Appendix C
Emplacement Ecological Assessment

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LandCorp

Report for Hilltop/Emplacement Crescent

Ecological assessment

June 2012

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

Contents

Table Index

Figure Index

Appendices

1. Background

1.1 Project

The Cockburn Coast Area has been subject to various development pressures in recent times. This recent pressure is additional to the area's long history of industrial development including transport, agriculture and heavy industry. The City of Cockburn is planning the development of the Cockburn Coast Area, including the Hilltop/Emplacement Crescent Area (the Project Site) which is situated east of Cockburn Road and south of Emplacement Crescent in the City of Cockburn. The location of the Project Site is shown at Figure 1 (Appendix A).

1.2 Purpose of study

This report (The Cockburn Coast; Hilltop/Emplacement Crescent Ecological Assessment Report) has been commissioned by LandCorp as a technical study to support the Local Structure Plan. It has been conducted to provide information on the ecological attributes of the Hilltop/Emplacement Crescent Project Site and will assist in supporting the City of Cockburn Development Area Provisions for the Cockburn Coast Project. The work is also a requirement of the City of Cockburn prior to adoption of the Scheme Amendment No. 89 for final approval.

1.3 Scope of works

The scope of works for this study involved both desktop and field components, with results obtained to establish any known and potential ecological constraints to development. The assessment included the following:

- Review of previous assessments and surveys undertaken by GHD for LandCorp in the vicinity;
- Review of Federal and State databases for the potential presence of threatened and other conservation significant flora and fauna species and ecological communities on the Project Site;
- Site survey of the area resulting in vegetation mapping, significant tree assessment, flora list and fauna habitat assessment;
- Consideration of any potential risks as a result of the outcomes of the review and survey, and recommendations for potential next steps; and
- Mapping of relevant environmental constraints and provision of Project Site photographs.

The field component consisted of a Level 2 flora and Level 1 fauna survey of the Hilltop/Emplacement Crescent Project Site and aimed to satisfy all scoping requirements documented within the request for tender. The survey was undertaken in accordance with:

- Environmental Protection Authority (EPA) guidelines for flora surveys as outlined in Guidance Statement No. 51 Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (EPA, 2004a);
- EPA Guidelines for Terrestrial Biological Surveys as an Element of Biodiversity Protection, Position Statement No. 3 (EPA, 2002); and
- EPA Assessment of Environmental Factors for Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia. Guidance Statement No. 56 (EPA, 2004b).

1.4 Limitations

This Report: has been prepared by GHD for LandCorp and may only be used and relied on by LandCorp for the purpose agreed between GHD and LandCorp as set out in section 1.2 of this Report.

GHD otherwise disclaims responsibility to any person other than LandCorp arising in connection with this Report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this Report were limited to those specifically detailed in the Report and are subject to the scope limitations set out in the Report.

The opinions, conclusions and any recommendations in this Report are based on conditions encountered and information reviewed at the date of preparation of the Report. GHD has no responsibility or obligation to update this Report to account for events or changes occurring subsequent to the date that the Report was prepared.

The opinions, conclusions and any recommendations in this Report are based on assumptions made by GHD described in this Report (section 1.5). GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this Report on the basis of information provided by LandCorp and Government authorities, which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the Report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this Report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the Project Site may be different from the Project Site conditions found at the specific sample points. Investigations undertaken in respect of this Report are constrained by the particular Project Site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant Project Site features and conditions may have been identified in this Report.

Site conditions (including the presence of hazardous substances, Project Site contamination, species and communities of conservation significance) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the Project Site conditions. GHD is also not responsible for updating this Report if the Project Site conditions change.

Due to the low likelihood of any Department of Environment and Conservation (DEC)-listed plant species being present on the Project Site, data for significant flora was accessed from free, publicly available databases, rather than through a specific request for data through DEC, which can take up to 4 weeks to be provided.

1.5 Assumptions

The assessment is based on the Project Site footprints provided by LandCorp in the Project brief and shown in Plate 1 and Figure 1, Appendix A. Any changes to the Project Site or scope, outside the description provided above, are outside the scope of this assessment.

GHD has relied upon external data, namely publicly available databases, to identify species previously recorded in the area. The accuracy of this data lies with the provider, not with GHD.

2. Previous studies

Previous assessments of the wider Cockburn Coast area for LandCorp conducted by GHD in December 2009 (Cockburn Coast) (GHD, 2009) and March 2012 (Robb Jetty) (GHD, 2012) reported limited environmental constraints. The eastern area of the 2009 Project Site is immediately adjacent to the Hilltop/Emplacement Crescent Project site; the western area is immediately adjacent to the 2012 Project Site.

The 2012 Project Site reported no ecological aspects that required further investigation, nor was referral to the DSEWPaC required. Management of the three Declared Weeds and the retention of three Moreton Bay Fig trees growing in association with the Robb Jetty Chimney were recommended.

The 2009 Project Site was assessed as at variance with two of the ten clearing principles because parts of the vegetation were regarded as potential Black Cockatoo feeding habitat. PATN (statistical) analysis of the flora quadrat data from that study did not align any of the flora quadrats with Threatened or Priority Ecological Communities that may be present in the vicinity of the Project Site. The majority of the vegetation in the 2009 survey area was reported to be in completely degraded or degraded condition. Two specially protected fauna species were recorded utilising the Project Site during the 2009 study; Carnaby's Cockatoo (*Calyptorhynchus latirostris*) and the priority three skink *Lerista lineata*. The 2009 study also recorded the presence of *Lomandra maritima* which indicates the Project Site may be used by the threatened Graceful Sunmoth (*Synemon gratiosa*), and a targeted survey was recommended. A Graceful Sunmoth survey was undertaken in March 2011 in areas of likely habitat.

3. Desktop investigation

3.1 Conservation significant species

Desktop reviews for the Hilltop/Emplacement Crescent Project Site were conducted using the Department of Sustainability, Environment, Water, People and Community (DSEWPaC) *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) and DEC NatureMap databases for the potential presence of conservation significant flora and fauna. These reviews revealed:

- Twenty-six conservation significant flora species have been previously reported within 10 km of the Project Site; and
- Thirty-nine conservation significant terrestrial fauna species have been previously reported within 10 km of the Project Site.

These species are shown at Appendices C and D.

3.2 Threatened and Priority Ecological Communities

Ecological communities are defined as naturally occurring biological assemblages that occur in a particular type of habitat (English & Blythe, 1997). Threatened Ecological Communities (TECs) are ecological communities that have been assessed and assigned to one of four categories related to the status of the threat to the community i.e. Presumed Totally Destroyed, Critically Endangered, Endangered and Vulnerable.

TECs are listed under both State and Federal legislation; Federally-listed TECs are protected under the EBPC Act administered by the DSEWPaC. DEC maintains a list of TECs for Western Australia; some of these TECs are also protected under the EPBC Act.

DEC also maintains a Priority Ecological Community (PEC) List. PECs are not listed under any formal Federal or State legislation but are considered by DEC as important as whole ecosystems (including their processes and communities). Priorities 1, 2 and 3 PECs are ecological communities that are adequately known; are rare but not threatened, or meet criteria for Near Threatened. PECs that have been recently removed from the threatened list are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.

Further information on the conservation codes is provided in Appendix B.

A desktop review of the DEC NatureMap database for the potential presence of TECs and PECs within 5 km of the Project Site identified five occurrences of a TEC. This TEC is most likely Floristic Community Type (FCT) 30c (*Callitris preissii* (or *Melaleuca lanceolata*) forests and woodlands, Swan Coastal Plain), listed by the State as Vulnerable (Appendix C). No Federally-listed TECs were identified in the EPBC Act Protected Matters Search (Appendix C).

4. Flora field survey

4.1 Vegetation and flora

The flora and vegetation of the Project Site was assessed using quadrat and opportunistic sampling methodologies on 16 May 2012. The location of the assessment points (quadrats and photo points) are shown in Figure 1 (Appendix A). Field surveys were undertaken with regard to the EPA Guidance Statement No. 51, Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia and included a representative number of quadrats located in each vegetation type. Quadrat sampling sites were an area of 10 m × 10 m and the position of each quadrat was recorded using a GPS unit. In addition to quadrat sampling, opportunistic sampling was conducted throughout the Project Site to provide more thorough spatial coverage. Eight quadrats (Appendix C) were sampled, with the following five vegetation types (Figure 1, Appendix A) identified by means of a combination of aerial photography, topographical features and field observation:

- **VT1** Shrubland of *Melaleuca huegelii* and *Banksia sessilis* var. *cygnorum* over *Templetonia retusa* and *Grevillea preissii* subsp. *preissii* over weed-dominated understorey;
- **VT2** Open Shrubland of *Acacia rostellifera*, *Banksia sessilis* var. *cygnorum* and *Templetonia retusa* with **Leptospermum laevigatum* over a weed-dominated understorey;
- **VT3** Cleared area now dominated by weed grassland;
- **VT5** Tall Shrubland of *Melaleuca huegelii*, *Acacia rostellifera* and *Banksia sessilis* var. *cygnorum* over *Spyridium globulosum* over a weed-dominated understorey; and
- **VT7** Very Open Shrubland of **Leptospermum laevigatum* over a weed-dominated understorey.

These vegetation types are matched to the vegetation types described in the Cockburn Coast Supplementary Flora and Fauna Assessment (GHD, 2009).

Where field identification of plant taxa was not possible, specimens were collected in a systematic manner and then later identified at the West Australian Herbarium by comparison with the reference collection and use of taxonomic identification methods.

4.2 Vegetation condition

The vegetation condition of the Project Site was assessed using the vegetation condition rating scale developed by Keighery (1994) that recognises the intactness of vegetation, which is defined by the following:

- Completeness of structural levels;
- Extent of weed invasion;
- Historical disturbance from tracks and other clearing or dumping; and
- The potential for natural or assisted regeneration.

The scale, therefore, consists of six rating levels as outlined in Table 1.

Table 1 Vegetation condition rating scale

Vegetation condition rating	Vegetation condition	Description
1	*Pristine or nearly so*	No obvious signs of disturbance.
2	*Excellent*	Vegetation structure intact, disturbance affecting individual species, and weeds are non-aggressive species.
3	*Very Good*	Vegetation structure altered, obvious signs of disturbance.
4	*Good*	Vegetation structure significantly altered by very obvious signs of multiple disturbances retains basic vegetation structure or ability to regenerate it.
5	*Degraded*	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not in a state approaching good condition without intensive management.
6	*Completely Degraded*	The structure of the vegetation is no longer intact and the area is completely or almost without native species.

(Keighery, 1994)

The vegetation condition of the Project Site ranges from *Completely Degraded* to *Very Good–Good* with the majority *Completely Degraded* where clearing and infrastructure developments have resulted in a complete modification of the vegetation in the southern and middle sections of the Project Site (Plates 1, 2 and 5). Densely vegetated areas of the Project Site were generally in *Very Good–Good* condition with the extensive presence of the aggressive weed, bridal creeper (**Asparagus asparagoides*) (see section 4.5 for details). The northern extent of the Project Site has been recently burned (Plates 3 and 4). Vegetation condition mapping is provided in Figure 2 (Appendix A).

