component of larger action** Is the proposed action a component of a larger action?		No
		X	Yes, you must also complete Section 2.7
1.13	**Related actions/proposals** Is the proposed action related to other actions or proposals in the region (if known)?	X	No
			Yes, provide details:
1.14	**Australian Government funding** Has the person proposing to take the action received any Australian Government grant funding to undertake this project?	X	No
			Yes, provide details:
1.15	**Great Barrier Reef Marine**	X	No

Park Is the proposed action inside the Great Barrier Reef Marine Park?	☐	Yes, you must also complete Section 3.1 (h), 3.2 (e)

2 Detailed description of proposed action

2.1 Description of proposed action

TfNSW proposes to deliver a new train maintenance facility at a site in Kangy Angy on the Central Coast of NSW to support the procurement of the New Intercity Fleet. The facility would be undertake light and heavy train maintenance activities for the New Intercity Fleet, including but not limited to

- Regular maintenance/servicing
- Repair/replacement of train components
- Interior and Exterior cleaning

The proposed facility would include about 6 kilometres of electrified railway, would be 7 tracks wide at its widest point, covering an area of approximately 48 hectares, and would be bounded by a perimeter fence. The proposed facility would include the following key elements:

Maintenance facility:

- Maintenance building
- Auxiliary workshops
- Electronic clean room
- Material storage, including flammable liquid storage
- Wheel lathe
- Train wash
- Site access roads

Ancillary facilities:

- Security
- Administration
- Facilities for presentation and train maintenance staff
- Operational control
- Training rooms
- Train simulator
- Power supply (traction power, bulk power, signalling power supply and backup generators)
- Detention basins
- Car parks
- Access roads

2.2 Alternatives to taking the proposed action

The existing intercity train fleet is operated by NSW Trains, with services provided on 3 main routes as follows

- Sydney – Central Coast/Newcastle (Main North Line)
- Sydney – Blue Mountains (Western Line)
- Sydney – Wollongong/Nowra (Southern Line)

The intercity routes described above are shown below in Figure 1.

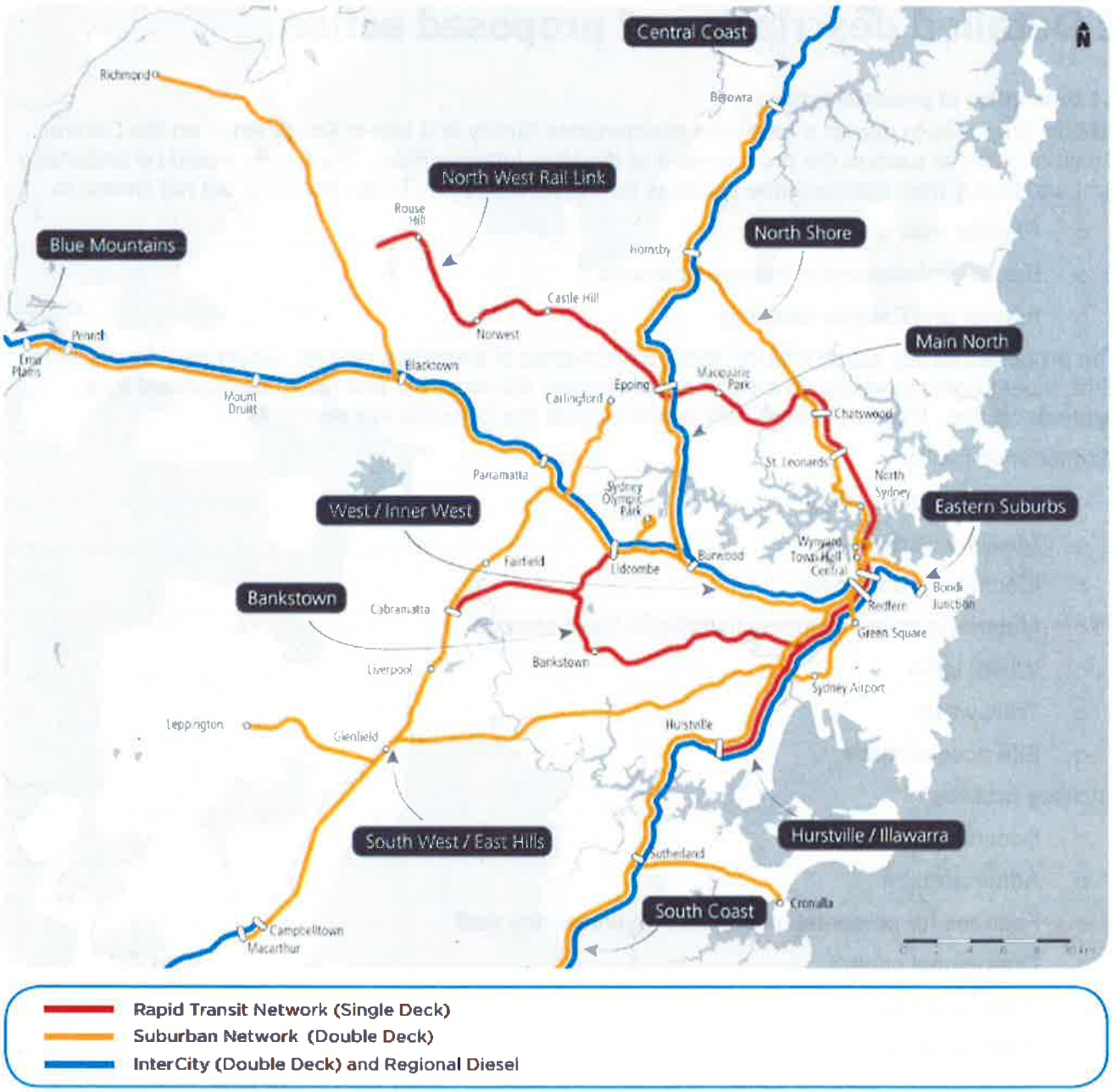


Figure 1 – Intercity rail corridors within the Sydney Region (shown in blue) (Source: Sydney's Rail Future)

Services for the New Intercity Fleet will generally be consistent with existing operations. Accordingly, the Maintenance Facility is required to be alongside, or easily accessible to the Main North, Western or Southern Lines. TfNSW considered potential sites across the Main North, Western and Southern lines. To minimise empty train movements the preference is to locate the maintenance facility closer to where trains commence and conclude their runs. The Main North line will receive the largest proportion of NIF and as a result was considered the preferable location for the maintenance facility.

The initial key criteria were:

- The area must be larger than 10 hectares
- The area must be adjacent to the railway line
- The area must be on a straight piece of track

Eight potential sites on the Main North Line were identified based on the initial criteria. A multi criteria assessment of these sites was undertaken to identify a preferred location, against the following criteria:

- Ecology (including threatened species/communities)
- Indigenous and non-indigenous heritage
- Noise impacts to sensitive receivers
- Access requirements (during construction and operation)
- Contamination
- Flooding
- Timing
- Cost

Kangy Angy was selected as the final preferred site.

As part of the options assessment process, TfNSW also investigated the "do-nothing" option of using existing train stabling and maintenance facilities used for other fleets types. However it was found that the utilisation of such facilities was not feasible due to existing stabling needs, functional constraints, and extensive works that would be required to adapt existing infrastructure to stable the longer New Intercity Fleet trains.

2.3 Alternative locations, time frames or activities that form part of the referred action

No alternative locations, time frames or activities form part of the referred action.

2.4 Context, planning framework and state/local government requirements

The *NSW Long Term Transport Master Plan (2012)* and its supporting document, *Sydney's Rail Future (2012)*, identifies the need to deliver a fleet of new intercity trains to support the needs of longer distance rail customers. To deliver the new fleet it was identified that a new maintenance facility is required.

The New Intercity Fleet Maintenance Facility project is the subject of a Review of Environmental Factors (REF) under Part 5 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). The REF is currently being prepared by TfNSW.

In addition a Species Impact Statement (SIS) will be prepared under Section 112 of the EP&A Act. To undertake the SIS, Chief Executive Requirements (CERs) have been requested and obtained from the Office of Environment and Heritage under section 111 of the *Threatened Species Conservation Act 1995* (TSC Act) (Attachment 4) . The CERs will inform the preparation of the SIS and will include specific requirements for the biodiversity impact assessment to address the potential ecological impacts of the project.

2.5 Environmental impact assessments under Commonwealth, state or territory legislation

The project is the subject of an REF and a SIS under Part 5 of the NSW EP&A Act as described above. The REF will include the following specialist studies:

- Ecology
- Aboriginal and Non Aboriginal Heritage
- Noise and vibration
- Air quality
- Flooding and drainage
- Groundwater
- Landscape and visual
- Socio-economic
- Sustainability

- Traffic, transport and access

The REF will be prepared in accordance with the requirements of the EP&A Act and the TfNSW standard Planning Approvals and Environmental Impact Assessment. A draft Table of Contents is provided in Attachment 3. The SIS is being prepared in accordance with the CERs issued by the NSW Office of Environment and Heritage (Attachment 4). The REF and SIS would be placed on public exhibition in mid 2016 for a period not less than 28 days.

Section 4.1 of the EPBC Bilateral Agreement between the Commonwealth and NSW Governments states that 'an action does not require assessment under Part 8 of the EPBC Act if the action is in the class of actions specified in Schedule 1 to this agreement'. Section 2(a) (ix) of Schedule 1 of the bilateral agreement states:

> Actions that are assessed under Part 5 (other than Division 5 Part 5 or where an EIS is required) of the *Environmental Planning and Assessment Act 1979* (NSW) where the assessment has been undertaken in accordance with the requirements of Item 3 of this Schedule 1.

In submitting this referral, should the project be determined to be a controlled action, TfNSW requests that the Bilateral Agreement between the Commonwealth and NSW Governments be applied to the project.

2.6 Public consultation (including with Indigenous stakeholders)

As part of the ongoing concept design and environmental assessment phase the following key consultation activities are being or will be undertaken:

- Display of the preferred design and the REF for community comment in mid 2016.
- Project notifications and project updates for nearby residents, businesses and stakeholders.
- Door-knocking nearby residents and businesses.
- Meetings and briefings for stakeholders, businesses and residents.
- Letters, emails and target correspondence.
- Project updates on the TfNSW website.

An Aboriginal heritage study is being undertaken by Artefact. This will include a desktop assessment and consultation and field survey with representatives from Darkinjung Local Aboriginal Land Council and any other relevant Indigenous stakeholders. This consultation will be undertaken in accordance with the following NSW Office of Environment and Heritage guidelines:

- Aboriginal cultural heritage consultation requirements for proponents 2010

Other key stakeholders for the project include:

- Owners of adjacent or directly impacted properties.
- Local residents and business owners.
- Wyong Shire Council.
- State and Federal Members of Parliament.
- Government agencies and departments.
- Utility authorities.
- Nearby schools and other facilities.
- Community groups.
- Transport companies.
- Emergency Services.
- Interest groups.

- Media.

2.7 A staged development or component of a larger project

The *NSW Long Term Transport Master Plan (2012)* and its supporting document, *Sydney's Rail Future (2012)*, identifies the need to deliver a fleet of new intercity trains to support the needs of longer distance rail customers. The new fleet will operate in the Intercity and outer suburban areas, linking Newcastle and the Hunter, South Coast, the Blue Mountains and the Sydney CBD. The new trains will come into service progressively, with the first trains delivered by 2019 and the remainder of the fleet being delivered through to 2024. The New Intercity Fleet Maintenance Facility is required to support the new fleet.

To support the introduction of the new fleet, a number of separate enabling infrastructure projects will be undertaken across the rail network. These may include:

- Corridor widening works on the Blue Mountains Line to allow the operations of medium width trains.
- Potential modifications to the Eveleigh Maintenance Facility to enable it to be used in the commissioning and early maintenance phases for the new trains.
- Provision of additional stabling space at existing stabling facilities at Mt Victoria.

These enabling works are geographically separate to the Kangy Angy site, and are unlikely to impact on matters of national environmental significance. In addition the full scope of the above works is reliant on the final fleet design, which is currently being determined through a tender evaluation process. As such they have not been included in this referral. Separate environmental assessment would be undertaken for these aspects once their scope has been finalised.

3 Description of environment & likely impacts

3.1 Matters of national environmental significance

Potential impacts of the project on EPBC Act listed Matters of National Environmental Significance (MNES) are described in the following sections. The Protected Matters Search Tool (PMST) was accessed on 5 May 2015 and again on 12 February 2016. The original search results were considered further in the Preliminary Ecological Assessment (EMM 2015) (Attachment 5).

3.1 (a) World Heritage Properties

Description

No World Heritage Properties have been identified as occurring within the locality or catchment of the New Intercity Fleet Maintenance Facility.

Nature and extent of likely impact

Nil

3.1 (b) National Heritage Places

Description

No National Heritage Places have been identified as occurring within the locality or catchment of the New Intercity Fleet Maintenance Facility.

Nature and extent of likely impact

Nil

3.1 (c) Wetlands of International Importance (declared Ramsar wetlands)

Description

No Wetlands of International Importance (declared Ramsar wetlands) have been identified as occurring within the locality or catchment of the New Intercity Fleet Maintenance Facility.

Nature and extent of likely impact

Nil

3.1 (d) Listed threatened species and ecological communities

Description

Threatened flora species

The Protected Matters Search Tool predicts that 23 threatened flora species and two Endangered Ecological Communities (EECs) listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) may occur within 10 km of the project area. Table 1 outlines the threatened flora species, habitat requirements, likelihood of occurrence and requirement for further survey.

Table 1 Threatened flora species recorded or with the potential to occur within 10 km of the survey area

Species	Source	Status		Habitat requirements[1]	Likelihood of occurrence*	Further assessment and survey required?
		TSC Act	EPBC Act			
FLORA						
Asterolasia elegans	PMST	E	E	Found in sheltered forests on mid- to lower slopes and valleys, e.g. in or adjacent to gullies which support sheltered forest. The canopy at known sites includes Turpentine (*Syncarpia glomulifera* subsp. *glomulifera*), Smooth-barked Apple (*Angophora costata*), Sydney Peppermint (*Eucalyptus piperita*), Forest Oak (*Allocasuarina torulosa*) and Christmas Bush (*Ceratopetalum gummiferum*).	Low	No
Astrotricha crassifolia	PMST	-	V	The Thick-leaf Star-hair grows on dry ridgetops to 300 m altitude and is associated with very rich heath, or dry sclerophyll woodland (Harden 1992). Vegetation associations include typical sandstone genera such as Hakea, Banksia and Xylomelum.	None	No
Biconvex Paperbark *Melaleuca biconvexa*	NPWS Atlas, PlantNet, PMST	V	V	Biconvex Paperbark is only found in NSW, with scattered and dispersed populations found in the Jervis Bay area in the south and the Gosford-Wyong area in the north. Biconvex Paperbark generally grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects. Flowering occurs over just 3-4 weeks in September and October. This species re-sprouts following fire.	Recorded	Yes
Black-eyed Susan *Tetratheca juncea*	NPWS Atlas	V	V	Black-eyed Susan is usually found in low open forest/woodland with a mixed shrub understorey and grassy groundcover. However, it has also been recorded in heathland and moist forest. The majority of populations occur on low nutrient soils associated with the Awaba Soil Landscape. While some studies show the species has a preference for cooler southerly aspects, it has been found on slopes with a variety of aspects. It generally prefers well-drained sites below 200m elevation and annual rainfall between 1000 - 1200mm. The preferred substrates are sandy skeletal soil on sandstone, sandy-loam soils, low nutrients; and clayey soil from conglomerates, pH neutral. It usually spreads via underground stems which can be up to 50 cm long. Consequently, individual plants may be difficult to identify. It also reproduces sexually but this requires insect pollination. Large populations of this species are particularly important.	None	No
Bynoe's Wattle *Acacia bynoeana*	NPWS Atlas	E	V	Occurs in heath or dry sclerophyll forest on sandy soils. Seems to prefer open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and in recently burnt patches. Associated overstorey species include Red Bloodwood, Scribbly Gum, Parramatta Red Gum, Saw Banksia and Narrow-leaved Apple.	None	No
Camfield's Stringybark *Eucalyptus camfieldii*	PMST	V	V	Occurs in poor coastal country in shallow sandy soils overlying Hawkesbury sandstone. Coastal heath mostly on exposed sandy ridges. Occurs mostly in small scattered stands near the boundary of tall coastal heaths and low open woodland of the slightly more fertile inland	None	No

				areas. Associated species frequently include stunted species of Narrow-leaved Stringybark (*E. oblonga*), Brown Stringybark (*E. capitellata*) and Scribbly Gum (*E. haemastoma*). Population sizes are difficult to estimate because its extensive lignotubers may be 20 m across. A number of stems arise from these lignotubers giving the impression of individual plants. Flowering period is irregular, flowers recorded throughout the year. Poor response to too frequent fires.		
Charmhaven Apple *Angophora inopina*	NPWS Atlas	V	V	This species is a member of the *A. bakeri* complex. None of the related species are known from the same area as *A. inopina*, although A. bakeri does occur sporadically in the ranges to the west, and near Kurri Kurri. Occurs most frequently in four main vegetation communities: (i) *Eucalyptus haemastoma–Corymbia gummifera–Angophora inopina* woodland/forest; (ii) *Hakea teretifolia–Banksia oblongifolia* wet heath; (iii) *Eucalyptus resinifera–Melaleuca sieberi–Angophora inopina* sedge woodland; (iv) *Eucalyptus capitellata–Corymbia gummifera–Angophora inopina* woodland/forest. Ecological knowledge about this species is limited. Is lignotuberous, allowing vegetative growth to occur following disturbance. However, such vegetative reproduction may suppress the production of fruits/seeds, necessary for the recruitment of new individuals to a population, and the time between such disturbance and the onset of sexual reproduction is not known. Flowering appears to take place principally between mid-December and mid-January, but is generally poor and sporadic. Preliminary experiments indicate that neither pollination nor seed viability are limiting factors in the life cycle.	None	No
Eastern Underground Orchid *Rhizanthella slateri*	PMST	V	E	Habitat requirements are poorly understood and no particular vegetation type has been associated with the species, although it is known to occur in sclerophyll forest. Highly cryptic given that it grows almost completely below the soil surface, with flowers being the only part of the plant that can occur above ground. Therefore usually located only when the soil is disturbed. Flowers September to November.	Low	No
Leafless Tongue Orchid *Cryptostylis hunteriana*	PlantNET, PMST	V	V	The larger populations of these species typically occur in woodland dominated by Scribbly Gum (*Eucalyptus sclerophylla*), Silvertop Ash (*E. sieberi*), Red Bloodwood (*Corymbia gummifera*) and Black Sheoak (*Allocasuarina littoralis*); appears to prefer open areas in the understorey of this community and is often found in association with the Large Tongue Orchid (*C. subulata*) and the Tartan Tongue Orchid (*C. erecta*). Little is known about the ecology of the species; being leafless it is expected to have limited photosynthetic capability and probably depends upon a fungal associate to meet its nutritional requirements from either living or dead organic material. In addition to reproducing from seed, it is also capable of vegetative reproduction and thus forms colonies which can become more or less permanent at a site.	None	No
Magenta Lilly Pilly	NPWS Atlas	E	V	On the central coast, the Magenta Lilly Pilly occurs on gravels, sands, silts and clays in	Moderate	Yes

Syzygium paniculatum				riverside gallery rainforests and remnant littoral rainforest communities.		
Omeo's Storksbill *Pelargonium* sp. Striatellum	PMST	E	E	Omeo's Storksbill has a specific habitat that is usually just above the high-water level of irregularly inundated or ephemeral lakes, in the transition zone between surrounding grasslands or pasture and the wetland or aquatic communities. It sometimes colonises exposed lake beds during dry periods. It occurs in habitats that are mostly or wholly included in the two Endangered Ecological Communities (EECs): 'Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory' and 'Upland Wetlands of the New England Tablelands (New England Tableland Bioregion) and the Monaro Plateau (South Eastern Highlands Bioregion)', as listed under the EPBC Act.	None	No
Pimelea curviflora var. *curviflora*	PMST	V	V	Occurs on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands. Also recorded in Illawarra Lowland Grassy Woodland habitat at Albion Park on the Illawarra coastal plain. Flowers October to May.	None	No
Smooth Bush-pea *Pultenaea glabra*	PMST	V	V	Grows in swamp margins, hillslopes, gullies and creek banks and occurs within dry sclerophyll forest and tall damp heath on sandstone. Flowers September to November, fruit matures October to December.	None	No
Rough Doubletail *Diuris praecox*	PMST	V	V	Rough Doubletail grows on hills and slopes of near-coastal districts in open forests which have a grassy to fairly dense understorey. Exists as subterranean tubers most of the year. It produces leaves and flowering stems in winter.	Low	No
Siah's Backbone *Streblus pendulinus*	PMST	-	E	Siah's Backbone occurs from Cape York Peninsula to Milton, south-east New South Wales (NSW), as well as Norfolk Island. On the Australian mainland, Siah's Backbone is found in warmer rainforests, chiefly along watercourses. The altitudinal range is from near sea level to 800 m above sea level. The species grows in well developed rainforest, gallery forest and drier, more seasonal rainforest.	Moderate	Yes
Somersby Mintbush *Prostanthera junonis*	PMST	E	E	The species is restricted to the Somersby Plateau. It occurs on both the Somersby and Sydney Town soil landscapes on gently undulating country over weathered Hawkesbury sandstone within open forest/low woodland/open scrub. It occurs in both disturbed and undisturbed sites. The dominant flowering period for this species is October to mid-December depending on weather/site conditions. The plant is very difficult to identify outside of this time.	None	No
Small-flower Grevillea *Grevillea parviflora* subsp. *parviflora*	PMST	V	V	Small-flower Grevillea occurs in a range of vegetation types from heath and shrubby woodland to open forest. In Sydney it has been recorded from Shale Sandstone Transition Forest and in the Hunter in Kurri Sand Swamp Woodland. However, other communities occupied include Corymbia maculata - Angophora costata open forest in the Dooralong area, in Sydney Sandstone Ridgetop Woodland at Wedderburn and in Cooks River / Castlereagh Ironbark Forest at Kemps Creek.	None	No

				Often occurs in open, slightly disturbed sites such as along tracks. Plants are capable of suckering from a rootstock and most populations demonstrate a degree of vegetative spread, particularly after disturbance such as fire.		
Thick-lipped Spider Orchid *Caladenia tessellata*	PMST	E	V	Thick-lipped Spider Orchid is generally found in grassy sclerophyll woodland on clay loam or sandy soils, though the population near Braidwood is in low woodland with stony soil. The single leaf regrows each year. Flowers appear between September and November (but apparently generally late September or early October in extant southern populations).	None	No
Tranquility Mintbush *Prostanthera askania*	NPWS Atlas	E	E	Occurs adjacent to, but not immediately in, drainage lines on flat to moderately steep slopes formed on Narrabeen sandstone and alluvial soils derived from it. Occurs in moist sclerophyll forest and warm temperate rainforest communities, and the ecotone between them. These communities are generally tall forests with a mesic understorey; Sydney Blue Gum *Eucalyptus saligna* and Turpentine *Syncarpia glomulifera* are usually present, though canopy species present can be highly variable.	Moderate	Yes
Variable Midge Orchid *Genoplesium insigne* (syn. *Corunastylis insigne)*	PMST	E	CE	Variable Midge Orchid grows in patches of Kangaroo Grass (*Themeda australis*) amongst shrubs and sedges in heathland and forest. Associated vegetation is described as dry sclerophyll woodland dominated by Scribbly Gum (*Eucalyptus haemastoma*), Red Bloodwood (*Corymbia gummifera*), Smooth-barked Apple (*Angophora costata*) and Black She-oak (*Allocasuarina littoralis*). Fewer than twenty plants are recorded from three localities, while the number of plants present at the fourth locality (Chain Valley Bay) is not known. Flowering period is September to October.	None	No
Corunastylis sp. Charmhaven	GHD 2014	CE	CE	It occurs within low woodland to heathland with a shrubby understorey and ground layer. Dominants include Black She-oak (*Allocasuarina littoralis*), Prickly Tea-tree (*Leptospermum juniperinum*), Prickly-leaved Paperbark (*Melaleuca nodosa*), Narrow-leaved Bottlebrush (*Callistemon linearis*) and Zig-zag Bog-rush (*Schoenus brevifolius*). Flowering occurs approximately six weeks after the initialising rain event, usually in February or March.	None	No
Wyong Sun Orchid *Thelymitra adorata*	PMST	CE	CE	Currently known from a few localised occurrences in the area bounded by the towns of Wyong, Warnervale and Wyongah on the New South Wales Central Coast, within the Wyong Local Government Area. Occurs from 10-40 m a.s.l. in grassy woodland or occasionally derived grassland in well-drained clay loam or shale derived soils. The vegetation type in which the majority of populations occur (including the largest colony) is a Spotted Gum - Ironbark Forest with a diverse grassy understorey and occasional scattered shrubs.	None	No
Yellow Gnat Orchid *Genoplesium baueri*	PMST	E	E	Grows in dry sclerophyll forest and moss gardens over sandstone. Flowers February to March.	None	No

*The likelihood that threatened and migratory species previously recorded or predicted to occur within 10 km of the study area was assessed.

Searches were completed for scats, tracks, burrows, fallen timber, tree hollows, swamps, soaks and foraging resources to indicate the likelihood that these threatened and migratory fauna would occur in the study area. Habitat recorded in the study area was compared to the specific habitat requirements of each threatened or migratory species, and assessed against the criteria in Table X to determine their likelihood of occurrence. The likelihood of occurrence was used to determine whether the species required further assessment.

Table X Assessment criteria		
Likelihood	Description	Further assessment required?
Recorded	The species was observed in the study area during the current survey.	Yes
High	It is highly likely that a species inhabits the study area due to the presence of suitable habitat, and has been recorded recently in the surrounding area.	Yes
Moderate	Potential habitat is present in the study area, although it has not been recorded recently in the study area and surrounds. The species is unlikely to be dependent (ie. for breeding) on habitat within the study area.	Yes
Low	It is unlikely that the species inhabits the study area, and may be an occasional visitor. Habitat similar to the study area is widely distributed in the local area, meaning that the species is not dependent (ie. for breeding) on it.	No
None	Suitable habitat is absent from the study area.	No

The EECs identified in the search were:

- Coastal Upland Swamps in the Sydney Basin Bioregion
- Subtropical and Temperate Coastal Saltmarsh

Neither of these EECs were identified on the site during the field surveys.

Threatened Fauna Species

The Protected Matters Search Tool predicts that the following fauna species listed under the EPBC Act may occur within 10 km of the project area.

- four threatened terrestrial birds (marine birds were excluded from this assessment);
- five threatened frog species; and
- seven threatened mammal species.

Marine animals were excluded from the search as the project is over 4km from the nearest marine environment. Table 2 outlines the details, habitat requirements, likelihood of occurrence and requirement for further survey.

Table 2 Threatened fauna species recorded or with the potential to occur within 10 km of the survey area

Species	Source	Status		Habitat requirements	Likelihood of occurrence*	Further assessment and survey required?
		TSC Act	EPBC Act			
Fauna - birds						
Australasian Bittern *Botaurus poiciloptilus*	PMST	E	E	Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (*Typha* spp.) and spikerushes (*Eleocharis* spp.). Hides during the day amongst dense reeds or rushes and feed mainly at night on frogs, fish, yabbies, spiders, insects and snails. Feeding platforms may be constructed over deeper water from reeds trampled by the bird; platforms are often littered with prey remains. Breeding occurs in summer from October to January; nests are built in secluded places in densely-vegetated wetlands on a platform of	Low	No

				reeds; there are usually six olive-brown eggs to a clutch.		
Eastern Bristlebird *Dasyornis brachypterus*	PMST	E	E	Habitat of the Eastern Bristlebird is characterised by dense, low vegetation including heath and open woodland with a heathy understorey; in northern NSW, this species occurs in open forest with tussocky grass understorey; all of these vegetation types are fire prone.	None	No
Regent Honeyeater *Anthochaera phrygia*	NPWS Atlas	CE	E	The Regent Honeyeater mainly inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. These birds are also found in drier coastal woodlands and forests in some years. Every few years non-breeding flocks are seen foraging in flowering coastal Swamp Mahogany (*Eucalyptus robusta*) and Spotted Gum (*Corymbia maculata*) forests, particularly on the central coast and occasionally on the upper north coast. Birds are occasionally seen on the south coast.	High	Yes
Swift Parrot *Lathamus discolor*	NPWS Atlas	E	E	The Swift Parrot migrates to the Australian south-east mainland between March and October. On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations.	High	Yes
FAUNA - Frogs						
Giant Barred Frog *Mixophyes iteratus*	PMST	E	E	Found on forested slopes of the escarpment and adjacent ranges in riparian vegetation, subtropical and dry rainforest and wet sclerophyll forests. This species is associated with flowing streams with high water quality, though habitats may contain weed species. They occur amongst deep, damp leaf litter in rainforests, moist eucalypt forest and nearby dry eucalypt forest, at elevations below 1000 m. They breed around shallow, flowing rocky streams from late spring to summer. Females lay eggs onto moist creek banks or rocks above water level, from where tadpoles drop into the water when hatched. Their distribution occurs along the coast and ranges from south-eastern Queensland to the Hawkesbury River in NSW. North-eastern NSW, particularly the Coffs Harbour-Dorrigo area, is now a stronghold.	None	No
Giant Burrowing Frog *Heleioporus australiacus*	PMST	V	V	The Giant Burrowing Frog is found in heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based. They spend more than 95% of their time in non-breeding habitat in areas	None	No

				up to 300 m from breeding sites. Whilst in non-breeding habitat, the Giant Burrowing Frog burrows below the soil surface or in the leaf litter.		
Green and Golden Bell Frog *Litoria aurea*	PMST	E	V	Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (*Typha spp.)* or spikerushes (*Eleocharis spp.*). Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (*Gambusia holbrooki*), have a grassy area nearby and diurnal sheltering sites available. Some sites, particularly in the Greater Sydney region occur in highly disturbed areas, such as brick pits, landfill areas, disused industrial sites and cleared lands. Formerly distributed from the NSW north coast near Brunswick Heads, southwards along the NSW coast to Victoria where it extends into east Gippsland. Records from west to Bathurst, Tumut and the ACT region. Since 1990 there have been approximately 50 recorded locations in NSW, most of which are small, coastal, or near coastal populations. These locations occur over the species' former range, however they are widely separated and isolated. Large populations in NSW are located around the metropolitan areas of Sydney, Shoalhaven and mid north coast (one an island population). There is only one known population on the NSW Southern Tablelands.	None	No
Littlejohns Tree Frog *Littoria littlejohni*	PMST	V	V	The Littlejohn's Tree Frog has a distribution that includes the plateaus and eastern slopes of the Great Dividing Range from Watagan State Forest (90 km north of Sydney) south to Buchan in Victoria. Non-breeding habitat is heath based forests and woodlands where it shelters under leaf litter and low vegetation, and hunts for invertebrate prey either in shrubs or on the ground.	None	No
Stuttering Frog *Mixophyes balbus*	PMST	E	V	The Stuttering Frog is restricted to the eastern slopes of the Great Divide, from the Cann River catchment in far East Gippsland, Victoria, to tributaries of the Timbarra River near Drake, New South Wales. They are found in association with permanent streams through temperate and sub-tropical rainforest and wet sclerophyll forest, rarely in dry open tableland riparian vegetation.	None	No
FAUNA - Mammals						
Brush-tailed	PMST	E	V	In NSW the Brush-tailed Rock Wallaby	None	No

Rock Wallaby *Petrogale penicillata*				occurs from the Queensland border in the north to the Shoalhaven in the south, with the population in the Warrumbungle Ranges being the western limit. This species occupies rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north. The Brush-tailed Rock Wallaby browse on vegetation in and adjacent to rocky areas eating grasses and forbs as well as the foliage and fruits of shrubs and trees.		
Grey-headed Flying-fox *Pteropus poliocephalus*	NPWS Atlas	V	V	Grey-headed Flying foxes occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy.	High	Yes
Koala *Phascolarctos cinereus*	NPWS Atlas	V	V	In NSW, the koala mainly occurs on the central and north coast with some populations in the west of the Great Dividing Range. The Koala inhabits eucalypt woodlands and forests. They feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species.	High	Yes
Large-eared Pied Bat *Chalinolobus dwyeri*	PMST	V	V	The Large-eared Pied Bat roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (*Petrochelidon ariel*), frequenting low to mid-elevation dry open forest and woodland close to these features.	Low	No
Long-nosed Potoroo *Potorous tridactylus tridactylus*	PMST	V	V	The Long-nosed Potoroo inhabits coastal heaths and dry and wet sclerophyll forests. A dense understorey with occasional open areas is an essential part of this species' habitat, and may consist of grass-trees, sedges, ferns or heath, or of low shrubs of tea-trees or melaleucas.	Moderate	Yes
New Holland Mouse *Pseudomys novaehollandiae*	NPWS Atlas	-	V	The New Holland Mouse is known to inhabit open heathlands, woodlands and forests with a heathland understorey and vegetated sand dunes. It is a social animal, living predominantly in burrows shared with other individuals.	None	No
Spotted-tailed Quoll *Dasyurus maculatus*	NPWS Atlas	V	E	The Spotted-tailed Quoll inhabits a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian	Low	No

				forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites.		

*The likelihood that threatened and migratory species previously recorded or predicted to occur within 10 km of the study area was assessed. Searches were completed for scats, tracks, burrows, fallen timber, tree hollows, swamps, soaks and foraging resources to indicate the likelihood that these threatened and migratory fauna would occur in the study area. Habitat recorded in the study area was compared to the specific habitat requirements of each threatened or migratory species, and assessed against the criteria in Table X to determine their likelihood of occurrence. The likelihood of occurrence was used to determine whether the species required further assessment.

Table X Assessment criteria

Likelihood	Description	Further assessment required?
Recorded	The species was observed in the study area during the current survey.	Yes
High	It is highly likely that a species inhabits the study area due to the presence of suitable habitat, and has been recorded recently in the surrounding area.	Yes
Moderate	Potential habitat is present in the study area, although it has not been recorded recently in the study area and surrounds. The species is unlikely to be dependent (ie. for breeding) on habitat within the study area.	Yes
Low	It is unlikely that the species inhabits the study area, and may be an occasional visitor. Habitat similar to the study area is widely distributed in the local area, meaning that the species is not dependent (ie. for breeding) on it.	No
None	Suitable habitat is absent from the study area.	No

Nature and extent of likely impact

Targeted searches (within 10 kilometres of the project area) were completed across the project area for the following threatened flora species:

- *Melaleuca biconvexa*
- *Angophora inopina* (Charmhaven Apple)
- *Syzygiu, paniculatum* (Magenta Lilly Pilly)
- *Prostanthera askania* (Tranquillity Mintbush)
- *Genopleasium insigne* (Variable Midge Orchid)
- *Thelymitra adorata* (Wyong Sun Orchid)
- *Corunastylis sp.* Charmhaven

Note: surveys were completed within the flowering period of the abovementioned orchids.

Preliminary field surveys identified a large population of *Melaleuca biconvexa*. It is estimated that up to 500 individuals may be present, which would be confirmed during surveys for the detailed ecological assessment of the proposed activity. Two large patches of *Melaleuca biconvexa* in the rail corridor are not affected by the proposed design. However the proposal would result in the removal of several full patches and some partial patches.

A preliminary EPBC assessment of significance concluded that the project is likely to result in significant impacts for *Melaleuca biconvexa* as:

- the project may affect an important population and/or critical habitat for the species; and
- a large stand would be removed and small areas would be removed from smaller stands.

Targeted fauna surveys have not yet been completed for the proposal. The Preliminary Ecological Assessment identified a number of fauna species that are likely to utilise the study area. EPBC assessments of significance have not yet been undertaken.

Further detailed surveys and assessment are required to extend the findings of the preliminary ecological assessment. This would be undertaken as part of the preparation of the REF and SIS in accordance with the NSW Office of Environment and Heritage CERs.

3.1 (e) Listed migratory species

Description

The Protected Matters Search Tool predicts that nine migratory fauna species listed under the Commonwealth EPBC Act may occur within 10 km of the project area. Table 3 outlines the details, habitat requirements, likelihood of occurrence and requirement for further survey.

Table 3 Migratory fauna species recorded or with the potential to occur within 10 km of the survey area

Species	Source	Status		Habitat requirements	Likelihood of occurrence*	Further assessment and survey required?
		TSC Act	EPBC Act			
Fauna - birds						
Black-faced Monarch *Monarcha melanopsis*	PMST	-	Mi	The Black-faced Monarch occurs mainly in rainforest ecosystems but sometimes is found in nearby open eucalypt forests in gullies with a dense, shrubby, or patchy understorey.	Moderate	Yes

Cattle Egret *Ardea ibis*	NPWS Atlas	-	Mi	The Cattle Egret occurs in tropical and temperate grasslands, wooded lands and terrestrial wetlands.	Low	No
Fork-tailed Swift *Apus pacificus*	NPWS Atlas	-	MI	In Australia, the Fork-tailed Swift mostly occurs over inland plains but sometimes above foothills or in coastal areas. This species can also occur over cliffs and beaches and also over islands and sometimes well out to sea.	None	No
Rainbow Bee-eater *Merops ornatus*	NPWS Atlas	-	Mi	The Rainbow Bee-eater is distributed across much of mainland Australia, and occurs on several near-shore islands. It is not found in Tasmania, and is thinly distributed in the most arid regions of central and Western Australia. It usually occurs in open, cleared or lightly-timbered areas that are often, but not always, located in close proximity to permanent water. The Rainbow Bee-eater is also common in cleared and semi-cleared habitats ie farmland.	Moderate	Yes
Rufous Fantail *Rhipidura rufifrons*	PMST	-	Mi	In east and south-east Australia, the Rufous Fantail mainly inhabits wet sclerophyll forests, often in gullies dominated by eucalypts such as Tallow-wood (*Eucalyptus microcorys*), Mountain Grey Gum (*E. cypellocarpa*), Narrow-leaved Peppermint (*E. radiata*), Mountain Ash (*E. regnans*), Alpine Ash (*E. delegatensis*), Blackbutt (*E. pilularis*) or Red Mahogany (*E. resinifera*); usually with a dense shrubby understorey often including ferns.	None	No
Satin Flycatcher *Myiagra cyanoleuca)*	PMST	-	Mi	The Satin Flycatcher is widespread in eastern Australia and vagrant to New Zealand (Blakers et al. 1984; Coates 1990). Satin Flycatchers inhabit heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, and on migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests.	None	No
Spectacled Monarch *Monarcha trivirgatus*	PMST	-	Mi	The Spectacled Monarch prefers thick understorey in rainforests, wet gullies and waterside vegetation, as well as mangroves.	Moderate	Yes
White-bellied Sea Eagle *Haliaeetus leucogaster*	NPWS Atlas	-	Mi	The White-bellied Sea-Eagle is found in coastal habitats (especially those close to the sea-shore) and around terrestrial wetlands in tropical and temperate regions of mainland Australia and its offshore islands. The habitats occupied by the sea-eagle are characterised by the presence of large areas of open water (larger rivers, swamps, lakes and the sea).	Low	No
White-throated Needletail *Hirundapus*	NPWS Atlas	-	Mi	The White-throated Needletail occurs in open forest, rainforest, heathland, grassland and swamps. The species breeds in wooded lowlands and sparsely	Low	No

caudacutus				vegetated hills, as well as mountains covered with coniferous forests.		

*The likelihood that threatened and migratory species previously recorded or predicted to occur within 10 km of the study area was assessed. Searches were completed for scats, tracks, burrows, fallen timber, tree hollows, swamps, soaks and foraging resources to indicate the likelihood that these threatened and migratory fauna would occur in the study area. Habitat recorded in the study area was compared to the specific habitat requirements of each threatened or migratory species, and assessed against the criteria in Table X to determine their likelihood of occurrence. The likelihood of occurrence was used to determine whether the species required further assessment.

Table X Assessment criteria		
Likelihood	Description	Further assessment required?
Recorded	The species was observed in the study area during the current survey.	Yes
High	It is highly likely that a species inhabits the study area due to the presence of suitable habitat, and has been recorded recently in the surrounding area.	Yes
Moderate	Potential habitat is present in the study area, although it has not been recorded recently in the study area and surrounds. The species is unlikely to be dependent (ie. for breeding) on habitat within the study area.	Yes
Low	It is unlikely that the species inhabits the study area, and may be an occasional visitor. Habitat similar to the study area is widely distributed in the local area, meaning that the species is not dependent (ie. for breeding) on it.	No
None	Suitable habitat is absent from the study area.	No

Nature and extent of likely impact

Parts of the study area containing native vegetation may represent potential habitat for migratory fauna species. The importance of habitat in the study area to these migratory fauna is currently unknown, and would be determined during targeted fauna surveys. Therefore assessments of significance have not been completed for migratory fauna. Assessments of significance would be completed following targeted fauna surveys. These would be undertaken as part of the REF and SIS in accordance with the NSW Office of Environment and Heritage CERs.

3.1 (f) Commonwealth marine area

Description

There is no Commonwealth Marine Area in the locality (10 km radius) of the site.

