Figure 7: Vegetation zones within construction footprint

Figure 8: Plot and transect locations

3.4 Current and future site value scores

The current and future site value scores for the single vegetation zone were calculated based on the data from the four plots and transects collected on site and entered into the BCC. The current site value score is 61.67 / 100. A number of values, such as native plant species, ground cover (shrubs and other) and fallen logs are within benchmark. Conversely, some other features (such as over-storey cover, mid-storey cover, ground cover (grasses), exotic plant cover and trees with hollows) are significantly below benchmark.

The future site value score, as complete clearing is required within the track footprint, is 0 / 100. See Table 7.

Table 7: Current and future site value scores

Vegetation zone ID	PCT ID / Biometric vegetation ID	Condition	PCT name	Area impacted (ha)	Current site value	Future site value
1	PCT1822 / ME101	Moderate - Good	Heath-leaved Banksia – Scrub She-oak heath on sandstone headlands in the Sydney basin	0.027	61.67	0

4. Assessing threatened species and populations

4.1 Species credit species

4.1.1 Geographic and habitat questions

Species credit species are those species that cannot be reliably predicted by habitat surrogates, the PCT or distribution, and therefore require additional assessment, and potentially targeted survey.

A component of preparing a candidate species list for survey includes the completion of geographic and habitat questions required by the BCC. The question posed and responses are provided below (Table 8). No impact will occur through the proposal to any species or habitat type listed in the geographic/habitat questions in the BCC.

Table 8: Assessment of geographic and/or habitat features

Common name	Scientific name	Feature	Impacted?
Green and Golden Bell Frog	*Litoria aurea*	Land within 100 m of emergent aquatic or riparian vegetation.	No, habitat features are not present within the locality.
Rosenberg's Goanna	*Varanus rosenbergi*	Land within 250 m of termite mounds or rock outcrops.	No, suitable habitat features are not present within the locality.
Giant Burrowing Frog	*Heleioporus australiacus*	Land within 40 m of heath, woodland or forest with sandy or friable soils.	No, the species has not been recorded within range of the subject site (<10km radius). Soils poorly friable.
Broad-headed Snake	*Hoplocephalus bungaroides*	Land within 500 m of sandstone escarpments with hollow-bearing trees, rock crevices or flat sandstone rocks on exposed cliff edges and sandstone outcropping.	No, the species has not been recorded within range of the subject site (<10km radius). No hollow bearing trees, limited rock crevices of suitable size.

4.1.2 Candidate list for survey

After answering the geographic and habitat questions the BCC produces a candidate species list for further consideration. Consistent with Section 6.5.1.3 of the FBA (OEH 2014), each species listed was reviewed and a habitat assessment conducted to determine if the species required further assessment, including targeted survey.

Fourteen species and three endangered populations were identified by the BCC as requiring further consideration. Two of these species were subject to targeted survey within the subject site, with no evidence of either occurring within the subject site or surrounding area. The

remaining fifteen candidates were discounted and eligible to be removed from the candidate species list consistent with FBA (OEH 2014) Section 6.5.1.3 (see Table 9 for justification for each species).

The following threatened 'species credit' flora were deemed as having potential to occur on the subject site, Magenta Lillypilly (*Szygyium paniculatum*), Netted Bottle Brush (*Callistemon linearifolius*) and Sunshine Wattle (*Acacia terminalis subsp. terminalis*). Targeted searches were conducted for each of these species. The searches were conducted by Narla Ecologist Emily Strautins and Dean Sugden during the field assessment on the 7 and 9th of February 2017, as this aligned with the flowering period (when the species are most conspicuous) and had greatest chance of displaying key diagnostic features. The species were not located within during survey (Table 9).

A threatened flora and fauna likelihood table was prepared for the project and is provided in Appendix 3.

4.1 Ecosystem credit species

4.1.1 Predicted ecosystem credit species

Species that require ecosystem credits have a high likelihood of being present on the development site, based on the data entered into the BCC including PCT details, patch size and the location of the development.

Two ecosystem credit species were identified by the BCC, the Little Lorikeet (*Glossopsitta pusilla*) and Swift Parrot (*Lathamus discolour*). A habitat assessment was conducted for each species to determine if the species should remain in the assessment or be removed consistent with Section 6.3.1.8 of the FBA (OEH 2014).

4.1.2 Presence of habitat components for ecosystem credit species

The habitat components for the Swift Parrot and Little Lorikeet were reviewed and a habitat assessment conducted for the site (Table 10). The habitat assessment found that neither species are likely to occupy the site as the habitat components they require are not present. As such both the Little Lorikeet and Swift Parrot were removed from the assessment. No other ecosystem credit species were predicted by the BCC.

A threatened flora and fauna likelihood table was prepared for the project and is provided in **Appendix 3**.

Table 9: Identifying candidate species for further assessment (species credit species)

Common name	Scientific name	TSC Act status	EPBC Act status	Species require further assessment	Justification / notes
Bauer's Midge Orchid	*Genoplesium baueri*	Endangered	Endangered	No	This species has not been recorded within a 10km radius of the subject site (OEH 2017). The habitat available within the subject site is considered unsuitable to this species normally found within dry sclerophyll forest and moss gardens over sandstone.
Bynoe's Wattle	*Acacia bynoeana*	Endangered	Vulnerable	No	This species has not previously been recorded within a 10km radius of the subject site (OEH 2017). The subject site is outside the range of any known populations, and is therefore considered unlikely to naturally occur in the locality. The subject site does not support any of the five canopy species normally associated with this occurrence of this species, thus provides suboptimal habitat conditions.
Camfield's Stringybark	*Eucalyptus camfieldii*	Vulnerable	Vulnerable	No	This species has not previously been recorded within a 10km radius of the subject site (OEH 2017). The species is known from localised and scattered distribution sites at Norah Head (Tuggerah Lakes), Peats Ridge, Mt Colah, Elvina Bay Trail (West Head), Terrey Hills, Killara, North Head, Menai, Wattamolla and a few other sites in Royal National Park. None of these are within range of the subject site, as such the species is considered unlikely to occur naturally within the locality.
Darwinia biflora	*Darwinia biflora*	Vulnerable	Vulnerable	No	Recorded distribution is in Ku-ring-gai, Hornsby, Baulkham Hills and Ryde local government areas. The northern, southern, eastern and western limits of the range are at Maroota, North Ryde, Cowan and Kellyville, respectively. The subject site is therefore outside the expected range of this species, with no previous records found to occur within a 10km radius of the subject site (OEH 2017).

