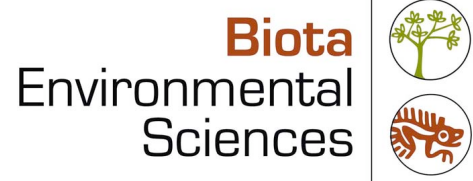




A Flora and Fauna Assessment of RGP5 DMMA A, Port Hedland Harbour





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A Flora and Fauna Assessment of DMMA A

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1.0 Summary

1.1 Background

BHPBIO is seeking approval under Part IV of the *Environmental Protection Act 1986* for dredging at Harriet Point on Finucane Island. The proposal is a component of the RPG5 expansion to increase the throughput capacity of BHPBIO to 205 Mtpa.

The proposal involves the dredging of approximately 3.9 million cubic metres (Mm³) of material for two new berth pockets and extensions to the existing departure channel and swing basin at Harriet Point to accommodate vessels of approximately 250,000 dead weight tonnes (DWT).

The management of the dredged material to Dredged Material Management Areas (DMMA) will be dependent on its characteristics. PASS material will be disposed offshore at the PHPA Spoil Ground 'I'. All other dredged material will be managed at DMMA B1 and B2, with excess fines managed at DMMA A. SKM commissioned Biota Environmental Sciences in February 2008 to conduct a flora and fauna assessment of DMMA A in order to confirm the findings from a desktop review (Biota 2007).

1.2 Methods

1.2.1 Flora

DMMA A was surveyed between the 26th and 27th of February in 2008. The survey included:

- mapping of vegetation types; and
- systematic searches for rare flora across the entire area (during which the locations of weed species were noted).

1.2.2 Fauna

DMMA A was surveyed between the 26th and 27th of February, 2008. The survey included:

- avifauna censuses;
- ground-truthing and field assessment of fauna habitats;
- opportunistic recording of terrestrial vertebrate species, including trace observations; and
- a non-intensive search for Short-Range-Endemic (SRE) species.

1.3 Terrestrial Vegetation

Two vegetation types were identified within DMMA A:

- *Halosarcia halocnemoides* subsp. *tenuis*, (*Halosarcia indica* subsp. *leiostachya*) low open shrubland to low open heath on the saline mudflats; and
- *Triodia epactia/pungens*, (*Triodia secunda*) closed hummock grassland over *Cenchrus ciliaris* and *Sporobolus virginicus* open tussock to tussock grassland on the low sandy islands occurring within the saline mudflats.

Both vegetation types are considered to be of moderate conservation significance. The samphire shrublands are restricted to the narrow mudflat habitats along the coast and are susceptible to disturbance. The sandy island vegetation contains the spinifex species *Triodia secunda*, which has a limited distribution in the Pilbara.

1.4 Terrestrial Flora

1.4.1 Overall Flora

A total of 24 taxa of native vascular flora from 21 genera belonging to 17 families was recorded from within DMMA A.

1.4.2 Flora of Conservation Significance

No Declared Rare Flora or Priority species were recorded from the survey area, despite systematic targeted searches.

1.4.3 Introduced Flora (Weeds)

Two species of introduced flora, Buffel Grass (**Cenchrus ciliaris*) and Kapok (**Aerva javanica*), were recorded on the low sandy islands in the survey area. Both are considered to be serious environmental weeds in the Pilbara.

1.5 Fauna

1.5.1 Vertebrate Fauna Summary

The survey of DMMA A yielded a total of 20 vertebrate fauna species, representing 16 families. This comprised 13 avifauna species, three mammal species (one native and two introduced) and two herpetofauna species (two reptiles; Table 1.1).

Table 1.1: Fauna species observed in DMMA A.

Fauna Group	Number of Species
Avifauna	13
Native non-volant mammals	1
Non-native mammals	2
Herpetofauna	2

1.5.2 Short-Range Endemic (SRE) Species

Non-systematic sampling for invertebrate groups supporting potential short-range endemic taxa was conducted at DMMA A. Groups targeted during these activities included:

- Mygalomorph (Trap-door) spiders;
- Pseudoscorpions; and
- Terrestrial snails.

No potential short-range endemic taxa were recorded during this site visit, despite searches being conducted.

1.5.3 Fauna of Conservation Significance

Two avifauna species listed as Migratory under the *EPBC Act 1999* were recorded in the survey area- the Whimbrel and Eastern Curlew. The Eastern Curlew is also a Priority 4 species under the *Wildlife Conservation (Specially Protected Fauna) Notice 2006*.

1.6 Conclusions and Recommendations

It is likely that all vegetation, particularly that of the low sandy islands, would decline in condition with the disposal of dredge spoil within DMMA A. This would, in turn, reduce the ability of the site to support local populations of terrestrial fauna. Should this site be utilised for dredge spoil management, the clearing of terrestrial vegetation should be minimised.

2.0 Introduction

2.1 Background to Project

BHPBIO is seeking approval under Part IV of the *Environmental Protection Act 1986* for dredging at Harriet Point on Finucane Island. The proposal is a component of the RPG5 expansion to increase the throughput capacity of BHPBIO to 205 Mtpa.

The proposal involves the dredging of approximately 3.9 million cubic metres (Mm³) of material for two new berth pockets and extensions to the existing departure channel and swing basin at Harriet Point to accommodate vessels of approximately 250,000 dead weight tonnes (DWT).

The management of the dredged material to Dredged Material Management Areas (DMMA) will be dependent on its characteristics. PASS material will be disposed offshore at the PHPA Spoil Ground 'I'. All other dredged material will be managed at DMMA B1 and B2, with excess fines managed at DMMA A. SKM commissioned Biota Environmental Sciences in February 2008 to conduct a flora and fauna assessment of DMMA A in order to confirm the findings from a desktop review (Biota 2007).

2.2 Location of the Study Area

DMMA A is approximately 123.2 ha in size, and is situated west of the access road leading to Finucane Island, south-west of the main harbour (see Figure 2.1).



Figure 2.1: Aerial view of DMMA A.

2.3 Scope and Objectives

This report presents a flora and fauna assessment of DMMA A along with an assessment of the conservation significance of this site. Any specific features of flora or fauna conservation value have also been identified. The outcomes of this work will be used as an input to site option evaluation and to contribute to the environmental assessment of the proposed port expansion and associated dredging activities. Mangrove ecosystems have not been considered here, as we understand that these have been addressed in a separate study.

This study was planned and implemented as far as practicable according to the Environmental Protection Authority (EPA) position Statement No. 3 "Terrestrial Biological Surveys as an Element of Biodiversity Protection" (EPA 2002), Guidance Statement No. 51 "Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia" (EPA 2004a), Guidance Statement No. 56 "Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia" (EPA 2004b).

2.4 Geological and Physiographic Context of the Study Area

2.4.1 Geology

The Geological Survey of Western Australia 1:500,000 scale mapsheet (Thorne and Trendall 2001) shows two broad geological units in the vicinity of the area being considered for dredge spoil management. These are:

- **Qm** (Clay, mud, silt and sand: tidal and supratidal deposits, mangroves, lagoons and coastal dunes); and
- **Qx** (Undivided Quaternary deposits: includes colluvium, reworked alluvium, eolian sand and clay).

2.4.2 Major Physiographic Units

DMMA A falls into the Pilbara bioregion (PIL) as defined in the most recent Interim Bioregionalisation of Australia (IBRA) report (Environment Australia 2000). The Pilbara bioregion consists of four subregions:

- **Chichester subregion (PIL1):** Archaean granite and basalt plains support shrub steppe characterised by *Acacia pyrifolia* over *Triodia pungens* hummock grasses. Snappy gum tree steppes occur on the ranges. Subregional area is 9,044,560 ha;
- **Fortescue Plains subregion (PIL2):** Alluvial plains and river frontages. Salt marsh, mulga-bunch grass, and short grass communities characterise alluvial plains. Rivergum woodlands fringe the drainage lines. Subregional area is 2,041,914 ha;
- **Hamersley subregion (PIL3):** Mountainous area of Proterozoic sedimentary ranges and plateaux, supporting mulga low woodland over bunch grasses on fine textured soils, and *Eucalyptus leucophloia* over *Triodia brizoides* on skeletal sandy soils. Subregional area is 6,215,092 ha; and
- **Roebourne subregion (PIL4):** Quaternary alluvial plains with a grass savannah with mixed bunch and hummock grasses, and dwarf shrub steppe of *Acacia stellaticeps* over *Triodia pungens*. Samphires, *Sporobolus* and mangal occur on marine alluvial flats. Arid tropical with summer rain. Subregional area is 2,008,983 ha.