Nature and extent of likely impact

Nil

3.1 (g) Commonwealth land

Description

The project is not being undertaken on Commonwealth land, or would result in impacts to any Commonwealth land in proximity to the site.

Nature and extent of likely impact

Nil

3.1 (h) The Great Barrier Reef Marine Park

Description

The Project is located over 1000km from the Great Barrier Reef Marine Park (GBRMP), and therefore no impacts are expected.

Nature and extent of likely impact

Nil

3.1 (i) A water resource, in relation to coal seam gas development and large coal mining development

Description

The Project does not involve coal seas gas or mining activities.

Nature and extent of likely impact

Nil

3.2 Nuclear actions, actions taken by the Commonwealth (or Commonwealth agency), actions taken in a Commonwealth marine area, actions taken on Commonwealth land, or actions taken in the Great Barrier Reef Marine Park

3.2 (a)	**Is the proposed action a nuclear action?**	X	No
			Yes (provide details below)
	If yes, nature & extent of likely impact on the whole environment		
	Not applicable		
3.2 (b)	**Is the proposed action to be taken by the Commonwealth or a Commonwealth agency?**	X	No
			Yes (provide details below)
	If yes, nature & extent of likely impact on the whole environment		
	Not applicable		
3.2 (c)	**Is the proposed action to be taken in a Commonwealth marine area?**	X	No
			Yes (provide details below)
	If yes, nature & extent of likely impact on the whole environment (in addition to 3.1(f))		
	Not applicable		
3.2 (d)	**Is the proposed action to be taken on Commonwealth land?**	X	No
			Yes (provide details below)
	If yes, nature & extent of likely impact on the whole environment (in addition to 3.1(g))		
	Not applicable		
3.2 (e)	**Is the proposed action to be taken in the Great Barrier Reef Marine Park?**	X	No
			Yes (provide details below)

If yes, nature & extent of likely impact on the whole environment (in addition to 3.1(h))
Not applicable

3.3 Other important features of the environment

3.3 (a) Flora and fauna

A preliminary ecological assessment was undertaken by EMM Consulting which included a desktop assessment and field surveys. (Attachment 5) The EPBC listed species are discussed in Section 3.1(d). The following section discusses other flora and fauna that have been identified or may occur on the project site.

Flora
Two EECs listed under the TSC Act occur within the project area, namely the

- *River Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions; and*
- *Swamp Sclerophyll Forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions.*

Database searches identified 24 threatened flora species listed on the TSC Act may occur within the project area. None of these species were identified in the preliminary field surveys. Additional targeted surveys will be undertaken as part of the SIS and REF in accordance with the NSW Office of Environment and Heritage CERs.

Fauna
Database searches identified 39 species of fauna listed under the TSC Act recorded within 10 kilometres of the project area; including four frog, two reptile, 21 bird and 12 mammal species. The project will be undertaking targeted fauna surveys to inform the environmental impact assessment.

3.3 (b) Hydrology, including water flows

Ourimbah Creek runs parallel to the project area approximately 400 metres to the north-west. Ourimbah Creek flows into Tuggerah Lake. Chittaway Creek, a tributary of Ourimbah Creek runs through the southern section of the project area. During periods of heavy rainfall across the Ourimbah Creek catchment, there is potential for water to overtop the banks of the creek system and inundate the adjoining floodplain.

Assessment and modelling of existing water quality, flooding and groundwater conditions will be undertaken as part of the environmental impact assessment for the project.

3.3 (c) Soil and Vegetation characteristics

The project area is located within a system of quaternary sediments comprised of gravel, sand, silt and clay. Soil landscape characteristics observed in the project area include the following which are associated with the Yarramalong Soil Landscape:

- Loose brown sand – topsoil + subsoil
- Brown pedal loam – topsoil + subsoil
- Earthy yellowish brown sandy clay loam - subsoil
- Brown pedal clay – subsoil

3.3 (d) Outstanding natural features

The project area does not contain outstanding natural features, such as significant landforms, or geological formations. There are, however, features of high ecological importance within the project area, including:

- Swamp Sclerophyll Forest and Lowland Rainforest EEC
- Potential foraging habitat for a selection of threated fauna species that are listed under the TSC Act and EPBC Act.

3.3 (e) Remnant native vegetation

Vegetation assemblages across the site have been described and mapped as part of the Preliminary Ecological Assessment prepared by EMM (see Attachment 5).

Two EEC's exist within the project area, which include:

- Swamp Mahogany Forest (Swamp Sclerophyll Forest EEC) – the majority of this community is of moderate to good condition. There are fragments of this EEC that are currently being managed as a high voltage electricity easement, where the trees and shrubs have largely been removed and the structure of the community consists predominately of open grassland. These fragments are therefore considered of low condition.
- Lowland Rainforest EEC – two small patches of moderate to good condition.

The project area contains a large population of *Melaleuca biconvexa* which is listed under both the TSC Act and EPBC Act, and occurs within the Swamp Sclerophyll Forest EEC. Targeted surveys will be undertaken to determine the number of individuals within the project area and to inform the environmental impact assessment.

3.3 (f) Gradient (or depth range if action is to be taken in a marine area)

Consistent with the soil landscape classification of the site (quaternary sediments), the topography of the project area is generally flat, with minimal local relief.

3.3 (g) Current state of the environment

The project area is dominated by EEC's of a generally moderate to good condition as noted in section 3.3(e). There has been a moderate level of disturbance within sections of the project area as a result of the construction of the rail corridor and associated infrastructure (i.e. access roads); construction of residential dwellings and associated infrastructure (i.e. sewer line, sheds, fences) and an Ausgrid electrical easement bordering the eastern perimeter of the site, adjacent to the rail corridor. In addition anecdotal evidence suggests that parts of the project area were used to keep cattle in the past.

3.3 (h) Commonwealth Heritage Places or other places recognised as having heritage values

There is no Commonwealth Heritage Places or other known places recognised as having heritage significance in close proximity to the site.

3.3 (i) Indigenous heritage values

An Aboriginal cultural heritage due diligence assessment (Attachment 6) was undertaken by Biosis, which included a desktop assessment and field surveys. A search of the Aboriginal Information Management System (AHIMS) database was undertaken on the 3 September 2015 to identify the location of any known items within the vicinity (10x10 kilometre search) of the project area. The search identified that the area surrounding the project site contains 32 Aboriginal sites (predominately artefact sites and grinding grooves), however none of the registered sites are within the project area.

The project area is considered to have a high potential for artefact scatters within minimally disturbed elevated areas overlooking creeklines; a moderate potential for scarred trees within uncleared areas of the project site and a high potential for grinding grooves or rock engravings on suitable sandstone outcrops (if present).

3.3 (j) Other important or unique values of the environment

The nearest wetlands of national importance are located approximately 3.5 kilometres to the east (downstream) of the project area. The project will not result in any direct impacts on these wetlands. With the implementation of appropriate environmental management measures during construction and operation it is unlikely that there would be any significant indirect impacts.

3.3 (k) Tenure of the action area (eg freehold, leasehold)

Landowners within the project area include:

- RailCorp
- Wyong Council
- Private properties

TfNSW is currently negotiating with existing private property owners and Wyong Council for the acquisition of their respective land holdings in accordance with the NSW *Land Acquisition (Just Terms Compensation) Act 1991*.

3.3 (l) Existing land/marine uses of area

The project area is characterised by semi-rural land uses adjacent to the main north railway line. Portions of the site have been previously cleared for rural and residential purposes; however the majority of the site is vegetated.

The majority of the project site is zoned as E2 – Environmental Conservation, with the adjacent rail line zoned as SP2 – Infrastructure under the Wyong Council Location Environmental Plan (LEP).

3.3 (m) Any proposed land/marine uses of area

Aside from the construction and operation of the New Intercity Fleet Maintenance Facility, there are no other known proposed changes of land use within the project area.

4 Environmental outcomes

The New Intercity Fleet Maintenance Facility is located predominantly on vegetated land. As a result it is unlikely that ecological impacts can be fully avoided. As part of the detailed design phase, options would be considered to minimise the impact of the project, particularly on *Melaleuca biconvexa*, including opportunities to modify the alignment of access roads, services, and the layout of the maintenance facility and ancillary infrastructure.

TfNSW will prepare a biodiversity offset strategy to offset unavoidable residual impacts of the New Intercity Fleet Maintenance Facility proposal on biodiversity values. The strategy will be developed with reference to the following:

- Chief Executive Requirements for the SIS
- Principles for the use of Biodiversity Offsets in NSW (DECC 2008)
- BioBanking Assessment Methodology (BBAM)
- EPBC Act environmental offsets policy

TfNSW is committed to delivering an offset package that will appropriately offset the impacts of the Project.

A draft set of outcomes based conditions for the New Intercity Fleet Maintenance Facility will be prepared in accordance with Department of the Environment *draft Outcomes-based Conditions Policy (2015)* and *Outcomes-based Conditions Guidance (2015)* as part of the REF.

5 Measures to avoid or reduce impacts

In order to address the potential impacts of the New Intercity Fleet Maintenance Facility on biodiversity, the following detailed mitigation measures are proposed. These mitigation measures will be further considered and revised as appropriate in response to the outcomes of the detailed ecological assessment and the REF.

General	Ensure environmental inductions are provided during construction.
	Prepare a flora and fauna management plan as part of the Construction Environmental Management Plan (CEMP).
Design	Undertake the strategic design taking into consideration ecological constraints to minimise the footprint (for example, by using retaining walls for the rail overbridge where possible and feasible).
	Identify construction compounds and construction site boundaries in close liaison with the ecologist for the project to avoid where possible and feasible ecologically sensitive areas.
	Consider options to minimise the impact of the project upon *Melaleuca biconvexa*, including opportunities to modify the alignment of access roads, services, and the layout of the maintenance facility and ancillary infrastructure.
Vegetation and habitat loss	Limit disturbance of vegetation to the minimum necessary to construct works.
	Where appropriate mark the limits of clearing and install fencing around the construction footprints prior to the commencement of construction activities to avoid unnecessary vegetation and habitat removal.
	Restrict equipment storage and stockpiling of resources to designated areas in cleared land.
Threatened flora	Undertake pre-clearing surveys for Melaleuca biconvexa to mark out areas of remaining populations.
	Temporary fencing of remaining populations of *Melaleuca biconvexa* during construction to avoid accidental impacts.
Fauna habitat	Clearing of mature and hollow-bearing trees should be minimised where practicable.
	The removal of hollow-bearing trees is to be undertaken in accordance with a tree hollow management protocol (to be included in the CEMP), and would include the presence of a qualified ecologist or wildlife specialist experienced in the rescue of fauna.
Weeds	Develop a weed management plan to be included in the CEMP to manage weeds during the construction phase.
	Develop an operational weed management plan for the ongoing operation of the maintenance facility.
Water quality and erosion control	Erosion and sediment controls should be implemented in accordance with Volume 2D of Managing Urban Stormwater: soils and construction (Department of Environment and Climate Change 2008).
Rehabilitation	Undertake rehabilitation works for any areas that are likely to require revegetation after construction works are completed. These rehabilitation works are to undertaken by a qualified bushland regeneration contractor (as part of the CEMP) and are to reflect the vegetation mapped within the vicinity.

6 Conclusion on the likelihood of significant impacts

6.1 Do you THINK your proposed action is a controlled action?

	No, complete section 6.2
X	Yes, complete section 6.3

6.2 Proposed action IS NOT a controlled action.

Not applicable

6.3 Proposed action IS a controlled action

	Matters likely to be impacted
	World Heritage values (sections 12 and 15A)
	National Heritage places (sections 15B and 15C)
	Wetlands of international importance (sections 16 and 17B)
x	Listed threatened species and communities (sections 18 and 18A)
	Listed migratory species (sections 20 and 20A)
	Protection of the environment from nuclear actions (sections 21 and 22A)
	Commonwealth marine environment (sections 23 and 24A)
	Great Barrier Reef Marine Park (sections 24B and 24C)
	A water resource, in relation to coal seam gas development and large coal mining development (sections 24D and 24E)
	Protection of the environment from actions involving Commonwealth land (sections 26 and 27A)
	Protection of the environment from Commonwealth actions (section 28)
	Commonwealth Heritage places overseas (sections 27B and 27C)

Preliminary ecological assessments have indicated there is likely to be significant impacts to the *Melaleuca biconvexa* which listed is as vulnerable on the EPBC Act because:

- the project may affect an important population and/or critical habitat for the species; and
- a large stand would be removed and small areas would be removed from smaller stands.

As detailed in the Preliminary Ecological Assessment prepared by EMM (2015), the Project is likely to have a significant impact on an existing population of *Melaleuca biconvexa*, which is listed as a vulnerable species under the EPBC Act. Based on this conclusion and information known at this stage, TfNSW considers the New Intercity Fleet Maintenance Facility Proposal is likely to be a Controlled Action. In submitting this referral, TfNSW requests that the Bilateral Agreement between the Commonwealth and NSW Governments be applied to the project.

7 Environmental record of the responsible party

		Yes	No
7.1	**Does the party taking the action have a satisfactory record of responsible environmental management?** **Provide details** TfNSW is the lead State Government entity responsible for the delivery of major transport projects, and has a strong history of working to ensure projects minimise, mitigate and offset impacts. TfNSW has a robust Environmental Management System and is committed to achieving good environmental outcomes. Examples of best practice undertaken by TfNSW in environmental management include: o an environmental management system externally certified as meeting the requirements of *ISO 14001 – Environmental Management Systems* o no prosecutions under any environmental statute o a detailed guide to environmental planning and assessment o a Planning and Environment Compliance Monitoring System implemented across TfNSW's transport infrastructure activities. o regular environmental inspections of construction works for all projects o representatives or independent environmental management representatives for all projects TfNSW has engaged appropriately qualified and experienced ecologists to undertake environmental assessments for the project to ensure impacts to the environment are comprehensively considered and impacts avoided or minimised wherever possible.	x	
7.2	**Has either (a) the party proposing to take the action, or (b) if a permit has been applied for in relation to the action, the person making the application - ever been subject to any proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources?** **If yes, provide details** N/A		x
7.3	**If the party taking the action is a corporation, will the action be taken in accordance with the corporation's environmental policy and planning framework?** **If yes, provide details of environmental policy and planning framework** A copy of the TfNSW Environmental Policy is provided as Attachment 7. As detailed above, the TfNSW Environmental Management System is externally certified externally certified as meeting the requirements of under ISO 14001. The New Intercity Fleet Maintenance Facility project will be undertaken in accordance with the TfNSW Environmental Management System.	x	

7.4	**Has the party taking the action previously referred an action under the EPBC Act, or been responsible for undertaking an action referred under the EPBC Act?** Yes **Provide name of proposal and EPBC reference number (if known)** Parramatta Rail Link referred in May 2002. EPBC reference number 2002/673. Determined to be a 'non-controlled action' on 24 June 2002. Quakers Hill to Vineyard referred in May 2009. EPBC reference number 2009/4872. Determined to be a "non-controlled action" on 1 June 2009. Waterfall Commuter Car Park referred in November 2009. EPBC reference number 2009/5206. Determined to be a "non-controlled action" on 17 December 2009. North West Rail Link referred in April 2012. EPBC reference number 2012/6360. Determined to be a "controlled action" on 21 May 2012. Epping to Thornleigh Third Track referred in February 2013. EPBC reference number 2013/6760. Determined to be a "non-controlled action" on 21 May 2013.	X	

8 Information sources and attachments

8.1 References

- Biosis, 2015. *New Intercity Fleet - Maintenance Facility: Aboriginal Cultural Heritage Due Diligence Assessment.*
- Catchment Simulation Solutions, 2013. *Ourimbah Creek Catchment Flood Study.*
- Commonwealth of Australia, 2013. *Matters of National Significance: Significant impact guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999.*
- Commonwealth of Australia, 2015. *Draft Outcomes-based Conditions Policy Environment Protection and Biodiversity Conservation Act 1999.*
- Commonwealth of Australia, 2015. *Draft Outcomes-based Conditions Guidance Environment Protection and Biodiversity Conservation Act 1999.*
- Department of Environment and Climate Change 2008. *Managing Urban Stormwater: soils and construction.*
- EMGA Mitchell McLennan, 2015. *Preliminary Ecological Assessment - New Intercity Maintenance Facility.*
- Office of Environment and Heritage 2016. *Chief Executive's Requirements for a Species Impact Statement for a Proposed New Intercity Fleet Maintenance Facility, Kangy Angy, Wyong LGA, NSW.*

8.2 Reliability and date of information

The information provided in this referral has been sourced from:

- Specialist and field work for ecology and heritage. These studies have been commissioned for the REF.
- Various online databases.
- Desktop research.

The information used for the preparation of this referral is current given the concurrent environmental assessment and approval process under Part 5 of the EP&A Act.

8.3 Attachments

		✓ attached	Title of attachment(s)
You must attach	figures, maps or aerial photographs showing the project locality (section 1)	✓	Attachment 1
	GIS file delineating the boundary of the referral area (section 1)		
	figures, maps or aerial photographs showing the location of the project in respect to any matters of national environmental significance or important features of the environments (section 3)	✓	Attachment 2

If relevant, attach	copies of any state or local government approvals and consent conditions (section 2.5)	N/A	
	copies of any completed assessments to meet state or local government approvals and outcomes of public consultations, if available (section 2.6)	N/A	
	copies of any flora and fauna investigations and surveys (section 3)	✓	Attachment 5
	technical reports relevant to the assessment of impacts on protected matters that support the arguments and conclusions in the referral (section 3 and 4)	✓	Attachment 5
	report(s) on any public consultations undertaken, including with Indigenous stakeholders (section 3)	N/A	

9 Contacts, signatures and declarations

Project title:

9.1 Person proposing to take action

1. Name and Title:	Fil Cerone, A/ Director, Planning and Environment Services
2. Organisation	Transport for NSW
3. EPBC Referral Number	Not known
4: ACN / ABN	18 804 239 602
5. Postal address	Locked Bag 6501 St Leonards NSW 2065
6. Telephone:	9200 0200
7. Email:	Fil.Cerone@transport.nsw.gov.au
Declaration	I declare that to the best of my knowledge the information I have given on, or attached to this form is complete, current and correct. I understand that giving false or misleading information is a serious offence. I agree to be the proponent for this action. I declare that I am not taking the action on behalf of or for the benefit of any other person or entity.
Signature	Date 24/3/16

9.2 Person preparing the referral information (if different from 8.1)

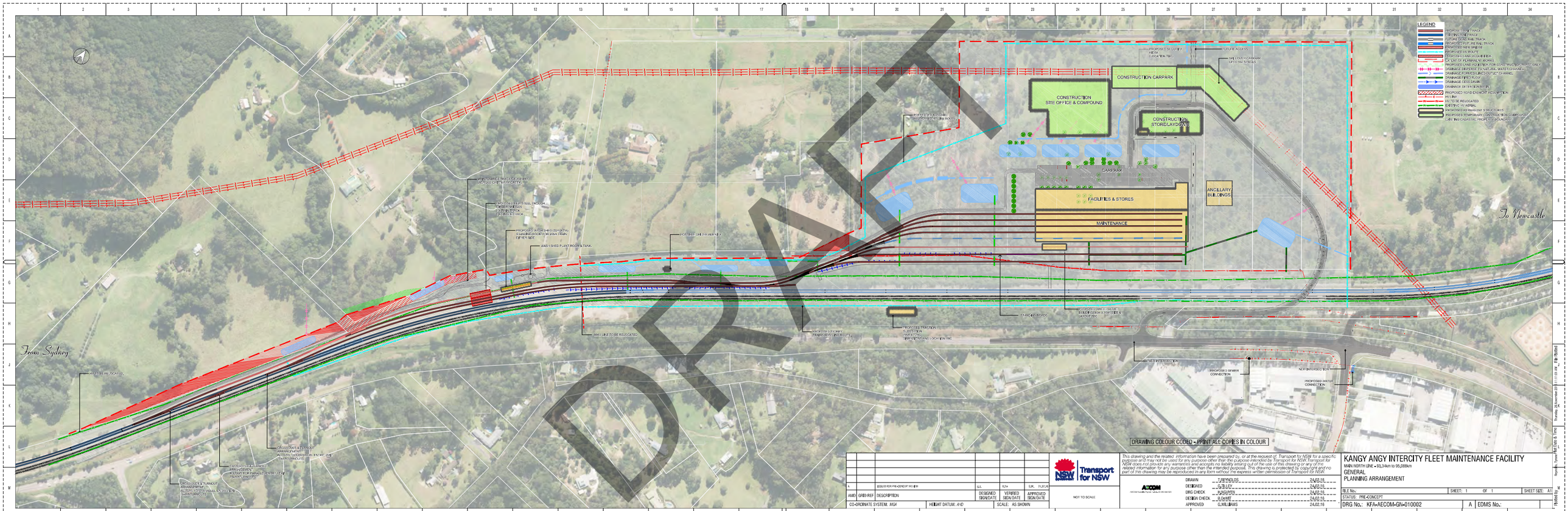
Name	Philippa Hendy
Title	Environment and Planning Manager
Organisation	Transport for NSW
ACN / ABN (if applicable)	18 804 239 602
Postal address	Locked Bag 6501 St Leonards NSW 2065
Telephone	9200 0934
Email	Philippa.Hendy@transport.nsw.gov.au
Declaration	I declare that to the best of my knowledge the information I have given on, or attached to this form is complete, current and correct. I understand that giving false or misleading information is a serious offence.
Signature	Date 18/3/16

REFERRAL CHECKLIST

HAVE YOU:

- ☑ Completed all required sections of the referral form?
- ☑ Included accurate coordinates (to allow the location of the proposed action to be mapped)?
- ☑ Provided a map showing the location and approximate boundaries of the project area?
- ☑ Provided a map/plan showing the location of the action in relation to any matters of NES?
- ☑ Provided a digital file (preferably ArcGIS shapefile, refer to guidelines at Attachment A) delineating the boundaries of the referral area?
- ☑ Provided complete contact details and signed the form?
- ☑ Provided copies of any documents referenced in the referral form?
- ☑ Ensured that all attachments are less than three megabytes (3mb)?
- ☑ Sent the referral to the Department (electronic and hard copy preferred)?

Attachment 1 – Location of proposed Maintenance Facility



A		ISSUED FOR PRE-CONCEPT REVIEW	SJL	RJH	SJK	15.01.16
AMD	GRID REF	DESCRIPTION	DESIGNED SIGN/DATE	VERIFIED SIGN/DATE	APPROVED SIGN/DATE	
CO-ORDINATE SYSTEM: MGA			HEIGHT DATUM: AHD		SCALE: AS SHOWN	

NOT TO SCALE

KANGY ANGY INTERCITY FLEET MAINTENANCE FACILITY

MAIN NORTH LINE - 93.34km to 95.088km

GENERAL

PLANNING ARRANGEMENT

DRAWN	T.REYNOLDS	24.02.16
DESIGNED	G.STILEY	24.02.16
DRG CHECK	N.HAYNES	24.02.16
DESIGN CHECK	R.HYATT	24.02.16
APPROVED	G.WILLIAMS	24.02.16

FILE No.: | SHEET: 1 OF 1 | SHEET SIZE: A1

STATUS: PRE-CONCEPT

DRG No.: KFA-AECOM-GN-010002 | A | EDMS No.:

TABLE OF CONTENTS

LIST OF TABLES

LIST OF APPENDICES

NSW GOVERNMENT | Office of Environment & Heritage

Your reference: 4869854-1
Our reference: DOC16/22703-4
Contact: Robert Gibson, 4908 6851

Mr Ben Groth
Principle Manager, Environmental Impact Assessment
Transport for NSW
Locked Bag 6501
ST LEONARDS NSW 2065

Attention: Tanya Coates

Dear Mr Groth

RE: CHIEF EXECUTIVE'S REQUIREMENTS FOR PROPOSED NEW INTERCITY FLEET MAINTENANCE FACILITY AT KANGY ANGY

I refer to your letter dated 15 January 2016 seeking Chief Executive's Requirements (CER's) for the proposed new Intercity Fleet train maintenance facility at Kangy Angy in accordance with Section 111 of the *Threatened Species Conservation Act 1995* (TSC Act). The Office of Environment and Heritage (OEH) understands that Transport for NSW (TNSW) is planning to construct this new facility under the Part 5 provisions of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

In response to your request, please find attached CER's for a Species Impact Statement (SIS) (**Attachment A**) to address all known and potential threatened species, populations and ecological communities (including their habitat). The Preliminary Ecological Assessment for this project concluded that the project is likely to have a significant impact on occurrences of Swamp Sclerophyll Forest Endangered Ecological Community (EEC) and also stands of Biconvex Paperbark (*Melalueca biconvexa*), both of which are listed under the TSC Act. In addition to this EEC and paperbark, OEH is of the opinion that the SIS must address all likely species, populations, ecological communities and their habitats that may be directly or indirectly impacted by the proposal. A list of potential species, populations and ecological communities has been provided in Attachment A.

Following completion of the SIS, if TNSW determines that the proposal is likely to have a significant effect on threatened species, populations or ecological communities (including their habitat), then the concurrence of the Chief Executive of OEH is required before consent may be granted. A concurrence application is not required should TNSW decide to reject the application or if TNSW determines that the proposal is unlikely to have a significant effect on threatened species, populations or ecological communities.

The SIS must be submitted to OEH as part of a request for concurrence within 12 months of this letter. As the consent authority, TNSW must ensure the SIS is compliant with the CER's. If concurrence is requested outside the 12 month timeframe, OEH must be consulted to determine whether the CER's need to be modified to reflect, among other things, changes to the listings of threatened species, populations and ecological communities, new information on threatened species, populations and ecological communities or changes to relevant legislation.

Please note that the issuing of CER's is a statutory requirement for OEH and should not be considered as support or endorsement of the proposed development.

Locked Bag 1002 Dangar NSW 2309
Level 4/26 Honeysuckle Drive Newcastle NSW 2300
rog.hcc@environment.nsw.gov.au
ABN 30 841 387 271
www.environment.nsw.gov.au

If seeking concurrence, OEH requests that TNSW provide: one (1) printed copy and a searchable electronic copy (i.e. *.pdf format) of the SIS (including copies of survey data sheets etc.), the original development application, any social and economic appraisal of the development and any supporting or background reports (including previous surveys etc.). A checklist for determining if the SIS has met the requirements of the Minister administering the TSC Act is provided in **Attachment B**.

If you require any further information regarding this matter please contact Robert Gibson, Regional Biodiversity Conservation Officer, on 4927 3154.

Yours sincerely

11 FEB 2016

RICHARD BATH
Senior Team Leader Planning, Hunter Central Coast Region
Regional Operations

Enclosures: Attachments A & B

ATTACHMENT A:

CHIEF EXECUTIVE'S REQUIREMENTS FOR A SPECIES IMPACT STATEMENT FOR A PROPOSED NEW INTERCITY FLEET TRAIN MAINTENANCE FACILITY, KANGY ANGY, WYONG LGA, NSW

The purpose of a Species Impact Statement (SIS) is to:

- allow the applicant or proponent to identify threatened species issues and provide appropriate amelioration for adverse impacts resulting from the proposal
- assist consent and determining authorities in the assessment of a development application under Part 4 or request for Part 5 approval under the EP&A Act
- assist the Chief Executive of OEH in deciding whether or not concurrence should be granted for the purposes of Parts 4 or 5 of the EP&A Act
- assist the Chief Executive of OEH or the Minister for the Environment when consulted for the purposes of Parts 4 or 5 of the EP&A Act
- assist the Chief Executive of OEH in the assessment of Section 91 Licence applications lodged under the TSC Act.

DEFINITIONS

The definitions given below are relevant to these requirements:

- ***abundance*** means a quantification of the population of the species or community
- ***activity*** has the same meaning as in the EP&A Act
- ***affected species*** means subject species likely to be affected by the proposal
- ***conservation status*** is regarded as the degree of representation of a species or community in formal conservation reserves
- ***DA*** number means Development Application number
- ***development*** has the same meaning as in the EP&A Act
- ***Chief Executive*** means the Chief Executive of the Office of Environment and Heritage
- ***DP*** means *Deposited Plan* which is the **plan** number given to a subdivision that is registered by the Land Property Information
- ***LGA*** means local government area
- ***locality*** means the area within a five (5) kilometre radius of the study area.
- ***region*** has the same meaning as that contained in the TSC Act
- ***significant species*** means species not listed in the TSC Act but considered to be of regional or local significance
- ***study area*** is the subject site and any additional areas which are likely to be affected by the proposal, either directly or indirectly.
- ***subject site*** means the area which is proposed for development/activity
- ***subject species*** means those threatened and significant species, populations and ecological communities which are known or considered likely to occur in the study area
- ***threatening process*** has the same meaning as that contained in the TSC Act; the definition is not limited to key threatening processes.

All other definitions are the same as those contained in the TSC Act.

MATTERS WHICH HAVE BEEN LIMITED OR MODIFIED

The following Section 110 matters in the TSC Act need only be addressed where relevant:

- all reference to threat abatement plans; and
- all reference to critical habitat. At the time of printing, the areas of declared critical habitat are not relevant to this proposal.

The proponent should be aware that recovery plans may be approved, critical habitat may be declared and key threatening processes may be listed between the issue of these requirements and the granting of consent. If this occurs, these additional matters will need to be addressed in the SIS and considered by the consent, determining or concurrence authority.

MATTERS TO BE ADDRESSED

The TSC Act provides that the SIS must meet all the matters specified in Sections 109 and 110 of the TSC Act with the exception of those matters limited above. The requirements outlined in Sections 109 and 110 (excluding the matters limited above) have been repeated below (italics) along with the specific CER's for your proposal. Previous surveys and assessments that are relevant to the locality may be used to assist in addressing these requirements.

Section 111 (1) of the TSC Act states that an applicant must comply with the CER's concerning the form and content of the SIS. Failure to fully comply with the CER's is therefore a potential breach of the legislation, and may result in OEH being unable to grant concurrence to a request by the consent authority to carry out the activity. Accordingly, the SIS must be formatted to follow the sections and subsections provided in the CER's.

1 FORM OF THE SPECIES IMPACT STATEMENT

1.1 A species impact statement must be in writing (Section 109 (1));
1.2 A species impact statement must be signed by the principal author of the statement and by:
(a) the applicant for the licence, or
(b) if the species impact statement is prepared for the purposes of the Environmental Planning and Assessment Act 1979, the applicant for development consent or the proponent of the activity proposed to be carried out (as the case requires) Section 109(2)).

The applicant or proponent must sign the following declaration:

"I...[insert name], of ..[address], being the applicant for the development consent...[insert DA number, Lot & DP numbers, street, suburb and LGA names] have read and understood this species impact statement. I understand the implications of the recommendations made in the statement and accept that they may be placed as conditions of consent or concurrence for the proposal".

2. CONTEXTUAL INFORMATION

2.1 Description of proposal, subject site and study area

A species impact statement must include a full description of the action proposed, including its nature, extent, location, timing and layout (Section 110 (1))

2.1.1 Description of the proposal

A full description of the action includes a description of all associated actions, including, but not restricted to: - location of all lots / building envelopes, installation and maintenance of any proposed buildings / dwellings and associated structures, the proposed number and size of such lots, buildings / dwellings and associated structures, location of any associated facilities (including roads, amenities and other services), fire protection zones, access and egress routes, changes in surface water flows, impacts of noise disturbance and pollution, and any increases in people and road traffic. Actions that occur both on and off the subject land as a result of the proposal must be assessed; including actions conducted during any construction phase and any proposed action post-construction (e.g. proposed actions within a management plan).

2.1.2 Definition of SIS study area

The SIS study area must be defined. The study area will generally be larger than the development site as it includes any adjacent areas that will be directly or indirectly affected by the proposal. In defining the study area consideration shall be given to possible indirect effects of the proposed action on the area surrounding the subject site, for example habitat fragmentation, vegetation corridors, altered hydrology regimes, soil erosion, pollution, and increased human presence or associated impacts. These may include adjacent parcels of land containing suitable habitat for threatened species. It is therefore important to recognise that these parcels may need to be investigated along with the development site. The location, size and dimensions of the study area shall be provided.

The study area should be established before the list of likely impacted threatened species, populations, ecological communities (including their habitat) is determined so species etc. that are less obviously affected are also included. The study area must be clearly defined, marked on a geo-referenced map / aerial photograph (or equivalent), clearly showing the development site boundary and any additional areas facing indirect impact, and included in the final report.

Direct impacts are those that directly affect individuals or their habitat. Examples of direct impacts include:

- poisoning or removal of the organism itself
- removal of habitat
- clearing of native vegetation / habitat.

If the proposal involves the clearing of vegetation and/or removal / damage to habitat the environmental assessment must clearly articulate the size of this impact, and where applicable delineate this on the basis of vegetation / habitat type.

Indirect impacts occur when project-related activities affect species, populations or ecological communities in a manner other than direct loss. Examples of indirect impacts include (but not limited to):

- sediment, pollutant or nutrient runoff into adjacent vegetation
- habitat fragmentation or isolation
- implementation of asset protection zones (*though these may also represent direct impact)
- loss of genetic diversity of threatened species, populations or communities
- altered pollination syndromes that may adversely affect seed set
- soil erosion
- altered hydrology regimes (including downstream impacts)
- changes to the saline / freshwater balance in marine environments
- exposure to heat or predators, or loss of shade
- inhibition of nitrogen fixation
- weed invasion and feral animal incursion
- introduction and spread of pathogens, such as Dieback fungus (*Phytophthora*) and Myrtle Rust (*Uredo rangelii*)
- noise
- dust
- light pollution (i.e. increasing skyglow from uncontrolled urban uplight)
- fire (such as changes to intensity and frequency)
- fertilizer drift
- increased human activity (including litter) within or directly adjacent to sensitive habitat areas.

Indirect impacts should not be just limited to the terrestrial habitats. In stances where a development site adjoins marine, estuarine and/or riparian / riverine environs / habitat, impacts on these must be considered.

Note: Indirect impacts may lead to direct loss, and as such must be adequately quantified and assessed. Both impacts within the proposed development footprint and on adjacent / surrounding lands must be taken into account, and where appropriate adequately considered and addressed.

2.1.3 Description of SIS study area

The description of the study area must include (but not limited to):

- The vegetation communities and habitat types, including identification of the classification system used in the SIS. Details of the methodology adopted to delineate vegetation communities on site (e.g. random stratified sampling). Full floristic description of all vegetation communities present (including disturbed and undisturbed). A listing of the amount (in hectares) of each vegetation community in the study area. A geo-referenced map / aerial photograph (or equivalent) showing the location of the vegetation communities. A full floristic list in tabular format of all taxa (both native and exotic) recorded on the subject site, indicating which communities they occur in, their cover / abundance and frequency, conservation (including taxa of conservation significance) and comparisons to previous vegetation studies / mapping (if applicable);
- An examination of previous land uses and events, and the effect of these land uses and events on the study area. Examples of such land uses and events are clearing, timber felling, draining, recreational use and agricultural activities (including grazing);
- An examination of the fire history, or at least the time since the last fire, for the subject site is to be provided. Ideally, information on the frequency, season and intensity of fire events on the subject site will be provided. To adequately address this requirement, it may be necessary to consider fire events in the surrounding landscape;
- The local government land zoning and any proposed rezoning, and an examination of the degree of protection that current zoning and any proposed rezoning provides or will provide to native vegetation and threatened species, populations and ecological communities on the subject site and in the study area and the locality;
- The land tenure and any proposed changes (e.g. acquisition by OEH as a nature reserve, national park, regional park etc.), and an examination of the degree of protection that current land tenures and any proposed land tenures provides or will provide to native vegetation and threatened species in the study area;
- State Environmental Planning Policies (e.g. SEPP 14 Coastal Wetlands, SEPP 44 Koala Habitat Protection, SEPP 71 Coastal Protection) and an examination of the degree of protection these policies provide to native vegetation and threatened species on the subject site and in the study area; and
- Relevant Local Government planning instruments, including Local Environmental Plans and Development Control Plans, such as the 'Lake Macquarie Development Control Plan 2014'.

2.2 Provision of relevant plans and maps

A plan of the subject area, including the scale of the plan should be provided. An aerial photograph (preferably colour) of the locality (or reproduction of such a photograph) shall be provided, if possible. This aerial photograph should clearly show the subject site and the scale of the photograph. It should be geo-referenced and show the date of the photograph.

A geo-referenced topographic map or equivalent of the subject site and immediate surrounds at an appropriate scale should be provided. This map should detail the location of the proposal and location of works on site (including areas of indirect impact). Additionally, to provide an overview of the natural landscape in the general locality, the map should show or be overlain with details of vegetated (i.e. woody [e.g. forests, woodland, shrubland and heath] and non-woody native vegetation [e.g. grassland, sedgeland and saltmarsh]) vs. cleared areas, as well as indicating the current activities/usage of this land, such as rural, agricultural, industrial and residential. OEH expects a separate map will be provided to indicate what specific vegetation communities are on subject site (as detailed above in Section 2.1.3).

A map of the locality, showing any locally significant areas for threatened species such as parks and reserves, and areas of high human activity such as townships, regional centres and major roads will also be provided. The location, size and dimensions of study area shall be provided.

Where any biodiversity offsets are proposed, the proponent must provide OEH with a proper survey plan, prepared by a registered surveyor that clearly shows the location and boundaries of any offset land. A printed

copy of each survey plan must be provided to OEH at A1 or A0 scale. The survey plan must be of a form that is acceptable to OEH. Electronic copies should also be provided.

2.3 Land tenure information

Information about the land tenure across the study area. Any limitations to sampling across the study area (e.g. denied access to private land) shall be noted.

3 INITIAL ASSESSMENT

A general description of the threatened species or populations known or likely to be present in the area that is the subject of the action and in any area that is likely to be affected by the action (Section 110 (2)(a)).

3.1 Identifying subject species

3.1.1 Assessment of available information

In determining these species ('the subject species'), consideration shall be given to the habitat types present within the study area, recent and historic records of threatened species or populations in the locality and the known distribution of threatened species.

Databases such as OEH's *Atlas of NSW Wildlife* (www.bionet.nsw.gov.au/), *BioBanking Credit Calculator* (www.environment.nsw.gov.au/biobanking/calculator.htm), *Atlas of Living Australia* (www.ala.org.au/), *Australian Museum* (http://ozcam.org.au/), *Birdlife Australia* (http://birdsaustralia.ala.org.au/BDRS/home.htm), and the *Royal Botanic Gardens* (http://plantnet.rbgsyd.nsw.gov.au/) should be consulted to assist in compiling the list. It should be noted that if the OEH Wildlife Atlas is the only database that is referred to, due to data exchange agreements, the data provided by OEH will only include that for which OEH is a custodian. In many cases, this may only be a small subset of the data available. Other databases must also be consulted to create a comprehensive list of subject species.

The following species shall be considered for inclusion in the list of subject species, as they have either been recorded in the general area, are within the species' known geographic limits or their broad habitat preferences may be present on site:

Threatened Species
* indicates species that are listed on the *Environment Protection and Biodiversity Conservation Act 1999.*

Flora (6 taxa):

For targeted surveys please note the following known flowering / fruiting times for each species to time surveys appropriately. Surveying at these times is required for species that are not readily detectable (and/or are cryptic), where flowers and/or fruits are necessary for their positive identification. If targeted flora surveys for these species are conducted outside a species known phenology then justification must be provided as to why; if this is not provided or considered inappropriate, then all such species will be considered to be present on all available habitat and in viable numbers, and as such will require suitable biodiversity offsets or their habitat avoided. For species which do not require flowers / fruits for positive identification (e.g. large trees / shrubs), then survey as appropriate (though appropriate justification on methods used is still required).

Targeted flora surveys must also adequately sample / cover all suitable habitat on the study area, and utilise suitable detection techniques such as belt transects (at appropriate widths to spot cryptic species) or random meanders (that sufficiently cover all known / potential habitat areas [i.e. not just the tracks or readily accessible areas]). If targeted flora surveys are poorly conducted and/or surveyed then appropriate justification must be provided as to why; if this is not provided or considered inappropriate, then all such

affected species will be considered to be present on all available habitat and in viable numbers, and as such will require suitable biodiversity offsets or their habitat avoided.

Thick-lipped Spider Orchid (*Caladenia tessellata*) – is a perennial ground orchid that retreats in the summer to an underground tuber. Plants generally produce a single, sparsely-hairy linear leaf in autumn from the base of which an erect scape may be produced. The flowers have five long petals and sepals around a central labellum. The petals, sepals and labellum are cream coloured with reddish stripes. Plants generally flower in September and October (Harden, 2002);
Epacris purpurascens* var. *purpurascens – is a shrub from wetlands that grows to 1.8 m tall and has ovate to heart-shaped leaves which have a pungent point. Plants have been recorded flowering mainly between July and September (Harden, 2002). Leaf size and capsule length are required to tell it from the very similar *E. pulchella*. The other variety, *Epacris purpurascens* var. *onosmiflora*, is not recorded from the region and the two varieties are distinguished by such characters as leaf tip length, leaf margin nature, corolla tube length and style length;
Maundia triglochinoides – is a perennial rhizotomous herb that grows in shallow freshwater lakes and streams. Plants have a rhizome from which narrowly-triangular, partially emergent spongy & inflated leaves arise. Flowers are produced in the warmer months in a cylindrical cluster at the end of the often-emergent inflorescence (Harden, 2002);
Biconvex Paperbark (*Melaleuca biconvexa*) - flowering occurs over just 3 to 4 weeks in September and October (OEH – Threatened species profile database, accessed February 2016), though Harden (2002) notes generally summer. This species is identifiable by vegetative characters at any time of year;
Tranquility Mintbush (*Prostanthera askania*) – is a strongly-aromatic shrub to 1 m high with opposite leaves with deeply toothed margins and purple flowers produced in terminal clusters in Spring (Harden, 2002); and
Magenta Lilly Pilly (*Syzygium paniculatum*)* - flowers December to January / March (Harden 2002, Benson & McDougall 1998), though mature fruits are required to positively identify this species, which mature in May (Payne 1997).

