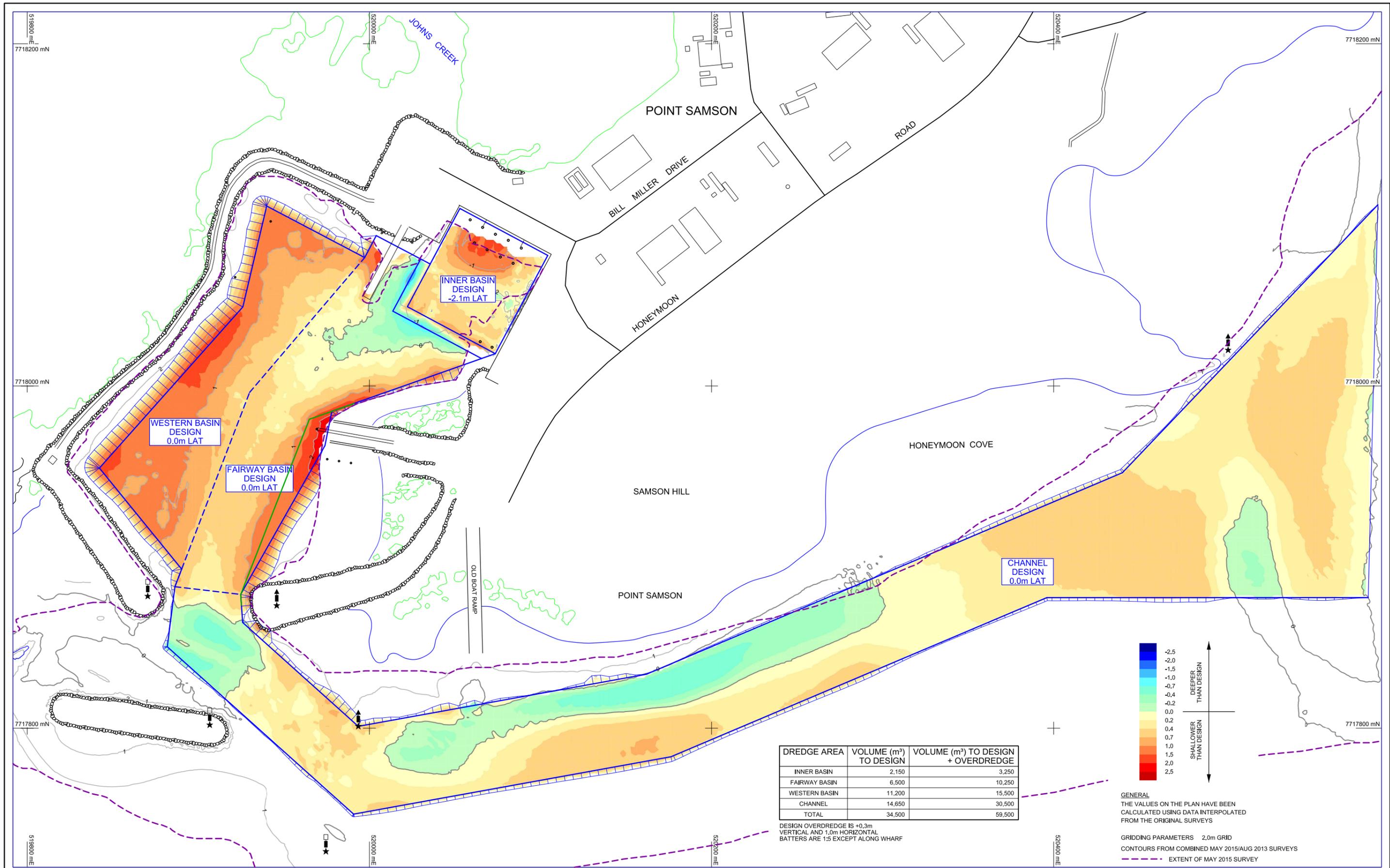


Appendix A

BMT JFA Dredge Design Drawing 1530-06-01



DESIGN OVERDREDGE IS +0.3m
 VERTICAL AND 1.0m HORIZONTAL
 BATTERS ARE 1:5 EXCEPT ALONG WHARF

GENERAL
 THE VALUES ON THE PLAN HAVE BEEN
 CALCULATED USING DATA INTERPOLATED
 FROM THE ORIGINAL SURVEYS

GRIDDING PARAMETERS 2.0m GRID
 CONTOURS FROM COMBINED MAY 2015/AUG 2013 SURVEYS
 - - - - - EXTENT OF MAY 2015 SURVEY

REV	DATE	AMENDMENT	DRN	APP
A	18/11/15	INITIAL ISSUE	SM	

ORIG SIZE ARCHIVE 15300601A.dgn, JC_Comb_2015-05+2013-08_mpa94_LAT.dwg
 A1 JC_Design_2015-11-18.dwg, JC_DRIPlot_2015-05 to Design_2015-11-18.dwg

NOTES

- MAY 2015 SURVEY BY PRECISION HYDROGRAPHIC SERVICES REFER PHS DOC. NO. PHS-15-006-RT-C018 TO C020
- AUGUST 2013 SURVEY DATA FROM FILE ps_20130831_mean.pro RECEIVED ON 8 SEPTEMBER 2015

SCALE 1 : 1000

DATUM