The area under review lies within the Roebourne subregion, which is characterised by alluvial plains, low stony hills and granite outcrops, comprising largely granitic soils with alluvial sands on the coastal portion.

2.4.3 Land Systems (Rangelands)

Land system (Rangelands) mapping covering the study area has been prepared by the Western Australian Department of Agriculture (van Vreeswyk et al. 2004). These are broad units that each consist of a series of "land units" that occur on characteristic physiographic types within the Land System. One hundred and seven (107) Land Systems occur in the Pilbara bioregion. (This information was obtained by merging the Ashburton Land System mapping (Payne et al. 1988) and Pilbara Land System mapping (van Vreeswyk et al. 2004) and intersecting this with the Pilbara bioregion (Environment Australia 2000) in ArcView 3.2).

The area under consideration for dredge spoil disposal includes the following Land Systems (see also Figure 4.1):

- **Littoral** Bare coastal mudflats with mangroves on seaward fringes, samphire flats, sandy islands, coastal dunes and beaches; and
- **Uaroo** Broad sandy plains.

2.5 Biological Context of the Study Area

2.5.1 Pilbara IBRA Bioregion

DMMA A lies within the Pilbara bioregion, one of 85 bioregions recognised under the Interim Biogeographic Regionalisation for Australia (IBRA; Environment Australia 2000). The Pilbara bioregion has four main components: the Hamersley, Chichester, Fortescue Plains and Roebourne subregions (Environment Australia 2000). These subregions are based largely on the physiographic work of Beard (1975), although the Roebourne subregion comprises only the coastal portion of Beards' Abydos Plains physiographic region, while the remainder of the Abydos Plain is included under the Chichester subregion. The study area lies in the northeastern coastal section of the Roebourne subregion.

The Roebourne subregion of the Pilbara bioregion is described by Kendrick and Stanley (2001) as: 'Quaternary alluvial and older colluvial coastal and sub-coastal plains with a grass savannah of mixed bunch and hummock grasses, and dwarf shrub steppe of *Acacia stellaticeps* or *A. pyrifolia* and *A. inaequilatera*. Uplands are dominated by *Triodia* hummock grasslands. Ephemeral drainage lines support *Eucalyptus victrix* or *Corymbia hamersleyana* woodlands. Samphire, *Sporobolus* and mangal occur on marine alluvial flats and river deltas. Resistant linear ranges of basalts occur across the coastal plains, with minor exposures of granite. Islands are either Quaternary sand accumulations, or composed of basalt or limestone, or combinations of any of these three. Climate is arid (semi-desert) tropical with highly variable rainfall, falling mainly in summer. Cyclonic activity is significant, with several systems affecting the coast and hinterland annually. The subregional area is 2,008,983 hectares.'

With increasing survey work in the Pilbara, it is becoming more apparent that the Pilbara bioregion is one of the centres of biodiversity in Western Australia. This appears to be related to the diversity of geological, altitudinal and climatic elements in the region, as well as a function of its location. The Pilbara is located in a transitional zone between the floras of the Eyrean (central desert) and southern Torresian (tropical) bioclimatic regions, and contains elements of both floras (see for example van Leeuwen and Bromilow 2002) for a detailed discussion of the significance of the Hamersley Range). In recognition of this high species diversity and the high levels of endemism in the region, the Pilbara has been nominated as one of 15 national biodiversity "hotspots" by the Minister for the Environment and Heritage (see www.environment.gov.au/biodiversity/hotspots/national-hotspots.html).

The Pilbara bioregion is listed as a medium priority for funding for land purchased under the National Reserves System Co-operative Program due to the limited representation of the area in conservation reserves. Portions of various pastoral leases in the region have been nominated for exclusion for public purposes in 2015, when the leases come up for renewal. Many of the

submissions are from the Department of Environment and Conservation (DEC), with the intention of adding these areas to the existing conservation estate in order to provide a comprehensive, adequate and representative reserve system. None of these proposed exclusions are located in the area under review.

2.5.2 Beard's Vegetation Mapping

Beard (1975) mapped the vegetation of the Pilbara at a scale of 1:1,000,000. The study area lies entirely within the Abydos Plain Botanical District of the Eremaean Botanical Province as defined by Beard. The vegetation of this province is typically open, and frequently dominated by spinifex, wattles and occasional Eucalypts.

The Port Hedland region contains two of Beard's broad mapping units:

- Mangrove; stature variable, normally scrub on this coast; and
- Grass steppe of soft spinifex (*Triodia epactia*/*T. pungens*).

Given the broad scale of Beard's mapping, these mapping units show a broad correspondence with the vegetation types identified during the recent survey (see Section 4.0).

3.0 Methodology

3.1 Terrestrial Vegetation

3.1.1 Botanical Survey Team and Timing of Field Survey

The terrestrial flora survey work was conducted by Rachel Warner (of Biota) between the 26th and 27th of February, 2008. This survey included:

- mapping of vegetation types; and
- systematic searches for rare flora across the area (during which the locations of weed species were also noted).

The survey followed cyclonic activity in early 2008. Port Hedland received 71.4 mm of rain between September and the March field survey, with most falling during February (63.6 mm). Conditions were adequate for the collection of ephemeral flora and flowering grasses.

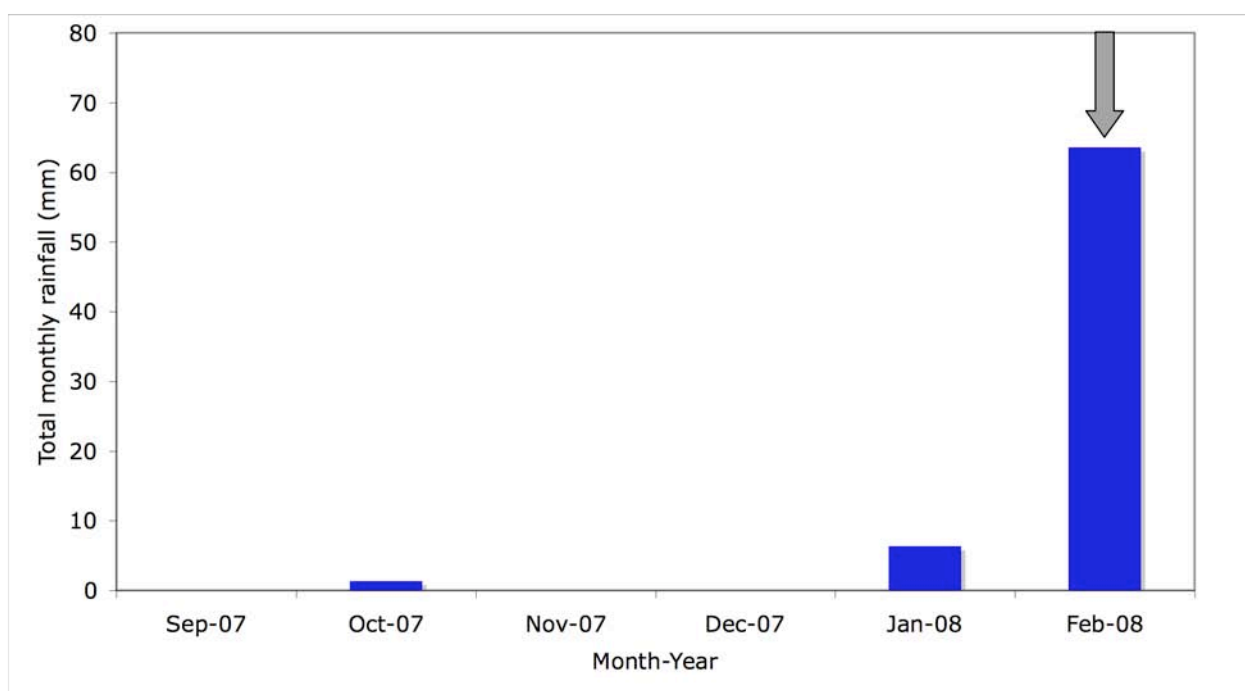


Figure 3.1: Monthly rainfall for Port Hedland from September 2007 to February 2008 (data supplied from Bureau of Meteorology) and timing of survey (arrow).

3.1.2 Vegetation Description and Mapping

Vegetation structure and condition (health) was ranked according to the classifications in Appendix 2. Descriptions were made as the area was traversed to ground-truth the boundaries of vegetation types.

To gather the spatial information, the vegetation descriptions gathered in the field were used in association with digital photography to prepare a draft map of vegetation, using rectified 1:20,000 scale colour digital photography as the background. The vegetation boundaries were subsequently digitised on-screen using ArcView 3.2.