Fauna

For Fauna species please be aware of: (i) habitat preferences and known distribution for each of the species as an indication as to whether they may occur in the study area, and (ii) the best times of year these species may be detected if subject to surveys. If animals are captured with an uncertain taxonomy, species should be forwarded to the Australian Museum by a suitably qualified scientific licence holder.

Amphibians (7 species):
- Wallum Froglet *Crinia tinula*
- Giant Burrowing Frog *Heleioporus australiacus*
- Green-thighed Frog *Litoria brevipalmata*
- Green and Golden Bell Frog *Litoria aurea*
- Green-thighed *Frog Litoria brevipalmata*
- Stuttering Frog *Mixophyes balbus*
- Giant Barred Frog *Mixophyes iteratus*

Reptiles (3 species):
- Stephens banded Snake *Hoplocephalus stephensii*
- Pale-headed Snake *Hoplocephalus bitirquatus*
- Rosenberg's Goanna *Varanus rosenbergi*

Birds (26 taxa):
- Regent Honeyeater *Anthochaera phrygia**
- Bush Stone-curlew *Burhinus grallarius*
- Gang-gang Cockatoo *Callocephalon fimbriatum*
- Glossy Black Cockatoo *Calyptorhynchus lathami*
- Speckled Warbler *Chthonicola sagittata*
- Spotted Harrier *Circus assimilis*

Varied Sittella *Daphoenositta chrysoptera*
Black-necked Stork *Ephippiorhynchus asiaticus*
Black Falcon *Falco niger*
Little Lorikeet *Glossopsitta pusilla*
Painted Honeyeater *Grantiella picta*
Little Eagle *Hieraaetus morphnoides*
Black Bittern *Ixobrychus flavicollis*
Swift Parrot *Lathamus discolor**
Square-tailed Kite *Lophoictinia isura*
Barking Owl *Ninox connivens*
Powerful Owl *Ninox strenua*
Eastern Osprey *Pandion cristatus*
Scarlet Robin *Petroica boodang*
Flame Robin *Petroica phoenicea*
Grey-crowned Babbler *Pomatostomus temporalis temporalis*
Wampoo Fruit-Dove *Ptilinopus magnificus*
Superb Fruit-Dove *Ptilinopus superbus*
Diamond Firetail *Stagonopleura guttata*
Masked Owl *Tyto novaehollandiae*
Sooty Owl *Tyto tenebricosa*

Mammals (17 species):

Eastern Pygmy-possum *Cercartetus nanus*
Spotted-tailed Quoll *Dasyurus maculatus**
Eastern False Pipistrelle *Falsistrellus tasmaniensis*
Southern Brown Bandicoot *Isoodon obesulus obesulus*
Golden-tipped Bat *Kerivoula papuensis*
Little Bentwing-bat *Miniopterus australis*
Eastern Bent-wing Bat *Miniopterus schreibersii* subsp. *oceanensis*
Eastern Freetail bat *Mormopterus norfolkensis*
Large-footed Myotis *Myotis adversus*
Yellow-bellied Glider *Petaurus australis*
Squirrel Glider *Petaurus norfolcensis*
Koala *Phascolarctos cinereus*
Long-nosed Potoroo *Potorous tridactylus*
Eastern Chestnut Mouse *Pseudomys gracilicaudatus*
Grey-headed Flying-fox *Pteropus poliocephalus**
Yellow-bellied Sheath-tailed Bat *Saccolaimus flaviventris*
Greater Broad-nosed Bat *Scoteanax rueppellii*

Endangered ecological communities (6)

- *Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*
- *Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions*
- *River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*
- *Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*
- *Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*
- *Sydney Freshwater Wetlands in the Sydney Basin Bioregion.*

The above lists are not necessarily exhaustive. The applicant must carry out their own process of determining the subject species. This process should incorporate consideration of:

- the vegetation communities present within the study area

- the presence, quantity, quality and degree of fragmentation of likely habitat for individual threatened species
- recent (within the last ten years) records of threatened species, populations and ecological communities in the locality
- the known distribution of threatened species, populations and ecological communities
- the known and predicted use of habitat for all potential species.

OEH's *Atlas of NSW Wildlife*, *Australian Museum* and *Royal Botanic Gardens* databases, the *Birds Australia* and *NSW Bird Atlas* databases (for birds) and other relevant databases should be used to assist in compiling or assessing the list. The Data Licensing Officer at OEH's Head Office should be contacted on 9585 6684 to obtain information on the Atlas database.

Threatened species, populations and ecological communities on the above list may be excluded from further consideration as subject species only if a fully documented justification, robust to external examination, is provided. This documentation must address, as a minimum, the criteria for determining subject species that are listed above. In particular, threatened species that are cryptic, mobile or little surveyed (or possess combinations of these parameters (e.g. bats)), and for which the study area provides suitable habitat and falls within the species' range, must not be excluded solely on the basis of a lack of records in the locality. Furthermore, threatened species that occur in a range of habitats must not be excluded on the basis that their core habitat is not present in the study area or locality.

The proponent should be aware that additional species, populations, and ecological communities could be added to the schedules of the TSC Act between the issue of these requirements and the granting of consent. If this occurs, these additional matters will need to be addressed in the SIS and considered by the consent, determining, or concurrence authority.

Preliminary Listed Species

OEH draws your attention to species that may have preliminary listing under the TSC Act. They may be found on the website of the NSW Scientific Committee at www.environment.nsw.gov.au/committee/ListOfScientificCommitteeDeterminations.htm. Any preliminary-listed may receive final determination under the Act during your SIS process and hence you would need to consider them.

Any 'final determination' to list a species, population or ecological community as 'critically endangered' or 'endangered' made after lodgement of a development application or activity proposal needs to be included in the consideration of impacts and the application of the assessment of significance. Vulnerable species listed after lodgement are not subject to impact assessment as long as the application is determined within 12 months of lodgement.

4 SURVEY

4.1 Requirement to survey

A fauna and flora survey must be conducted in the study area. Targeted surveys should be conducted for all subject species determined in accordance with Section 3.1. Recent (less than 5 years old) surveys and assessments may be used to assist in addressing this requirement. However, previous surveys will not be considered to have addressed this requirement if they have:

- been undertaken in seasons, weather conditions or following extensive disturbance events when the target subject species are unlikely to be detected or present (e.g. outside known flowering / fruiting periods, adverse drought conditions, flooding, bushfire [though some species are 'fire obligates' requiring fire to germinate], slashing and overgrazing etc.); or

- utilised methodologies, survey sampling intensities, timeframes or baits that are not the most appropriate ones for detecting the target subject species unless these differences can be clearly demonstrated to be likely to have had an insignificant impact upon the outcomes of the surveys.

Surveys must be undertaken by appropriately experienced and qualified persons. A recognised expert, from institutions such as the Australian Museum (Sydney), the National Herbarium of NSW at the Royal Botanic Gardens (Sydney) or the Queensland Herbarium (Brisbane), or who is otherwise considered acceptable by OEH, must be used to determine or confirm the identification of species that are unknown or which have been only provisionally identified.

Survey methods adopted must be those considered by experienced wildlife surveyors to be those most likely to detect the targeted subject species (more than one survey method must be utilized for those subject species for which complementary methods have the potential to result in a significant increase in detection). Survey effort (including intensity, repetition and coverage) must be at a level that can be reasonably expected to detect the subject species if present in the study area. Surveys must be undertaken at the time of year when the subject species are most likely to be detected (e.g. targeted threatened flora should be carried out when a species is flowering and/or fruiting, as these features are typically required to positively identify species) and, where possible, in appropriate weather conditions. OEH expects the weather conditions (e.g. minimum ambient air temperature, maximum ambient air temperature, amount of precipitation that occurs each 24 hour period, details about wind speed and direction and the amount of cloud cover) and the phase of the moon to be recorded for each day of survey (including dates) to be documented and included in the report.

Survey procedures and assessment of results should be consistent with those procedures and assessment approaches contained within the following OEH publications:

- '*Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities*' (DEC – November 2004)'. (*Note: Section 6.1 *Assessment of Significance* has now been amended by DECC 2007b)
- '*Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna – Amphibians* (DECC – April 2009)'
- '*Threatened Species Assessment Guidelines: The Assessment of Significance*' (DECC – August 2007b).

*Note that OEH has recently produced new survey guidelines to cover Amphibians (frogs), which replaces the amphibian section in the DEC (2004) guidelines. However, the survey requirements for all other species (flora and fauna) are still found in the DEC (2004) guidelines.

The above documents can be located on OEH's website under the 'Threatened species survey and assessment guidelines' at:

- www.environment.nsw.gov.au/threatenedspecies/surveyassessmentgdlns.htm

If a proposed survey methodology is likely to vary significantly from widely accepted methods, the proponent should discuss the proposed methodology with OEH prior to undertaking the SIS, to determine whether OEH considers that it is appropriate.

In addition to the above guidelines, OEH has recently posted new information on OEH website to ensure appropriate surveys are completed, with particular reference to fauna surveying. Below is a summary of this information as well as other clarifying points, often relating to vegetation survey. This updated information can be accessed from:

- www.environment.nsw.gov.au/threatenedspecies/surveymethodsfauna.htm

False absences and imperfect detection

While the presence of a target species can often be confirmed at a site relatively easily, it is generally impossible to confirm a species is absent. Unless a species has a 100% chance of being detected on a single

visit (i.e. it has a probability detection of 1) non-detection does not necessarily mean the species is absent (MacKenzie *et al.* 2002). Very few species are so conspicuous that they are always detected in each survey (MacKenzie *et al.* 2002).

A species' detectability is influenced by several factors (Tyre *et al.* 2003). Such factors include:

- the species in question – fauna species with large home ranges are especially likely to go undetected in an area, as at any given time they may be in another part of their range
- climatic conditions (e.g. temperature, rainfall)
- experience of the surveyor/s
- the survey methodology used.

An observed absence may be due to an observer failing to detect a species that is actually resident at the site, for example, a bird that was elsewhere in its home range at the time of the survey or failed to call during a point count (MacKenzie 2005). False absences have serious consequences for habitat modelling and monitoring studies as well as impact assessments. When fauna surveys are conducted for the purpose of impact assessment, false absences may result in inadequate conservation measures and an increased risk of local extinction (Wintle *et al.* 2005).

Hence, the SIS should be conservative when determining whether a species, population and/or community (including their habitat) are potentially present (i.e. precautionary approach).

Stratifying the site

When designing a field survey, firstly stratify the study area (i.e. divide the area into relatively homogenous units – often referred to as 'environmental sampling units' or 'stratification units'). Stratified sampling provides a logical, objective and efficient method of undertaking surveys and ensures that the full range of potential habitats and vegetation types will be systematically sampled and mapped. For the mapping of vegetation and delineation of habitat types, the study area / subject site should be initially stratified on biophysical attributes (e.g. landform, geology, elevation, slope, soil type, aspect, climate, rainfall etc.) that best delineate likely vegetation changes across the landscape. Vegetation structure or type (as per the OEH Biometric vegetation type or other acknowledged vegetation mapping / classification), condition and disturbance history may be used to better define the boundaries of stratification units.

Once the stratification units have been identified, they should be recorded on a survey map. Remote sensing such as aerial or satellite photograph interpretation coupled with ground truthing will help better refine and determine the spatial vegetation patterns and habitat types across a study area.

For further information on stratification and the use of Biometric tool (BioBanking Credit Calculator) in this process (particularly for fauna) refer to the new information posted on OEH website, as detailed above.

Visiting the site

Conduct a preliminary site visit to refine the initial stratification units, determine the broad vegetation types (e.g. if using OEH Biometric determine the CMA vegetation types) present at the site, assess the vegetation condition and conduct a broad habitat assessment to help delineate specific features suitable for sampling.

Taking a copy of OEH's Biometric Vegetation Types Database (www.environment.nsw.gov.au/biobanking/VegTypeDatabase.htm) for the relevant former Catchment Management Authority (CMA) or equivalent (e.g. existing vegetation mapping) into the field during the preliminary site visit, may be useful in determining the likely vegetation types present. However, for some CMAs this should only be used as a guide as some vegetation types / communities have not been captured or delineated in the NSW Vegetation Types Database.

Survey Design

Once the site has been stratified, an adequate survey design (e.g. stratified random sampling for vegetation / flora) should be developed which adequately samples all stratification units and habitat types. Vegetation survey sites should be selected randomly and be based on the variation inherent in the stratification, while fauna sites are likely to be selected on the basis of vegetation change and specific habitat types present (e.g. hollow bearing trees, feed trees, rock outcrop, presence of water etc.). Additional targeted surveying will be required for threatened species that are dependent on specific vegetation types and/or habitats or require specific sampling because of seasonality (e.g. flowering season for some plants, warmer months for fauna etc.).

To sample vegetation, for example, a standard plot should be adopted to ensure the structural and floristic character of all vegetation types on site is adequately captured (e.g. 0.04 ha [20m × 20m] quadrat).

Targeted Surveys - Flora

For targeted flora surveys please note the known flowering / fruiting times for each species to time surveys appropriately (as listed above for potential 'subject species'). Surveying at known flowering times is required for all potential species that are not readily detectable (and/or are cryptic), where flowers and/or fruits are necessary for their positive identification. If targeted flora surveys for potential species are conducted outside a species known phenology then justification must be provided as to why; if this is not provided or considered inappropriate, then all such species will be considered to be present on all available habitat and in viable numbers, and as such will require suitable biodiversity offsets or their habitat avoided. For species which do not require flowers / fruits for positive identification (e.g. large trees / shrubs), then survey as appropriate (though appropriate justification on methods used is still required).

Targeted flora surveys must also adequately sample / cover all suitable habitat on the study area, and utilise suitable detection techniques such as belt transects (at appropriate widths to spot cryptic species) or random meanders (that sufficiently cover all known / potential habitat areas [i.e. not just the tracks or readily accessible areas]). If targeted flora surveys are poorly conducted and/or surveyed then appropriate justification must be provided as to why; if this is not provided or considered inappropriate, then all such affected species will be considered to be present on all available habitat and in viable numbers, and as such will require suitable biodiversity offsets or their habitat avoided.

Targeted Surveys – Fauna

When undertaking targeted fauna surveys you must be aware of: (i) habitat preferences and known distribution for each of the species as an indication as to whether they may occur in the study area, (ii) the best times of year these species may be detected if subject to surveys, and (iii) suitable survey techniques to adequately detect a potential species. If targeted fauna surveys are poorly conducted, inappropriately surveyed and/or undertaken outside known detection periods, then appropriate justification must be provided as to why; if this is not provided or considered inappropriate, then all such affected species will be considered to be present on all available habitat and in viable numbers, and as such will require suitable biodiversity offsets or their habitat avoided.

If animals are captured with an uncertain taxonomy, species should be forwarded to the Australian Museum by a suitably qualified scientific licence holder.

Habitat assessment

Habitat assessment is recommended for all sites and should be used to supplement surveying and survey design. In instances where intensive or species specific surveys have not been carried out due to either timing or seasonality constraints, habitat assessment may be used as a surrogate for intensive surveys. However, in this instance threatened species should be assumed present if their habitat requirements are met. Ensure all impact assessments include a thorough habitat assessment.

Undertaking a habitat assessment of the study area will assist with predicting the occurrence of threatened species in the study area and will guide the location of targeted surveys. A comprehensive habitat assessment should be conducted across the whole site, identifying key habitat features for both flora and fauna.

You should be familiar with the habitat requirements of each threatened species identified as possibly occurring in the study area. This information can be obtained from OEH's recovery plans website (www.environment.nsw.gov.au/threatenedspecies/recoveryplans.htm), threatened species profiles and scientific literature. Threatened species profiles are available on OEH website:

- www.environment.nsw.gov.au/threatenedspecies/

The habitat assessment should include information on:

- landscape features in the study area (e.g. river banks, rocky outcrops, dry slopes, wetlands, undulating terrain)
- any other features that could provide habitat such as hollow-bearing trees or culverts
- the vegetation types present (such as OEH's Biometric vegetation types (www.environment.nsw.gov.au/biobanking/VegTypeDatabase.htm) and/or appropriate vegetation mapping).

It is important to record all areas of native and introduced vegetation, as even weeds can potentially provide habitat for threatened fauna. As part of the habitat assessment, you should look for:

- hollow-bearing trees, including dead stags;
- bush rock and rocky outcrops;
- natural burrows, such as those of the Hastings River Mouse;
- large trees with basal cavities;
- logs;
- wetlands, streams, rivers, dams and other water bodies;
- nests and roosts;
- wombat burrows;
- dens used by yellow-bellied gliders, squirrel gliders and brush-tailed phascogales;
- yellow-bellied glider and squirrel glider sap feed trees;
- distinctive scats (e.g. those of the spotted-tailed quoll or koala);
- latrine and den sites of the spotted-tailed quoll;
- Allocasuarina spp.;
- flying-fox camps;
- Microchiropteran bat tree roosts;
- Microchiropteran bat subterranean roosts (caves, culverts, tunnels and disused mineshafts);
- swift parrot and regent honeyeater feed or nest trees;
- winter-flowering eucalypts;
- mistletoes;
- permanent soaks and seepages; and
- areas that can act as corridors for plant or animal species.

Another important factor to consider is the connectivity value of the site. If the proposal site forms an important corridor in the area, the development is likely to have an effect on threatened species in the region.

A geo-referenced map / aerial photograph (or equivalent), of the study area detailing key habitat features, including the vegetation types, must be included in the report.

Flora / Vegetation Survey and Mapping

Typically a floristic quadrat / transect will be used for vegetation based surveying. This should record the vegetation structure and cover of all structural layers, all species present, including their cover and

abundance, and general location (e.g. Global Positioning System (GPS) co-ordinates etc.) and physiographic details (e.g. condition, position in landscape, soils etc.). These techniques are described in the OEH guidelines and are generally the accepted national (NVIS – National Vegetation Inventory System) standard (www.environment.gov.au/topics/science-and-research/databases-and-maps/national-vegetation-information-system). Each stratification unit must be adequately sampled.

All quadrats / transects should be adequately assessed to determine a suitable vegetation classification which accurately reflects the site. This may be done manually, or through the aid of appropriate statistical software / numerical analysis, such as cluster analysis and ordination analysis computer packages (e.g. PATN (Belbin 1989)). The latter will be dependent on how detailed the survey was, the size of the area sampled, the inherent diversity / complexity of vegetation on site and the amount of plot data collected. Details of the classification and how it was determined must be supplied in the report.

To complement and better refine the vegetation classification, ground truthing and aerial photograph or satellite imagery interpretation should be used. This will be used to generate the vegetation map and enable greater definition / delineation of vegetation communities present, and ensure a more accurate map. Ground-truthing and/or Aerial Photograph Interpretation (API) should be conducted at a level which captures all the obvious vegetation changes / communities on the subject site (particularly those that are noticeable at the ground-level) and ensure that all vegetation communities are adequately delineated on a geo-referenced map (the 'vegetation map'). Floristic quadrats / transects and any associated analysis will help define and describe the communities shown on the vegetation map. Recognition and delineation of native vegetation patterns on aerial photography may be based on combinations of:

- texture (crown size and shape)
- vegetation height and density
- vegetation and background tone and colour
- landuse pattern (non-woody areas).

Determining Biometric vegetation types

The classification of native vegetation in NSW follows the system described by Dr David Keith in '*Ocean Shores to Desert Dunes: The Native Vegetation of New South Wales and the ACT*' (Keith 2004). This classification scheme divides native vegetation into 17 broad vegetation formations. Each formation consists of a number of vegetation classes. There are 99 vegetation classes.

OEH has developed a 'NSW Vegetation Types Database' for use with the BioMetric tool, which is designed to assist in assessing biodiversity values when preparing property vegetation plans under the *Native Vegetation Act 2003* and BioBanking agreements under the TSC Act. OEH has provided a spreadsheet containing a definition of these vegetation types on a catchment management authority basis, which is located at:

- www.environment.nsw.gov.au/biobanking/tools.htm

If you are proposing to conduct a biodiversity assessment using BioBanking Assessment Methodology under Biodiversity Banking and Offsets Scheme, as outlined in the 'BioBanking Assessment Methodology 2014' (OEH 2014), to determine the offset requirements of the proposal, then it is advisable and advantageous that during the survey component of the SIS that you collect the relevant data in the appropriate format for the Biometric tool (i.e. BioBanking Credit Calculator) (*Note: this may reduce duplication or further surveying at a later date). This process can provide details of the required ecosystem and species (threatened) credits that need to be retired to offset the impacts of the development. Under this scenario all vegetation types in the study area should be identified and matched to an OEH BioMetric vegetation type.

For details on the use of Biometric, the 'BioBanking Assessment Methodology 2014' (OEH 2014) and BioBanking in general refer to the following OEH website (Note: - the new information posted on the OEH website, as detailed above, includes details on site selection, survey intensity and methodology, and vegetation condition measurements):

- www.environment.nsw.gov.au/biobanking/

If a BioBanking assessment is conducted using the Credit Calculator then OEH requests that the proponent provide an explanation of how the local vegetation communities were assigned to Biometric vegetation types, copies of BioBanking Credit Reports, copies of all field data sheets, an explanation of the underlying assumptions used at every step of the BioBanking Credit Calculator (see Section 4.5 below), and the submission of the credit calculator files via the OEH portal (as described in **Appendix 2**).

4.2 Documentation of survey effort and technique

4.2.1 Description of survey techniques and survey sites

Survey technique(s) must be described and a reference given, where available, outlining the survey technique employed. Specific subject species targeted by each survey technique should be listed.

Survey site(s) and stratification units must be identified on a geo-referenced map / aerial photograph (or equivalent), with a clear legend, at the same scale as previous maps where possible. The size, orientation and dimensions of a quadrat or a length of transect should be clearly noted for each type of survey technique undertaken. Full Australian Map Grid (AMG) grid (Geocentric Datum of Australia (GDA) compliant) references for the survey site(s) should be noted.

4.2.2 Documenting survey effort

The time invested in each survey technique applied shall be summarised in the SIS e.g. - number of person hours per transect, duration of call playback, number of nights traps set. It is not sufficient to aggregate all time spent on all survey techniques. Effort must be expressed for each separate survey technique and each separate vegetation community. Environmental conditions during the survey should be noted at the commencement of each survey technique.

Personnel details including name of all surveyor(s) and contact phone number should be provided. The person who identified records (e.g. Anabat, hair tubes, motion-sensor camera, and scat analysis) should also be identified.

4.3 Survey results

4.3.1 Subject species survey results

The report should provide a full list of all flora and fauna recorded in the study area / subject site.

Subject species recorded in the study area shall be identified, and the vegetation community in which they were recorded noted. Information concerning all records of threatened species made during the survey is to be provided in an appendix to the SIS. This information is to be in a form consistent with *Atlas of NSW Wildlife* data recording cards and include information for all fields listed on these cards.

The limitations of survey techniques employed (including survey intensity, detectability of species, seasonality, weather conditions and adverse disturbance conditions) must be considered and discussed with respect to the results of the survey, and additional subject species considered to potentially occur in the study area identified. This assessment must be robust to external evaluation.

4.3.2 General species survey results

The SIS must provide details of all the vegetation communities (including disturbed and undisturbed / modified), habitat types, and all fauna and flora recorded on the subject site and study area in general.

A full list of the protected fauna and native plant species (as defined by the *National Parks and Wildlife Act 1974*) found during the course of surveys must be included. Such information is indicative of the habitat

quality of the site. This list must indicate the significance of each species, whether the species is introduced, and the habitat in which each species was recorded.

4.4 Subject species habitat mapping

Areas identified as known or potential habitat in the study area are to be mapped on a geo-referenced map / aerial photograph (or equivalent) separately for each of the subject species. These maps should be at the same scale as previous maps where feasible, and are to include any point locality records of the relevant subject species recorded from the SIS survey in the study area. Note: Records obtained from the 'Atlas of NSW Wildlife' database can be used in determining likely habitat, but they are not to be schematically mapped in the SIS, as this is considered a breach of licence conditions for such records.

While in some circumstances the task of identifying potential habitat can be problematic, the SIS should provide the best expert estimate of the habitat of each threatened species, populations and ecological communities known or considered likely to occur in the study area. This is necessary in order to clearly support conclusions concerning the quantitative significance of habitat loss associated with the proposal. Information which can be used in preparing these maps includes records of threatened species in the local area, maps of vegetation communities and broad habitat types in the study area, information on the habitat requirements of threatened species and site-specific knowledge gained through field survey and inspection during preparation of the SIS.

4.5 General report structure

In summary, the report must include details on the following (but not be limited to):

- a description of the subject site, study area and its regional context; including a geo-referenced map / aerial photograph (or equivalent) indicating their location;
- details of the survey methodology and design adopted, including:
    - the number and location of traps (e.g. cage, Elliott, hair sampling tubes etc.), call playback sites, diurnal searches, random meanders, quadrats and transects,
    - the number of repetitions (Note: – you will need to provide a justification if this differs from the recommendations in these guidelines),
    - details of all floristic plots and/or transects,
    - details of the stratification,
    - identification of the classification system used (e.g. Specht *et. al.* (1974), Walker & Hopkins (1998) [Note: the classification must have regard to both structural and floristic composition elements]),
    - timing of surveying, climatic (weather) conditions and phases of the moon during survey,
    - details of how the vegetation classification for the site was developed, including details and associated products (e.g. dendrograms / two-way tables) of any analyses used, if applicable,
    - copies of any analyses used (e.g. PATN or other statistical files) and all field data sheets, and
    - geo-referenced maps / aerial photographs (or equivalent) showing the location of all survey points, quadrats and transects, and stratification units.
- detailed description of all vegetation communities / types (both undisturbed and disturbed) on the site and study area (it is preferable to link them to, OEH's Plant Community Types / Biometric vegetation types – in which case a step by step summary of how the site vegetation was matched with available Biometric vegetation types should also be included), including a geo-referenced map / aerial photograph (or equivalent) showing their location. The descriptions should include: - a general description, characteristic features (e.g. lacks a mid-storey, restricted to a particular geomorphic / edaphic feature etc.), their distribution and size (e.g. hectares), their vegetation structure (including cover), their condition, key diagnostic species, relationship to other communities, species richness and any significant species present (e.g. threatened species, Rare or Threatened Australian Plants (ROTAP: Briggs & Leigh 1996), regionally significant taxa);
- details of all habitat features / types should be included and mapped (where appropriate), such as frequency and location of stags, hollow bearing trees (including size), mature / old growth trees, culverts, rock shelters, rock outcrops, presence of feed tree / shrub / groundcover species (e.g. winter-

flowering eucalypts, *Acacia* and *Banksia* trees, *Casuarina / Allocasuarina* and areas of native grasses], crevices, caves, drainage lines, soaks etc.;

- if a BioBanking assessment is conducted for the development site and any offset sites then the proponent must provide:
  - copies of any BioBanking Credit Reports and BioBanking Agreement Credit Reports generated,
  - copies of all field data sheets,
  - copies of a checklist that includes the data and underlying assumptions used at every step of the BioBanking Credit Calculator, and
  - submission of the credit calculator files via the OEH portal (as outlined in **Appendix 2**).
- a list of all flora and fauna detected on the study area / subject site during the surveys, including threatened species. All threatened species, populations and ecological communities must be clearly marked on geo-referenced map / aerial photograph (or equivalent);
- details of how the proposal will impact (both direct and indirect) and affect known and potential threatened species, populations and ecological communities (including their habitat). This is likely to include a revised 5A assessment of significance;
- details of the habitat assessment;
- details of how the proposal may impact on corridors, connective links and fragmentation;
- details of how the proposal will impact (both directly and indirectly) on adjacent and/or nearby OEH conservation estate and/or if applicable, other internationally / nationally important areas, (e.g. Ramsar wetlands, wetlands listed in the Directory of Important Wetlands, SEPP14 mapped wetlands and Forestry flora reserves);
- details of any impacts on or relevance of other environmental policies and/or guidelines (as outlined in Section 2.1.3);
- details of mitigation and offset / compensatory habitat measures;
- details of any other approvals required under any other State and/or Federal legislation;
- names, qualifications and experience of all personnel involved in the field surveys, analysis of results and report writing;
- paper copies of any maps of proposed biodiversity offset areas at A0 or A1 scale that clearly show the location and boundaries of any proposed offset area. These maps must be prepared by a registered surveyor and be proper survey plans that are acceptable to local Councils;
- an assessment of how the project meets the principles of Ecologically Sustainable Development, as defined in section 6(2) of the *Protection of the Environment Administration Act 1991*;
- a discussion of the likely social and economic consequences of granting or of not granting concurrence; and
- any other information outlined elsewhere in these guidelines, such as background and comparisons to previous studies (e.g. vegetation mapping reports), mitigation and offset measures etc. that should be included in the report.

5 ASSESSMENT OF LIKELY IMPACTS ON THREATENED SPECIES AND POPULATIONS

Section 5 need only be addressed if threatened species or endangered populations are likely to be affected.

Assessment of impacts must include the assessment of indirect impacts and those of associated activities, including, but not restricted to: installation and maintenance of utilities, access and egress routes; and changes in surface water flows. These actions or impacts may occur on or off the subject land.

Assessment of impacts must also include an assessment of impacts from the provision of fire protection zones. If, as part of the development, there will be a requirement to provide fuel free and/or fuel reduced zones in retained bushland, the impacts of this on any threatened species and/or populations must be addressed as part of the impacts of the overall proposal. Proponents should also consider recommendations in '*Planning for Bushfire Protection*' (NSW Rural Fire Service 2006) and consider the use of perimeter roads as an option in providing fuel free zones and reducing impacts on retained bushland.

5.1 Assessment of species likely to be affected

An assessment of which threatened species or populations known or likely to be present in the area are likely to be affected by the action (*Section* 110(2)(b)).

This requirement is asking you to refine your list of subject species and populations (given the outcome of survey and analysis of likely impacts) in order to identify which threatened species or endangered populations may be affected and the nature of the impact.

The remaining requirements in this section need only be addressed for those species that are likely to be affected by the proposal.

5.2 Discussion of conservation status

For each species or population likely to be affected, details of its local, regional and State-wide conservation status, the key threatening processes generally affecting it, its habitat requirements and any recovery plan or threat abatement plan applying to it (*Section* 110 (2)(c)).

An assessment of whether those species or populations are adequately represented in conservation reserves (or other similar protected areas) in the region (*Section* 110 (2)(e)).

An assessment of whether any of those species or populations is at the limit of its known distribution (*Section* 110 (2)(e1)).

Assessment should include reference to the threatening processes that are generally accepted by the scientific community as affecting the species or population and are likely to be caused or exacerbated by the proposal. Assessment should also include reference to any approved or draft recovery plans which may be relevant to the proposal; including those prepared by other state Governments of the Commonwealth Government.

5.3 Discussion of local and regional abundance

An estimate of the local and regional abundance of those species or populations (Section 110 (2)(d)).

5.3.1 Discussion of other known local populations

A discussion of other known populations in the locality shall be provided, along with an assessment of their regional significance. The long-term security of other habitats shall be examined as part of this discussion. The relative significance of the subject site for threatened species or endangered population in the locality shall be discussed.

5.3.2 Discussion of habitat utilisation

An estimate of the numbers of individuals utilising the area and how these individuals use the area (e.g. residents, transients, adults, juveniles, nesting, foraging). This should include discussion of the significance of these individuals to the viability of the threatened species or endangered population in the locality.

5.3.3 Description of vegetation

The vegetation present within the study area and the area covered by each vegetation community should be mapped and described, as previously stated in Section 4.3.2.

5.4 Assessment of habitat

A full description of the type, location, size and condition of the habitat (including critical habitat) of those species and populations and details of the distribution and condition of similar habitats in the region (Section 110 (2)(f)).

5.4.1 Description of habitat values

Specific habitat features shall be described, such as frequency and location of stags, hollow bearing trees (including size), mature / old growth trees, culverts, rock shelters, rock outcrops, presence of feed tree / shrub / groundcover species (e.g. winter-flowering eucalypts, Acacia and Banksia trees, *Casuarina / Allocasuarina*, Mistletoes and areas of native grasses), crevices, caves, drainage lines, soaks etc.), and density of understorey vegetation / groundcover.

The condition of the habitat within the study area shall be discussed, including the prevalence of introduced species, species of weeds present and an estimate of the total weed cover as a percentage of each vegetation community, whether trampling or grazing is apparent, effects of erosion, prevalence of rubbish dumping, history of resource extraction or logging and proximity to roads, and assessment of the potential for native seed bank resilience in disturbed areas.

Details of the fire history of the subject site (e.g. frequency, time since last fire, intensity) and the source of fire history (e.g. observation, local records) shall be provided.

5.4.2 Extent of habitat removal

The location, nature and extent of habitat removal or modification (e.g. including impacts of Asset Protection Zones (APZs)) which may result from the proposed action including the cumulative loss and fragmentation (isolation) of habitat from the study area (including all Development Applications and those areas in the subject area already with development consent or identified for development) and the impacts of this on the viability of the threatened species or endangered population in the locality.

This shall include an assessment of the proportion of the habitat of the affected species to be affected by the proposal, in relation to the total extent of the habitat in the study area and subject site, and the impact of this on the viability of the affected species in the locality.

5.4.3 Consideration of corridors

Areas within the subject site which may act as local or regional corridors (or part thereof) for affected species must be identified and described. A geo-referenced map showing identified corridors must be provided, and the impact of the proposal on these areas shall be discussed. If relevant, this section should include consideration of *Key Habitats and Corridors for Forest Fauna* (NPWS Occasional Paper 32: Scotts 2003) and regional linkages, as identified within *Regional Conservation Assessment, Lower Hunter and Central Coast Region* (2004), or other appropriate studies (e.g. Council specific LES, LEP documents and structure plans).

5.4.4 Impacts on Threatened Species and/or Populations in OEH Estate

This section only needs to be addressed when threatened species and/or populations in OEH estate (e.g. National Parks, Nature Reserves) are likely to be either directly or indirectly impacted upon.

The SIS must assess the potential impacts on any threatened species and/or populations which may likely be directly or indirectly impacted upon that reside with OEH estate, including but not limited to fragmentation or loss of connective linkages, edge effects (e.g. increased boundary to area ratio), increased predation potential, weed invasion, loss or impacts on pollination vectors, changes to hydrology, nutrient increases, pollution, anthropogenic impacts (e.g. increased visitation, refuse) etc.

OEH notes the following conservation estate which contain threatened species in the vicinity (5 km radius) of the proposed development that may be affected or impacted upon either directly or indirectly (e.g. fragmentation or reduction of corridor links): -.Jilliby State Conservation Area, Palm Grove Nature Reserve, Tuggerah Nature Reserve, Tuggerah State Conservation Area, Wambina Nature Reserve and Wyrrabalong National Park.

5.5 Description of feasible alternatives

A description of any feasible alternatives to the action that are likely to be of lesser effect and the reasons justifying the carrying out of the action in the manner proposed, having regard to the biophysical, economic and social considerations and the principles of ecologically sustainable development (Section 110(2)(h)).

Where a Statement of Environmental Effects (SEE), Environmental Impact Statement (EIS) or Review of Environmental Factors (REF) deals with these matters, the SIS may refer to the relevant section of the SEE, EIS or REF.

This section must include details of the condition and use of other parts of the subject area and why these can or cannot be considered as feasible alternatives.

6 ASSESSMENT OF LIKELY IMPACTS ON ECOLOGICAL COMMUNITIES (ENDANGERED AND CRITICALLY ENDANGERED)

Section 6 need only be addressed when ecological communities are likely to be affected.

Assessment of impacts must include the assessment of indirect impacts and those of associated activities, including, but not restricted to: installation and maintenance of utilities, access and egress routes; and changes in surface water flows. These actions or impacts may occur on or off the subject land.

Assessment of impacts must also include an assessment of impacts from the provision of fire protection zones. If, as part of the development, there will be a requirement to provide fuel free and/or fuel reduced zones in retained bushland, the impacts of this on any endangered and/or critically endangered ecological communities must be addressed as part of the impacts of the overall proposal. Proponents should also consider recommendations in 'Planning for Bushfire Protection' (NSW Rural Fire Service 2006) and consider the use of perimeter roads as an option in providing fuel free zones and reducing impacts on retained bushland.

6.1 Assessment of ecological communities (both endangered and critically endangered) likely to be affected

A general description of the ecological community present in the area that is the subject of the action and in any area that is likely to be affected by the action (Section 110(3)(a)).

This must include reference to the ecological community as described by the NSW Scientific Committee, including maps of the extent and condition of the community with particular reference to those parts of the community that may only be represented by soil stored seed with no above ground components of the community present.

6.2 Discussion of conservation status

For each ecological community present, details of its local, regional and State-wide conservation status, the key threatening processes generally affecting it, its habitat requirements and any recovery plan or any threat abatement plan applying to it (Section 110(3)(b)).

An assessment of whether those ecological communities are adequately represented in conservation reserves (or other similarly protected areas) in the region (Section 110(3)(b1)).

An assessment of whether any of those ecological communities is at the limits of its known distribution (Section 110(3)(b2)).

Assessment should include reference to the threatening processes that are generally accepted by the scientific community as affecting the endangered and/or critically endangered ecological community and are likely to be caused or exacerbated by the proposal. The assessment should also include reference to any approved or draft recovery plans which may be relevant to the proposal.

6.2.1 Significance within a local context

An assessment of the community on the subject site in relation to other sites in the study area and in the locality. The tenure and long term security of other localities shall be examined as part of this discussion.

The relative significance of the subject site for the endangered and/or critically endangered ecological community shall be discussed. The assessment of the community should be considered in terms of the following features including, the size of the remnant, the quality of the habitat and the level of disturbance on this site in comparison to other sites in the locality.

6.2.2 Discussion of corridor values

The potential of the proposal to increase fragmentation of the community and increase edge effects.

If corridors that allow connectivity between localities of endangered and/or critically endangered ecological communities are present within the subject site, the impact of the proposal on these areas shall also be discussed.

6.2.3 Discussion of regional significance

The significance of the locality for the community from a regional perspective shall be noted and discussed.

6.2.4 Impacts on Ecological Communities in OEH Estate

This section only needs to be addressed when endangered and/or critically endangered ecological communities in OEH estate are likely to be either directly or indirectly impacted upon.

The SIS must assess the potential impacts on any endangered and/or critically endangered ecological communities which may likely be directly or indirectly impacted upon that reside with OEH estate.

OEH notes a number of conservation estates which may contain ecological communities in the vicinity (5 km radius) as outlined in Section 5.4.4.

6.3 Assessment of habitat

A full description of the type, location, size and condition of the habitat of the ecological community and details of the distribution and condition of similar habitats in the region (Section 110 (3)(c)).

6.3.1 Description of disturbance history

If the site shows signs of disturbance, details should be provided of the site's disturbance history and an assessment should be made of the ability of the ecological community to recover to a pre-disturbance condition.

6.3.2 Extent of habitat removal

The location, nature and extent of habitat removal or modification which may result from the proposed action including the cumulative loss of habitat from the study area (including all proposed DAs and those areas in the subject area already with development consent or identified for development) and the impacts of this on the viability of the endangered and/or critically endangered ecological community in the locality.

This shall include an assessment of the proportion of the ecological community to be affected by the proposal, in relation to the total extent of the ecological community, and the impact of this on the viability of the ecological community in the locality.

6.4 Description of feasible alternatives

A description of any feasible alternatives to the action that are likely to be of lesser effect and the reasons justifying the carrying out of the action in the manner proposed having regard to the biophysical, economic and social considerations and the principles of ecologically sustainable development (Section 110(3)(e)).

Where a Statement of Environmental Effects (SEE), Environmental Impact Statement (EIS) or Review of Environmental Factors (REF) deals with these matters, the SIS may refer to the relevant section of the SEE, EIS or REF.

In the discussion of feasible alternatives to the proposed development with regards to biophysical, economic and social considerations, and the principles of ecologically sustainable development, the SIS must also include details on the condition and use of other parts of the subject area and why these can or cannot be considered as feasible alternatives.

7 AMELIORATIVE MEASURES

7.1 Description of ameliorative measures

A full description and justification of the measures proposed to avoid or mitigate any adverse effect of the action on the species and populations and ecological community including a compilation (in a single section of the statement) of those measures (Section 110 (2)(i) and Section 110 (3)(f)).

7.1.1 Long-term management strategies

Consideration shall be given to developing long-term management strategies to protect areas within the study area which are of particular importance for the threatened species, endangered populations or endangered / critically endangered ecological communities likely to be affected. This may include proposals to restore, improve or provide long term protection for habitat on site where possible. Any such proposal is to be accompanied by a plan of management identifying the specific areas to be restored, improved or protected, the threatened species / ecological community values of those areas, and detailing the management actions to be implemented to maintain and protect those values, including corrective actions to be taken in the event that monitoring indicates that management does not achieve specified objectives.