Plate 1 ***Completely Degraded*** **vegetation condition (Photo Point 2)**

Plate 2 ***Completely Degraded*** **vegetation condition (Photo Point 5)**

Plate 3 **Recently burned vegetation (Photo Point 6)**

Plate 4 **Recently burned vegetation (Photo Point 6)**

Plate 5 ***Completely Degraded*** **vegetation condition (Photo Point 5)**

4.3 Flora diversity

Desktop searches identified 900 species having been recorded within 10 km of the Project Site. A total of 55 plant taxa (including subspecies and varieties) representing 29 families and 46 plant genera were

recorded in the survey area. This total is comprised of 28 native species and 27 introduced (exotic) and planted species. A flora species list is provided in Appendix C.

Dominant families recorded from the Project Site were:

- Myrtaceae 11 taxa; and
- Fabaceae seven taxa.

The majority of the Project Site is dominated by introduced species, including coast teatree (**Leptospermum laevigatum*) and castor oil plant (**Ricinus communis*). As the survey was undertaken in autumn (instead of spring, which is recommended), many herb species and annual weedy grasses were not present or unidentifiable.

4.4 Threatened and Priority Ecological Communities

Although vegetation types identified in previous surveys by GHD (2009 and 2012) did not appear to align with any TECs or PECs, vegetation type VT1 appears to share some species with FCT 26a (*Melaleuca huegelii – Melaleuca acerosa* [currently *M. systena*] shrublands on limestone ridges), which is a DEC-listed TEC; a vegetation survey in spring (when annual species are present) would be required to confirm this.

4.5 Weeds

A total of 27 introduced (exotic) species were recorded during the survey. One species (bridal creeper) is listed as a Declared Plant under Section 37 of the *Agricultural and Related Resources Protection Act 1976 (WA)* and as a Weed of National Significance (WoNS) by the Australian Government. “The WoNS program coordinates the national effort against 20 of Australia’s worst invasive plants. These weeds have degraded large portions of Australia’s natural and productive landscape and require action at a national level to reduce their impacts” (Australian Weeds Committee, 2010).

4.5.1 Bridal creeper (**Asparagus asparagoides*) – Declared (Priority 1) and WoNS

According to Agriculture & Resource Management Council of Australia & New Zealand, Australian & New Zealand Environment & Conservation Council and Forestry Ministers (2000), “bridal creeper is a South African vine that smothers native plants in many areas of southern Australia. It forms a thick mat of underground tubers, impeding root growth of native plants and preventing seedling establishment. Seed dispersal by birds has enabled rapid spread within and between remnant native vegetation and bridal creeper now poses a major threat to biodiversity and conservation in Australia’s temperate natural ecosystems. It is widespread in Western Australia, South Australia and Victoria and is spreading in New South Wales and Tasmania. Unless effective and efficient management is implemented and maintained, rare or threatened plant species are at risk of extinction and the Aboriginal, tourism and recreational uses of native vegetation will significantly decline. Significant progress has been made on control techniques for bridal creeper, including the use of herbicides and biological control. There is a strong need to implement these techniques in a coordinated and sustained manner on a large scale against the weed”.

Bridal creeper is listed as a Declared Plant (Priority 1 for the whole of the state which prohibits movement of plants or their seeds within the State; prohibits the movement of contaminated machinery and produce including livestock and fodder) and a WoNS (Australian Weeds Committee, 2004).

Bridal creeper was found extensively across the Project Site, predominantly in dense remnant vegetation.

5. Fauna field survey

The fauna assessment was consistent with a Level 1 assessment (reconnaissance survey) in accordance with Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia – Guidance Statement No. 56.

The fauna assessment undertaken was a reconnaissance survey only and thus only sampled those species that can be easily seen, heard or have distinctive signs, such as tracks, scats, diggings etc. Many cryptic and nocturnal species cannot be identified during a reconnaissance survey

5.1 Fauna habitat

The fauna habitat types at the Project Site are closely aligned with the five vegetation types and vegetation conditions identified (reported in sections 4.1 and 4.2, respectively).

The Project Site would provide habitat for assembles of small reptiles, some birds species and small ground mammals, though the mammals are all likely to be introduced taxa (such as rabbits and cats). The presence of housing, industrial areas and roads reduces the habitat values of the Project Site. The value of the Project Site as Black Cockatoo habitat is discussed further in detail in section 6.2.

5.2 Fauna diversity

Twenty-two fauna species were recorded during the field survey on the 16 May 2012 including 16 native and six introduced species; these are listed in Appendix D. Two migratory species were recorded; the Black-faced Cuckoo-shrike and Black shouldered Kite; however, these species are widespread and the Project Site is not considered to constitute significant habitat for them. One conservation significant fauna species, Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*), was recorded during the field survey.

5.3 Introduced species

Six introduced species were observed during the field assessment. These included the European rabbit, cat, domesticated dog, horse, pigeon and rainbow lorikeet. These species are commonly recorded in developed areas throughout the Perth metropolitan area. The presence of the domesticated dog and horse provide evidence that the Project Site is used for recreational activities.

6. Conservation significant species

6.1 Conservation significant flora species

Species of significant flora are protected under both Federal and State legislation. Any activities that are deemed to have a significant impact on species that are recognised by the EPBC Act, and/or the *Wildlife Conservation Act 1950* (WC Act) can warrant referral to the DSEWPaC and/or the EPA.

In Western Australia, DEC also maintains a list of Priority Listed Flora species. Conservation codes for Priority species are assigned by DEC to define the level of conservation significance. Priority species are not currently protected under the WC Act. For the purposes of this assessment, all species listed under the EPBC Act, WC Act and DEC Priority species are considered conservation significant. Further information on the conservation codes relevant to this report is provided in Appendix B.

Desktop identifications identified 27 species of conservation significance as potentially occurring within 10 km of the Project Site (Appendix C). No species of conservation significance were recorded during the GHD field assessment.

6.1.1 Likelihood of occurrence assessment

A likelihood of occurrence assessment of conservation significant species identified (based on the range, habitat requirements and previous records of the species) (Appendix C) determined that nine species (one EPBC Act- and WC Act-listed and eight DEC-listed) are likely to or could possibly occur at the Project Site. Due to a lack of habitat information available, a further six species have the potential to occur at the Project Site (Table 2).

The Threatened species, *Caladenia huegelii*, could potentially occur at the Project Site, but is only present and identifiable during a few weeks in spring. This species generally occurs in *Banksia* woodland, and the habitat at the Project Site is marginal for this species.

Table 2 Summary of conservation significant flora species likely to or to possibly occur at the Project Site

Species	Status		Likelihood of occurrence
	State	Federal	
Austrostipa mundula	P2		Unknown
Beyeria cinerea subsp. *cinerea*	P3		Unknown
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid	T	E	Possible
Dampiera triloba	P1		Unknown
Dodonaea hackettiana Hackett's Hopbush	P4		Likely
Grevillea olivacea Olive Grevillea	P4		Likely
Grevillea thelemanniana subsp. *thelemanniana* Spider Net Grevillea	P4		Unknown
Hibbertia spicata subsp. *leptotheca*	P3		Likely
Jacksonia gracillima	P3		Unknown
Jacksonia sericea Waldjumi	P4		Likely
Microtis quadrata	P4		Unknown
Phlebocarya pilosissima subsp. pilosissima	P3		Possible
Pimelea calcicola	P3		Likely
Stylidium maritimum	P3		Likely
Thelymitra variegata Queen of Sheba	P3		Possible

Conservation codes are available in Appendix B.

6.2 Conservation significant fauna species

The Federal conservation level of fauna species and their significance status is assessed under the EPBC Act. The significance levels for fauna used in the EPBC Act are those recommended by the International Union for the Conservation of Nature and Natural Resources (IUCN).

The State conservation level of fauna species and their significance status is assessed under State the *Wildlife Conservation Act 1950* (WC Act) *(Wildlife Conservation (Specially Protected Fauna) Notice 2010(2))*. The WC Act uses a set of Schedules but also classifies species using some of the IUCN categories. Schedule 3 fauna species are those which are "subject to an agreement between the Government of Australia and the Governments of Japan, China and the Republic of Korea relating to the protection of migratory birds, are declared to be fauna that is in need of special protection" (Government of Western Australia, 2010)

Additionally, in Western Australia, DEC produces a supplementary list of Priority Fauna, these being species that are not considered Threatened under the WC Act but for which the Department feels there is a cause for concern. These species have no special legislative protection, but their presence would normally be considered relevant to an assessment of the conservation status of an area. Such taxa need further survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.

Desktop investigations identified 39 species of conservation significance as potentially occurring within 10 km of the Project Site (Appendix D). The EPBC Act-listed Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) was observed feeding on *Banksia sessilis* within the Project Site (Plate 6). In addition, two conservation significant fauna species are considered to possibly occur in the Project Site:

- *Calyptorhynchus banksii naso* (Forest Red-tailed Black Cockatoo)
- *Calyptorhynchus baudinii* (Baudin's Black Cockatoo)

Plate 6 Carnaby's Cockatoo foraging on *Banksia sessilis* within the Project Site

6.2.1 Likelihood of occurrence

A likelihood of occurrence assessment of conservation significant species identified (based on the range, habitat requirements and previous records of the species) (Appendix D) determined that eight species (four EPBC Act-listed, five WC Act-listed and four Priority species) are likely to or could possibly occur at the Project Site (Table 3).

Reports of conservation significant marine fauna species were generated by desktop investigations as the Project Site is within 1 km of the coastline; however, these species do not occur within the project Site as it does not have marine habitat.

The presence of EPBC Act-listed species and their habitat may trigger referral of the Project to the DSEWPaC, while those with State protection may trigger referral of the Project to the EPA.

Table 3 Summary of conservation significant terrestrial fauna species likely to or to possibly occur at the Project Site

Species	Status		Likelihood of occurrence
	State	Federal	
Birds			
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo	Threatened	Vulnerable	Likely
Calyptorhynchus baudinii Baudin's Cockatoo	Threatened	Vulnerable	Likely
Calyptorhynchus latirostris Carnaby's Black-Cockatoo, Short-billed Black-Cockatoo	Threatened	Endangered	Known
Insects			
Leioproctus contrarius Bee	P3		Possible
Hylaeus globuliferus Bee	P3		Possible
Synemon gratiosa Graceful Sun Moth	Threatened	Endangered	Possible
Reptiles			
Lerista lineata Skink	P3		Possible
Morelia spilota subsp. *imbricate* Carpet Python	S		Possible
Neelaps calonotos Black-striped Snake	P3		Possible

Conservation codes are available in Appendix B.

