
FORM C7 Attachment 1

Trieste 3D Seismic Survey Environment Plan

(provided as a separate document)

FORM C7 Attachment 2

Description of EPBC Act listed threatened species and potential impacts

C7, Attachment 2 – Description of EPBC Act-listed threatened species and potential impacts

The results from the EPBC Protected Matters Search Tool (PMST) for the survey area, conducted in March 2017, are provided in Table 1 (flora) and Table 2 (fauna).

In summary, there are:

- Thirteen (13) flora species.
 - 3 trees.
 - 5 shrubs.
 - 3 herbs.
 - 2 orchids.
- Fifteen (15) fauna species.
 - 11 birds (8 marine/wetland/shorebird, 3 terrestrial).
 - 2 mammals.
 - 1 reptile.
 - 1 insect.

Below is a description of the field surveys undertaken to validate the EPBC PMST results.

Vegetation field surveys

A targeted field assessment of the flora and vegetation of the proposed survey area was undertaken by seven experienced botanists from Mattiske Consulting between August and November 2017. This was undertaken in accordance with the methods outlined in *Technical Guidance – Flora and vegetation surveys for environmental impact assessment* (EPA, 2016b).

Survey methodology consisted of foot traverses along the proposed source lines and then the proposed receiver lines, both to a maximum width of 20 m. These survey lines were refined by Lattice prior to the surveys to avoid wherever possible remnant vegetation within private properties, the course of the Arrowsmith River, and the Nature Reserve R25495.

Targeted orchid surveys were conducted over potential habitat identified during the initial foot traverses. These surveys in October and November were not just confined to the seismic line corridors and instead targeted vegetation supporting historic records, or identified during foot traverses to be potential habitat. The orchid surveys were focussed mainly around the lateritic ridges along Robb Road, as this is the habitat deemed most suitable for their growth. The width of the potential habitat (ridge or ridge slope) was traversed at approximately 20 m zig-zags. Where the orchids were encountered, the survey intensity was increased in the immediate area (up to 50 m).

If suspected or known species of conservation significance were encountered, a specimen was collected and plant numbers were recorded for the population. All plant specimens collected during the field surveys were dried and processed in accordance with the requirements of the WAH. The plant species were identified based on taxonomic literature and through comparison with pressed specimens housed at the Western Australian Herbarium (WAH). Where appropriate, plant taxonomists with specialist skills were consulted. Nomenclature of the species recorded is in accordance with the WAH.

All source and receiver lines intersecting native vegetation within the UCL were surveyed, and all source and receiver lines intersecting remnant vegetation within the accessible private properties were surveyed, resulting in approximately 300 km of foot traverses.

Line deviation notes were recorded for patches of slow growing species (e.g., trees/large shrubs, grass trees), obstacles (fences, gravel mounds, steep drop offs, inaccessible ridges), beehive locations, threatened flora locations, and where old firebreaks or tracks were utilised.

According to *Technical guidance – Flora and vegetation surveys for environmental impact assessment* (EPA, 2016b), the primary survey timing for the South-west and Interzone

Botanical Province is spring (September-November). The surveys were timed, where possible, to align with peak flowering periods of conservation significant flora with the potential to occur in the proposed survey area. A total of seven experienced botanists undertook the surveys between August and November 2017 over a total of 78 field days. The majority of the surveys (80%) were undertaken during September and October 2017 when the majority of the species of conservation significance were likely to be in flower (and thus more readily identifiable).

Targeted fauna field survey

The fauna survey was undertaken in accordance with the following documents:

- Statement of Environmental Principles, Factors and Objectives (EPA, 2016a);
- Environmental Factor Guidelines – Terrestrial Fauna (EPA, 2016b);
- Technical Guide – Terrestrial Fauna Surveys (EPA, 2016c);
- Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA & DEC, 2010); and
- EPBC Act Referral Guidelines for three threatened black cockatoos: Carnaby's Cockatoo, Baudin's Cockatoo and Forest Red-tailed Black-Cockatoo (DSEWPC, 2012).

The field survey was carried out by one zoologist by vehicle and on foot between the 6th and 7th November 2017 and included:

- Identification of broad fauna habitats.
- Opportunistic records of fauna.
- Targeted search for evidence of any conservation significant species, particularly foraging, breeding or roosting habitat for Carnaby's black-cockatoo (*Calyptorhynchus latirostris*).

Species of conservation significance were classified as:

- Conservation Significance 1 (CS1) – listed under the EPBC Act (Cth) or the *Wildlife Conservation Act 1950* (WA).
- Conservation Significance 2 (CS2) – listed as a Priority species by the DBCA (not listed under State or Commonwealth legislation, but may be considered regionally significant). Priorities are defined by the DBCA as:
 - Priority 1 – Poorly known species (on threatened lands).
 - Priority 2 – Poorly known species in few locations (some on conservation lands).
 - Priority 3 – Poorly known species in several locations (some on conservation lands).
 - Priority 4 – Rare, near threatened and other species in need of monitoring.
- Conservation Significance 3 (CS3) – a locally significant species, not listed under legislation or assigned a Priority rating by the DBCA. Such species may be at the limit of their distribution or have a very restricted range.

Taxonomy and nomenclature for fauna species used in this report follow the WA Museum checklists.

The field study component of a Level 1 fauna survey is primarily to identify the fauna habitats present in the study area. In addition, all vertebrate fauna encountered during the field survey were recorded. The fauna species recorded are usually conspicuous species such as birds, large mammals and large reptiles. The presence of other species may be inferred from evidence such as tracks, burrows, scats or evidence of foraging. Particular attention was paid to searching for evidence of conservation significant species, or habitats likely to support conservation significant species.

Although not all stands of *Banksia* could be visited in a short site visit, several patches were searched for evidence of foraging Carnaby's black-cockatoo. In addition, conspicuous fauna species were recorded if sighted by Matiske Consulting personnel during their flora survey work in the study area between August and October 2017.

Table 1. Description of EPBC Act-listed flora species recorded or that may occur within the survey area, and potential impacts

Species	EPBC Act status	Description	Habitat and distribution	Field survey results and/or likelihood of occurrence, and potential impacts
<i>Trees</i>				
<i>Eucalyptus crispata</i> Yandanooka mallee*	Vulnerable	An erect or spreading mallee up to 5 m tall, with smooth grey bark on its upper trunk and peeling flakes at the base. It has yellow-cream coloured flowers that bloom from March to June.	Found on yellow sand on the Geraldton Sandplains.	Two plants were recorded in a single location around the northeast corner of the survey area along the edge of a dry creekline associated with <i>E. accadens</i> (powerbark wandoo) and <i>E. arachnaea</i> (black-stemmed mallee). There will be no impacts to this species – the location listed above has been excised from the survey area in response to the survey results.
<i>Eucalyptus impensa</i> Eneabba mallee*	Endangered	A straggly mallee growing to 1.5 m high with pink coloured flowers that bloom in June and July.	Found on yellow sand on the Geraldton Sandplains.	Not recorded during field vegetation surveys – <u>possible</u> likelihood of occurrence. No significant impacts are likely. Trees are only likely to be mulched if present as small seedlings.
<i>Eucalyptus leprophloia</i> Scaly butt mallee*	Endangered	An erect mallee growing to 5 m high with scaly, curly bark to 1 m and smooth grey over pale-copper bark above. It has cream-white coloured flowers that bloom from August to October.	Found on white or grey sand over laterite in the Avon Wheatbelt and the Geraldton Sandplains.	This species was recorded in one location (22 plants) in the same association as the <i>E. crispata</i> , but in the south-eastern end of the creekline within the UCL. There will be no impacts to this species – this part of the UCL has been excised from the survey area in response to the survey results.
<i>Eucalyptus x balanites</i> Cadda road mallee^	Endangered	A mallee growing to 5 m high with white coloured flowers that bloom from October to February.	Found on sand with lateritic gravel in the Geraldton Sandplains and Swan Coastal Plain.	Not recorded during field vegetation surveys – <u>low</u> likelihood of occurrence. No significant impacts are likely. Trees are only likely to be mulched if present as small seedlings.

Species	EPBC Act status	Description	Habitat and distribution	Field survey results and/or likelihood of occurrence, and potential impacts
<i>Shrubs</i>				
<i>Chorizema humile</i> Prostrate flame pea [^]	Endangered	A small, prostrate shrub growing to 60 cm in diameter with yellow and red/brown coloured flowers that bloom from July to September. Endemic to WA.	Found in red loam, brown sandy clay with decomposing granite or in clay soils on plains in scrub or open tree mallee in the Avon Wheatbelt and the Geraldton Sandplains. This species has 13 populations that are severely fragmented and in poor habitat quality with key threats to its survival being grazing, trampling, road maintenance activities, weed competition and inappropriate fire regimes.	Not recorded during field vegetation surveys – <u>low</u> likelihood of occurrence. These populations are all listed as occurring well east of the proposed survey area (east of Coorow and Bindi Bindi) (DEC, 2009). No significant impacts are likely given the known locations of this species.
<i>Daviesia speciosa</i> Beautiful daviesia*	Endangered	A multi-stemmed shrub growing to 80 cm high with red flowers that bloom in April and May. Endemic to WA.	Found on gravelly lateritic soils on undulating plains and rises in the Avon Wheatbelt and Geraldton Sandplains.	Not recorded during field vegetation surveys – <u>possible</u> likelihood of occurrence. No significant impacts are likely. Any mulched individuals would be likely to regenerate from rootstock.
<i>Hemiandra gardneri</i> Red snakebush*	Endangered	A prostrate, pungent shrub growing to 20 cm high with red/pink-red coloured flowers that bloom from August to October.	Found on grey or yellow sand, clayey sand in the Avon Wheatbelt and Geraldton Sandplains	Not recorded during field vegetation surveys – <u>possible</u> likelihood of occurrence. No significant impacts are likely. Any mulched individuals would be likely to regenerate from rootstock.

Species	EPBC Act status	Description	Habitat and distribution	Field survey results and/or likelihood of occurrence, and potential impacts
<i>Leucopogon obtectus</i> Hidden beard-heath^	Endangered	A spindly to dense shrub growing to 1.7 m high with cream-yellow coloured flowers that bloom from August to October.	Found on white-grey/yellow-brown sand.	Not recorded during field vegetation surveys – <u>possible</u> likelihood of occurrence. Records exist immediately outside the survey area. No significant impacts are likely. Any mulched individuals would be likely to regenerate from rootstock.
<i>Tetratheca nephelioides</i> *	Critically endangered	A dwarf shrub growing to 30 cm high with purple coloured flowers that bloom in September.	Found on grey sand.	Not recorded during field vegetation surveys – <u>possible</u> likelihood of occurrence. No significant impacts are likely. Any mulched individuals would be likely to regenerate from rootstock.
<i>Herbs</i>				
<i>Conostylis dielsii</i> subsp. <i>teres</i> Irwin's conostylis*	Endangered	A rhizomatous tufted perennial herb growing to 33 cm high. Cream to yellow-coloured flowers that bloom in July and August.	Prefers white, grey or yellow sand or gravel on the Geraldton Sandplains.	Not recorded during field vegetation surveys – <u>possible</u> likelihood of occurrence. No significant impacts are likely. Any mulched individuals would be likely to regenerate from rhizomes.
<i>Conostylis micrantha</i> Small-flowered conostylis*	Endangered	A rhizomatous tufted perennial herb growing to 24 cm high. Yellow/cream/red coloured flowers that bloom in July and August.	Found on white or grey sand in the Avon Wheatbelt and Geraldton Sandplains	Not recorded during field vegetation surveys – <u>possible</u> likelihood of occurrence. No significant impacts are likely. Any mulched individuals would be likely to regenerate from rhizomes.

Species	EPBC Act status	Description	Habitat and distribution	Field survey results and/or likelihood of occurrence, and potential impacts
<i>Wurmbea tubulosa</i> Long-reference nancy*	Endangered	A cormous, perennial herb growing to 3 cm high with white-pink coloured flowers that bloom from June to August.	Found on clay, loam in the Avon Wheatbelt and Geraldton Sandplains.	Not recorded during field vegetation surveys – <u>possible</u> likelihood of occurrence. No significant impacts are likely. Mulching is planned to occur outside of the flowering period when the species is dormant below ground.
<i>Orchids</i>				
<i>Paracaleana dixonii</i> Sandplain duck orchid*	Endangered	A tuberous perennial orchid growing to 20 cm high with yellow and brown coloured flowers that bloom from October to December.	Found on grey-white sand over laterite on the Geraldton Sandplains and Swan Coastal Plain.	Twenty-nine (29) plants were recorded during the vegetation surveys at five populations within the UCL. Five historic records were not relocated, however four of the 2017 populations were recorded within 500 m of the historic records. No significant impacts are likely. Survey lines have been carefully re-designed to avoid populations recorded during the field surveys.
<i>Thelymitra stellata</i> Star sun-orchid*	Endangered	A tuberous perennial orchid growing to 25 cm high with yellow and brown coloured flowers that bloom from October to November.	Found on sand, gravel and lateritic loam in the Avon Wheatbelt, Geraldton Sandplains, Jarrah Forest, Mallee and and Swan Coastal Plain.	Thirty-eight (38) plants were recorded during the vegetation surveys at seven populations. Five of these populations were within the UCL, with the other two populations located on private land to the north of the UCL. No significant impacts are likely. Survey lines have been carefully re-designed to avoid populations recorded during the field surveys.

Commonwealth conservation listings current as at 30 March 2017.

Key

Listed threatened species	A native species listed in Section 178 of the EPBC Act as either extinct, extinct in the wild, critically endangered, endangered, and vulnerable or conservation dependent.
*	Conservation Advice has been prepared for the species under the <i>EPBC Act 1999</i> (Cth).
^	Recovery Plan has been prepared for the species under the <i>EPBC Act 1999</i> (Cth).