 VERTICAL POINT SAMSON, LAT 2004, WHICH IS 8.302m BELOW SSM A892 AND 3.466m BELOW AHD SEPTEMBER 2010.
 HORIZONTAL MAP GRID OF AUSTRALIA BASED ON GDA 94, ZONE 50

Government of Western Australia
 Department of Transport
 Spatial Information

BMT JFA Consultants
 "Where will our knowledge take you?"

ENGINEER	J.McKay	18/11/2015
DRAWN	S.Mouchemore	18/11/2015
DRAFTING CHECK	G.Bebbington	18/11/2015
ENGINEERING CHECK		
APPROVED PROJECT MGR		

**POINT SAMSON - JOHNS CREEK BOAT HARBOUR
 DREDGING SCOPING 2015/16
 COLOUR CODED DIFFERENCES
 COMBINED MAY 2015/AUG 2013 SVYS TO PRELIM DESIGN**

DRAWING NUMBER **1530 - 06 - 01**

NOT YET REVIEWED

Appendix B

EPBC Act Protected Matters Search Tool and DPaW Nature Map Database Results



EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 10/05/16 13:40:03

[Summary](#)

[Details](#)

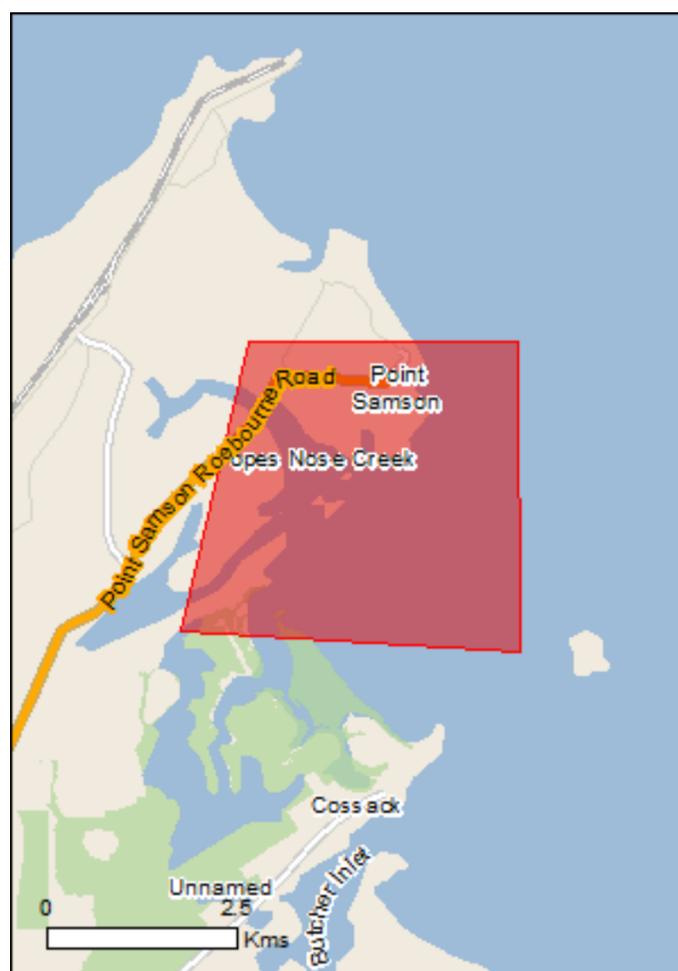
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