6.2.2 Black cockatoos

There are three species of Black cockatoo that occur on the Swan Coastal Plain (potentially including the Project Site):

- *Calyptorhynchus latirostris* (Carnaby's Black Cockatoo) is listed as *Endangered* by the EPBC Act and *Threatened* by the WC Act. This species has previously been recorded within 5 km of the Project Site, and was recorded during the field survey;
- *Calyptorhynchus baudinii* (Baudin's Black Cockatoo) is listed as *Vulnerable* by the EPBC Act and *Threatened* by the WC Act. This species has been recorded within 5 km of the Project Site; and
- *Calyptorhynchus banksii naso* (Forest Red-tailed Black Cockatoo) is listed as *Vulnerable* by the EPBC Act. This species has been recorded within 5 km of the Project Site.

Foraging

These cockatoo species are known to feed on *Banksia* and *Eucalyptus* species, both of which were identified at the Project Site (DSEWPaC, 2011; Groom, 2011). The *Banksia sessilis* present throughout the Project Site would provide potential foraging habitat for Black Cockatoo species, and is a high value foraging species for Carnaby's Black Cockatoo (Groom, 2011). Three of the vegetation types within the Project Site (a total area of 2.96 ha) contain *Banksia sessilis* (Figure 3, Appendix A). The majority of this area is located on the limestone outcrop area in the east of the Project Site, and within the fenced area which was not accessed. Only a small amount of the foraging habitat falls within Lot 31 and 32. Black Cockatoos are also known to opportunistically use a wide variety of plant taxa as food resources; therefore all vegetation within the Project Site was generally assessed for signs of use by Black Cockatoos. There was evidence that the Project Site was being used by Black Cockatoos for foraging, with Carnaby's Black Cockatoo being observed feeding on *Banksia sessilis* (Plate 6) and chew marks found on *Banksia sessilis* branches.

Roosting

Baudin's and Carnaby's Black Cockatoos generally roost in or near riparian environments, or permanent water sources, in *Eucalyptus* species; Forest Red-tailed Black Cockatoos generally roost in tall Jarrah (*Eucalytpus marginata*) or Marri (*Corymbia calophylla*) trees within or on the edges of forests (DSEWPaC, 2011). As the Project Site is not situated within a riparian environment or forest, it is unlikely that the area is used by Black Cockatoo species for roosting. However, there is one Carnaby's Cockatoo known roosting site located less than 1 km south of the Project Site, within Manning Park (Department of Planning, 2011). Therefore, the Project Site is likely to provide a habitat linkage between other foraging and roosting sites.

Breeding

Trees with potential nesting qualities are Tuart (*Eucalyptus gomphocephala*), Wandoo (*Eucalyptus wandoo*), Jarrah and Marri with a diameter at breast height (DBH) of greater than 500 mm. Trees of this size are considered to have nesting potential now, or will develop hollows within 100 years. One Tuart tree with a DBH greater than 500 mm was recorded during this field survey. This Tuart tree was located on the western edge of the site near Cockburn road (at 383103 mE, 6449183 mN); this tree is mapped on Figure 3 (Appendix A) and shown in Plate 7. There was, however, no evidence that the Project Site was being used by Black Cockatoos for breeding.

Plate 7 Significant habitat tree – Tuart (*Eucalyptus gomphocephala*) Photo Point 4

6.2.3 Assessing Impact on Black Cockatoos

Significant Impact Guidelines

The *Matters of National Environmental Significance – Significant Impact Guidelines 1.1* (DSEWPaC, 2009) provide guidance on whether or not any person should submit a referral to DSWEPaC for assessment under the EPBC Act. Under these guidelines a 'significant impact' is defined an impact which is important, notable, or of consequence, having regard to its context or intensity. For this significant impact to be considered 'likely' that impact on the environment has a real, or not remote chance or possibility of happening (DSEWPaC, 2009).

Following these guidelines, clearing of the Project Site has the potential for impact on matters of national environmental significance due the presence of Black Cockatoo foraging habitat. In order to assess whether clearing of the Project Site is likely to have a significant impact, the 'significant impact criteria' were used. Carnaby's Black Cockatoo is listed as *Endangered* by the EPBC Act and Baudin's Black Cockatoo and Forest Red-tailed Black Cockatoo are listed as *Vulnerable* by the EPBC Act, and therefore the criteria for both *Endangered* and *Vulnerable* species were used. Clearing of the Project Site is likely to have a significant impact on Black Cockatoos if there is a real chance or possibility that it will meet any of the significant impact criteria. A summary of the significant impact assessment of clearing the Project Site is provided in Table 4.

Outcome

Clearing of the Project Site is unlikely to have a **significant** impact as a result of clearing 2.96 ha of high quality foraging Black Cockatoo habitat (Table 4)

It should be noted, however, that there is no defined measure or threshold within the Significant Impact Guidelines to assess whether clearing the 2.96 ha would be considered significant. Therefore, the assessment of this significance took into account the broader regional context. This regional context is included in Table 4 and is discussed further below.

Table 4 Department of Sustainability, Environment, Water, Population and Communities' Significant Impact Assessment

Significant Impact Criteria		Project assessment
Endangered species	Vulnerable species	
Lead to a long-term decrease in the size of a population	Lead to a long-term decrease in the size of an important population of a species	Clearing the Project Site is unlikely meet this criteria for a significant impact.
Reduce the area of occupancy of the species	Reduce the area of occupancy of an important population	Clearing the Project Site is unlikely meet this criteria for a significant impact.
Fragment an existing population into two or more populations	Fragment an existing important population into two or more populations	Clearing the Project Site is unlikely meet this criteria for a significant impact.

Significant Impact Criteria		Project assessment
Endangered species	Vulnerable species	
Adversely affect habitat critical to the survival of a species	Adversely affect habitat critical to the survival of a species	Habitat critical to the survival of a species is defined in the guidelines as 'areas that are necessary for activities such as foraging, breeding, roosting, or dispersal'. Only one potential nesting tree was recorded within the Project Site. Clearing of this tree is unlikely to adversely affect Black Cockatoo potential breeding habitat. There is 2.96 ha of high quality Black Cockatoo foraging habitat (*Banksia sessilis* woodland) present within the Project Site. Clearing of the Project Site will adversely affect this foraging habitat. The 2.96 ha of high quality foraging habitat is connected to a larger strip of bushland including Manning Park, which provides foraging habitat for Black Cockatoos. The Project Site has also been mapped by the Department of Planning as potential feeding vegetation for Carnaby's Black Cockatoo on the Swan Coastal Plain (Department of Planning, 2011). Therefore, while the majority of the Project Site is degraded and borders developed areas, due to its linkage to other foraging habitat the 2.96 ha extends the available protected habitat in Beeliar Regional Park. Clearing the 2.96 ha will have an impact on the species' regional feeding resources, but it is unlikely to be critical in terms of the species long term survival. The majority of the foraging habitat is located on the limestone outcrop area in the east of the Project Site, and within a fenced industrial area. It is recommended that clearing of the habitat in these areas be minimized or avoided if possible.
Disrupt the breeding cycle of a population	Disrupt the breeding cycle of an important population	Clearing the Project Site is unlikely meet this criteria for a significant impact.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Clearing the Project Site is unlikely meet this criteria for a significant impact.

Significant Impact Criteria		Project assessment
Endangered species	Vulnerable species	
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat	Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Clearing the Project Site is unlikely meet this criteria for a significant impact.
Introduce disease that may cause the species to decline	Introduce disease that may cause the species to decline	Clearing the Project Site is unlikely meet this criteria for a significant impact.
Interfere with the recovery of the species.	Interfere substantially with the recovery of the species	Clearing the Project Site is unlikely meet this criteria for a significant impact.

Draft Federal referral guidelines

In late 2011, DSEWPaC released draft referral guidelines for the assessment of projects for potential impacts on Black Cockatoos (DSEWPaC, 2011). These draft guidelines are for all Black Cockatoo species, and do not provide information relative to particular areas of the State, but provide information to decide whether a project may trigger referral.

Within these draft guidelines, DSEWPaC provides a risk table that gives guidance on what it views as risks/impacts to Black Cockatoos that will trigger referral (Table 5). Risk is broken into three categories, high, uncertain and low, and primarily focuses on breeding, feeding and roosting areas as well as indirect impacts. If there is uncertainty with regard to risks on Black Cockatoos then the DSEWPaC recommends referring the project or contacting the DSEWPaC to ensure legal certainty.

It is important to note, however, that the referral guidelines used in this assessment are in the draft phase and are open to interpretation; referral may not be required unless ensuring legal certainty is required. If there is uncertainty in regards to risks on Black Cockatoos then the DSEWPaC recommends referring the project or contacting the Department to ensure legal certainty.

Outcome

Clearing of the Project Site may trigger referral to DSEWPaC due to there being greater than 1 ha of foraging habitat (*Banksia sessilis* Shrubland) within the Project Site (Table 5).

Table 5 Department of Sustainability, Environment, Water, Population and Communities Black Cockatoo risk referral table

Risk type	Referral trigger
High risk of significant impacts: referral to DSEWPaC recommended	
Clearing of any known nesting tree.	Referral is not triggered; there are no known breeding trees within the Project Site.
Clearing of any part or degradation of breeding habitat in a woodland or forest within a species' known breeding range.	Referral is not triggered
Clearing of more than 1 ha of quality foraging habitat.	Referral is triggered. There is more than 1 ha of high quality foraging habitat (*Banksia sessilis* woodland – 2.96 ha) present within the Project Site.
Creating a gap or greater than 4 km between patches of Black Cockatoo habitat (breeding, foraging or roosting).	Referral is not triggered
Clearing or degradation (including pruning of top canopy) of a known roosting site.	Referral is not triggered
Uncertainty: referral recommended or contact the DSEWPaC	
Degradation (such as through altered hydrology or fire regimes) of more than 1 ha of foraging habitat. Significance will depend on the level and extent of degradation and the quality of the habitat.	Referral should be sought for legal certainty as there is 2.96 ha of foraging habitat present within the Project Site. This potential foraging habitat varies from *Good* to *Degraded* condition.

Risk type	Referral trigger
Clearing or disturbance in areas surrounding Black Cockatoo habitat that has the potential to degrade habitat through introduction of invasive species, edge effect, hydrological changes, increase human visitation or fire.	Referral is not triggered as the site is already disturbed and fragmented within the industrial and urban environment.
Actions that do not directly affect the listed species but that have the potential for indirect impacts such as increasing competitors for nest hollows.	Referral is not triggered
Actions with the potential to introduce known plant diseases such as *Phytophthora* spp.	Referral is not triggered: given the highly fragmented nature of the surrounding environment, plant diseases are likely to be present within the site. *Phytophthora* spp. is known to widely occur on the Swan Coastal Plain and is potentially present at the site.
Low risk of significant impacts: referral may not be required but may refer to DSEWPaC for legal certainty	
Actions that do not affect Black Cockatoo habitat or individuals.	Not applicable
Actions whose impacts occur outside the modelled distribution of the three Black Cockatoos.	Not applicable

Regional context

The Project site is located on the Swan Coastal Plain, which is considered to be important to Black Cockatoos (Department of Planning, 2012). The Swan Coastal Plain becomes an important feeding ground for Carnaby's Black Cockatoo at the end of the breeding season as large flocks of this species migrate towards coastal areas. Between late summer and winter, woodlands in these higher rainfall areas are the main feeding habitat for these species (Department of Planning, 2012). The Swan Coastal Plain is also considered to be important as a feeding ground for the Forest Red-tailed Black Cockatoo.

