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1 INTRODUCTION

Biologic Environmental Survey Pty Ltd (Biologic) was commissioned to undertake a desktop fauna assessment for Lot 195, Great Northern Highway in Muchea (herein referred to as the "Study Area"). This desktop assessment may be used to support future environmental approval for a proposed warehouse and transport depot at the Study Area (Figure 1.1)

The Study Area is located approximately 6 km north-east of Muchea and approximately 40 km north of Midland, Perth. It is 41.9 ha in size with a proposed disturbance footprint (direct and indirect) of 13.7 ha. The Study Area is located within remnant disturbed bushland, with immediate surrounding areas cleared for agriculture. A small nature reserve, Barracca Nature Reserve is approximately 2 km north of the Study Area, larger DPaW land tenure regions including Leda Nature Reserve, Avon Valley National Park and Julimar Conservation Park are within a 20 km proximity. Located approximately 20 km west of the Study Area is the Gnangara pine plantation.

370000 380000 390000 400000 410000 420000 430000

6520000 6510000 6500000 6490000 6480000 6470000 6460000 6450000 6440000

Muchea Study Area

PERTH

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Legend

Study Area

N

1:240,000

biologic

0 2,875 5,750 11,500 m

Urban and Rural Perspectives

Black Cockatoo Habitat Assessment Muchea

Fig. 1.1: Location of Study Areas

A3. Created 27/04/2016
Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator
Datum: GDA 1994

2 METHODS

2.1 DATABASE REVIEW

Desktop searches were undertaken in the Protected Matters database of Threatened Flora, Fauna or Migratory species listed under the Commonwealth Environment Protection and Biodiversity Conservation (EPBC) Act, and in the Department of Parks and Wildlife (DPaW) NatureMap database in February 2017. A 10km radius around the centre of the Study Site (31° 32` 27.24" S, 116° 1.0` 3.36" E) was used for both databases.

2.2 LITERATURE REVIEW

A desktop search was conducted for literature and reports relevant to the Study Site. There has been one previous fauna survey conducted within the Study Area (Biologic, 2016), a targeted survey and habitat assessment for Black Cockatoos. Although no sightings of Black-Cockatoo's were made during the field survey, a small amount of feeding activity was recorded associated with pine trees adjacent to the Study Area with a number of pine cones showing seed extraction, most likely from Carnaby's Black-Cockatoo.

In addition, a small corridor of the Study Area adjacent to the Great Northern Highway has previously been assessed for Black-Cockatoo species for the proposed highway upgrade (Phoenix 2015). The 2015 assessment recorded numerous sightings of Carnaby's Black-Cockatoo, evidence of feeding signs and suitable nesting trees within the Muchea North Study Area (Phoenix 2015).

Ecological (2013) conducted a comprehensive targeted fauna survey for Carnaby's Black Cockatoos at 27 localities within the Perth-Peel region on the Swan Coastal Plain. The survey boundaries included two survey localities in Muchea in proximity to the Study Area. In addition, a potential new roost harbouring 300 Carnaby's Cockatoos was found on the eastern edge of a large plantation bordering native Banksia woodland. However, as the roost is located approximately 5 km north of a known roost, and 2.4 km south-east of another known roost, it is yet to be determined whether the new roost only represents an extended roosting area given its proximity to known roosts.

3 RESULTS

3.1 DESKTOP STUDY

The DPaW NatureMap search, using a 10 km buffer, recorded five species of mammals (including one introduced), 118 species of birds, 17 species of reptiles and eight amphibian species. Nine species of significance were recorded, as shown in Table 3.1.

Table 3.1: Terrestrial Fauna species of conservation significance listed in the NatureMap Report, based on a circle of 10 km radius from the Study Site centre.