Common name	Scientific name	TSC Act status	EPBC Act status	Species require further assessment	Justification / notes
Deane's Paperbark	*Melaleuca deanei*	Vulnerable	Vulnerable	No	Deane's Paperbark occurs in two distinct areas, in the Ku-ring-gai/Berowra and Holsworthy/Wedderburn areas respectively. There are also more isolated occurrences at Springwood (in the Blue Mountains), Wollemi National Park, Yalwal (west of Nowra) and Central Coast (Hawkesbury River) areas. The subject site is therefore outside the expected range of this species, with no previous records found to occur within a 10km radius of the subject site (OEH 2017).
Eastern Pygmy-possum	*Cercartetus nanus*	Vulnerable	-	No	This species has not been recorded within a 10km radius of the subject site (OEH 2017). It is presumed to be locally extinct.
Gang-gang Cockatoo population, Hornsby and Ku-ring-gai Local Government Areas	*Callocephalon fimbriatum population in the Hornsby and Ku-ring-gai Local Government Areas*	Endangered population	-	No	The population is believed to be largely confined to an area bounded by Thornleigh and Wahroonga in the north, Epping and North Epping in the south, Beecroft and Cheltenham in the west and Turramurra/South Turramurra to the east. It is known to inhabit areas of Lane Cove National Park, Pennant Hills Park and other forested gullies in the area. The subject site is therefore outside of the expected range of this species, and holds no suitable foraging or nesting habitat. No previous records are found to occur within a 10km radius of the subject site (OEH 2017).
Hairy Geebung	*Persoonia hirsuta*	Endangered	Endangered	No	Species records from within a 10km radius detected a single recorded Hairy Geebung, however the accuracy of this record was offset by 2500m (OEH 2017). It is considered unlikely to occur within the highly altered subject site.
Hibbertia puberula	*Hibbertia puberula*	Critically Endangered	Critically Endangered	No	This species is currently known to occur in only one population at Bankstown Airport in Sydney's southern suburbs, in the Bankstown local government area. Within the Sydney Metro catchment t is considered to be

Common name	Scientific name	TSC Act status	EPBC Act status	Species require further assessment	Justification / notes
					strongly associated with Castlereagh Ironbark Forest or possibly Castlereagh Scribbly Gum, with remnant vegetation essential. No such habitat is available within the subject site or adjoining areas. No previous records are found to occur within a 10km radius of the subject site (OEH 2017).
Little Penguin population, Manly	*Eudyptula minor population - endangered population*	Endangered Population	-	No	This species has not previously been recorded within a 10km radius of the subject site (OEH 2017). The subject site is located outside of the breeding range of this endangered population and contains no marine foraging habitat suitable for this species.
Long-nosed Bandicoot population, North Head	*Perameles nasuta population - endangered population*	Endangered Population	-	No	This species has not previously been recorded within a 10km radius of the subject site (OEH 2017). The subject site is located outside of the range of this endangered population.
Netted Bottle Brush	*Callistemon linearifolius*	Vulnerable	-	Survey conducted – not found	A targeted search was undertaken for this species at optimal flowering times, with no evidence of its presence found within the subject site or the immediately adjoining area. There are no previous records for this species within the targeted area or immediate surrounds (OEH 2017).
Regent Honeyeater	*Anthochaera phrygia*	Critically Endangered	Critically Endangered	No	Habitat assessment undertaken found that the subject site provided insufficient foraging resources (absence of tall nectar-bearing trees) to attract the Regent Honeyeater. No previous records were found to indicate the species occurrence within a 10km radius (OEH 2017).
Southern Brown Bandicoot (eastern)	*Isoodon obesulus subsp. obesulus*	Endangered	Endangered	No	This species has not previously been recorded within a 10km radius of the subject site (OEH 2017). The subject site is located outside of the range of known populations for this species.

Common name	Scientific name	TSC Act status	EPBC Act status	Species require further assessment	Justification / notes
Sunshine Wattle	*Acacia terminalis subsp. terminalis*	Endangered	Endangered	Survey conducted – not found	A targeted search was undertaken for this species at optimal flowering times, with no evidence of its presence found within the subject site or the immediately adjoining area.
Tetratheca glandulosa	*Tetratheca glandulosa*	Vulnerable	-	No	This species has only been identified within woodland communities of Baulkham Hills, Gosford, Hawkesbury, Hornsby, Ku-ring-gai, Pittwater, Ryde, Warringah, and Wyong. There are no previous records for this species within a 10km radius of the subject site (OEH 2017). Thus subject site was therefore considered to provide unsuitable habitat and outside potential range of distribution.
Thick Lip Spider Orchid	*Caladenia tessellata*	Endangered	Vulnerable	No	There are no previous records for this species within a 10km radius of the subject site (OEH 2017). The species is typically found in cooler regions, with populations occurring in coastal Victoria. Onsite habitat conditions were deemed unsuitable for this species.

Table 10: Identifying candidate species for further assessment (ecosystem credit species)

Common name	Scientific name	TSC Act status	EPBC Act status	Species present in vegetation zone?	Justification for removal from assessment
Little Lorikeet	*Glossopsitta pusilla*	Vulnerable	-	No	This species only nests in tall, hollow-bearing eucalypt and other myrtaceous trees. Tall, nectar-bearing eucalyptus trees, the primary foraging resource for this species were not found within the subject site. No historical records have been recorded within a 10km radius of the subject site (OEH 2017)
Swift Parrot	*Lathamus discolor*	Endangered	Critically Endangered	No	This species does not breed in NSW. Tall, nectar bearing eucalyptus trees, the primary foraging resource for this species were not found within the subject site. The nearest historical record of this species is10km away (OEH 2017).

5. Impact assessment and credit calculations

5.1 Final project footprint

The proposed walkway impacts on 0.027 ha of native vegetation mapped as ME101 / PCT 1822: *Heath-leaved Banksia - Scrub She-oak heath on sandstone headlands in the Sydney* basin. Biometric plot and transect data revealed the native vegetation across the subject site is in moderate to good condition, with some values within benchmark, and others absent or below benchmark. The final project impact is provided in Table 11 and the footprint is displayed in Figure 9.

Table 11: Total impact on native vegetation

Plant community type	Area (ha)	Area impacted (ha)
PCT 1822 - Heath-leaved Banksia - Scrub She-oak heath on sandstone headlands in the Sydney basin	0.40	0.027

5.2 Assessment of direct and indirect impacts

A direct impact will occur to all vegetation within the 0.027 ha footprint of the proposed walkway. This totals 6.75% of the total native bushland area. Vegetation within the footprint is contiguous to the surrounding area as such no significant decrease in native flora species diversity and structure across the subject site is anticipated. The direct impacts of vegetation clearance will be limited to the extent of the walkway and nooks. No additional clearing will be required for the construction of the walkway.

Once constructed the proposed walkway has the potential to increase the manifestation of edge effects by further fragmenting the bushland patch and acting as a potential source of exotic flora propagules. During construction, steps will be taken to ensure exotic propagules are not inadvertently introduced to the site on machinery, tools or equipment, limiting indirect impacts. Vegetation management, including the management of weed species, will be completed on site (see Section 5.3).

As local soils are naturally prone to erosion and disturbance associated with the removal of vegetation, measures will be implemented (both during and post construction) to minimise erosion and sedimentation.

Impacts to sandstone outcrops have been limited; however the proximity of the works to sandstone outcrops means there remains a risk of indirectly impacting on these habitat features. Measures employed during construction will reduce these impacts (see Section 5.3).

5.3 Mitigation of impacts

Several measures will be implemented to reduce impacts where possible. Details are provided below.

- Keeping the width of the walkway as narrow a width as practicable (no wider than 1.5 m) without reducing its purpose.
- Micro-siting the route of the pathway to avoid habitat which holds high habitat value such as sandstone outcrops, larger shrubs or canopy species. If required route of walkway may be altered a maximum distance of 1m.
- Assigning an Ecologist to undertake a pre-clearing survey of the vegetation prior to track construction. If any significant ecological values such as nests are found, these are to be avoided through shifting the path of the track of waiting until the nest is vacated.
- Assigning an Ecologist to be present on site during the clearing of the access to track. The Ecologist will be able to guide works crews away from sensitive ecological features, and will be on hand to capture and relocate displaced fauna.
- Preventing the inadvertent introduction of exotic flora propagules by following the DEP (2015) 'Arrive Clean, Leave Clean' Guidelines.
- Ensuring the track runs parallel with the contours of the subject site across as little topographic gradient as possible to help reduce erosion risk.
- Ensuring appropriate erosion and sedimentation controls are maintained throughout the construction phase and the period immediately following as outlined in the 'Blue Book' (Landcom 2004).
- Reducing the incidence of multiple informal tracks being cut through the area (as has previously occurred), thus minimising the total area of disturbance. The single established walkway is intended to be the only thoroughfare utilised across the vegetation patch.
- Increasing social value of the bushland through improved public access to the native vegetation on the campus to encourage appreciation of its sensitivity to disturbances such as illegal dumping or clearing (as has previously occurred).
- Maintaining and enhancing bushland revegetation and weed management post construction phase.