Table 2. Description of EPBC Act-listed fauna species recorded or that may occur within the survey area, and potential impacts

Species	EPBC Act status	Description	Habitat and distribution	Field survey results and/or likelihood of occurrence, and potential impacts
<i>Birds – non-marine/shoreline/waterfowl</i>				
<p><i>Calyptorhynchus latirostris</i> Carnaby's black-cockatoo[^]</p>	<p>Endangered</p>	<p>Carnaby's black-cockatoo is a large, mostly black bird with white cheek patches, large white panels on the tail and a strong curved bill. Adults range from 53-58 cm in length and 520-790 g in weight.</p> <p>It is one of the five Australian endemic black cockatoo species, and is endemic to southwest WA. Carnaby's black-cockatoo was once very numerous in WA, with its decline due to the loss and fragmentation of habitat. Its population in 2010 was estimated at 40,000 birds.</p> <p><u>Breeding</u></p> <p>The species is highly mobile and displays a seasonal migratory pattern linked to breeding, and occurs in the inland parts of its range in areas with annual average rainfall of 300-750 mm. It breeds from July/August to January/February in hollows in long-lived trees in woodlands and forests (DSEWPC, 2012). For most preferred breeding trees, hollows form in trees with a diameter at breast height (DBH) of 500 mm, or 300 mm for salmon gum (<i>Eucalyptus salmonopholia</i>) and wandoo (<i>E. wandoo</i>).</p>	<p>Occurs in the IBR of Avon Wheatbelt, Esperance Plains, Geraldton Sandplains, Jarrah Forest, Swan Coastal Plain, Warren and Yalgoo.</p> <p>The species has been recorded within 55 km of the study area, including a large flock of 350 just to the north of the study area.</p> <p>Habitat critical for the survival of the Carnaby's cockatoo is:</p> <ul style="list-style-type: none"> • Eucalypt woodlands with nest hollows for breeding combined with nearby vegetation that provides feeding, roosting and watering habitat; • Woodlands; and • Areas with food resources for the non-breeding season. <p>Carnaby's cockatoos nest in the hollows of live or dead eucalypts, primarily the smooth-barked salmon gum and wandoo, though breeding has been reported in other wheatbelt tree species and some tree species on the Coastal Plain.</p>	<p>No birds sighted during the fauna (or vegetation) surveys.</p> <p><u>Breeding</u></p> <p>As the targeted surveys were within the breeding season, it suggests that the species is not using the study area as a foraging resource to support breeding (noting that the absence of records does not necessarily prove an absence).</p> <p>The wandoo woodland on the minor creek contains trees with a DBH >30 cm, and is therefore considered 'potential breeding habitat'.</p> <p>Woodlands along the Arrowsmith River are also potential breeding habitat.</p>

Species	EPBC Act status	Description	Habitat and distribution	Field survey results and/or likelihood of occurrence, and potential impacts
				<p>Impacts to breeding or breeding habitat – nil to negligible. Habitat trees will not be removed and riparian vegetation is excluded from the survey. Mulchers are not able to mulch vegetation with trunks >20 cm DBH.</p>

Species	EPBC Act status	Description	Habitat and distribution	Field survey results and/or likelihood of occurrence, and potential impacts
<p><i>Carnaby's black-cockatoo (cont'd)</i></p> <p><i>Annex C7 - Attachment 2</i></p>		<p>During the non-breeding season, the birds migrate to the higher rainfall coastal regions west or south where water is more plentiful.</p> <p><u>Foraging</u> This species feeds mostly on native seeds, flowers and nectar in kwongan heathland and woodland dominated by <i>Banksia</i>, <i>Dryandra</i>, <i>Hakea</i> and <i>Grevillea</i> species (DSEWPC, 2012). With changing habitat, the diet also includes increased amounts of seeds from introduced plant species such as commercial broad-acre crops (e.g., canola) and in the non-breeding part of the species' range, plantation pines.</p> <p>While breeding, the species generally forages within a 6-12 km radius of the nesting site (DSEWPC, 2012). Communal night roosting sites are used, generally for a period of weeks until the local foraging resources are exhausted, in or near riparian environments with permanent water (DSEWPC, 2012).</p> <p><u>Roosting</u> This species roosts in tall trees, usually in riparian habitats.</p>	<p>Carnaby's Black-Cockatoo is known to breed in the region, with the nearest breeding records to the east at Three Springs and southeast at Coomallo. The study area falls on the boundary of the known breeding range of this species, as mapped by DoEE (2017b), with no breeding known to occur further west.</p>	<p><u>Foraging</u> Contains some foraging habitat, with patches of <i>Banksia</i> shrubland on sands or gravelly sands, and small areas of <i>Hakea trifurcata</i> and <i>Banksia sessilis</i> on some of the laterite rises. The species may use vegetated parts of the survey area as a seasonal foraging resource.</p> <p>Impacts to foraging – although the habitat loss is temporary, for the period of time until the mulched tracks regenerate there is likely to be a loss of more than 1 ha of foraging habitat, which is considered to be a 'high risk' of a significant impact under the DSEWPC (2012) guidelines. However, as only 1.8% of the native vegetation in the survey area is subject to mulching, plentiful foraging habitat remains for this species. Impacts are reversible as the mulched vegetation regenerates.</p>

Species	EPBC Act status	Description	Habitat and distribution	Field survey results and/or likelihood of occurrence, and potential impacts
				<p><u>Roosting</u> It may occur along the Arrowsmith River (or Irwin River, north of the survey area).</p> <p>Impacts to roosting – no vegetation clearing will be taking place along the Arrowsmith River, so impacts are likely to be nil to negligible.</p>

Species	EPBC Act status	Description	Habitat and distribution	Field survey results and/or likelihood of occurrence, and potential impacts
<p><i>Leipoa ocellata</i> Malleefowl[^]</p>	<p>Vulnerable</p>	<p>The malleefowl is a large, stocky ground-dwelling bird about the size of a domestic chicken with strong feet and a short bill.</p> <p><u>Breeding</u> Malleefowl are generally monogamous and are thought to pair for life, breeding annually except in drought years.</p> <p>Malleefowl have developed a most sophisticated and elaborate technique of incubation, constructing an incubator mound of sand usually 3.5 m in diameter and one metre high. This is constructed during autumn to spring by both members of a pair. Heat for egg incubation comes from microbial decomposition of the litter within the mound early in the season and then from the heat of the sun late in the season.</p> <p>Egg laying usually begins in September with an egg laid every 5-7 days until mid to late summer. The average breeding life is thought to be about 15 years.</p> <p>Apart from rainfall and habitat type, sheep grazing appears to explain different breeding densities; densities in grazed areas are about 10% of those in ungrazed areas.</p>	<p>The malleefowl is the most southerly distributed of three species of megapode that occur in Australia. It is restricted to the mainland and differs from all other extant megapodes in that it inhabits semi-arid and arid habitats (dominated by mallee and/or acacias and associated habitats such as broombush (<i>Melaleuca uncinata</i>) and scrub pine (<i>Callitris verrucosa</i>)) rather than damp forests across southern Australian. In WA, malleefowl are also occasionally found in woodlands dominated by eucalypts such as wandoo (<i>E. wandoo</i>), marri (<i>Corymbia calophylla</i>) and mallet (<i>E. astringens</i>).</p> <p>A sandy substrate and abundance of leaf litter are required for breeding. Densities of the birds are generally greatest in areas of higher rainfall and on more fertile soils where habitats tend to be thicker and there is an abundance of food plants. The Malleefowl is thought never to have been common in the vicinity of the proposed survey area, with higher density populations occurring to the east of a line between Kalbarri and Wongan Hills.</p>	<p>No nesting mounds or animals were recorded during the fauna (and vegetation) surveys.</p> <p>Although some of the shrubland habitats in the study area may be suitable habitat for foraging malleefowl, much of the vegetation present is too low and sparse to support breeding.</p> <p>This species <u>potentially occurs at low density</u> in the survey area, most likely as occasional dispersing individuals.</p> <p>No significant impacts are likely based on the absence of nesting mounds and its low habitat suitability.</p>

Species	EPBC Act status	Description	Habitat and distribution	Field survey results and/or likelihood of occurrence, and potential impacts
<i>Malleefowl (cont'd)</i>		<p><u>Foraging</u></p> <p>Malleefowl are generalist feeders, with a diet that is characteristically variable and with different foods being important at different times and locations.</p> <p>Their diet consists of the seeds, flowers and fruits of shrubs (especially legumes), herbs, invertebrates, tubers and fungi.</p>	<p>In WA, the malleefowl's range has contracted by 28% since 1981.</p> <p>In WA, occupancy of small remnants in the wheatbelt found that remnants occupied by malleefowl typically possessed a greater amount of litter, greater cover of tall shrubs, greater abundance of food shrubs and a greater soil gravel content than those that were not occupied.</p> <p>There are 15 records of this species within 55 km of the study area. Three of these records are undated historical records, the remainder ranging from 1964 to 2011. The most recent record in 2011 is of a bird on Beekeepers Rd at Arrowsmith, indicating that this species still maintains a presence in the region.</p>	

Species	EPBC Act status	Description	Habitat and distribution	Field survey results and/or likelihood of occurrence, and potential impacts
<p><i>Merops ornatus</i> Rainbow bee-eater</p>	<p>Listed (marine)</p>	<p>The rainbow bee-eater is a medium-sized bird, and the only species of bee-eater in Australia.</p> <p>The species is capable of living for up to 24 months in the wild, with no information available on the ages of sexual maturity or natural mortality.</p> <p><u>Breeding</u></p> <p>In Australia, the breeding season occurs from August to January. The nest is located in an enlarged chamber at the end of long burrow or tunnel that is excavated by both sexes in flat or sloping ground, in the banks of rivers, creeks or dams, in roadside cuttings, in the walls of gravel pits or quarries, in mounds of gravel, or in cliff-faces. Nesting areas are often re-used and at least some migrant birds return to the same nesting area each year.</p> <p><u>Foraging</u></p> <p>Rainbow bee-eaters feed mainly on insects, consisting of bees and wasps along with beetles, moths, butterflies, damselflies, dragonflies, flies, ants and bugs. Most prey is captured in flight, although it also takes food items from the ground and from foliage.</p>	<p>The rainbow bee-eater has a very large range and is distributed across much of mainland Australia, and occurs on several near-shore islands. It is thinly distributed in the most arid regions of central and western Australia. Records indicate that the distribution of the species has expanded in south-western Australia.</p> <p>The rainbow bee-eater occurs mainly in open forests and woodlands, shrublands, and in various cleared or semi-cleared habitats, including farmland and areas of human habitation. It usually occurs in open, cleared or lightly-timbered areas that are often, but not always, located in close proximity to permanent water.</p> <p>The movement patterns of this bird are complex, and are not fully understood. Populations that breed in southern Australia are migratory. After breeding, they move north and remain there for the duration of the Australian winter. However, populations that breed in northern Australia are considered to be resident.</p>	<p>A common species that was recorded during the fauna survey.</p> <p>No significant impacts based on the species' widespread distribution and absence of breeding habitat in the survey area.</p>

Species	EPBC Act status	Description	Habitat and distribution	Field survey results and/or likelihood of occurrence, and potential impacts
<i>Birds – marine/shoreline/waterfowl</i>				
<p><i>Apus pacificus</i> Fork-tailed swift</p>	<p>Listed (migratory, marine)</p>	<p>The fork-tailed swift is a medium to large bird with a length of 18–21 cm, a wingspan of 40–42 cm and weighs around 30–40 g.</p> <p><u>Breeding</u> This species does not breed in Australia. In their breeding range, they nest on mountain cliffs or island rock caves, inside narrow crevices or in cracks on vertical cliff faces. They usually arrive in Australia around October.</p> <p><u>Foraging</u> The fork-tailed swift is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher.</p> <p>Their prey species in Australia are not well known, however, they are known to be insectivorous, feeding on small bees, wasps, termites and moths in proximity to cyclonic weather.</p>	<p>The fork-tailed swift is native and vagrant in many countries.</p> <p>They are highly mobile while in Australia, with large flocks often preceding or following low-pressure systems as they cross the country in search of food. In WA, they are common in Broome, with maximum numbers occurring in February.</p> <p>Fork-tailed swifts leave southern Australia from mid-April and depart the Darwin area by the end of April.</p> <p>In WA, there are widespread in coastal and sub-coastal areas between Augusta and Carnarvon. There are sparsely scattered inland records, especially in the Wheatbelt, from Lake Annean and Wittenoom.</p> <p>They mostly occur over dry or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh. They are also found at treeless grassland and sandplains covered with spinifex, open farmland and inland and coastal sand dunes.</p>	<p>No birds recorded during the fauna (or vegetation) surveys – possible likelihood of occurrence, but only as an aerial species overflying the area.</p> <p>No significant impacts are likely based on almost exclusive aerial nature and lack of breeding in Australia.</p>

Species	EPBC Act status	Description	Habitat and distribution	Field survey results and/or likelihood of occurrence, and potential impacts
<p><i>Motacilla cinerea</i> Grey wagtail</p>	<p>Listed (migratory, marine)</p>	<p>The grey wagtail is a small bird, growing to 18 cm, and is distinguished as the only wagtail with pinkish (not black) legs. It has grey plumage with a yellow breast.</p> <p><u>Breeding</u> This species breeds in Europe from March to August. Some populations are highly migratory and travel south after breeding.</p> <p><u>Foraging</u> This species feeds on a variety of insects caught from shallow water.</p>	<p>The grey wagtail is widespread cosmopolitan species found in northern Africa, Europe and Asia that prefers fast-moving watercourses. In Australia, it is present in latitudes north of Cairns (Qld) and is a vagrant species.</p>	<p>No birds recorded during the fauna (or vegetation) surveys.</p> <p>This species' preference for aquatic habitats, which are avoided by the survey, means it is <u>unlikely</u> to occur within the survey area.</p> <p>No significant impacts are likely based on its widespread distribution and lack of breeding in Australia.</p>

Species	EPBC Act status	Description	Habitat and distribution	Field survey results and/or likelihood of occurrence, and potential impacts
<p><i>Haliaeetus leucogaster</i> White-bellied sea-eagle</p>	<p>Listed (marine)</p>	<p>The white-bellied sea-eagle is a large raptor that has long, broad wings and a short, wedge-shaped tail.</p> <p><u>Breeding</u> Breeding has been recorded from only a relatively small area of the total distribution. Breeding records are patchily distributed, mainly along the coastline, and especially the eastern coast.</p> <p><u>Foraging</u> The species generally forages over large expanses of open water, feeding on a variety of fish, birds, reptiles, mammals and crustaceans, and on carrion and offal. They hunt from a perch, or whilst in flight, usually launching into a dive or shallow glide to snatch its prey, usually in one foot, from the ground or water surface.</p>	<p>The white-bellied sea-eagle is distributed along the coastline (including offshore islands), around terrestrial wetlands in tropical and temperate regions of mainland Australia and its offshore islands.</p> <p>It is considered to be a common species throughout much of its range, and has an estimated global population of more than 10,000 individuals.</p> <p>The habitats occupied by the sea-eagle are characterised by the presence of large areas of open water (larger rivers, swamps, lakes, the sea). Birds have been recorded in (or flying over) a variety of terrestrial habitats.</p>	<p>No birds recorded during the fauna (or vegetation) surveys.</p> <p>No significant impacts are likely due to the absence of large bodies of water in the survey area.</p>