3.1.3 Searches for Rare Flora and Weeds

The rare flora searches were conducted in 50-100 m wide traverses throughout the survey area. The width between traverses was dependent on the terrain and vegetation. Where the vegetation remained consistent and contained bare ground, the distance between traverses

was wider. The field botanist was equipped with a Magellan™ hand-held GPS unit with a polygon overlay of the survey area up-loaded onto the device to ensure that the correct area was surveyed.

Location coordinates in WGS84 datum (zone 50) were recorded using a hand-held GPS for all flora and weed species noted. Numbers of individuals were counted or estimated for each location, and other details such as habitat and associated species were also recorded. All records of flora of conservation significance and weed species are presented in Appendix 3. A list of all flora recorded is presented in Appendix 1.

3.1.4 Specimen Nomenclature and Data Entry

Common species that were well known to the survey botanist were identified in the field. Voucher specimens of all other species were collected and assigned a unique number to facilitate tracking of data. These were pressed and dried in the field.

These vouchers were then identified by keying out, reference to appropriate publications, use of a reference collection held by Biota Environmental Sciences, and comparison to the collections held at the Western Australian Herbarium. Rachel Warner identified most specimens, with assistance from Michi Maier and Paul Hoffman (of Biota). Specimens will be lodged with the Western Australian Herbarium for all taxa for which suitable material is available.

Nomenclature was checked against the current listing of scientific names recognised by the Western Australian Herbarium and updated as necessary.

Following the identification of the specimens, all data was entered into an Access database.

3.2 Fauna

The fauna survey was conducted in conjunction with the flora survey between the 26th and 27th of February by Erin Harris of Biota. The survey included:

- avifauna censuses between 8:00 and 11:30am;
- opportunistic recording of terrestrial vertebrate species, including trace observations; and
- a non-intensive search for Short-Range-Endemic (SRE) species. Tree bark, soil below *Triodia* hummocks and rock piles were examined where present. Groups targeted during these activities included Mygalomorph (Trap-door) spiders, pseudoscorpions, scorpions, millipedes and terrestrial snails.

Field assessment of habitats was also completed to validate desktop assessments of the likelihood of Threatened Fauna occurrence completed by Biota (2007).

3.3 Limitations of this Study

The following limitations should be recognised by the reader of this report:

- The fauna assessment was non-systematic, particularly the searches for SRE species, and thus should not be treated as an exhaustive or conclusive account of the fauna of the area.
- Avifauna censusing occurred on one occasion only. It is likely that repeated sampling would augment the list of species recorded.
- Fungi and non-vascular flora (e.g. algae, mosses, and liverworts) were not specifically sampled and have therefore not been considered here.
- Conditions were not optimal for the collection of annuals and flowering grasses.
- Mangrove ecosystems, and their associated biota, were not considered as part of this review.

4.0 Terrestrial Vegetation

4.1 Vegetation Types

Two vegetation types were identified within DMMA A (see Figure 4.1):

- ***Halosarcia halocnemoides* subsp. *tenuis*, (*Halosarcia indica* subsp. *leiostachya*) low open shrubland to low open heath.**

This vegetation was predominant in the survey area, covering approximately 82.7 ha, extending along the saline coastal mudflats. Other associated species included *Muellerolimon salicorniaceum*, *Trianthema turgidifolia*, *Neobassia astrocarpa* and *Sporobolus virginicus*. (Plate 4.1). This vegetation type was previously recorded to the east of the Finucane Island access road (see Biota 2007) and from the Hope Downs Rail Corridor survey in the vicinity of Port Hedland (Biota and Trudgen 2002).

- ***Triodia epactia/pungens*, (*Triodia secunda*) closed hummock grassland/ **Cenchrus ciliaris*, *Sporobolus virginicus* open tussock- tussock grassland.**

This vegetation type (approximately 31.6 ha) occurred on the low sandy islands scattered through the saline mudflats. Other associated species included *Commelina ensifolia*, *Sarcostemma viminale* subsp. *australe*, *Neobassia astrocarpa*, *Cassytha cappilaris* and *Trianthema turgidifolia* (Plate 4.2). It was also recorded to the east of the Finucane Island access road (see Biota 2007) and in the Port Hedland area by Biota and Trudgen (2002) during the Hope Downs rail corridor survey.



Plate 4.1: Vegetation of the saline coastal mudflats in DMMA A.



Plate 4.2: Vegetation of the low sandy islands scattered through DMMA A.

4.2 Conservation Significance of the Vegetation Types

Both vegetation types within DMMA A are considered to be of moderate conservation significance. The samphire shrublands are restricted to the narrow mudflat habitats along the coast and are susceptible to disturbance. The sandy island vegetation contains the spinifex species *Triodia secunda*, which has a limited distribution in the Pilbara.

4.3 Vegetation Condition

The vegetation was in very good condition, with small amounts of the weed species **Cenchrus ciliaris* (see Plate 4.3) and scattered individuals of **Aerva javanica* occurring on the sandy islands (see Plate 4.4).



Plate 4.3: **Cenchrus ciliaris* on a sandy island in DMMA A.



Plate 4.4: **Aerva javanica* occurred as scattered individuals on the low sandy islands.

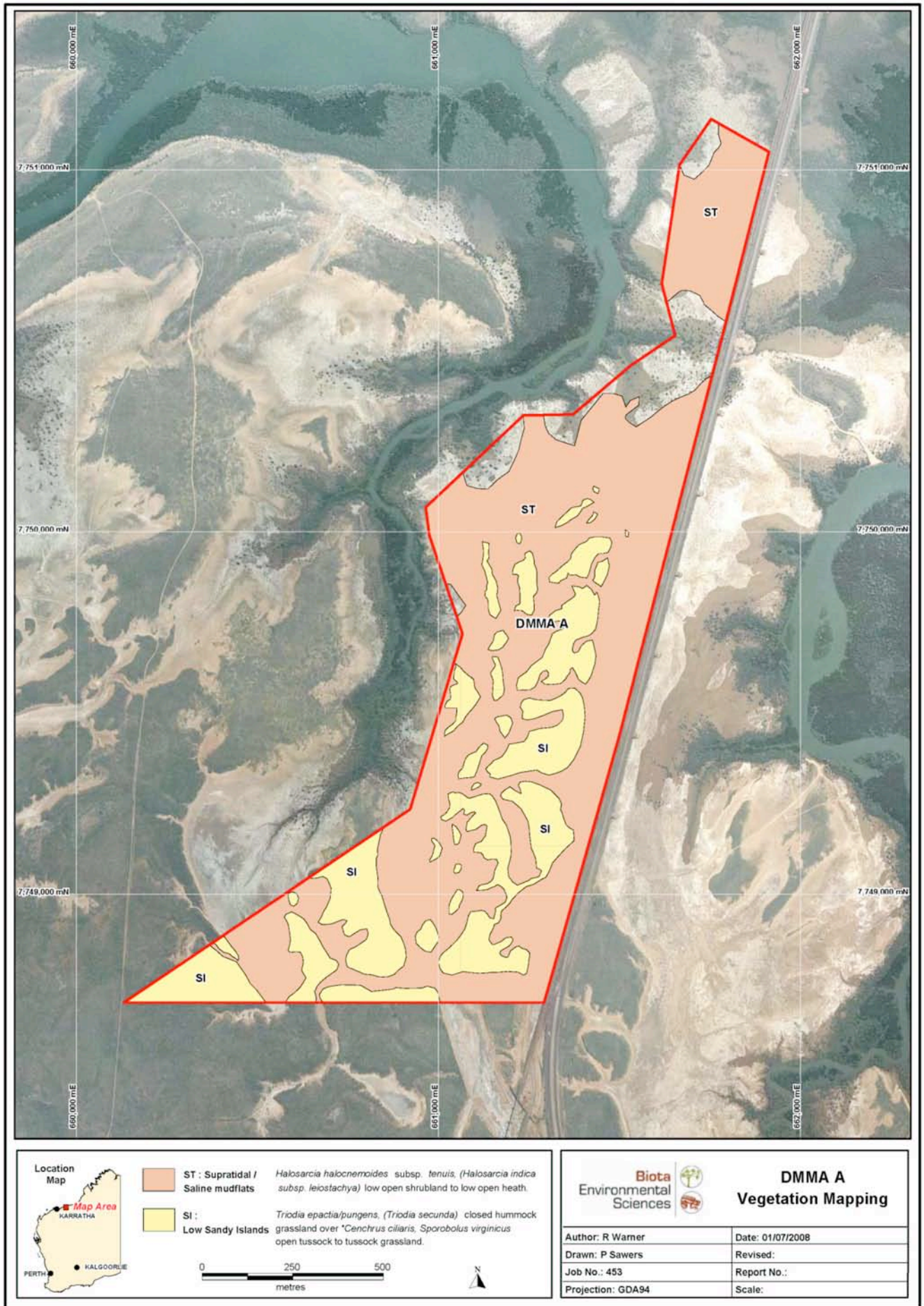


Figure 4.1: Vegetation types occurring in DMMA A.