7.1.2 Compensatory strategies

OEH notes that its 'offset provision' principles (**Appendix 1**) state that impacts must be avoided first by using prevention and mitigation measures (DECC 2007a). Where significant modification of the proposal to minimise impacts on threatened species, populations or endangered / critically endangered ecological communities is not possible then compensatory strategies should be considered. These should include offsite or local area proposals that contribute to long term conservation of affected threatened species, population or ecological communities. If on or off-site compensatory habitat is not considered appropriate, justification must be provided. OEH is of the opinion that where a proposal which involves the clearing of threatened

species habitat (i.e. native vegetation) that cannot be avoided or mitigated against, and then appropriate offsets which compensate for the clearing of the habitat must be provided. The proponent must provide proper survey plans of any biodiversity offsets with the SIS, as described in sections 2.2 and 4.5 above.

Compensatory benefits likely to result from such measures proposed for alternative sites are to be discussed and evaluated along with a discussion of mechanisms of how they might best occur.

The tenure of lands, land use and the future use of lands proposed to support compensatory habitat must be considered.

Justification for any area(s) proposed as compensatory habitat / offsets is to include an assessment of the threatened species / biodiversity values impacted on by the proposed works (i.e. those of the subject site) and a comparison of whether the proposed offset area(s) provides equivalent or greater values – 'improve or maintain important biodiversity values'.

To determine the adequate biodiversity offset required to compensate the loss of threatened species, populations, ecological communities and/or their habitat (e.g. vegetation communities) either one of the following methodologies are to be used:

- OEH's 'offsetting principles', as outlined on OEH's website: *Principles for the use of biodiversity offsets in NSW* (OEH's website - www.environment.nsw.gov.au/biodivoffsets/index.htm) can be used as general guide for offsetting and compensatory habitat requirements
- a biodiversity assessment using BioBanking Assessment Methodology under Biodiversity Banking and Offsets Scheme, as outlined in the '*BioBanking Assessment Methodology 2014*' (OEH 2014). This would provide details of the required ecosystem and species (threatened) credits that need to be retired to offset the impacts of the development.

Although the '*BioBanking Assessment Methodology (BBAM) 2014*' (OEH 2014) under the Biodiversity Banking and Offsets Scheme represents an alternative pathway to that of the SIS for Part 4 matter, OEH is of the opinion that a biodiversity assessment using process provides a transparent framework and a quantitative alternative to the principles-based approach (i.e. 'offset provision' principles as outlined in the biodiversity accreditation guideline - DECC 2011 – Appendix 1). OEH acknowledges that in this instance BBAM is a voluntary process and not a requirement under the SIS CER's, but believes it provides a valuable insight and quantitative appraisal into what would be an acceptable offset package to compensate the likely impacts of the development. OEH notes that under the *Principles for the use of biodiversity offsets in NSW* – Principle 9 states that '*offsets must be quantifiable – the impacts and benefits must be reliably estimated*', in that offsets should be based on quantitative assessment of the loss in biodiversity from the clearing or other development and the gain in biodiversity from the offset. OEH is of the opinion that the BBAM represents the only currently recognised quantitative methodology that ensures offsets are quantifiable.

Note: On 1 October 2014, a new version of the BioBanking Credit Calculator (BioBanking Assessment Methodology 2014 [OEH 2014]) has become the compulsory version of the tool to use for BioBanking assessments (see www.environment.nsw.gov.au/biobanking/calculator.htm for more details). The credit calculator is now web-based and no longer produces 'xml' files. Instead a copy of the assessment can be sent electronically to OEH by following the steps outlined in **Appendix 2**. The requirement of submitting background files for OEH to use in checking the BioBanking assessment still stands and is also explained in **Appendix 2**.

The following principles are relevant to areas without an existing biodiversity offsets program. Offsets will require the proponent to consider adequate conservation in perpetuity, appropriate management regimes (including other habitat enhancement or mitigation measures) and financial security with respect to ongoing management. OEH would typically consider suitable measures to ensure conservation in perpetuity, such as:

- the establishment of BioBanking sites with BioBanking agreements under the TSC Act
- the retirement of BioBanking credits (where appropriate credits are available)
- the dedication of land as a public reserve under the NPW Act
- a Conservation Agreement in-perpetuity registered on title under s69A-KA of the NPW Act

- a Trust Agreement in-perpetuity registered on title under the Nature Conservation Trust Act 2001
- a Planning Agreement under s 93F (soon to be s116T) of the EP&A Act.

Note:

- OEH preferred method of securing an offset is under the BioBanking provisions of the *Threatened Species Conservation Act 1995* (i.e. a registered BioBanking Agreement site).
- OEH no longer supports public positive covenant under s88E of the *Conveyancing Act 1919* as an appropriate conservation mechanism to secure and/or manage biodiversity offsets.
- Although OEH supports the use of conservation agreements under the NPW Act as one of the acceptable offsetting mechanisms, we are reviewing this approach and it is advisable that if you are considering this mechanism you contact OEH's Conservation Partners Program (ph: 9995 6761) about its applicability.

The principles do not apply where there is legislation defining requirements for biodiversity offsets (e.g. under the *Native Vegetation Act 2003*).

To appropriately manage any proposed compensatory offsets, any retained habitat enhancement features within the development footprint and/or impact mitigation measures (including proposed rehabilitation and/or monitoring programs), OEH would require that an appropriate Management Plan (such as vegetation or habitat) be developed as a key amelioration measure. These plans should be prepared prior to any potential approval of the development. Management Plans should clearly document how any retained vegetated areas or habitat features will be managed with respect to long-term conservation and viability, including clear details on how they will be funded. They should cover (where applicable), but not be limited to, the following issues:

- weed management (both control and suppression) and monitoring
- management of retained native vegetation and habitat (including buffer zones)
- feral animal control
- fire management (including asset protection zones [APZs])
- public access (including restriction of, increased traffic, and associated impacts, such as increased refuse and pets)
- size and management of buffer zones
- minimisation of edge effects and fragmentation
- stormwater control and changes to hydrology (including stormwater / runoff control and sediment / erosion control measures)
- management of specific habitat enhancement measures (e.g. hollow / habitat trees, animal fencing to facilitate movement, artificial hollows and nest boxes etc.)
- fauna displacement and if appropriate translocation (including any licence requirements)
- proposed surveys, such as pre-extraction baseline, pre-clearance and rehabilitation surveys
- details of long-term monitoring (including proposed timing)
- details of any rehabilitation program, including details of timing (including proposed staging details), rehabilitation measures (including details of proposed revegetation and species mix), and post-rehabilitation monitoring
- measures to ensure conservation in perpetuity (e.g. transfer to OEH [NPWS] estate, conservation agreements or covenants)
- funding details of long-term financial commitment to any proposed conservation measures, including any mechanisms to be implemented to achieve this.

7.1.3 Ongoing monitoring

Any proposed pre-construction flora, fauna or vegetation monitoring plans or on-going monitoring of the effectiveness of the mitigation measures shall be outlined in detail, including the objectives of the monitoring program, method of monitoring, reporting framework, duration and frequency. Generally, ameliorative strategies which have not previously been proved effective should be undertaken under experimental design conditions, appropriately monitored and appropriately analyzed. Data analysis could include an 'Analysis of

similarities' (ANOSIM) assessment of changes in foliage cover of plant species recorded in fixed quadrats or transects between sampling periods (Clarke 1993). Objectives of any monitoring plans are to include identifying any modifications needed to improve the effectiveness of ameliorative measures. These aspects should also be covered in any relevant management plans. Additionally a review of management plans should be undertaken at regular interviews (e.g. 5 years) to ensure adaptive management, where required, is undertaken.

8 ASSESSMENT OF SIGNIFICANCE OF LIKELY EFFECT OF PROPOSED ACTION

An 'Assessment of Significance' (s. 5A EP&A Act) is to be provided for each of the affected species (threatened species, populations or ecological communities) identified in the SIS, incorporating relevant information from sections 5.1 to 7 of the SIS. On the basis of these assessments a conclusion is to be provided concerning whether, based on more detailed assessment through the SIS process and consideration of alternatives and/or ameliorative measures proposed in the SIS, the proposal is still considered likely to have a significant effect on threatened species, populations or ecological communities or their habitats.

The threatened species 'Assessment of significance' should be consistent with those procedures and assessment approaches contained within OEH publication:

- *'Threatened Species Assessment Guidelines: The Assessment of Significance'* (DECC – August 2007b). This document is available from OEH's website: www.environment.nsw.gov.au/threatenedspecies/tsaguide.htm

9 ADDITIONAL INFORMATION

9.1 Qualifications and experience

A species impact statement must include details of the qualifications and experience in threatened species conservation of the person preparing the statement and of any other person who has conducted research or investigations relied on in preparing the statement (Section 110(4)).

You should have extensive experience in conducting field surveys and should be able to identify threatened species and their habitats relevant to the study area, as well as any similar species that may be confused with them. You should familiarise yourself with herbarium or museum specimens of any threatened species you are not already familiar with, before you conduct field surveys.

9.2 Other approvals required for the development or activity

A list of any approvals that must be obtained under any other Act or law before the action may be lawfully carried out, including details of the conditions of any existing approvals that are relevant to the species or population or ecological community (Sections 110(2)(j) and 110(3)(g)).

In providing a list of other approvals the following shall be included:

- Where a consent is required under Part 4 of the *Environmental Planning and Assessment Act 1979*, the name of the consent authority and the timing of the development application should be included; or
- Where an approval(s) is required under Part 5 of the *Environmental Planning and Assessment Act 1979*, the name of the determining authority or authorities, the basis for the approval and when these approvals are proposed to be obtained should be included; or
- Where an approval(s) is required under *Native Vegetation Act 2003*, the name of the determining authority or authorities, the basis for the approval and when these approvals are proposed to be obtained should be included.

Environment Protection and Biodiversity Conservation Act 1999

An action will require the approval of the Federal Minister for the Environment (in addition to any State or Local Government approval or determination) if that action will have, or is likely to have, a significant impact on a matter of national environmental significance. Threatened species and communities listed in the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) are considered to be a matter of national environmental significance.

Many of the species and ecological communities listed in the TSC Act are also listed in the Commonwealth EPBC Act. Further information regarding the operation of the EPBC Act (including Commonwealth -listed threatened species and communities) may be obtained from the Australian Government Department of the Environment (DOE) website www.environment.gov.au/ or by contacting the DOE on (02) 6274 1111.

9.3 Licensing matters relating to the survey

Persons conducting flora and fauna surveys must have appropriate licences or approvals under relevant legislation. The relevant legislation and associated licences and approvals that may be required are listed below:

National Parks and Wildlife Act 1974:

- General Licence (Section 120) to harm or obtain protected fauna (this may include threatened fauna).
- Licence to pick protected native plants (Section 131).
- Scientific Licence (Section 132C) to authorise the carrying out of actions for scientific, educational or conservation purposes.

Threatened Species Conservation Act 1995:

- Licence to harm threatened animal species, and/or pick threatened plants and/or damage the habitat of a threatened species (Section 91).

Animal Research Act 1985:

- Animal Research Authority to undertake fauna surveys.

Typically you will require a licence under section 132C of the NPW Act to undertake an activity (e.g. survey) for scientific, educational or conservation purposes that is likely to result in one or more of the following:

- harm to any protected fauna, or to an animal that is a threatened species or is part of an endangered population or an endangered ecological community
- harm to any protected native plant, or any plant that is a threatened species or is part of an endangered population or an endangered ecological community. You will need a licence if you plan to collect voucher specimens for identification purposes, pick cuttings or whole plants, or collect seed
- damage to critical habitat
- damage to a habitat of a threatened species, an endangered population or an endangered ecological community.

Information pertaining to section 132C licences can be obtained from the following website:

- www.environment.nsw.gov.au/wildlifelicences/ScientificResearchLicences.htm

Section 132C licences came into effect in January 2003 and replaced the previous need for separate licences under other provisions of the NPW Act and the TSC Act.

It is a condition of all licences that you submit a report of the work carried out under the licence, including any results and specific details / locations of all flora and fauna, to OEH within two months of the expiry of the licence.

Also, be aware of the requirements relating to animal care and ethics when conducting wildlife surveys. The handling and capture of animals is regulated by the *Animal Research Act 1985* and the Animal Research Regulation 1995, which are administered by Department of Trade and Investment, Regional Infrastructure and Services. The Act requires that every person undertaking animal research must hold an Animal Research Authority. Under the Act, animal research includes the 'use' (e.g. handling, trapping etc.) of animals in field surveys. Details on animal ethics can be obtained from the following website:

- www.animalethics.org.au/home

All surveys must be carried out in accordance with the NSW Department of Trade and Investment, Regional Infrastructure and Service's Guidelines for wildlife surveys located at:

- www.animalethics.org.au/policies-and-guidelines/wildlife-research/wildlife-surveys

9.4 Section 110 (5) reports

Section 110(5) of the TSC Act has the effect of requiring OEH to provide that information regarding the State-wide conservation status of the subject species that it has available, in order to satisfy ss.110(2)&(3) of the Act. These documents are available on the internet at:

- www.environment.nsw.gov.au/threatenedspecies/index.htm

This website provides basic profiles for the majority of species listed as threatened, as well as links to the Scientific Committee determinations, more detailed profiles, environmental impact assessment guidelines and recovery plans, where these documents are available. OEH is unable to provide any further information for section 110(5) reports.

References:

Belbin, Lee (1989). PATN Technical Reference. CSIRO Division of Wildlife and Ecology, P.O. Box 84, Lyneham, ACT, 2602. 167p. www.patn.com.au/

Benson, D. and McDougall, L. (2002) Ecology of Sydney plant species - Part 9: Monocotyledon families Agavaceae to Juncaginaceae. *Cunninghamia*, 7(4): 695-930.

Briggs, J.D. and Leigh, J.H. (1996) *Rare or Threatened Australian Plants*. 5th Revised Edition. Australian Nature Conservation Agency / CSIRO Publishing, Collingwood.

Clarke, K.R. (1993) Non-parametric multivariate analyses of changes in community structure. *Australian Journal of Ecology* 18, 117-143.

DEC (2004) *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities*. Working Draft. November 2004. Department of Environment and Conservation (NSW)

DECC (2007a) *Biodiversity Certification of Environmental Planning Instruments: Working Draft*. April 2007. Department of Environment and Climate Change (NSW).

DECC (2007b) *Threatened Species Assessment Guidelines: The Assessment of Significance*. August 2007. Department of Environment and Climate Change (NSW).

DECC (2009a) *Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna – Amphibians*. April 2009. Department of Environment and Climate Change (NSW), Goulburn Street, Sydney.

Harden, G.J. (ed.) (1990-2002) *Flora of New South Wales: Volumes 1 - 4*. New South Wales University Press, Kensington.

Keith, D. (2004) *Ocean Shores to Desert Dunes: The Native Vegetation of New South Wales and the ACT*. Department of Environment and Conservation, Hurstville, NSW.

NSW Rural Fire Service (2006) *Planning for Bushfire Protection – A Guide for Councils, Planners, Fire Authorities and Developers*. NSW Rural Fire Service in cooperation with the Department of Planning.

MacKenzie, D.I. (2005) What are the issues with presence-absence data for wildlife managers? *Journal of Wildlife Management*, **69**: 849-860.

MacKenzie, D.I., Nichols, J.D., Lachman, G.B., Droege, S., Royle, A. and Langtimm, C.A. (2002) Estimating site occupancy rates when detection probabilities are less than one. *Ecology*, **83**: 2248-2255.

Morison, A. and House, S. (2004) *Regional Conservation Assessment, Lower Hunter and Central Coast Region.* Hunter Councils on behalf of the Hunter and Central Coast Regional Environmental Strategy, Thornton NSW.

OEH (2011) BioBanking Assessment Methodology and Credit Calculator Operational Manual. Office of Environment and Heritage (NSW), Goulburn Street, Sydney. www.environment.nsw.gov.au/resources/biobanking/09181bioopsman.pdf

OEH (2014) BioBanking Assessment Methodology 2014. Office of Environment and Heritage (NSW), Goulburn Street, Sydney: www.environment.nsw.gov.au/resources/biobanking/140661BBAM.pdf

Payne, R. (1997) *The Distribution and Reproductive Ecology of Syzygium paniculatum and Syzygium australe (Myrtaceae) in the Gosford-Wyong Region.* Unpublished Thesis prepared for the award of Masters of Natural Resources, University of New England, Armidale NSW.

Scotts, D. (2003) *Key Habitats and Corridors for Forest Fauna.* NPWS Occasional Paper 32, National Parks and Wildlife Service, Hurstville, NSW.

Specht, R.L., Roe, E.M., and Boughton, V.H. (1974) Conservation of major plant communities in Australia and Papua New Guinea. *Australian Journal of Botany*. Supplementary Series No. 7.

Tyre, A.J., Tenhumberg, B., Field, S.A., Niejalke, D., Parris, K. and Possingham, H. (2003) Improving precision and reducing bias in biological surveys: estimating false-negative error rates. *Ecological Applications*, **13**: 1790-1801.

Walker, J. and Hopkins, M. S. (1998) Vegetation. In R. C. McDonald, R. F. Isbell, J. G. Speight, J. Walker, and M. S. Hopkins (eds.) *Australian Soil and Land Survey Field Handbook Second Edition.* Inkata Press, Melbourne.

Wintle, B.A., Kavanagh, R.P., McCarthy, M.A., Burgman, M.A. (2005) Estimating and dealing with detectability in occupancy surveys for forest owls and arboreal marsupials. *Joumal of Wildlife Management*, **69**: 905-917.

APPENDIX 1:

Principles for the use of biodiversity offsets in NSW (OEH 2014)

Located at: www.environment.nsw.gov.au/biodivoffsets/oehoffsetprincip.htm

These principles have been developed by the Office of Environment and Heritage (OEH) to provide a useful framework when considering biodiversity impacts and appropriate offset requirements.

They are intended to be used for proposals other than those for state significant development (SSD) or state significant infrastructure (SSI). A Biodiversity Offsets Policy for Major Projects has been developed to deal with proposals for SSD and SSI.

1. Impacts must be avoided first by using prevention and mitigation measures.
Offsets are then used to address the remaining impacts. This may include modifying the proposal to avoid an area of biodiversity value or putting in place measures to prevent offsite impacts.

2. All regulatory requirements must be met.
Offsets cannot be used to satisfy approvals or assessments under other legislation, such as assessment requirements for Aboriginal heritage sites and for pollution or other environmental impacts (unless specifically provided for by legislation or additional approvals).

3. Offsets must never reward ongoing poor performance.
Offset schemes should not encourage landholders to deliberately degrade or mismanage offset areas in order to increase the value from the offset.

4. Offsets will complement other government programs.
A range of tools is required to achieve the NSW Government's conservation objectives, including the establishment and management of new national parks, nature reserves, state conservation areas and regional parks, and incentives for private landholders.

5. Offsets must be underpinned by sound ecological principles.
They must:

- include the conservation of structure, function and compositional elements of biodiversity, including threatened species
- enhance biodiversity at a range of scales
- consider the conservation status of ecological communities
- ensure the long-term viability and functionality of biodiversity.

Biodiversity management actions, such as enhancement of existing habitat and securing and managing land of conservation value for biodiversity, can be suitable offsets. Reconstruction of ecological communities involves high risks and uncertainties for biodiversity outcomes and is generally less preferable than other management strategies, such as enhancing existing habitat.

6. Offsets should aim to result in a net improvement in biodiversity over time.
Enhancement of biodiversity in offset areas should be equal to or greater than the loss in biodiversity from the impact site.
Setting aside areas for biodiversity conservation without additional management or increased security is generally not sufficient to offset the loss of biodiversity. Factors to consider include protection of existing biodiversity (removal of threats), time-lag effects, and the uncertainties and risks associated with actions such as revegetation.
Offsets may include:

- enhancing habitat
- reconstructing habitat in strategic areas to link areas of conservation value
- increasing buffer zones around areas of conservation value
- removing threats by conservation agreements or reservation.

7. Offsets must be enduring – they must offset the impact of the development for the period that the impact occurs.
As impacts on biodiversity are likely to be permanent, the offset should also be permanent and secured by a conservation agreement or reservation and management for biodiversity. Where land is donated to a public authority or private conservation organisation and managed as a biodiversity offset, it should be accompanied by resources for its management. Offsetting should only proceed if an appropriate legal mechanism or instrument is used to secure the required actions.

8. Offsets should be agreed prior to the impact occurring.
Offsets should minimise ecological risks from time-lags. The feasibility and in-principle agreements to the necessary offset actions should be demonstrated prior to the approval of the impact. Legal commitments to the offset actions should be entered into prior to the commencement of works under approval.

9. Offsets must be quantifiable – the impacts and benefits must be reliably estimated.
Offsets should be based on quantitative assessment of the loss in biodiversity from the clearing or other development and the gain in biodiversity from the offset. The methodology must be based on the best available science, be reliable and used for calculating both the loss from the development and the gain from the offset. The methodology should include:

- the area of impact
- the types of ecological communities and habitat or species affected
- connectivity with other areas of habitat or corridors
- the condition of habitat
- the conservation status and/or scarcity or rarity of ecological communities
- management actions
- level of security afforded to the offset site.

The best available information or data should be used when assessing impacts of biodiversity loss and gains from offsets. Offsets will be of greater value where:

- they protect land with high conservation significance
- management actions have greater benefits for biodiversity
- the offset areas are not isolated or fragmented
- the management for biodiversity is in perpetuity, such as secured through a conservation agreement.

Management actions must be deliverable and enforceable.

10. Offsets must be targeted.
They must offset impacts on the basis of like-for-like or better conservation outcomes. Offsets should be targeted according to biodiversity priorities in the area, based on the conservation status of the ecological community, the presence of threatened species or their habitat, connectivity and the potential to enhance condition by management actions and the removal of threats.

Only ecological communities that are equal or greater in conservation status to the type of ecological community lost can be used for offsets. One type of environmental benefit cannot be traded for another: for example, biodiversity offsets may also result in improvements in water quality or salinity but these benefits do not reduce the biodiversity offset requirements.

11. Offsets must be located appropriately.
Wherever possible, offsets should be located in areas that have the same or similar ecological characteristics as the area affected by the development.

12. Offsets must be supplementary.
They must be beyond existing requirements and not already funded under another scheme. Areas that have received incentive funds cannot be used for offsets. Existing protected areas on private land cannot be used for offsets unless additional security or management actions are implemented. Areas already managed by the government, such as national parks, flora reserves and public open space, cannot be used as offsets.

13. Offsets and their actions must be enforceable through development consent conditions, licence conditions, conservation agreements or contracts.
Offsets must be audited to ensure that the actions have been carried out, and monitored to determine that the actions are leading to positive biodiversity outcomes.

Page last updated: 08 September 2014

APPENDIX 2

Checklist of information required when utilising the Biobanking Assessment Methodology and Submitting BioBanking assessments to OEH using the BioBanking Credit Calculator v.4.0

The 'Assessors' Guide to Using the BioBanking Credit Calculator v.4.0' has been finalised and it is now available for download from the Office of Environment and Heritage (OEH) website www.environment.nsw.gov.au/resources/biobanking/120182AssessGdeBBCC.pdf. The guide provides information on the operation and use of the web-based BioBanking Credit Calculator version.4.0.

To submit your assessment to OEH, open your assessment in *Edit* mode. Navigate to the *Assessment details* page and select the *Submit* button in the top right hand corner. A *Submit the assessment for approval* box will appear (Figure 1), where you can confirm submission (*OK* button) or cancel submission (*Cancel* button). Once a case has been submitted to OEH, the status of the case will change in your *My work* tab from *Work in progress (WIP)* to *submitted*. Please note that you cannot make any edits to an assessment that has been submitted, although you will be able to view the assessment.

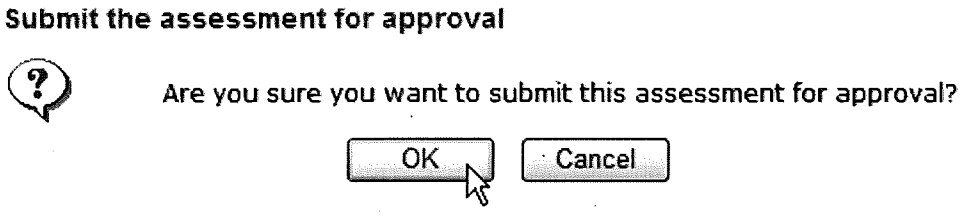


Figure 1: Submitting an assessment

The following documentation must be submitted with your Environmental Impact Statement or Species Impact Statement report (in hard copy and soft copy):

- BioBanking Assessment Report including a list of dominant indigenous species for overstorey, mid-storey and ground cover for each vegetation type and, where required:
  - local benchmark data,
  - request for increase in gain of site value,
  - a description of the proposed development,
  - measures to avoid and mitigate the impacts of development,
  - an assessment of indirect impacts,
  - a statement of onsite measures,
  - a description of the application of the BioBanking Assessment Methodology, including details of and assumptions made in utilising the methodology, such as (but not limited to) placement of assessment circles, remnant value, connectivity and reasoning behind selection of vegetation types in the Biometric Vegetation Type database,
  - plot and transect values including a list of the indigenous plant species identified in each of the plots,
  - a description of targeted threatened flora and fauna surveys, and any general baseline surveys (incl. vegetation specific surveys). These should be also be provided schematically, and

  Where required, the BioBanking Assessment Report should also include:
  - expert reports,
  - an application for a determination on red flag areas,
  - more appropriate use of local data for vegetation types, benchmarks or threatened species,
  - environmental contributions accompanied by a BioBanking Agreement Credit Report (if applicable), and
  - application for deferred retirement arrangements (if applicable).

- Copies of completed field data sheets, and updated with correct plant taxonomy in instances where field names have been used.

- Maps (soft copy as A4 jpgs) of:

  - offset site / BioBanking Agreement boundary or development footprint
  - vegetation zones
  - management zones
  - and where required:
    - existing waste
    - existing erosion
    - existing structures (in waterways)

- Separate shape files should be supplied for all the maps mentioned above plus:
  - plots and transects
  - assessment circles
  - species polygons
  - polygons for adjacent remnant area
  - the location or habitat area of sensitive species, and the management area related to that sensitive species (as this information cannot be displayed publicly).

All maps must include:

- a title (as per the names above)
- the site's name, location and lot/DP numbers
- the scale
- the date it was prepared
- a clear and unambiguous legend.

Boundaries and zones must be confirmed on the site using a GPS. This information should be digitised onto an ortho-rectified aerial photo or SPOT-5 image. Maps must be easily readable and submitted to OEH as a Geographic Information System (GIS) file that is ESRI compatible. Shape files must use GDA94 datum. Name each shape file as: 'biobank site name_descriptor'. For example, 'Hill Farm_photo points' or 'Hill Farm_management zones'.

Photo points should be named A, B, C, D, E, F, G, etc. Photo points should be located in areas where change is expected (i.e. where replanting, natural regeneration, intensive weeding or other active management actions are to be carried out). As a rough guide, include at least one photo point in each management zone where active management actions will be undertaken. Boundaries and zones must be confirmed on the site using a GPS. This information should be digitised onto an ortho-rectified aerial photo or SPOT-5 image. Maps must be easily readable and submitted to OEH as a Geographic Information System (GIS) file that is ESRI compatible.

Shape files must use GDA94 datum. Name each shape file as: 'biobank/development site name_descriptor'. For example, 'Hill Farm_photo points' or 'Hill Farm_management zones'.

Additional requirements for offset sites that may be required (based on liaison with OEH):

- completed biobanking agreement management action template (provided in MS-Word format), and
- Biodiversity Credits Pricing Spreadsheet

Once the case has been received OEH will review the data entered, and any supporting documentation. For State Significant Development (SSD), State Significant Infrastructure and residual Part 3A (under the *Environmental Planning and Assessment Act 1979*) this review will take place during the assessment of the Environmental Impact Statement or Environmental Assessment report (for Part 3A matters).

ATTACHMENT B:

CHECKLIST FOR DETERMINING IF AN SIS HAS MET THE REQUIREMENTS OF THE MINISTER ADMINISTERING THE THREATENED SPECIES CONSERVATION ACT

Under the *Environmental Planning and Assessment Act 1979*, where a significant effect on threatened species, populations or ecological communities is likely, a development application must be accompanied by concurrence from the Minister administering the *Threatened Species Conservation Act 1995* (TSC Act). As such a species impact statement prepared in accordance with Division 2 of Part 6 of the TSC Act must accompany the application.

The development is taken not to significantly affect threatened species, populations or ecological communities, or their habitats if:

a) the development is to be carried out on biodiversity certified land (within the meaning of Part 7AA of the TSC Act, or

b) a BioBanking statement has been issued in respect of the development under Part 7A of the TSC Act.

Therefore, before deciding to issue consent or approval and consequently requesting the concurrence of the Minister administering the TSC Act, it is required of the consent or determining authority to determine whether the SIS meets the Chief Executive's Requirements (CER's).

This checklist has been drawn up to assist consent and determining authorities in this matter. A comments column has been included to allow authorities to provide, among other things, reasons for their decisions or comments on whether an omission is significant.

Note that this is a generic checklist and some items may not be relevant to the application being reviewed or the CER's issued. If the requirements do not specify one of the matters below, then it is recommended that this be noted in the comments column. Consultants preparing an SIS may also use this checklist as a brief guide to preparing the SIS.

Matter	Yes/No	Comments
Has the SIS been signed by both its author and the applicant for consent/approval?		
Has the description of the proposal included all associated activities and works, such as hazard reduction zones, access roads and road upgrades, utilities, etc?		
Have all requested plans, maps and aerial photographs been provided? This includes any A1 or A0 sized proper survey plans prepared by a registered surveyor that clearly show the location and boundaries of any proposed offsets.		
Has the SIS determined the subject species by reviewing the suggested list in the CER's, other available information and survey results and assessing which species, populations and ecological communities are to be impacted by the development?		
Has the survey undertaken provided sufficient information to determine the likely impacts of		

Matter	Yes/No	Comments
the proposal on threatened species, populations and ecological communities?		
Have surveys been undertaken during the appropriate season(s) for the detection of the species that may possibly occur on site?		
Have surveys been undertaken during appropriate weather conditions?		
Have climatic conditions preceding the surveys (e.g. drought c.f. wet) affected the possibility of subject species being detected?		
Have all specific survey methods, techniques and intensities requested in the CER's been followed completely?		
Has the documentation of survey effort, locations and techniques provided sufficient information to determine the above?		
Has the assessment of impacts included the impacts of ALL activities associated with the development, including fire hazard reduction requirements, access road upgrades, downstream and downslope impacts, detention basins, severing of fauna movement corridors, etc.		
Has the SIS discussed the extent, conservation significance and security of other occurrences of the subject species' in the locality (locality is defined in the CER's)?		
Has the SIS discussed the significance of the population/remnant to be affected, relative to others within the locality?		
Has the SIS discussed the extent, conservation significance and security of other occurrences of the subject species in the region (region is defined in the TSC Act).		
Has the SIS discussed the significance of the population/remnant to be affected, relative to others within the region?		
Have alternatives to the proposal been discussed? Alternatives may include relocation of infrastructure or, for example, reducing minimum lot size so that a similar number of lots may be realised whilst retaining a larger conservation lot within a subdivision, or changing mining techniques.		
Has the discussion of alternatives included assessment of the social and economic (not merely financial) aspects of these alternatives (particularly, of not proceeding)?		
Has the discussion included an assessment of how the project meets the principles of Ecologically Sustainable Development, as defined in section 6(2) of the *Protection of the Environment Administration Act 1991*?		

Matter	Yes/No	Comments
Have all proposals for compensatory actions (e.g. purchase of similar vegetation / habitat or revegetation of habitat, where appropriate) been discussed with the relevant landowners/manager?		
Is there documented agreement for sale or revegetation activities?		
Is there agreement to change zoning or enter into a covenant on title in order to secure the conservation of the properties being purchased or revegetated?		
If translocation is proposed, has the impact of the translocation on the recipient site(s) been assessed?		
Is there a 'Plan of Management' or similar titled document?		
Has the SIS utilised relevant information from published draft and final recovery plans? If no plan has been published, but it is known that one is being prepared, has the SIS utilised advice from the NPWS as to the likely contents of that recovery plan (liaison to obtain this advice may have been specified in the CER's)? For example, would the proposal result in the loss of a local population or remnant that a recovery plan describes as being of particular importance to the conservation of the species, population or ecological community?		
If a BioBanking assessment has been done for the proposal have the following been provided: copies of BioBanking Credit reports, copies of field datasheets, and copies of a checklist that includes all data used in the credit calculator and the underlying assumptions, such as how local vegetation communities were assigned to BioMetric vegetation types?		
Has the SIS discussed the relationship of the proposal to any listed Key Threatening Processes (e.g. does the proposal result in the need for High Frequency Fire as a fire hazard reduction measure, or does it result in the Clearing of Native Vegetation)?		
Has the SIS discussed the relationship of the proposal to any published Threat Abatement Plan (e.g. does the proposal result in an increased threat in a manner that is specifically at odds with a published plan)?		
Has a revised Part 5A assessment of significance been included?		
Has the 'Additional Information' specified in section 9 of the CER's been provided?		
Have the qualifications and experience of those involved in the surveys been included?		

Matter	Yes/No	Comments
Have other approvals which are required for the development or activity been documented?		
Any licensing requirements (e.g. s.91 under TSC Act).		

EMGA Mitchell McLennan

Preliminary Ecological Assessment

New Intercity Maintenance Facility

Prepared for Transport for NSW | 15 October 2015

Planning + Environment + Acoustics

Preliminary Ecological Assessment

New Intercity Maintenance Facility

Prepared for Transport for NSW | 15 October 2015

Ground Floor, Suite 01, 20 Chandos Street
St Leonards, NSW, 2065

T +61 2 9493 9500
F +61 2 9493 9599
E info@emmconsulting.com.au

emgamm.com

Preliminary Ecological Assessment

Final

Report J15099RP3 | Prepared for Transport for NSW | 15 October 2015

Prepared by	**Katie Whiting**	Approved by	**Duncan Peake**
Position	Ecology Services Manager	Position	Executive Leader
Signature		Signature	
Date	15 October 2015	Date	15 October 2015

Document Control

Version	Date	Prepared by	Reviewed by
1	21 September 2015	Katie Whiting	Duncan Peake
2	7 October 2015	Katie Whiting	Duncan Peake
3	15 October 2015	Katie Whiting	Duncan Peake

EMM
EMGA Mitchell McLennan

T +61 (0)2 9493 9500 | F +61 (0)2 9493 9599

Ground Floor | Suite 01 | 20 Chandos Street | St Leonards | New South Wales | 2065 | Australia

emgamm.com

Table of contents

Table of contents *(Cont'd)*

Appendices

Tables

Figures

1 Introduction

1.1 Background

Transport for NSW (TfNSW) is a public authority whose primary function is to develop and deliver major infrastructure projects that meet the growing need for transport. Strategic transport planning reviews including the *NSW Long Term Transport Master Plan* (TfNSW 2012a) and *Sydney's Rail Future* (TfNSW 2012b) have identified the need to upgrade the existing intercity train fleet as a key priority.

1.2 The project

1.2.1 Overview

TfNSW plans to construct and operate a new train maintenance facility (the project) at Kangy Angy, on the NSW Central Coast. The site is bound by Chittaway Creek in the south, Ourimbah Creek in the north, Orchard Road to the west, and the main North Railway Line to the east. Project components comprise a train maintenance facility, rail tracks, internal access roads, an improved external access road, and buildings (see Figure 1.1).

1.2.2 Previous ecological surveys

To inform the site selection process, high-level ecological surveys were undertaken at several locations on the Central Coast during the *Draft Central Coast Train Stabling and Maintenance Facility Comparative Site Analysis* (GHD 2014). The Kangy Angy site was selected for the project following a review of the site options.

The high-level ecological survey results indicated that two endangered ecological communities (EECs) listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act) occur at the Kangy Angy site:

- River Flat Eucalypt Forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions and
- Swamp Sclerophyll Forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions.

Results also identified potential for the threatened Charmhaven Orchid (*Corunastylis* sp. Charmhaven) to occur. In preparation of the Comparative Site Analysis, mentioned above, a targeted survey was completed for this species during its flowering period in February 2015, however it was not detected.

1.3 Scope of work

TfNSW commissioned EMGA Mitchell McLennan Pty Limited (EMM) to prepare a preliminary ecological assessment (PEA) to determine the likelihood for significant impacts from the project, and inform the Statement of Impact Assessment Report being prepared by TfNSW for the project.

This PEA report:

- builds on site knowledge from previous ecological surveys;
- identifies ecological constraints and opportunities at the site to inform and guide detailed design;

- provides guidance on avoiding, minimising and offsetting impacts;
- determines if significant biodiversity impacts are likely to result from the project;
- provides guidance on the project approval pathway based on the significance of impacts and the need for an EPBC referral; and
- Identifies future field survey requirements for the ecological assessment of the project.

EMM
EMGA Mitchell McLennan

The project

New Intercity Fleet Maintainance Facility
Preliminary Ecological Assessment

Figure 1.1

2 Method

2.1 Desktop review

2.1.1 Vegetation mapping

The vegetation mapping dataset that accompanies the *Lower Hunter Central Coast Regional Biodiversity Conservation Strategy* (LHCCREMS 2003) was searched to provide an indication of vegetation types that could occur in the project area.

2.1.2 Database searches

Table 2.1 summarises the database searches and background research performed to identify threatened species; important habitat for migratory species; and critical habitats in and surrounding the project area.

Table 2.1 Database searches

Source	Date	Search radius around the project area
Atlas of NSW Wildlife www.environment.nsw.gov.au/atlasapp	8 September 2015	10 km
PlantNET spatial search plantnet.rbgsyd.nsw.gov.au/search/spatial.htm	16 September 2015	10 km
Threatened species and communities of the Wyong Catchment Management (CMA) subregion http://www.environment.nsw.gov.au/threatenedspeciesapp/cmaSearchResults.aspx?SubCmaId=94	16 September 2015	Wyong CMA subregion
Critical habitat register www.environment.nsw.gov.au/criticalhabitat/CriticalHabitatProtectionByDoctype.htm	16 September 2015	Not applicable, as individual sites are listed as critical habitat in NSW
Protected Matters Search Tool www.environment.gov.au/webgis-framework-apps/pmst/pmst.jsf	5 May 2015	10 km

2.2 Field survey

Preliminary surveys of the study area (Figure 2.1) were completed on 10, 16 and 17 September 2015. The study area covers approximately 40 ha.

2.2.1 Preliminary classification of vegetation communities

Vegetation mapping and community descriptions in LHCCREMS (2003) were used as a guide to identifying plant communities and plant community types in the project area.

Vegetation data was collected from four 20 x 20 m plots (Figure 2.1) to assist in identifying vegetation communities in the project area. Twelve rapid vegetation assessments were completed where patches of vegetation were too small to complete a 20 x 20 m plot, and for the purposes of mapping vegetation across the project area. The main canopy, mid and understorey species were recorded during rapid vegetation assessments to characterise the vegetation present.

Vegetation communities identified in the project area were classified into Plant Community Types (PCTs) described by the NSW Office of Environment and Heritage (OEH). The vegetation information system (VIS) classification database (OEH 2015) which contains descriptions of all PCTs identified was established as the NSW standard community level vegetation classification for use in site based planning processes and standardised vegetation mapping.

i Limitations of preliminary vegetation mapping

Parts of the project area could not be accessed during surveys for the PEA. Where access was not possible, rapid vegetation assessments were completed from the roadside or adjoining fence line where vegetation was representative of the inaccessible areas. The locations of plot and rapid assessment surveys are shown on Figure 2.1.

2.2.2 Targeted searches and habitat assessment

Based on the findings of the previous ecological studies and database searches, targeted searches were completed across the study area for the following threatened flora species in suitable habitat given the previous records of the species within 10 km of the project:

- Biconvex Paperbark;
- Charmhaven Apple (*Angophora inopina*);
- Magenta Lilly Pilly (*Syzygium paniculatum*);
- Tranquility Mintbush (*Prostanthera askania*);
- Variable Midge Orchid (*Genoplesium insigne*);
- Wyong Sun Orchid (*Thelymitra adorata*); and
- *Corunastylis* sp. Charmhaven.

Surveys were completed within the flowering period of the abovementioned orchids.

2.2.3 Fauna habitat assessment

Habitat features on site were compared to the specific requirements of threatened and migratory fauna species previously recorded within 10 km of the project. The likelihood that these threatened and migratory species would occur within and adjacent to the study area was assessed (Appendix A). Targeted fauna surveys were not completed given the preliminary stage of the project.

EMM

Methods

New Intercity Fleet Maintainance Facility
Preliminary Ecological Assessment

Figure 2.1

3 Results

3.1 Desktop review

3.1.1 Vegetation mapping datasets

Lower Hunter Central Coast Regional Biodiversity Conservation Strategy (LHCCREMS 2003) mapping predicts that Alluvial Tall Moist Forest, dominated by Sydney Blue Gum (*Eucalyptus saligna*), Turpentine (*Syncarpia glomulifera*) and Turpentine (*Glochidion ferdinandi*) covers the entire project area.