[Coordinates](#)

Buffer: 0.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	21
Listed Migratory Species:	31

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	65
Whales and Other Cetaceans:	12
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	9
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Macronectes giganteus Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Mammals		
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Dasyurus hallucatus Northern Quoll [331]	Endangered	Species or species habitat known to occur within area
Macrotis lagotis Greater Bilby [282]	Vulnerable	Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Rhinonictoris aurantia (Pilbara form) Pilbara Leaf-nosed Bat [82790]	Vulnerable	Species or species habitat may occur within area
Reptiles		
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area

Name	Status	Type of Presence
Ctenotus angusticeps Airlie Island Ctenotus [25937]	Vulnerable	Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Liasis olivaceus barroni Olive Python (Pilbara subspecies) [66699]	Vulnerable	Species or species habitat likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Sharks		
Carcharodon carcharias Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Listed Migratory Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Migratory Marine Species		
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Carcharodon carcharias Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Dugong dugon Dugong [28]		Species or species

Name	Threatened	Type of Presence
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	habitat known to occur within area Breeding known to occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat known to occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat likely to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within

Name	Threatened	Type of Presence area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [\[Resource Information \]](#)

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Macronectes giganteus Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area
Fish		
Bulbonaricus brauni Braun's Pughead Pipefish, Pug-headed Pipefish [66189]		Species or species habitat may occur within area
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
Doryrhamphus negrosensis Flagtail Pipefish, Masthead Island Pipefish [66213]		Species or species habitat may occur within area
Festucalex scalaris Ladder Pipefish [66216]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus nitidus Glittering Pipefish [66224]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus trimaculatus Three-spot Seahorse, Low-crowned Seahorse, Flat-faced Seahorse [66720]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Solenostomus paegnius Rough-snout Ghost Pipefish [68425]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Mammals		
Dugong dugon Dugong [28]		Species or species habitat known to occur within area
Reptiles		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur within area
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within

Name	Threatened	Type of Presence area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Aipysurus tenuis Brown-lined Seasnake [1121]		Species or species habitat may occur within area
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Emydocephalus annulatus Turtle-headed Seasnake [1125]		Species or species habitat may occur within area
Ephalophis greyi North-western Mangrove Seasnake [1127]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Hydrelaps darwiniensis Black-ringed Seasnake [1100]		Species or species habitat may occur within area
Hydrophis czeblukovi Fine-spined Seasnake [59233]		Species or species habitat may occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Hydrophis mcdowellii null [25926]		Species or species habitat may occur within area
Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [1111]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat likely to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Extra Information

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resources Audit, 2001.

Name	Status	Type of Presence
Birds		

Name	Status	Type of Presence
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Mammals		
Equus caballus Horse [5]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-20.624243 117.177269,-20.624243 117.209027,-20.658299 117.209198,-20.65605 117.169201,-20.65605 117.169201,-20.624243 117.177269

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [-Office of Environment and Heritage, New South Wales](#)
- [-Department of Environment and Primary Industries, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment, Water and Natural Resources, South Australia](#)
- [-Parks and Wildlife Commission NT, Northern Territory Government](#)
- [-Department of Environmental and Heritage Protection, Queensland](#)
- [-Department of Parks and Wildlife, Western Australia](#)
- [-Environment and Planning Directorate, ACT](#)
- [-Birdlife Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- Natural history museums of Australia
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-South Australian Museum](#)
- [-Queensland Museum](#)
- [-Online Zoological Collections of Australian Museums](#)
- [-Queensland Herbarium](#)
- [-National Herbarium of NSW](#)
- [-Royal Botanic Gardens and National Herbarium of Victoria](#)
- [-Tasmanian Herbarium](#)
- [-State Herbarium of South Australia](#)
- [-Northern Territory Herbarium](#)
- [-Western Australian Herbarium](#)
- [-Australian National Herbarium, Atherton and Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence Forestry Corporation, NSW](#)
- [-Geoscience Australia](#)
- [-CSIRO](#)
- Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact Us](#) page.