5.0 Flora

5.1 Overview of Flora of the Study Area

A total of 24 taxa of native vascular flora from 21 genera belonging to 17 families was recorded from DMMA A. In addition, two species of introduced flora were recorded.

5.2 Flora of Conservation Significance

5.2.1 Legislative and Administrative Levels of Flora Protection

While all native flora are protected under the *Wildlife Conservation Act 1950-1979*, a number of plant species are assigned an additional level of conservation significance based on the limited number of known populations and the perceived threats to these populations (Table 5.1). Species of the highest conservation significance are designated Declared Rare Flora (DRF), either extant or presumed extinct. Species that appear to be rare or threatened, but for which there is insufficient information to properly evaluate their conservation significance, are assigned to one of four Priority flora categories.

In addition, the presence of some flora species means that it may be necessary to refer proposals to the Federal Minister for the Environment under the *Environment Protection and Biodiversity Conservation Act 1999*. In the Pilbara, only the two Declared Rare Flora species, Hamersley *Lepidium* *Lepidium catapycnon* and Mountain *Thryptomene* *Thryptomene wittweri*, are currently listed under the *EPBC Act 1999*. *Lepidium catapycnon* is typically found on stony hillslopes of the Hamersley Range, while *Thryptomene wittweri* is only known from high altitudes in the Hamersley Range and at Mt Augustus.

Table 5.1: Categories of conservation significance for flora species (Atkins 2006).

R: Declared Rare Flora – Extant Taxa. Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection.
X: Declared Rare Flora – Presumed Extinct Taxa. Taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently.
1: Priority One – Poorly Known Taxa. Taxa which are known from one or a few (generally <5) populations which are under threat.
2: Priority Two – Poorly Known Taxa. Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat.
3: Priority Three – Poorly Known Taxa. Taxa which are known from several populations, and the taxa are not believed to be under immediate threat.
4: Priority Four – Rare Taxa. Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors.

5.2.2 Flora of Conservation Significance Previously Recorded in the Vicinity of the Study Area

The search of the DEC and WA Herbarium databases for rare flora previously recorded in the Port Hedland area yielded 18 records of seven species:

- two Priority 1 species (*Ptilotus appendiculatus* var. *minor* and *Tephrosia andrewii*);
- two Priority 2 species (*Euphorbia clementii* and *Gomphrena pusilla*); and
- three Priority 3 species (*Acacia glaucocaesia*, *Goodenia pascua* and *Gymnanthera cunninghamii*).

In addition to this search, the Priority 3 species, *Bulbostylis burbridgeae* has been recorded during recent surveys conducted by Biota in the region. These eight species are described below.

• ***Ptilotus appendiculatus* var. *minor*** **Priority 1**

Ptilotus appendiculatus var. *minor* has, to date, only been recorded as occurring in the Port Hedland, Boodarie area. It is a prostrate to ascending perennial herb or shrub.

• ***Tephrosia andrewii*** **Priority 1**

Although voucher specimens of *Tephrosia andrewii* have only been lodged from two coastal sites in the Dampierland subregion of the Kimberley bioregion, this species has also apparently been recorded at Port Hedland (Atkins 2006). It has orange flowers and a shrubby multi-stemmed growth form to 0.8 m, and grows in pindan country on sandy soils.

• ***Euphorbia clementii*** **Priority 2**

Euphorbia clementii is described as an erect herb to 50 cm high, which occurs on gravelly hillsides and stony ground (Paczkowska and Chapman 2000). This species is known from Yarrie, near Shay Gap and near Port Hedland (Atkins 2006), and was also recorded twice from a survey at Panorama, south-south-east of Port Hedland (Trudgen et al. 2002), and once ~3 km south of Chinnamon Creek during the initial survey of the Hope Downs rail corridor from Port Hedland to near Newman (Biota and Trudgen 2002).

• ***Gomphrena pusilla*** **Priority 2**

Gomphrena pusilla has been recorded within the Pilbara bioregion, as well as the Dampierland subregion of the Kimberley bioregion. It is a slender branching annual herb to 0.2 m high, with white flowers in March-June, which is found growing in fine beach sand behind foredunes, on limestone.

• ***Acacia glaucocaesia*** **Priority 3**

Acacia glaucocaesia has been recorded at a number of sites along coastal and inland regions of both the Dampierland subregion and Pilbara bioregion. It is a dense, glabrous shrub or tree, 1.8–6 m high, flowering in July to September. *A. glaucocaesia* has been recorded on red loam, sandy loam and clay of floodplains.

• ***Goodenia pascua*** **Priority 3**

Goodenia pascua has been recorded along coastal and inland areas of the Pilbara and Carnarvon bioregions. It is described as an ascending to erect herb to 0.5 m high, with yellow flowers in May-August, and is found on red sandy soils and basaltic plains.

• ***Gymnanthera cunninghamii*** **Priority 3**

Gymnanthera cunninghamii is an erect (to 2 m high), multistemmed suckering shrub, which flowers in January-December and typically grows on sandy soils. This species appears to occur as clones of a few stems, but mostly of one individual. Although uncommon in the Fortescue Botanical District, this species is known from several locations in the Pilbara including Boodarie, 80 Mile Beach, the Dampier Archipelago, the Burrup Peninsula (Trudgen 2002), Shaw River (Trudgen et al. 2002), FMG Stage A rail corridor (Biota 2004a) and the initial Hope Downs rail corridor (Biota and Trudgen 2002). It appears to be very widespread, having also been recorded growing in the Dampierland, Carnarvon and Great Sandy Desert bioregions, as well as the Northern Territory and Queensland (Atkins 2006).

• ***Bulbostylis burbridgeae*** **Priority 3**

This small sedge species was recorded twice during a biological assessment for the proposed Utah Point Berth Development (Biota 2007). It occurred within the sandy island vegetation close to the Finucane Island access road, forming dense stands of around 20 individuals. This location lies close to DMMA A. This species was also recorded a number of times in association with granitic boulder

outcrops on the Abydos Plain during the Hope Downs rail corridor survey (Biota and Trudgen 2002), appearing restricted to these isolated soil pockets. Within the Utah Point project area, *Bulbostylis burbridgeae* occurred in a more general habitat type and in a disturbed environment (Biota 2007). This suggests that the distribution of this species may be less restricted than previously documented, and that further populations may be identified with additional collecting through the Pilbara in favourable seasons.

5.2.3 Declared Rare Flora Occurring in the Study Area

No Declared Rare Flora were recorded from the survey area, and none would be expected to occur on the basis of their known distributions and habitat preferences. There is no suitable habitat for *Thryptomene wittweri* (mountain crests of >1000m elevation) or *Lepidium catapycnon* (stony plains) within the survey area.

5.2.4 Priority Flora Occurring in the Study Area

There were no priority species within DMMA A at the time of the survey. However, as conditions were not optimal for the collection of ephemeral flora and cryptic annual species, repeated visits to this area would be necessary to provide a more definitive assessment.

5.3 Introduced Flora (Weeds)

Two introduced flora species were recorded from DMMA A (Table 5.2). Locations are provided in Appendix 3. Both are common and widespread weeds of the Pilbara region and have been previously recorded in the area (see Biota 2007b). They are considered to be serious environmental weeds and are discussed below.

- Buffel Grass **Cenchrus ciliaris* was introduced by pastoralists as a fodder species. Buffel Grass has demonstrated allelopathic capacities, whereby it releases chemicals that inhibit the growth of other plants, and is an aggressive and effective competitor with native flora. This perennial grass forms dense tussock grasslands, particularly along creeklines, floodplains and in sandy coastal areas. Buffel grass was common on the sandy islands occurring within DMMA A.
- Kapok **Aerva javanica* is a native of northern Africa and South West Asia, which was introduced to assist with rangeland revegetation (Hussey et al. 1997). This perennial shrub is now a widespread weed of arid regions and can be quite invasive in disturbed sandy substrates in the Pilbara. It was recorded occasionally, scattered through the sandy islands of the survey area.

Table 5.2: Introduced flora species and number of records in DMMA A.