3.1.2 Database searches

The Atlas of NSW Wildlife reports that the following species listed under the TSC Act have been recorded within 10 km of the project:

- six flora species;
- four frog species;
- two reptile species;
- 21 bird species; and
- 12 mammal species.

The PlantNET spatial search reports that 16 threatened flora species listed under the TSC Act occur within 10 km of the project area.

The threatened species database for the Wyong CMA subregion (OEH 2015) reports that sixteen threatened ecological communities are known to occur within 10 km of the project, comprising:

- Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions;
- Low Woodland with Heathland on indurated sand at Norah Head;
- Quorrobolong Scribbly Gum Woodland in the Sydney Basin Bioregion;
- Swamp Sclerophyll Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions;
- River Flat Eucalypt Forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions;
- Sydney Freshwater Wetlands in the Sydney Basin Bioregion;
- Umina Coastal Sandplain Woodland in the Sydney Basin Bioregion;
- Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions;
- Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner Bioregions;

- Freshwater Wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions;
- Lower Hunter Spotted Gum-Ironbark Forest in the Sydney Basin Bioregion;
- Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions;
- *Themeda* grassland on headlands and coastal seacliffs of the NSW North Coast, Sydney Basin and South East Corner Bioregions;
- Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions;
- Kincumber Scribbly Gum Forest in the Sydney Basin Bioregion; and
- Coastal Upland Swamps in the Sydney Basin Bioregion.

The Protected Matters Search Tool predicts that the following biodiversity listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) may occur within 10 km of the project area:

- two EECs;
- 23 threatened flora species;
- one threatened terrestrial reptile (marine reptiles were excluded from this assessment);
- five threatened terrestrial birds (marine birds were excluded from this assessment);
- three threatened fish species;
- five threatened frog species; and
- seven threatened mammal species.

An assessment of the likelihood of each of the species, identified in the above database searches, would occur in the project area is provided in Appendix A, and discussed further in the following sections.

3.2 Field surveys

3.2.1 Preliminary vegetation classifications

Vegetation types have been classified in accordance with the PCTs described in the VIS database (OEH 2015). Two vegetation types were recorded from the project area. These are described in Table 3.1 and shown on Figure 3.1.

Table 3.1 Plant community types in the project area

Plant Community Type	Endangered ecological community	Dominant canopy species	Dominant shrub species	Dominant understorey species	Extent in study area
1725 Swamp Mahogany - Broad-leaved Paperbark - Swamp Water Fern - Plume Rush swamp forest on coastal lowlands of the Central Coast and Lower North Coast (Swamp Mahogany Forest)	Swamp Sclerophyll Forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions	Swamp Mahogany	Biconvex Paperbark, Broad-leaved Paperbark (*M. quinquenervia*)	*Baloskion tetraphyllum,* Red-fruit Saw Sedge (*Gahnia sieberiana*), Bracken (*Pteridium esculentum*)	30 ha
1528 Jackwood – Lilly Pilly – Sassafras Warm Temperate Rainforest of the Central Coast (Jackwood Lilly Pilly Rainforest)	Lowland Rainforest in the North Coast and Sydney Basin Bioregion	Sydney Blue Gum (*E. saligna*), Camphor laurel (*Cinnamomum camphora*), Sassafras (*Doryphora sassafras*)	Cabbage Tree Palm, Bangalow, Small-leaved Privet (*Ligustrum sinense*)	Cabbage Tree Palm	0.6 ha

Swamp Mahogany Forest, the plant community type observed during field surveys, was compared with the final determination for Swamp Sclerophyll Forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions (NSWSC 2004), listed as an endangered ecological community (EEC) under the TSC Act. The Swamp Mahogany Forest in the project area is consistent with the listed Swamp Sclerophyll Forest community for the following reasons:

- associated with humic clay loams and sandy loams, on waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains;
- it occurs below 20 m elevation (10 m average elevation in project area);
- it is in the Wyong LGA;
- it contains an open to dense tree layer of Eucalypts and Melaleucas;
- it contains areas of dense fernland and tall reedland; and
- it contains characteristic species comprising Swamp Mahogany, Cabbage Palm, Blueberry Ash (*Elaeocarpus reticulatus*), Cheese Tree (*Glochidion ferdinandi*), Paperbarks (*M. biconvexa, M. quinquenervia, M. ericifolia* and *M. linariifolia)*, Common Silkpod (*Parsonsia straminea*), False Bracken (*Calochlaena dubia*) and Blady Grass (*Imperata cylindrica*).

The key threatening process, *'Forest dieback associated with over-abundant psyllids and bell miners'* was identified as operating within the Swamp Sclerophyll Forest EEC in the study area. Numerous Bell Miners were observed and a large area of Swamp Mahogany trees were identified as showing signs of dieback.

Jackwood – Lilly Pilly Rainforest was compared to the final determination for Lowland Rainforest in the North Coast and Sydney Basin Bioregion, listed as an EEC under the TSC Act. It meets the description of the listed community as:

- it is in the Sydney Basin Bioregion;
- it has emergent, canopy and sub-canopy layers;
- it contains occasional emergent Sydney Blue Gum trees; and
- it contains characteristic species including Sydney Blue Gum, Bangalay Palm, Cabbage Tree Palm, Sweet Morinda (*Morinda jasminoides*), Rasp Fern (*Doodia aspera*) and Sassafras (*Doryphora sassafras*).

3.2.2 Threatened flora recorded and likely to occur

The preliminary survey identified several hundred individuals of the threatened Biconvex Paperbark, listed as a vulnerable species under the TSC and EPBC Acts, in the project area (Figure 3.1). However, the final determination for the TSC Act listed species (NSWSC 1998) recognises that multiple stems may arise from single rootstocks, so that an estimate of population size is not possible from visual inspection of stands. The number of individuals of this species occurring in the study area needs to be confirmed during future ecological surveys.

In addition, potential habitat was identified for the following threatened flora species listed under the TSC Act in the Jackwood – Lilly Pilly Rainforest in the project area:

- Magenta Lilly Pilly (*Syzygium paniculatum*);
- Rainforest Cassia (*Senna acclinis*); and
- Tranquility Mintbush (*Prostanthera askania*).

No individuals of this species were observed during the field surveys. Magenta Lilly Pilly and Tranquility Mintbush are also listed as threatened species under the EPBC Act.

EMM
EMGA Mitchell McLennan

Results

New Intercity Fleet Maintainance Facility
Preliminary Ecological Assessment

Figure 3.1

3.2.3 Threatened and migratory fauna habitat assessment

The preliminary survey identified habitat for the following threatened and migratory fauna species in the Swamp Mahogany Forest EEC (Table 3.2):

Table 3.2 Potential threatened and migratory fauna habitats in Swamp Mahogany Forest of the study area

Species	TSC Act conservation status	EPBC Act conservation status	Potential habitat in the study area
Birds			
Black-necked Stork (*Ephippiorhynchus asiaticus*)	E	-	Potential to occasionally forage in swamps (Figure 3.1) when inundated.
Gang-gang Cockatoo (*Callocephalon fimbriatum*)	V	-	Swamp Mahogany trees represent potential foraging habitat.
Glossy Black Cockatoo (*Calyptorhynchus lathami*)	V	-	Small area of Black She-oaks represents (Figure 3.1) potential foraging habitat. Only predicted to use the site occasionally as this is not a dominant species in the study area.
Little Eagle (*Hieraeetus morphnoides*)	V	-	Open parts of Swamp Mahogany Forest represent potential hunting habitat.
Little Lorikeet (*Glossopsitta pusilla*)	V	-	Swamp Mahogany trees represent potential foraging habitat.
Masked Owl (*Tyto novaehollandiae*)	V	-	Large Blackbutt trees containing hollows represent potential nesting habitat, while the Swamp Mahogany Forest itself represents potential hunting habitat.
Rainbow Bee-eater (*Merops ornatus*)	-	Mi	Swamp Mahogany Forest represents potential foraging habitat when this migratory species is present in the area.
Regent Honeyeater (*Anthochaera phrygia*)	CE	CE	Swamp Mahogany trees in the study area may represent an important foraging resource for this species during winter, when food is scarce.
Swift Parrot (*Lathamus discolor*)	E	E	Swamp Mahogany trees in the study area may represent an important foraging resource for this species during winter, when food is scarce.
Frogs			
Wallum Froglet (*Crinia tinnula*)	V	-	Swamps (Figure 3.1) may represent potential breeding habitat.
Mammals			
Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*)	V	-	The Swamp Mahogany Forest may represent potential foraging habitat. As caves and road culverts are absent from the study area, this species would not roost. It breeds outside the study area.
Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)	V	-	Large Blackbutt trees with small hollows may represent potential shelter and breeding habitat, while open parts of the Swamp Mahogany Forest itself may represent foraging habitat.
Grey-headed Flying-fox (*Pteropus poliocephalus*)	V	V	Swamp Mahogany trees in the study area may represent an important foraging resource for this species during winter, when food is scarce. The species does not roost or breed in the study area.

Table 3.2 Potential threatened and migratory fauna habitats in Swamp Mahogany Forest of the study area

Species	TSC Act conservation status	EPBC Act conservation status	Potential habitat in the study area
Koala (*Phascolarctos cinereus*)	V	V	Swamp Mahogany is recognised by the Koala Recovery Plan (DECCW 2008) as a primary Koala food tree on the Central Coast. Therefore, Swamp Mahogany Forest represents 'potential Koala habitat' in accordance with *State Environment Planning Policy 44: Koala Habitat Protection.*
Long-nosed Potoroo (*Potorous tridactylus tridactylus*)	V	V	Dense groundcover in the Swamp Mahogany Forest may represent potential habitat for the species.
Squirrel Glider (*Petaurus norfolcensis*)	V	-	Large Blackbutt trees may represent potential shelter and breeding habitat, while the Swamp Mahogany Forest itself may represent foraging habitat.
Yellow-bellied Glider (*Petaurus australis*)	V	-	Large Blackbutt trees may represent potential shelter and breeding habitat, while the Swamp Mahogany Forest itself may represent foraging habitat.

Notes *1. TSC Act – Threatened Species Conservation Act 1995.*

2. EPBC Act – Environment Protection and Biodiversity Conservation Act 1999.

The final determination for Swamp Sclerophyll Forest EEC (NSWSC 2004) recognises that the community provides habitat for a broad range of animals, including many that are dependent on trees for food, nesting or roosting. The blossoms of Swamp Mahogany and Broad-leaved Paperbark (*Melaleuca quinquenervia*) are an important food source for the Grey-headed Flying Fox, Yellow-bellied Glider, Regent Honeyeater and Swift Parrot and Wallum Froglet, which are all listed under the TSC Act. With the exception of the Wallum Froglet and Yellow-bellied Glider, these species are also listed as threatened under the EPBC Act.

The preliminary survey identified habitat for the following threatened and migratory fauna species in the Jackwood – Lilly Pilly Rainforest (Table 3.3):

Table 3.3 Potential threatened and migratory fauna habitats in Jackwood – Lilly Pilly Rainforest of the study area

Species	TSC Act conservation status	EPBC Act conservation status	Potential habitat in the study area
Birds			
Black-faced Monarch (*Monarcha melanopsis*)	-	Mi	Rainforest represents potential foraging habitat for the species.
Sooty Owl (*Tyto tenebricosa*)	V	-	Hollows in large Sydney Blue Gums may represent potential nesting and shelter habitat, while the Jackwood – Lilly Pilly Rainforest itself may represent potential hunting habitat.
Spectacled Monarch (*Monarcha trivirgatus*)	-	Mi	Rainforest represents potential foraging habitat for the species.
Wompoo Fruit Dove (*Ptilinopus magnificus*)	V	-	Rainforest vines and fruits may represent potential foraging habitat for the species.

Table 3.3 Potential threatened and migratory fauna habitats in Jackwood – Lilly Pilly Rainforest of the study area

Species	TSC Act conservation status	EPBC Act conservation status	Potential habitat in the study area
Powerful Owl (*Ninox strenua*)	V	-	Large hollows in Sydney Blue Gums may represent potential nesting habitat, dense midstorey shrubs may represent daytime shelter habitat, and the rainforest itself may represent hunting habitat.
Frogs			
Green-thighed Frog (*Litoria brevipalmata*)	V	-	Bangalow Creek, which runs through the Jackwood – Lilly Pilly Rainforest may represent potential breeding habitat when water levels are low.
Reptiles			
Pale-headed Snake (*Hoplocephalus bitorquatus*)	V	-	This species is only found occasionally in rainforest. Jackwood – Lilly Pilly Rainforest in the study area may represent habitat.
Stephen's Banded Snake (*Hoplocephalus stephensii*)	V	-	Hollow Sydney Blue Gums in the Jackwood – Lilly Pilly Rainforest may represent shelter habitat for the species, while Bangalow Creek may provide hunting habitat.
Mammals			
Golden-tipped Bat (*Kerivoula papuensis*)	V	-	Vines in the rainforest may provide shelter and foraging habitat for the species. Its primary roosting habitat, Yellow-throated Scrubwren and Brown Gerygone nests were not observed during preliminary surveys.
Greater Broadnosed Bat (*Scoteanax rueppellii*)	V	-	Hollow Blue Gums in the rainforest may represent shelter and breeding habitat, while the rainforest itself may provide foraging habitat.
Grey-headed Flying-fox (*Pteropus poliocephalus*)	V	V	Rainforest trees, when in flower or fruit, may represent foraging habitat for the species. No roosting camps are present in rainforest in the study area.

Notes *1. TSC Act – Threatened Species Conservation Act 1995.*

2. EPBC Act – Environment Protection and Biodiversity Conservation Act 1999.

The final determination for Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregion (Lowland Rainforest EEC) recognises that the community provides habitat for the Powerful Owl, Sooty Owl, Golden-tipped Bat, Greater Broadnosed Bat, Pale-headed Snake and Stephen's Banded Snake.

3.3 Summary

The desktop review and preliminary survey of the project area identified EECs and potential habitat for species listed under the TSC Act and the EPBC Act (Table 3.2 and Table 3.3). The importance of habitats in the study area to threatened and migratory fauna species should be determined during targeted fauna surveys for the ecological assessment.

4 Ecological constraints, opportunities and potential impacts

4.1 Ecological constraints and impacts

4.1.1 Constraints identification

Ecological constraints were classified into the following categories:

- very high ecological constraint – the area contains multiple threatened species and/or communities in moderate to good condition, and would require compensatory measures if impacted by the project;
- high ecological constraint – the area contains one threatened ecological community in moderate to good condition and would require compensatory measures if impacted by the project; and
- moderate ecological constraint – the area contains one threatened ecological community in low condition, and is unlikely to require compensatory measures if impacted by the project.

Constraint levels relevant to the identified threatened species and communities identified or likely to occur in the study area are discussed in the following sections. Recommended measures to avoid, minimise and offset are discussed in Chapter 5.

4.1.2 Endangered ecological communities

The Swamp Mahogany Forest (Swamp Sclerophyll Forest EEC) occurs across much of the study area, covering 30 ha. Much of the community contains a tree layer (though is sparse in some areas). These areas are represented as Swamp Mahogany Forest (moderate to good condition) on Figure 3.1. Given the presence of an EEC in moderate to good condition, these areas have been identified as containing high ecological constraint (Figure 4.1).

Parts of the Swamp Sclerophyll Forest EEC in the study area are currently being managed as a high voltage electricity easement. Trees and shrubs have been largely removed from the community and the structure now represents an open grassland dominated by Blady Grass, however it still contains native ferns and sedges indicative of the community. This is represented as Swamp Mahogany Forest (low condition) on Figure 3.1. Given that the community is in low condition, these areas have been identified as containing moderate ecological constraint (Figure 4.1).

Based on the proposed layout, it is estimated that 8.5 ha of moderate to good condition Swamp Sclerophyll Forest EEC would be cleared by the draft design. A preliminary assessment of significance (Appendix B) was completed in accordance with Section 5a of the *Environmental Planning and Assessment Act 1979* (EP&A Act) to assess the impacts of the draft design on Swamp Sclerophyll Forest EEC.

The local occurrence of Swamp Sclerophyll Forest EEC in the study area covers 30 ha. Given the site's location on a floodplain, much of the original Swamp Sclerophyll Forest has likely been cleared for rural residential properties and horse agistment. The local occurrence may extend to Berkeley Vale, approximately 2 km east of the project area; however this has not been confirmed. The topography is steep to the north and south of the project, which would not support Swamp Sclerophyll Forest EEC. This means that the local occurrence of Swamp Sclerophyll Forest EEC (ie within 5 km of the project) is likely to be restricted to the study area.

The preliminary assessment concluded that the project is likely to result in significant impacts to Swamp Sclerophyll Forest EEC as:

- it would reduce the local occurrence of the community by 8.5 ha;
- it would cause partial fragmentation of the local occurrence; and
- it may exacerbate the key threatening process, *'Forest dieback associated with over-abundant psyllids and bell miners'* in the study area.

Two small patches (totalling 0.6 ha) of Lowland Rainforest EEC are present in the study area. These areas are in moderate to good condition, and therefore have been identified as containing high ecological constraint (Figure 4.1).

The draft design would remove this 0.6 ha of Lowland Rainforest EEC from the study area. A preliminary assessment of significance (Appendix B) was completed in accordance with Section 5a of the EP&A Act to assess the impacts of the draft design on Lowland Rainforest EEC. The preliminary assessment concluded that the project is unlikely to result in significant impacts to Lowland Rainforest EEC as:

- only 0.6 ha would be removed from the study area, while the local occurrence extends along Bangalow Creek outside the study area; and
- fragmentation would occur, however it would only be minor.

4.1.3 Threatened flora species

The study area contains a large population of Biconvex Paperbark (Figure 3.1). It is estimated that up to 500 individuals may be present, which would need to be confirmed during surveys for the future detailed ecological assessment of the proposed activity. Areas containing Biconvex Paperbark have been identified as very high constraint, as they are listed as a vulnerable species under both the TSC and EPBC Act, and occur within Swamp Sclerophyll Forest EEC.

Two large patches of Biconvex Paperbark in the rail corridor are not affected by the proposed design. However, the draft design would remove the edge of a large patch in the rail corridor, and the new rail tracks created would completely remove a large patch (Figure 3.1 and Figure 4.1). Preliminary assessments of significance were completed in accordance with Section 5a of the EP&A Act for Biconvex Paperbark. The preliminary assessment concluded that the project is likely to result in significant impacts for Biconvex Paperbark as:

- a large stand of the community would be removed from the study area, and the edge of two smaller stands would be removed;
- the project would cause the isolation of stands of the species; and
- the species has been identified on the threatened species profile database as one that cannot withstand further loss in the Hunter-Central Rivers CMA area, in which the project is located.

Similarly, the EPBC assessment of significance concluded that the project is likely to result in significant impacts for Biconvex Paperbark as:

- the project may affect an important population and/or critical habitat for the species; and
- a large stand would be removed and small areas would be removed from smaller stands.

4.1.4 Threatened and migratory fauna species

Parts of the study area containing native vegetation may represent potential habitat for up to 25 threatened and migratory fauna species (Table 3.2 and Table 3.3). The importance of habitat in the study area to these threatened and migratory fauna is currently unknown, and needs to be determined during targeted fauna surveys. Therefore, constraint levels have not been identified and assessments of significance have not been completed for threatened and migratory fauna. It is recommended that assessments of significance are completed following targeted fauna surveys, as detailed in Table 7.1.

4.1.5 Summary of impacts to ecological constraints

Areas containing various levels of ecological constraint are present in the study area, which are listed below and shown in Figure 4.1:

- very high constraint – 1.9 ha contains known EECs in moderate to good condition and threatened flora species;
- high constraint – 27.5 ha contains known EECs in moderate to good condition; and
- moderate constraint– 1.2 ha contains a known EEC in low condition.

Up to 1.9 ha of very high constraint and 6.6 ha of high constraint areas will be removed for the project. Moderate constraint areas will not be impacted by the project, however do not represent an opportunity for rehabilitation. The moderate constraint area is underneath a transmission line, and requires routine vegetation management to ensure that line clearance is maintained.

4.2 Ecological opportunities

Up to 21.5 ha of Swamp Sclerophyll Forest EEC in the study area will not be impacted by the project. These areas represent an opportunity to offset the impact of clearing up to 8.5 ha of the community for the project.

Cleared parts of the study area, covering 10.6 ha, represent ecological opportunities for the project. These areas have been highly modified and now represent exotic grassland. These areas represent an opportunity for realignment of the facilities to avoid or minimise impacts to indentified ecological constraints, or to be rehabilitated in accordance with a future offset management plan. These areas are not shown as constraints on Figure 3.1 or Figure 4.1.

EMM
EMGA Mitchell McLennan

Constraint levels

New Intercity Fleet Maintainance Facility
Preliminary Ecological Assessment

Figure 4.1

5 Recommendations for avoidance, mitigation and offsets

5.1 Avoidance

Given that the majority of the site contains some level of ecological constraint, it is unlikely ecological impacts would be avoided fully. The study area was one of two areas that were considered during the *Draft Central Coast Train Stabling and Maintenance Facility Comparative Site Analysis* (GHD 2014) and deemed to have less ecological constraints.

5.2 Minimisation and mitigation

The following measures are recommended to minimise and/or mitigate impacts to ecological constraints resulting from the project:

- relocating the train maintenance facility and new railway tracks to the eastern extent of the study area, which would minimise the area of Biconvex Paperbark removed;
- minimising the area of clearance of roadside and rail corridor vegetation containing EECs or Biconvex Paperbark; and
- ensuring stockpiling and laydown areas are contained within areas proposed for clearing as part of the design.

5.3 Offsets

TfNSW have prepared a *Vegetation Offset Guide* (TfNSW 2014) which provides a framework for a consistent approach to offsetting vegetation impacts on their projects. It provides guidance for the selection of suitable biodiversity offset sites and a method to calculate offset areas during the project development stage.

The requirement to offset in accordance with the *Vegetation Offset Guide* applies where there is vegetation clearing proposed, and the impact of the proposed clearing is not deemed to be a significant impact in accordance with Section 111 of the EP&A Act. In addition, the guide does not apply if the project is predicted to:

- have a significant impact on threatened species, populations or communities listed under the TSC Act or EPBC Act;
- have a significant impact on native vegetation which is part of a wetland of international importance, natural heritage values of a World Heritage property or National Heritage place; and
- be declared a 'controlled action' by the Commonwealth Minister for the Environment.

As significant impacts are predicted for Swamp Sclerophyll Forest (listed under the TSC Act) and Biconvex Paperbark (listed under the TSC and EPBC Acts), the *Vegetation Offset Guide* does not apply to the project.

Although a significant impact is not predicted for Lowland Rainforest, biodiversity offsets are likely to be required as it is an EEC. It is recommended that offsets for this community are calculated using the OEH BioBanking calculator, and not the *Vegetation Offset Guide* calculator, to simplify the offset package.

The OEH is likely to require biodiversity offsets to compensate for residual impacts to Swamp Sclerophyll Forest EEC, Lowland Rainforest EEC and Biconvex Paperbark. Two mechanisms are available to calculate the credits required to compensate for impacts to threatened species and communities, comprising:

- the OEH BioBanking calculator, which calculates ecosystem credits for threatened ecological communities, and threatened species that can be predicted by habitat type, which are listed under the TSC Act. The BioBanking calculator can calculate credits related to linear infrastructure projects, major projects and small projects; and

- the Commonwealth offset calculator, which calculates the area of endangered ecological communities, the number of threatened flora individuals and the area of threatened fauna habitat required to be offset for EPBC listed species and communities.

Credits should be calculated using the OEH BioBanking calculator for:

- ecosystem credits: for EECs and threatened fauna species that can be reliably predicted by vegetation type; and

- species credits: any TSC Act listed threatened flora or fauna species recorded during targeted surveys of the study area that cannot be reliably predicted by vegetation or habitat type (ie species credit species).

The study area contains suitable land to compensate for impacts to Swamp Sclerophyll Forest EEC and Biconvex Paperbark. Credits should be calculated using the OEH Offset calculator to determine the feasibility of the remaining parts of the study area providing the required number of credits to offset impacts. As a 'species credit' species, Biconvex Paperbark is likely to generate a high number of credits for which offsets would need to be found. Therefore, it is recommended that the impact to this species is minimised through design optimisation.

Credits should also be determined using the Commonwealth offset calculator for Biconvex Paperbark, as it is also listed under the EPBC Act. T

All Lowland Rainforest EEC that occurs in the study area would be removed by the draft design, and therefore it does not contain suitable land to compensate for impacts to the community. However, Lowland Rainforest does occur on land adjacent to the study area. The feasibility of these areas to provide suitable offsets should be determined during the future ecological assessment.

The legislative framework for biodiversity offsets are discussed in Section 6.2.

6 Guidance on approval pathways

6.1 Approval pathway

Section 110(1) of the EP&A Act defines a determining authority as:

> a Minister or public authority and, in relation to any activity, means the Minister or public authority by or on whose behalf the activity is or is to be carried out or any Minister or public authority whose approval is required in order to enable the activity to be carried out.

In accordance with clause 79 of the State Environmental Planning Policy (Infrastructure) 2007, TfNSW is the proponent and determining authority for the proposed activity.

Under Part 5, section 111 of the EP&A Act, TfNSW is required to consider the potential environmental impacts of the proposal before reaching a determination. This is done through the preparation of a review of environmental factors (REF) of the proposed activity.

Of relevance to the project area where the draft project design comprises ecological constraints, section 111(4) states:

> Without limiting subsection (1), a determining authority must consider the effect of an activity on:
>
> (a) critical habitat, and
>
> (b) in the case of threatened species, populations and ecological communities, and their habitats, whether there is likely to be a significant effect on those species, populations or ecological communities, or those habitats, and
>
> (c) any other protected fauna or protected native plants within the meaning of the National Parks and Wildlife Act 1974.

Section 112 of the EP&A Act requires that if the proposal is assessed as likely to have a significant impact on the environment, an Environmental Impact Statement (EIS) is to be prepared. Similarly, section 112(1B) states:

> without limiting subsection (1), a determining authority must not carry out an activity, or grant an approval in relation to an activity, being an activity that is in respect of land that is, or is a part of, critical habitat or is likely to significantly affect threatened species, populations or ecological communities, or their habitats, unless a species impact statement, or an environmental impact statement that includes a species impact statement, has been prepared (in each case) in accordance with Division 2 of Part 6 of the Threatened Species Conservation Act 1995.

Clause 228 of the NSW Environmental Planning and Assessment Regulation 2000 (EP&A Regulation) requires assessments under Part 5 of the EP&A Act to consider the factors provided in the general guidelines in force under the Regulation, to assess the significance of the impacts on the environment. An EIS (rather than an REF) should be prepared if the activity is likely to result in a significant impact on the environment.

However, section 112(1C) states:

> An environmental impact statement is not required (despite subsection (1)(a)) in respect of an activity that:
>
> (a) is on land that is, or is part of, critical habitat, or is likely to significantly affect threatened species, populations or ecological communities, or their habitats, and
>
> (b) is not likely to significantly affect the environment except as described in paragraph (a).
>
> if the determining authority has obtained or been furnished with a species impact statement in respect of the activity, prepared in accordance with Division 2 of Part 6 of the TSC Act. However, the provisions of this Part relating to environmental impact statements (other than subsection (1)(a)(i)) apply to the species impact statement as if references to an environmental impact statement included a reference to the species impact statement.

Based on the draft design, the results of this PEA indicate likely significant impacts to Swamp Sclerophyll Forest EEC and Biconvex Paperbark, which would require the preparation of a species impact statement (SIS) for TfNSW to consider before reaching a determination in satisfaction of both section 111(4) and 112(1B) of the EP&A Act. The concurrence of the OEH may also be required under section 112C of the EP&A Act. Any required compensatory measures (such as offsets) would form part of the matters to be considered by the OEH as concurrence authority under section 112D of the EP&A Act.

A SIS would require assessment requirements be issued by the relevant Secretary (or Director General) in accordance with clause 111 of the TSC Act.

However, should the project design be optimised and significant impacts avoided, a SIS would not be required.

6.2 Biodiversity offsets

The NSW Biodiversity Banking and Offset Scheme (the BioBanking Scheme) is established under Part 7A of the TSC Act. The BioBanking Scheme is administered in accordance with the BioBanking Assessment Methodology (BBAM), under section 127B of the TSC Act, and is made by order of the Minister for the Environment and published in the NSW *Government Gazette.*

The BBAM is used to assess the biodiversity values of a development site to obtain a biobanking statement, or a biobank site to enter into a biobanking agreement. The BBAM describes the requirements for reliable and transparent assessment of biodiversity values on land in order to:

- identify the biodiversity values on land subject to a proposed development or land proposed as a biobank site;
- determine the impacts of developments on biodiversity as part of an application for approval to undertake the development under NSW planning legislation;
- quantify and describe the biodiversity credits required for the unavoidable impacts of developments of biodiversity values; and
- quantify and describe the biodiversity credits to assess all biodiversity values on the development site where a biobanking statement is sought by a proponent.

Section 127ZJ of the TSC Act states that the BioBanking Scheme is applicable to activities in accordance with 5 of the EP&A Act. However, participation in the scheme is voluntary. If a biobanking statement is obtained under Part 7A of the TSC Act for the project, then the determining authority is not required to consider the effect of an activity on biodiversity values as outlined in section 111(4) of the EP&A Act. However, it will be difficult to get an approved biobanking statement for the project given the presence of 'red flags' (EECs and threatened species). Therefore, the informal calculation of credits using the OEH Biodiversity Offset Calculator is recommended.

Although it is not mandatory to use the BioBanking Scheme, the OEH is likely to require biodiversity offsets to compensate for impacts to threatened species and communities if concurrence is sought under section 112C of the EP&A Act. Therefore, it is recommended that credits are calculated using the OEH Biodiversity Offset Calculator.

6.3 Commonwealth referral

If the draft design is adopted, Biconvex Paperbark is likely to be significantly impacted by the project, which would trigger the requirements of the EPBC Act. There is a bilateral agreement (signed February 2015) is in place between the NSW and Commonwealth governments which provides for a 'one stop' shop for environmental assessments, including those under Part 5 of the EP&A Act. Section 4.1 of the bilateral agreement states that 'an action does not require assessment under Part 8 of the EPBC Act if the action is in the class of actions specified in Schedule 1 to this agreement'. Section 2(a)(ix) of Schedule 1 of the bilateral agreement states:

> actions that are assessed under Part 5 (other than Division 5 Part 5 or where an EIS is required) of the *Environmental Planning and Assessment Act 1979* (NSW) where the assessment has been undertaken in accordance with the requirements of Item 3 of this Schedule 1.

Item 3 of Schedule 1 sets out the requirements for assessments, such as relevant guidelines to follow, direction for public exhibition of documentation (14 days for projects under Part 5 of the EP&A Act), and preparation of an assessment report by the determining authority.

A bilateral assessment process (whereby the NSW assessment process is undertaken on behalf of DoE process) would be the preferential approval pathway should EPBC approval be required for the project. Undertaking the bilateral process for project would remove the need for a separate EPBC approval as Part 5 of the EP&A Act is accredited under the bilateral agreement, as described above. Consultation with DoE regarding the approval pathway is recommended during the early phase of assessment. Consideration should also be given to the potential for offsets under the EPBC Act for impacts to matters of national environmental significance in accordance with Item 3 of Schedule 1 of the bilateral agreement.

7 Further assessment

7.1 Survey effort and method guidelines

A detailed ecological assessment should be completed to inform the Environmental Impact Assessment (Review of Environmental Factors or EIS). The purpose of the detailed ecological assessment would be to collect information not covered by the scope of this PEA, specifically:

- targeted fauna surveys for threatened species that are likely to occur; and
- determining the number of Biconvex Paperbarks in the study area.

Surveys for the detailed ecological assessment should be completed in accordance with the following guidelines:

- the required number of plots and transects in accordance with Section 5.3.2 of the *Biobanking Assessment Methodology* (OEH 2014a) or *Framework for Biodiversity Assessment* (OEH 2014b);
- *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC 2004);
- *Threatened species survey and assessment guidelines: field survey methods for fauna (Amphibians)* (DECC 2009);
- *Survey guidelines for Australia's threatened birds* (SEWPaC 2011a);
- *Survey guidelines for Australia's threatened frogs* (SEWPaC 2011b); and
- *Survey guidelines for Australia's threatened mammals* (SEWPaC 2011c).

7.2 Flora survey effort

The BioBanking Methodology (OEH 2014a), which is applied to smaller projects and Framework for Biodiversity Assessment (OEH 2014b), which is applied to major projects, describes the method to complete BioBanking plots and transects in the field. This method must be used to undertake vegetation surveys and classification to collect the required data for entry into the OEH BioBanking calculator. Additional plots and transects should be completed in accordance with the BioBanking methodology (OEH 2014a) to satisfy agency requirements.

The detailed ecological assessment should also determine the number of Biconvex Paperbark individuals in the study area. The number of individuals would need to be determined to inform calculations on the OEH BioBanking Calculator and Commonwealth offset calculator. It is recommended that 20 x 20 m plots are completed in the larger stands to determine the number of individuals per 400m². The number can then be extrapolated to estimate the number of individuals in the study area.

7.3 Survey timing

Table 7.1 provides the recommended timing to complete targeted surveys for threatened and migratory species relevant to the study area. It is noted that the majority of species listed in Table 7.1 are detectable year round. If the project timeframe does not allow for targeted surveys for all threatened species, it is recommended that when offsets are calculated using the OEH BioBanking calculator that where suitable habitat occurs, they are assumed to be present.

Table 7.1 Threatened species survey timing

Threatened or migratory species	Survey timing
Magenta Lilly Pilly	Year round
Rainforest Cassia	February to March
Tranquility Mintbush	September to December
Black-faced Monarch	Year round (except winter)
Black-necked Stork	Year round
Little Eagle	Year round
Little Lorikeet	Year round
Masked Owl	Year round
Powerful Owl	Year round
Rainbow Bee-eater	Year round
Regent Honeyeater	March to August
Sooty Owl	Year round
Spectacled Monarch	December to February
Wompoo Fruit Dove	Year round
Green-thighed Frog	October to March (within 3 days of heavy rain)
Wallum Froglet	Year round (however peaks in March to May)
Eastern Bentwing Bat	October to March
Eastern False Pipistrelle	October to March
Eastern Freetail Bat	October to March
Golden-tipped Bat	October to March
Greater Broadnosed Bat	October to March
Grey-headed Flying-fox	Year round
Koala	Year round (easiest during breeding season August to February)
Little Bentwing Bat	October to March
Long-nosed Potoroo	Year round
Squirrel Glider	Year round

7.4 Assessment and reporting

Following the completion of additional field surveys, an ecological assessment report should be prepared. The ecological assessment should build on the PEA results by:

- collecting additional information to inform the revised assessments of significance for Swamp Sclerophyll Forest EEC, Lowland Rainforest EEC and Biconvex Paperbark; and
- using the data collected during additional field surveys to complete assessments of significance for threatened flora or fauna species recorded or likely to occur.

8 Conclusion

A PEA has been completed by conducting preliminary field surveys and impact assessment of the proposed train maintenance facility at Kangy Angy. A number of constraints were identified at the site, with key constraints comprising the presence of Swamp Sclerophyll Forest EEC, Lowland Rainforest EEC and a large population of Biconvex Paperbark which are listed under both the TSC Act and EPBC Act.

Areas of very high ecological constraint were identified where multiple threatened species and/or communities in moderate condition occur, which would require compensatory measures if impacted by the project. Areas of high ecological constraint were identified where one threatened ecological community occurs in moderate to good condition, which would require compensatory measures if impacted by the project. An area of moderate ecological constraint was identified one threatened ecological community occurs in low condition, which is unlikely to require compensatory measures if impacted by the project. Areas of no ecological constraint were also identified, which would not require compensatory measures if impacted by the project.

Preliminary assessments of significance (Appendix B) were completed in accordance with section 5a of the EP&A Act and the EPBC Act for Swamp Sclerophyll Forest EEC, Lowland Rainforest EEC and Biconvex Paperbark. The preliminary assessments concluded that the project was likely to result in significant impact for Swamp Sclerophyll Forest EEC and Biconvex Paperbark, and that impacts were unlikely to be significant for Lowland Rainforest EEC. Completion of detailed ecological assessments of the optimised project design would update these preliminary findings.

Avoidance of impacts is unlikely as most of the study area contains ecological constraints. These constraints have been identified with recommendations made to optimise the project design to minimise and, if required, offset these impacts.

Should significant impacts be unavoidable, the project would likely require an SIS under Part 5 of the EP&A Act. Determination of the project would require the concurrence of the OEH. A referral under the EPBC Act may also be required due to impacts resulting from the draft project design. Utilisation of the bilateral agreement between the NSW and Commonwealth governments is recommended to streamline the assessment process. Early consultation with DoE is recommended should this be the case.

The site contains potential habitat for up to 25 threatened and migratory fauna species. Targeted fauna surveys to determine the importance of the habitats present to the species would require completion in accordance with the relevant OEH and DoE guidelines. This would allow for an accurate assessment of impacts to be made. Recommendations have been made for the scope and timing of surveys for the future ecological assessment.