Species	EPBC Act status	Description	Habitat and distribution	Field survey results and/or likelihood of occurrence, and potential impacts
<p><i>Calidris ferruginea</i> Curlew sandpiper*</p>	<p>Critically endangered</p>	<p>A small, slim sandpiper 18–23 cm long and weighing 57 g, with a wingspan of 38–41 cm. It has a long decurved black bill with a slender tip; the legs and neck are also long. It has a square white patch across the lower rump and uppertail-coverts, a prominent flight character in all plumages. The sexes are similar, but females have a slightly larger and longer bill and a slightly paler underbelly in breeding plumage.</p> <p><u>Breeding</u> The species breeds in Siberia and they live up to 18 years.</p> <p><u>Foraging</u> Curlew sandpipers forage on mudflats and nearby shallow water. In non-tidal wetlands, they usually wade, mostly in water 15–30 mm. They forage on invertebrates, including worms, molluscs, crustaceans, and insects, as well as seeds.</p> <p><u>Roosting</u> They roost in open situations with damp substrate, especially on bare shingle, shell or sand beaches, sandspits and islets in or around coastal or near-coastal lagoons and other wetlands.</p>	<p>In Australia, curlew sandpipers occur around the coasts and are also widespread inland, though erratic in their appearance across much of the interior. There are records from all states during the non-breeding period, and also during the breeding season when many non-breeding birds remain in Australia rather than migrating north.</p> <p>They occur mainly on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They occur in both fresh and brackish waters.</p> <p>In WA, they are widespread around coastal and sub-coastal plains from Cape Arid to the southwest Kimberley. They occur in thousands to tens of thousands at Port Hedland Saltworks, Eighty-mile Beach, Roebuck Bay and Lake Macleod, over 1,000 km northwest of the survey area.</p>	<p>No birds recorded during the fauna (or vegetation) surveys.</p> <p>No significant impacts are likely due to the absence of its preferred wetland foraging sites and shoreline roosting sites within the survey area.</p>

Species	EPBC Act status	Description	Habitat and distribution	Field survey results and/or likelihood of occurrence, and potential impacts
<p><i>Numenius madagascariensis</i> Eastern curlew*</p>	<p>Critically endangered Listed (migratory, marine)</p>	<p>The eastern curlew is the largest migratory shorebird in the world, with a long neck, long legs, and a very long down-curved bill.</p> <p><u>Breeding</u> The species breeds in Russia and they live up to 19 years.</p> <p><u>Foraging</u> The species mainly forages during the non-breeding season on soft sheltered intertidal sandflats or mudflats, open and without vegetation or covered with seagrass, often near mangroves, on salt flats and in saltmarsh, rockpools and among rubble on coral reefs, and on ocean beaches near the tideline.</p> <p>The eastern curlew is carnivorous during the non-breeding season, mainly eating crustaceans, small molluscs and insects.</p> <p><u>Roosting</u> This species roosts during high tide periods on sandy spits, sandbars and islets, especially on beach sand near the high-water mark, and among coastal vegetation including low saltmarsh or mangroves. They occasionally roost on reef-flats, in the shallow water of lagoons and other near-coastal wetlands.</p>	<p>Within Australia, the eastern curlew has a primarily coastal distribution. The species is found in all states. They have a continuous distribution from Barrow Island and Dampier Archipelago in WA, through the Kimberley and along the Northern Territory, Queensland, and NSW coasts and the islands of Torres Strait. They are patchily distributed elsewhere.</p> <p>In WA, the species is a scarce visitor to Houtman Abrolhos and the adjacent mainland, and is also recorded around Shark Bay.</p> <p>During the non-breeding season in Australia, the eastern curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass (Zosteraceae).</p>	<p>No birds recorded during the fauna (or vegetation) surveys.</p> <p>No significant impacts are likely due to the absence of its preferred shoreline feeding and roosting habitat within the survey area.</p>

Species	EPBC Act status	Description	Habitat and distribution	Field survey results and/or likelihood of occurrence, and potential impacts
<p><i>Pandion haliaetus</i> Osprey</p>	<p>Listed (migratory, marine)</p>	<p>The osprey is a medium-sized raptor. They usually occur singly, occasionally in twos, or more rarely in family groups. Osprey can live up to 22 years.</p> <p><u>Breeding</u> Osprey breed from April to February, with the breeding seasons of individual pairs varying according to latitude (commencing progressively later on a cline from north to south).</p> <p><u>Foraging</u> Osprey require extensive areas of open fresh, brackish or saline water for foraging where they feed mainly on fish, especially mullet where available, and rarely take molluscs, crustaceans, insects, reptiles, birds and mammals.</p>	<p>The breeding range of the osprey extends around the northern coast of Australia (including many offshore islands) from Albany in WA to Lake Macquarie in NSW, and is considered to be moderately common. The species is most abundant in northern Australia, where high population densities occur in remote areas. The species is rare to uncommon in southern WA.</p> <p>Osprey occur in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands. They are mostly found in coastal areas but occasionally travel inland along major rivers, particularly in northern Australia.</p> <p>Adult ospreys are mostly resident or sedentary around breeding territories. They forage more widely but continue to make at least intermittent visits to their breeding grounds in the non-breeding season.</p>	<p>No birds recorded during the fauna (or vegetation) surveys.</p> <p>No significant impacts are likely due to the absence of preferred open water foraging sites and elevated roosting sites in the survey area.</p>

Species	EPBC Act status	Description	Habitat and distribution	Field survey results and/or likelihood of occurrence, and potential impacts
<p><i>Ardea alba</i> Great egret</p>	<p>Listed (marine)</p>	<p>The great egret is a moderately large bird (83–103 cm in length, 700–1,200 g in weight) with white plumage, a black or yellow bill and long reddish and black legs.</p> <p>They often occur solitarily, or in small groups when feeding. They roost in large flocks that may consist of hundreds of birds. The species usually nest in colonies and rarely in solitary pairs.</p> <p><u>Breeding</u></p> <p>In Australia, the breeding season of the great egret is variable, depending to some extent on rainfall, but generally extends from November to April (with pairs at southern latitudes breeding in spring and summer, particularly November and December.</p> <p>Breeding sites are located in wooded and shrubby swamps, with melaleuca swamps preferred in southwest WA.</p> <p><u>Foraging</u></p> <p>Great egrets have a diverse diet that includes fish, insects, crustaceans, molluscs, frogs, lizards, snakes, small birds and mammals.</p> <p>They mostly forage by standing in shallow to moderately deep water capturing prey that wanders nearby. Prey is taken from water and vegetation but not from sediments.</p>	<p>The great egret is a widespread species of southern and eastern Asia and Australasia. There has been no systematic survey of the Australian population of the great egret, with a preliminary estimate of 60,000 individuals derived from data on breeding colonies. This is thought to represent 11 to 74% of the total global population.</p> <p>The great egret occurs in a wide range of wetland habitats (e.g., inland and coastal, freshwater and saline, permanent and ephemeral, open and vegetated, large and small, natural and artificial) and includes swamps and marshes, margins of rivers and lakes, damp or flooded grasslands, pastures or agricultural lands, reservoirs, salt marshes, streams and so forth. The species usually frequents shallow waters.</p>	<p>No birds recorded during the fauna (or vegetation) surveys.</p> <p>No significant impacts are likely due to the absence of preferred watercourse habitats, which are avoided by the survey.</p>

Species	EPBC Act status	Description	Habitat and distribution	Field survey results and/or likelihood of occurrence, and potential impacts
<p><i>Ardea ibis</i> Cattle egret</p>	<p>Listed (marine)</p>	<p>The cattle egret is small, stocky and mostly white with a short neck and stout yellow-red bill. The name comes from its association with cattle; namely its habit of eating ticks and flies off the backs of livestock.</p> <p><u>Breeding</u> The cattle egret breeds in colonies, either mono-specific or with other egrets/herons. The principal breeding sites are along the Australian east coast from October to January, with some breeding colonies also observed at Wyndham, WA to Arnhem Land, Northern Territory.</p> <p>Cattle egret roosts in trees, or amongst ground vegetation in or near lakes and swamps.</p> <p><u>Foraging</u> Cattle egret often forage away from water on low lying grasslands, improved pastures and croplands.</p> <p>Grasshoppers make up the majority of the diet during the breeding season. Other insect prey includes cicadas, centipedes, spiders, cattle ticks, frogs, lizards (particularly skinks) and small mammals.</p>	<p>The cattle egret is widespread and common. Two major distributions have been located; from north-east WA to the Top End of the Northern Territory and around south-east Australia. In WA and the Northern Territory, the Cattle Egret is located from Wyndham to Arnhem Land.</p> <p>The population estimate for Australia, New Guinea and New Zealand is 100,000 birds</p> <p>The species occurs in tropical and temperate grasslands, wooded lands and terrestrial wetlands. It has occasionally been seen in arid and semi-arid regions however this is extremely rare.</p> <p>High numbers have been observed in moist, low-lying poorly drained pastures with an abundance of high grass; it avoids low grass pastures.</p> <p>It is commonly associated with the habitats of farm animals, particularly cattle, but also pigs, sheep, horses and deer.</p>	<p>No birds recorded during the fauna (or vegetation) surveys.</p> <p>No significant impacts are likely as no vegetation clearing is required in farmland. Disturbance is likely to be limited to temporary movement away from surveying activities due to noise.</p>
<p><i>Mammals</i></p>				

Species	EPBC Act status	Description	Habitat and distribution	Field survey results and/or likelihood of occurrence, and potential impacts
<p><i>Dasyurus geoffroii</i> Chuditch, western quoll^</p>	<p>Vulnerable</p>	<p>The chuditch is the largest carnivorous marsupial occurring in WA. At maturity it is about the size of a small domestic cat, weighing up to 1.3 kg. This is a nocturnal, solitary and nomadic species that is distinguishable from other mammals within its present range by its white spotted brown pelage, large rounded ears, pointed muzzle, large dark eyes and a non-hopping gait. The tail has a black 'brush' over the dorsal surface of the distal portion.</p> <p><u>Breeding</u></p> <p>Males and females are sexually mature and can breed in their first year. They are seasonal breeders, mating in late April to early July. Females can produce up to 50 fetuses, but only 2-6 young successfully attach to the available six nipples. The young are fully weaned at 6 months and subsequently disperse.</p> <p><u>Foraging</u></p> <p>Chuditch are opportunistic feeders, foraging primarily on the ground and at night. In the forest, insects and other large invertebrates comprise the bulk of their diet, though some mammals, birds and lizards are also consumed. They will also scavenge for food scraps around campsites and consume the remains of road kill.</p>	<p>This species used to occur across much of the continent (~70%), but is now restricted to the southwest of WA.</p> <p>Although they used to occupy a range of habitats, the majority (~75%) of chuditch now occur in the jarrah forest, with some wheatbelt/goldfields populations in drier woodlands, heath and mallee shrublands.</p> <p>A population was translocated to Kalbarri National Park, about 200 km north of the survey area. The translocation was successful, and records of the chuditch to the south are presumably individuals dispersing from this area. There is a single record of the chuditch within 55 km of the survey area, from Dongara in 2012.</p> <p>The taller shrublands and woodland in the minor creek potentially support chuditch.</p>	<p>Not recorded during the fauna (or vegetation) surveys.</p> <p>No significant impacts are likely as riparian vegetation will not be mulched. If present, it is likely to be at low densities or represented by a few dispersing individuals.</p>

Species	EPBC Act status	Description	Habitat and distribution	Field survey results and/or likelihood of occurrence, and potential impacts
<p><i>Parantechinus apicalis</i> Dibbler*</p>	<p>Endangered</p>	<p>The dibbler is a small carnivorous marsupial, readily distinguished by white rings around their eyes, a tapering, hairy tail and the freckled appearance of its fur.</p> <p><u>Breeding</u> Dibblers are seasonal breeders. They breed in autumn with mating beginning in late March. The mating season is short and intense, typically lasting two to three weeks. Young are typically born from early April to late May as litters of up to eight young. Females produce one litter per year.</p> <p><u>Foraging</u> The dibbler's diet is dominated by arthropods with some vegetative matter. Scat analysis has identified beetles, cockroaches, grasshoppers, termites, ants and spiders in the diet.</p>	<p>Dibblers were formerly widely distributed in a broad band along the west and southern coasts of Australia. No records of the species were made between 1904 and 1967, when the species was 're-discovered' in a survey at Cheyne Beach, WA.</p> <p>Dibblers are currently restricted to three small offshore islands (Boullanger, Whitlock and Escape Islands near Jurien Bay), Fitzgerald National Park on the WA south coast and at three more reintroduction sites (Peniup Nature Reserve; Stirling Range National Park and three releases into a 380 ha fox and cat-free enclosure in Waychinicup National Park.</p> <p>The mainland habitat is characterised by the presence of long-unburnt heathland, typified by sandy substrates and occasionally lateritic soils.</p>	<p>Not recorded during the fauna (or vegetation) surveys.</p> <p>No significant impacts are likely given its restricted distribution on offshore island and along the southern coastline.</p>
<p><i>Reptiles</i></p>				

Species	EPBC Act status	Description	Habitat and distribution	Field survey results and/or likelihood of occurrence, and potential impacts
<i>Egernia stokesii badia</i> Western spiny-tailed skink [^]	Endangered	This subspecies of <i>E. stokesii</i> is a stout-bodied skink with well-developed limbs each with 5 digits. It can reach snout-vent lengths of up to 195 mm, with the tail up to a further 45% of this. There are large variations in adult size between populations. It is reddish-brown in colour with a strong pattern of blotches or irregular bands of white or cream on the dorsal surface.	This subspecies occurs in open eucalypt woodlands and <i>Acacia</i> -dominated shrublands in semi-arid to arid areas of south-western WA (Geraldton Sandplains and Yalgoo IBRA). It shelters in logs, in cavities in the trunks and branches of shrubs, as well as in houses and ruins, especially in accumulations of old corrugated iron.	Not recorded during the fauna (or vegetation) surveys. No significant impacts are likely, as there is no suitable habitat in the survey area and mapping in DEC (2012) indicates records generally occur further inland.
<i>Insects</i>				
<i>Idiosoma nigrum</i> Shield-backed trapdoor spider*	Vulnerable	The shield-backed trapdoor spider is a large spider with females up to 30 mm in body length and males up to 18 mm in body length. It is dark brown to black in colour and easily recognisable by the distinctive structure of the abdomen, as the end of the abdomen is flattened and shield-like.	This spider is endemic to WA and known from only a few locations. It typically inhabits eucalypt woodlands or <i>Acacia</i> shrublands on clay soils, where it builds a burrow using leaf litter and twigs. There are five records of this species within 55 km of the study area. Two are from Woolaga Creek, Ikewa in 1954 and three are from the Eneabba region in 1987.	Not recorded during the fauna (or vegetation) surveys. No significant impacts are likely, as there is no suitable habitat in the proposed survey area.