Introduced Flora	Number of Records	Location within Survey Area
Amaranthaceae		
<i>*Aerva javanica</i>	6	Low sandy islands within the saline mudflats
Poaceae		
<i>*Cenchrus ciliaris</i>	12	Low sandy islands within the saline mudflats

6.0 Fauna

6.1 Overview of Habitat Types

The field survey identified the following habitat types at DMMA A:

- **Samphire/Mudflats:** These areas are generally devoid of vegetation, fringed by low open samphires and are generally hypersaline. They are unlikely to be utilised on a regular basis by terrestrial fauna.
- **Sandy Islands:** The sandy islands scattered within the saline flats are generally small, somewhat isolated and represent a low *Triodia* hummock grass habitat widespread in the locality (Biota 2002).
- **Grasslands:** These areas are common in the locality and may support potential SRE species and a range of terrestrial vertebrates.

6.2 Overview of Fauna Occurring in DMMA A

The survey of DMMA A yielded a total of 18 vertebrate fauna species, representing 16 families. This comprised 13 avifauna species, three mammal species (one native and two introduced) and two herpetofauna species (reptiles).

Table 6.1: Fauna species recorded from DMMA A at Port Hedland.

Family	Species	Common Name	Conservation Status State and Commonwealth Listed	Number Observed
Aves				
Ardeidae	<i>Ardea garzetta</i>	Little Egret		1
Accipitridae	<i>Circus approximans</i>	Swamp Harrier		2
Scolopacidae	<i>Numenius phaeopus</i>	Whimbrel	Migratory; Priority 4	2
	<i>Numenius madagascariensis</i>	Eastern Curlew	Migratory; Priority 4	1
Columbidae	<i>Geophaps lophotes</i>	Crested Pigeon		2
	<i>Geophaps plumifera</i>	Spinifex Pigeon		1
Maluridae	<i>Malurus leucopterus</i>	White-winged Fairy-wren		12
Meliphagidae	<i>Lichenostomus virescens</i>	Singing Honeyeater		4
Pachycephalidae	<i>Pachycephala lanioides</i>	White-breasted Whistler		3
Dicruridae	<i>Rhipidura leucophrys</i>	Willie Wagtail		3
Artamidae	<i>Artamus leucorhynchus</i>	White-breasted Woodswallow		6
Passeridae	<i>Taeniopygia guttata</i>	Zebra Finch		15
Motacillidae	<i>Anthus novaeseelandiae</i>	Australian Pipit		1
Mammals				
Macropodidae	<i>Macropus robustus</i>	Euro		1
Canidae	<i>Vulpes vulpes</i>	Red fox	Non-native	1
Bovidae	<i>Bos taurus</i>	European Cattle	Non-native	1
Herpetofauna				
Agamidae	<i>Lophognathus longirostris</i>	Long-nosed Dragon		1
Elapidae	<i>Ephalophis grayae</i>	Mangrove Mud Snake		1

All species recorded during the field survey are widespread and well represented in similar coastal habitats in the Pilbara bioregion (e.g. Biota 2002, 2004b, 2006b).

6.3 Fauna Species of Conservation Significance

6.3.1 Legislative and Administrative Levels of Fauna Protection

Native fauna species which are rare, threatened with extinction or have high conservation value are specifically protected by law under the State *Wildlife Conservation Act 1950-1979*. In addition, many of these species are listed under the Federal *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act 1999)*.

1. EPBC Act 1999

Fauna species of national conservation significance are listed under the *EPBC Act 1999*, and may be classified as 'critically endangered', 'endangered', 'vulnerable' or 'conservation dependent' (consistent with IUCN categories (IUCN 1996)). Migratory wader species are also protected under this Act. The national List of Migratory Species consists of those species listed under the following International Conventions:

- Japan-Australia Migratory Bird Agreement (JAMBA);
- China-Australia Migratory Bird Agreement (CAMBA);
- Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention).

2. Wildlife Conservation Act 1950-1979

Classification of rare and endangered fauna under the *Wildlife Conservation (Specially Protected Fauna) Notice 2006* recognises four distinct schedules of taxa:

- Schedule 1 taxa are fauna which are rare or likely to become extinct and are declared to be fauna in need of special protection;
- Schedule 2 taxa are fauna which are presumed to be extinct and are declared to be fauna in need of special protection;
- Schedule 3 taxa are birds which are subject to an agreement between the governments of Australia, Japan and China relating to the protection of migratory birds and birds in danger of extinction which are declared to be fauna in need of special protection; and
- Schedule 4 taxa are fauna that are in need of special protection, otherwise than for the reasons mentioned in paragraphs (1), (2) and (3).

In addition to the above classification, fauna are also recognised under five Priority levels:

Priority One Taxa with few, poorly known populations on threatened lands.

Taxa which are known from few specimens or sight records from one or a few localities on lands not managed for conservation. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.

Priority Two Taxa with few, poorly known populations on conservation lands, or taxa with several, poorly known populations not on conservation lands.

Taxa which are known from few specimens or sight records from one or a few localities on lands not under immediate threat of habitat destruction or degradation. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.

Priority Three Taxa with several, poorly known populations, some on conservation lands.

Taxa which are known from few specimens or sight records from several localities, some of which are on lands not under immediate threat of habitat destruction or degradation. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.

Priority Four Taxa in need of monitoring.

Taxa which are considered to have been adequately surveyed or for which sufficient knowledge is available and which are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands. Taxa which are declining significantly but are not yet threatened.

Priority Five Taxa in need of monitoring.

Taxa which are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.

6.3.2 Fauna Species of Conservation Significance Potentially Occurring in DMMA A

The following assessment of Threatened Fauna taxa that may potentially occur within the Port Hedland harbour area was based on:

- a review of the broad habitat types likely to be present;
- the results from past surveys associated with the study region (e.g. Biota 2002, Biota 2007b);
- the results of a search of Western Australia Recent Bird Sightings Archives for the Port Hedland region (Appendix 4);
- the results of previous searches of the DEC Threatened Fauna database (Appendix 5); and
- fauna specimens lodged with the WA Museum from the region (Appendix 6).

The combined searches (based on an area that extended approximately 50 km west, 50 km south and 50 km east from Port Hedland) yielded a total of five Schedule and eight Priority species potentially occurring in the survey area. A further seven species potentially occurring in the survey area are listed as Migratory under the *EPBC Act 1999*. However, based on preferred habitat type, it is unlikely that all of these species would occur in the proposed area. Only three Priority species and six Migratory species are likely to rely on the habitat types present in the study area, and these species are discussed below.

Little North-western Mastiff Bat *Mormopterus loriae cobourgensis*: Priority 1

The Little North-western Mastiff Bat has been recorded within the vicinity of the proposed spoil locations, and is assumed to rely, at least partly, on the mangrove habitat for prey foraging (Biota 2002) and roosting (Churchill 1998). The bat is listed as a Priority 1 species, with few or poorly known populations on threatened lands along the northwest coast (Churchill 1998). This species has a strong preference for mangal habitat but can be found in adjacent areas as well. The species, while restricted to mangroves (not addressed in this report), is relatively widespread and well represented in mangroves along the Pilbara coast (Churchill 1998, Biota and Halpern Glick Maunsell 2000). The proposed development is not considered likely to have a significant impact on this species.

Australian Bustard *Ardeotis australis*: Priority 4

This species has previously been recorded at a variety of locations within the Abydos Plain (Biota 2002) and one bird was sighted flying over *Acacia* low shrubland within ~20 km of the harbour area (Biota 2006b). The Australian Bustard occurs over much of Western Australia, with its wider distribution including eastern Australia and New Guinea. The species prefers open or lightly wooded grassy plains including sandplains with spinifex *Triodia* (Johnstone and Storr 1998). The proposed development is not considered likely to have a significant impact on this species.

Rainbow Bee-Eater *Merops ornatus* : 'Migratory' under *EPBC Act 1999*

This species forages aerially for insects and nests in burrows in the ground (Higgins 1999). It occurs in habitats that provide suitable soil for nesting and a tall stratum of vegetation for perching. This species breeds nesting in small holes excavated in sandy banks or flat sandy surfaces. The proposed development is not considered likely to have a significant impact on this species.

Eastern Curlew *Numenius madagascariensis*: Priority 4 ('Migratory' under *EPBC Act 1999*)

One individual of this species was noted in DMMA A (see Table 6.1). A previous survey of the project area recorded the Eastern Curlew on mudflats adjacent to the mangroves at Finucane

Island (Biota 2006b). This species occurs throughout coastal Western Australia, south to Bunbury (Johnstone and Storr 1998), and breeds in northern Asia. It is a summer migrant to Australia and is considered moderately common along the tidal mudflats, reef flats and sandy beaches of the Pilbara coast (Johnstone and Storr 1998). The proposed development is not considered likely to have a significant impact on this species.