Appendix A

Likelihood of occurrence for threatened species

Table A.1 Threatened species recorded or with the potential to occur within 10 km of the survey area

Species	Source	Status		Habitat requirements[1]	Likelihood of occurrence	Further assessment and survey required?
		TSC Act	EPBC Act			
FLORA						
Asterolasia elegans	PMST	E	E	Found in sheltered forests on mid- to lower slopes and valleys, e.g. in or adjacent to gullies which support sheltered forest. The canopy at known sites includes Turpentine (*Syncarpia glomulifera* subsp. *glomulifera*), Smooth-barked Apple (*Angophora costata*), Sydney Peppermint (*Eucalyptus piperita*), Forest Oak (*Allocasuarina torulosa*) and Christmas Bush (*Ceratopetalum gummiferum*).	Low	No
Astrotricha crassifolia	PMST	-	V	The Thick-leaf Star-hair grows on dry ridgetops to 300 m altitude and is associated with very rich heath, or dry sclerophyll woodland (Harden 1992). Vegetation associations include typical sandstone genera such as Hakea, Banksia and Xylomelum.	None	No
Biconvex Paperbark *Melaleuca biconvexa*	NPWS Atlas, PlantNet, PMST	V	V	Biconvex Paperbark is only found in NSW, with scattered and dispersed populations found in the Jervis Bay area in the south and the Gosford-Wyong area in the north. Biconvex Paperbark generally grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects. Flowering occurs over just 3-4 weeks in September and October. This species re-sprouts following fire.	Recorded	Yes
Black-eyed Susan *Tetratheca juncea*	NPWS Atlas	V	V	Black-eyed Susan is usually found in low open forest/woodland with a mixed shrub understorey and grassy groundcover. However, it has also been recorded in heathland and moist forest. The majority of populations occur on low nutrient soils associated with the Awaba Soil Landscape. While some studies show the species has a preference for cooler southerly aspects, it has been found on slopes with a variety of aspects. It generally prefers well-drained sites below 200m elevation and annual rainfall between 1000 - 1200mm. The preferred substrates are sandy skeletal soil on sandstone, sandy-loam soils, low nutrients; and clayey soil from conglomerates, pH neutral. It usually spreads via underground stems which can be up to 50 cm long. Consequently, individual plants may be difficult to identify. It also reproduces sexually but this requires insect pollination. Large populations of this species are particularly important.	None	No
Bynoe's Wattle *Acacia bynoeana*	NPWS Atlas	E	V	Occurs in heath or dry sclerophyll forest on sandy soils. Seems to prefer open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and in recently burnt patches. Associated overstorey species include Red Bloodwood, Scribbly Gum, Parramatta Red Gum, Saw Banksia and Narrow-leaved Apple.	None	No

Table A.1 Threatened species recorded or with the potential to occur within 10 km of the survey area

Species	Source	Status		Habitat requirements[1]	Likelihood of occurrence	Further assessment and survey required?
		TSC Act	EPBC Act			
Camfield's Stringybark *Eucalyptus camfieldii*	PMST	V	V	Occurs in poor coastal country in shallow sandy soils overlying Hawkesbury sandstone. Coastal heath mostly on exposed sandy ridges. Occurs mostly in small scattered stands near the boundary of tall coastal heaths and low open woodland of the slightly more fertile inland areas. Associated species frequently include stunted species of Narrow-leaved Stringybark (*E. oblonga*), Brown Stringybark (*E. capitellata*) and Scribbly Gum (*E. haemastoma*). Population sizes are difficult to estimate because its extensive lignotubers may be 20 m across. A number of stems arise from these lignotubers giving the impression of individual plants. Flowering period is irregular, flowers recorded throughout the year. Poor response to too frequent fires.	None	No
Charmhaven Apple *Angophora inopina*	NPWS Atlas	V	V	This species is a member of the *A. bakeri* complex. None of the related species are known from the same area as *A. inopina*, although A. bakeri does occur sporadically in the ranges to the west, and near Kurri Kurri. Occurs most frequently in four main vegetation communities: (i) *Eucalyptus haemastoma–Corymbia gummifera–Angophora inopina* woodland/forest; (ii) *Hakea teretifolia–Banksia oblongifolia* wet heath; (iii) *Eucalyptus resinifera–Melaleuca sieberi–Angophora inopina* sedge woodland; (iv) *Eucalyptus capitellata–Corymbia gummifera–Angophora inopina* woodland/forest. Ecological knowledge about this species is limited. Is lignotuberous, allowing vegetative growth to occur following disturbance. However, such vegetative reproduction may suppress the production of fruits/seeds, necessary for the recruitment of new individuals to a population, and the time between such disturbance and the onset of sexual reproduction is not known. Flowering appears to take place principally between mid-December and mid-January, but is generally poor and sporadic. Preliminary experiments indicate that neither pollination nor seed viability are limiting factors in the life cycle.	None	No
Eastern Underground Orchid *Rhizanthella slateri*	PMST	V	E	Habitat requirements are poorly understood and no particular vegetation type has been associated with the species, although it is known to occur in sclerophyll forest. Highly cryptic given that it grows almost completely below the soil surface, with flowers being the only part of the plant that can occur above ground. Therefore usually located only when the soil is disturbed. Flowers September to November.	Low	No

Table A.1 Threatened species recorded or with the potential to occur within 10 km of the survey area

Species	Source	Status		Habitat requirements[1]	Likelihood of occurrence	Further assessment and survey required?
		TSC Act	EPBC Act			
Epacris purpurascens var. *purpurascens*	NPWS Atlas	V	-	Found in a range of habitat types, most of which have a strong shale soil influence.	None	No
Leafless Tongue Orchid *Cryptostylis hunteriana*	PlantNET, PMST	V	V	The larger populations of these species typically occur in woodland dominated by Scribbly Gum (*Eucalyptus sclerophylla*), Silvertop Ash (*E. sieberi*), Red Bloodwood (*Corymbia gummifera*) and Black Sheoak (*Allocasuarina littoralis*); appears to prefer open areas in the understorey of this community and is often found in association with the Large Tongue Orchid (*C. subulata*) and the Tartan Tongue Orchid (*C. erecta*). Little is known about the ecology of the species; being leafless it is expected to have limited photosynthetic capability and probably depends upon a fungal associate to meet its nutritional requirements from either living or dead organic material. In addition to reproducing from seed, it is also capable of vegetative reproduction and thus forms colonies which can become more or less permanent at a site.	None	No
Magenta Lilly Pilly *Syzygium paniculatum*	NPWS Atlas	E	V	On the central coast, the Magenta Lilly Pilly occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities.	Moderate	Yes
Maundia triglochinoides	NPWS Atlas	V	-	Grows in swamps, lagoons, dams, channels, creeks or shallow freshwater 30 - 60 cm deep on heavy clay, low nutrients. Flowers November-January.	None	No
Omeo's Storksbill *Pelargonium* sp. Striatellum	PMST	E	E	Omeo's Storksbill has a specific habitat that is usually just above the high-water level of irregularly inundated or ephemeral lakes, in the transition zone between surrounding grasslands or pasture and the wetland or aquatic communities. It sometimes colonises exposed lake beds during dry periods. It occurs in habitats that are mostly or wholly included in the two Endangered Ecological Communities (EECs): 'Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory' and 'Upland Wetlands of the New England Tablelands (New England Tableland Bioregion) and the Monaro Plateau (South Eastern Highlands Bioregion)', as listed under the EPBC Act.	None	No
Pimelea curviflora var. *curviflora*	PMST	V	V	Occurs on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands. Also recorded in Illawarra Lowland Grassy Woodland habitat at Albion Park on the Illawarra coastal plain. Flowers October to May.	None	No

Table A.1 Threatened species recorded or with the potential to occur within 10 km of the survey area

Species	Source	Status		Habitat requirements[1]	Likelihood of occurrence	Further assessment and survey required?
		TSC Act	EPBC Act			
Smooth Bush-pea *Pultenaea glabra*	PMST	V	V	Grows in swamp margins, hillslopes, gullies and creek banks and occurs within dry sclerophyll forest and tall damp heath on sandstone. Flowers September to November, fruit matures October to December.	None	No
Rainforest Cassia *Senna acclinis*	NPWS Atlas	E	-	Grows on the margins of subtropical, littoral and dry rainforests. Often found as a gap phase shrub. Flowering occurs in spring and summer and the fruit is ripe in summer and autumn.	Moderate	Yes
Rough Doubletail *Diuris praecox*	PMST	V	V	Rough Doubletail grows on hills and slopes of near-coastal districts in open forests which have a grassy to fairly dense understorey. Exists as subterranean tubers most of the year. It produces leaves and flowering stems in winter.	Low	No
Siah's Backbone *Streblus pendulinus*	PMST	-	E	Siah's Backbone occurs from Cape York Peninsula to Milton, south-east New South Wales (NSW), as well as Norfolk Island. On the Australian mainland, Siah's Backbone is found in warmer rainforests, chiefly along watercourses. The altitudinal range is from near sea level to 800 m above sea level. The species grows in well developed rainforest, gallery forest and drier, more seasonal rainforest.	Moderate	Yes
Somersby Mintbush *Prostanthera junonis*	PMST	E	E	The species is restricted to the Somersby Plateau. It occurs on both the Somersby and Sydney Town soil landscapes on gently undulating country over weathered Hawkesbury sandstone within open forest/low woodland/open scrub. It occurs in both disturbed and undisturbed sites. The dominant flowering period for this species is October to mid-December depending on weather/site conditions. The plant is very difficult to identify outside of this time.	None	No
Small-flower Grevillea *Grevillea parviflora* subsp. *parviflora*	PMST	V	V	Small-flower Grevillea occurs in a range of vegetation types from heath and shrubby woodland to open forest. In Sydney it has been recorded from Shale Sandstone Transition Forest and in the Hunter in Kurri Sand Swamp Woodland. However, other communities occupied include Corymbia maculata - Angophora costata open forest in the Dooralong area, in Sydney Sandstone Ridgetop Woodland at Wedderburn and in Cooks River / Castlereagh Ironbark Forest at Kemps Creek. Often occurs in open, slightly disturbed sites such as along tracks. Plants are capable of suckering from a rootstock and most populations demonstrate a degree of vegetative spread, particularly after disturbance such as fire.	None	No

Table A.1 Threatened species recorded or with the potential to occur within 10 km of the survey area

Species	Source	Status		Habitat requirements[1]	Likelihood of occurrence	Further assessment and survey required?
		TSC Act	EPBC Act			
Thick-lipped Spider Orchid *Caladenia tessellata*	PMST	E	V	Thick-lipped Spider Orchid is generally found in grassy sclerophyll woodland on clay loam or sandy soils, though the population near Braidwood is in low woodland with stony soil. The single leaf regrows each year. Flowers appear between September and November (but apparently generally late September or early October in extant southern populations).	None	No
Tranquility Mintbush *Prostanthera askania*	NPWS Atlas	E	E	Occurs adjacent to, but not immediately in, drainage lines on flat to moderately steep slopes formed on Narrabeen sandstone and alluvial soils derived from it. Occurs in moist sclerophyll forest and warm temperate rainforest communities, and the ecotone between them. These communities are generally tall forests with a mesic understorey; Sydney Blue Gum *Eucalyptus saligna* and Turpentine *Syncarpia glomulifera* are usually present, though canopy species present can be highly variable.	Moderate	Yes
Variable Midge Orchid *Genoplesium insigne* (syn. *Corunastylis insigne)*	PMST	E	CE	Variable Midge Orchid grows in patches of Kangaroo Grass (*Themeda australis*) amongst shrubs and sedges in heathland and forest. Associated vegetation is described as dry sclerophyll woodland dominated by Scribbly Gum (*Eucalyptus haemastoma*), Red Bloodwood (*Corymbia gummifera*), Smooth-barked Apple (*Angophora costata*) and Black She-oak (*Allocasuarina littoralis*). Fewer than twenty plants are recorded from three localities, while the number of plants present at the fourth locality (Chain Valley Bay) is not known. Flowering period is September to October.	None	No
Corunastylis sp. Charmhaven	GHD 2014	CE	CE	It occurs within low woodland to heathland with a shrubby understorey and ground layer. Dominants include Black She-oak (*Allocasuarina littoralis*), Prickly Tea-tree (*Leptospermum juniperinum*), Prickly-leaved Paperbark (*Melaleuca nodosa*), Narrow-leaved Bottlebrush (*Callistemon linearis*) and Zig-zag Bog-rush (*Schoenus brevifolius*). Flowering occurs approximately six weeks after the initialising rain event, usually in February or March.	None	No
Wyong Sun Orchid *Thelymitra adorata*	PMST	CE	CE	Currently known from a few localised occurrences in the area bounded by the towns of Wyong, Warnervale and Wyongah on the New South Wales Central Coast, within the Wyong Local Government Area. Occurs from 10-40 m a.s.l. in grassy woodland or occasionally derived grassland in well-drained clay loam or shale derived soils. The vegetation type in which the majority of populations occur (including the largest colony) is a Spotted Gum - Ironbark Forest with a diverse grassy understorey and occasional scattered shrubs.	None	No

Table A.1 Threatened species recorded or with the potential to occur within 10 km of the survey area

Species	Source	Status		Habitat requirements[1]	Likelihood of occurrence	Further assessment and survey required?
		TSC Act	EPBC Act			
Yellow Gnat Orchid *Genoplesium baueri*	PMST	E	E	Grows in dry sclerophyll forest and moss gardens over sandstone. Flowers February to March.	None	No
FAUNA - Birds						
Australasian Bittern *Botaurus poiciloptilus*	PMST	E	E	Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (*Typha* spp.) and spikerushes (*Eleocharis* spp.). Hides during the day amongst dense reeds or rushes and feed mainly at night on frogs, fish, yabbies, spiders, insects and snails. Feeding platforms may be constructed over deeper water from reeds trampled by the bird; platforms are often littered with prey remains. Breeding occurs in summer from October to January; nests are built in secluded places in densely-vegetated wetlands on a platform of reeds; there are usually six olive-brown eggs to a clutch.	Low	No
Black Bittern *Ixobrychus flavicollis*	NPWS Atlas	V	-	The Black Bittern inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. Where permanent water is present, the species may occur in flooded grassland, forest, woodland, rainforest and mangroves.	Low	No
Black Falcon *Falco subniger*	NPWS Atlas	V	-	The Black Falcon is found along tree-lined watercourses and in isolated woodlands, mainly in arid and semi-arid areas. Black Falcons nest along tree-lined creeks and rivers of inland drainage systems.	None	No
Black-faced Monarch *Monarcha melanopsis*	PMST	-	Mi	The Black-faced Monarch occurs mainly in rainforest ecosystems but sometimes is found in nearby open eucalypt forests in gullies with a dense, shrubby, or patchy understorey.	Moderate	Yes
Black-necked Stork *Ephippiorhynchus asiaticus*	NPWS Atlas	E	-	Black-necked Storks are mainly found on shallow, permanent, freshwater terrestrial wetlands, and surrounding marginal vegetation, including swamps, floodplains, watercourses and billabongs, freshwater meadows, wet heathland, farm dams and shallow floodwaters, as well as extending into adjacent grasslands, paddocks and open savannah woodlands.	Moderate	Yes
Bush Stone-curlew *Burhinus grallarius*	NPWS Atlas	E	-	Inhabits open forests and woodlands with a sparse grassy groundlayer and fallen timber. Largely nocturnal, being especially active on moonlit nights. Feed on insects and small vertebrates, such as frogs, lizards and snakes. Nest on the ground in a scrape or small bare patch. Two eggs are laid in spring and early summer.	None	No

Table A.1 Threatened species recorded or with the potential to occur within 10 km of the survey area

Species	Source	Status		Habitat requirements[1]	Likelihood of occurrence	Further assessment and survey required?
		TSC Act	EPBC Act			
Cattle Egret *Ardea ibis*	NPWS Atlas	-	Mi	The Cattle Egret occurs in tropical and temperate grasslands, wooded lands and terrestrial wetlands.	Low	No
Comb-crested Jacana *Irediparra gallinacean*	NPWS Atlas	V	-	Inhabit permanent freshwater wetlands, either still or slow-flowing, with a good surface cover of floating vegetation, especially water-lilies, or fringing and aquatic vegetation. Forage on floating vegetation, walking with a characteristic bob and flick. They feed primarily on insects and other invertebrates, as well as some seeds and other vegetation.	None	No
Eastern Bristlebird *Dasyornis brachypterus*	PMST	E	E	Habitat of the Eastern Bristlebird is characterised by dense, low vegetation including heath and open woodland with a healthy understorey; in northern NSW, this species occurs in open forest with tussocky grass understorey; all of these vegetation types are fire prone.	None	No
Eastern Osprey *Pandion cristatus*	NPWS Atlas	V	-	Favour coastal areas, especially the mouths of large rivers, lagoons and lakes. Feed on fish over clear, open water. Breed from July to September in NSW. Nests are made high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea.	None	No
Fork-tailed Swift *Apus pacificus*	NPWS Atlas	-	MI	In Australia, the Fork-tailed Swift mostly occurs over inland plains but sometimes above foothills or in coastal areas. This species can also occur over cliffs and beaches and also over islands and sometimes well out to sea.	None	No
Flame Robin *Petroica phoenicia*	NPWS Atlas	V	-	Breeds in upland tall moist eucalypt forests and woodlands, often on ridges and slopes. Prefers clearings or areas with open understoreys. The ground layer of the breeding habitat is dominated by native grasses and the shrub layer may be either sparse or dense. Occasionally occurs in temperate rainforest, and also in herbfields, heathlands, shrublands and sedgelands at high altitudes. In winter, birds migrate to drier more open habitats in the lowlands (i.e. valleys below the ranges, and to the western slopes and plains).	None	No
Gang-gang Cockatoo *Callocephalon fimbriatum*	NPWS Atlas	V	-	In summer, the Gang-gang Cockatoo is generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter, they may occur at lower altitudes in drier more open eucalypt forests and woodlands, and often found in urban areas.	Moderate	Yes

Table A.1 Threatened species recorded or with the potential to occur within 10 km of the survey area

Species	Source	Status		Habitat requirements[1]	Likelihood of occurrence	Further assessment and survey required?
		TSC Act	EPBC Act			
Glossy Black-Cockatoo *Calyptorhynchus lathami*	NPWS Atlas	V	-	The Glossy Black Cockatoo inhabits open forest and woodlands of the coast and the Great Dividing Range up to 1000 m in which stands of She-oak species, particularly Black She-oak (*Allocasuarina littoralis*), Forest She-oak (*A. torulosa*) or Drooping She-oak (*A. verticillata*) occur.	None	No
Little Eagle *Hieraaetus morphnoides*	NPWS Atlas	V	-	The Little Eagle is found throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment. It occurs as a single population throughout NSW. This species occupies open eucalypt forest, woodland or open woodland. Sheoak or *Acacia* woodlands and riparian woodlands of interior NSW are also used.	Moderate	Yes
Little Lorikeet *Glossopsitta pusilla*	NPWS Atlas	V	-	The Little Lorikeet is distributed widely across the coastal and Great Divide regions of eastern Australia from Cape York to South Australia. It forages primarily in the canopy of open *Eucalyptus* forest and woodland, yet also finds food in *Angophora, Melaleuca* and other tree species. Riparian habitats are particularly used by this species, due to higher soil fertility and hence greater productivity.	High	Yes
Masked Owl *Tyto novaehollandiae*	NPWS Atlas	V	-	The Masked Owl lives in dry eucalypt forests and woodlands from sea level to 1100 m. Its diet typically consists of tree-dwelling and ground mammals, especially rats.	Moderate	Yes
Painted Honeyeater *Grantiella picta*	NPWS Atlas	V	-	Inhabits Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus *Amyema.*	None	No
Powerful Owl *Ninox strenua*	NPWS Atlas	V	-	In NSW, the Powerful Owl is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered, mostly historical records on the western slopes and plains. This species roosts by day in dense vegetation comprising species such as Turpentine (*Syncarpia glomulifera)*, Black She-oak (*Allocasuarina littoralis)*, Blackwood (*Acacia melanoxylon)*, Rough-barked Apple (*Angophora floribunda)*, Cherry Ballart (*Exocarpus cupressiformis)* and a number of eucalypt species.	Moderate	Yes

Table A.1 Threatened species recorded or with the potential to occur within 10 km of the survey area

Species	Source	Status		Habitat requirements[1]	Likelihood of occurrence	Further assessment and survey required?
		TSC Act	EPBC Act			
Rainbow Bee-eater *Merops ornatus*	NPWS Atlas	-	Mi	The Rainbow Bee-eater is distributed across much of mainland Australia, and occurs on several near-shore islands. It is not found in Tasmania, and is thinly distributed in the most arid regions of central and Western Australia. It usually occurs in open, cleared or lightly-timbered areas that are often, but not always, located in close proximity to permanent water. The Rainbow Bee-eater is also common in cleared and semi-cleared habitats ie farmland.	Moderate	Yes
Regent Honeyeater *Anthochaera phrygia*	NPWS Atlas	CE	E	The Regent Honeyeater mainly inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. These birds are also found in drier coastal woodlands and forests in some years. Every few years non-breeding flocks are seen foraging in flowering coastal Swamp Mahogany (*Eucalyptus robusta*) and Spotted Gum (*Corymbia maculata*) forests, particularly on the central coast and occasionally on the upper north coast. Birds are occasionally seen on the south coast.	High	Yes
Rufous Fantail *Rhipidura rufifrons*	PMST	-	Mi	In east and south-east Australia, the Rufous Fantail mainly inhabits wet sclerophyll forests, often in gullies dominated by eucalypts such as Tallow-wood (*Eucalyptus microcorys*), Mountain Grey Gum (*E. cypellocarpa*), Narrow-leaved Peppermint (*E. radiata*), Mountain Ash (*E. regnans*), Alpine Ash (*E. delegatensis*), Blackbutt (*E. pilularis*) or Red Mahogany (*E. resinifera*); usually with a dense shrubby understorey often including ferns.	None	No
Satin Flycatcher *Myiagra cyanoleuca)*	PMST	-	Mi	The Satin Flycatcher is widespread in eastern Australia and vagrant to New Zealand (Blakers et al. 1984; Coates 1990). Satin Flycatchers inhabit heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, and on migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests.	None	No
Scarlet Robin *Petroica boodang*	NPWS Atlas	V	-	In NSW, the Scarlet Robin occurs from the coast to the inland slopes. This species lives in both mature and regrowth vegetation. It occasionally occurs in mallee or wet forest communities, or in wetlands and tea-tree swamps. Scarlet Robin habitat usually contains abundant logs and fallen timber: these are important components of its habitat.	Low	No
Sooty Owl *Tyto tenebricosa*	NPWS Atlas	V	-	The Sooty Owl occurs in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests.	Moderate	Yes

Table A.1 Threatened species recorded or with the potential to occur within 10 km of the survey area

Species	Source	Status		Habitat requirements[1]	Likelihood of occurrence	Further assessment and survey required?
		TSC Act	EPBC Act			
Spectacled Monarch *Monarcha trivirgatus*	PMST	-	Mi	The Spectacled Monarch prefers thick understorey in rainforests, wet gullies and waterside vegetation, as well as mangroves.	Moderate	Yes
Speckled Warbler *Chthonicola sagittata*	NPWS Atlas	V	-	The Speckled Warbler lives in a wide range of *Eucalyptus* dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy.	None	No
Swift Parrot *Lathamus discolor*	NPWS Atlas	E	E	The Swift Parrot migrates to the Australian south-east mainland between March and October. On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations.	High	Yes
Varied Sittella *Daphoenositta chrysoptera*	NPWS Atlas	V	-	The Varied Sittella inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. This species feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees and small branches and twigs in the tree canopy.	Low	No
Wompoo Fruit Dove *Ptilinopus magnificus*	NPWS Atlas	V	-	Occurs in, or near rainforest, low elevation moist eucalypt forest and brush box forests. Feeds on a diverse range of tree and vine fruits and is locally nomadic - following ripening fruit. Thought to be an effective medium to long-distance vector for seed dispersal.	Moderate	Yes
White-bellied Sea Eagle *Haliaeetus leucogaster*	NPWS Atlas	-	Mi	The White-bellied Sea-Eagle is found in coastal habitats (especially those close to the sea-shore) and around terrestrial wetlands in tropical and temperate regions of mainland Australia and its offshore islands. The habitats occupied by the sea-eagle are characterised by the presence of large areas of open water (larger rivers, swamps, lakes and the sea).	Low	No
White-throated Needletail *Hirundapus caudacutus*	NPWS Atlas	-	Mi	The White-throated Needletail occurs in open forest, rainforest, heathland, grassland and swamps. The species breeds in wooded lowlands and sparsely vegetated hills, as well as mountains covered with coniferous forests.	Low	No

Table A.1 Threatened species recorded or with the potential to occur within 10 km of the survey area

Species	Source	Status		Habitat requirements[1]	Likelihood of occurrence	Further assessment and survey required?
		TSC Act	EPBC Act			
FAUNA - Frogs						
Giant Barred Frog *Mixophyes iteratus*	PMST	E	E	Found on forested slopes of the escarpment and adjacent ranges in riparian vegetation, subtropical and dry rainforest and wet sclerophyll forests. This species is associated with flowing streams with high water quality, though habitats may contain weed species. They occur amongst deep, damp leaf litter in rainforests, moist eucalypt forest and nearby dry eucalypt forest, at elevations below 1000 m. They breed around shallow, flowing rocky streams from late spring to summer. Females lay eggs onto moist creek banks or rocks above water level, from where tadpoles drop into the water when hatched. Their distribution occurs along the coast and ranges from south-eastern Queensland to the Hawkesbury River in NSW. North-eastern NSW, particularly the Coffs Harbour-Dorrigo area, is now a stronghold.	None	No
Giant Burrowing Frog *Heleioporus australiacus*	PMST	V	V	The Giant Burrowing Frog is found in heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based. They spend more than 95% of their time in non-breeding habitat in areas up to 300 m from breeding sites. Whilst in non-breeding habitat, the Giant Burrowing Frog burrows below the soil surface or in the leaf litter.	None	No
Green and Golden Bell Frog *Litoria aurea*	PMST	E	V	Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (*Typha spp.)* or spikerushes (*Eleocharis spp*.). Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (*Gambusia holbrooki*), have a grassy area nearby and diurnal sheltering sites available. Some sites, particularly in the Greater Sydney region occur in highly disturbed areas, such as brick pits, landfill areas, disused industrial sites and cleared lands. Formerly distributed from the NSW north coast near Brunswick Heads, southwards along the NSW coast to Victoria where it extends into east Gippsland. Records from west to Bathurst, Tumut and the ACT region. Since 1990 there have been approximately 50 recorded locations in NSW, most of which are small, coastal, or near coastal populations. These locations occur over the species' former range, however they are widely separated and isolated. Large populations in NSW are located around the metropolitan areas of Sydney, Shoalhaven and mid north coast (one an island population). There is only one known population on the NSW Southern Tablelands.	None	No

Table A.1 Threatened species recorded or with the potential to occur within 10 km of the survey area

Species	Source	Status		Habitat requirements[1]	Likelihood of occurrence	Further assessment and survey required?
		TSC Act	EPBC Act			
Green-thighed Frog *Litoria brevipalmata*	NPWS Atlas	V	-	Green-thighed Frogs occur in a range of habitats from rainforest and moist eucalypt forest to dry eucalypt forest and heath, typically in areas where surface water gathers after rain. It prefers wetter forests in the south of its range, but extends into drier forests in northern NSW and southern Queensland. Breeding occurs following heavy rainfall from spring to autumn, with larger temporary pools and flooded areas preferred. Frogs may aggregate around breeding sites and eggs are laid in loose clumps among water plants, including water weeds. The larvae are free swimming. The frogs are thought to forage in leaf-litter.	Moderate	Yes
Littlejohns Tree Frog *Littoria littlejohni*	PMST	V	V	The Littlejohn's Tree Frog has a distribution that includes the plateaus and eastern slopes of the Great Dividing Range from Watagan State Forest (90 km north of Sydney) south to Buchan in Victoria. Non-breeding habitat is heath based forests and woodlands where it shelters under leaf litter and low vegetation, and hunts for invertebrate prey either in shrubs or on the ground.	None	No
Stuttering Frog *Mixophyes balbus*	PMST	E	V	The Stuttering Frog is restricted to the eastern slopes of the Great Divide, from the Cann River catchment in far East Gippsland, Victoria, to tributaries of the Timbarra River near Drake, New South Wales. They are found in association with permanent streams through temperate and sub-tropical rainforest and wet sclerophyll forest, rarely in dry open tableland riparian vegetation.	None	No
Wallum Froglet *Crinia tinnula*	NPWS Atlas	V	-	Wallum Froglets are found in wallum swamps and associated low land meandering watercourses on coastal plains. This species is primarily restricted to coastal areas of southern Queensland and northern New South Wales and is thought to be confined to acid paperbark swamps and a range of habitats from heath plains to rainforests. The species is a late winter breeder and breeds in low (acidic) pH areas.	High	Yes
FAUNA -Mammals						
Brush-tailed Rock Wallaby *Petrogale penicillata*	PMST	E	V	In NSW the Brush-tailed Rock Wallaby occurs from the Queensland border in the north to the Shoalhaven in the south, with the population in the Warrumbungle Ranges being the western limit. This species occupies rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north. The Brush-tailed Rock Wallaby browse on vegetation in and adjacent to rocky areas eating grasses and forbs as well as the foliage and fruits of shrubs and trees.	None	No

Table A.1 Threatened species recorded or with the potential to occur within 10 km of the survey area

Species	Source	Status		Habitat requirements[1]	Likelihood of occurrence	Further assessment and survey required?
		TSC Act	EPBC Act			
Eastern Bentwing Bat *Miniopterus schreibersii oceanensis*	NPWS Atlas	V	-	Eastern Bentwing Bats occur along the east and north-west coasts of Australia. Caves are the primary roosting habitat for this species, but they also use derelict mines, storm-water tunnels, buildings and other man-made structures. The Eastern Bentwing Bat forms discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young.	Moderate – foraging only	Yes
Eastern False Pipistrelle *Falsistrellus tasmaniensis*	NPWS Atlas	V	-	The Eastern False Pipistrelle is found on the south-east coast and ranges of Australia, from southern Queensland to Victoria and Tasmania. This species prefers moist habitats, with trees taller than 20 m, generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings.	High	Yes
Eastern Freetail Bat *Mormopterus norfolkensis*	NPWS Atlas	V	-	The Eastern Freetail-Bat is found along the east coast from south Queensland to southern NSW. The Eastern Freetail Bat occurs in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. This species roosts mainly in tree hollows but will also roost under bark or in man-made structures.	High	Yes
Golden-tipped Bat *Kerivoula papuensis*	NPWS Atlas	V	-	Found in rainforest and adjacent wet and dry sclerophyll forest up to 1000m. Also recorded in tall open forest, Casuarina-dominated riparian forest and coastal Melaleuca forests. Bats will fly up to two kilometres from roosts to forage in rainforest and sclerophyll forest on mid and upper-slopes. Roost mainly in rainforest gullies on small first- and second-order streams in usually abandoned hanging Yellow-throated Scrubwren and Brown Gerygone nests modified with an access hole on the underside. Bats may also roost under thick moss on tree trunks, in tree hollows, dense foliage and epiphytes.	Moderate	Yes
Greater Broadnosed Bat *Scoteanax rueppellii*	NPWS Atlas	V	-	The Greater Broad-nosed Bat is found mainly in the gullies and river systems that drain the Great Dividing Range, from north-eastern Victoria to the Atherton Tableland. It extends to the coast over much of its range. In NSW it is widespread on the New England Tablelands, however does not occur at altitudes above 500 m. This species utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest.	High	Yes

Table A.1 Threatened species recorded or with the potential to occur within 10 km of the survey area

Species	Source	Status		Habitat requirements[1]	Likelihood of occurrence	Further assessment and survey required?
		TSC Act	EPBC Act			
Grey-headed Flying-fox *Pteropus poliocephalus*	NPWS Atlas	V	V	Grey-headed Flying foxes occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy.	High	Yes
Koala *Phascolarctos cinereus*	NPWS Atlas	V	V	In NSW, the koala mainly occurs on the central and north coast with some populations in the west of the Great Dividing Range. The Koala inhabits eucalypt woodlands and forests. They feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species.	High	Yes
Large-eared Pied Bat *Chalinolobus dwyeri*	PMST	V	V	The Large-eared Pied Bat roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (*Petrochelidon ariel*), frequenting low to mid-elevation dry open forest and woodland close to these features.	Low	No
Little Bentwing Bat *Miniopterus australis*	NPWS Atlas	V	-	The Little Bentwing Bat is distributed on the East coast and ranges of Australia from Cape York in Queensland to Wollongong in NSW. It is generally found in well-timbered areas. Little Bentwing-bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats.	Moderate – foraging only	Yes
Long-nosed Potoroo *Potorous tridactylus tridactylus*	PMST	V	V	The Long-nosed Potoroo inhabits coastal heaths and dry and wet sclerophyll forests. A dense understorey with occasional open areas is an essential part of this species' habitat, and may consist of grass-trees, sedges, ferns or heath, or of low shrubs of tea-trees or melaleucas.	Moderate	Yes
New Holland Mouse *Pseudomys novaehollandiae*	NPWS Atlas	-	V	The New Holland Mouse is known to inhabit open heathlands, woodlands and forests with a heathland understorey and vegetated sand dunes. It is a social animal, living predominantly in burrows shared with other individuals.	None	No

Table A.1 Threatened species recorded or with the potential to occur within 10 km of the survey area

Species	Source	Status		Habitat requirements[1]	Likelihood of occurrence	Further assessment and survey required?
		TSC Act	EPBC Act			
Southern Myotis *Myotis macropus*	NPWS Atlas	V	-	The Southern Myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. It is rarely found more than 100 km inland, except along major rivers. They generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Southern Myotis forage over streams and pools catching insects and small fish by raking their feet across the water surface.	Low	No
Spotted-tailed Quoll *Dasyurus maculatus*	NPWS Atlas	V	E	The Spotted-tailed Quoll inhabits a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites.	Low	No
Squirrel Glider *Petaurus norfolcensis*	NPWS Atlas	V	-	Inhabits dry sclerophyll forest and woodland where it is absent from the dense coastal ranges. Forages on pollen and nectar and the gum that acacias produce. Also eats sap from gums and the green seeds of the Golden Wattle. Associated with dry hardwood forest and woodlands. Habitats typically include gum-barked and high nectar-producing species, including winter flowering species. The presence of hollow-bearing eucalypts is a critical habitat value. The Squirrel Glider is sparsely distributed along the east coast and immediate inland districts from western Victoria to north Queensland.	High	Yes
Yellow-bellied Glider *Petaurus australis*	NPWS Atlas	V	-	Occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. Forest type preferences vary with latitude and elevation; mixed coastal forests to dry escarpment forests in the north; moist coastal gullies and creek flats to tall montane forests in the south.	Moderate	Yes
FAUNA - Reptiles						
Pale-headed Snake *Hoplocephalus bitorquatus*	NPWS Atlas	V	-	The Pale-headed Snake is a highly cryptic species that can spend weeks at a time hidden in tree hollows. Found mainly in dry eucalypt forests and woodlands, cypress forest and occasionally in rainforest or moist eucalypt forest. In drier environments, it appears to favour habitats close to riparian areas. Shelter during the day between loose bark and tree-trunks, or in hollow trunks and limbs of dead trees.	Moderate	Yes

Table A.1 Threatened species recorded or with the potential to occur within 10 km of the survey area

Species	Source	Status		Habitat requirements[1]	Likelihood of occurrence	Further assessment and survey required?
		TSC Act	EPBC Act			
Stephen's Banded Snake *Hoplocephalus stephensii*	NPWS Atlas	V	-	Rainforest and eucalypt forests and rocky areas up to 950 m in altitude. Stephens' Banded Snake is nocturnal, and shelters between loose bark and tree trunks, amongst vines, or in hollow trunks limbs, rock crevices or under slabs during the day. At night it hunts frogs, lizards, birds and small mammals.	Moderate	Yes

Appendix B

Preliminary assessments of significance

B.1 Significant impact criteria in accordance with the TSC Act

Section 5A of the EP&A Act provides the criteria that must be considered in the assessment of the significance of potential impacts on all threatened species listed under the TSC Act. Assessment of Significance (known as the seven-part test) is made up of the following seven questions:

1. 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;

2. 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;

3. In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

    a) 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;

    b) 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;

4. In relation to the habitat of a threatened species, population or ecological community:

    a) the extent to which habitat is likely to be removed or modified as a result of the action proposed;

    b) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action;

    c) 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;

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

6. Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan; and

7. 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.

Assessments of significance are undertaken in accordance with *Threatened species assessment guidelines: The assessment of significance* (DEC 2007).

B.1.1 Preliminary assessments of significance

Preliminary seven-part tests have been prepared for species and communities listed under the TSC Act in accordance with the criteria presented in B.2. It is expected that these assessments would be revised following the completion of detailed ecological surveys of the site.

Preliminary assessments have been undertaken for guilds of species or communities which have similar habitat requirements. The results of tests have been tabulated for ease of reading and are presented in the following sections.

i Endangered ecological communities: Swamp Sclerophyll Forest and Lowland Rainforest

Swamp Sclerophyll Forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions (Swamp Sclerophyll Forest) is listed as an endangered ecological community under the NSW TSC Act. Swamp Mahogany Forest, which is representative of Swamp Sclerophyll Forest EEC, occurs across much of the study area. The community is associated with humic clay loams and sandy loams, on waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains. Up to 8.5 ha of the community in this area would be cleared according to the draft project design.

Lowland Rainforest on the NSW North Coast and Sydney Basin Bioregions (Lowland Rainforest) is listed as an endangered ecological community under the NSW TSC Act. Small patches of Lowland Rainforest occur in the study area, and its local distribution extends outside the study area along Bangalow Creek. The draft project design would remove 0.6 ha of this community from the study area.

A preliminary assessment of significance has been completed to assess potential impacts of the draft project design on these endangered ecological communities (Table B.1).

Table B.1 Preliminary assessment of significance for Swamp Sclerophyll Forest and Lowland Rainforest

Criteria	Discussion
1: life cycle of threatened species	Swamp Sclerophyll Forest and Lowland Rainforest are endangered ecological communities. Therefore, this question is not relevant to the assessment.
2: life cycle of endangered population	Swamp Sclerophyll Forest and Lowland Rainforest are endangered ecological communities. Therefore, this question is not relevant to the assessment.

Table B.1 Preliminary assessment of significance for Swamp Sclerophyll Forest and Lowland Rainforest

Criteria	Discussion
3: EEC extent of removal and modification	*Swamp Sclerophyll Forest* The local occurrence of Swamp Sclerophyll Forest EEC in the study area covers 30 ha. Given the site's location on a floodplain, much of the original Swamp Sclerophyll Forest has likely been cleared for rural residential properties and horse agistment, meaning that the study area represents the local occurrence of the community. The draft project design would remove up to 8.5 ha of the local occurrence of Swamp Sclerophyll Forest. This reduction in extent is likely to have an adverse effect on the local occurrence of the ecological community, such that without management, the remaining areas would be subject to increased weed invasion and changes to hydrology. This may adversely modify the composition of the ecological community and increase its extinction risk, given that it is an isolated patch that is not connected to other patches of the community. *Lowland Rainforest* The local occurrence of Lowland Rainforest in the study area covers 0.6 ha. As the community is likely to occur along much of Bangalow Creek, much of the local occurrence is located outside the study area and would not be directly impacted by the project. As only 0.6 ha would be removed from a larger patch of the community, the project is unlikely to have an adverse effect on the ecological community such that its extinction risk is increased. Without management, the project could adversely modify the composition of the ecological community adjacent to the project area through the introduction of weeds and changes to hydrology.
4: habitat removal, fragmentation, isolation and importance	*Swamp Sclerophyll Forest* The draft project design would remove up to 8.5 ha of Swamp Sclerophyll Forest from the study area. The proposed maintenance facility and rail lines would partially fragment the community into a linear remnant along the rail corridor and a remnant to the north. However, connectivity would be retained through the three eastern most lots. The occurrence of Swamp Sclerophyll Forest in the study area is important as it represents the local occurrence of the community. Surrounding vegetation is higher in altitude and relief, and does not support this community. *Lowland Rainforest* The draft project design would remove up to 0.6 ha of Lowland Rainforest from the study area. The proposed road extension in the north of the study area would cause minor fragmentation of Lowland Rainforest. Minor fragmentation would also occur in the patch that occurs in the rail corridor. The larger local occurrence of Lowland Rainforest along Bangalow Creek is important to the survival of the community. The removal of these two small patches and minor fragmentation is not expected to substantially modify this community.
5: critical habitat	Critical habitat under the TSC Act has not been declared for Swamp Sclerophyll Forest or Lowland Rainforest.
6: consistency with recovery or threat abatement plans	A recovery or threat abatement plan has not been prepared for Swamp Sclerophyll Forest or Lowland Rainforest. Management actions identified for the communities include further research and protection of remnants. The project does not interfere with research, however it is inconsistent with management actions for the community as they would be partially cleared in the study area.
7: key threatening processes	The impacts to key threatening processes '*clearing of native vegetation*' have been considered for the modification. Under the final determination (NSWSC 2011), clearing is defined as the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss, or long term modification, of the structure, composition and ecological function of stand or stands. The project is likely to increase the operation of this key threatening process relevant to Swamp Sclerophyll Forest given the large area to be cleared, but not for Lowland Rainforest given that only small patches would be removed. The key threatening process, '*Forest Eucalypt dieback associated with over-abundant psyllids and bell miners*' is in operation in part of the Swamp Sclerophyll Forest in the study area. As Bell Miners are edge specialists, new edges created by clearing are likely to cause their numbers to increase in the study area. Therefore, the project is likely to exacerbate this key threatening process relevant to Swamp Sclerophyll Forest.

Table B.1 Preliminary assessment of significance for Swamp Sclerophyll Forest and Lowland Rainforest

Criteria	Discussion
Conclusion	The project is likely to result in significant impacts to Swamp Sclerophyll Forest EEC as: • it would reduce the local occurrence by 8.5 ha; • it would cause partial fragmentation of the local occurrence; and • it may exacerbate the key threatening process, *'Forest dieback associated with over-abundant psyllids and bell miners'* in the study area. The project is unlikely to result in significant impacts to Lowland Rainforest EEC as: • only 0.6 ha would be removed from the study area, while the local occurrence extends along Bangalow Creek outside the study area; and • fragmentation would occur, however it would only be minor.

ii Threatened flora: Biconvex Paperbark (*Melaleuca biconvexa*)

Biconvex Paperbark is listed as a vulnerable species under the TSC Act. It occurs as several large and small patches in low-lying parts of the study area. Two large and two small patches containing several hundred individuals would be affected by the draft project design.

A preliminary assessment of significance under Section 5A of the EP&A Act has been completed for this threatened plant species (Table B.2).

Table B.2 Assessment of impact criteria for Biconvex Paperbark

Criteria	Discussion
1: Life cycle of threatened species	The life cycle of flora species can be affected in the following main ways: • impacts to pollination (internal mechanisms or impacts to pollinators) – Biconvex Paperbark is pollinated by insects, mammals, birds and the wind. The draft project design would remove habitat for pollinators from two large and two small stands of the species, and therefore may affect pollination in retained individuals. As pollination may be affected, it may reduce the ability of retained individuals to produce flowers and set seed. • ability to reproduce and ability of seedlings to grow– the species reproduces through vegetated suckers. Many small individuals were observed in the area to be removed, and therefore the project would prevent reproduction in this area. The project would not directly affect suckers outside the area of impact.
2: Life cycle of endangered population	This question refers to endangered populations, therefore is not relevant to this assessment.
3: EEC extent and modification	This question refers to EECs, therefore is not relevant to this assessment.

Table B.2 Assessment of impact criteria for Biconvex Paperbark

Criteria	Discussion
4: Habitat removal, fragmentation, isolation and importance	The number of individuals of Biconvex Paperbark has not been confirmed on the site. However, the draft project design would remove a large stand for the proposed maintenance facility, remove the edge of a large stand in the rail corridor, and remove the edge of a smaller stand in the roadside. Biconvex Paperbark has been identified on the threatened species profile database as one that cannot withstand further loss in the Hunter-Central Rivers CMA, in which the project is located. The removal of the large stand for the maintenance facility would isolate the retained patches in the rail corridor from those in the roadside. Individuals in the study area are considered important, as they represent the western extent of the population in the area.
5: Critical habitat	Critical habitat has not been declared for these species.
6: Consistency with recovery or threat abatement plans	Biconvex Paperbark does not have a recovery plan. It is currently managed as a 'site-managed species' under OEH's saving our species program. Three management sites have been established for large populations of the species: at Wyong, Ourimbah and the Shoalhaven. The population in the study area is not currently managed for conservation. Therefore, the project does not interfere with management actions for the species.
7: Key threatening processes	The impacts to key threatening processes '*clearing of native vegetation*' have been considered for the modification. Under the final determination (NSWSC 2011), clearing is defined as the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation so as to result in the loss, or long term modification, of the structure, composition and ecological function of stand or stands. As a large stand of the species would be cleared, the project would exacerbate the key threatening process, '*clearing of native vegetation*'.
Conclusion	The project is likely to result in significant impacts for Biconvex Paperbark as: • a large stand of the community would be removed from the study area, and the edge of two smaller stands would be removed; • the project would cause the isolation of stands of the species; and • the species has been identified on the threatened species profile database as one that cannot withstand further loss in the Hunter-Central Rivers CMA area, in which the project is located.