Key on following page.

Commonwealth conservation listings current as at 30 March 2017.

Key

Listed migratory species:	A native species that from time to time is included in the appendices to the Bonn Convention and the annexes of JAMBA, CAMBA and ROKAMBA, as listed in Section 209 of the EPBC Act.
Listed threatened species:	A native species listed in Section 178 of the EPBC Act as either extinct, extinct in the wild, critically endangered, endangered, and vulnerable or conservation dependent. <ul style="list-style-type: none"> • 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 very high risk of extinction in the wild in the medium-term future.
*	Conservation Advice has been prepared for the species under the EPBC Act.
^	Recovery Plan has been prepared for the species under the EPBC Act.

FORM C7 Attachment 3

**Assessment of potential impacts to the Carnaby's black-cockatoo
against EPBC Act significant impact criteria**

C7, Attachment 3 – Assessment of potential impacts to the Carnaby's black-cockatoo against EPBC Act significant impact criteria

According to the Significant Impact Guidelines 1.1 (DoE, 2013, pg 9), an action is likely to have a significant impact on an endangered species if there is a real chance or possibility that it will:

1. Lead to a long-term decrease in the size of a population;
2. Reduce the area of occupancy of the species;
3. Fragment an existing population into two or more populations;
4. Adversely affect habitat critical to the survival of a species;
5. Disrupt the breeding cycle of a population;
6. Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;
7. Result in invasive species that are harmful to an endangered species becoming established in the endangered species' habitat;
8. Introduce disease that may cause the species to decline; or
9. Interfere with the recovery of the species.

The DoEE has determined that the Trieste seismic survey is a 'controlled action' because of potential impacts on the Carnaby's black-cockatoo (*Calyptorhynchus latirostris*). An assessment of the significant impact criteria against potential impacts to the Carnaby's black cockatoo is provided below for this proposal.

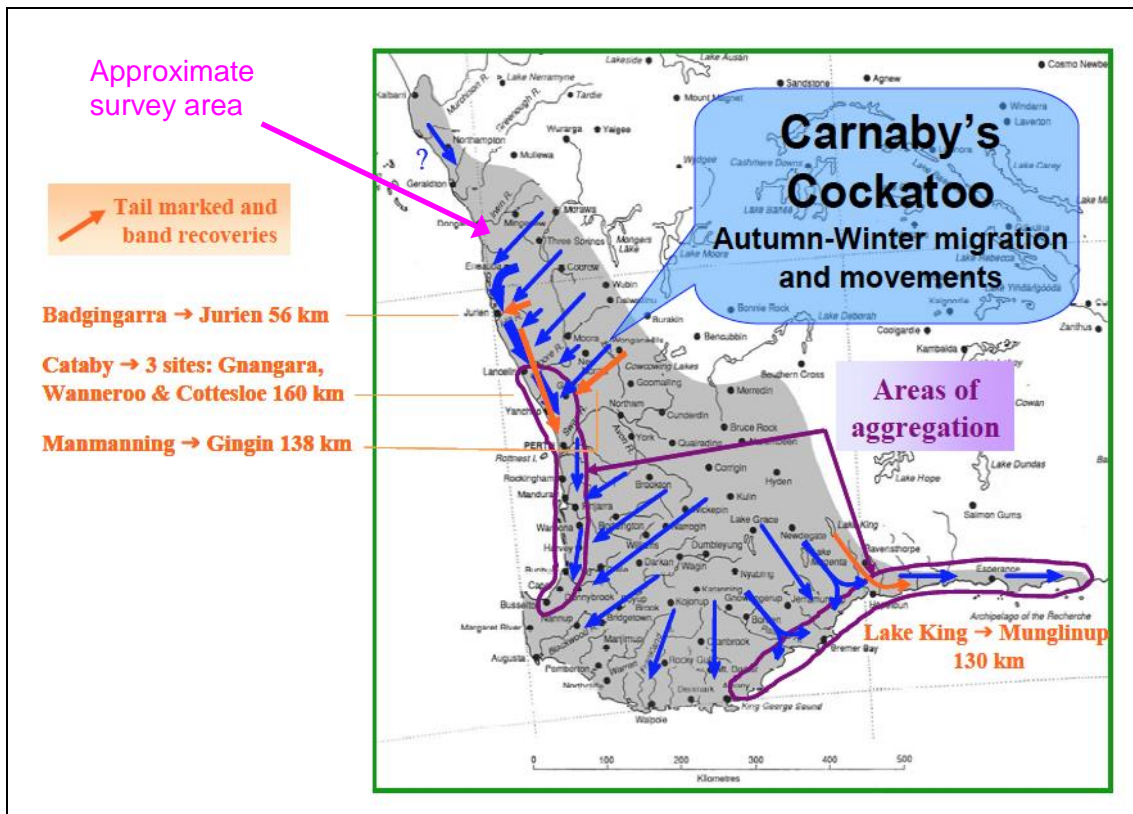
1. Lead to a long-term decrease in the size of the population.

Proposal does not trigger this criteria.

There is a paucity of information regarding discreet populations of Carnaby's black-cockatoo in the Eneabba region. Table 1 in C7 Attachment 2 of this application describes the species' habitat and distribution. It is known however, that a flock of about 300 birds remain in the Eneabba area during the autumn-winter period, roosting in tall river gums in and around the town and foraging in remnant native vegetation and adjacent farmlands (Johnstone & Kirkby, 2010). A flock of 350 birds is known to occur to the north of the proposed survey area (Western Wildlife, 2017) (it is unclear whether these two flocks are one in the same). A breeding population is recorded as occurring at Three Springs, approximately 30 km to the east of the proposed survey area (Western Wildlife, 2017). The DBCA recently advised Lattice that there is a breeding colony of Carnaby's black cockatoos at Wilson Nature Reserve (7.5 km east of the project area).

The proposed survey area is not considered to be an aggregation area for the Carnaby's black-cockatoo, but rather it is part of the migration route as the species moves from more inland areas to coastal and southern habitats (Johnstone & Kirkby, 2010) (Figure 1).

The largest threat to the Carnaby's black cockatoo is the loss of habitat and food sources including *Banksia* or Kwongan heaths and *Pinus* plantations on the northern Swan Coastal Plain (between Lancelin and Perth). In particular, the clearing of pine plantations at Yanchep, Pinjar and Gnangara (~200 km, 225 km and 235 km southeast of the project area, respectively) is reported to threaten the loss of half the birds in the Perth and Peel region. The cockatoo has turned to the introduced pine tree plantations as a food source given the widespread clearing of native foraging habitat.



Source: Johnstone & Kirkby (2010).

Figure 1. Migration and movement of Carnaby's black-cockatoo

The following factors indicate that the proposed survey will not lead to a long-term decrease in the size of the Carnaby's black cockatoo population:

- There are only isolated and very small areas of *Banksia* shrubland in the proposed survey area (see Figure 9 of the EP);
- The loss of such foraging habitat will be temporary (due to mulching rather than broadscale clearing);
- The targeted fauna survey found no evidence of cockatoo foraging in the *Banksia* shrublands (e.g., chewed *Banksia* cones); and
- The survey area is not located in an aggregation area (see Figure 1).

2. Reduce the area of occupancy of the species.

Proposal does not trigger this criterion.

The creation of survey lines through native vegetation that are up to 4 m wide and spaced 360 m apart will not fragment existing Carnaby's black-cockatoo populations. Vegetation proposed to be mulched for the project does not contain any breeding or roosting habitat, as such habitat trees, typically salmon gum (*Eucalyptus salmonopholia*) and wandoo (*E. wandoo*), which have been excised from the project area.

The DBCA recently advised Lattice that there is a breeding colony of Carnaby's black cockatoos at Wilson Nature Reserve (7.5 km east of the project area). The eastern half of the UCL in the project area occurs within a 12 km radius of the Wilson Nature Reserve. Other known Carnaby's black-cockatoo breeding locations and sightings are illustrated in Figure 5.9 of the EP. As the project will avoid clearing breeding

habitat (see Section 5), there is no risk that the project will reduce the area of occupancy of the species.

3. Fragment an existing population into two or more populations.

Proposal does not trigger this criterion.

There are no known breeding locations, nor recorded sightings (from databases or the surveys undertaken for this project) of the Carnaby's black-cockatoo in the proposed survey area, as illustrated in Figure 5.9 of the EP.

DSWEPC (2012) states that breaks more than 4 km are known to prevent breeding black-cockatoos reaching resources. This project will create temporary breaks in vegetation of no greater than 4 m (about 1,000 times narrower than that required to prevent movement between resources). As such, the proposed survey will not fragment an existing population (e.g., the known breeding population at Wilson Nature Reserve) into two or more populations.

4. Adversely affect habitat critical to the survival of a species.

Proposal does not trigger this criterion.

The proposed clearing of survey lines will involve the mulching of 124 ha of native vegetation, representing 1.8% of the 6,834 ha of native vegetation in the project area. This vegetation is dominated by kwongan heath, and five small isolated areas of *Banksia* shrubland, which is known to provide foraging habitat for the cockatoo. The entire 124 ha of mulched survey lines is not likely to provide foraging habitat.

During the targeted Level 1 fauna survey undertaken in November 2017 (along with 27 days of flora surveys undertaken between August and November 2017), no Carnaby's black-cockatoo were sighted or heard. As these surveys were undertaken during the breeding season, this suggests that the species is not using the survey area as a foraging resource. In addition, there was no evidence of foraging by the cockatoo (e.g., chewed *Banksia* cones) at the time of the Level 1 field survey, despite searching through the *Banksia* shrublands. Where such shrubs have trunks > 20 cm DBH, they will not be mulched.

The project area is surrounded by (and connected to) other large areas of native vegetation (heathland) growing in Unallocated Crown Land (UCL) and private properties that also provides foraging habitat or similar quality for the species.

Additionally, as outlined in Section 2, no breeding or roosting habitat will be cleared for the project. The results of the EPBC Act Protected Matters Search Tool (PMST) for the proposed survey area (including a 1 km buffer) also indicates that there are no critical habitats listed.

5. Disrupt the breeding cycle of a population.

Proposal does not trigger this criterion.

Carnaby's black-cockatoos nest in the hollows of live or dead eucalypts, primarily the smooth-barked salmon gum and wandoo, though breeding has been reported in other wheatbelt tree species and some tree species on the Swan Coastal Plain and jarrah forest (DPaW, 2013).

- The project will not clear hollow-bearing trees important for Carnaby's black-cockatoos, which are now largely restricted to remnant patches of woodland and individual trees within cleared sites (e.g., paddock trees). A lack of natural recruitment of trees that grow old enough to provide hollows (it takes 100-200 years for trees to develop suitable hollows) is caused by a salinity,

reduced annual rainfall, a lack of regeneration events, trampling and soil compaction caused by stock and grazing by stock and rabbits, competition from introduced grasses, and altered hydrological and fire regimes (DPaW, 2013). These effects will not be exacerbated by the project.

- A patch of wandoo woodland (given the presence of wandoo trees with a DBH > 30 cm, it may be cockatoo breeding habitat) on a minor creek line in the northeast part of the UCL has been excised from the survey area, so no survey lines will be mulched through this habitat. Potential breeding habitat in this vegetation will therefore not be impacted.
- Riparian vegetation along the Arrowsmith River (containing potential breeding habitat) has also been excised from the project area, so no survey lines will be mulched through this habitat. Potential breeding habitat in this vegetation will therefore not be impacted.

DPaW (2013) reports that breeding success is dependent on the quality and proximity of feeding habitat within 12 km of nesting sites. The DBCA recently advised Lattice that there is a breeding colony of Carnaby's black-cockatoos at Wilson Nature Reserve (7.5 km east of the project area). The eastern half of the UCL in the project area occurs within a 12 km radius of the Wilson Nature Reserve.

- While the project will result in the temporary loss of some foraging habitat, the strict environmental management controls proposed by Lattice will ensure the quality of remaining habitat is not compromised. Also within a 12 km radius of Wilson Nature Reserve are the Kadathinni Nature Reserve, Reserve WA12705, Reserve WA48098 and other large remnants of native vegetation on private agricultural properties that provide foraging habitat.
- During the targeted Level 1 fauna survey undertaken in November 2017 (along with 27 days of flora surveys undertaken between August and November 2017), no Carnaby's black-cockatoo were sighted or heard. As these surveys were undertaken during the breeding season, this suggests that the species is not using the survey area as a foraging resource to support breeding. However, the five isolated areas of *Banksia* shrubland are highly likely to be used by foraging cockatoos in the non-breeding season (January-June) (Western Wildlife, 2017).

DPaW (2013) reports that the clearing of heathlands from around woodland breeding sites and the removal of corridors of native vegetation that connect breeding and foraging sites in the wheatbelt region of WA reduces the amount of food available for breeding birds, which can lead to a reduction in productivity and survival of young.

- The project will not clear vegetation in roadsides or along watercourses, which provide key connecting corridors for fauna movement.