The area of Black Cockatoo foraging habitat within the Project Site is 2.96 ha, which is a relatively small area compared to nearby reserves and Bush Forever sites which could be utilised by Black Cockatoos. These reserves and sites are summarised below.

Regional reserves

There are several conservation reserves within close proximity to the Project Site, including Beeliar Regional Park (Bibra Lake, Manning Park and Thomsons Lake), Yangebup Lake Reserve and Lake Coogee Reserve.

Bush Forever

The Bush Forever Strategy is a 10 year strategic plan which formally commenced in 2000 to protect approximately 51 200 ha of regionally significant bushland within approximately 290 Bush Forever Sites. This strategy represents, where achievable, a target of at least 10% of each of the original 26 vegetation

complexes of the Swan Coastal Plain portion of the Perth Metropolitan Region (The Government of Western Australia, 2000).

The Project Site is located adjacent to Bush Forever Site No. 247 (Manning Lake and adjacent bushland, Hamilton Hill/Spearwood) which is part of Beeliar Regional Park. This site covers an area of 50.6 ha and includes open water, vegetated wetland, vegetated upland and limestone ridge. The Site meets the selection criteria for providing a representation of ecological communities, rarity, general criteria for the protection of wetland, streamline and estuarine fringing and coastal vegetation.

Other regionally significant Bush Forever Sites surrounding the Project Site include:

- Site No. 244 – North Lake and Bibra Lake, North Lake/Bibra Lake
- Site No. 254 – South Lake
- Site No. 256 – Yangebup and Little Rush Lakes, Yangebup
- Site No. 261 – Lake Coogee and Adjacent Bushland, Munster
- Site No. 341 – Woodman Point, Coogee/Munster
- Site No. 346 – Brownman Swamp, Mt Brown Lake and Adjacent Bushland, Henderson/Naval Base
- Site No. 391 – Thomsons Lake Nature Reserve and Adjacent Bushland, Beeliar

Several of these sites are included in the Beeliar Regional Park.

Summary

Each of these reserves and Bush Forever Sites could provide potential habitat for Black Cockatoos, and subsequently it could be considered that clearing the small area of foraging habitat present within the Project Site would be likely to have minimal impact on Black Cockatoos. However, while irregular use of small bushland areas for foraging may not be significant individually, the collective use of these remnants is likely to be important for the long-term survival of Black Cockatoos. Therefore, although only 2.96 ha of high quality Black Cockatoo foraging habitat is present within the Project Site, clearing it could potentially impact the future survival of Black Cockatoos on the Swan Coastal Plain.

6.2.4 Graceful Sun Moth

The Graceful Sun Moth (*Synemon gratiosa*; GSM) is a day-flying moth endemic to the south-west of Western Australia. Once widespread on the Swan Coastal Plain, the moth is now only present in a few scattered conservation areas, due to dramatically increased urban development destroying the moths' habitat. The species is listed as rare or likely to become extinct under the WC Act, and endangered under the EPBC Act.

There is limited information on the ecology and biology of the GSM, however, it appears that the remaining populations are severely fragmented and declining (Department of Environment and Conservation, 2010a). The larvae of the GSM inhabit sandy soils and feed upon root mats formed by *Lomandra maritima* and *L. hermaphrodita*. The GSM is only active in autumn, unlike the majority of Lepidoptera that are most active during spring and summer months. The active periods for the GSM dictate the scheduling for field surveys for the species; DEC has published species and habitat survey guidelines for the GSM (Department of Environment and Conservation, 2010b).

The GSM is closely associated with *Banksia* woodland and this vegetation occurs within the Project site. There is some limited suitable habitat within the Project Site and *Lomandra maritima* was recorded in the

field survey, as well as during the 2009 survey (GHD, 2009). This indicates that the Project Site may be used by the Graceful Sunmoth; however, a GSM survey conducted by GHD in 2011 in several Lot areas to the south of the Project Site recorded no GSM (GHD, 2011), and therefore it is unlikely that the GSM would be present within the Project Site. While this 2011 survey did not include the Project Site, it is still unlikely that the GSM would inhabit the Project site due to the highly degraded nature of the vegetation and surrounding development.

7. Conclusion

7.1 Summary

Overall the Project Site is largely degraded, developed for industry and is dominated by weeds. However, there are patches of vegetation in good condition that would provide potential foraging habitat for Black Cockatoos. Carnaby's Black Cockatoo was identified during the field survey as present and utilising this habitat within the Project Site. Accordingly, an impact assessment of clearing the Project Site was carried out using the Significant Impact Guidelines 1.1 (DSEWPaC, 2009) and the Draft DSEWPaC referral guidelines (DSEWPaC, 2011).

Based on the Significant Impact Guidelines 1.1 (DSEWPaC, 2009), clearing of 2.96 of good quality feeding habitat is unlikely to be considered critical to the survival of Black Cockatoo species. This outcome is partly due to the Project Site being connected to a larger corridor of bushland, Manning Park, which is part of Beeliar Regional Park, and which provides feeding habitat.

Based on the draft DSEWPaC referral guidelines, clearing the vegetation and development of the Hilltop/Emplacement Crescent Project Site would have a direct impact on Black Cockatoo feeding habitat and given this, referral to DSEWPaC may be required. It is important to note, however, that the referral guidelines used in this assessment are in the draft phase and are open to interpretation; referral may not be required unless to ensure legal certainty. It is recommended that clearing of the feeding habitat, which occurs primarily on the eastern edge of the Project Site, be minimised or avoided.

Furthermore, vegetation type VT1, which occurs on the limestone ridge on the eastern side of the Project Site, has similarities to a DEC-listed TEC, (*Melaleuca huegelii – Melaleuca acerosa* [currently *M. systena*] shrublands on limestone ridges). A vegetation survey in spring (when annual species are present) would be required to confirm whether VT1 is a TEC.

One weed species, bridal creeper (**Asparagus asparagoides*) (Declared and WoNS), should be managed during construction phase to prevent the spread of the plants.

7.2 Recommendations

Based on the likely impacts to Black Cockatoos, in particular to Carnaby's Black Cockatoo, it is recommended that:

- Clearing of the 2.96 ha of foraging habitat should be minimised or avoided;
- A further assessment of VT1 is required in Spring to provide certainty on its status as a TEC; and
- Where possible clearing and development be undertaken in areas that are degraded.

8. References

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Appendix A

Figures

382,850 383,200 383,550

6,449,750 6,449,400 6,449,050

BELLION DR

ROLLINSON RD

COCKBURN RD

PP1 PP2 PP3 PP4 PP5 PP6

Q1 Q2 Q3 Q4 Q5 Q6 Q7 Q8

Locality Map

PERTH

KWINANA

INDIAN OCEAN

Note: These vegetation type descriptions match up with GHD (2009)

LEGEND

- Photo Point
- Quadrat
- Study Area
- Burnt
- No Access
- Cadastre

Vegetation Type

- V1 Shrubland of *Melaleuca huegelii* and *Banksia sessilis* var. *cygnorum* over *Templetonia retusa* and *Grevillea preissii* subsp. *preissii* over weed-dominated understorey
- V2 Open Shrubland of *Acacia rostellifera, Banksia sessilis* var. *cygnorum* and *Templetonia retusa* with **Leptospermum laevigatum* over a weed-dominated understorey
- V3 Cleared area now dominated by weed grassland
- V5 Tall Shrubland of *Melaleuca huegelii, Acacia rostellifera* and *Banksia sessilis* var. *cygnorum* over *Spyridium globulosum* over a weed-dominated understorey
- V7 Very Open Shrubland of **Leptospermum laevigatum* over a weed-dominated understorey
- HD Highly Disturbed

1: 3,500 (at A3)

0 17.5 35 70 105 140 175

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

powered by SLIP ENABLER

Landcorp
Hilltop/Emplacement Crescent
Ecological Assessment

Job Number	61-28212
Revision	0
Date	12 Jun 2012

Vegetation Type

Figure 1

G:\61\28212\GIS\Maps\MXD\6128212_G001_Fig1_Rev0.mxd

239 Adelaide Terrace Perth WA 6004 Australia T 61 8 6222 8222 F 61 8 6222 8555 E permail@ghd.com.au W www.ghd.com.au

Data source: Landgate - Roads - 20120528, Cadastre - 20120501, Metro West 2011 Mosaic - 20120528; GHD: Study Area - 20120528, Vegetation Type - 20120528, No Access - 20120528, Burnt Area - 20120528, Photo Point - 20120524, Quadrat - 20120524; GA: 250K Australian Topographic Series - 2006. Created by: cagilbert

382,850 383,200 383,550

6,449,750 6,449,400 6,449,050

BELLION DR

ROLLINSON RD

COCKBURN RD

6

5

4

4

5

6

4-5

4

Locality Map

PERTH

INDIAN OCEAN

KWINANA

382,850 383,200 383,550

LEGEND

Study Area
Cadastre

Vegetation Condition

1. Pristine or Nearly So
2. Excellent
3. Very Good
4. Good
5. Degraded
6. Completely Degraded

Burnt
No Access

1: 3,500 (at A3)

0 17.5 35 70 105 140 175

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

powered by SLIP ENABLER

Landcorp
Hilltop/Empacement
Crescent Ecological Assessment

Job Number 61-28212
Revision 0
Date 11 Jun 2012

Vegetation Condition

Figure 2

G:\61\28212\GIS\Maps\MXD\6128212_G003_Fig2_Rev0.mxd

239 Adelaide Terrace Perth WA 6004 Australia T 61 8 6222 8222 F 61 8 6222 8555 E permail@ghd.com.au W www.ghd.com.au

Data source: Landgate - Boundaries - 20120528, Cadastre - 20120501, Metro West 2011 Mosaic - 20120528; GHD: Study Area - 20120528,Vegetation Condition - 20120528; Burnt - 20120528, No Access - 20120528; GA: 250K Australian Topographic Series - 2006. Created by: cagilbert

382,850 383,200 383,550

6,449,750 6,449,400 6,449,050

BELLION DR

ROLLINSON RD

COCKBURN RD

Locality Map

PERTH

KWINANA

INDIAN OCEAN

LEGEND

- Black Cockatoo Habitat Tree
- Black Cockatoo Habitat
- Study Area
- Cadastre
- Burnt
- No Access

1: 3,500 (at A3)

0 17.5 35 70 105 140 175

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

GHD

LANDCORP

powered by SLIP ENABLER

Landcorp
Hilltop/Emplacement Crescent
Ecological Assessment

Job Number	61-28212
Revision	0
Date	11 Jun 2012

Black Cockatoo Habitat

Figure 3

G:\61\28212\GIS\Maps\MXD\6128212_G002_Fig3_Rev0.mxd

239 Adelaide Terrace Perth WA 6004 Australia T 61 8 6222 8222 F 61 8 6222 8555 E permail@ghd.com.au W www.ghd.com.au

Data source: Landgate/Landcorp - 20120528, Cadastre - 20120501, Metro West 2011 Mosaic - 20120528; GHD: Study Area - 20120528, Black Cockatoo Habitat - 20120528, Black Cockatoo HabitatTree - 20120528, Burnt - 20120528, No Access - 20120528; GA: 250K Australian Topographic Series - 2006. Created by: cagilbert

Appendix B

Conservation codes

Categories and Definitions for EPBC Act Listed Flora and Fauna Species

Conservation Category	Definition
Extinct	Taxa not definitely located in the wild during the past 50 years.
Extinct in the Wild	Taxa known to survive only in captivity.
Critically Endangered	Taxa facing an extremely high risk of extinction in the wild in the immediate future.
Endangered	Taxa facing a very high risk of extinction in the wild in the near future.
Vulnerable	Taxa facing a high risk of extinction in the wild in the medium-term.
Near Threatened	Taxa that risk becoming Vulnerable in the wild.
Conservation Dependent	Taxa whose survival depends upon ongoing conservation measures. Without these measures, a conservation dependent taxon would be classified as Vulnerable or more severely threatened.
Data Deficient (Insufficiently Known)	Taxa suspected of being Rare, Vulnerable or Endangered, but whose true status cannot be determined without more information.
Least Concern	Taxa that are not considered Threatened.