The unavoidable impact of clearing vegetation to construct the walkway will be mitigated through an increase in onsite vegetation management across the patch. The condition of the vegetation will be improved by removing weeds and maintaining a weed free patch of bushland. The extent of native vegetation will be increased by revegetating an area currently occupied by exotic turf. Weed management and vegetation restoration will all be outlined in detail within the Biodiversity Management Plan (BMP) (Narla 2017). The BMP will provide a best practice guide to address site specific requirements and recommendation to enhance local biodiversity.

Figure 9: Development footprint and native vegetation extent

5.4 Credit calculations

5.4.1 Ecosystem credits

Ecosystem credits were calculated based on the landscape value assessment, native vegetation assessment and threatened species assessment documented in this report.

In total 0.42 credits are required for the proposed impact of 0.027 ha. As the credit amount is below 0.5 credits, and the credit amount is rounded down, no ecosystem credits are required for the proposal. The ecosystem credit offset requirement is summarised in Table 12, and the final credit report is displayed in Appendix 4.

Table 12: Ecosystem credit requirement

				Offset options	
Plant community type	**Condition**	**Area impacted (ha)**	**Credits required**	**Plant community type(s)**	**IBRA subregion(s)**
PCT 1822 - Heath-leaved Banksia - Scrub She-oak heath on sandstone headlands in the Sydney basin	Moderate - Good	0.027	0.42 (rounded to 0)	Heath-leaved Banksia - Scrub She-oak heath on sandstone headlands in the Sydney basin, (PCT 1822 / ME101)	Pittwater (Part B) and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

5.4.1 Species credits

No species credits are required for the proposal. Refer to Section 4.1.

5.5 Thresholds for the assessment and offsetting of unavoidable impacts

Section 9: Table 4 of the FBA (OEH 2014) provides thresholds for the assessment and offsetting for the unavoidable impacts of development. Four thresholds have been defined, including:

I. Impacts that require further consideration by consent authority
II. Impacts for which the assessor is required to determine an offset
III. Impacts for which the assessor is not required to determine an offset
IV. Impacts that do not require further assessment by the assessor.

The proposed development meets the requirements of (III), as outlined below.

As documented in Section 9.3 of the FBA (OEH 2014) projects which have unavoidable impacts on native vegetation are not required to determine an offset when the impacts to native vegetation are to a PCT that:

- has a site value score <17, or
- are not identified as CEECs / EECs and
- are not associated with threatened species habitat and are not identified as CEECs / EECs

Irrespective of the final credit calculation outcome (which is zero (0) credits) the proposed development is not required to determine an offset as:

- The plant community type being impacted (ME101 / PCT 1822: Heath-leaved Banksia – Scrub She-oak heath on sandstone headlands in the Sydney basin) is not a CEEC / EEC under either the NSW TSC Act or the Commonwealth EPBC Act
- The plant community type being impacted at the development site is not associated with threatened species habitat. As outlined previously in the report, the two predicted species on site (Little Lorikeet and Swift Parrot) were both removed from the assessment after a habitat assessment was conducted. This resulted in no threatened species being associated with the PCT at the development site.

6. Conclusion

The proposed development has been assessed consistent with the FBA, including the preparation of a site scale vegetation map and completion of the four Biometric plots and transects. The results of the assessment found that zero (0) ecosystem credits were required to offset 0.027 ha of impact to native vegetation from the proposed walkway. No species credits are required for the proposal.

The application of threshold III in the FBA (OEH 2014) means the development is not required to determine an offset. It is therefore proposed that the development proceeds without the purchase or retirement of ecosystem or species credits irrespective of the credit calculation results.

Existing site condition will be enhanced through the application of a site specific BMP. This will guide specific on-site vegetation management to both minimise and mitigate any impacts associated with the proposed development and to address issues such as weed infestations and erosion already present within the subject site (Narla 2017).

References

Benson D & Howell J 1990. Taken for Granted - The Bushland of Sydney and its suburbs. Kangaroo Press, Kenthurst.

Chapman and Murphy (1989) Soil Landscapes of the Sydney 1:100 000 Sheet, Soil Conservation Service of NSW, Sydney.

Commonwealth of Australia Threatened Species Scientific Committee (TSSC) (2015) Conservation Advice for Eastern Suburbs Banksia Scrub of the Sydney Region, s266B of the Environment Protection and Biodiversity Conservation Act 1999, approved by the Delegate of the Minister on 01 October 2015.

Department of the Environment (DEP) (2015) Arrive Clean, Leave Clean: Guidelines to help prevent the spread of invasive plant diseases and weeds threatening our native plants, animals and ecosystems, The Commonwealth of Australia

Department of Environment and Climate Change NSW (2009a) Best Practice Guidelines Eastern Suburbs Banksia Scrub, Accessed May 2016 http://www.environment.nsw.gov.au/resources/threatenedspecies/0942eastsubsbanksiascrubbpg.pdf

Department of Environment and Climate Change NSW (2009b) Protecting and restoring Eastern Suburbs Banksia Scrub, Accessed May 2016 http://www.environment.nsw.gov.au/resources/threatenedspecies/0968tsdsesbanksiascrub.pdf

NSW Land and Property Information (LPI) (2015). SIX Maps. https://maps.six.nsw.gov.au/

Francis-Jones Morehen Thorp Studio (FJMT) (2016a) SK-5.02 Tree Management Plan – UNSW Cliffbrook Campus (Preliminary Plans)

Francis-Jones Morehen Thorp Studio (FJMT) (2016b) SK-5.03-4 Landscape Plans: East and West– UNSW Cliffbrook Campus (Preliminary Plans)

Herbert, C. (1983) Geology of the 1:100 000 Sheet 9130. Geological Survey of NSW, Sydney.

Landcom (2004) Managing urban stormwater: harvesting and reuse 'The Blue Book'

Narla Environmental Pty Ltd (2017) Biodiversity Management Plan: UNSW Cliffbrook Campus. Commissioned by the University of New South Wales. March 2016

NSW Department of Primary Industries (DPI) (2016) Weeds declared in the Local Control Authority area of Randwick City Council, Weeds Wise, [February 2017] http://weeds.dpi.nsw.gov.au/WeedDeclarations?RegionId=95

NSW Office of Environment and Heritage (2017) Atlas of NSW Wildlife database (Bionet). [February- March 2017].

NSW Office of Environment and Heritage (OEH) (2011a) NSW Scientific Committee - final determination: Eastern Suburbs banksia scrub in the Sydney Basin Bioregion - endangered

ecological community listing, [Febrary 2017] http://www.environment.nsw.gov.au/determinations/EasternSuburbsBanksiaScrubEndComListing.htm

NSW Office of Environment and Heritage (OEH) (2011b) Heritage places and items search: Cliffbrook, Date significance updated: 09 Sep 11, http://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=5045282

NSW Office of Environment and Heritage (OEH) (2013) The Native Vegetation of the Sydney Metropolitan Area, Volume 2: Vegetation Community Profiles, Version 2.0, NSW Office of Environment and Heritage, Sydney.