Another key threat described by DPaW (2013) is the clearing, fragmentation and degradation of foraging and night roosting habitat in the non-breeding parts of Carnaby's cockatoo range in the south-west of WA. In particular, the clearing of feeding habitat (e.g., *Banksia* woodlands and commercial pine plantations which provide a significant food resource).

- The project area contains five small isolated areas of *Banksia* shrubland (*Banksia attenuata*, *B. hookeriana*, *B. sphaerocarpa* and *B. scabrella*, shown in Figure 5.9 of the EP), which contained no evidence of foraging by the cockatoo (e.g., chewed *Banksia* cones) at the time of the Level 1 field survey, despite searching through these shrublands. Where such shrubs have trunks > 20 cm DBH, they will not be mulched. There are no radiata pines that need to be cleared.

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

Proposal does not trigger this criterion.

The project area contains five small isolated areas of *Banksia* shrubland, which may or may not be in the path of planned survey lines. Receiver line widths may be reduced in select locations as determined at the time of line preparation in order to reduced impacts further. Native vegetation will be mulched to create survey lines, so if *Banksias* and other species that provide foraging habitat are mulched, their availability will be temporarily reduced until they regenerate from root stock left behind in the mulching process (it may take 3-5 years before regenerating plants flower again, depending on environmental conditions during the rehabilitation period).

Because of the widespread availability of vegetation types in the region similar to those of the proposed survey (including immediately adjacent to and connected with the survey area), this temporary loss of small areas of potential foraging habitat makes it highly unlikely that nearby populations of Carnaby's black-cockatoo will decline in number.

7. Result in invasive species that are harmful to an endangered species becoming established in the endangered species' habitat;

Proposal does not trigger this criterion.

The EPBC Act PMST lists the following four weeds as potentially occurring within the proposed survey area:

- Bridal creeper (*Asparagus asparagoides*);
- Buffel grass (*Cenchrus ciliaris*);
- African boxthorn (*Lycium ferocissium*); and
- Athel pine (*Tamarix aphylla*);

The vegetation survey notes that other than some edge effects of weeds from private properties (and the creekline in the northeast of the UCL), the overall condition of the UCL was very high.

The EPBC Act PMST lists the following 10 fauna pest species as potentially occurring within the proposed survey area:

- Domestic dog (*Canis lupus*);
- Goat (*Capra hircus*);
- Domestic cat (*Felis catus*);
- House mouse (*Mus musculus*);
- Rabbit (*Oryctolagus cuniculus*);
- Pig (*Sus scrofa*);
- Red fox (*Vulpes vulpes*);
- Rock pigeon (*Columba livia*);
- Eurasian tree sparrow (*Passer montanus*); and
- Laughing turtle-dove (*Streptopelia senegalensis*).

The field surveys found evidence of pest species including foxes, rabbits and goats was common across the study area.

The environmental performance standards provided in Table 7.3 (vegetation clearing), Table 7.7 (soil disturbance), Table 7.10 (weeds and pathogens) and Table 7.13 (wildfire) of the EP have been designed to minimise the risk of introducing new or spreading existing weeds and facilitating pest incursion.

Feral European honeybees are known to compete for hollows with the cockatoo (DPaW, 2013). Given that no potential cockatoo breeding habitat trees will be cleared (i.e., riparian vegetation along the Arrowsmith River and wandoo trees in the northeast part of the UCL), the project will not exacerbate this issue.

8. Introduce disease that may cause the species to decline.

Proposal does not trigger this criterion.

Phytophthora cinnamomi ('cinnamon fungus') is the key pathogen of concern in southwest WA. It is an introduced soil-borne pathogen (a water mould) that invades and destroys the function of the root systems of a large range of plants (CALM, 2003b), with susceptible species including *Banksia*. It depends on moist conditions for survival, sporulation and dispersal and feeds of host plants via a mass of microscopic thread-like mycelium.

These mycelia may be transported in soil and host tissue. Once introduced to an area, it may lead to poor health of host plants (reduced vigour, flowering and seed set) or death. This in turn result may result in localised population declines for the affected species (lost biodiversity), localised extinctions, altered vegetation community structure (e.g., increased dominance of resistant plants such as grasses, rushes and sedges) and reduced feeding and sheltering opportunities for native fauna.

In WA, the presence of this pathogen is:

- More prevalent in that part of the southwest land division that receives mean annual rainfall >800 mm;
- Widespread but less extensive occurrence in the 600-800 mm rainfall zone; and
- Restricted to circumstances where local hydrological effects cause effective rainfall to substantially exceed regional patterns in areas receiving <600 mm rainfall per annum (CALM, 2003b).

The latter category is the zone in which the proposed survey area occurs.

CALM (2003) indicates that there are several positive records of *Phytophthora cinnamomi* in the Eneabba area, mostly south of the Eneabba–Three Springs Road, with isolated records north of this point and west of the Brand Highway (with all these areas being south of the proposed survey area) (Iluka Resources, 2009).

The rainfall in the proposed survey area is likely to be similar to the nearest town of Three Springs, which has an average annual rainfall of 390 mm (less than the amount of rainfall that creates favourable conditions for dieback).

During the ecological surveys that took place from July until November 2017, no dieback was observed in the proposed survey area. There have been many site inspections over the past 18 months and there has been no observed occurrences of

dieback in the area. Lattice is partnering with Iluka to support the stringent hygiene standards for the project, as Iluka has a proven track record in managing dieback.

The risk of encountering the pathogen in the proposed survey area is already low. A thorough assessment of the potential introduction of pathogens such as *Phytophthora cinnamomic* is provided in Table 7.10 (weeds and pathogens) of the EP. The environmental performance criteria have been specifically designed to minimise the risk of introducing new or spreading existing disease into the survey area.

Based on the project location, timing of the activity during the drier months and strict control measures, Beach can demonstrate the risk of spreading any dieback is reduced to as low as reasonably possible (ALARP).

9. Interfere with the recovery of the species.

Proposal does not trigger this criterion.

DPaW (2013) lists the following recovery actions for the Carnaby's black-cockatoo:

- 1) Protect and manage important habitat.
- 2) Undertake regular monitoring.
- 3) Conduct research to inform management.
- 4) Manage other impacts.
- 5) Engage with the broader community.
- 6) Undertake information and communication activities.

Recovery actions 2-6 will not be impacted by the project, as they are not related to on-ground activities.

Action 1 of the Carnaby's Cockatoo Recovery Plan (pp 38- 40 in DPaW, 2013) comprises multiple tasks, with Table 1 outlining whether the project is likely to have an impact on these tasks.

Table 1. Project activities measures against the Carnaby's Cocking Recovery Plan

#	Task ('protect and manage important habitat')	Project compliance with recovery plan tasks
Management of breeding habitat and associated feeding habitat		
A	Locate and map breeding sites, including currently recognised Important Bird Areas (IBA), across the breeding range and identify those that are most important for the conservation of the species based on factors such as site size, site productivity and the number of breeding pairs that use the site.	Not impacted. The nearest IBA is at Coomallo, 60 km south of the proposed survey area.
B	Ensure protection of areas of existing and potential breeding habitat, including consideration during statutory planning and environmental approvals processes.	Not impacted. Potential breeding habitat along the Arrowsmith River and in the wandoo woodland have been excised from the survey area. The UCL that occurs within the proposed survey area is not protected.

#	Task ('protect and manage important habitat')	Project compliance with recovery plan tasks
		Sections 5 and 6 describe why the vegetation in the survey area is not likely to form important foraging habitat.
C	<p>Implement management to protect and improve the condition of breeding habitat and associated feeding habitat, including activities that:</p> <ul style="list-style-type: none"> • Prevent clearing and loss of breeding and associated feeding habitat. • Control grazing (e.g. fencing to exclude stock and control rabbits). • Manage fire regimes, salinity, weeds and dieback. • Promote regeneration and revegetate areas within and adjacent to breeding habitat and associated feeding habitat. • Prevent further degradation of habitat. • Maintain natural and artificial water sources used by cockatoos. 	<p>No breeding habitat will be cleared. Very little foraging habitat will be cleared (suitable vegetation in the survey area has not been confirmed to be used as foraging habitat). The DBAC stated they are comfortable with the state's assessment of the project to date. Unlikely to be impacted.</p> <p>Not impacted.</p> <p>Not impacted.</p> <p>Ignition of wildfire is addressed in Section 7.2.5 of the EP and the introductions of weeds and pathogens are addressed in Section 7.2.2 of the EP.</p> <p>Not impacted.</p> <p>Not impacted.</p> <p>Not impacted.</p> <p>The Arrowsmith River has been excised from the survey area.</p>
D	Replace any loss of feeding habitat, and increase the area of feeding habitat near known breeding sites (within 12 km) by regeneration and revegetation with cockatoo feed species.	<p>Vegetation will be mulched and will regenerate naturally. Very little foraging habitat will be cleared (suitable vegetation in the survey area has not been confirmed to be used as foraging habitat). A Rehabilitation Monitoring Plan will be implemented in the years proceeding the survey, with active revegetation to take place if natural regeneration does not meet completion criteria.</p>
E	Increase hollow availability by reducing the impact of nest competitors (e.g. feral European honeybees, galahs and corellas) and repairing damaged and suboptimal hollows.	Not impacted.
F	Supplement hollow availability at breeding sites by installing and maintaining artificial nest hollows.	Not impacted.

#	Task ('protect and manage important habitat')	Project compliance with recovery plan tasks
G	Improve the protection of breeding habitat and associated feeding habitat through purchase and transfer of vesting, conservation covenants, or other appropriate means.	Not impacted.
Protection and management of non-breeding habitat		
H	Locate and map feeding habitat sites (with associated night roosts and watering sites) throughout the non-breeding range and identify the most important areas that if lost would have the greatest impacts on the species. Prioritise the following protection and management actions on these sites to maximise the conservation benefits of management.	Not impacted. Surveys through the proposed survey area found no cockatoos or signs of foraging in <i>Banksia</i> shrublands.
I	Improve the security of tenure and management of important areas of feeding habitat through purchase and transfer of vesting, conservation covenants, or other appropriate means.	Not impacted.
J	Ensure protection of important areas of feeding and night roost habitat, including consideration during statutory planning and environmental approvals processes.	The UCL that occurs within the proposed survey area is not protected. Sections 5 and 6 describe why the vegetation in the survey area is not likely to form important foraging habitat.
K	<p>Implement management to protect and improve the condition of feeding habitat and night roosts throughout the non-breeding range, including activities that:</p> <ul style="list-style-type: none"> Prevent clearing and permanent habitat loss. Control grazing (e.g. fencing to exclude stock and control rabbits). Manage fire regimes, salinity, weeds and dieback. Promote regeneration and revegetate within and adjacent to night roosts and associated feeding habitat. 	<p>The project will not result in any permanent habitat loss. Survey lines will be 'cleared' by mulching only, facilitating natural regeneration.</p> <p>A Rehabilitation Monitoring Plan will be implemented in the years proceeding the survey, with active revegetation to take place if natural regeneration does not meet completion criteria.</p> <p>Not impacted.</p> <p>Not impacted.</p> <p>Ignition of wildfire is addressed in Section 7.2.5 of the EP and the introductions of weeds and pathogens are addressed in Section 7.2.2 of the EP.</p> <p>Mulching of survey lines will facilitate natural regeneration.</p> <p>A Rehabilitation Monitoring Plan will be implemented in the years proceeding the survey, with active revegetation to take place if natural</p>

#	Task ('protect and manage important habitat')	Project compliance with recovery plan tasks
	<ul style="list-style-type: none"> Maintain natural and artificial water sources used by cockatoos. 	<p>regeneration does not meet completion criteria.</p> <p>Not impacted.</p> <p>The Arrowsmith River has been excised from the survey area.</p>
L	Maintain or increase the area of non-breeding feeding habitat and night roosts by planting areas of native vegetation (to increase area, provide a buffer or a linkage, particularly within 6 km of existing roost sites) and investigate the value of providing artificial water sources at potential roost locations.	Not impacted.
M	Develop and implement approaches to avoid, mitigate or offset impacts of harvesting pine trees without replacement, especially in the Yanchep, Pinjar and Gnangara plantations.	<p>Not impacted.</p> <p>The pine plantations at Yanchep, Pinjar and Gnangara are ~200 km, 225 km and 235 km southeast, respectively, of the proposed survey area.</p>

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FORM C2 Attachment 2

Principles for clearing native vegetation

C2, Attachment 2 – Principles for clearing native vegetation

Under the *Environmental Protection Act 1986 (WA)* (EP Act), clearing of native vegetation is not generally permitted where the biodiversity values, land conservation and water protection roles of native vegetation would be significantly adversely impacted.

Under the Act, clearing is defined as:

- (a) The killing or destruction of;
- (b) The removal of;
- (c) The severing or ringbarking of trunks or stems of; or
- (d) The doing of any other substantial damage to, some or all of the native vegetation in an area, and includes the draining or flooding of land, the burning of vegetation, the grazing of stock, or any other act or activity that causes -
- (e) The killing or destruction of;
- (f) The severing of trunks or stems of; or
- (g) Any other substantial damage to some or all of the native vegetation in an area.

The mulching of native vegetation for the proposed Trieste 3D seismic survey triggers point (c), as the process of mulching will cut off plants (less than 20 cm DBH) at their stems close to the soil surface.

Under Section 51O of the EP Act, the CEO of the DEWR must have regard to the clearing principles, outlined in Schedule 5 of the EP Act, when deciding to grant, or refuse, a permit. Under Schedule 5 of the EP Act, native vegetation should not be cleared if:

- 1) It comprises a high level of biological diversity; or
- 2) It comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia; or
- 3) It includes, or is necessary for the continued existence of, rare flora; or
- 4) It comprises the whole or a part of, or is necessary for the maintenance of a threatened ecological community; or
- 5) It is significant as a remnant of native vegetation in an area that has been extensively cleared; or
- 6) It is growing in, or in association with, an environment associated with a watercourse or wetland; or
- 7) The clearing of the vegetation is likely to cause appreciable land degradation; or
- 8) The clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area; or
- 9) The clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water; or
- 10) The clearing of the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.

This document addresses each of these principles for the proposed Trieste 3D seismic survey.

- 1) Native vegetation should not be cleared if it comprises a high level of biological diversity.

Proposal may be at variance to this principle.