WC Act and DEC Conservation Codes and Descriptions for Threatened (Declared Rare) and Priority Flora Species.

Code	Conservation Category	Definition
X	Presumed Extinct Flora (Declared Rare Flora – Extinct)	Taxa which have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such (Schedule 2 under the Wildlife Conservation Act 1950).
T	Threatened Flora (Declared Rare Flora – Extant)	Taxa which have been adequately searched for, and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such (Schedule 1 under the Wildlife Conservation Act 1950). Threatened Flora are further ranked by the Department according the their level of threat using IUCN Red List criteria: ◗ CR: Critically Endangered – considered to be facing an extremely high risk of extinction in the wild; ◗ EN: Endangered – considered to be face a very high risk of extinction in the wild; and ◗ VU: Vulnerable – considered to be facing a high risk of extinction in the wild.

P1	Priority 1 – Poorly Known Taxa	Taxa that are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes
P2	Priority 2 – Poorly Known Taxa	Taxa that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes.
P3	Priority 3 – Poorly Known Taxa	Taxa that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Taxa may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.
P4	Priority 4 – Rare, Near Threatened and other taxa in need of monitoring	Rare. Taxa that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands. ◗ Near Threatened. Taxa that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. ◗ Taxa that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.
P5	Priority 5 – Conservation Dependent Taxa	Taxa that are not threatened but are subject to a specific conservation program, the cessation of which would result in the taxon becoming threatened within five years.

Department of Agriculture and Food Declared Plant Control Classes

Priority Class	Description
P1	Prohibits movement of plants or their seeds within the State. This prohibits the movement of contaminated machinery and produce including livestock and fodder.
P2	Eradicate infestation to destroy and prevent propagation each year until no plants remain. The infested area must be managed in such a way that prevents the spread of seed or plant parts on or in livestock, fodder, grain, vehicles and/or machinery.
P3	Control infestation in such a way that prevents the spread of seed or plant parts within and from the property on or in livestock, fodder, grain, vehicles and/or machinery. Treat to destroy and prevent seed set all plants.
P4	Prevent the spread of infestation from the property on or in livestock, fodder, grain, vehicles and/or machinery. Treat to destroy and prevent seed set on all plants.
P5	Infestations on public lands must be controlled.

Listed migratory species

The EPBC Act protects lands and migratory species that are listed under International Agreements.

- Appendices to the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals) for which Australia is a Range State under the Convention;
- The Agreement between the Government of Australia and the Government of the Peoples Republic of China for the Protection of Migratory Birds and their Environment (CAMBA);
- The Agreement between the Government of Japan and the Government of Australia for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment (JAMBA); and
- The Agreement between the Government of Australia and the Government of the Republic of Korea on the Protection of Migratory Birds (ROKAMBA).
- other international agreements approved by the Commonwealth Environment Minister.

An action will require approval from the Environment Minister if the action has, will have, or is likely to have a significant impact on a listed migratory species. Note that some migratory species are also listed as threatened species. The criteria below are relevant to migratory species that are not threatened.

An action has, will have, or is likely to have a significant impact on a migratory species if it does, will, or is likely to:

- substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat of the migratory species, or
- result in invasive species that is harmful to the migratory species becoming established* in an area of important habitat of the migratory species, or
- seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of the species.

An area of important habitat is:

1. habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species, or
2. habitat utilised by a migratory species which is at the limit of the species range, or
3. habitat within an area where the species is declining.

Listed migratory species cover a broad range of species with different life cycles and population sizes. Therefore, what is an ecologically significant proportion of the population varies with the species (each circumstance will need to be evaluated).

**Introducing an invasive species into the habitat may result in that species becoming established. An invasive species may harm a migratory species by direct competition, modification of habitat, or predation.*

Western Australian *Wildlife Conservation Act 1950* Fauna Conservation Codes

Conservation Code	Description
Schedule 1	"…fauna that is rare or likely to become extinct, are declared to be fauna that is in need of special protection."
Schedule 2	"… fauna that is presumed to be extinct, are declared to be fauna that is in need of special protection."
Schedule 3	"… birds that are subject to an agreement between the governments of Australia and Japan relating to the protection of migratory birds and birds in danger of extinction are declared to be fauna that is in need of special protection."
Schedule 4	"… fauna that is in need of special protection, otherwise than the reasons mentioned [in Schedule 1-3]".

DEC Priority Fauna Codes

Conservation Category	Description
Priority 1	Taxa with few, poorly known populations on threatened lands.
Priority 2	Taxa with few, poorly known populations on conservation lands. Taxa which are known from few specimens or sight records from one or a few localities on lands not under immediate threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown Land , water reserves, etc.
Priority 3	Taxa, which are known from few specimens or sight records, some of which are on lands not under immediate threat of habitat destruction or degradation.
Priority 4	Rare taxa. Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years.
Priority 5	Taxa is in need of monitoring. Taxa which are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.

Appendix C

Flora

Species list

Quadrat data

Likelihood of occurrence assessment

Threatened and Priority Ecological Communities map

Flora species observed at the Project Site

Family	Name	Status
Apiaceae	*Foeniculum vulgare*	*
Apocynaceae	*Nerium oleander*	*
Arecaceae	*Phoenix dactylifera*	*
Asparagaceae	*Acanthocarpus preissii*	
Asparagaceae	*Asparagus asparagoides*	*
Asparagaceae	*Lomandra maritima*	
Asphodelaceae	*Trachyandra divaricata*	*
Asteraceae	*Taraxacum officinale*	*
Caprifoliaceae	*Scabiosa atropurpurea*	*
Casuarinaceae	*Allocasuarina huegeliana*	
Chenopodiaceae	*Rhagodia baccata*	
Crassulaceae	*Crassula* sp.	
Cyperaceae	*Ficinia nodosa*	
Cyperaceae	*Lepidosperma squamatum*	
Euphorbiaceae	*Euphorbia terracina*	*
Euphorbiaceae	*Ricinus communis*	*
Fabaceae	*Acacia cyclops*	
Fabaceae	*Acacia lasiocarpa*	
Fabaceae	*Acacia rostellifera*	
Fabaceae	*Acacia saligna*	
Fabaceae	*Lupinus cosentinii*	*
Fabaceae	*Templetonia retusa*	
Fabaceae	*Trifolium sp.*	*
Geraniaceae	*Pelargonium capitatum*	*
Hemerocallidaceae	*Dianella revoluta*	
Iridaceae	*Gladiolus sp.*	*
Iridaceae	*Romulea rosea*	*
Meliaceae	*Melia azedarach*	
Moraceae	*Ficus carica*	*
Myrtaceae	*Agonis flexuosa*	
Myrtaceae	*Callistemon sp.*	*
Myrtaceae	*Calothamnus quadrifidus*	
Myrtaceae	*Eucalyptus decipiens*	
Myrtaceae	*Eucalyptus gomphocephala*	
Myrtaceae	*Eucalyptus petrensis*	
Myrtaceae	*Eucalyptus platypus*	*
Myrtaceae	*Leptospermum laevigatum*	*
Myrtaceae	*Melaleuca huegelii*	
Myrtaceae	*Melaleuca lanceolata*	planted
Myrtaceae	*Melaleuca systena*	
Oleaceae	*Olea europaea*	*
Onagraceae	*Oenothera sp.*	*
Poaceae	*Bromus diandrus*	*
Poaceae	*Cynodon dactylon*	*
Poaceae	*Lagurus ovatus*	*
Proteaceae	*Banksia dallanneyi*	
Proteaceae	*Banksia sessilis*	
Proteaceae	*Grevillea preissii*	

Flora species observed at the Project Site

Family	Name	Status
Proteaceae	*Hakea prostrata*	
Ranunculaceae	*Clematis linearifolia*	
Restionaceae	*Desmocladus flexuosus*	
Rhamnaceae	*Spyridium globulosum*	
Scrophulariaceae	*Eremophila glabra*	planted
Solanaceae	*Solanum nigrum*	*
Vitaceae	*Vitis sp.*	*

* weed species

Hilltop/Emplacement Cres **Site** Q1

Described by ML&LZ **Date** 16/05/2012 **Type** Quadrat 10 m x 10 m

MGA Zone 50 383300 **mE** 6449145 **mN** 115.763357 **E** -32.087853 **S**

Habitat Ridge of limestone outcrop

Soil Light grey-white sand

Rock Type Limestone 2-10%

Vegetation Closed Tall Scrub of *Banksia sessilis*, *Spyridium globulosum* and *Templetonia retusa* over mixed weedy Grassland and Very Open Herbland of **Euphorbia terracina* and **Asparagus asparagoides* (Declared P1 and WoNS).

Veg Condition Good

Fire Age Very Old (>20 years)

Notes Flat.
Good drainage.
Weeds (including bridal creeper), rabbits, rubbish.
Bare ground <2%
Logs 0%
Twigs 2-10%
Leaves 10-30%

Species
Acacia cyclops
**Asparagus asparagoides* (Declared P1 and WoNS)
Banksia sessilis
**Euphorbia terracina*
Lomandra maritima
Melaleuca systena
Spyridium globulosum
Templetonia retusa

Hilltop/Emplacement Cres **Site** Q2

Described by ML&LZ **Date** 16/05/2012 **Type** Quadrat 10 m x 10 m

MGA Zone 50 383313 **mE** 6449225 **mN** 115.763504 **E** -32.087133 **S**

Habitat Mid-slope of limestone outcrop

Soil Light grey-white sand

Rock Type Limestone 2-10%

Vegetation Shrubland of *Melaleuca huegelii* and *Templetonia retusa* over Low Open Shrubland of *Banksia sessilis* and *Melaleuca systena* over mixed weedy Very Open Grassland.