NSW Office of Environment and Heritage (OEH) (2014) Framework for biodiversity assessment. State of NNW and Office of Environment and Heritage, Sydney.

NSW Office of Environment and Heritage (OEH) (2016a) NSW soil and land information, eSPADE Online Database, http://www.environment.nsw.gov.au/eSpadeWebapp/

PlantNET (The NSW Plant Information Network System)(2016), 'NSW Flora Online: Plant Species Profiles' Royal Botanic Gardens and Domain Trust, Sydney. [February 2017] http://plantnet.rbgsyd.nsw.gov.au

Ralph, M. (2003) 'Growing Australian Native Plants from Seed – For Revegetation Tree Planting and Direct Seeding', Second Edition, Bushland Horticulture Publications

Randwick City Council (RCC) (2015) Gordon's Bay Reserve Bushcare http://www.randwick.nsw.gov.au/community/whats-on/events/2015/regular/gordons-bay-reserve-bushcare?SQ_CALENDAR_DATE=2015-03-08

Richardson, F, Ricardson, R., Shepard, R. (2011) 'Weeds of the South-East – An Identification Guide for Australia', Second Edition, R.G. and F.J Richardson

Robinson, L. (2003) 'Field Guide to the Native Plants of Sydney', Third Edition, Kangaroo Pres

Appendix

Appendix 1 – Flora inventory

Appendix 2 - Sample Survey Pro-forma

Appendix 3 - Threatened Biota Occurrence Likelihood Tables

Appendix 4 – Biodiversity credit report

Appendix 1 -Flora list for the subject site

Scientific Name	Common Name	Candidate Vegetation Communities (OEH 2013)			
		ESBS component: Coastal Sand Mantle Heath S_HL03; PCT 664; ME022	**ESBS component:** Coastal Sandplain Heath S_HL04; PCT 1061; ME011	**Coastal Dune Heath:** Coastal Foredune Wattle Scrub S_HL05; PCT 772; ME006	**Coastal Headland Heath:** Coastal Headland Banksia Heath S_HL06; PCT 1822; SR618
Acacia longifolia sophorae	Coastal Wattle	*	*	*	*
Acacia myrtifolia	Red-stemmed Wattle				
Acemena smithii	Common Lilly Pilly				
Adiantum aethiopicum	Maidenhair Fern				
Allocasuarina distyla	Black She-oak	*	*		*
Angophora costata	Smooth Barked Apple				
Araucaria het erophylla	Norfolk Island Pine				
Asplenium australascium	Birds Nest Fern				
Baeckea imbricata	Heath Myrtle				*
Banksia ericifolia	Heath-leaved Banksia	*			*
Banksia integrifolia	Coastal Banksia			*	
Bauera rubioides	Dog Rose				
Breynia oblongifolia	Coffee Bush				
Callistemon citrinus	Crimson Bottlebrush				
Calochlaena dubia	Common Ground Fern				
Carpobrotus glauscens	Pigface			*	
Casuarina glauca	Swamp She-Oak				
Christella dentata	Binung Fern				
Commelina cyanea	Scurvy Weed				
Correa alba	White Correa				
Crinium pendeculatum	Swamp Lily				
Cupaniopsis anacardioides	Tuckeroo				
Cyperus brevifolius	Globe Kyllinga				
Cyrtomium fal catum	Holly Fern				
Dianella caerulea	Blue Flax Lily				*

Scientific Name	Common Name	Candidate Vegetation Communities (OEH 2013)			
		ESBS component: Coastal Sand Mantle Heath S_HL03; PCT 664; ME022	**ESBS component:** Coastal Sandplain Heath S_HL04; PCT 1061; ME011	**Coastal Dune Heath:** Coastal Foredune Wattle Scrub S_HL05; PCT 772; ME006	**Coastal Headland Heath:** Coastal Headland Banksia Heath S_HL06; PCT 1822; SR618
Dianella revoluta	Blue Flax Lily				
Dichelachne crinita	Longhair Plume Grass				
Dicksonia antarctica	Soft Tree Fern				
Dodonaea triquetra	Common Hopbush				
Eleaocarpus reticulatus	Blueberry Ash				
Erogrostis brownii	Browns Love Grass				
Eucalyptus botryoideis	Southern Mahogany				
Ficinia nodosa	Knotted Club-rush			*	
Ficus rubiginosa	Port Jackson Fig				
Gahnia sp					
Glochidion ferdinandi	Cheese Tree				
Grevilea hookeriana	Hookers Grevillea				
Hakea gibbosa	Needlebush				
Hakea teretifolia	Dagger Hakea				*
Hardenbergia violacea	Purple Coral Pea				
Hibbertia scandens	Snake Vine				
Histiopteris incisa	Bats Wing Fern				
Imperata cylindrica	Blady Grass				
Juncus continuus	Juncus				
Kunzea ambigua	Tick Bush				*
Leptospermum laevigatum	Coastal Teatree	*	*	*	*
Livistona australis	Cabbage Palm				
Lobelia ancepslata	Angled lobelia				
Lomandra longifolia	Spiny Mat Rush		*		*
Melaleuca armillaris	Bracelet Honey-myrtle				*
Melaleuca nodosa	Ball Honeymyrtle	*	*		*
Microlaena sti poides	Weeping Grass				

Scientific Name	Common Name	Candidate Vegetation Communities (OEH 2013)			
		ESBS component: Coastal Sand Mantle Heath S_HL03; PCT 664; ME022	**ESBS component: Coastal Sandplain Heath S_HL04; PCT 1061; ME011**	**Coastal Dune Heath: Coastal Foredune Wattle Scrub S_HL05; PCT 772; ME006**	**Coastal Headland Heath: Coastal Headland Banksia Heath S_HL06; PCT 1822; SR618**
Opercularia as pera	Course Stinkweed				
Oplismenus imbecillis	Basket Grass				
Oxalis rubens	Coastal Oxalis				
Pittosporum undulatum	Sweet Pittosporum				*
Portulaca oler acea	Pigweed				
Pteridium esculentum	Bracken Fern		*		
Sigesbeckia orientalis	Common St. Paul's Wort				
Stephania japonica	Tape Vine				
Tetragonia tetragonoides	New Zealand Spinach				
Viola hederacea	Native Violet				
Westringia fruticosa	Coastal Rosemary				
Count of Positive Diagnostic Species:		**5**	**6**	**5**	**12**
Vegetation community determinant (OEH 2013) :		A 0.04 hectare site located in this map unit is expected to contain at least 9 positive diagnostic species (95 per cent confidence interval) provided the total number of native species in the site is 24 or greater.	A 0.04 hectare site located in this map unit is expected to contain at least 12 positive diagnostic species (95 per cent confidence interval) provided the total number of native species in the site is 27 or greater.	A 0.04 hectare site located in this map unit is expected to contain at least 3 positive diagnostic species (95 per cent confidence interval) provided the total number of native species in the site is 5 or greater.	A 0.04 hectare site located in this map unit is expected to contain at least 5 positive diagnostic species (95 per cent confidence interval) provided the total number of native species in the site is 24 or greater.

Appendix 2 - Sample site plot and transect pro-forma

Monitoring Plot Data Sheet (Biometric) | Site Sheet No.