NatureMap Species Report

Created By Guest user on 12/05/2016

Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 117° 11' 30" E, 20° 38' 12" S
Buffer 5km
Group By Kingdom

Kingdom	Species	Records
Animalia	406	1109
Fungi	1	1
Plantae	149	291
TOTAL	556	1401

Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
Animalia				
1.	<i>Acanthopagrus latus</i>			
2.	<i>Acrosterigma</i> sp.			
3.	41323 <i>Actitis hypoleucos</i> (Common Sandpiper)		IA	
4.	<i>Adisura marginalis</i>			
5.	<i>Albula forsteri</i>			
6.	<i>Alitropus typus</i>			Y
7.	<i>Alpheus parvirostris</i>			
8.	<i>Amniataba caudavittata</i>			
9.	30833 <i>Amphibolurus longirostris</i> (Long-nosed Dragon)			
10.	<i>Anampses lennardi</i>			
11.	24312 <i>Anas gracilis</i> (Grey Teal)			
12.	24316 <i>Anas superciliosa</i> (Pacific Black Duck)			
13.	<i>Anhinga novaehollandiae</i>			
14.	<i>Anomalocardia (Anomalocardia) squamosa</i>			
15.	<i>Antigona (Antigona) chemnitzii</i>			
16.	<i>Antigona (Antigona) lamellaris</i>			
17.	24285 <i>Aquila audax</i> (Wedge-tailed Eagle)			
18.	<i>Arca ventricosa</i>			
19.	41324 <i>Ardea modesta</i> (Eastern Great Egret)		IA	
20.	25560 <i>Ardea sacra</i> (Eastern Reef Egret, Eastern Reef Heron)		IA	
21.	25736 <i>Arenaria interpres</i> (Ruddy Turnstone)		IA	
22.	<i>Argiocnemis rubescens</i>			
23.	<i>Arothron manilensis</i>			
24.	25566 <i>Artamus cinereus</i> (Black-faced Woodswallow)			
25.	25567 <i>Artamus leucorhynchus</i> (White-breasted Woodswallow)			
26.	24354 <i>Artamus leucorhynchus</i> subsp. <i>leucopygialis</i> (White-breasted Woodswallow)			
27.	24355 <i>Artamus minor</i> (Little Woodswallow)			
28.	<i>Asaphis violascens</i>			
29.	<i>Astralium pileolum</i>			
30.	<i>Athanas dimorphus</i>			
31.	<i>Austrocnemis maccullochi</i>			
32.	<i>Austrocochlea odontis</i>			Y
33.	<i>Bankia australis</i>			
34.	<i>Barbatia (Cucullaearca) foliata</i>			
35.	<i>Barbatia (Savignyarca) scazon</i>			
36.	<i>Barbatia</i> sp.			
37.	<i>Bistolida hirundo</i>			
38.	<i>Boleophthalmus birdsongi</i>			Y
39.	<i>Bostrychopsis jesuita</i>			
40.	<i>Bostrychus sinensis</i>			
41.	<i>Botrylloides leachii</i>			
42.	<i>Brachidontes</i> sp.			
43.	<i>Brogammerus reticulatus</i>			Y