Veg Condition Good

Fire Age Very Old (>20 years)

Notes Moderate-steep NNW slope.
Good drainage.
Weeds (including bridal creeper), rabbits.
Bare ground 2-10%
Logs 0%
Twigs 2-10%
Leaves 2-10%

Species
**Asparagus asparagoides* (Declared P1 and WoNS)
Banksia sessilis
**Lagurus ovatus*
Melaleuca huegelii
Melaleuca systena
**Romulea rosea*
Templetonia retusa

Hilltop/Emplacement Cres **Site** Q3
Described by ML&LZ **Date** 16/05/2012 **Type** Quadrat 10 m x 10 m
MGA Zone 50 383198 **mE** 6449126 **mN** 115.762274 **E** -32.088014 **S**
Habitat Flat weedy swale.
Soil Dark grey-light brown sand
Rock Type Limestone <2%
Vegetation Tall Shrubland of **Leptospermum laevigatum* over mixed weedy Grassland and Herbland.
Veg Condition Completely Degraded
Fire Age Old (>5 years)
Notes Gentle W slope.
Good drainage.
Asbestos, dumped rubbish, weeds, 4x4 tracks.
Bare ground <2%
Logs 0%
Twigs <2%
Leaves 2-10%

Species
Acacia saligna
**Foeniculum vulgare*
**Gladiolus* sp.
**Leptospermum laevigatum*
**Pelargonium capitatum*
**Ricinus communis*
**Scabiosa atropurpurea*

Hilltop/Emplacement Cres **Site** Q4
Described by ML&LZ **Date** 16/05/2012 **Type** Quadrat 10 m x 10 m
MGA Zone 50 383237 **mE** 6449112 **mN** 115.762686 **E** -32.088144 **S**
Habitat Weedy lower slope/breakaway.
Soil Light grey-white sand
Rock Type Limestone 30-70%
Vegetation Tall Open Scrub of **Leptospermum laevigatum* with weedy understorey.
Veg Condition Completely Degraded
Fire Age Old (>20 years)
Notes Steep S slope.
Good drainage.
Weeds.
Bare ground 30-70%
Logs 0%
Twigs 0%
Leaves <2%

Species
**Leptospermum laevigatum*
Templetonia retusa

Hilltop/Emplacement Cres **Site** Q5

Described by ML&LZ **Date** 16/05/2012 **Type** Quadrat 10 m x 10 m

MGA Zone 50 383228 **mE** 6449138 **mN** 115.762593 **E** -32.087909 **S**

Habitat Middle slope.

Soil Light grey-white sand

Rock Type Limestone <2%

Vegetation Closed Tall Scrub of *Templetonia retusa*, *Spyridium globulosum* and *Melaleuca huegelii* over Low Open Shrubland of *Melaleuca systena*, *Acacia rostellifera* and *Banksia sessilis* over mixed weedy Grassland and Herbland.

Veg Condition Good

Fire Age Very Old (>20 years)

Notes Moderate W slope.
Good drainage.
Weeds (including bridal creeper), rabbits, 4x4 tracks.
Bare ground <2%
Logs 0%
Twigs 2-10%
Leaves 10-30%

Species
Acacia rostellifera
**Asparagus asparagoides* (Declared P1 and WoNS)
Banksia sessilis
**Euphorbia terracina*
**Lagurus ovatus*
Melaleuca huegelii
Melaleuca systena
Spyridium globulosum
Templetonia retusa

Hilltop/Emplacement Cres **Site** Q6

Described by ML&LZ **Date** 16/05/2012 **Type** Quadrat 10 m x 10 m

MGA Zone 50 383286 **mE** 6449231 **mN** 115.763219 **E** -32.087076 **S**

Habitat Mid-slope.

Soil Light grey-white sand

Rock Type Limestone <2%

Vegetation Tall Open Scrub of *Acacia rostellifera*, **Leptospermum laevigatum* and *Spyridium globulosum* over mixed weedy Very Open Grassland and Very Open Herbland of **Euphorbia terracina*, *Clematis linearifolia*, **Trachyandra divaricata* and **Scabiosa atropurpurea*.

Veg Condition Good

Fire Age Old (5-20 years)

Notes Moderate NW slope.
Good drainage.
Weeds, edge effect rabbits.
This quadrat was assessed from the track as there was no access to this fenced area.
Bare ground <2%
Logs 0%
Twigs 2-10%
Leaves 2-10%

Species
Acacia rostellifera
Acanthocarpus preissii
Clematis linearifolia
**Euphorbia terracina*
**Leptospermum laevigatum*
**Scabiosa atropurpurea*
Spyridium globulosum
**Trachyandra divaricata*

Hilltop/Emplacement Cres **Site** Q7
Described by ML&LZ **Date** 16/05/2012 **Type** Quadrat 10 m x 10 m
MGA Zone 50 383350 **mE** 6449291 **mN** 115.763905 **E** -32.086541 **S**
Habitat Mid-slope/breakaway
Soil Light grey-white sand
Rock Type Limestone 10-30%
Vegetation Closed Tall Scrub of *Melaleuca huegelii* and *Spyridium globulosum* over mixed weedy Very Open Grassland and Very Open Herbland of **Asparagus asparagoides* (Declared P1, WoNS), *Clematis linearifolia* and weedy species.
Veg Condition Good
Fire Age Very Old (>20 years)
Notes Steep N slope.
Good drainage.
Weeds (including bridal creeper).
Bare ground 10-30%
Logs 0%
Twigs 2-10%
Leaves 2-10%

Species
Acacia rostellifera
**Asparagus asparagoides* (Declared P1 and WoNS)
Clematis linearifolia
Melaleuca huegelii
Melaleuca systena
Spyridium globulosum

Hilltop/Emplacement Cres **Site** Q8

Described by ML&LZ **Date** 16/05/2012 **Type** Quadrat 10 m x 10 m

MGA Zone 50 383287 **mE** 6449192 **mN** 115.763225 **E** -32.087428 **S**

Habitat Lower slope.

Soil Light grey-white sand

Rock Type Limestone <2%

Vegetation Tall Open Scrub of *Acacia rostellifera*, **Leptospermum laevigatum* and *Spyridium globulosum* over mixed weedy Very Open Grassland and Very Open Herbland of **Euphorbia terracina* and **Scabiosa atropurpurea*.

Veg Condition Good-Degraded

Fire Age Old (5-20 years)

Notes Gentle NW slope.
Good drainage.
Weeds, edge effect rabbits.
This quadrat was assessed from the track as there was no access to this fenced area.
Bare ground <2%
Logs 0%
Twigs 2-10%
Leaves 2-10%
Ph4266

Species
Acacia rostellifera
**Euphorbia terracina*
**Leptospermum laevigatum*
**Scabiosa atropurpurea*
Spyridium globulosum

Hilltop/Emplacement Cres **Site** PP1

Described by ML&LZ **Date** 16/05/2012 **Type** Photo point

MGA Zone 50 383121 **mE** 6449142 **mN**

Hilltop/Emplacement Cres **Site** PP2
Described by ML&LZ **Date** 16/05/2012 **Type** Photo point
MGA Zone 50 383280 **mE** 6449131 **mN**

Hilltop/Emplacement Cres **Site** PP3
Described by ML&LZ **Date** 16/05/2012 **Type** Photo point
MGA Zone 50 383104 **mE** 6449222 **mN**

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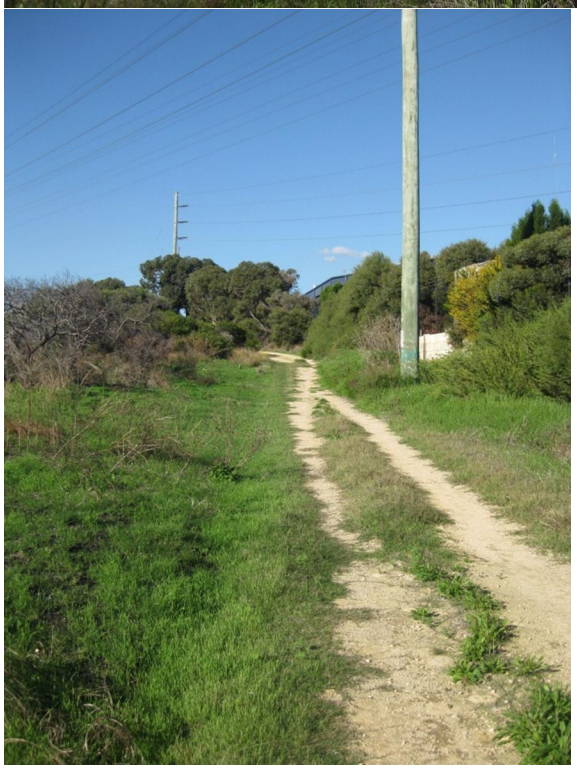
Hilltop/Emplacement Cres **Site** PP4

Described by ML&LZ **Date** 16/05/2012 **Type** Photo point

MGA Zone 50 383103 **mE** 6449183 **mN**

Hilltop/Emplacement Cres **Site** PP5
Described by ML&LZ **Date** 16/05/2012 **Type** Photo point
MGA Zone 50 383160 **mE** 6448901 **mN**



Hilltop/Emplacement Cres **Site** PP6
Described by ML&LZ **Date** 16/05/2012 **Type** Photo point
MGA Zone 50 383185 **mE** 6449784 **mN**

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Definitions for flora likelihood of occurrence assessment

Likelihood of occurrence	Definition
Known	Species definitely recorded within the Project Site either from previous records or field survey results.
Likely	Species previously recorded within 10 km and suitable habitat occurs at the Project Site.
Possible	Species previously recorded within 10 km with marginally suitable habitat occurring at the Project Site. OR Species not previously recorded within 10 km, but suitable habitat occurs at the Project Site.
Unlikely	Species previously recorded within 10 km but suitable habitat does not occur at the Project Site.
Highly unlikely	Species not previously recorded within 10 km, suitable habitat does not occur at the Project Site and/ or Project Site is outside the species' natural distribution.

Conservation significant flora likelihood of occurrence assessment

Species	Status		Description and habitat requirements	Search		Likelihood of occurrence
	State	Federal		NatureMap	EPBC	
Acacia lasiocarpa var. *bracteolata* long peduncle variant (G.J. Keighery 5026)	P1		Shrub, 0.4-1.5 m high. Fl. yellow, May or Aug. Grey or black sand over clay. Swampy areas, winter wet lowlands.	X		Unlikely Recorded within 10 km but no suitable habitat.
Andersonia gracilis Slender Andersonia	Threatened	Endangered	Slender erect or open straggly shrub, 0.1-0.5(-1) m high. Fl. white-pink-purple, Sep to Nov. White/grey sand, sandy clay, gravelly loam. Winter-wet areas, near swamps.		X	Highly Unlikely Not recorded within 10 km and no suitable habitat.