Bioregion

The vegetation of WA has been assigned to bioregions and subregions under the Interim Biogeographical Regionalisation for Australia (IBRA), with the proposed survey area falling within the Lesueur Sandplain subregion of the Geraldton Sandplain region.

The Geraldton Sandplain 3 (GS3 – Lesueur Sandplain subregion) is described as having high floristic diversity and levels of endemism, with vegetation composed mainly of proteaceous scrub-heaths on the sandy earths of an extensive, undulating lateritic sandplain mantling Permian to Cretaceous strata. Extensive york gum (*Eucalyptus loxophleba*) and Jam (*Acacia acuminata*) woodlands occur on outwash plains associated with drainage. The Department of Agriculture and Food (DAF) Western Australian-classified land systems dominant in the proposed survey area include:

- Mount Adams System (224 Ma) – a gently undulating sandplain with low gravel ridges and occasional laterite breakaways;
- Correy System (221 Cy) – broad sandy alluvial fan of the lower Arrowsmith River (a smaller influence); and
- Eneabba Plain System (221 En) – with pale deep sands with Banksia woodlands and heathlands (Figure 5.6 of the EP).

Rare or special values

CALM (2003a) notes that GS3 exhibits extremely high floristic endemism, with over 250 species of sandplain flora endemic to the subregion. CALM (2003a) lists the following as rare features of the GS3:

- Lesueur floristic communities - a large number of distinct, species rich and geographically restricted communities occur in the Mt Lesueur and Coomallo area.
- Stygofauna of cave communities in the Beekeepers Nature Reserve area.

Based on the work of Mattiske (2017) conducted for this project, the above-listed rare communities are not recorded to occur within the project area. The Mt Lesueur National Park and Coomallo Nature Reserve are located 50 km and 55 km to the south, respectively, of the project area, while the Beekeepers Nature Reserve is located 65 km southwest of the project area.

Landscape

Based on aerial photography, it is estimated that 6,834 ha out of a total of 21,820 ha (or 31.3%) of the proposed survey area comprises native vegetation. The largest central remnant vegetation block in the survey area has considerable fire scars, most likely from a fire in the region in 2010 (Landgate, 2017).

Landforms supporting species of conservation significance include the lateritic ridges in the central and north-eastern parts of the UCL, and in the northern private properties, as well as the creek line in the north-eastern portion of the UCL.

Vegetation associations

The survey area lies within the Irwin Botanical District of the South-West Botanical Province. Beard (1976) mapped the dominant vegetation association across the survey area as:

- 379: shrublands; scrub-heath on lateritic sandplain in the central Geraldton Sandplain Region (x4SZc).

The survey area also intersects smaller sections of vegetation association:

- 378: shrublands; scrub-heath with scattered *Banksia* spp., *Eucalyptus todtiana* and *Xylomelum angustifolium* on deep sandy flats in the Geraldton Sandplains Region (x5SZc).

The vegetation is characterised by Mucina et al (2014) as 'kwongan heath', with three dominant forms: myrtaceous-proteaceous kwongan, grasstree kwongan and sedge kwongan. Banksia woodlands are also known to be occasionally present in the region.

CALM (2003a) lists vegetation associations 378 and 379 as having 'medium' reservation priorities. GS3 has 17.67% of the subregion in conservation reserves.

Vegetation structure

The field surveys (see later section) confirm that the vegetation is open heathland (myrtaceous-proteaceous kwongan, grasstree kwongan and sedge kwongan), sometimes with isolated trees (usually coastal blackbutt, *Eucalyptus todtiana* and/or sandplain woody pear [*Xylomelum angustifolium*]). Also present are open woodlands (powderbark wandoo [*Eucalyptus accedens*] and black-stemmed mallee [*E. arachnaea* subsp. *arachnaea*]) and open shrublands (either dominated by hooker's banksia [*Banksia hookeriana*] and slender banksia [*Banksia attenuata*]), or *Allocasuarina campestris*, or Burma Road banksia (*Banksia scabrella*) and *Banksia leptophylla*, often over open heathland or sedgeland (*Mesomelaena* spp.).

Field survey

A targeted field assessment of the flora and vegetation of the proposed survey area was undertaken by seven experienced botanists from Mattiske Consulting between August and November 2017. This was undertaken in accordance with the methods outlined in *Technical Guidance – Flora and vegetation surveys for environmental impact assessment* (EPA, 2016b).

Survey methodology consisted of foot traverses along the proposed source lines and then the proposed receiver lines, both to a maximum width of 20 m. These survey lines were refined by Lattice prior to the surveys to avoid wherever possible remnant vegetation within private properties, the course of the Arrowsmith River, and the Nature Reserve R 25495.

All source and receiver lines intersecting native vegetation within the UCL were surveyed, and all source and receiver lines intersecting remnant vegetation within the accessible private properties were surveyed, resulting in approximately 300 km of foot traverses.

Survey results

A total of 107 threatened and priority flora species were identified in the desktop assessment as having the potential to occur within the project area. Twenty-one (21) priority-listed species were recorded within the survey area (Table 1, Figure 5.7 of the EP).

As a result of the extensive foot traverses (see previous sub-section), a total of 26 threatened and priority flora species were recorded during the 2017 surveys in the Trieste 3D Seismic Project (Table 1).

Table 1. Comparative numbers of species of conservation significance

Conservation status	Number of species identified in the desktop review (in project area)	Number of species identified during the field surveys
Threatened	16 (3)	4
Priority 1	13 (1)	2
Priority 2	20 (2)	3
Priority 3	39 (7)	11
Priority 4	19 (8)	6

The field surveys found 14 threatened species listed under the EPBC Act or *Wildlife Conservation Act 1999* (WA) that could occur within the proposed survey area.

The three species listed as being at risk of impact from the project in the EPBC Act referral decision (2017/8133, dated 10 April 2018) are described below:

- 1) *Eucalyptus crispata* – located at a single location, along the edge of a dry creekline associated with wandoo woodland. Only two individuals were found. Given the discreet occurrence of this species, the wandoo woodland has been excised from the survey area, and this species will not be impacted by the project.
 - 2) *Paracaleana dixonii* – Twenty-nine (29) plants were recorded during the flora surveys at five populations within the UCL. Deviations have since been built into the survey design to avoid these individuals. Mulching will occur outside the flowering period, and combined with the height of the mulching device being set at 5-10 cm (thereby avoiding rosettes, if present), it is unlikely these species will be impacted by clearing.
 - 3) *Thelymitra stellata* – Thirty-eight (38) plants were recorded during the flora surveys at seven locations. Five of these populations were within the UCL, with the other two populations located on private land to the north of the UCL. Deviations have since been built into the survey design to avoid these individuals. Mulching will occur outside the flowering period, and combined with the height of the mulching device being set at 5-10 cm (thereby avoiding rosettes, if present), it is unlikely these species will be impacted by clearing.
- 2) **Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia**

Project is not at variance with this principle.

Section 5.2.2 of the attached EP lists and describes fauna of WA and Commonwealth significance, and the presence or absence of habitat for these species.

The EPBC referral decision states that the project is likely to have a significant impact on the endangered Carnaby's black-cockatoo (*Calyptorhynchus latirostris*). This section therefore focuses on this species.

Description

Carnaby's black-cockatoo is a large, mostly black bird with white cheek patches, large white panels on the tail and a strong curved bill. Adults range from 53-58 cm in length and 520-790 g in weight.

It is one of the five Australian endemic black cockatoo species, and is endemic to southwest WA. Carnaby's black-cockatoo was once very numerous in WA, with its decline due to the loss and fragmentation of habitat. Its population in 2010 was estimated at 40,000 birds.

This species occurs in the IBRA of Avon Wheatbelt, Esperance Plains, Geraldton Sandplains, Jarrah Forest, Swan Coastal Plain, Warren and Yalgoo. It has been recorded within 55 km of the study area, including a large flock of 350 just to the north of the study area (see Figure 5.9 of the EP).

Habitat critical for the survival of the Carnaby's cockatoo is:

- Eucalypt woodlands with nest hollows for breeding combined with nearby vegetation that provides feeding, roosting and watering habitat;
- Woodlands; and
- Areas with food resources for the non-breeding season.

Breeding

The species is highly mobile and displays a seasonal migratory pattern linked to breeding, and occurs in the inland parts of its range in areas with annual average rainfall of 300-750 mm.

It breeds from July/August to January/February in hollows in long-lived trees in woodlands and forests (DSEWPC, 2012; DPaW, 2013). For most preferred breeding trees, hollows form in trees with a diameter at breast height (DBH) of 500 mm, or 300 mm for salmon gum (*Eucalyptus salmonopholia*) and wandoo (*E. wandoo*), their preferred nesting trees.

The proposed survey area falls on the boundary of the known breeding range of this species, as mapped by DoEE (2017b), with no breeding known to occur further west. During the non-breeding season, the birds migrate to the higher rainfall coastal regions west or south where water is more plentiful.

Field survey. Carnaby's black-cockatoo was not sighted during the vegetation and wildlife surveys (Western Wildlife 2017). As these surveys occurred during the breeding season, it suggests that the species is not using the survey area as a foraging resource to support breeding (noting that the absence of records does not necessarily prove an absence).

Potential impacts to breeding. The wandoo woodland on the minor creek contains trees with a DBH of 30 cm or more, and is therefore considered 'potential breeding habitat'. Woodlands along the Arrowsmith River are also potential breeding habitat. Both areas are excised from the survey and as such, suitable breeding habitat for the species will not be removed by the survey activities. The DBCA recently advised Lattice that there is a breeding colony of Carnaby's black cockatoos at Wilson Nature Reserve (7.5 km east of the project area). As illustrated in Figure 5.9 of the EP, the other nearest breeding records occur to the east of the proposed survey area at Three Springs and southeast at Coomallo.

Given that breeding trees will not be cleared for the survey, and that disturbance near potential breeding sites (such as near the Arrowsmith River) will be temporary and not dissimilar to existing cropping activities in terms of noise generation, it is unlikely that there will be any impacts to cockatoo breeding as a result of the project.

Foraging

Carnaby's black-cockatoo feeds mostly on native seeds, flowers and nectar in kwongan heathland and woodland dominated by *Banksia*, *Dryandra*, *Hakea* and

Grevillea species (DSEWPC, 2012). With changing habitat, the diet also includes increased amounts of seeds from introduced plant species such as commercial broad-acre crops (e.g., canola) and in the non-breeding part of the species' range, plantation pines. The pine plantations immediately north of Perth have been recognised as an important food resource for this cockatoo for over 60 years.

While breeding, the species generally forages within a 6-12 km radius of the nesting site (DSEWPC, 2012). Communal night roosting sites are used, generally for a period of weeks until the local foraging resources are exhausted, in or near riparian environments with permanent water (DSEWPC, 2012).

Field survey. The proposed survey area contains some suitable foraging habitat, with patches of *Banksia* shrubland on sands or gravelly sands, and small areas of *Hakea trifurcata* and *Banksia sessilis* on some of the laterite rises.

Potential impacts to foraging. The DBCA recently advised Lattice that there is a breeding colony of Carnaby's black cockatoos at Wilson Nature Reserve (7.5 km east of the project area). The project area is therefore within the 12 km radius for foraging. As illustrated in Figure 5.9 of the EP, the nearest other breeding records occur to the east of the proposed survey area near Three Springs, which is about 20 km away. This is beyond the 6-12 km foraging range quoted in DSEWPC (2012). There are numerous large areas of native vegetation (including nature reserves such as Dookanooka, Wilson, Kadathinni and Sweetman) between the proposed survey area and the Three Springs region that offer foraging habitat similar for the Carnaby's black-cockatoo.

Additionally, only 1.8% of the native vegetation within the proposed survey area will be mulched. Although this is an area of 124 ha, it is difficult to envisage that this 124 ha is of any greater importance than the remaining 6,710 ha of native vegetation within the survey area. While 124 ha of vegetation is temporarily lost as foraging habitat, this vegetation will regenerate over several years to again provide foraging habitat. Lattice's experience with seismic surveys in the region, including within EP320 itself, indicates that regeneration of mulched lines is successful in the long-term. For example, the *Hibbertia* 3D seismic survey was undertaken in EP320 in late 2001. Monitoring of rehabilitation along these mulched survey lines in 2002, 2003, 2015 and 2018 indicates that many sites exhibited good regeneration very soon after the survey was completed. Thirteen years after the survey (in 2015), vegetation cover on the majority of survey lines is such that they are not distinguishable from surrounding vegetation.

In summary, it is predicted that vegetation clearing (i.e., mulching) in the proposed survey is not significant for the long-term maintenance of Carnaby's black-cockatoo (which is indigenous to WA) because:

- It is a small loss of vegetation (1.8% of the native vegetation within the survey area);
- The loss of potential foraging habitat is likely to be smaller still, with only five isolated and small patches of *Banksia* shrubland on sands or gravelly sands recorded in the survey area;
- There is an abundance of suitable habitat within the survey area and between it and known breeding areas to the east;
- The targeted presence/absence survey for the species did not sight or hear it (the survey was conducted during the breeding season), suggesting that the species is not using the study area as a foraging resource; and
- Vegetation will be mulched, allowing it to regenerate and again provide foraging habitat in the future.

Roosting

This species roosts in tall trees, usually in riparian habitats. Riparian habitat is present along the Arrowsmith River.

Potential impacts to roosting. Because no riparian vegetation will be cleared for line preparation, there will be no impacts to roosting habitat for the cockatoo.

- 3) Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.

Project is not at variance with this principle.

The areas of native vegetation intersected by the proposed survey area (the UCL and two parcels of vegetation on private farming land) is not in itself necessary for the continued existence of rare flora (interpreted to fall under the definition of 'threatened' under the WA *Wildlife Conservation Act 1950* (WA) and EPBC Act 1999 (Cth)).

None of the threatened flora identified are described as having highly localised distributions centred in or around the proposed survey area.

Three of the EPBC Act-listed threatened species will be avoided because the survey lines have been designed to avoid them. Of the 20 WA priority-listed species that may be affected by mulching, three can be avoided as they occur as single plants. Many others can be avoided because they occur as 1) distinct clumps, 2) occur mostly as underground rhizomes or 3) can be avoided by hand deployment in discreet areas.

See Section 5.2.1 and Section 7.1.1 of the EP for further information.