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
44.	<i>Bursa granularis</i>			
45.	<i>Cabestana tabulata</i>			
46.	<i>Cacatua (Licmetis) sanguinea subsp. sanguinea</i>			
47.	25716 <i>Cacatua sanguinea (Little Corella)</i>			
48.	<i>Cacozeliana granarium</i>			
49.	<i>Caecum sp.</i>			
50.	24779 <i>Calidris acuminata (Sharp-tailed Sandpiper)</i>		IA	
51.	24780 <i>Calidris alba (Sanderling)</i>		IA	
52.	25738 <i>Calidris canutus (Red Knot)</i>		IA	
53.	24784 <i>Calidris ferruginea (Curlew Sandpiper)</i>		T	
54.	24788 <i>Calidris ruficollis (Red-necked Stint)</i>		IA	
55.	<i>Callista (Costacallista) impar</i>			
56.	<i>Callista (Costacallista) planatella</i>			
57.	<i>Calomela jansoni</i>			
58.	<i>Carpilius sp.</i>			Y
59.	25600 <i>Centropus phasianinus (Pheasant Coucal)</i>			
60.	<i>Ceratosoma trilobatum</i>			
61.	24181 <i>Chaerephon jobensis (Northern Freetail-bat)</i>			
62.	<i>Chaetodon aureofasciatus</i>			
63.	25575 <i>Charadrius leschenaultii (Greater Sand Plover)</i>		IA	
64.	25576 <i>Charadrius mongolus (Lesser Sand Plover)</i>		T	
65.	24377 <i>Charadrius ruficapillus (Red-capped Plover)</i>			
66.	<i>Cheilinus chlorourus</i>			
67.	25336 <i>Chelonia mydas (Green Turtle)</i>		T	
68.	<i>Chicoreus (Chicoreus) cornucervi</i>			
69.	<i>Chicoreus (Triplex) cervicomis</i>			
70.	<i>Chimarra luminaris</i>			
71.	<i>Choerodon schoenleinii</i>			
72.	<i>Chroicocephalus novaehollandiae</i>			
73.	<i>Chromodoris sp.</i>			
74.	24431 <i>Chrysococcyx basalis (Horsfield's Bronze Cuckoo)</i>			
75.	<i>Circe (Circe) scripta</i>			
76.	<i>Circe sp.</i>			
77.	<i>Colochirus quadrangularis</i>			
78.	24399 <i>Columba livia (Domestic Pigeon)</i>	Y		
79.	<i>Conger cinereus</i>			
80.	<i>Congrogadus subducens</i>			
81.	<i>Conus anemone</i>			
82.	<i>Conus sp.</i>			
83.	<i>Conus trigonus</i>			
84.	<i>Conus victoriae</i>			
85.	25568 <i>Coracina novaehollandiae (Black-faced Cuckoo-shrike)</i>			
86.	24416 <i>Corvus bennetti (Little Crow)</i>			
87.	25701 <i>Coturnix ypsilophora (Brown Quail)</i>			
88.	24672 <i>Coturnix ypsilophora subsp. cervina (Brown Quail)</i>			
89.	24420 <i>Cracticus nigrogularis (Pied Butcherbird)</i>			
90.	25595 <i>Cracticus tibicen (Australian Magpie)</i>			
91.	<i>Craterocephalus capreoli</i>			
92.	<i>Craterocephalus mugiloides</i>			
93.	<i>Cribrarula cribraria subsp. exmouthensis</i>			Y
94.	<i>Cronia (Cronia) avellana</i>			
95.	<i>Cronia sp.</i>			
96.	<i>Cryptophebia ombrodelta</i>			
97.	25458 <i>Ctenophorus caudicinctus (Ring-tailed Dragon)</i>			
98.	24874 <i>Ctenophorus isolepis subsp. citrinus (Crested Dragon, Military Dragon)</i>			
99.	24882 <i>Ctenophorus nuchalis (Central Netted Dragon)</i>			
100.	25043 <i>Ctenotus grandis subsp. titan</i>			
101.	25463 <i>Ctenotus pantherinus (Leopard Ctenotus)</i>			
102.	25073 <i>Ctenotus saxatilis (Rock Ctenotus)</i>			
103.	25077 <i>Ctenotus serventyi</i>			
104.	<i>Ctenotus sp.</i>			
105.	<i>Cyllene sulcata</i>			
106.	<i>Cymbiola nivosa</i>			
107.	<i>Dactyloptena orientalis</i>			
108.	24091 <i>Dasykaluta rosamondae (Little Red Kaluta)</i>			
109.	24093 <i>Dasyurus hallucatus (Northern Quoll)</i>		T	
110.	<i>Dendrodoris sp.</i>			
111.	<i>Diodon holocanthus</i>			
112.	<i>Diploprion bifasciatum</i>			
113.	24896 <i>Diporiphora pindan</i>			