Plot Information		Recorders	ES / DS	Date	9/2/17
Site Name/Code	UNSW2				
Start Easting		20m Easting		50m Easting	
Start Northing		20m Northing		50m Northing	
Orientation of transect plot (direction and degrees)	ESE	Photo No. start	✓	Slope (degrees)	15° → S
		Photo No. end of 50m transect	✓		

* Record Easting and Northing of each stake, from the start, 20m mark and end of 50m transect

Vegetation Zone Identification	
Location	P3
Vegetation Community	
Condition (Low or Mod-Good)	Mod-Good (leading to low?)
Habitat Features (rocks etc.)	
Comments	edge close to lawn, active regeneration / planting bed

		5	10	15	20	25	30	35	40	45	50		
Native 50m transect – 10 points (at 5m spaces)	Native overstorey cover (%)	0	0	0	55	0	5	0	0	0	0	Sum /10 60/10	% 6
	Native midstorey cover (%)	10	45	0	65	0	0	2	15	0	55	Sum /10 192	% 19
Native 50m transect – 50 Points (at 1m spaces)	Native ground cover (tally hits/50 points) - shrubs	𝍸 𝍸 𝍸 I									=16	Sum x 2 32/	% 0.64
	Native ground cover (tally hits/50 pts) - grasses	𝍸 𝍸 𝍸 𝍸 𝍸									= 25	Sum x2 50/	% 1
	- cryptogam	0										Sum x2	%
	Leaf litter (tally/ 50 pts)	𝍸 𝍸 𝍸									= 15	30/	0.6
	Leaf litter (tally/50 pts) other	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸									= 30	60/	1.2
Exotic: 50m transect – 50 points	Ground cover (tally hits/50 points) - grasses or shrubs	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸									=60	Sum x2 120	% 120
Exotic: 50m transect – 10 points (at 5m spaces)	Exotic overstorey cover (%)	0	0	0	0	0	0	0	0	0	0	Sum/10 0	% 0
	Exotic midstorey cover (%)	0	0	0	0	0	0	0	100	85	20	Sum/10 205	% 20.5

20m x 50m Quadrat	Number of individual trees with hollows (only hollow ≥5cm diameter):	Total length fallen logs in metres (only logs >10cm width)
	0	10+4+11+2+4 = 31

Whole Veg. Zone	Over-storey regeneration	Over-storey Species	Regenerating (<5cm)	Comments
		Little evidence except planted		

Cover: <1, 1,2,3,4,5, 15,20,25,30,35 etc foliage cover %

Appendix 3 - Threatened Biota Occurrence Likelihood Tables

Threatened Species Occurrence Tables Key

Likelihood of occurrence	**Potential criteria**
High	Have a high incidence of previous records in the Project Area and locality · Populations are known in the Project Area or locality
Moderate	There are infrequent recorded for the species in the Project Area and locality · Preferential habitats of the species are present in the Project Area but these are mainly in a poor or modified condition · Are cryptic flowering flora species that were not seasonally targeted during survey
Low	Have not been recorded previously in the Project Area or locality and the Project Area is beyond the known distribution or range · Are dependent on a narrow range or specific habitats that do not or are not likely to occur in the Project Area · Are considered locally extinct · Are a non-cryptic perennial flora species that were targeted during field surveys · Are flora species that have a very limited range and highly specific dispersal mechanisms
Negligible	Habitat not present on site · Habitat present but sufficient targeted survey has been conducted at an optimal time of year and species wasn't recorded

Status Codes

E	Endangered
V	Vulnerable
CE	Critically Endangered
X	Extinct
C	China Migratory Bird Agreement (CAMBA)
J	Japan Migratory Bird Agreement (JAMBA)
K	Republic of Korea Migratory Bird Agreement (ROKAMBA)

Threatened Fauna Occurrence Likelihood Table. List Generated through Bionet Search of records within a 10km radius centred on subject site.

Scientific Name	Common Name	NSW status	Commonwealth status	Habitat Description	Likely Occurrence in subject Site	Rationale for Likelihood Ranking
Amphibians						
Pseudophryne australis	Red-crowned Toadlet	V		Red-crowned Toadlets are quite a localised species that appear to be largely restricted to the immediate vicinity of suitable breeding habitat. Red-crowned Toadlets are usually found as small colonies scattered along ridges coinciding with the positions of suitable refuges near breeding sites. Occurs in open forests, mostly on Hawkesbury and Narrabeen Sandstones. Inhabits periodically wet drainage lines below sandstone ridges that often have shale lenses or cappings.	Negligible	Unsuitable habitat
Litoria aurea	Green and Golden Bell Frog	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.	Negligible	Unsuitable habitat
Reptiles						
Chelonia mydas	Green Turtle	V	V	Ocean-dwelling species spending most of its life at sea. Widely distributed in tropical and sub-tropical seas. Usually found in tropical waters around Australia but also occurs in coastal waters of NSW, where it is generally seen on the north or central coast, with occasional records from the south coast. Eggs laid in holes dug in beaches throughout their range.	Negligible	Unsuitable habitat within subject site -animal is marine.
Birds						

Scientific Name	Common Name	NSW status	Commonwealth status	Habitat Description	Likely Occurrence in subject Site	Rationale for Likelihood Ranking
Anseranas semipalmata	Magpie Goose	V		The Magpie Goose is still relatively common in the Australian northern tropics, but had disappeared from south-east Australia by 1920 due to drainage and overgrazing of reed swamps used for breeding. Mainly found in shallow wetlands (less than 1 m deep) with dense growth of rushes or sedges.	Negligible	Unsuitable habitat
Stictonetta naevosa	Freckled Duck	V		Prefer permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds. Generally rest in dense cover during the day, usually in deep water. Feed at dawn and dusk and at night on algae, seeds and vegetative parts of aquatic grasses and sedges and small invertebrates	Negligible	Unsuitable habitat (no large waterbody within subject site)
Ptilinopus superbus	Superb Fruit-Dove	V		The Superb Fruit-dove occurs principally from north-eastern in Queensland to north-eastern NSW. It is much less common further south, where it is largely confined to pockets of suitable habitat as far south as Moruya. Inhabits rainforest and similar closed forests where it forages high in the canopy, eating the fruits of many tree species such as figs and palms. It may also forage in eucalypt or acacia woodland where there are fruit-bearing trees. Part of the population is migratory or nomadic. There are records of single birds flying into lighted windows and lighthouses, indicating that birds travel at night. At least some of the population, particularly young birds, moves south through Sydney, especially in autumn.	Low (vagrant)	Unsuitable habitat

Scientific Name	Common Name	NSW status	Commonwealth status	Habitat Description	Likely Occurrence in subject Site	Rationale for Likelihood Ranking
Apus pacificus	Fork-tailed Swift		C,J,K	In NSW, the Fork-tailed Swift is recorded in all regions. Many records occur east of the Great Divide. In Australia, they mostly occur over inland plains but sometimes above foothills or in coastal areas. They often occur over cliffs and beaches and also over islands and sometimes well out to sea. They also occur over settled areas, including towns, urban areas and cities. They mostly occur over dry or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh	Moderate (fly over)	Potential to fly over only. No suitable habitat.
Hirundapus caudacutus	White-throated Needletail		C,J,K	In eastern Australia, it is recorded in all coastal regions of Queensland and NSW. During the non-breeding season the species has also occurred as a vagrant on various outlying islands, including Christmas Island and possibly the Cocos-Keeling Islands in the Indian Ocean, Norfolk and Lord Howe Islands in the Pacific Ocean, and Macquarie Island in the Southern Ocean	High (fly over)	Potential to fly over only. No suitable habitat.
Diomedea exulans	Wandering Albatross	E	E,J	Wandering albatross spend the majority of their time in flight, soaring over the southern oceans. They breed on a number of islands just north of the Antarctic Circle. The Wandering Albatross visits Australian waters extending from Fremantle, Western Australia, across the southern water to the Whitsunday Islands in Queensland between June and September. It has been recorded along the length of the NSW coast.	Low	Potential to fly over only. No suitable habitat.