- 4) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a threatened ecological community.

Project is not at variance with this principle.

No threatened or priority ecological communities are listed as occurring in the proposed survey area or within a 10 km buffer of the proposed survey area according to the EPBC PMST or the WA Threatened and Priority Flora Search.

The Shire of Three Springs (n.d) indicates that there are no groundwater dependent ecosystems within or immediately surrounding the proposed survey area.

- 5) Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.

Project is not at variance with this principle.

Based on aerial photography, it is estimated that 6,834 ha out of a total of 21,820 ha (or 31.3%) of the proposed survey area comprises native vegetation. The remaining 14,986 ha (68.6%) comprises farmland, this being mostly wheat cropping and sheep grazing.

Beard (1976) mapped the dominant vegetation association across the survey area as:

- 379: shrublands; scrub-heath on lateritic sandplain in the central Geraldton Sandplain Region (x4SZc). This vegetation association retains approximately 20% of its pre-European extent, which is less than the 30% threshold level recommended in the National Objectives Targets for

Biodiversity Conservation below which, species loss appears to accelerate exponentially at an ecosystem level.

The survey area also intersects smaller sections of vegetation association:

- 378: shrublands; scrub-heath with scattered *Banksia* spp., *Eucalyptus todtiana* and *Xylomelum angustifolium* on deep sandy flats in the Geraldton Sandplains Region (x5SZc). Documented information listing this vegetation association's pre-European extent cannot be located.

While the extent of vegetation association 379 is below the recommended threshold level for biodiversity conservation, clearing activities within remnant vegetation will only consist of mulching vegetation to define survey tracks, with no new tracks to be constructed within native vegetation.

The UCL in the survey area is contiguous with vegetated UCL to its east and west. While the region has been extensively cleared by wheat cropping and sheep farming, there remains significant areas of native vegetation around the proposed survey area located on UCL and within private properties.

As such, **the native vegetation subject to mulching in the proposed survey area is not considered 'significant' as a remnant of native vegetation within an otherwise cleared area.** As per Category 3, the native vegetation within the proposed survey area is not known to contain habitat or species that are limited in their distribution to this specific area.

Vegetation condition

With the exception of some edge effects of weeds from surrounding private properties (and the creek line in the northeast of the UCL), the overall condition of the UCL is assessed as '*pristine or nearly so, with no obvious sign of disturbance or damage caused by human activities since European settlement*' (Category 1 using the Keighery, 1994 classification system). Feral animal influences, including goats, foxes and rabbits were noted during the field survey.

The remnant vegetation in the three private properties surveyed to the north of the UCL were ranked as category 1 or 2 ('*vegetation structure intact, disturbance affecting individual species, and weeds are non-aggressive species*'). The private property visited to the south of the UCL was in similar condition, with weeds evident along the edge of the remnant vegetation block but was otherwise in category 2 to 1.

Several areas were noted to have been affected by fire.

- 6) **Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.**

Project is not at variance with this principle.

River Systems

The Arrowsmith River runs east to west through the southern part of the survey area. Survey lines will not be created through the riparian vegetation of this river (varying in width between 100 m and 500 m).

The river's sub-catchment is 183,326 ha (DAF, 2007) and predominately flows in an east to west direction into the Dandaragan Plateau across the Urella Fault. The Arrowsmith River has a high density of drainage lines along the Dandaragan Scarp that are incised and form a distinctive dendritic drainage system (DAF, 2007), and has no defined ocean outlet, terminating in Arrowsmith Lake and flowing into caves in the Tamala Limestone, 9 km inland from Cliff Head (DoW, 2017).

A Department of Water (DoW) streamflow gauge installed on the Arrowsmith River (with a catchment of 810 km²) indicates it has a mean annual flow of 5 GL/annum (based on 2000-2015 data), with the average stream salinity being 3,000-3,5000 mg/L TDS (classifying it as saline) (DoW, 2017). Monthly streamflow distribution shows a general winter flow pattern with very little to no summer flow (DoW, 2017).

Wetlands

No permanent or ephemeral wetlands exist within the proposed survey area.

The low impact nature of the activities (where vegetation rootstock remains intact and mulched vegetation is retained *in situ* to minimise soil erosion) is unlikely to result in any significant impact to any waterways as natural surface water flow patterns are not disturbed.

- 7) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.

Project is not at variance with this principle.

Land relief

The region is typically low lying and gently undulating. The relief across the survey area is 0.7° west to east, with a high point of 250 above sea level towards the northeast part of the survey area.

Soils

The soils in the Lesueur Sandplain subregion (as classified by CALM, 2003a) range from extensive yellow sandplains in south-eastern parts to alluvials associated with drainage systems (CALM, 2003a). Low natural nutrition as well as agriculture-induced acidity are major soil constraints in the region.

Tille (2006) classifies the soils of the survey area as being part of the Greenough Province, which covers an area of 30,150 km², the vast bulk of which is located within the agricultural area. It covers the area between Gingin, Eneabba, Mullewa, Geraldton and the Murchison River. Yellow deep sands are most common in the Greenough Province and dominate the sandplains. Pale deep sands and Gravelly pale deep sands are also present, with some Red deep sands and Yellow sandy earths. Deep sandy gravels, Duplex sandy gravels and Shallow gravels are found on broad crests in the southern sandplains. Red-brown hardpan shallow loams appear on the relict drainage systems in the northern sandplains (Tille, 2006).

In areas of dissected plateaux, shallow gravels occur on the ridges. Pale deep sands, yellow deep sands, gravelly pale deep sands and deep sandy gravels occur on the slopes along with some duplex sandy gravels and grey deep sandy duplexes. On the granitic terrain of the Northampton Complex there are red shallow loamy duplexes, red shallow sandy duplexes, red loamy earths and yellow/brown shallow sandy duplexes (Tille, 2006).

The WA Department of Agriculture and Food (DAF) (2007) classifies soil landscape zones of its West Midlands Region, with the proposed survey area occurring almost evenly over the Geraldton Zone and Arrowsmith Zone. These are described as:

- Geraldton Zone (187,185 ha) – consists of dunes with alluvial plains and sand sheets, with low hills of Pleistocene Tamala Limestone, recent calcareous and siliceous dunes. It has yellow/brown shallow sands, yellow deep sands, calcareous deep and shallow sands and pale deep sands.
- Arrowsmith Zone (387,173 ha) – a dissected lateritic terrain with hills, breakaways and plateau and sandplain remnants. It has sandy and gravelly

soils formed in colluvium and weathered in-situ rock. There are also deep sands, ironstone gravelly soils and sandy duplex.

Despite the various classification systems, it appears there is broad agreement between the classifications that the proposed survey area contains mostly deep yellow and pale sands with alluvial soils around drainage systems.

Potential impacts

The following activities will result in disturbance to soil:

- Vibroseis trucks (and other survey vehicles) travelling along natural landforms;
- Vibroseis base plate contact with the soil; and
- Nodes placed into and recovery from soil.

The known and potential environmental risks from disturbance to soil are:

- Soil erosion (and resulting sedimentation);
- Soil ruts; and/or
- Soil compaction.

Vibroseis buggies and associated survey vehicles travelling along natural landforms (i.e., not formed tracks or roads) may result in soil compaction, rutting or erosion if vehicle tyres churn loose soil or trucks become bogged in wet soil. This in turn may result in poor vegetation growth, as erosion results in the loss of soil nutrients and compacting can hamper water infiltrating to the root zone. Given the predominantly sandy nature of the soil in the survey area, compaction is likely to be limited. This would be more likely in riparian zones where loamy soils are present, but such soils are avoided by avoiding work along the Arrowsmith River. In areas of native vegetation, the presence of mulched vegetation along the survey lines (as opposed to bare soil resulting from other methods of clearing, such as bulldozing) acts to minimise the potential for soil compaction and erosion.

Soil compaction or rutting may result in localised and temporary water ponding. Such water ponding is not expected to be significant enough to divert water flows away from natural drainage lines, especially given the sandy nature of the soils in the proposed survey area.

Soil disturbed through the placement of receiver node spikes into the soil will naturally close over once they are removed, especially in sandy soils where holes collapse easily (or they will be backfilled upon the removal of the nodes). Over the space of a few days, these small soil pockets are expected to resume pre-disturbance structures, resulting in no long-term soil disturbance.

The following controls measures will be in place to minimise impacts to soil:

- Create source and receiver lines only by mulching native vegetation and not creating permanent tracks. The retained plant roots will minimise the potential for mass soil erosion.
- Retain mulched vegetation in situ to minimise wind or water erosion of the soil.
- Use existing roads and tracks (including farm tracks) wherever possible to provide access to new survey lines.
- Fit balloon tyres to vibroseis buggies for use on farmland to minimise soil compaction.

- Do not travel along survey lines during or immediately after heavy rain. The Field Survey Manager will track weather forecasts to minimise the risk of vehicles being on site during heavy rains.
- Do not create survey lines within the Arrowsmith River riparian corridor (cadastral boundaries) in order to minimise the risk of erosion and sedimentation into the river.
- Use ATVs in private properties (rather than passenger vehicles) in order to minimise soil compaction.
- Backfill soil divots created during nodes recovery so as to avoid soil pock-marking.
- Undertake a post-survey inspection along the survey lines to ascertain if soil damage has occurred. Remediate any soil damage in accordance with landholder requirements.

As a result of these control measures, there will be no appreciable land degradation as a result of the survey.

- 8) [Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.](#)

Project is not at variance with this principle.

An unnamed nature reserve (WA25495) is located in the southwest corner of the proposed survey area (abutting the eastern side of the Brand Highway and northern side of Skipper Road). It covers 145 ha (1.45 km²) ([Figure 5.13 of EP](#)) and will be avoided by the survey. The following unconnected nature reserves occur near the proposed survey area:

- The Yordanogo Nature Reserve – located 11 km west of the proposed survey area and covers an area of about 6,500 ha.
- Nature reserve WA47436 – occurs within EP320 but about 8.5 km west of the survey area and is 63 ha in size.
- Wilson Nature Reserve – located 7.5 km east of the proposed survey area and overlaps a portion of the Arrowsmith River.

Several other unnamed nature reserves are located around the proposed survey area.

Nature reserve WA25495 will not be entered as part of the survey and is adjacent to farmland. The property to the north of the nature reserve is cropping land and the property to the south is sheep grazing. The physical creation of survey lines will not be required in cropping land (surveying will only occur when the land is fallow) and the grazing property will have grazed pasture that will not require slashing. As such, the absence of mulchers or slashers means the potential for weed or pathogen incursion to the nature reserve is highly reduced. Nevertheless, the following weed and hygiene controls will be implemented for vibroseis and other survey vehicles (as outlined in Section 7.2.2 of the EP) and will minimise the risk of weed or pathogen incursion to the nature reserve:

- Ensure that all Lattice, Terrex and sub-contractor equipment and vehicles arrive on site ready to commence operations with a valid Vehicle and Mobile Plant Hygiene Inspection Report.

- Clean down facilities (for vehicles and footwear) will be available at the laydown sites and Iluka Resources sites and available for the duration of the project.
- All Lattice, contractor and sub-contractor equipment and vehicles will be subject to clean down procedures upon entry to a new property in accordance with landholder requests:
 - Blowdown will occur in preference to wash down where practicable, so as to avoid creating conditions suitable for *Phytophthora cinnamomi* (warm, moist conditions). Mobile clean down stations will be provided to facilitate this.
 - An accredited certifier (trained with Clean and Inspect Vehicle and Machinery certification, AHC BIO201A, or equivalent) will be present to inspect equipment and vehicles and certify them clean prior to proceeding to the next property.
- Do not drive over areas other than designated access roads and tracks and survey lines (i.e., not over roadside vegetation or through the riparian vegetation of the Arrowsmith River). Access across the Arrowsmith River is via existing causeways only.
- Inspect and clean each node prior to deployment.
- Retain mulched/slashed vegetation in situ so as to prevent the potential spread of weeds and pathogens.
- Avoid preparing survey lines and undertaking survey acquisition during periods of heavy rain (and immediately afterwards, while pooled water is present and ground conditions are too soft) to prevent soil rutting/churning (which in turn promote conditions favouring weed and pathogen invasion).
- Induct all project personnel into weed and pathogen management requirements prior to the commencement of line preparation.
- In the event that plant seedlings are used for active survey line rehabilitation, they will be certified as *Phytophthora*-free.

9) **Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.**

Project is not at variance with this principle.

Principle 6 describes the surface waters of the proposed survey area and surrounds.

Section 5.1.7 of the EP describes the groundwater environment of the proposed surface, and is presented here.

The survey area is located within the Perth Basin groundwater province (DoW, 2017).

The larger aquifers located beneath the Arrowsmith Surface catchment Management Zone are the Leederville-Parmelia and Yarragadee Aquifers and the smaller aquifers include the Cattamarra and Eneabba-Lesueur Aquifers which are located west of the catchment (Earth Tech, 2002; DoW, 2017).

The majority of groundwater is found within two major aquifer units, described here.

Yarragadee Aquifer

The major aquifer in the region is the Yarragadee Aquifer. The formation is multi-layered and up to 3,000 m thick, with groundwater occurring within beds of fine to course-grained sandstone confined between thick sequences of shale and siltstone

(Earth Tech, 2002; Shire of Irwin, 2016). The water table is fairly deep, ranging up to as much as 150 m below the surface. The water table comes to the ground surface in the Hill River valley where the aquifer is artesian around Hill River Spring. Springs, swamps and lakes such as Beharra Spring are areas of evaporative discharge (Earth Tech, 2002).

The direction of flow in the aquifer is predominantly to the west (Shire of Irwin, 2016).

Groundwater salinity is lowest (500-700 mg/L, equivalent to marginal salinity) within the middle of the catchment and highest (1,000-1,500 mg/L, equivalent to brackish salinity) towards the east of the catchment along the boundary with the Urella Fault (Earth Tech, 2002). Areas of higher salinity occur along the Arrowsmith River and the Irwin River due to recharge of brackish runoff water. Groundwater salinity is also known to vary within the different sandstone beds and there is a general trend of increasing salinity with depth (Johnson and Commander, 2006).

Potential bore yields are very large with up to 6,000 kL/day achieved at Eneabba (Johnson and Commander, 2006). The major bore fields are at Allanooka supplying Geraldton, and at Eneabba supplying mineral sands operations and town water. The aquifer is also used for town water supply at Badgingarra, Dongara and Denison (Johnson and Commander, 2006).