Species	Conservation Status	Likelihood of presence in Study Area
BIRDS		
Calyptorhynchus latirostris (Carnaby's Black Cockatoo)	EPBC Endangered, WA Act Endangered	Highly likely, based on previous reports
*Calyptorhynchus banksii naso (*Forest red-tailed Black Cockatoo)	EBPC Vulnerable, WA Act Vulnerable	Highly likely, based on previous reports
Botaurus poiciloptilus (Australasian Bittern)	EPBC Endangered, WA Act Endangered	Unlikely to occur – Study Area does not include required habitat of water bodies
Merops ornatus (Rainbow Bee-eater)	EPBC Migratory, WA Act Schedule 5	Likely - May occur during post-nuptial summer migration to SW Australia
Ardea modesta (Eastern Great Egret)	EPBC Migratory, WA Act Schedule 5	Unlikely to occur – Study Area does not include required habitat of water bodies
Plegadis falcinellus (Glossy Ibis)	EPBC Migratory, WA Act Schedule 5	Possible transient visitor after suitable rain
Falco peregrinus (Peregrine Falcon)	WA Act S7	May occur – Study Area contains habitat that can be used as foraging grounds
MAMMALS		
*Isoodon obesulus fusciventer (*Southern Brown Bandicoot)	DPaW Priority 4	Possible – suitable habitat exists, however no nearby records
REPTILES		
Neelaps calonotos (Black-striped Snake)	DPaW Priority 3	Possible – database records exist within suitable habitat

The EPBC report lists eleven threatened species or species' habitats that may occur within the area (see Table 3.2).

Table 3.2: Terrestrial Fauna species listed on the EPBC Protected Matters Report, based on a circle of 10 km radius from the Study Site centre

Species	Conservation Status	Presence According to Database	Likelihood of Presence in Study Area
Threatened Bird Species			
Numenius madagascariensis Eastern Curlew	EPBC Critically Endangered, WA Act Vulnerable	Species or species habitat may occur within area	Unlikely to occur – Study Area does not include required habitat of water bodies
Calidris ferruginea Curlew Sandpiper	EPBC Critically Endangered, WA Act Vulnerable	Species or species habitat may occur within area	Unlikely to occur – Study Area does not include required habitat of water bodies
Calyptorhynchus latirostris	EPBC Endangered,	Breeding likely to occur	Likely to occur based on

Species	Conservation Status	Presence According to Database	Likelihood of Presence in Study Area
Carnaby's Black Cockatoo	WA Act Endangered	within area	previous reports
Rostratula australis Australian Painted Snipe	EPBC Vulnerable, WA Act Endangered	Species habitat likely to occur within area	Unlikely to occur – Study Area does not include required habitat of water bodies
Leiopoa ocellata Malleefowl	EPBC Vulnerable, WA Act Vulnerable	Species habitat likely to occur within area	Highly unlikely to occur
Calyptorhynchus banksii naso Forest red-tailed Black Cockatoo	EPBC Vulnerable, WA Act Vulnerable	Species habitat likely to occur within area	Likely to occur based on previous reports
Threatened Mammal Species			
Dasyurus geoffroii Chudditch	EPBC Vulnerable, WA Act Vulnerable	Species habitat likely to occur within area	Unlikely based on habitat quality
Migratory Terrestrial Birds			
Merops ornatus Rainbow Bee-eater	EPBC Migratory, WA Act Schedule 5	Species habitat likely to occur within area	Likely - May occur during post-nuptial summer migration to SW Australia
Apus pacificus Fork tailed Swift	EPBC Migratory, WA Act Schedule 5	Species or species habitat likely to occur within area	Possible - May occur as a transient species during migration
Motacilla cinerea Grey Wagtail	EPBC Migratory, WA Act Schedule 5	Species or species habitat may occur within area	Unlikely to occur
Pandion haliaetus Eastern Osprey	EPBC Migratory, WA Act Schedule 5	Species or species habitat may occur within area	Unlikely to occur

3.2 Habitat

Two habitat types, "Tall Marri and Jarrah foraging habitat" and "Low open Banksia foraging habitat" have been previously described within the Study Area (Biologic, 2016), as well as a third habitat type ("Disturbed") surrounding the Study Area. The Tall Marri and Jarrah foraging habitat is described as open tall forest of Marri and / or Jarrah with open shrubland dominated by *Xanthorrhoea preissii*, *Banksia dallanneyi* and *Hibbertia hypericoides* with isolated sedge ground cover. It includes some disturbed areas which still contain mature trees. The Low open Banksia foraging habitat is described as low open woodland of *Banksia menziesii* and *B. attenuata*, also includes *Eucalyptus todtiana, Eremaea pauciflora* and *Hibbertia hypericoides*. The immediate surrounding area ("Disturbed") has been cleared for agriculture.