Scientific Name	Common Name	NSW status	Commonwealth status	Habitat Description	Likely Occurrence in subject Site	Rationale for Likelihood Ranking
Thalassarche chrysostoma	Grey-headed Albatross		E	The Grey-headed Albatross is marine, pelagic and migratory. Its habitat includes subantarctic, subtropical, and occasionally Antarctic waters in the Pacific, Indian, Atlantic and Southern Oceans.	Low	Potential to fly over only. No suitable habitat.
Ardenna carneipes	Flesh-footed Shearwater	V	J,K	Ranges throughout the Pacific and Indian Oceans. There are two main breeding areas in the world: one in the South West Pacific includes Lord Howe Island and New Zealand; the other along the coast of Western Australia.	Low	Potential to fly over only. No suitable habitat.
Ardenna pacificus	Wedge-tailed Shearwater		J	The Wedge-tailed Shearwater is a pelagic, marine bird known from tropical and subtropical waters. The species tolerates a range of surface-temperatures and salinities, but is most abundant where temperatures are greater than 21 °C and salinity is greater than 34.6 ‰. In tropical zones the species may feed over cool nutrient-rich waters. The species has been recorded in offshore waters of eastern Victoria and southern NSW, mostly over continental slope.	Low	Potential to fly over only. No suitable habitat.
Botaurus poiciloptilus	Australasian Bittern	E	E	Australasian Bitterns are widespread but uncommon over south-eastern Australia. In NSW they may be found over most of the state except for the far north-west. Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (Typha spp.) and spike rushes (Eleocharis spp.). Hides during the day amongst dense reeds or rushes and feed mainly at night on frogs, fish, yabbies, spiders, insects and snails	Negligible	No suitable habitat.

Scientific Name	Common Name	NSW status	Commonwealth status	Habitat Description	Likely Occurrence in subject Site	Rationale for Likelihood Ranking
Erythrotriorchis radiatus	Red Goshawk	E	V	Red Goshawks inhabit open woodland and forest, preferring a mosaic of vegetation types, a large population of birds as a source of food, and permanent water, and are often found in riparian habitats along or near watercourses or wetlands. In NSW, preferred habitats include mixed subtropical rainforest, Melaleuca swamp forest and riparian Eucalyptus forest of coastal rivers. Distributed sparsely through northern and eastern Australia, from the western Kimberley Division of northern Western Australia to north-eastern Queensland and south to far north-eastern NSW, and with scattered records in central Australia.	Negligible	Extinct in NSW
Hieraaetus morphnoides	Little Eagle	V		Occupies open eucalypt forest, woodland or open woodland. She-oak or Acacia woodlands and riparian woodlands of interior NSW are also used. Nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter.	Low	No suitable habitat.
Haematopus fuliginosus	Sooty Oystercatcher	V		Favours rocky headlands, rocky shelves, exposed reefs with rock pools, beaches and muddy estuaries. Forages on exposed rock or coral at low tide for foods such as limpets and mussels.	Low	Potential to fly over only. No suitable habitat.
Haematopus longirostris	Pied Oystercatcher	E		In NSW the species is thinly scattered along the entire coast, with fewer than 200 breeding pairs estimated to occur in the State. Favours intertidal flats of inlets and bays, open beaches and sandbanks. Forages on exposed sand, mud and rock at low tide, for molluscs, worms, crabs and small fish. The chisel-like bill is used to pry open or break into shells of oysters and other shellfish.	Low	Potential to fly over only. No suitable habitat.

Scientific Name	Common Name	NSW status	Commonwealth status	Habitat Description	Likely Occurrence in subject Site	Rationale for Likelihood Ranking
Pluvialis squatarola	Grey Plover		C,J,K	In non-breeding grounds in Australia, Grey Plovers occur almost entirely in coastal areas, where they usually inhabit sheltered embayment's, estuaries and lagoons with mudflats and sandflats, and occasionally on rocky coasts with wave-cut platforms or reef-flats, or on reefs within muddy lagoons. They also occur around terrestrial wetlands such as near-coastal lakes and swamps, or salt-lakes.	Low	Potential to fly over only. No suitable habitat..
Calidris acuminata	Sharp-tailed Sandpiper		C,J,K	In Australasia, the Sharp-tailed Sandpiper prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. This includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, saltpans and hypersaline salt lakes inland.	Low	Potential to fly over only. No suitable habitat.
Calidris melanotos	Pectoral Sandpiper		J,K	In Australasia, the Pectoral Sandpiper prefers shallow fresh to saline wetlands. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands.	Low	Potential to fly over only. No suitable habitat.
Gallinago hardwickii	Latham's Snipe		C,J,K	In Australia, Latham's Snipe occurs in permanent and ephemeral wetlands up to 2000 m above sea-level. They usually inhabit open, freshwater wetlands with low, dense vegetation (e.g. swamps, flooded grasslands or heathlands, around bogs and other water bodies). However, they can also occur in habitats with saline or brackish water, in modified or artificial habitats, and in habitats located close to humans or human activity	Low	Insufficient habitat. Known only from limited historic records within a 10km radius
Limosa lapponica	Bar-tailed Godwit		C,J,K	The Bar-tailed Godwit is found mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. It is found often around beds of seagrass and, sometimes, in nearby saltmarsh. It has been sighted in coastal sewage farms and saltworks, saltlakes and brackish wetlands near coasts, sandy ocean beaches, rock platforms, and coral reef-flats.	Low	Potential to fly over only. No suitable habitat.

Scientific Name	Common Name	NSW status	Commonwealth status	Habitat Description	Likely Occurrence in subject Site	Rationale for Likelihood Ranking
Numenius minutus	Little Curlew		C,J,K	The Little Curlew is most often found feeding in short, dry grassland and sedgeland, including dry floodplains and blacksoil plains, which have scattered, shallow freshwater pools or areas seasonally inundated. Open woodlands with a grassy or burnt understorey, dry saltmarshes, coastal swamps, mudflats or sandflats of estuaries or beaches on sheltered coasts, mown lawns, gardens, recreational areas, ovals, racecourses and verges of roads and airstrips are also used. When resting during the heat of day, the Little Curlew congregates around pools, river beds and water-filled tidal channels, and shallow water at edges of billabongs. The species prefers pools with bare dry mud (including mudbanks in shallow water) and they do not use pools if they are totally dry, flooded or heavily vegetated.	Low	Insufficient habitat. Known only from historic records within a 10km radius. Vagrant.
Tringa nebularia	Common Greenshank		C,J,K	The species is known to forage at edges of wetlands, in soft mud on mudflats, in channels, or in shallows around the edges of water often among pneumatophores of mangroves or other sparse, emergent or fringing vegetation, such as sedges or saltmarsh. It will occasionally feed on exposed seagrass bed. It roosts and loafs round wetlands, in shallow pools and puddles, or slightly elevated on rocks, sandbanks or small muddy islets. Occasionally the species will perch and roost on stakes	Low	Potential to fly over only. No suitable habitat.
Tringa stagnatilis	Marsh Sandpiper		C,J,K	The Marsh Sandpiper usually forages in shallow water at the edge of wetlands. They probe wet mud of mudflats or feed among marshy vegetation. he Marsh Sandpiper has been recorded roosting or loafing on tidal mudflats, near low saltmarsh, and around inland swamps.	Low	Potential to fly over only. No suitable habitat.