Oriental Pratincole *Glareola maldivarum*: 'Migratory' under EPBC Act 1999

Large flocks of Oriental Pratincoles have been sighted in the Port Hedland vicinity (Birds Australia, Appendix 4). The species typically roosts on bare ground beside water and feeds at tidal flats and floodwaters (Johnstone and Storr 1998). The proposed development is not considered likely to have a significant impact on this species.

Oriental Plover *Charadrius veredus*: 'Migratory' under EPBC Act 1999

The Oriental Plover has been sighted within 60 km of the proposed harbour development (Birds Australia, Appendix 4), typically inhabiting sparsely vegetated plains, beaches and tidal flats. The proposed development is not considered likely to have a significant impact on this species.

Little Curlew *Numenius minutus*: 'Migratory' under EPBC Act 1999

The Little Curlew's abundance in the Pilbara region is variable. Johnstone and Storr (1998) found it to be scarce south of Port Hedland, however the species has been sighted in the Port Hedland vicinity (Birds Australia, Appendix 4). The Little Curlew prefers short-grass plains as habitat, including sports grounds and tidal mud flats. The proposed development is not considered likely to have a significant impact on this species.

Whimbrel *Numenius phaeopus variegatus*: 'Migratory' under EPBC Act 1999

Two individuals were recorded in DMMA A. The species has been recorded from mudflat habitats within the Port Hedland area, usually foraging or roosting in moderate sized groups (see Biota 2002). The Whimbrel is a migratory species, common on north-west Australian coasts south to Cape Naturaliste (Johnstone and Storr 1998). The proposed development is not considered likely to have a significant impact on this species.

Common Sandpiper *Tringa hypoleucos*: 'Migratory' under EPBC Act 1999

A few individuals have been recorded foraging along the tide margin on the mudflats within the Port Hedland area (Biota 2002). The Common Sandpiper is generally found on the edge of sheltered waters such as mangrove creeks and estuaries along the West Australian coast and on many islands (Johnstone and Storr 1998). The proposed development is not considered likely to have a significant impact on this species.

Grey-tailed Tattler *Tringa brevipes*: 'Migratory' under EPBC Act 1999

The Grey-tailed Tattler, whilst scarce in the proposed project area, inhabits tidal mud flats and estuarine sand flats along most north-western Australian coasts (Johnstone and Storr 1998). Biota (2002) recorded a few foraging birds in the vicinity of a tidal creek pool on Finucane Island. The proposed development is not considered likely to have a significant impact on this species.

6.3.3 Fauna Species of Conservation Significance in DMMA A

Two avifauna species listed as Migratory under the EPBC Act 1999 were recorded in Area A, the Whimbrel (two records) and Eastern Curlew (one record). The Eastern Curlew is also a Priority 4 species under the *Wildlife Conservation (Specially Protected Fauna) Notice 2006*.

6.4 Short Range Endemic (SRE) Species

Some of the key habitats where SRE fauna may be expected (including isolated landforms, rockpiles, south-facing vine thickets, mulga drainage lines) were not present in the survey area. It is therefore relatively unlikely that the area would be of high value for SRE fauna. The potential SRE taxa that may be expected to occur in the range, such as land snails, were not detected during the field survey. The habitats present in the survey area are well represented locally and

genetic data from other studies (e.g. Biota 2006 and 2008), suggest it is unlikely species would be restricted to an area the size of the dredge spoil management area, even if present.

7.0 Conclusions and Recommendations

7.1 Flora and Vegetation

No DRF or Priority species were recorded from DMMA A. DRF flora (*Lepidium catapycnon* and *Thryptomene wittweri*) would not be expected to occur in the area under review as they are located well beyond the probable distribution of both species and suitable habitat is absent.

Samphire shrublands and *Triodia secunda* hummock grasslands are vegetation types considered to be of moderate conservation significance based on their restricted distributions and these are dominant within DMMA A, covering 114.3 ha and 200.1 ha respectively.

7.2 Fauna

Two avifauna species listed as Migratory under the *EPBC Act 1999* were recorded, the Whimbrel and Eastern Curlew. The Eastern Curlew is also a Priority 4 species under the *Wildlife Conservation (Specially Protected Fauna) Notice 2006*. The site under consideration for development will not affect a significant area of potential habitat for these species.

7.3 Recommendations

It is highly unlikely, based on the recent site assessment, that spoil storage at DMMA A will impact on any flora and fauna of high conservation significance. Should DMMA A be selected for dredge spoil management, the clearing of terrestrial vegetation should be minimised.

8.0 References

- Atkins K.J. (2006). Declared Rare and Priority Flora List for Western Australia. Department of Conservation and Land Management, 30 June 2006.
- Beard J.S. (1975). Vegetation Survey of Western Australia. 1:100,000 Vegetation Series Map Sheet 5 - Pilbara.
- Biota Environmental Sciences (2002). Proposed Hope Downs Rail Corridor from Weeli Wolli Siding to Port Hedland - Vertebrate Fauna Survey, February 2002. A unpublished report prepared for Hope Downs Management Services, February 2002.
- Biota Environmental Sciences (2004a). Vegetation and Flora Survey of the Proposed FMG Stage A Rail Corridor. An unpublished report for Fortescue Metals Group, August 2004.
- Biota Environmental Sciences (2004b). Fauna Habitats and Fauna Assemblage of the Proposed FMG Stage A Rail Corridor, August 2004.
- Biota Environmental Sciences (2004c). Fortescue Metals Group Stage B Rail Corridor, Christmas Creek, Mt Lewin, Mt Nicholas and Mindy Mindy Mine Areas – Vegetation and Flora Survey. Unpublished report for Fortescue Metals Group, December 2004.
- Biota Environmental Sciences (2006a). Port Hedland Solar Saltfield Expansion Botanical Survey- Flora and Vegetation Report. An unpublished report for Dampier Salt Ltd, May 2006.
- Biota Environmental Sciences (2006b). Port Hedland Solar Saltfield Expansion Fauna Survey. An unpublished report for Dampier Salt Ltd.
- Biota Environmental Sciences (2007). A Biodiversity Assessment of the Utah Point Berth Development, Port Hedland. An unpublished report for Sinclair Knight Merz.
- Biota Environmental Sciences (2007b). Port Hedland Harbour RGP5 Project Dredge Spoil Areas Flora and Fauna Review. An unpublished report for Sinclair Knight Merz.
- Biota Environmental Sciences and M.E. Trudgen (2002). Hope Downs Rail Corridor, Port Hedland to Weeli Wolli Creek – Vegetation and Flora Survey. Unpublished report prepared for Hope Downs Management Services, February 2002.
- Environment Australia (2000). Revision of the Interim Biogeographic Regionalisation for Australia (IBRA) and Development of Version 5.1. Summary report. Nov 2000.
- Environmental Protection Authority (2001). Guidance for the Protection of tropical arid zone mangroves along the Pilbara coastline. Guidance for the Assessment of Environmental Factors No. 1. Environmental Protection Authority, Perth.
- Hope Downs Management Services (2002). Hope Downs Iron Ore Project: Rail and Port. Public Environmental Review. Hope Downs Management Services, Perth.
- Higgins P. (ed.) (1999). Handbook of Australian, New Zealand and Antarctic Birds. Volume 4: Parrots to Dollarbird. Oxford University Press, Melbourne, Australia.
- Hussey B.M.J., G.J. Keighery, R.D. Cousens, J. Dodd and S.G. Lloyd (1997). *Western Weeds- A Guide to the Weeds of Western Australia*. The Plant Protection Society of Western Australia, Perth.
- Johnstone R.E. and G.M. Storr (1998). *Handbook of Western Australian Birds. Volume 1 – Nonpasserines (Emu to Dollarbird)*. Western Australian Museum, Perth WA.