Based on vegetation community mapping (Biologic, 2016), a total of 13.7 ha and 11.4 ha of foraging habitat for Carnaby's Black-Cockatoo and Forest Red-tailed Black-Cockatoo respectively was recorded within the proposed disturbance footprint (direct and indirect). A total of of 23 trees measured at greater than 500 mm Diameter Breast Height (16 Marri and 7 Jarrah) assessed as potential nest and roost trees were recorded within the proposed disturbance footprint.

3.2.1 Threatened & Priority Ecological Communities

Threatened species and ecological community conservation is coordinated by DPaW's Nature Conservation Division, primarily through the Western Australian Threatened Species and Associations Unit (WATSCU). No State legislation deals specifically with TECs, however, TECs can be listed as nationally threatened, and are protected under the Environment Protection and Biodiversity Conservation Act (1999).

A search of the EPBC database on the coordinates listed in Section 2.1 confirmed there were four TECs occurring within a 10km radius of the Study Site, as described in Table 3.4 below.

Table 3.3 Threatened Ecological Communities as identified by the EPBC Threatened Species and Communities Database search

Threatened Ecological Community	Conservation status	Presence according to database	Likelihood of presence in Study Area
Banksia Woodlands of the Swan Coastal Plain	EPBC Endangered	Community likely to occur within area	Possibly present
Shrublands and Woodlands on Muchea Limestone of the Swan Coastal Plain	EPBC Endangered	Community known to occur within area	
Assemblages of plants and invertebrate animals of tumulus (organic mound) springs of the Swan Coastal Plain	EPBC Endangered	Community known to occur within area	
Claypans of the Swan Coastal Plain	EPBC Critically Endangered	Community likely to occur within area	

3.3 Conservation Significant Species

Based on database and literature reviews, nine conservation significant species may occur within the Study Area. Of these, Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) and the Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksia naso*) are the most likely to be impacted from the proposed development of the Study Area.

3.3.1 Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*)

Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) is listed as Endangered (EPBC Act) and Schedule 1 (Rare or Likely to Become Extinct) under the WC Act. Carnaby's Black-Cockatoo is endemic to south west Western Australia, and is distributed from the Murchison River to Esperance and inland to Coorow, Kellerberrin and Lake Cronin (Cale, 2003). The species was once common, but the population has declined significantly in the last half century (Johnstone and Storr, 1998) and is now locally extinct in some areas (Shah, 2006). The total population of Carnaby's Cockatoo is currently estimated at 40,000 (Johnstone and Johnstone, 2008).

Carnaby's Black-Cockatoos feed on seeds, nuts and flowers of a variety of native and exotic plants, including *Banksia* (including those previously included in the genus *Dryandra*), Pine trees (*Pinus* sp.), Marri, Jarrah, *Grevillea*, *Allocasuarina,* and *Hakea* (Shah, 2006). For Carnaby's Cockatoo, the seeds from *Banksia* seed pods and the cones of pine trees provide the highest energetic yield (Cooper *et al.*, 2002) as Carnaby's Cockatoo are less efficient at extracting Marri seeds than Baudin's Cockatoo (Cooper *et al.*, 2002).

Trees used as nest sites by Carnaby's Black-Cockatoo are mature, hollow bearing trees, usually with a crown containing dead limbs and a sparse canopy (Cale, 2003; Johnstone and Storr, 1998). They generally nest in hollows of smooth barked Eucalypts, especially Salmon Gum and Wandoo, and on the Swan Coastal Plain most nests are in Tuart (Johnstone and Storr, 1998); however, they are said to nest in any species of Eucalypt with a suitable hollow (Saunders, 1979; Cale 2003). Breeding has been recorded from early July to mid-December and primarily occurs in the Wheatbelt (Johnstone and Storr, 1998). On the Swan Coastal Plain, Carnaby's Black-Cockatoo are known to breed in small numbers at Regans Ford, Yanchep, Gingin, Mandurah and Bunbury (Johnstone and Johnstone, 2004).