B.2 Significant impact criteria in accordance with the EPBC Act

The following sections provide the criteria that must be considered in the assessment of all threatened species listed under the EPBC Act. There are separate criteria for each listing category under the EPBC Act, in accordance with *'EPBC Act Policy Statement 1.1 Significant Impact Guidelines: Matters of National Environmental Significance'* (DoE 2013).

B.2.1 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:

- lead to a long-term decrease in the size of an important population of a species;
- reduce the area of occupancy of an important population;
- fragment an existing important population into two or more populations;
- adversely affect habitat critical to the survival of a species;

- disrupt the breeding cycle of an important population;
- modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;
- result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species habitat;
- introduce disease that may cause the species to decline; or
- interfere substantially with the recovery of the species.

i Vulnerable plant: Biconvex Paperbark

See Section B.1.1 (ii) for a description of the vulnerable plants. A preliminary assessment of significance has been completed to assess potential impacts on Biconvex Paperbark (Table B.3). It is expected that this assessment would be revised following the completion of detailed ecological surveys of the site.

Table B.3 Preliminary assessment of significance for Biconvex Paperbark

Criteria	Discussion
1: Long-term decrease of an important population	*EPBC Act Policy Statement 1.1 Significant Impact Guidelines* (DoE 2013) defines an important population as: "...a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are: • key source populations either for breeding or dispersal; • populations that are necessary for maintaining genetic diversity; and/or • populations that are near the limit of the species range. As the number of individuals has not yet been determined, it is currently unknown if the study area contains a key source population or one that is necessary for maintaining genetic diversity. The population in the study area is located near the western limit of the species range. For the purposes of this assessment, the precautionary principle has been used and it is assumed that the study area contains an important population. A large stand of the community would be removed for the proposed maintenance facility. This is the largest stand in the study area, and is likely to be important to the species continued persistence at the site. This may lead to a long-term decrease of the assumed important population at the site as retained populations are smaller and would become more vulnerable to extinction without the larger stand.
2: Reduce area of occupancy of an important population	For the purposes of this assessment, it has been assumed that an important population of the species occurs in the study area. The proposed maintenance facility would reduce the area of occupancy at the site by removing the largest population from the study area.
3: Fragment an important population	For the purposes of this assessment, it has been assumed that an important population of the species occurs in the study area. Removal of the largest stand of the species from the study area would cause the fragmentation of stands of the individuals in the rail corridor and those on the roadside.

Table B.3 Preliminary assessment of significance for Biconvex Paperbark

Criteria	Discussion
4: Adversely affect critical habitat	Critical habitat has not been declared on the EPBC register for Biconvex Paperbark. However, critical habitat for a species under the EPBC Act is also defined as areas that are necessary for: • for activities such as foraging, breeding, roosting, or dispersal; • for the long-term maintenance of the species (including the maintenance of species essential to the survival of the species such as pollinators); • to maintain genetic diversity and long-term evolutionary development; and • for reintroduction of populations or recovery of the species. As stated above, the number of individuals in the study area has not yet been determined. Therefore, it is unknown whether the site contains critical habitat for the species. Using the precautionary principle it has been assumed that critical habitat may be present for the species, which would be adversely affected by the project.
5: Disrupt the breeding cycle of an important population	For the purposes of this assessment, it has been assumed that an important population of the species occurs in the study area. The breeding cycle of flora species can be affected in the following main ways: • impacts to pollination (internal mechanisms or impacts to pollinators) – Biconvex Paperbark is pollinated by insects, mammals, birds and the wind. The draft project design would remove habitat for pollinators from two large and two small stands of the species, and therefore may affect pollination in retained individuals. As pollination may be affected, it may reduce the ability of retained individuals to produce flowers and set seed; and • ability to reproduce and ability of seedlings to grow– the species reproduces through vegetated suckers. Many small individuals were observed in the area to be removed, and therefore the project would prevent reproduction in this area. The project would not directly affect suckers outside the area of impact.
6: Modify, destroy, remove or isolate or decrease availability or quality of habitat	The number of individuals of Biconvex Paperbark has not been confirmed on the site. However, the draft project design would remove a large stand for the proposed maintenance facility, remove the edge of a large stand in the rail corridor, and remove the edge of a smaller stand in the roadside. This would decrease the availability and quality of habitat in the study are for the species. The removal of the large stand for the maintenance facility would isolate the retained patches in the rail corridor from those in the roadside. Individuals in the study area are considered important, as they represent the western extent of the population in the area.
7: Result in invasive species	As the project would disturb soil at the site, without management it has the potential to introduce new weeds or increase the level of invasion of existing weeds at the site.
8: Introduce disease	Biconvex Paperbark is not known to be subject to disease.
9: Interfere with recovery	Biconvex Paperbark does not have a recovery plan. Management actions identified in the *Approved Conservation Advice for Biconvex Paperbark* (TSSC 2008) focus on identifying populations of conservation priority and their protection. As a large stand of the species would be removed from the site and small areas would be removed from smaller stands, the project is not consistent with the species recovery.
Conclusion	The project would likely result in significant impacts for Biconvex Paperbark as: • the project may affect an important population and/or critical habitat for the species; and • a large stand would be removed and small areas would be removed from smaller stands.

EMGA Mitchell McLennan

SYDNEY
Ground floor, Suite 1, 20 Chandos Street
St Leonards, New South Wales, 2065
T 02 9493 9500 F 02 9493 9599

NEWCASTLE
Level 5, 21 Bolton Street
Newcastle, New South Wales, 2300
T 02 4927 0506 F 02 4926 1312

BRISBANE
Suite 1, Level 4, 87 Wickham Terrace
Spring Hill, Queensland, 4000
T 07 3839 1800 F 07 3839 1866

New Intercity Fleet - Maintenance Facility:

Aboriginal Cultural Heritage Due Diligence Assessment

FINAL

Prepared for Transport for New South Wales (TfNSW)

16 October 2015

Biosis offices

AUSTRALIAN CAPITAL TERRITORY

Canberra

Floor 1, Unit 3, 38 Essington Street
Mitchell ACT 2911

Phone: (02) 6241 2333
Fax: (03) 9646 9242
Email: canberra@biosis.com.au

NEW SOUTH WALES

Sydney

Unit 14, 17-27 Power Avenue
Alexandria NSW 2015

Phone: (02) 9690 2777
Fax: (02) 9690 2577
Email: sydney@biosis.com.au

Wollongong

8 Tate Street
Wollongong NSW 2500

Phone: (02) 4229 5222
Fax: (02) 4229 5500
Email: wollongong@biosis.com.au

Newcastle

39 Platt Street
Waratah NSW 2298

Phone: (02) 4968 4901
Fax: (02) 9696 9242
Email: Newcastle@biosis.com.au

QUEENSLAND

Brisbane

Suite 4 First Floor, 72 Wickham Street
Fortitude Valley QLD 4006

Phone: (07) 3831 7400
Fax: (07) 3831 7411
Email: brisbane@biosis.com.au

VICTORIA

Ballarat

506 Macarthur Street
Ballarat VIC 3350

Phone: (03) 5331 7000
Fax: (03) 5331 7033
Email: ballarat@biosis.com.au

Melbourne (Head Office)

38 Bertie Street
Port Melbourne VIC 3207

Phone: (03) 9646 9499
Fax: (03) 9646 9242
Email: melbourne@biosis.com.au

Wangaratta

16 Templeton Street
Wangaratta VIC 3677

Phone: (03) 5721 9453
Fax: (03) 5721 9454
Email: wangaratta@biosis.com.au

Document information

Report to:	Transport for New South Wales (TfNSW)
Prepared by:	James Cole Nicole Castle
Biosis project no.:	20143
File name:	20143.TfNSW.NewInterCityFleet.ADD.FIN01.20151016.docx
Citation:	Biosis (2015). New Intercity Fleet - Maintenance Facility: Aboriginal Cultural Heritage Due Diligence Assessment. Report for Transport for New South Wales. Authors: J Cole & N Castle, Biosis Pty Ltd, Sydney. Project no. 20143

Document control

Version	Internal reviewer	Date issued
Draft version 01	Amanda Atkinson	28/09/2015
Final version 01	Alex Beben	16/10/2015

Acknowledgements

Biosis acknowledges the contribution of the following people and organisations in undertaking this study:

- TfNSW: Swathi Gowda, Stephanie Mifsud, Tony Waters, Ben Groth and Tanya Coates

The following Biosis staff were involved in this project:

- Nicole Castle for assistance in the field
- James Shepherd and Lauren Harley for mapping

Contents

List of Tables

List of Figures

List of Plates

Glossary

AHIMS	Aboriginal Heritage Information Management System
AMBS	Australian Museum Business Services
DECCW	Department of Environment, Climate Change & Water
DoE	Department of the Environment
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
GPS	Global Positioning System
LEP	Local Environment Plan
MGA	Map Grid of Australia
NPW Act	*National Parks and Wildlife Act 1974*
NSW	New South Wales
OEH	NSW Office of Environment and Heritage
PAD	Potential Archaeological Deposit
TfNSW	Transport for New South Wales

Summary

Biosis Pty Ltd (Biosis) has been commissioned by Transport for New South Wales (TfNSW) to undertake an Aboriginal Cultural Heritage Due Diligence Assessment for the proposed Maintenance Facility as part of the New Intercity Fleet Program at Kangy Angy, NSW.

Background research was undertaken into the study area, including a search of the Aboriginal Heritage Information Management System (AHIMS) register and a review of previous studies undertaken in the local area. Two previous assessments have been undertaken which have included the northern portion of the study area.

For the purpose of the site survey, the study area was separated into Study Area 1 and Study Area 2, due to timing of access to privately owned properties. The site survey for Study Area 1 and Study Area 2 was conducted on 14 September 2015 and 21 September 2015, respectively by Nicole Castle (Consultant Archaeologist - Biosis). During the site survey areas of previous disturbance were noted and recorded. Areas of ground surface exposure were targeted in order to identify any Aboriginal objects within the study area. No previously unrecorded sites or objects were located during the site survey.

There is a high potential for artefact scatters to be present within minimally disturbed elevated areas overlooking creeklines. There is also a moderate potential for scarred trees to be present within uncleared areas of the study area which were unable to be surveyed due to restricted access. There is also a high potential for grinding grooves or rock engravings to be present within suitable sandstone outcrops within the study area.

The likelihood of unknown Aboriginal objects or places being impacted within the study area is assessed as high. The *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (DECCW 2010) ('due diligence code') provides a flowchart with the steps of the due diligence process outlined. This flowchart is provided in Figure 7 in order to demonstrate that each step of the process has been addressed.

The following management recommendations have been developed relevant to the study area and influenced by:

- Predicted impacts to Aboriginal cultural heritage.
- The planning approvals framework.
- Current best conservation practise, widely considered to include:
  - Ethos of the Australia ICOMOS Burra Charter; and,
  - The *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010) ('the code')

Prior to any impacts occurring within the study area, the following is recommended:

Recommendation 1: *Further archaeological assessment is required*

Further archaeological assessment is required in the study area prior to the proposed impacts due to areas of the study area assessed as having high and low archaeological potential (Figure 6). Further assessment would be required in the form of an Aboriginal Cultural Heritage Assessment in accordance with the *Code of Practice for the Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010). Consultation with the Aboriginal community would also be required as a part of the further archaeological assessment in accordance with the *Aboriginal cultural heritage consultation requirements for proponents* (DECCW 2010).

Recommendation 2: *No further archaeological assessment is required within the rail corridor*

No further archaeological assessment is required within the existing rail corridor and areas of associated disturbance including the railway underbridge due to the extensive disturbance which has taken place within this area (Figure 6).

Recommendation 3: *Discovery of Unanticipated Aboriginal Objects*

All Aboriginal objects and places are protected under the *National Parks and Wildlife Act 1974*. It is an offence to knowingly disturb an Aboriginal site without a consent permit issued by the Office of Environment and Heritage (OEH). Should any Aboriginal objects be encountered during works associated with this proposal within those areas outlined in Recommendation 2, works must cease in the vicinity and the find should not be moved until assessed by a qualified archaeologist. If the find is determined to be an Aboriginal object the archaeologist will provide further recommendations. These may include notifying the OEH and Aboriginal stakeholders.

Recommendation 4: **Discovery of Aboriginal Ancestral Remains**

Aboriginal ancestral remains may be found in a variety of landscapes in NSW, including middens and sandy or soft sedimentary soils. If any suspected human remains are discovered during any activity you must:

1. Immediately cease all work at that location and not further move or disturb the remains
2. Notify the NSW Police and OEH's Environmental Line on 131 555 as soon as practicable and provide details of the remains and their location
3. Not recommence work at that location unless authorised in writing by OEH.

1 Introduction

1.1 Project background

Biosis Pty Ltd has been commissioned by TfNSW to undertake an Aboriginal Cultural Heritage Due Diligence Assessment for a proposed Maintenance Facility as part of the New Intercity Fleet Program at Kangy Angy, NSW (the Project).

The objectives of this project are to develop a new maintenance facility which:

- Caters for intercity fleet capacity requirements to at least 2036
- Provides more cost effective maintenance operation than current NSW intercity facilities
- Supports efficient operation of trains
- Supports condition monitoring and component change out functionality

One recorded Aboriginal site was identified during a previous search of the area and areas of high potential for Aboriginal archaeological sensitivity were identified in association with watercourses within the study area as a part of the *Draft Central Coast Train Stabling and Maintenance Comparative Site Analysis* completed by GHD in 2015. Therefore, an assessment in accordance with the due diligence code has been undertaken for the study area in order to inform responsibilities with regards to Aboriginal cultural heritage. The tasks involved with this assessment included searches of the relevant registers including the Aboriginal Heritage Information Management System (AHIMS) register and the Wyong Local Environmental Plan (LEP) 2013, an extended background review, and an archaeological survey has been conducted, in order adequately map areas of archaeological potential within the study area. From these tasks, an impact statement has been prepared for the study area, including recommendations for the management of Aboriginal heritage within the area.

1.2 Location of the study area

The study area is located within the Wyong Shire Local Government Area (LGA) (Figure 1). The study area is located on the western side of the rail corridor, near the suburb of Kangy Angy, between Ourimbah and Tuggerah on the NSW Central Coast. The site is bounded by Chittaway Creek to the south, Ourimbah Creek to the north, Orchard Road to the west, and the Main North Railway Line to the east. For the purpose of the site survey, the study area has been separated into Study Area 1 and Study Area 2 (Figure 2).

The study area lies approximately 3.5 kilometres west of Chittaway Bay, at the south-eastern corner of the Tuggerah Lake. To its south, north, and west it is surrounded by cleared paddocks, bordered by the Pacific Highway. To its east across the railway line is an industrial area, along with a number of residential dwellings.

1.3 Planning approvals

The proposed development would be assessed against Part 5 of the *Environmental Planning and Assessment Act 1979* NSW. Other relevant legislation and planning instruments that will inform the assessment include:

- *Environmental Planning and Assessment (EP & A) Act 1979* (NSW)
- *National Parks and Wildlife (NPW) Act 1974* (NSW)
- *National Parks and Wildlife Amendment Act 2010* (NSW)
- *Wyong Local Environmental Plan (LEP) 2013*.

1.4 Scope of the assessment

The following is a summary of the major objectives of the assessment:

- Register searches to ascertain whether there are any recorded Aboriginal sites or areas of cultural significance in the vicinity of the study area.
- Background research to discuss previous Aboriginal heritage studies in the vicinity of the study area.
- A site survey each for Study Area 1 and Study Area 2.
- The preparation of an impact assessment including recommendations for management and mitigation of any Aboriginal sites that may be impacted.

1.5 Aboriginal consultation

Consultation with the Aboriginal community is not a formal requirement of the Due Diligence process, however it is recognised in NSW that Aboriginal people are the primary determinants of the significance of their cultural heritage. A landscape may hold intangible values that can be assessed only by the Aboriginal community. Given the confidential nature of the project at this stage, this assessment has been prepared without consultation with the Aboriginal Community.

2 Desktop assessment

A desktop assessment has been undertaken to review existing archaeological studies for the study area and surrounding region. This information has been synthesised to develop an Aboriginal site prediction model for the study area and identify known Aboriginal sites and/or Places recorded in the study area.

2.1 Landscape context

2.2 Geology, soils and landforms

Soil landscapes have distinct morphological and topological characteristics that result in specific archaeological potential. They are defined by a combination of soils, topography, vegetation and weathering conditions, soil landscapes are essentially terrain units that provide a useful way to summarise archaeological potential and exposure. The study area is located within a system of quaternary sediments comprised of gravel, sand, silt, and clay (Figure 3) (Murphy 1993, p. 84).

The Yarramalong Soil Landscape is present within the study area (Figure 4). It is characterised as a series of deep alluvial soils and siliceous sands on higher ground, deep alluvial soils and red earths along levee banks, and alluvial soils and yellow earths on terraces. Local relief is less than 10 metres, and the wider landform pattern is described as a narrow to moderately broad alluvial plain (Murphy 1993, pp. 84-86) (Table 1).

Table 1 Yarramalong soil landscape characteristics (Murphy 1993).

Soil material	Description
Loose brown sand	Loose brown sand to sandy loam. It usually occurs as topsoil (A 1 horizon) but can occur as both topsoil and subsoil.
Brown pedal loam	Brown moderately pedal light sandy clay loam to silty clay loam with sub-angular blocky structure and rough ped fabric. It usually occurs as topsoil (A horizon) but can occur as both topsoil and subsoil.
Earthy yellowish brown sandy clay loam	Yellowish brown sandy clay loam with apedal massive structure and earthy fabric. It usually occurs as subsoil (B horizon) on levee banks and terraces.
Brown pedal clay	Strongly pedal, when dry, light or medium clay with strong angular blocky structure and smooth ped fabric. It usually occurs as subsoil (B horizon) in more poorly drained country away from river channels.

The nearest permanent water source to the study area is Ourimbah Creek, which runs parallel to the study area, around 400 metres to its north-west. Two tributaries of Ourimbah Creek flow through the southern portions of the study area, one of these is a first order creek (flowing north through the south-western extent of the study area) and the other a second order creek (flowing north through the north-western extent of the study area).

Ourimbah Creek find its outlet in the Tuggerah Lake, and begins in the southern slopes of the Hunter Ranges around 1.6 kilometres south of Kulnura (Geographical Names Board 2015). Aboriginal Heritage Information

Management System (AHIMS) results indicate that further upstream from the study area, grinding grooves and rock shelters are common in close proximity to Ourimbah Creek and its tributaries. Downstream from the study area moving towards Tuggerah Lake, artefact sites become more common in close proximity to Ourimbah Creek.

2.3 Flora and fauna

The study area is part of the Wyong subregion of the Sydney Basin Bioregion. This broad subregion contains a wide variety of native vegetation, typically smooth-barked apple, red bloodwood, brown stringybark, spotted gum, northern grey ironbark and grey gum on hills and hillslopes. Prickly-leaved tea-tree and other shrubs with swamp mahogany, swamp oak, sedges and common reed are typically present on swampy creek flats (NPWS 2003, p. 192).

2.4 Resource statement

The Tuggerah Lakes would have generally provided a number of resources used by Aboriginal inhabitants, particularly in estuarine and riverine areas.

The wider region includes distinct ecological zones, including open forest and open woodland, with riparian vegetation extending along many of the watercourses. Each ecological zone hosts a different array of floral and faunal species, many of which would have been utilised according to seasonal availability. Aboriginal inhabitants of the region would have had access to a wide range of avian, terrestrial and aquatic fauna and repeated firing of the vegetation would have opened up the foliage allowing ease of access through and between different resource zones.

Plant resources were used in a variety of ways. Fibres were twisted into string, which was used for many purposes, including the weaving of nets, baskets and fishing lines. String was also used for personal adornment. Bark was used in the provision of shelter; a large sheet of bark being propped against a stick to form a gunyah (Attenbrow 2002). As well as being important food sources, animal products were also used for tool making and fashioning a myriad of utilitarian and ceremonial items. Tail sinews are known to have been used to make fastening cord, while 'bone points', which would have functioned as awls or piercers, are often an abundant part of the archaeological record. Animals such as Brush-tailed Possums were highly prized for their fur, with possum skin cloaks worn fastened over one shoulder and under the other. Kangaroo teeth were incorporated into decorative items, such as head bands (Attenbrow 2002).

2.5 Land use

Exploration of the wider Gosford and Wyong regions began shortly after European colonization of NSW, with Governor Phillip pushing north of Sydney along the coast in the 1780s and 1790s. Early townships set up in the area included Gosford, Kincumber, and Snodgrass Valley (Strom 1982, pp. 1-10). Closer to the study area, at Ourimbah, a timber cutting mill was established, with the proprietors immediately beginning to exploit blackbutt and blue gum resources in the area. The broader area covered by the lease entitled the owner to gather timber along Ourimbah Creek to the north of Ourimbah (Strom 1982, p. 14, David Scobie Architects 2010, p. 55). Although no maps are available which demonstrate the extent of this lease, it is likely that it encompassed the study area.

The study area lies within what is currently a semi rural suburb within the central coast of NSW. The earliest parish map available for the area dates to 1924, and indicates that the area has been earmarked for subdivision for at least that long. The pattern of subdivision appears to have changed little in that time compared to surrounding areas, and current aerials show only a few dwellings within the study area, suggesting that it has not been as heavily impacted by residential development as the surrounding lots.

Previous surveys conducted in the vicinity of the study area have noted heavy disturbance from clearing, ploughing, and the construction of residential dwellings. These disturbances do not appear to be as prevalent within the study area, although localised disturbance will be present from houses in the southern portion of it, along with access tracks and roads which have been constructed.

3 Aboriginal context

3.1 Ethnohistory and contact history

The study area falls within the Sydney Basin. Aboriginal occupation in this region dates back well into the Pleistocene period (i.e. before 10,000 years ago). This evidence comes from radiocarbon dates retrieved from excavated sites such as Shaw's Creek K2 (14,700 years before present (BP)) (Attenbrow 2002, p. 18) and George & Charles Street Parramatta (circa (c.) 25,000-30,000 BP) (JMCHM 2005). This area is identified by Tindale (1974) as associated with the Darkinjung language group, however it is noted that these boundaries are not firm and may have changed over time. Closer to the study area in the Gosford and Wyong regions, the majority of identified sites which have been dated date to the late Holocene (Kuskie 2008, p. 14). This could be in part due to rising sea levels.

Early interactions between Europeans and the Darkinjung people are recorded as being peaceful, with European settlement to the north of Sydney initially occurring at a slow pace. The discovery of the Windsor area in 1789, with its fertile flats, drove development in that part of the colony. Prior to 1820s, there was a penal colony present at Newcastle, which also hindered development on the central coast as the governor wish to create a buffer between it and the Sydney settlement (David Scobie Architects 2010, p. 11).

From 1825 onwards, colonisation in the area developed at a faster pace. As occurred in the Sydney area, the increased European presence in the area led to traditional food sources used by local Aboriginal groups to dwindle, and led to competition for limited resources, ultimately leading to violence. This violence appears to have been sparked by local William Cape, who regularly threatened local Aboriginals with a loaded musket. By the mid 1800s, local Aboriginal populations dwindled heavily (David Scobie Architects 2010, pp. 11-20).

3.2 Regional context

Australian Museum Business Services (AMBS 2014) undertook an archaeological survey for the Pacific Motorway widening and replacement between Tuggerah and Doyalson, approximately 3 kilometres north of the current study area. The assessment identified no sites, and determined that no further assessment was required.

The study also identified a number of regional reports which have made predictions in relation to site locations in distributions. The review undertaken by AMBS (2014) made a number of points, including:

- Sites are less likely to be identified in low lying swampy areas and elevated areas surrounding them. The areas focused on for this assessment were a series of excavations and surveys to the south and west of the Tuggerah Lakes area. The majority of assessments identified few or no sites, and those that went to excavation tended to contain low numbers of artefacts, if any.
- There are a small number of sites that do contradict this trend, particularly one excavated by Therin. AMBS was unable to obtain the report for their assessment, but noted the high number of artefacts recovered, with a density of 2 to 65 artefact per square metre.
- Site variety and density is likely to be greater in coastal or estuarine environments.
- Stone artefact density is likely to be greater in closer proximity to major water resources, however these sites may still be of relatively low density.

Artefact Heritage (Artefact 2012) completed a survey on behalf of Roads and Maritime Services for the upgrade of the Pacific Highway / Wyong Road intersection at Tuggerah. This assessment also noted the low numbers of sites identified by previous surveys and excavations. Part of the reason for this may be high levels of disturbance in the area, and local terrain and conditions, also discussed by AMBS (2014), which may have made the environment of the area undesirable for local groups.

Artefact referenced a number of statements made in a predictive model by Vinnicombe (1980), with the caveat that at the time of writing, relatively few archaeological surveys had been undertaken in the area and as such this model was not certain. Vinnicombe's findings were that:

- *"Open middens occur on sand, alluvium, and sandstone; often in protected locations near water.*
- *Artefact scatters and open camp sites are relatively rare within the region, but may occur on any flat terrain near water.*
- *Rock shelter sites are found in exposed Hawkesbury sandstone terrain above valley floors or below ridge tops.*
- *Axe grinding grooves occur within exposures of Hawkesbury sandstone near water."* (Artefact 2012, p. 12)

Further assessment was undertaken by Dallas (1987), who noted that the most common site types would be middens, scatters, and scarred trees. Dallas also observed that most of the recorded sites in the area were in riverine zones and sandstone coastal areas, but that this may be a function of disturbance, that is, the lack of impact caused by development in these areas rather than a proper reflection of site distribution (Artefact 2013, p. 12).

The survey undertaken by Artefact identified no sites, owing largely to the extremely high levels of disturbance in the area.

3.3 Local context

Dyall (1981) completed a survey of the Chittaway Point area (including the northern portion of the current study area), at the location of a proposed power station. The study area encompassed by Dyall's survey took in a large area around the shore in the southern and western margins of the Tuggerah lake, and further west towards Deep Creek.

The survey identified two shell middens, 12 artefact sites, three grinding groove sites, and one rock shelter (located outside of the study area). It appears that Dyall walked a single transect through the current study area (Dyall 1981, p. 6), and did not survey it extensively, focusing much more closely on the margins of Ourimbah Creek.

None of the artefact sites identified within the study area were considered to have particularly high significance in the report, with the recommendations stating that a permit to destroy be sought from the National Parks and Wildlife Service.

Resource Planning (1992) undertook an archaeological survey in advance of a rezoning application for a number of parcels of land, including the northern portion of the current study area. An initial survey was undertaken by vehicle to identify areas of high and low disturbance, as well as those that would be readily accessible for a pedestrian survey. Subsequent to this, a pedestrian survey was undertaken of areas that had been identified as potentially sensitive.

The current study area was not surveyed on foot as a part of this assessment, and was classed as 'disturbed area (urban development etc)' (Resource Planning 1992, p. 7). The survey identified a single site (45-3-1143),

on elevated ground near a wetland area. The survey also attempted to relocate two previously identified sites within its study area, however they were not found.

The report identified no constraints within the current study area, as there were no identified areas of moderate or high potential within it.

3.3.1 Identified Aboriginal archaeological sites – study area

A search of the Aboriginal Information Management System (AHIMS) database was conducted on 3 September 2015. The search identified 32 Aboriginal archaeological sites within a 10 x 10 kilometre search area, centred on the proposed study area (Table 2). None of these registered sites are located *within* the study area (Figure 5). The mapping coordinates recorded for these sites were checked for consistency with their descriptions and location on maps from Aboriginal heritage reports where available. These descriptions and maps were relied where notable discrepancies occurred.

It should be noted that the AHIMS database reflects Aboriginal sites that have been officially recorded and included on the list. Large areas of NSW have not been subject to systematic archaeological survey, hence AHIMS listings may reflect previous survey patterns and should not be considered a complete list of Aboriginal sites within a given area.

Table 2 AHIMS search results.

Site ID	Site name	Site type
45-3-3181	WP1	Artefact
45-3-3182	H1	Artefact
45-3-0193	Blackbutt Range; Drop Down Creek;	Grinding Groove
45-6-2338	Berkeley Rd 1	Artefact
45-3-0572	Grassy Knoll; Blackbutt Range;	Shelter with Art
45-3-0573	Palm Dale;	Grinding Groove
45-3-0577	Middle Ridge;	Grinding Groove, Shelter with Art
45-3-0522	Mangrove Road; same site as 45-3-2966	Isolated Find
45-3-3251	Isolated Find.	Modified Tree
45-3-3229	Burragah Rd Chittaway Bay	Artefact
45-3-3359	OW23-A	Artefact
45-3-3393	Mardi to Mangrove 3	Artefact Scatter
45-3-3384	Tuggerah PAD 1	PAD
45-3-3576	MARDI TO MANGROVE	Isolated Find
45-3-3061	Groovy; Berkeley Vale	Grinding Groove, Water Hole
45-3-1141	Tacoma South; Tacoma;	Artefact, Grinding Groove
45-3-1143	Ourimbah;	Artefact
45-3-1144	Tuggerah;	Artefact
45-3-1146	Tangy Dangy;	Artefact

45-3-0988	Middle Ridge Grooves; Palm Dale;	Grinding Groove
45-3-0994	Footes Gully;	Grinding Groove, Shelter with Art
45-3-2067	BWNP;	Rock Engraving
45-3-1097	Prestons Ridge; Palm Dale;	Shelter with Art
45-3-1098	Prestons Ridge; Palm Dale;	Shelter with Deposit
45-3-1101	Chittaway Point;	Artefact
45-3-1102	Main Range;	Shelter with Deposit
45-3-1108	Tuggerah;	Artefact
45-3-1297	Tooby's Creek;	Grinding Groove
45-3-1306	Tooby's Creek;	Grinding Groove
45-3-0816	Tangy Dangy; Sydney;	Quarry
45-3-1948	Niagara Park;	Shelter with Art
45-3-3177	CHITTAWAY BAY	Artefact, Shell

A simple analysis of the AHIMS results shows that the area surrounding the study area contains a wide variety of site types, with artefact sites (40.54%), grinding grooves (24.32%) and rock shelters (18.92%) being the most common. The majority of sites present are located within 100 metres of a water course, and sites that do not fall within this range are most commonly artefact sites.

Only one PAD was identified in the AHIMS results, lying approximately 3 kilometres northeast north of the study area. Excavations at this site, conducted by Kayandel Archaeological Services (2009) determined that there were not artefacts or other cultural material present, and as such its site status has been revised to 'Not a site'.

Table 3 AHIMS site type frequencies

Site type	Number	%
Artefact	10	31.25
Artefact scatter	1	3.13
Artefact, grinding groove	1	3.13
Artefact, shell	1	3.13
Grinding groove	5	15.63
Grinding Groove, shelter with art	2	6.25
Grinding groove, water hole	1	3.13
Isolated find	2	6.25
Modified tree	1	3.13
Pad	1	3.13
Quarry	1	3.13

Site type	Number	%
Rock engraving	1	3.13
Shelter with art	3	9.38
Shelter with deposit	2	6.25
Total	32	100

Site cards were obtained for sites within a 2 kilometre radius of the study area, in order to give a better understanding of the local context of the study area.

Ourimbah AHIMS # 45-3-1143

Site identified by Dyall (1980), consisting of two stone artefacts, one 'small waste flake' of grey chert, and one 'large flaking core' of yellow chert. The site was located within an open paddock on bare sand, with Dyall stating that the artefacts were not found in situ, but may have been dredged from the banks of Ourimbah Creek. The site was located 100 metres from the banks of Ourimbah Creek, and approximately 800 metres north-east of the study area.

Tangy Dangy AHIMS # 45-3-1146

This site was also identified by Dyall (1980), and consisted of 24 artefacts. 23 of these artefacts were identified as 'waste flakes', including 16 chert, six rhyolite, and one quartzite artefacts, as well as one quartzite core. The landowner claimed to have identified a ground-edge 'tomawhawk' in the area 10 years earlier, but did not still have it in his possession. The scatter was identified on a track through a horse paddock, approximately 250 metres from Ourimbah Creek, adjacent to a tributary of it, and approximately 260 metres north-west of the current study area. Soils in the area consisted of alluvial sand.

Berkeley Rd 1 AHIMS # 45-6-2338

This site also consists of an artefact scatter, identified in a house paddock by Resource Planning (1992). A total of 20 artefacts were identified, with the author noting that more exist in the area. Of the artefacts, nine were flakes, eight were flaked pieces, two were cores, and one was a backed blade. Raw materials included chert, silcrete, quartz, chalcedony, and volcanic material. The site was recorded as being in a poor condition, unlikely to contain stratified deposits, in part owing to the ploughing or grading which had taken place over the site. The site was located approximately 1 kilometre east of the study area, and was around 230 metres from a low order tributary of Ourimbah Creek.

3.3.2 Predictive model

A model has been formulated to broadly predict the type and character of Aboriginal cultural heritage sites likely to exist throughout the study area and where they are more likely to be located.

This model is based on:

- Local and regional site distribution in relation to landform features identified within the study area.
- Consideration of site type, raw material types and site densities likely to be present within the study area.
- Findings of the ethnohistorical research on the potential for material traces to present within the study area.
- Potential Aboriginal use of natural resources present or once present within the study area.
- Consideration of the temporal and spatial relationships of sites within the study area and surrounding region.

Based on this information, a predictive model has been developed, indicating the site types most likely to be encountered during the survey and subsequent sub-surface investigations across the present study area (Table 4). The definition of each site type is described firstly, followed by the predicted likelihood of this site type occurring within the study area.

Table 4 Aboriginal site prediction statements

Site type	Site description	Potential
Flaked stone artefact scatters and isolated artefacts	Artefact scatter sites can range from high-density concentrations of flaked stone and ground stone artefacts to sparse, low-density 'background' scatters and isolated finds.	**Moderate-high**: Stone artefact sites have been previously recorded in the region across a variety of landforms, but typically in close proximity to water sources. Given the presence of two lower order tributaries within the study area, the likelihood of this site type being identified is assessed as moderate-high.
Shell middens	Deposits of shells accumulated over either singular large resource gathering events or over longer periods of time.	**N/A**: There may be potential for this site type to occur in or around the study area. Although there are no previously recorded instances of it occurring in the vicinity of the study area, there is not enough evidence available to make a predictive statement.
Quarries	Raw stone material procurement sites.	**N/A**: There may be potential for this site type to occur in or around the study area. Although there are no previously recorded instances of it occurring in the vicinity of the study area, there is not enough evidence available to make a predictive statement.
Potential Archaeological Deposits (PADs)	Potential sub surface deposits of cultural material.	**Moderate**: Only one PAD has previously been identified in the vicinity of the study area, with test excavations on it showing that no archaeological deposit was present.

Site type	Site description	Potential
		There is some history of disturbance present within the study area, however given the presence of less disturbed landforms in close proximity to water sources, there is potential for this site type to be present.
Scarred trees	Trees with cultural modifications	**Moderate**: Scarred trees are an uncommon site type in the vicinity of the study area. Given the history of clearing in the vicinity of the study area, It is unlikely that this site type will be identified, however the potential is still present in stands of mature growth.
Grinding grooves	Grooves created in stone platforms through ground stone tool manufacture.	**High**: Suitable horizontal sandstone rock outcrops occur within the study area where grinding grooves may be present.
Burials	Aboriginal burial sites.	**N/A**: There may be potential for this site type to occur in or around the study area. Although there are no previously recorded instances of it occurring in the vicinity of the study area, the deep alluvial sands required for burials are present within the Yarramalong soil landscape. There is not enough evidence available to make a predictive statement.
Rock shelters with art and / or deposit	Rock shelter sites include rock overhangs, shelters or caves, and generally occur on, or next to, moderate to steeply sloping ground characterised by cliff lines and escarpments. These naturally formed features may contain rock art, stone artefacts or midden deposits and may also be associated with grinding grooves.	**Low**: The sites will only occur where suitable sandstone overhangs possessing sufficient sheltered space exist, which not present within study area.
Aboriginal ceremony and dreaming sites	Such sites are often intangible places and features and are identified through oral histories, ethnohistoric data, or Aboriginal informants.	**N/A**: There may be potential for this site type to occur in or around the study area. Although there are no previously recorded instances of it occurring in the vicinity of the study area, there is not enough evidence available to make a predictive statement.

Site type	Site description	Potential
Post-contact sites	These are sites relating to the shared history of Aboriginal and non-Aboriginal people of an area and may include places such as missions, massacre sites, post-contact camp sites and buildings associated with post-contact Aboriginal use.	**Low**: There are no post-contact sites previously recorded in the study area and historical sources do not identify one.
Aboriginal places	Aboriginal places may not contain any "archaeological" indicators of a site, but are nonetheless important to Aboriginal people. They may be places of cultural, spiritual or historic significance. Often they are places tied to community history and may include natural features (such as swimming and fishing holes), places where Aboriginal political events commenced or particular buildings.	**N/A**: There may be potential for this site type to occur in or around the study area. Although there are no previously recorded instances of it occurring in the vicinity of the study area, there is not enough evidence available to make a predictive statement.

4 Archaeological survey

For the purpose of the site survey, the study area was separated into Study Area 1 and Study Area 2, due to timing of access to privately owned properties. The site survey for Study Area 1 and Study Area 2 was conducted on 14 September 2015 and 21 September 2015 respectively, by Nicole Castle (Consultant Archaeologist - Biosis). The field survey sampling strategy, methodology and a discussion of results are provided below.

4.1 Archaeological survey aims

The principle aims of the site survey was to:

- Assess the previous disturbance to the study area
- Assess the potential of the study area to possess intact Aboriginal heritage
- Locate any Aboriginal objects or Places present within the study area.

4.2 Survey methods

The archaeological survey was conducted on foot. Information that was recorded during the survey included:

- Aboriginal objects or sites if present in the study area during the survey.
- Survey coverage.
- Any resources that may have potentially have been exploited by Aboriginal people.
- Landform elements, distinguishable areas of land approximately 40m across or with a 20m radius (Speight 2009).
- Photographs of the site indicating landform.
- Ground surface visibility (GSV) and areas of exposure.
- Observable past or present disturbances to the landscape from human or animal activities; and,
- Aboriginal artefacts, culturally modified trees or any other Aboriginal sites.

Where possible, identification of natural soil deposits within the study area was undertaken. Photographs and recording techniques were incorporated into the survey including representative photographs of landform, vegetation coverage, ground surface visibility and the recording of soil information where possible. Any potential Aboriginal objects observed during the survey were documented and photographed. The location of Aboriginal objects or sites if present were recorded using a hand-held Global Positioning System (GPS) and the Map Grid of Australia (MGA) (94) coordinate system.

4.3 Constraints to the survey

With any archaeological survey there are several factors that influence the effectiveness (the likelihood of finding sites) of the survey. The factors that contributed most to the effectiveness of the survey within the study area were poor GSV due to medium to dense vegetation cover and restricted access to properties. Lots 31 and 41, both private properties within Study Area 2, were unable to be accessed during the site inspection

however were viewed from the sealed and unsealed roads and aerial maps. It appeared that the majority of the lots comprised of medium to dense vegetation cover with the exception of cleared areas, including existing houses and an animal yard. Despite these constraints a sufficient amount of the study area was able to be accessed to inform this assessment.

4.4 Visibility

In most archaeological reports and guidelines visibility refers to ground surface visibility, and is usually a percentage estimate of the ground surface that is visible and allowing for the detection of (usually stone) artefacts that may be present on the ground surface (NSW NPWS 1997: Appendix 4).

GSV was variable throughout the study area, typically remaining between 0 – 10 percent, in areas with a surface coverage ranging from low to medium grass cover (Plate 1). There were some areas of dense vegetation in throughout the study area, including the council owned properties within Study Area 1 and those areas close to the creek line within Study Area 2, which had a surface visibility of 0 per cent and 5 per cent respectively (Plate 2 and Plate 3).

Plate 1 Low GSV due to grass cover within Study Area 2, view west

Plate 2 Dense vegetation in council property within Study Area 1

Plate 3 Dense vegetation adjacent to creekline in Study Area 2, view west, 1m scale

4.5 Exposure

Exposure refers to the geomorphic conditions of the local landform being surveyed, and attempts to describe the relationship between those conditions and the likelihood the prevailing conditions provide for the exposure of (buried) archaeological materials. Whilst also usually expressed as a percentage estimate, exposure is different to visibility in that it is in part a summation of geomorphic processes, rather than a simple observation of the ground surface (Burke and Smith 2004, p. 79, NSW NPWS 1997, Appendix 4). Overall, the study area displayed areas of exposure along the rail corridor, unsealed and sealed roads, the bases of trees, and around fences (Plate 4).