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114.	42402 <i>Diporiphora vescus</i> (Northern Pilbara Tree Dragon)			
115.	<i>Dischistodus darwiniensis</i>			
116.	<i>Dosinia contusa</i>			
117.	<i>Dosinia deshayesii</i>			
118.	<i>Dosinia incisa</i>			
119.	<i>Dosinia scalaris</i>			
120.	<i>Drepane punctata</i>			
121.	<i>Drupella cornus</i>			
122.	<i>Drupella</i> sp.			
123.	24084 <i>Dugong dugon</i> (Dugong)		S	
124.	<i>Ecnomus clavatus</i>			
125.	<i>Egretta garzetta</i>			
126.	<i>Egretta novaehollandiae</i>			
127.	<i>Elanus axillaris</i>			
128.	<i>Elseomyrmis melanops</i>			
129.	24631 <i>Emblema pictum</i> (Painted Finch)			
130.	<i>Eolophus roseicapillus</i>			
131.	24653 <i>Eopsaltria pulverulenta</i> (Mangrove Robin)			
132.	25362 <i>Ephalophis greyae</i>			
133.	25578 <i>Ephippiorhynchus asiaticus</i> (Black-necked Stork)			
134.	<i>Epinephelus bilobatus</i>			
135.	<i>Epinephelus corallicola</i>			
136.	<i>Epinephelus malabaricus</i>			
137.	<i>Epinephelus merra</i>			
138.	<i>Epinephelus quoyanus</i>			
139.	43381 <i>Eremiascincus pallidus</i> (Western Narrow-banded Skink, Narrow-banded Sand Swimmer)			
140.	<i>Eretes australis</i>			
141.	25473 <i>Eretmochelys imbricata</i> (Hawksbill Turtle)		T	
142.	<i>Ergalatax margariticola</i>			
143.	<i>Ergalatax</i> sp.			
144.	<i>Erosaria caputserpentis</i>			
145.	<i>Erosaria helvola</i>			
146.	<i>Erronea cylindrica</i>			
147.	<i>Erronea erronea</i>			
148.	<i>Erronea xanthodon</i>			Y
149.	24360 <i>Esacus neglectus</i> (Beach Stone-curler)			
150.	<i>Eucrassatella pulchra</i>			
151.	<i>Eulimella coacta</i>			Y
152.	<i>Euprotomus vomer</i> subsp. <i>iredalei</i>			
153.	25622 <i>Falco cenchroides</i> (Australian Kestrel)			
154.	25623 <i>Falco longipennis</i> (Australian Hobby)			
155.	25624 <i>Falco peregrinus</i> (Peregrine Falcon)		S	
156.	25327 <i>Fordonia leucobalia</i> (White-bellied Mangrove Snake)			
157.	25727 <i>Fulica atra</i> (Eurasian Coot)			
158.	<i>Gafrarium tumidum</i>			
159.	42314 <i>Gavialis virescens</i> (Singing Honeyeater)			
160.	24958 <i>Gehyra punctata</i>			
161.	24959 <i>Gehyra variegata</i>			
162.	<i>Gelochelidon nilotica</i>			
163.	24401 <i>Geopelia cuneata</i> (Diamond Dove)			
164.	24402 <i>Geopelia humeralis</i> (Bar-shouldered Dove)			
165.	25585 <i>Geopelia striata</i> (Zebra Dove)			
166.	24404 <i>Geophaps plumifera</i> (Spinifex Pigeon)			
167.	34030 <i>Geotria australis</i> (Pouched Lamprey)		P1	
168.	24276 <i>Gerygone tenebrosa</i> (Dusky Gerygone)			
169.	<i>Glycymeris (Glycymeris) striatularis</i>			
170.	<i>Gnathanodon speciosus</i>			
171.	<i>Gnathia mulieraria</i>			Y
172.	24443 <i>Grallina cyanoleuca</i> (Magpie-lark)			
173.	24484 <i>Grus rubicunda</i> (Brolga)			
174.	<i>Gymnanthenea globigera</i>			
175.	<i>Gymnothorax pseudothyrsoides</i>			
176.	<i>Gymnothorax undulatus</i>			
177.	25627 <i>Haematopus fuliginosus</i> (Sooty Oystercatcher)			
178.	24487 <i>Haematopus longirostris</i> (Pied Oystercatcher)			
179.	24293 <i>Haliaeetus leucogaster</i> (White-bellied Sea-Eagle)		IA	
180.	25541 <i>Haliastur indus</i> (Brahminy Kite)			
181.	24295 <i>Haliastur spheurnus</i> (Whistling Kite)			
182.	<i>Haliotis asinina</i>			