- Paczkowska G. and A.R. Chapman (2000). *The Western Australian Flora: A Descriptive Catalogue*. Wildflower Society of Western Australia, Western Australian Herbarium, CALM and the Botanic Gardens and Parks Authority.
- Payne et al. (1988). Land Systems Mapping of the Ashburton Region, WA. Mapping prepared by the Western Australian Department of Agriculture.
- Thorne A.M. and A.F. Trendall (2001). Geology of the Fortescue Group, Pilbara Craton, Western Australia. Geological Survey of Western Australia, Bulletin 144.
- Tinley K.L. (1991). Chapter 4. Vegetation, habitats and biogeographic context. Pp 30-77 In Ecological Survey of Abydos-Woodstock Reserve, Western Australia. *Rec. West. Aust. Mus. Suppl.* No. 37.
- Trudgen M.E. (2005). A flora & vegetation survey of 3 small areas in the Dampier Salt Port Hedland salt works area. Unpublished report prepared for Biota Environmental Sciences. June 2005.
- Trudgen M.E., B.R. Morgan and E.A. Griffin (2002). A flora and vegetation survey of the proposed mine areas and access road for the Panorama project. Volumes 1-3. Unpublished report prepared for Astron Environmental by M.E. Trudgen and Associates.
- van Vreeswyk, A.M.E., A.L. Payne, K.A. Leighton and P. Hennig (2004). An inventory and condition survey of the Pilbara region, Western Australia. Department of Agriculture Technical Bulletin No. 92, December 2004.

Appendix 1

List of Vascular Flora Recorded from DMMA A



* denotes introduced species (weeds).

DMMA A

Aizoaceae (110)

Trianthema turgidifolia

Amaranthaceae (106)

**Aerva javanica*

Asclepiadaceae (305)

Sarcostemma viminalis subsp. *australe*

Asteraceae (345)

Pluchea tetranthera

Pterocaulon sphaeranthoides

Chenopodiaceae (105)

Halosarcia halocnemoides subsp. *tenuis*

Halosarcia indica subsp. ? *leiostachya*

Neobassia astrocarpa

Commelinaceae (047)

Commelina ensifolia

Convolvulaceae (307)

Evolvulus alsinoides var. *villosicalyx*

Cyperaceae (032)

Fimbristylis microcarya

Frankeniaceae (236)

Frankenia ambita

Goodeniaceae (341)

Scaevola spinescens

Lauraceae (131)

Cassytha capillaris

Mimosaceae (163)

Acacia bivenosa

Myoporaceae (326)

Myoporum montanum

Papilionaceae (165)

Indigofera linnaei

Rhynchosia minima

Plumbaginaceae (294)

Muellerolimon salicorniaceum

Poaceae (031)

**Cenchrus ciliaris*

Sporobolus virginicus

Triodia pungens

Triodia secunda

Solanaceae (315)

Solanum diversiflorum

Solanum ellipticum

Sterculiaceae (223)

Melhania oblongifolia

Appendix 2

Vegetation Condition Scale and Structural Classes



Vegetation Structural Classification and Condition Scale used for the current survey

Vegetation Structural Classes*

Stratum	70-100% cover	30-70% cover	10-30% cover	2-10% cover	<2% cover
Trees over 30 m	Tall closed forest	Tall open forest	Tall woodland	Tall open woodland	Scattered tall trees
Trees 10-30 m	Closed forest	Open forest	Woodland	Open woodland	Scattered trees
Trees under 10 m	Low closed forest	Low open forest	Low woodland	Low open woodland	Scattered low trees
Shrubs over 2 m	Tall closed scrub	Tall open scrub	Tall shrubland	Tall open shrubland	Scattered tall shrubs
Shrubs 1-2 m	Closed heath	Open heath	Shrubland	Open shrubland	Scattered shrubs
Shrubs under 1 m	Low closed heath	Low open heath	Low shrubland	Low open shrubland	Scattered low shrubs
Hummock grasses	Closed hummock grassland	Hummock grassland	Open hummock grassland	Very open hummock grassland	Scattered hummock grasses
Grasses, Sedges, Herbs	Closed tussock grassland / sedgeland / herbland	Tussock grassland / sedgeland / herbland	Open tussock grassland / sedgeland / herbland	Very open tussock grassland / sedgeland / herbland	Scattered tussock grasses / sedges / herbs

* Based on Aplin's (1979) modification of the vegetation classification system of Specht (1970):
Aplin T.E.H. (1979). The Flora. Chapter 3 In O'Brien, B.J. (ed.) (1979). Environment and Science. University of Western Australia Press; Specht R.L. (1970). Vegetation. In The Australian Environment. 4th edn (Ed. G.W. Leeper). Melbourne.

Vegetation Condition Scale*

E = Excellent (=Pristine of BushForever) Pristine or nearly so; no obvious signs of damage caused by the activities of European man.
VG = Very Good (= Excellent of BushForever) Some relatively slight signs of damage caused by the activities of European man. For example, some signs of damage to tree trunks caused by repeated fire, the presence of some relatively non-aggressive weeds such as <i>*Ursinia anthemoides</i> or <i>*Briza</i> spp., or occasional vehicle tracks.
G = Good (= Very Good of BushForever) More obvious signs of damage caused by the activities of European man, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or by selective logging. Weeds as above, possibly plus some more aggressive ones such as <i>*Ehrharta</i> spp.
P = Poor (= Good of BushForever) Still retains basic vegetation structure or ability to regenerate to it after very obvious impacts of activities of European man, such as grazing, partial clearing (chaining) or frequent fires. Weeds as above, probably plus some more aggressive ones such as <i>*Ehrharta</i> spp.
VP = Very Poor (= Degraded of BushForever) Severely impacted by grazing, very frequent fires, clearing or a combination of these activities. Scope for some regeneration but not to a state approaching good condition without intensive management. Usually with a number of weed species including very aggressive species.
D = Completely Degraded (= Completely Degraded of BushForever) Areas that are completely or almost completely without native species in the structure of their vegetation; ie. areas that are cleared or 'parkland cleared' with their flora comprising weed or crop species with isolated native trees or shrubs.

* Based on Trudgen M.E. (1988). A Report on the Flora and Vegetation of the Port Kennedy Area. Unpublished

Appendix 3

Locations of Weed Species Recorded from DMMA A



DMMA A

Species	Easting (WGS84)	Northing (WGS84)	Number of Individuals
*Cenchrus ciliaris	661179	7749709	dense
*Cenchrus ciliaris	661153	7749651	dense
*Cenchrus ciliaris	661153	7749651	scattered
*Cenchrus ciliaris	661164	7749481	dense
*Cenchrus ciliaris	660837	7748943	scattered
*Cenchrus ciliaris	661390	7749930	scattered
*Cenchrus ciliaris	661350	7749720	scattered
*Cenchrus ciliaris	661280	7749430	scattered
*Cenchrus ciliaris	661160	7749180	scattered
*Cenchrus ciliaris	661300	7749190	scattered
*Cenchrus ciliaris	661070	7749550	scattered
*Cenchrus ciliaris	661100	7748840	scattered
*Aerva javanica	661179	7749709	2
*Aerva javanica	661280	7749430	scattered
*Aerva javanica	661160	7749180	
*Aerva javanica	660660	7748850	
*Aerva javanica	661390	7749930	
*Aerva javanica	661300	7749190	

Appendix 4

Birds Australia Western Australia Bird
Sightings Archive Search



Date	Observer/s	Species (Number)	Location
04/02/2006	George Swann	Oriental Pratincole (15,000+)	Great Northern Highway, Port Hedland
09/11/2005	Frank O'Connor Brian Little (UK)	Little Curlew (6)	Sports Oval (Port Hedland)
08/11/2005	Frank O'Connor Brian Little (UK)	Star Finch (30+)	South Hedland Sewage Ponds (Port Hedland)
08/11/2005	Frank O'Connor Brian Little (UK)	Barn Swallow (1)	South Hedland Sewage Ponds (Port Hedland)
02/11/2005	Chris Hassell	Red-necked Phalarope (14)	Port Hedland Salt Works (Port Hedland)
02/11/2004	Adrian Boyle Chris Hassell	Red-necked Phalarope (38)	Salt works (Port Hedland)
08/08/2004	Michael Nield Ada Nield	Flock Bronzewing (3)	De Grey Station (Port Hedland)
08/08/2004	Michael Nield Ada Nield	Flock Bronzewing (3)	Balla Balla Creek (Port Hedland)
02/08/2004	Michael Nield Ada Nield	Brolga (10)	De Grey Station (Port Hedland)
01/08/2004	Michael Nield Ada Nield	Australian Bustard (11)	De Grey Station (Port Hedland)
01/01/2003	Roy Teale Karen Edward	Plumed Whistling-Duck (8)	billabong, Mundabullangana Station (Port Hedland)
01/01/2003	Roy Teale Karen Edward	Pink-eared Duck (3)	billabong, Mundabullangana Station (Port Hedland)
01/01/2003	Roy Teale Karen Edward	Black-necked Stork (2)	billabong, Mundabullangana Station (Port Hedland)
01/01/2003	Roy Teale Karen Edward	Banded Stilt (1)	billabong, Mundabullangana Station (Port Hedland)
01/01/2003	Roy Teale Karen Edward	Red-necked Avocet (15)	billabong, Mundabullangana Station (Port Hedland)
27/12/2002	Roy Teale Karen Edward	Oriental Plover (12)	Cowrie Creek, Mundabullangana Station (Port Hedland)
27/12/2002	Roy Teale Karen Edward	Australian Pratincole (1)	Cowrie Creek, Mundabullangana Station (Port Hedland)

Appendix 5

DEC Threatened Fauna Search



Threatened and Priority Fauna Database

Page 1 of 2

19.86667 °S 119.2 °E / 20.84167 °S 118.1833 °E Dampier Salt works near Port Hedland

* *Date Certainty Seen Location Name**Method***Schedule 1 - Fauna that is rare or is likely to become extinct*****Lagostrophus fasciatus fasciatus*** **Banded Hare-wallaby** *1 records*

This small macropod occurs in low shrubland and extant populations occur on Bernier and Dorre islands in Shark Bay. An attempted reintroduction to Peron Peninsula showed that the species is highly vulnerable to predation from cats as well as foxes. The record for Port Hedland is historical. The species is unlikely to occur in the area today.