Suitable foraging, night roosting and nesting habitat for Black Cockatoos has been recorded within the Study Area, as well as a small amount of foraging evidence (pine cone seed extraction) adjacent to the Study Area (Biologic, 2016). In addition, the fauna survey conducted by Phoenix (2015) recorded numerous sightings of Carnaby's Black-Cockatoo, evidence of feeding signs and suitable nesting trees overlapping the Study Area. Ecological (2013) identified one potentially new roost site within the Muchea west area. Located approximately 20 km west of the Study Area is the Gnangara pine plantation, a significant area for Carnaby's Black-Cockatoo as a feeding area during the non-breeding season of summer (Byrne et. al. 2015).

3.3.2 Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*)

Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksia naso*) is listed as Vulnerable (EPBC Act) and Schedule 1 (Rare or Likely to Become Extinct) under the WC Act. The Forest Red-tailed Black-Cockatoo is distributed through the humid and sub-humid southwest of Western Australia from Gingin through the Darling Ranges to the southwest, from approximately Bunbury to Albany (Johnstone and Storr, 1998). Population size has been estimated recently at approximately 15,000 birds (Johnstone and Kirkby, 1999). Although not nomadic like Carnaby's and Baudin's Cockatoos, the Forest Red-tailed Black-Cockatoo has been known to exhibit extreme population fluctuations in response to food availability and fires. The Forest Red-tailed Black-Cockatoo occurs in pairs or small flocks, or occasionally large flocks of up to 200 (Johnstone and Storr, 1998). They inhabit dense Jarrah, Karri and Marri forests that receive more than 600 mm average annual rainfall (DSEWPaC, 2011), and breeds in the southwest of Western Australia between October and November, producing one or two eggs.

This species feeds primarily on Marri and Jarrah fruit (DSEWPaC, 2011) and have also been known to feed on Blackbutt (Eucalyptus patens), Albany Blackbutt (Eucalyptus staeri), Karri, Sheoak (Allocasuarina fraseriana) and Snottygobble (Persoonia longifolia). Forest Red-tailed Black-Cockatoos can obtain energy faster when feeding on Marri and Jarrah than other food sources (Cooper et al., 2002), and these two plant species make up 90% of their diet (Johnstone and Kirkby, 1999).

As described in Section 3.3.1, suitable foraging, night roosting and nesting habitat for Black Cockatoos has been recorded within the Study Area, as well as a small amount of foraging evidence (pine cone seed extraction) adjacent to the Study Area (Biologic, 2016).

3.3.3 Other Conservation Significant Species Likely to Occur within the Study Area

The DPaW Naturemap database and EPBC Threatened Species and Communities database searches identified an additional seven species as potentially occurring within the Study Area, as described below:

- **Southern Brown Bandicoot *Isoodon obesulus fusciventer***

  Listed as Priority 5 by the DPaW. Southern Brown Bandicoot habitat is described as scrubby, often swampy, vegetation with dense cover up to 1 m high, and they often feed in adjacent forest and woodland that is burnt on a regular basis and in areas of pasture and cropland lying close to dense cover (DPaW, 2012). They often populate Jarrah and Wandoo forests. The nearest record on the DPaW's NatureMap database of Southern Brown Bandicoots to the Study Area is 10 km to the southeast, and the majority of records for the species are to the south of the Study Area. However, the Study Area falls within the distribution range of the species and does provide suitable habitat for the species, and it is therefore considered possible that Southern Brown Bandicoot may occur within the Study Area.

- **Rainbow Bee-eater *Merops ornatus***

Listed as Migratory by the EPBC Act and Schedule 5 under the WC Act. Rainbow Bee Eaters are a migratory bird species that travel south to the south-west of Western Australia during spring and summer after breeding in the north of the state (DoE, 2017a). The species is well recorded in the region surrounding the Study Area, as well as a record from the DPaW NatureMap database at Muchea. This species is therefore likely to occur transiently in the Study Area during the warmer months, at least as a foraging ground.