Scientific Name	Common Name	NSW status	Commonwealth status	Habitat Description	Likely Occurrence in subject Site	Rationale for Likelihood Ranking
Stercorarius pomarinus	Pomarine Jaeger		C,J	Insufficient data	Low	Potential to fly over only. No suitable habitat.
Onychoprion fuscata	Sooty Tern	V		The Sooty Tern is found over tropical and sub-tropical seas and on associated islands and cays around Northern Australia. In NSW only known to breed at Lord Howe Island. Occasionally seen along coastal NSW, especially after cyclones.	Low	Potential to fly over only. No suitable habitat.
Sterna hirundo	Common Tern		C,J,K	Common Terns are marine, pelagic and coastal. In Australia, they are recorded in all marine zones, but are commonly observed in near-coastal waters, both on ocean beaches, platforms and headlands and in sheltered waters, such as bays, harbours and estuaries with muddy, sandy or rocky shores.	Low	Potential to fly over only. No suitable habitat.
Sternula albifrons	Little Tern	E	C,J,K	In NSW, it arrives from September to November, occurring mainly north of Sydney. Nests in small, scattered colonies in low dunes or on sandy beaches just above high tide mark near estuary mouths or adjacent to coastal lakes and islands. Often seen feeding in flocks, foraging for small fish, crustaceans, insects, worms and molluscs by plunging in the shallow water of channels and estuaries, and in the surf on beaches, or skipping over the water surface with a swallow-like flight.	Low	Potential to fly over only. No suitable habitat.

Scientific Name	Common Name	NSW status	Commonwealth status	Habitat Description	Likely Occurrence in subject Site	Rationale for Likelihood Ranking
Calyptorhynchus lathami	Glossy Black-Cockatoo	V		Inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of she-oak occur. Black She-oak (Allocasuarina littoralis) and Forest She-oak (A. torulosa) are important foods. Feeds almost exclusively on the seeds of several species of she-oak (Casuarina and Allocasuarina species), shredding the cones with the massive bill. Dependent on large hollow-bearing eucalypts for nest sites	Low	Less than ideal habitat, though some potential foraging sites may occur in surrounding area. No recent proximal records. Likely extinct in this part of Sydney.
Lathamus discolor	Swift Parrot	E	E	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. Favoured feed trees include winter flowering species such as Swamp Mahogany Eucalyptus robusta, Spotted Gum Corymbia maculata, Red Bloodwood C. gummifera, Mugga Ironbark E. sideroxylon, and White Box E. albens.	Low-Moderate	Potential to fly over only. No suitable habitat.

Scientific Name	Common Name	NSW status	Commonwealth status	Habitat Description	Likely Occurrence in subject Site	Rationale for Likelihood Ranking
Ninox strenua	Powerful Owl	V		The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It 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. The main prey items are medium-sized arboreal marsupials, particularly the Greater Glider, Common Ringtail Possum and Sugar Glider. There may be marked regional differences in the prey taken by Powerful Owls.	Moderate	Potential to fly over or temporarily perch only. No suitable foraging, roosting or breeding habitat.
Epthianura albifrons	White-fronted Chat	V		Found mostly in temperate to arid climates and very rarely sub-tropical areas, it occupies foothills and lowlands up to 1000 m above sea level. In NSW, it occurs mostly in the southern half of the state, in damp open habitats along the coast, and near waterways in the western part of the state. Along the coastline, it is found predominantly in saltmarsh vegetation but also in open grasslands and sometimes in low shrubs bordering wetland areas.	Low	No suitable habitat.

Scientific Name	Common Name	NSW status	Commonwealth status	Habitat Description	Likely Occurrence in subject Site	Rationale for Likelihood Ranking
Epthianura albifrons	White-fronted Chat population in the Sydney Metropolitan Catchment Management Area	E		Two isolated sub-populations of White-fronted Chats are currently known from the Sydney Metropolitan Catchment Management Authority (CMA) area; one at Newington Nature Reserve on the Parramatta River and one at Towra Point Nature Reserve in Botany Bay.	Low	No suitable habitat.
Petroica boodang	Scarlet Robin	V		The Scarlet Robin lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. This species lives in both mature and regrowth vegetation. It occasionally occurs in mallee or wet forest communities, or in wetlands and tea-tree swamps. Scarlet Robin habitat usually contains abundant logs and fallen timber: these are important components of its habitat.	Low	No suitable habitat.
Stagonopleura guttata	Diamond Firetail	V		Not commonly found in coastal districts, though there are records from near Sydney, the Hunter Valley and the Bega Valley. This species has a scattered distribution over the rest of NSW. Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum Eucalyptus pauciflora Woodlands. Also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities. Often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland.	Negligible	No suitable habitat.. Extinct in this part of Sydney.
Mammals						

Scientific Name	Common Name	NSW status	Commonwealth status	Habitat Description	Likely Occurrence in subject Site	Rationale for Likelihood Ranking
Dasyurus maculatus	Spotted-tailed Quoll	V	E	Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline.	Low-moderate	Only a single record within a 10km radius of the Subject Site. The size of the subject site is likely to be insufficient to support required foraging and breeding habitat as the site is isolated and lacking in habitat structure.
Dasyurus viverrinus	Eastern Quoll	E	CE	Highly flexible habitat selection, occurring in dry sclerophyll forest, scrub, heathland, pastures and even cultivated land. Opportunistic carnivore with insects as it's most important prey. Capable of taking prey nearly as large as itself. Home ranges vary between sexes and are dependent on habitat quality. In fertile habitats females restrict their movements to a few hundred metres surrounding their dens because prey are plentiful. Males often travel over a kilometre in a night, familiarising themselves with local mates	Negligible	No verified sightings of this species have occurred in NSW since 1963. Presumed extinct.
Aepyprymnus rufescens	Rufous Bettong	V		The original range from Coen in north Queensland to central Victoria has been reduced to a patchy distribution from Cooktown, Queensland, to north-eastern NSW as far south as Mt Royal National Park. In NSW it has largely vanished from inland areas but there are sporadic, unconfirmed records from the Pilliga and Torrington districts.	Negligible	Subject site is well outside of known or predicted range.
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Grey-headed Flying-foxes are generally found within 200 km of the eastern coast of Australia. 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	Known to frequent the surrounding area for foraging purposes. Known from recent observation records. No suitable habitat within proposed walking track impact area.

Scientific Name	Common Name	NSW status	Commonwealth status	Habitat Description	Likely Occurrence in subject Site	Rationale for Likelihood Ranking
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V		Eastern Bentwing-bats occur along the east and north-west coasts of Australia.Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young.	Moderate	No previous records within a 5km radius to the subject site. No suitable habitat within proposed impact area.
Myotis macropus	Southern Myotis	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. Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools catching insects and small fish by raking their feet across the water surface.	Moderate	No previous records within a 5km radius to the subject site. No suitable habitat within proposed impact area.
Dugong dugon	Dugong	E		Major concentrations of Dugongs occur in wide shallow protected bays, wide shallow mangrove channels and in the lee of large inshore islands. Will also occupy deeper waters if their sea grass food is available.	Negligible	No suitable habitat.
Arctocephalus forsteri	New Zealand Fur-seal	V		Occurs in Australia and New Zealand. Reports of non-breeding animals along southern NSW coast particularly on Montague Island, but also at other isolated locations to north of Sydney.	Negligible	No suitable habitat.
Arctocephalus pusillus doriferus	Australian Fur-seal	V		Reported to have bred at Seal Rocks, near Port Stephens and Montague Island in southern NSW. Haul outs are observed at isolated places along the NSW coast. Prefers rocky parts of islands with flat, open terrain	Negligible	No suitable habitat.