Plate 4 Areas of exposure along unsealed Turpentine Road, north of the rail corridor, view north-east, 1m scale

4.6 Disturbances

Disturbance in the study area is associated with natural and human agents. Natural agents generally affect small areas and include the burrowing and scratching in soil by animals, such as wombats, foxes, rabbits and wallabies, and sometimes exposure from slumping or scouring. Disturbances associated with recent human action are prevalent in the study area and cover large sections of the land surface. The agents include the

construction of the rail corridor as well as residential development, such as landscaping and construction of residential buildings; farming practices, such as initial vegetation clearance for creation of paddocks, fencing and stock grazing; agricultural practices such as fruit orchards; light industrial practices such as nursery and creation of artificial dams throughout the entire study area.

There has been a moderate level of disturbance throughout the study area. This is primarily the result of the construction of the existing rail corridor and associated infrastructure including the Turpentine Road underbridge (Plate 5 and Plate 6), as well as a number of sealed roads including Turpentine Road, Orchard Road, Ourimbah Road and Bridge Street (Plate 7). The impacts associated with the construction of the rail corridor and associated infrastructure as well as the sealed roads would have previously destroyed any Aboriginal sites or sub-surface archaeological deposits if present. Areas of localised disturbance were also observed including the construction of residential dwellings, a sewer line, sheds, fences, and a dam (Plate 8). The current land use is a combination of an existing rail corridor, a number of sealed public roads, residential land use and unused land. There are a number of unsealed dirt and gravel tracks running through the study area. These localised disturbances also would have impacted on any Aboriginal objects or sites if present. There is also evidence of some rubbish dumping having occurred in the study area as well, shown by plastic and broken glass.

Plate 5 Disturbance within the existing rail corridor, view west

Plate 6 View of Turpentine Road railway underpass, view south-west, 1m scale

Plate 7 Ourimbah Road, view north to north-west, 1m scale

Plate 8 A small dam within Study Area 2, view south, 1m scale

4.7 Survey results & discussion

There are no Aboriginal sites registered on AHIMS within the study area and no previously unidentified sites were recorded during the site survey. Areas of archaeological potential within the study area can be seen in Figure 6, including areas of high and low archaeological potential, as well as disturbance associated with the existing rail corridor.

An elevated area overlooking the creek was identified within Lot 82, which despite the close proximity to the existing rail corridor, appeared to be minimally disturbed. This area may have the potential to contain Aboriginal artefacts which may have not been subject to existing disturbances. The Yarramalong soil landscape present within the study area comprises of deep alluvial soils and the wider landform pattern is a narrow to moderately broad alluvial plain. Aboriginal artefacts, although not visible on the surface, are likely to be present within the sub-surface. Other areas close to the creeklines were also inspected where possible, however contained dense vegeation cover and access was hindered and a low GSV present (0-5%).

According to the predictive model in section 3.3.2, stone artefact sites have been previously recorded in the region across a variety of landforms, but typically in close proximity to water sources. Artefact sites account for approximately 40 per cent of site types within the local area, particularly in association with water sources. While PAD sites appear to be relatively uncommon in the local area with only one being identified previously according to the AHIMS register, this is not a reflection that this site type is unlikley to be present. The AHIMS database reflects Aboriginal sites that have been officially recorded and does not account for areas which have not been subject to previous systematic archaeological survey. AHIMS listings may reflect previous survey patterns and should not be considered a complete list of Aboriginal sites within a given area. PAD sites, and artefact scatter sites, may be present within minimally disturbed areas of the study area, particularly within alluvial deposits in close proximity to water sources. Therefore, given the presence of two tributaries within the study area, and areas exhibiting minimal disturbance, the likelihood of this site type being identified is assessed as high. The study area is assessed as having a high archaeological potential to contain Aboriginal objects or places within minimally disturbed areas within close proximity of the creeklines. This applies particularly to Study Area 2, on both eastern and western sides of the creek near Bridge Road and the north of the creekline within Lot 82. Other areas of the study area exhibited varying levels of disturbance where artefact scatters if present are unlikley to remain. The rail corridor, located within Study Area 1, contains extensive disturbance and Aboriginal objects or places are unlikley to be present. Other areas within Study Area 1 may contain grinding grooves or rock engravings within suitable sandstone outcrops if present. Survey was limited in these areas due to dense vegetation.

Other potential site types identified in the predictive modelling included grinding grooves, accounting for approximately 20 per cent of site types in the local area. Only one sandstone outcrop was able to be observed during the survey and was mostly covered by low lying vegeatation cover and debris. No grinding grooves were present. Although the geology of the study area includes quaternary sediments comprised of gravel, sand, silt, and clay, given the presence of sandstone outcrops within the study area, there is considered to be a high archaeological potential for grinding grooves or rock engravings where suitable sandstone outcrops are present. Mature growth trees within the study area were inspected where access was available, for signs of cultural modifications, but none were identified. The potential for scarred or culturally modified trees to be present within the study area is assessed as moderate, particularly within uncleared areas where mature trees are present.

5 Impact assessment

The current proposal put forward by TfNSW is to develop a maintenance facility for the intercity fleet which will:

- Cater for intercity fleet capacity requirements to at least 2036.
- Provide more cost effective maintenance operation than current NSW intercity facilities.
- Support efficient operation of trains.
- Support condition monitoring and component change out functionality.

The development of this maintenance facility has the potential to impact on Aboriginal heritage within the study area, with the following physical impacts occurring on site:

- Bulk earthworks.
- Development of site infrastructure including rail tracks and related roadways.
- Construction of a maintenance facility on site.

The construction of this facility and its related infrastructure has the potential to affect Aboriginal heritage, with both trees and the ground surface being impacted by these works. Although no Aboriginal sites have been identified within the study area, artefact sites may be present in minimally disturbed elevated areas overlooking the creeklines, particularly within Lot 82 and within the area for the proposed extension of Bridge Street. Grinding grooves or rock engravings may be present within suitable sandstone outcrops. Mature trees within Lots 32 and 41 should be inspected prior to any clearing to ensure there are no impacts to any scarred or culturally modified trees if present. Impacts may be avoidable as a part of the design process however if impacts are unavoidable, given the high potential of Aboriginal sites to be located within the study area, further assessment would be required to ensure Aboriginal objects, if present, are not impacted by the proposed works. Impacts within the existing rail corridor are unlikely to pose harm to potential Aboriginal sites given the level of extensive disturbance having taken place within these areas. Areas of archaeological potential have been mapped in Figure 6.

All Aboriginal objects and Places are protected under the NPW Act. It is an offence to knowingly disturb an Aboriginal site without a consent permit issued by the Office of Environment and Heritage. Should any Aboriginal objects be encountered during works associated with this proposal within the existing rail corridor, works must cease in the vicinity and the find should not be moved until assessed by a qualified archaeologist. If the find is determined to be an Aboriginal object the archaeologist will provide further recommendations. Further assessment is required for those areas outside of the existing rail corridor.

6 Conclusions and recommendations

6.1 Conclusions

There is a high potential for artefact scatters to be present within minimally disturbed elevated areas overlooking creeklines, particularly within Study Area 2, on both eastern and western sides of the creek near Bridge Road and the north of the creekline within Lot 82. There is also a moderate potential for scarred trees to be present within uncleared areas of the study area which were unable to be surveyed due to restricted access. There is also a high potential for grinding grooves or rock engravings to be present within suitable sandstone outcrops within the study area. It is therefore recommended that further assessment is required, as the due diligence code would not protect TfNSW under the NPW Act against any impacts to potential Aboriginal heritage as a part of the proposed works. Recommendations are outlined below.

6.2 Recommendations

The following management recommendations have been developed relevant to the study area and influenced by:

- Predicted impacts to Aboriginal cultural heritage.
- The planning approvals framework.
- Current best conservation practise, widely considered to include:
  - Ethos of the Australia ICOMOS Burra Charter; and,
  - The *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010)

Prior to any impacts occurring within the study area, the following is recommended:

Recommendation 1: *Further archaeological assessment is required*

Further archaeological assessment is required in the study area prior to the proposed impacts due to areas of the study area assessed as having high and low archaeological potential (Figure 6). Further assessment would be required in the form of an Aboriginal Cultural Heritage Assessment in accordance with the *Code of Practice for the Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010). Consultation with the Aboriginal community would also be required as a part of the further archaeological assessment in accordance with the *Aboriginal cultural heritage consultation requirements for proponents* (DECCW 2010).

Recommendation 2: *No further archaeological assessment is required within the rail corridor*

No further archaeological assessment is required within the existing rail corridor and areas of associated disturbance including the railway underbridge due to the extensive disturbance which has taken place within this area (Figure 6).

Recommendation 3: *Discovery of Unanticipated Aboriginal Objects*

All Aboriginal objects and places are protected under the *National Parks and Wildlife Act 1974*. It is an offence to knowingly disturb an Aboriginal site without a consent permit issued by the Office of Environment and Heritage (OEH). Should any Aboriginal objects be encountered during works associated with this proposal within those areas outlined in Recommendation 2, works must cease in the vicinity and the find should not be moved until assessed by a qualified archaeologist. If the find is determined to be an Aboriginal object the

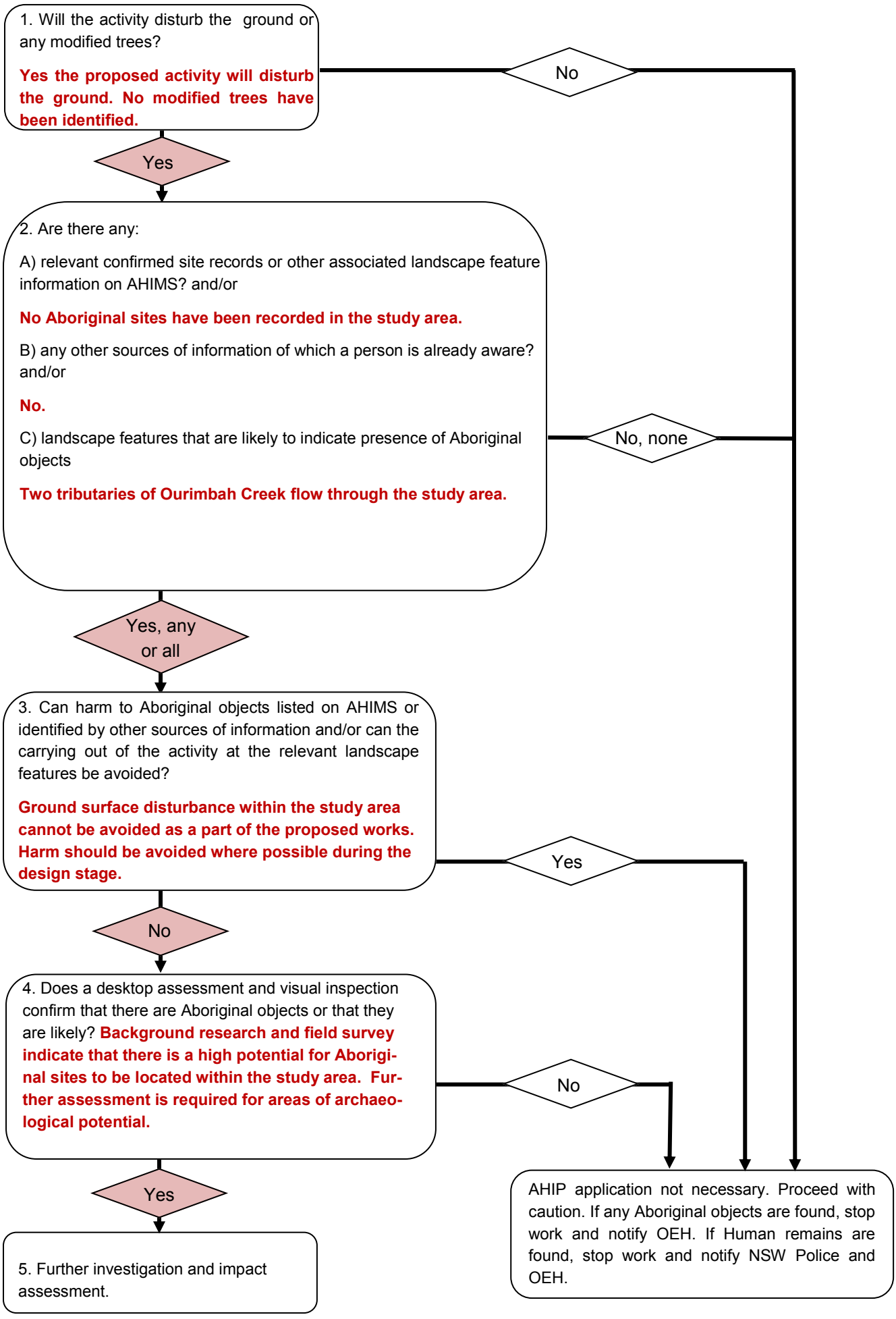
archaeologist will provide further recommendations. These may include notifying the OEH and Aboriginal stakeholders.

Recommendation 4: Discovery of Aboriginal Ancestral Remains

Aboriginal ancestral remains may be found in a variety of landscapes in NSW, including middens and sandy or soft sedimentary soils. If any suspected human remains are discovered during any activity you must:

4. Immediately cease all work at that location and not further move or disturb the remains
5. Notify the NSW Police and OEH's Environmental Line on 131 555 as soon as practicable and provide details of the remains and their location
6. Not recommence work at that location unless authorised in writing by OEH.

Figure 4: Due Diligence Flow Chart



7 References

Artefact Heritage 2012. Pacific Highway / Wyong Road intersection upgrade, Tuggerah Aboriginal Archaeological Survey Report. Report to SKM/RMS.

Attenbrow V. 2002. *Sydney's Aboriginal Past: Investigating the archaeological and historical records.* University of New South Wales Press Ltd, Sydney.

Australian Museum Business Services 2014. M1 Pacific Motorway widening and replacement, Tuggerah to Doyalson: Aboriginal Archaeological Survey Report. Report to SMEC Australia Pty Ltd.

David Scobie Architects 2010. Wyong Shire-wide Heritage Review Thematic History. Report to Wyong Shire Council.

Department of Environment, Climate Change and Water NSW (DECCW) 2010. Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales. Department of Environment, Climate Change and Water, Sydney.

Dyall L 1981. Report on Aboriginal Relics at Proposed Site for Power Station at Chittaway Point, NSW. Report to Electricity Commission of New South Wales.

GHD 2015. Central Coast Train Stabling and Maintenance Facility: Comparative Site Analysis. Report to Transport for New South Wales.

Geographical Names Board of New South Wales 2015. Geographical Names Register Extract, Ourimbah Creek. Accessed 22 September 2015 at: <http://www.gnb.nsw.gov.au/place_naming/placename_search/extract?id=ujckBKsETR>.

Jo McDonald Cultural Heritage Management 2005. *Archaeological Salvage Excavation of Site CG1 (NPWS #45-5-2648), at the corner of Charles and George Streets, Parramatta, NSW.* Unpublished report prepared for Meriton Apartments Pty. Ltd, Sydney, NSW.

Kuskie P 2008. Mardi to Mangrove Link Project: Preliminary Heritage Assessment. Report to GHD Pty Ltd.

Murphy, C 1993. *Soil Landscapes of the Gosford-Lake Macquarie 1:100000 Sheet*. Department of Conservation and Land Management, Sydney.

Resource Planning Pty Ltd 1992. Archaeological survey for an environmental study enterprise drive, Wyong. Report to Wyong Shire Council.

Strom, B 1982. *Gosford/Wyong- History and Heritage*. Gosford District Historical Research and Heritage Association, Gosford.

Tindale B 1974, *Aboriginal tribes of Australia : their terrain, environmental controls, distribution, limits, and proper names*. Australian National University Press, Canberra.

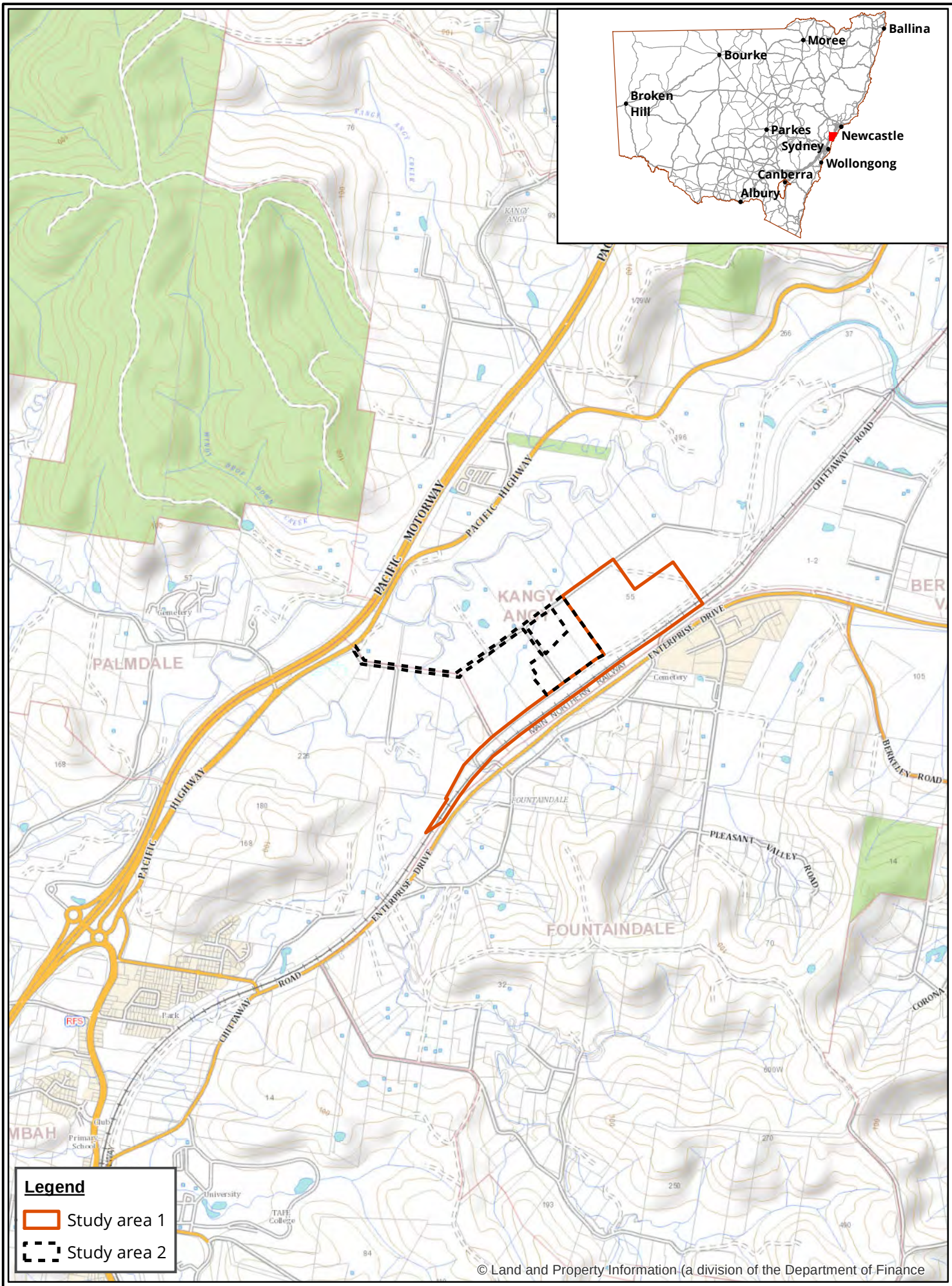
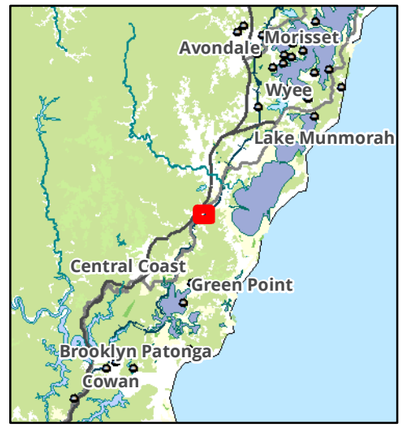


Figure 1: Location of the study area

Biosis Pty Ltd
Ballarat, Brisbane, Canberra, Melbourne, Newcastle, Sydney, Wangaratta & Wollongong

Matter: 20143
Date: 07 September 2015,
Checked by: NEC, Drawn by: LH, Last edited by: lharley
Location:P:\20100s\20143\Mapping\

0 250 500 750 1,000
Metres
N
Scale 1:25,000 @ A4, GDA 1994 MGA Zone 56



Legend

- Study area 1
- Study area 2

Figure 2: Aerial of the study area

0 60 120 180 240 300

Metres

Scale: 1:6,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

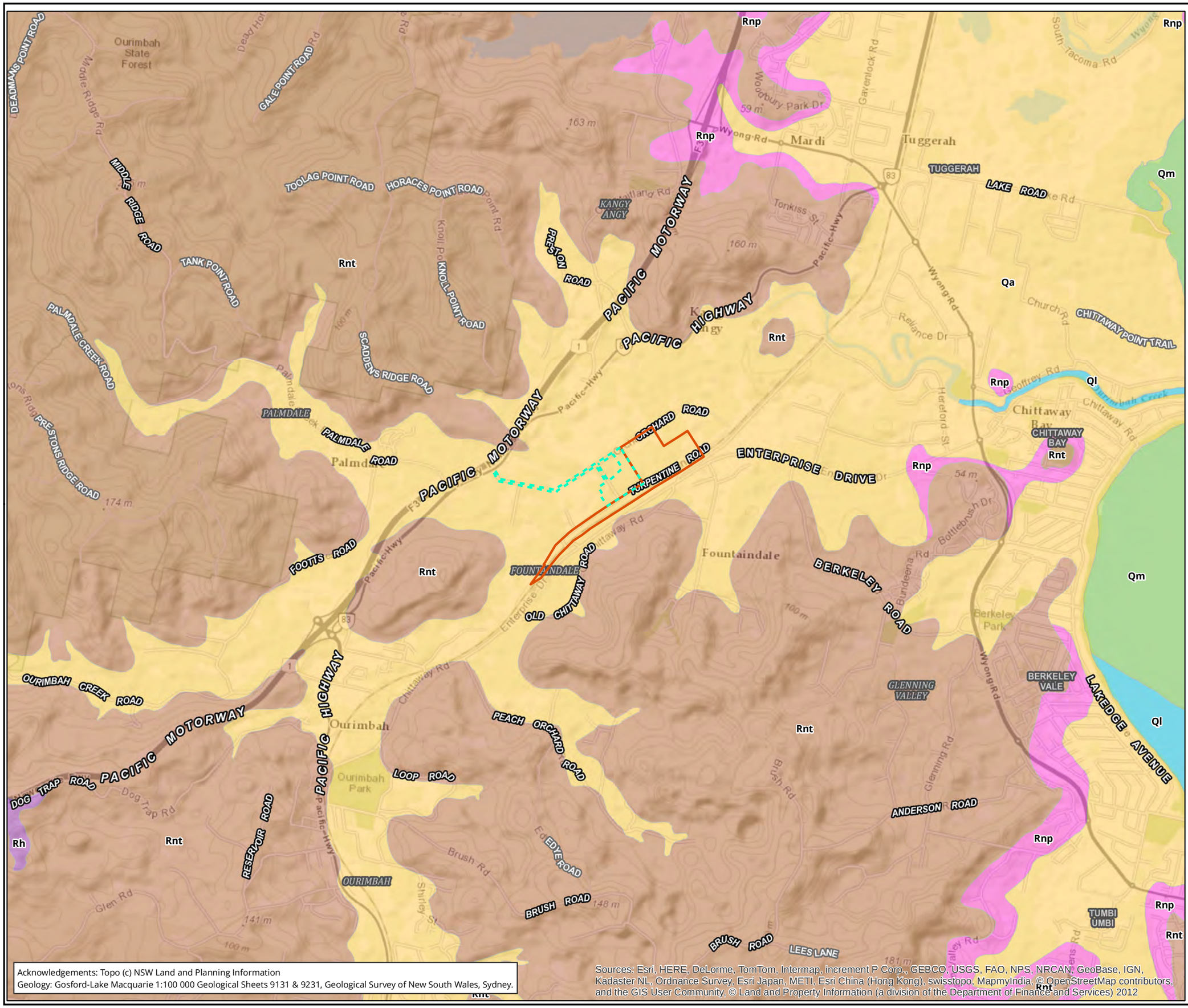
N

biosis

Biosis Pty Ltd

Ballarat, Brisbane, Canberra, Melbourne, Newcastle, Sydney, Wangaratta & Wollongong

Matter: 20143
Date: 07 September 2015,
Checked by: NEC, Drawn by: LH, Last edited by: lharley
Location:P:\20100s\20143\Mapping
20143_F2_StudyArea



Legend

- Study area 1
- Study area 2

Geological Units (1:100,000)

- Alluvial sand and gravel
- Coastal deposits- barrier lake facies (subaqueous)
- Coastal deposits- lagoon facies (subaqueous)
- Hawkesbury Sandstone
- Patonga Claystone
- Terrigal Formation

Figure 3: 1:100,000 geological units near the Project Area

0 340 680 1,020 1,360 1,700

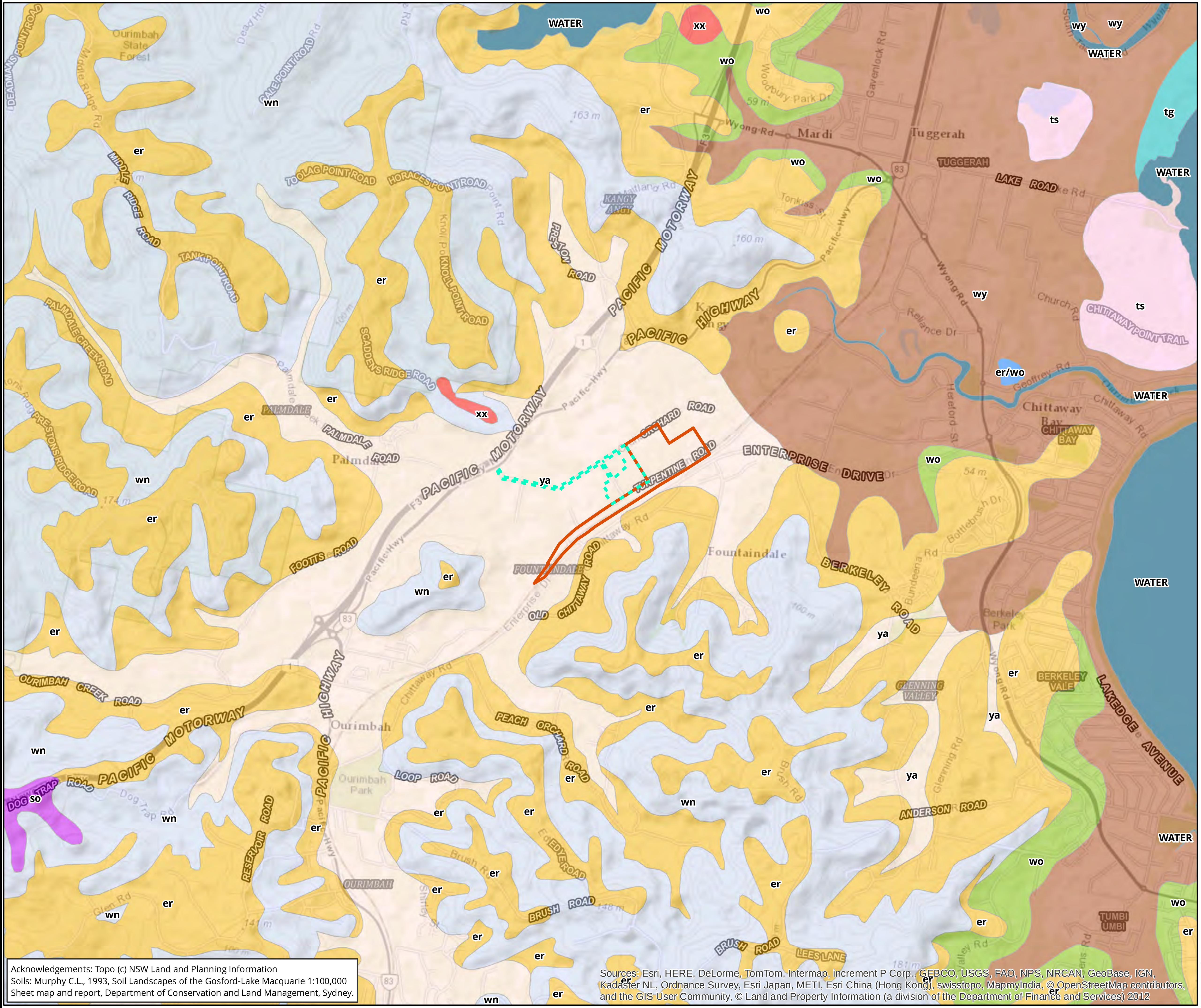
Metres
Scale: 1:30,000 @ A3
Coordinate System: GDA 1994 MGA Zone 55

N

Biosis Pty Ltd

Ballarat, Brisbane, Canberra, Melbourne, Sydney, Wangaratta & Wollongong

Matter: 20143,
Date: 25 September 2015,
Checked by: NEC, Drawn by: LH, Last edited by: lharley
Location:P:\20100s\20143\Mapping\20143_F3_Geology.mxd



Acknowledgements: Topo (c) NSW Land and Planning Information
Soils: Murphy C.L., 1993, Soil Landscapes of the Gosford-Lake Macquarie 1:100,000 Sheet map and report, Department of Conservation and Land Management, Sydney.

Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community, © Land and Property Information (a division of the Department of Finance and Services) 2012

Legend

- Study area 1
- Study area 2

Soil landscape units (1:100,000)

- DISTURBED TERRAIN
- ERINA
- ERINA/WOODBURYS BRIDGE
- SOMERSBY
- TACOMA SWAMP
- TUGGERAH
- WATAGAN
- WATER
- WOODBURYS BRIDGE
- WYONG
- YARRAMALONG

Figure 4: 1:100,000 soil landscapes near the Project Area

0 340 680 1,020 1,360 1,700

Metres

Scale: 1:30,000 @ A3

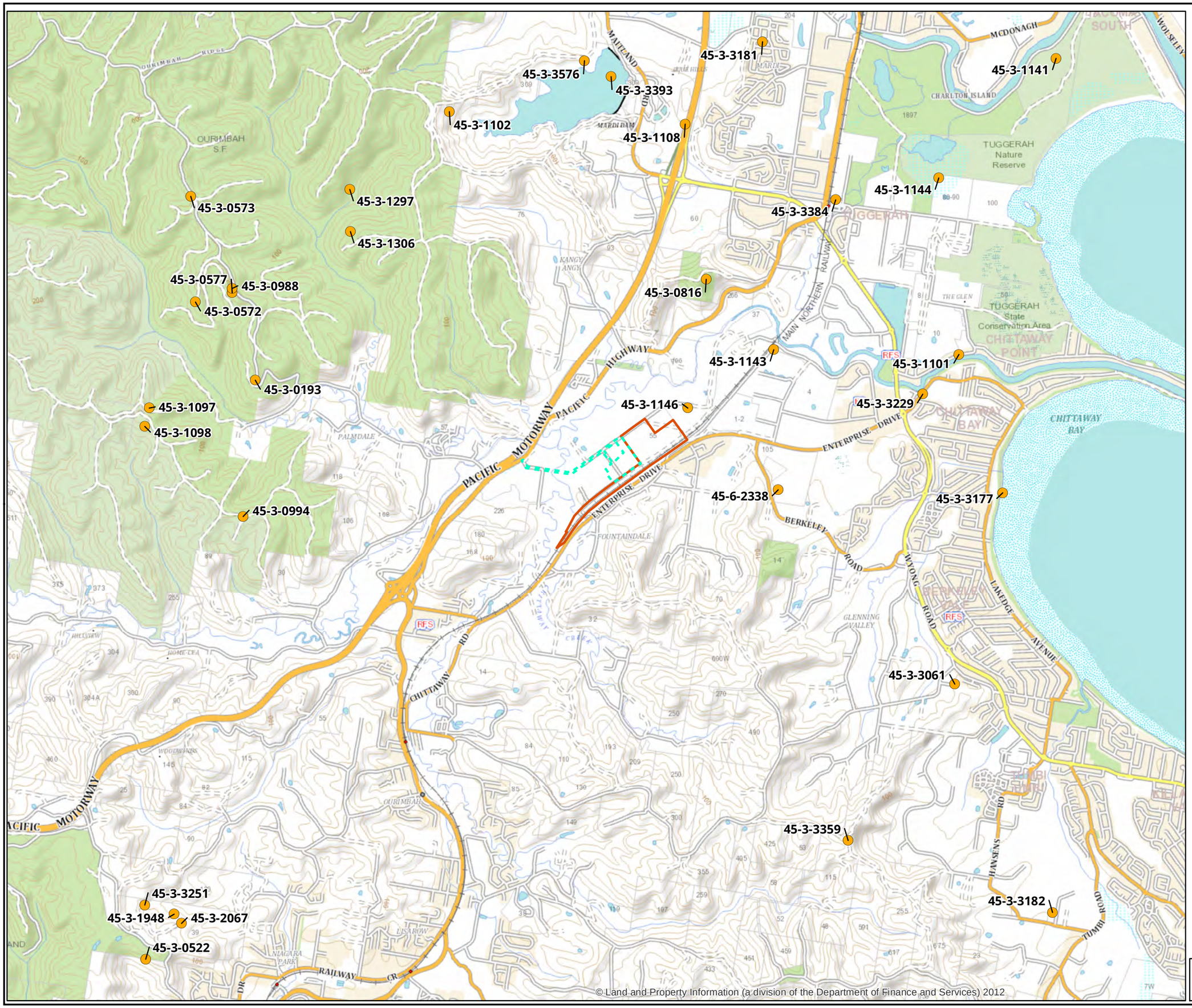
Coordinate System: GDA 1994 MGA Zone 55

biosis

Biosis Pty Ltd

Ballarat, Brisbane, Canberra, Melbourne, Sydney, Wangaratta & Wollongong

Matter: 20143,
Date: 28 September 2015,
Checked by: NEC, Drawn by: LH, Last edited by: lharley
Location:P:\20100s\20143\Mapping
20143_F4_Soils.mxd



Legend

- Study area 1
- Study area 2

Figure 5: AHIMS sites within the vicinity of the study area

0 380 760 1,140 1,520 1,900

Metres
Scale: 1:38,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

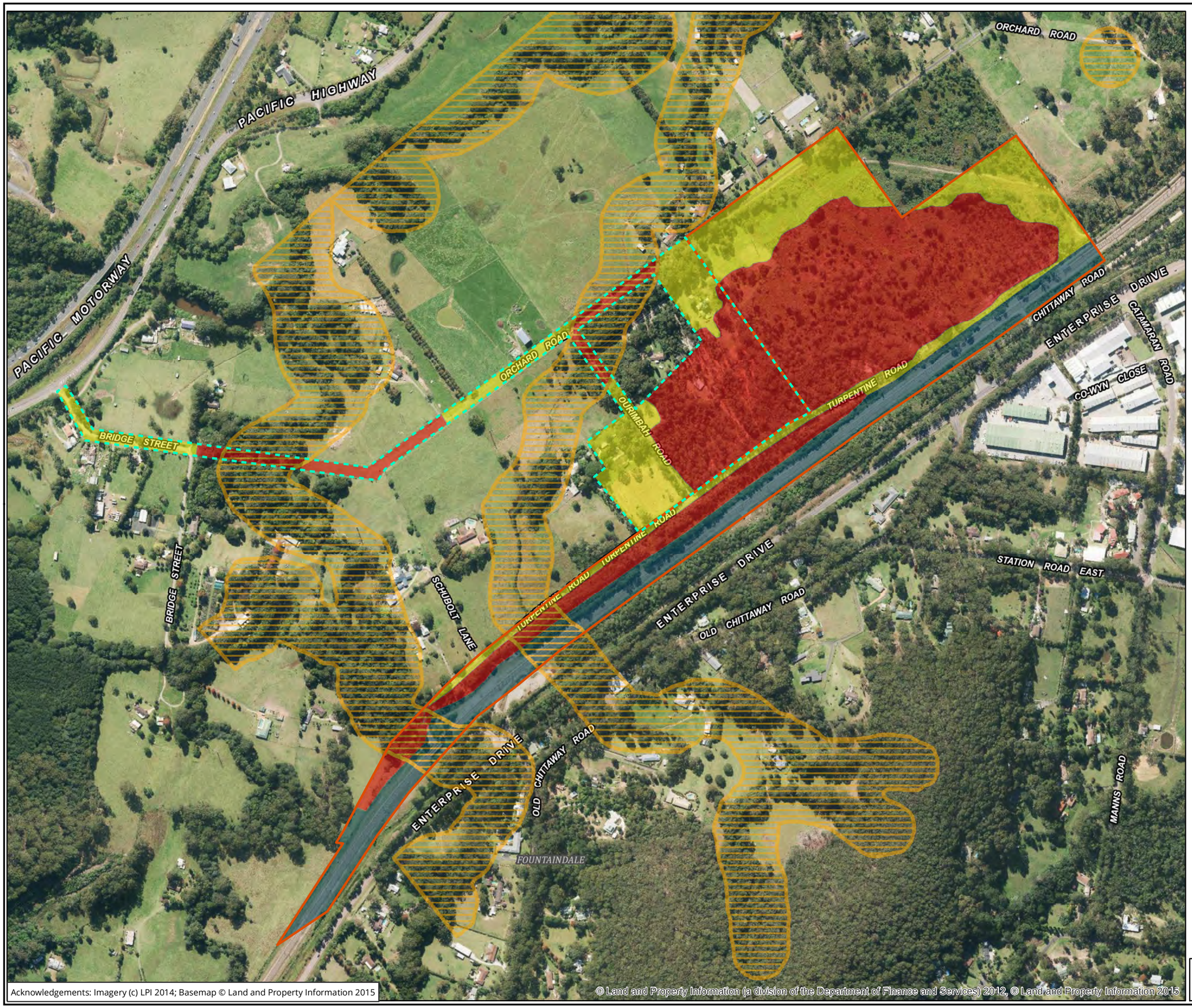
N

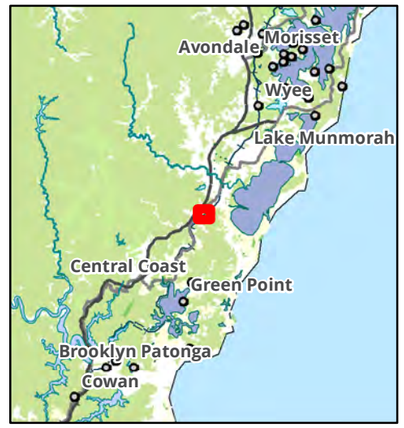
biosis

Biosis Pty Ltd

Ballarat, Brisbane, Canberra, Melbourne, Newcastle, Sydney, Wangaratta & Wollongong

Matter: 20143
Date: 28 September 2015,
Checked by: NEC, Drawn by: LH, Last edited by: lharley
Location:P:\20100s\20143\Mapping
20143_F5_AHIMS





Legend

- Study area 1
- Study area 2

Areas of archaeological potential

- High potential (GHD 2014)
- High potential (Biosis 2015)
- Low potential (Biosis 2015)
- Disturbance associated with rail corridor (Biosis 2015)

Figure 6: Areas of archaeological potential within the study area

0 60 120 180 240 300

Metres
Scale: 1:6,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

Biosis Pty Ltd

Ballarat, Brisbane, Canberra, Melbourne, Newcastle, Sydney, Wangaratta & Wollongong

Matter: 20143
Date: 02 October 2015,
Checked by: NEC, Drawn by: LH, Last edited by: lharley
Location:P:\20100s\20143\Mapping
20143_F6_Constraints

Environment and Sustainability Policy

Transport for NSW

Transport is essential to the economic and social development of NSW. It provides access to jobs, housing, goods and services. It provides for the movement of people in their daily lives to improve their quality of life.

Transport for NSW, together with its key agencies NSW Trains, Sydney Trains, Roads and Maritime Services and State Transit Authority are committed to delivering transport services, projects, operations and programs in a manner that balances economic, environmental and social issues to ensure a sustainable transport system for NSW. We work towards achieving this by:

- Minimising impacts on the environment, whether through transport operations, infrastructure delivery, maintenance or corporate activities
- Procuring, delivering and promoting sustainable transport options that promote value for money
- Complying with relevant legislation
- Developing, expanding and managing the transport network in a sustainable and climate change resilient way.

We will continuously improve our performance in line with this Environment and Sustainability Policy by:

- Implementing sound governance practices to set, apply and monitor the policy across the portfolio
- Setting objectives and targets to improve management and performance in line with best practice
- Reporting on our performance
- Raising the awareness and capacity of our staff to build the policy into their day-to-day business
- Forming constructive partnerships with government, industry and the community on environment and sustainability issues
- Contributing to and influencing the strategic environment and sustainability agenda of the NSW Government.

The Environment and Sustainability Policy flows from our obligations under the *Transport Administration Act* 1988 for "the delivery of transport services in an environmentally sustainable manner" and is reflected in our Corporate Plan "Connections - Towards 2017".

I commend the policy to all within the Transport cluster agencies.

Tim Reardon
Secretary
August 2015

TRANSPORT FOR NSW T 8202 2200 **F** 8202 2209
18 Lee Street, Chippendale NSW 2008 | PO Box K659, Haymarket 1240