The recharge for this aquifer occurs primarily to the west of the Dandaragan Scarp where the aquifer is unconfined and occurs by direct infiltration of rainfall, downward leakage from the Arrowsmith River and overlying formations. Nidagal (1995) noted that most groundwater discharges from the Yarragadee Formation into the Tamala Limestone with minor discharge in the Cattamarra Coal Measures across the Beagle Fault. Groundwater movement of the aquifer and overlying superficial aquifer is towards the coast (Earth Tech, 2002).

Superficial Aquifer

The superficial aquifer on the Swan Coastal Plain consists of Quaternary and late Tertiary sediments which extend from Geraldton in the north to Busselton in the south. There are several principal formations within this aquifer including the Tamala Limestone. The aquifer consists mainly of quartz sands, calcareous sands and limestone in the Tamala Limestone. The groundwater level is close to the surface in the south and in the centre but may be as much as 60 m below the surface, below the crests of the Tamala Limestone dunes along the coast. The average salinity is 4,224 mg/L and is hypersaline underneath the coastal lakes in the Perth area. The aquifer is developed for the Perth water supply but it is not a significant aquifer in the Dongara to Geraldton area where the groundwater salinity is generally non-potable. It has an average saturated thickness of 20 m and discharges to the ocean (Shire of Irwin, 2016).

Shallow groundwater lenses are located within the Tamala Limestone forming an unconfined aquifer in which the groundwater is mainly recharged from local rainfall (IRC Environment, 2004).

Townwater supplies

Water for the town of Three Springs, surrounding farms and the nearby talc mine is supplied from two Water Corporation Bores, located within the Dookanooka Water Reserve, 17 km west of Three Springs (Shire of Three Springs, n.d). This water is drawn from the Parmelia Formation, which forms a semi-confined aquifer. The water table is greater than 60 m deep and the bores are screened at a depth of over 200 m, resulting in a low risk of contamination to the water source from agricultural uses (Shire of Three Springs, n.d).

Potential impacts

The proposed mulching of 124 ha of native vegetation, with root stock remaining intact and therefore still withdrawing water from the groundwater table (especially during the regrowth phase), is highly unlikely to further increase salinity of the aquifers in the region, and therefore highly unlikely to deteriorate the quality of underground water.

- 10) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.

Project is not at variance with this principle.

The Arrowsmith River's sub-catchment is 183,326 ha (DAF, 2007). The mulching of 124 ha of native vegetation represents between 0.06% and 0.07% of this sub-catchment.

Given the small area of mulching as a proportion of the sub-catchment, combined with the retention of rootstock and mulched vegetation in situ (which minimises the risk of soil erosion from rainfall or river flooding), survey line preparation is highly unlikely to cause or exacerbate the incidence or intensity of floods in the catchment.

No work will be undertaken within the riparian vegetation alongside the Arrowsmith River, and no access will be permitted across the river other than at existing causeways.

Mulching of survey lines will be undertaken during the dry season (summer), which minimises the risk of winter rainfall causing erosion of mulched survey lines (thereby minimising sedimentation of drainage lines and waterways).

Summary

A summary of whether Lattice believes each of the clearing principles is triggered by the proposed Trieste 3D seismic survey is presented in **Table 2**.

Table 2. Summary of whether clearing principals are triggered

Clearing principal		Triggered?
1	It comprises a high level of biological diversity.	Possibly
2	It comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.	No
3	It includes, or is necessary for the continued existence of, rare flora.	No
4	It comprises the whole or a part of, or is necessary for the maintenance of a threatened ecological community.	No
5	It is significant as a remnant of native vegetation in an area that has been extensively cleared.	No
6	It is growing in, or in association with, an environment associated with a watercourse or wetland.	No
7	The clearing of the vegetation is likely to cause appreciable land degradation.	No
8	The clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.	No
9	The clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.	No

Clearing principal		Triggered?
10	The clearing of the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.	No

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FORM C2 Attachment 3

Petroleum Exploration Permit (EP) 320

STATE OF WESTERN AUSTRALIA
PETROLEUM AND GEOTHERMAL ENERGY RESOURCES ACT 1967
Section 42(6)
RENEWAL OF PETROLEUM EXPLORATION PERMIT EP 320

I, DENIS JOHN WILLIS, Acting Executive Director, Petroleum Division of the Department of Mines and Petroleum under delegation from the Minister for Mines and Petroleum, pursuant to section 42(6) of the *Petroleum and Geothermal Energy Resources Act 1967*, in response to the acceptance of the offer STP-EPR-0043, grant the renewal of the petroleum exploration permit in respect of the blocks described hereunder to:

Origin Energy Developments Pty Limited
ACN 008 432 479

AWE (Beharra Springs) Pty Ltd
ACN 009 362 645

This petroleum exploration permit will remain in force for a period of five (5) years commencing on 20 October 2016.

The grant is subject to the conditions set out hereunder and to the permittee at all times complying with the provisions of the Act and of any regulations for the time being in force under the Act and all directions given to him under the Act.

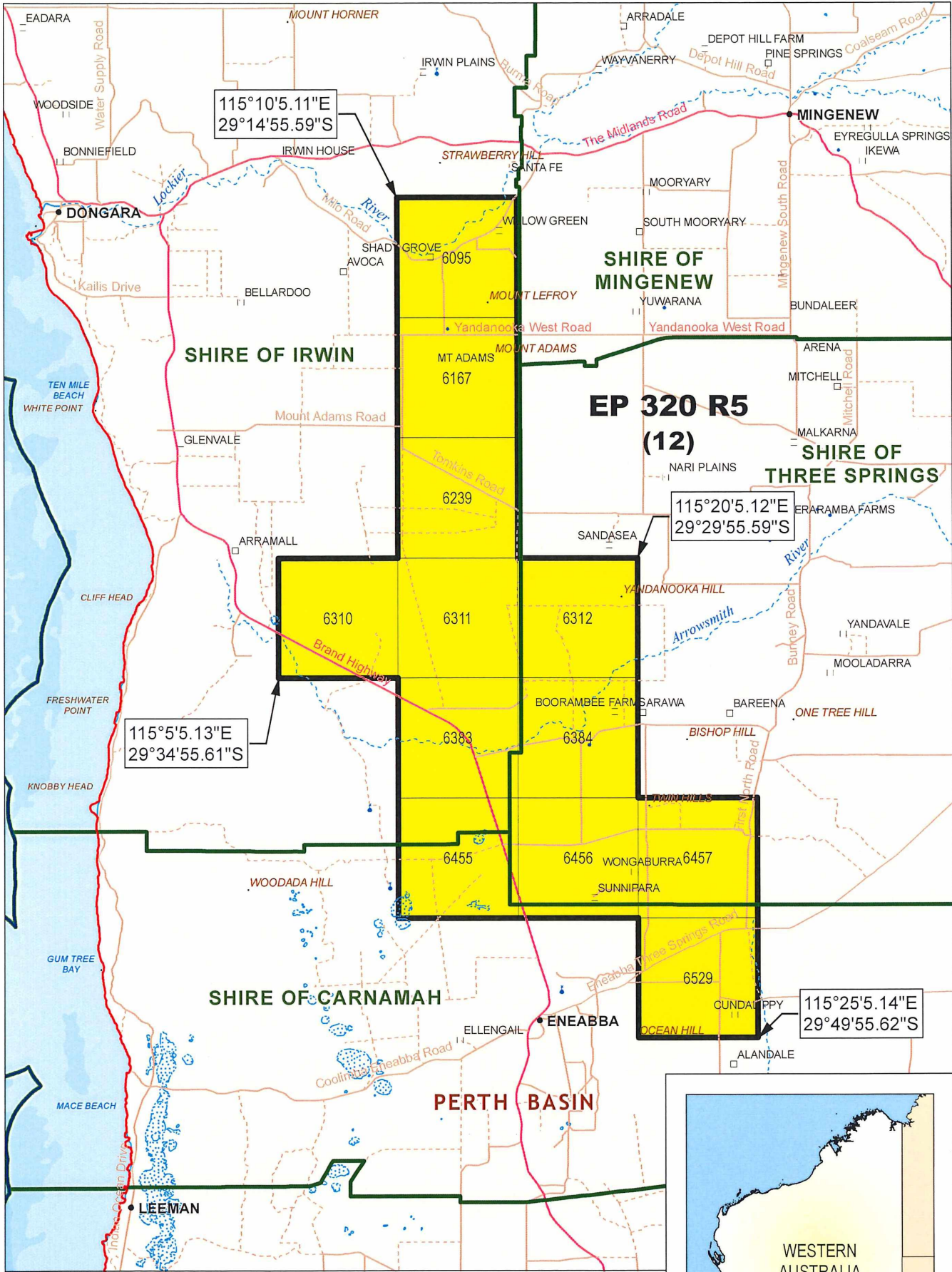
DESCRIPTIONS OF BLOCKS

(The references hereunder are to the names of map sheets of the 1:1,000,000 series published by the Minister and to the numbers of graticular sections shown thereon.)

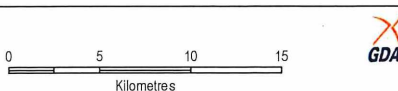
PERTH MAP SHEET (SH50)

Block No.	Block No.	Block No.	Block No.
6095	6167	6239	6310
6311	6312	6383	6384
6455	6456	6457	6529

The area is assessed to contain **12 blocks** to the extent only that the area is within the State as defined in section 26 of the Act.




 Government of Western Australia
 Department of Mines and Petroleum
Exploration Permit
EP 320 R5



Coordinates hereon are in accordance with
 Section 8 of the Petroleum and Geothermal Energy Resources Act 1967 (WA) (PGERA67)
 The displayed grid defining the 5' x 5' blocks is AGD66 and coordinates shown are GDA94.



CONDITIONS

1. (1) Subject to sub-clause (2), during a year of the term of the permit set out in the first column of the following table, the permittee:
 - (a) shall carry out in or in relation to the permit area, to a standard acceptable to the Minister, the work specified in the minimum work requirements set out opposite that year in the fourth column of the table;
 - (b) may at the discretion of the Minister carry out in or in relation to the permit area, to a standard acceptable to the Minister, all or part of the work specified in the minimum work requirements of a subsequent year or years of that term set out opposite that year or those years in the fourth column of the table; and
 - (c) may carry out in or in relation to the permit area, to a standard acceptable to the Minister, work in addition to the work specified in the minimum work requirements set out opposite that year and in the subsequent year or years, if any, of that term in the fourth column of the table.

- (2) The permittee shall not commence any works or petroleum exploration operations in the permit area except with, and in accordance with the approval in writing of the Executive Director, Petroleum Division.

Year of Term	Title Year Start	Title Year End	Minimum Work Requirements	Estimated Expenditure Constant dollars (indicative only) \$A
1	20/10/2016	19/10/2017	Geological and Geophysical Studies	1,000,000
2	20/10/2017	19/10/2018	100km ² 3D Seismic Survey	3,500,000
3	20/10/2018	19/10/2019	Geological and Geophysical Studies	1,000,000
4	20/10/2019	19/10/2020	One (1) Exploration Well	12,000,000
5	20/10/2020	19/10/2021	Geological and Geophysical Studies	1,000,000

INTERPRETATION

In this permit:

"the Act" means the *Petroleum and Geothermal Energy Resources Act 1967* and includes any Act with which that Act is incorporated and words used in this notice have the same respective meanings as in the Act;

"Minister" means the Minister for Mines and Petroleum or the Executive Director, Petroleum Division as his duly appointed delegate.

Dated at Perth this 20th day of October 2016.

Made under the *Petroleum and Geothermal Energy Resources Act 1967* of the State of Western Australia.



DENIS JOHN WILLS
 ACTING EXECUTIVE DIRECTOR
 PETROLEUM DIVISION
 DEPARTMENT OF MINES AND PETROLEUM

ENDORSEMENTS

1. In addition to any specific conditions that are endorsed on this permit, the holder in exercising the rights granted herein must first ensure that all necessary consents and permissions have been obtained and applicable compensation has been agreed to or determined and that consultation has occurred where the lawful rights of other land users and occupiers are concerned so that the activities of those other land users and occupiers are not interfered with to a greater extent than is necessary for the reasonable exercise of the rights and performance of the duties of the holder of this petroleum exploration permit.

2. The permittee's attention is drawn to the provisions of Division 3A of the Act which provides for petroleum and geothermal titles to subsist in respect to the same blocks.

3. The permittee's attention is drawn to the provisions of the *Aboriginal Heritage Act 1972*.

STATE OF WESTERN AUSTRALIA

PETROLEUM AND GEOTHERMAL ENERGY RESOURCES ACT 1967

SUSPENSION OF WORK PROGRAM AND EXTENSION OF TERM AFFECTING
PETROLEUM EXPLORATION PERMIT EP 320
STP-EPS-0267

I, JEFFREY HUNTLY HAWORTH, the Executive Director, Petroleum Division of the Department of Mines, Industry Regulation and Safety under delegation from the Minister for Mines and Petroleum, pursuant to section 97 of the *Petroleum and Geothermal Energy Resources Act 1967*, hereby:

1. Suspend the condition requiring the completion the year 2 work program for a period of 7 months from 19 October 2018 to 19 May 2019:

by replacing the table referenced to in Condition 1 of the Title Instrument for petroleum exploration permit EP 320 with the following table:

Year of Term	Title Year Start	Title Year End	Minimum Work Requirements	Estimated Expenditure Constant dollars (indicative only) \$A
1	20/10/2016	19/10/2017	Geological and Geophysical Studies	\$1,000,000
2	20/10/2017	19/05/2019	100km ² 3D Seismic Survey	\$3,500,000
3	20/10/2018	19/10/2019	Geological and Geophysical Studies	\$1,000,000
4	20/10/2019	19/10/2020	One (1) Exploration Well	\$12,000,000
5	20/10/2020	19/10/2021	Geological and Geophysical Studies	\$1,000,000

Dated this 12th day of January 2018

Made under the *Petroleum and Geothermal Energy Resources Act 1967* of the State of Western Australia.



JEFFREY HUNTLY HAWORTH
EXECUTIVE DIRECTOR
PETROLEUM DIVISION