Scientific Name	Common Name	NSW status	Commonwealth status	Habitat Description	Likely Occurrence in subject Site	Rationale for Likelihood Ranking
Eubalaena australis	Southern Right Whale	E	E	Temperate and subpolar waters of the Southern Hemisphere, with a circumpolar distribution between about 20°S and 55°S with some records further south to 63°S.	Negligible	No suitable habitat.
Megaptera novaeangliae	Humpback Whale	V	V	Oceanic and coastal waters worldwide	Negligible	No suitable habitat.

Threatened Flora Occurrence Likelihood Table. List Generated through Bionet Search of records within a 10km radius centred on subject site.

Scientific Name	Common Name	NSW status	Commonwealth status	Likely Occurrence in subject Site	Rationale for Likelihood Ranking	Habitat Description
Allocasuarina portuensis	Nielsen Park She-oak	E	E	Low	Potential habitat found locally. Not known from subject site.	The original habitat is tall closed woodland. Known original distribution is restricted to Nielsen Park, in Woollahra local government area. The original habitat occurs above a sandstone shelf approximately 20 m above the harbour. The shallow sandy soils are highly siliceous, coarsely textured and devoid of a soil profile. The plantings have occurred on similar soils. There are no plants left at the original site where it was discovered.
Hibbertia puberula		E		Low	Known from a historical record in an area adjacent to subject site. No recent records.	Habitats are typically dry sclerophyll woodland communities, although heaths are also occupied. It favours low heath on sandy soils or rarely in clay, with or without rocks underneath. Early records of this species are from the Hawkesbury River area and Frenchs Forest in northern Sydney, South Coogee in eastern Sydney, the Hacking River area in southern Sydney, and the Blue Mountains. Recent work on this species have shown it to be widespread, but never common.
Amperea xiphoclada var. pedicellata		E	X	Negligible	Presumed extinct	*Amperea xiphoclada var. pedicellatais* known only from the type specimen collected in 1892 from Sydney, NSW. The species has not been observed since and is presumed to be extinct. previously widespread in heath, woodland and forest in low-fertility, sandy soils
Acacia terminalis subsp. terminalis	Sunshine Wattle	E	E	Moderate	Recent records within the area surrounding subject site. Not present during the survey period but may occur on site in future.	Very limited distribution, mainly in near-coastal areas from the northern shores of Sydney Harbour south to Botany Bay, with most records from the Port Jackson area and the eastern suburbs of Sydney. Coastal scrub and dry sclerophyll woodland on sandy soils. Habitat is generally sparse and scattered. Most areas of habitat or potential habitat are small and isolated.

Scientific Name	Common Name	NSW status	Commonwealth status	Likely Occurrence in subject Site	Rationale for Likelihood Ranking	Habitat Description
Callistemon linearifolius	Netted Bottlebrush	V		Low	Targeted survey was undertaken with no evidence of the species found within the subject site or surrounding area.	The specie is known from only a few populations which are found in the Northern Beaches LGA, however it is known to grow in dry sclerophyll forest on the coast and adjacent ranges.
Prostanthera marifolia	Seaforth Mintbush	E	CE	Negligible	Subject Site is outside of known or predicted range.	Currently only known from the northern Sydney suburb of Seaforth and has a very highly restricted distribution within the Sydney Basin Bioregion. Occurs in localised patches in or in close proximity to the endangered Duffys Forest ecological community. Located on deeply weathered clay-loam soils associated with ironstone and scattered shale lenses, a soil type which only occurs on ridge tops and has been extensively urbanised.
Eucalyptus nicholii	Narrow-leaved Black Peppermint	V	V	Planted - out of range only ornamentals only.	Subject Site is outside of known or predicted range.	This species is sparsely distributed but widespread on the New England Tablelands from Nundle to north of Tenterfield. Typically grows in dry grassy woodland, on shallow soils of slopes and ridges. Found primarily on infertile soils derived from granite or metasedimentary rock
Eucalyptus scoparia	Wallangarra White Gum	E	V	Planted - out of range only ornamentals only.	No suitable habitat. Subject Site is outside of known or predicted range.	Found in open eucalypt forest, woodland and heaths on well-drained granite/rhyolite hilltops, slopes and rocky outcrops, typically at high altitudes.
Melaleuca deanei	Deane's Paperbark	V	V	Low	Little suitable habitat. No proximal records..	The species occurs mostly in ridgetop woodland, with only 5% of sites in heath on sandstone.
Syzygium paniculatum	Magenta Lilly Pilly	E	V	Moderate	Recent records within the area surrounding subject site. Not present during the survey period but may	Found only in NSW, in a narrow, linear coastal strip from Upper Lansdowne to Conjola State Forest. On the south coast the Magenta Lilly Pilly occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest. On the central coast Magenta Lilly Pilly occurs on

Scientific Name	Common Name	NSW status	Commonwealth status	Likely Occurrence in subject Site	Rationale for Likelihood Ranking	Habitat Description
					occur on site in future.	gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities.
Diuris arenaria	Sand Double-tail	E		Negligible	No suitable habitat. Subject Site is outside of known or predicted range.	This species occurs in coastal heath and dry grassy eucalypt forest on sandy flats. Grows in gently undulating country in eucalypt forest with a grassy understorey on clay soil. Known to occur only north of Newcastle
Dichanthium setosum	Bluegrass	V	V	Negligible	No suitable habitat. Subject Site is outside of known range.	Associated with heavy basaltic black soils and red-brown loams with clay subsoil. Known to occur in the New England Tablelands, North West Slopes and Plains and the Central Western Slopes of NSW, extending to northern Queensland.
Persoonia hirsuta	Hairy Geebung	E	E	Moderate	Recent records within the area surrounding subject site. Not present during the survey period but may occur on site in future.	Scattered distribution around Sydney. The species is distributed from Singleton in the north, along the east coast to Bargo in the south and the Blue Mountains to the west. Despite a large area of occurrence, this species occurs in small populations, or as isolated individuals increasing the species' fragmentation in the landscape. It can be found in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone.

Appendix 4 – Biodiversity credit report

Biodiversity credit report

This report identifies the number and type of biodiversity credits required for a major project.

Date of report: 1/03/2017 Time: 10:36:22AM Calculator version: v4.0

Major Project details

Proposal ID:	224/2017/4217MP
Proposal name:	UNSW Cliffbrook Campus Redevelopment
Proposal address:	45-51 Beach Street Coogee NSW 2034
Proponent name:	University of NSW
Proponent address:	45-51 Beach Street Coogee NSW 2034
Proponent phone:	(02) 9385 2172
Assessor name:	Kurtis Lindsay
Assessor address:	PO Box 406 Mona Vale NSW 2103
Assessor phone:	9986 1295
Assessor accreditation:	224

Summary of ecosystem credits required

Plant Community type	Area (ha)	Credits created
Heath-leaved Banksia - Scrub She-oak heath on sandstone headlands in the Sydney basin	0.03	0.42
Total	0.03	0

Credit profiles

1. Heath-leaved Banksia - Scrub She-oak heath on sandstone headlands in the Sydney basin, (ME101)

Number of ecosystem credits created 0

IBRA sub-region Pittwater (Part B)

Offset options - Plant Community types	Offset options - IBRA sub-regions
Heath-leaved Banksia - Scrub She-oak heath on sandstone headlands in the Sydney basin, (ME101)	Pittwater (Part B) and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

Summary of species credits required