Species	Status		Description and habitat requirements	Search		Likelihood of occurrence
	State	Federal		NatureMap	EPBC	
Angianthus micropodioides	P3		Erect or decumbent annual, herb, 0.03-0.15 m high. Fl. yellow-white, Nov to Dec or Jan to Feb. Saline sandy soils. River edges, saline depressions, claypans.	X		Unlikely Recorded within 10 km but no suitable habitat.
Austrostipa mundula	P2		No description.	X		Unknown. Recorded within 10 km but habitat unknown.
Beyeria cinerea subsp. *cinerea*	P3		No description.	X		Unknown. Recorded within 10 km but habitat unknown.
Bossiaea modesta	P2		Slender, trailing & twining shrub. Fl. yellow & red, Oct to Dec. Soils derived from granite. Damp areas close to stream.	X		Unlikely Recorded within 10 km but no suitable habitat.
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid	Threatened	Endangered	Tuberous, perennial, herb, 0.25-0.6 m high. Fl. green & cream & red, Sep to Oct. Grey or brown sand, clay loam.	X	X	Possible Recorded within 10 km and marginally suitable habitat is present.
Calothamnus graniticus subsp. *leptophyllus*	P4		Erect, multi-stemmed shrub, 1-2 m high. Fl. red, Jun to Aug. Clay over granite, lateritic soils. Hillsides.	X		Unlikely Recorded within 10 km but no suitable habitat.

Species	Status		Description and habitat requirements	Search		Likelihood of occurrence
	State	Federal		NatureMap	EPBC	
Centrolepis caespitosa	P4	Endangered	Tufted annual, herb (forming a rounded cushion up to 25 mm across). Fl. Oct to Dec. White sand, clay. Salt flats, wet areas.		X	Highly unlikely Not recorded within 10 km and no suitable habitat.
Dampiera triloba	P1		Erect perennial, herb or shrub, to 0.5 m high. Fl. blue, Aug to Dec.	X		Unknown. Recorded within 10 km but habitat unknown.
Darwinia foetida Muchea Bell	Threatened	Critically Endangered	Erect, or spreading, shrub to 0.7 m high, often using other shrubs for support. Young branches are slender, green-brown with prominent, decurrent leaf bases, becoming grey and woody. Fl. green, Oct to Nov. Grey or white sand, swampy, seasonally wet sites, alongside sump land (land acting as a pit or well where water collects). Winter-damp to wet clay under *Regelia inops* and *Kunzea recurva* tall shrubland, over Pink-flowered Myrtle (*Hypocalymma robustum)* low shrubland or low Melaleuca spp. shrubland.		X	Highly unlikely Not recorded within 10 km and no suitable habitat.
Dodonaea hackettiana Hackett's Hopbush	P4		Erect shrub or tree, 1-5 m high. Fl. yellow-green/red, mainly Jul to Oct. Sand. Outcropping limestone.	X		Likely Recorded within 10 km and suitable habitat is present.
Grevillea olivacea	P4		Erect, non-lignotuberous shrub, 1-4.5 m high. Fl.	X		Likely

Species	Status		Description and habitat requirements	Search		Likelihood of occurrence
	State	Federal		NatureMap	EPBC	
Olive Grevillea			red/red-pink, Jun to Sep. White or grey sand. Coastal dunes, limestone rocks. Amongst medium trees, or low trees; in gravelly soil, or sand, or loam; occupying limestone cave entrance, lateritic sandplain, limestone swamp flats.			Recorded within 10 km and suitable habitat is present.
Grevillea thelemanniana subsp. *thelemanniana* Spider Net Grevillea	P4		No description.	X		Unknown. Recorded within 10 km but habitat unknown.
Hibbertia spicata subsp. *leptotheca*	P3		Erect or spreading shrub, 0.2-0.5 m high. Fl. yellow, Jul to Oct. Sand. Near-coastal limestone ridges, outcrops & cliffs.	X		Likely Recorded within 10 km and suitable habitat is present.
Hydrocotyle lemnoides Aquatic Pennywort	P4		Aquatic, floating annual, herb. Fl. purple, Aug to Oct. Swamps.	X		Unlikely Recorded within 10 km but no suitable habitat.
Isopogon uncinatus Hook-leaf Isopogon	Threatened	Endangered	Tufted spreading or prostrate, non-lignotuberous shrub, 0.05-0.4 m high. Fl. yellow/cream, Oct to Nov. Loam or sand on granite, peaty sand. Swampy depressions, hillslopes.		X	Highly unlikely – this is probably a misidentification as *Isopogon uncinatus* appears to occur solely on the south coast of Western Australia (Department of Environment and Conservation, 2012).

Species	Status		Description and habitat requirements	Search		Likelihood of occurrence
	State	Federal		NatureMap	EPBC	
Jacksonia gracillima	P3		No description.	X		Unknown. Recorded within 10 km but habitat unknown.
Jacksonia sericea Waldjumi	P4		Low spreading shrub, to 0.6 m high. Fl. orange, usually Dec or Jan to Feb. Calcareous & sandy soils.	X		Likely Recorded within 10 km and suitable habitat is present.
Lepidosperma rostratum Beaked Lepidosperma	Threatened	Endangered	Rhizomatous, tufted perennial, grass-like or herb (sedge), 0.5 m high. Fl. brown. Peaty sand, clay.		X	Highly unlikely Not recorded within 10 km and no suitable habitat.
Microtis quadrata	P4		No description.	X		Unknown. Recorded within 10 km but habitat unknown.
Phlebocarya pilosissima subsp. pilosissima	P3		Shortly rhizomatous, compactly tufted perennial, grass-like or herb, 0.15-0.4 m high. Fl. cream-white, Aug to Oct. White or grey sand, lateritic gravel.	X		Possible Recorded within 10 km and marginally suitable habitat is present.
Pimelea calcicola	P3		Erect to spreading shrub, 0.2-1 m high. Fl. pink, Sep to Nov. Sand. Coastal limestone ridges.	X		Likely Recorded within 10 km and suitable habitat is present.
Stylidium longitubum	P3		Erect annual (ephemeral), herb, 0.05-0.12 m	X		Unlikely

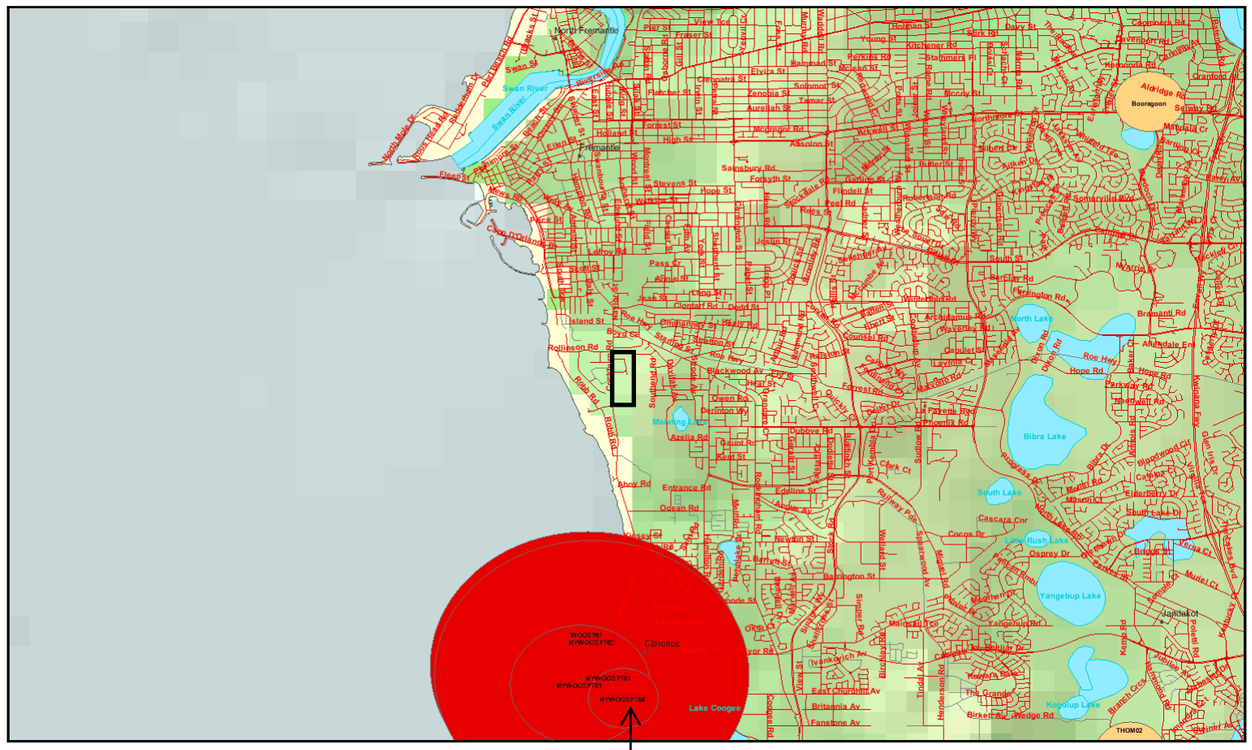
Species	Status		Description and habitat requirements	Search		Likelihood of occurrence
	State	Federal		NatureMap	EPBC	
Jumping Jacks			high. Fl. pink, Oct to Dec. Sandy clay, clay. Seasonal wetlands.			Recorded within 10 km but no suitable habitat.
Stylidium maritimum	P3		Caespitose perennial, herb, 0.3-0.7 m high, Leaves tufted, linear to narrowly oblanceolate, 10-40 cm long, 1-5.5 mm wide, apex acute to mucronate, margin involute, glabrous. Membraneous scale leaves present at base of mature leaves. Scape glandular throughout. Inflorescence paniculate. Fl. white/purple, Sep to Nov. Sand over limestone. Dune slopes and flats. Coastal heath and shrubland, open *Banksia* woodland.	X		Likely Recorded within 10 km and suitable habitat is present.
Thelymitra variegata Queen of Sheba	P3		Tuberous, perennial, herb, 0.1-0.35 m high. Fl. orange & red & purple & pink, Jun to Sep. Sandy clay, sand, laterite.	X		Possible Recorded within 10 km and marginally suitable habitat is present.
Verticordia plumosa var. *ananeotes*	Threatened	Endangered	Erect, sparsely branched shrub, 0.3-0.5 m high. Fl. pink-purple/white, Nov to Dec. Sandy loam. Seasonally inundated plains.	X		Unlikely Recorded within 10 km but no suitable habitat.