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183.	<i>Haliotis clathrata</i>			Y
184.	<i>Haliotis</i> sp.			
185.	<i>Haliotis squamata</i>			
186.	<i>Halophryne diemensis</i>			
187.	<i>Hapalochlaena lunulata</i>			
188.	<i>Helicoverpa punctigera</i>			
189.	<i>Heliocheilus albivenata</i>			
190.	<i>Heliocheilus cramboides</i>			
191.	<i>Heliopsis punctifera</i>			
192.	<i>Helyethira</i> sp.			
193.	<i>Hemipharis insularis</i>			
194.	<i>Hemiscyllium trispeculare</i>			
195.	<i>Herklotsichthys koningsbergeri</i>			
196.	<i>Herklotsichthys quadrimaculatus</i>			
197.	24961 <i>Heteronotia binoei</i> (Bynoe's Gecko)			
198.	<i>Hexaplex stainforthi</i>			
199.	25734 <i>Himantopus himantopus</i> (Black-winged Stilt)			
200.	24491 <i>Hirundo neoxena</i> (Welcome Swallow)			
201.	<i>Holconia neglecta</i>			
202.	43369 <i>Hydrophis peronii</i> (Spiny-headed Seasnake)			
203.	<i>Hydroprogne caspia</i>			
204.	<i>Iphione muricata</i>			
205.	<i>Iridomyrmex chasei</i>			
206.	<i>Iridomyrmex</i> sp.			
207.	<i>Isognomon isognomum</i>			
208.	<i>Isognomon legumen</i>			
209.	<i>Isognomon</i> sp.			
210.	<i>Isopedella gibсандi</i>			
211.	<i>Istiblennius edentulus</i>			
212.	<i>Istiblennius lineatus</i>			
213.	<i>Istigobius ornatus</i>			
214.	25562 <i>Ixobrychus flavicollis</i> (Black Bittern)			
215.	<i>Labracinus lineatus</i>			
216.	<i>Lactoria cornuta</i>			
217.	<i>Laevidentalium lubricatum</i>			
218.	<i>Lamellodiscus cirruspiralis</i>			Y
219.	24511 <i>Larus novaehollandiae</i> subsp. <i>novaehollandiae</i> (Silver Gull)			
220.	<i>Larus walkeri</i>			
221.	<i>Lepidota squamulata</i>			
222.	<i>Lepidonotus adpersus</i>			
223.	<i>Lepidonotus carinulatus</i>			
224.	<i>Lepidonotus glaucus</i>			
225.	<i>Lepidonotus torresiensis</i>			
226.	<i>Leptobrama muelleri</i>			
227.	25125 <i>Lerista bipes</i>			
228.	30928 <i>Lerista clara</i>			
229.	25155 <i>Lerista muelleri</i>			
230.	30921 <i>Lerista neviniae</i> (slider, skink)		T	
231.	<i>Lerista</i> sp.			
232.	25005 <i>Lialis burtonis</i>			
233.	<i>Lichmera</i> (<i>Lichmera</i>) <i>indistincta</i> subsp. <i>indistincta</i>			
234.	25661 <i>Lichmera indistincta</i> (Brown Honeyeater)			
235.	30932 <i>Limosa lapponica</i> (Bar-tailed Godwit)		IA	
236.	<i>Lophiocharon trisignatus</i>			
237.	30933 <i>Lucasium stenodactylum</i>			
238.	<i>Lunulicardia hemiacardium</i>			
239.	<i>Lutjanus vitta</i>			
240.	<i>Lyncina carneola</i>			
241.	<i>Lyrodus</i> sp.			
242.	<i>Mactra</i> (<i>Mactra</i>) <i>abbreviata</i>			
243.	<i>Mactra</i> (<i>Mactra</i>) <i>incarnata</i>			
244.	<i>Malurus</i> (<i>Musciparus</i>) <i>leucopterus</i> subsp. <i>leuconotus</i>			
245.	25651 <i>Malurus lamberti</i> (Variegated Fairy-wren)			
246.	25652 <i>Malurus leucopterus</i> (White-winged Fairy-wren)			
247.	24583 <i>Manorina flavigula</i> (Yellow-throated Miner)			
248.	<i>Marilyna darwinii</i>			
249.	<i>Mauritia eglantina</i>			
250.	24051 <i>Megaptera novaeangliae</i> (Humpback Whale)		T	
251.	25184 <i>Menetia greyii</i>			
252.	24598 <i>Merops ornatus</i> (Rainbow Bee-eater)		IA	