2		Port Hedland	Day sighting
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Schedule 4 - Other specially protected fauna***Aspidites ramsayi*** **Woma (southwest pop)** *2 records*

A nocturnal species of python restricted to arid areas.

2001	1	1	Day sighting
2001	1	1	Day sighting

Priority One: Taxa with few, poorly known populations on threatened lands***Mormopterus loriae cobourgiana*** **Little North-western Mastiff Bat** *3 records*

This species occurs along the northwest coast and is known to roost in mangroves.

2001	2	0	Heard
2001	2	0	Heard
2001	2	0	Heard

Aspidites ramsayi **Woma (southwest pop)** *2 records*

A nocturnal species of python restricted to arid areas.

2001	1	1	Day sighting
2001	1	1	Day sighting

Priority Four: Taxa in need of monitoring***Macroderma gigas*** **Ghost Bat** *1 records*

This species is Australia's only carnivorous bat and has a patchy distribution across northern Australia. It shelters in caves, mine shafts and deep rock fissures and is sensitive to disturbance.

2001	2	0	Scats
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Pseudomys chapmani **Western Pebble-mound Mouse (Ngadji)** *2 records*

This species is well-known for the characteristic pebble-mounds which it constructs over underground burrow systems. These mounds are most common on spurs and lower slopes of rocky hills.

1994	1		Cookes Hill
1996	2	0	Whim Creek

Ardeotis australis **Australian Bustard** *1 records*

This species is uncommon and may occur in open or lightly wooded grasslands.

2001	1	1	Day sighting
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Numenius madagascariensis **Eastern Curlew** *1 records*

This species is a migratory visitor and has been observed on reef flats and sandy beaches along the West Australian coast and in coastal estuaries.

1975	1	2	North Turtle Island Nature Reserve	Day sighting
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Thursday, 13 October 2005

Department of Conservation and Land Management



Appendix 6

WA Museum FaunaBase Search



**Amphibians collected between 19.86667°S,
119.2°E and 20.84167°S, 118.1833°E.**

Hylidae

Cyclorana australis
Cyclorana maini
Litoria rubella

**Reptiles collected between 19.86667°S,
119.2°E and 20.84167°S, 118.1833°E.**

Agamidae

Ctenophorus caudicinctus caudicinctus
Ctenophorus isolepis
Ctenophorus isolepis isolepis
Ctenophorus nuchalis
Diporiphora winneckeii
Lophognathus longirostris
Pogona minor
Pogona minor mitchelli

Boidae

Antaresia perthensis
Antaresia stimsoni
Antaresia stimsoni stimsoni
Aspidites melanocephalus
Aspidites ramsayi

Cheloniidae

Chelonia mydas
Eretmochelys imbricata bissa

Colubridae

Fordonia leucobalia

Elapidae

Acanthophis pyrrhus
Brachyurophis approximans
Demansia psammophis cupreiceps
Demansia reticulata
Demansia rufescens
Disteira stokesii
Ephalophis greyae
Furina ornata
Hydrelaps darwiniensis
Hydrophis elegans
Pseudechis australis
Pseudonaja modesta
Pseudonaja nuchalis
Simoselaps anomalus
Suta punctata

Gekkonidae

Diplodactylus ciliaris
Diplodactylus conspicillatus
Diplodactylus stenodactylus
Gehyra pilbara

Myobatrachidae

Limnodynastes spenceri
Neobatrachus aquilonius
Notaden nichollsi
Uperoleia glandulosa
Uperoleia russelli
Uperoleia sp

Gehyra punctata
Gehyra purpurascens
Gehyra variegata
Hemidactylus frenatus
Heteronotia binoei
Nephrurus levis pilbarensis
Rhynchoedura ornata
Strophurus ciliaris aberrans
Strophurus elderi
Strophurus jeanae

Pygopodidae

Delma butleri
Delma haroldi
Delma pax
Delma tincta
Lialis burtonis
Pygopus nigriceps

Scincidae

Carlia triacantha
Cryptoblepharus carnabyi
Cryptoblepharus plagioccephalus
Ctenotus duricola
Ctenotus grandis titan
Ctenotus helenae
Ctenotus pantherinus ocellifer
Ctenotus piankai
Ctenotus rufescens
Ctenotus saxatilis
Ctenotus serventyi
Ctenotus sp
Lerista bipes
Lerista muelleri
Menetia greyii
Morethia ruficauda exquisita
Morethia ruficauda ruficauda
Notoscincus ornatus ornatus
Proablepharus reginae
Tiliqua multifasciata

Typhlopidae

Ramphotyphlops ammodytes
Ramphotyphlops braminus
Ramphotyphlops grypus
Ramphotyphlops pilbarensis

Varanidae

Varanus acanthurus

Varanus brevicauda

Varanus eremius

Varanus gouldii

**Birds collected between 19.86667°S, 119.2°E
and 20.84167°S, 118.1833°E.**

Acanthizidae

Gerygone tenebrosa

Motacillidae

Motacilla flava simillima

Pachycephalidae

Pachycephala lanioides

Ardeidae

Nycticorax caledonicus hilli

Passeridae

Passer montanus

Artamidae

Artamus cinereus melanops

Artamus leucorhynchus

Campephagidae

Lalage tricolor

Charadriidae

Charadrius mongolus mongolus

Charadrius ruficapillus

Petroicidae

Eopsaltria pulverulenta

Petroica goodenovii

Phasianidae

Coturnix pectoralis

Psittacidae

Melopsittacus undulatus

Columbidae

Geopelia cuneata

Geopelia striata placida

Phaps histrionica

Ptilonorhynchidae

Ptilonorhynchus maculatus guttatus

Corvidae

Corvus orru ceciliae

Rallidae

Gallirallus philippensis mellori

Fregatidae

Fregata andrewsi

Recurvirostridae

Recurvirostra novaehollandiae

Halcyonidae

Todiramphus pyrrhopygia

Scolopacidae

Arenaria interpres interpres

Calidris acuminata

Calidris alba

Calidris ferruginea

Calidris ruficollis

Calidris tenuirostris

Gallinago stenura

Limicola falcinellus sibiricus

Limnodromus semipalmatus

Numenius madagascariensis

Phalaropus lobatus

Tringa brevipes

Tringa cinerea

Tringa stagnatilis

Hydrobatidae

Oceanites oceanicus

Laridae

Sterna albifrons

Sterna caspia

Sterna hybrida javanica

Sterna leucoptera

Sterna nilotica macrotarsa

Sterna sinensis

Maluridae

Malurus lamberti assimilis

Meliphagidae

Manorina flavigula

Sylviidae

Cincloramphus mathewsi

Turnicidae

Turnix velox

Tytonidae

Tyto alba delicatula

Mammals collected between 19.86667°S, 119.2°E and 20.84167°S, 118.1833°E.

Dasyuridae

Dasyercus cristicauda
Dasykaluta rosamondae
Dasyurus hallucatus
Ningauai timealeyi
Pseudantechinus roryi
Sminthopsis youngsoni

Delphinidae

Steno bredanensis

Dugongidae

Dugong dugon

Emballonuridae

Taphozous georgianus

Macropodidae

Macropus robustus
Macropus robustus erubescens
Macropus rufus

Molossidae

Chaerephon jobensis

Muridae

Mus musculus
Pseudomys delicatulus
Pseudomys desertor
Pseudomys hermannsburgensis

Pteropodidae

Pteropus scapulatus

Thylacomyidae

Macrotis lagotis

Vespertilionidae

Nyctophilus arnhemensis
Nyctophilus geoffroyi
Vespadelus finlaysoni