NatureMap
Mapping Western Australia's biodiversity

Threatened and Priority Ecological Communities surrounding the Hilltop/Emplacement Cresc Project Site

Printed by Melissa Longman on 6/6/2012

Query details :



Quadrats: MYWOODPT01, MYWOODPT02, MYWOODPT03, MYWOODPT04 and WOOD01
Most likely **TEC FCT 30a**
Callitris preissii (or *Melaleuca lanceolata*) forests and woodlands, Swan Coastal Plain (Vulnerable)

Only TEC/PEC within 5 km of Project Site described

FCT = Floristic Community Type

Department of Environment and Conservation
museum

NatureMap is a collaborative project of the Department of Environment and Conservation, Western Australia, and the Western Australian Museum.

Appendix D

Fauna

Species list

Likelihood of occurrence assessment

Fauna species observed at the Project Site

Family	Species	Common Name	Introduced	Status	Comments
Birds					
Accipitridae	*Elanus axillaris*	Black-shouldered Kite		Mi	
Artamidae	*Cracticus tibicen*	Australian Magpie			
Cacatuidae	*Eolophus roseicapillus*	Galah			
Psittacidae	*Calyptorhynchus latirostris*	Carnaby's Black-Cockatoo		T, En	2 flocks seen flying over, one group of 8 and one group of 14
Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike		Mi	
Columbidae	*Columba livia*	Pigeon	*		
Corvidae	*Corvus coronoides*	Australian Raven			
Cracticidae	*Gymnorhina tibicen dorsalis*	Australian Magpie			
Hirundinidae	*Hirundo neoxena*	Welcome Swallow			
Meliphagidae	*Anthochaera carunculata*	Red Wattlebird			
Meliphagidae	*Lichmera indistincta*	Brown Honeyeater			
Meliphagidae	*Phylidonyris niger*	White-cheeked Honeyeater			
Meliphagidae	*Phylidonyris novaehollandiae*	New Holland Honeyeater			
Monarchidae	*Grallina cyanoleuca*	Magpie lark			
Motacillidae	*Anthus novaeseelandiae*	Australasian Pipit			
Psittacidae	*Trichoglossus haematodus*	Rainbow Lorikeet	*		
Rhipiduridae	*Rhipidura leucophrys*	Willie Wagtail			
Timaliidae	*Zosterops lateralis*	Silvereye			
Mammals					
Canidae	*Canis lupus familiaris*	Domesticated Dog	*		
Felidae	*Felis catus*	Cat	*		
Leporidae	*Oryctolagus cuniculus*	European Rabbit	*		
Equidae	*Equus ferus caballus*	Horse	*		

Conservation significant fauna likelihood of occurrence assessment

(see Appendix C for definitions for fauna likelihood of occurrence assessment)

Species	Status		Search		Likelihood of occurrence
	State	Federal	NatureMap	EPBC	
Birds					
Anous tenuirostris melanops Australian Lesser Noddy	Threatened	Vulnerable	X	X	Unlikely No suitable habitat for the species within the Project Site. However, it has been recorded within 10 km of the Project Site.
Botaurus poiciloptilus Australasian Bittern	Threatened	Endangered		X	Highly Unlikely No suitable habitat, as this species prefers wetlands with dense vegetation.
Burhinus grallarius Bush Stone-curlew	P4		X		Unlikely No suitable habitat for the species within the Project Site, as this species prefers grassy woodlands. However, it has been recorded within 10 km of the Project Site.
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo	Threatened	Vulnerable	X	X	Likely Suitable foraging habitat present within the Project Site.
Calyptorhynchus baudinii Baudin's Cockatoo	Threatened	Vulnerable	X	X	Likely Suitable foraging habitat present within the Project Site.
Calyptorhynchus latirostris	Threatened	Endangered	X	X	Known

Species	Status		Search		Likelihood of occurrence
	State	Federal	NatureMap	EPBC	
Carnaby's Black-Cockatoo, Short-billed Black-Cockatoo					Observed flying over the site and feeding on Banksia during the field survey.
Charadrius rubricollis Hooded Plover	P4	Marine	X		Unlikely No suitable habitat for the species. This species prefers sandy beaches, but does habit inland salt lakes and has been recorded within 10 km of the Project Site.
Diomedea chlororhynchos Yellow-nosed Albatross	Threatened	Marine Migratory	X		Highly Unlikely No suitable habitat for the species within the Project Site.
Diomedea exulans amsterdamensis Amsterdam Albatross	Threatened	Endangered Marine Migratory		X	Highly Unlikely No suitable habitat for the species within the Project Site.
Diomedea exulans exulans Tristan Albatross	Threatened	Endangered Marine Migratory	X	X	Highly Unlikely No suitable habitat for the species within the Project Site.
Diomedea exulans gibsoni Gibson's Albatross	Threatened	Vulnerable Marine Migratory		X	Highly Unlikely No suitable habitat for the species within the Project Site.

Species	Status		Search		Likelihood of occurrence
	State	Federal	NatureMap	EPBC	
Diomedea exulans (sensu lato) Wandering Albatross	Threatened	Vulnerable Marine Migratory	X	X	Highly Unlikely No suitable habitat for the species within the Project Site.
Falco peregrinus Peregrine Falcon	S		X		Unlikely The species has been recorded within 10 km of the Project Site and there is some very limited habitat. The surrounding levels of development and disturbance would limit habitat values of the Project Site.
Falco peregrinus subsp. *macropus* Peregrine Falcon	S		X		Unlikely The species has been recorded within 10 km of the Project Site and there is some very limited habitat. The surrounding levels of development and disturbance would limit habitat values of the Project Site.
Ixobrychus minutus subsp. *dubius* Australian Little Bittern	P4		X		Unlikely No suitable habitat for the species within the Project Site, as it prefers terrestrial wetlands that have dense emergent vegetation. However, it has been recorded within 10 km of the Project Site.

Species	Status		Search		Likelihood of occurrence
	State	Federal	NatureMap	EPBC	
Halobaena caerulea Blue Petrel		Vulnerable Marine		X	Highly Unlikely No suitable habitat for the species within the Project Site.
Leipoa ocellata Malleefowl	Threatened	Vulnerable		X	Highly Unlikely This species requires habitat of long un-burnt woodland and there is no suitable habitat within the Project Site or in close proximity.
Macronectes giganteus Southern Giant-Petrel	Threatened	Endangered Marine Migratory	X	X	Unlikely No suitable habitat for the species within the Project Site. However, it has been recorded within 10 km of the Project Site.
Macronectes halli Northern Giant-Petrel	Threatened	Vulnerable Marine Migratory		X	Highly Unlikely No suitable habitat for the species within the Project Site.
Numenius madagascariensis Eastern Curlew	P4	Marine Migratory	X		Unlikely No suitable habitat for the species within the Project Site. However, it has been recorded within 10 km of the Project Site.
Phoebetria fusca	Threatened	Marine	X		Unlikely

Species	Status		Search		Likelihood of occurrence
	State	Federal	NatureMap	EPBC	
Sooty Albatross		Migratory			No suitable habitat for the species within the Project Site. However, it has been recorded within 10 km of the Project Site.
Pterodroma mollis Soft-plumaged Petrel	Threatened	Vulnerable Marine		X	Highly Unlikely No suitable habitat for the species within the Project Site.
Rostratula australis Australian Painted Snipe	Threatened	Vulnerable Marine Migratory		X	Highly Unlikely No suitable habitat for the species within the Project Site. This species prefers wetland areas.
Sternula nereis nereis Fairy Tern (Australian)	Threatened	Vulnerable		X	Highly Unlikely No suitable habitat for the species. This species prefers sandy beaches, but does habit inland salt lakes.
Thalassarche carteri Indian Yellow-nosed Albatross	Threatened	Vulnerable Marine Migratory		X	Highly Unlikely No suitable habitat for the species within the Project Site.
Thalassarche cauta cauta Shy Albatross, Tasmanian Shy Albatross	Threatened	Vulnerable Marine Migratory		X	Highly Unlikely No suitable habitat for the species within the Project Site.
Thalassarche melanophris Black-browed Albatross	Threatened	Vulnerable Marine Migratory	X	X	Unlikely No suitable habitat for the species within the Project Site. However, it has been recorded within 10 km of the Project Site.

Species	Status		Search		Likelihood of occurrence
	State	Federal	NatureMap	EPBC	
Tyto novaehollandiae subsp. *novaehollandiae* Masked Owl (southern subsp.)	P3		X		Unlikely Limited suitable habitat for the species within the Project Site, and has been recorded within 10 km of the Project Site.This species roost and nest in large tree hollows near foraging areas.
Insects					
Leioproctus contrarius Native Bee	P3		X		Possible This species appears to be dependent on flowers of Goodeniaceae and possibly *Leschenautia stenosepala* not present within the Project Site. However, it has been recorded within 10 km of the Project Site.
Hylaeus globuliferus Bee	P3		X		Possible This species is thought to favour flowers of *Adenanthos cygnorum* for feeding, and has also been recorded on *Banksia attenuate,* not present within the Project Site. However, it has been recorded within 10 km of the Project Site.
Synemon gratiosa Graceful Sun Moth	Threatened	Endangered	X	X	Possible Some suitable habitat, including *Lomandra maritima* and *Banksia* woodland present within the Project Site, and has been recorded within 10 km of the Project Site.
Mammals					
Dasyurus geoffroii		Vulnerable		X	Highly Unlikely

Species	Status		Search		Likelihood of occurrence
	State	Federal	NatureMap	EPBC	
Chuditch, Western Quoll					This species is locally extinct and has specific habitat requirements not present within the Project Site. The presence of feral cats would reduce the likelihood of the species.
Hydromys chrysogaster Water-rat	P4		X		Unlikely No suitable habitat present within the Project Site, and this species prefers habitat in the vicinity of permanent water. However, it has been recorded within 10 km of the Project Site.
Isoodon obesulus subsp. *fusciventer* Quenda	P5		X		Unlikely Limited suitable habitat present within the Project Site, however has been recorded within 10 km of the Project Site. The presence of feral cats would reduce the likelihood of the species.
Phascogale calura Red-tailed Phascogale	Threatened	Endangered		X	Highly Unlikely No suitable habitat present within the Project Site. This species prefers habitat containing rock sheoak and wandoo, with suitable hollows for nesting and shelter and a dense mid-storey canopy.
Setonix brachyurus Quokka	Threatened	Vulnerable	X	X	Unlikely This species is associated with dense forests and thickets, and is highly susceptible to predation from cats (present within the Project Site). However, it has been recorded within 10 km of the Project Site.
Reptiles					
Lerista lineata Skink	P3		X		Possible Suitable habitat present, as this species prefers sandy coastal heath and shrubland, and it has been recorded within 10 km of the Project Site.

Species	Status		Search		Likelihood of occurrence
	State	Federal	NatureMap	EPBC	
Morelia spilota subsp. *imbricata* Carpet Python	S		X		Possible Some limited habitat present within the Project Site, and has been recorded within 10 km of the Project Site. This species prefers Banksia woodland, eucalypt woodlands, and grasslands.
Neelaps calonotos Black-striped Snake	P3		X		Possible Some limited habitat, as this species tends to inhabit dunes and sand-plains vegetated with heaths and eucalypts/banksias. The species has been recorded within 10 km of the Project Site.

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