- **Fork tailed Swift *Apus pacificus***

Listed as Migratory by the EPBC Act and Schedule 5 under the WC Act. As a migratory and almost exclusively aerial species (DoE, 2017b), the Study Area may provide foraging grounds for Fork-tailed Swift as they utilise a multitude of habitats including dry or open areas, sclerophyll or open forest, and scrubland (DoE, 2017b). However, as most records are from coastal areas and with no records within 10km of the Study Area, the species is only considered as possible to occur.

- **Peregrine Falcon *Falco peregrinus***

Listed as Schedule 7 under the WC Act. Peregrine falcons are a widespread species occurring across Australia and with a large foraging range. The preferred habitat of the species includes cliffs and wooded watercourses, and nesting occurs mainly on cliff ledges, granite outcrops, quarries and in trees with old raven or Wedge-tailed Eagle nests (Johnstone & Storr 1998). DPaW's NatureMap database shows a record within 4 km of Muchea, and it considered possible that the species utilises the Study Area as a foraging ground.

- **Glossy Ibis *Plegadis falcinellus***

Listed as Migratory under the EPBC Act and Schedule 5 under the WC Act. Glossy Ibis are widespread throughout Australia except in the arid interior, and the preferred habitats include open wetlands and pastures and mudflats (Pizzey & Knight 2012). DPaW's NatureMap database lists one record of the species 10 km to the north of the Study Area. It is possible that the species is a transient visitior that may utilize the Study Area on grassed, low-lying areas following suitable rainfall.

- **Eastern Great Egret *Ardea modesta***

Listed as Migratory under the EPBC Act and Schedule 5 under the WC Act. Eastern Great Egrets occur throughout Australia except the arid regions but is more common in wetter areas, and uses a variety of wetlands including fresh, saline, permanent and ephemeral (Pizzey & Knight, 2012). Although most records of the species are coastal, DPaW's NatureMap database lists one record of the species 10 km to the north of the Study Area. However, although it is possible that the species may utilize the Study Area on grassed, low-lying areas following suitable rainfall, it is unlikely due to the coastal nature of the species.

- **Black-striped Snake *Neelaps calonotos***

Listed as Priority 3 under the WC Act. The species distribution is restricted to the sandy coastal strip of the Swan Coastal Plain between Mandurah and Lancelin, with some records existing inland at Gingin, Bullsbrook and Caversham (Storr *et al.* 2002). The habitat of the Black-striped Snake is dunes and sand-plains vegetated with heaths and Banksia woodlands (Ismar et al. 2010). DPaW's NatureMap database lists one record at Muchea, and it is therefore possible that the species may occur in shrubland habitat where suitable sandy substrates are present.

4 CONCLUSIONS

Previous fauna assessments of the Study Area and surrounds have identified suitable foraging, night roosting and nesting habitat for Carnaby's Black-Cockatoo and Forest Red-tailed Black-Cockatoo within the Study Area. In addition, foraging evidence of Black Cockatoos (pine cone seed extraction) has been previously recorded adjacent to the Study Area (Biologic, 2016), as well as direct observations and feeding evidence of Carnaby's Black Cockatoos in close proximity to the Study Area (Phoenix, 2015). Important feeding sites are known to occur in the vicinity, such as at the Gnangara Pine Plantation.

Based on vegetation community mapping (Biologic, 2016), a total of 13.7 ha and 11.4 ha of foraging habitat for Carnaby's Black-Cockatoo and Forest Red-tailed Black-Cockatoo respectively was recorded within the proposed disturbance footprint (direct and indirect). A total of 23 trees measured at greater than 500 mm Diameter Breast Height (16 Marri and 7 Jarrah) assessed as potential nest and roost trees were recorded within the proposed disturbance footprint.

In addition to the two Black Cockatoo species highly likely to occur within the Study Area, seven other conservation significant species are deemed Possible or Likely to utilise the habitats of the Study Area; Southern Brown Bandicoot, Rainbow Bee-Eater, Fork-Tailed Swift, Glossy Ibis, Eastern Great Egret, Peregrine Falcon and Black-Striped Snake. One Threatened Ecological Community (Banksia Woodlands of the Swan Coastal Plain, EPBC Endangered) is also recorded as likely to occur within the Study Area and requires consideration.

The habitat immediately surrounding the Study Area is disturbed due to clearing for agriculture. This may provide a dispersal barrier for some conservation significant species utilising the Study Area, and increase the significance of the Marri and Jarrah foraging and roosting habitat available. The EPBC Referral guidelines for the three Black-Cockatoo species identify clearing of greater than 1 ha of quality foraging habitat as a high risk of significant impact (DSEWPaC, 2011). Based on the results of previous assessments identifying greater than 1 ha of foraging habitat for Carnaby's Black-Cockatoo and Forest Red-tailed Black-Cockatoo within the proposed disturbance footprint of the Study Area, a referral to the DoE for assessment on Black-Cockatoo impacts is recommended.

5 REFERENCES

Biologic (2016). Black Cockatoo Habitat Assessment at Lot 195 Great Northern Highway, Muchea. Prepared for Urban & Rural Perspectives.

Byrne, M. G. Barrett, M. Blythman, H. Finn and M. Williams (2015). The 2015 Great Cocky Count: a community based survey for Carnaby's Black-Cockatoo (Calyptorhynchus latirostris) and Forest Red-tailed Black-Cockatoo (Calyptorhynchus banksii naso). BirdLife Australia, Floreat, Western Australia.

Cale, B. (2003) Carnaby's Black Cockatoo (Calyptorhynchus latirostris) Recovery Plan. Department of Conservation and Land Management, Perth.

Cooper, C., Withers, P., Mawson, P., Bradshaw, S., Prince, J. and Robertson, D. (2002) Metabolic ecology of cockatoos in the south-west of Western Australia. Australian Journal of Zoology 50:L 67-76.

Department of the Environment (2017a). *Merops ornatus* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: http://www.environment.gov.au/sprat. Accessed Tue, 7 Feb 2017

Department of the Environment (2017b). *Apus pacificus* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: http://www.environment.gov.au/sprat. Accessed Tue, 7 Feb 2017

DSWEPaC (2011) Environment Protection and Biodiversity Conservation Act 1999 Referral Guidelines for Three Threatened Black Cockatoo Species. Canberra, ACT.

Department of Parks and Wildlife (2016) NatureMap, Mapping Western Australia's Biodiversity, https://naturemap.dpaw.wa.gov.au/default.aspx. Accessed February 2017

Ecological (2013). Carnaby's Cockatoo Habitat Survey Assessment Of The Perth – Peel Region. Prepared for the Department of Sustainability, Environment, Water, Population and Communities.

Ismar, S. M. H., Hunter, C., Lay, K., Ward-Smith, T., Wilson, P. R. & Hauber, M. E. 2010. A virgin flight across the Tasman Sea? Satellite tracking of post-fledging movement in the Australasian Gannet Morus serrator. Journal of Ornithology 151: 755–759.

Johnstone, R. and Johnstone, C. (2004) *Review of Carnaby's Cockatoo, Calyptorhynchus latirostris within the Proposed Roe Highway Stage 7 Area Jandakot*. Unpublished report for Main Roads, WA.

Johnstone, R.E. and Kirkby, T. (1999) Food of the Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso* in south-west Western Australia. *Western Australian Naturalist* **22:** 167-177.

Johnstone, R. and Storr, G. (1998) Handbook of Western Australian Birds. Volume I – Non-passerines (Emu to Dollarbird). Western Australian Museum, Perth.

Phoenix Environmental Sciences (2015). Flora and fauna assessment for the Muchea North and Chittering study area. Prepared for Muchea to Wubin Integrated Project Team (Main Roads WA, Jacobs and Arup)

Pizzey, G. & Knight, F. 2012. The field guide to the birds of Australia. Harper Collins, Sydney, NSW.

Storr, G. M., Smith, L. A. & Johnstone, R. E. 2002. *Snakes of Western Australia - revised edition*. Western Australian Museum, Perth, WA.