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253.	<i>Mesoginella australis</i>			
254.	<i>Microcarbo melanoleucos</i>			
255.	<i>Miraíra (Miraíra) javanica subsp. woodwardi</i>			
256.	<i>Monetaria sp.</i>			
257.	<i>Monodonta labio</i>			
258.	<i>Morula (morula)</i>			
259.	<i>Morula sp.</i>			
260.	<i>Mugilogobius filifer</i>			
261.	<i>Muraenichthys gymnotus</i>			
262.	<i>Muraenichthys sp.</i>			
263.	<i>Murex (Murex) acanthostephes</i>			
264.	24223 <i>Mus musculus (House Mouse)</i>	Y		
265.	24445 <i>Myiagra alecto subsp. melvillensis (Shining Flycatcher)</i>			
266.	<i>Nassarius (Zeuxis) bicallosus</i>			
267.	<i>Nassarius (Zeuxis) clarus</i>			
268.	<i>Nassarius (Zeuxis) dorsatus</i>			
269.	25344 <i>Natator depressus (Flatback Turtle)</i>		T	
270.	<i>Nematalosa erebi</i>			
271.	<i>Nemipterus peronii</i>			
272.	<i>Neotrigonia uniophora</i>			
273.	<i>Nerita (Melanerita) atramentosa</i>			
274.	<i>Nerita (Ritena) undata</i>			
275.	25430 <i>Notaden nicholli (Desert Spadefoot)</i>			
276.	<i>Notocochlis gualteriana</i>			
277.	<i>Notograptus guttatus</i>			
278.	24798 <i>Numenius madagascariensis (Eastern Curlew)</i>		T	
279.	25742 <i>Numenius phaeopus (Whimbrel)</i>		IA	
280.	<i>Nyctiophylax (Paranyctiophylax) spiculatus</i>			
281.	24192 <i>Nyctophilus arnhemensis (Arnhem Land Long-eared Bat)</i>			
282.	<i>Nyctophilus geoffroyi subsp. pallascens</i>			
283.	24407 <i>Ocyphaps lophotes (Crested Pigeon)</i>			
284.	<i>Odontotrochus indistinctus</i>			
285.	<i>Oliva brethingami</i>			
286.	<i>Omolipus oblongus</i>			
287.	<i>Onchidium sp.</i>			
288.	<i>Opistognathus darwiniensis</i>			
289.	<i>Opistognathus inornatus</i>			
290.	<i>Orectolobus wardi</i>			
291.	<i>Pachycephala (Alisterornis) lanioides subsp. carnavoni</i>			
292.	<i>Pachycephala (Alisterornis) lanioides subsp. lanioides</i>			
293.	<i>Pachycephala (Pachycephala) melanura subsp. melanura</i>			
294.	24620 <i>Pachycephala lanioides (White-breasted Whistler)</i>			
295.	25678 <i>Pachycephala melanura (Mangrove Golden Whistler)</i>			
296.	24621 <i>Pachycephala melanura subsp. melanura (Mangrove Golden Whistler)</i>			
297.	<i>Palmadusta clandestina</i>			
298.	<i>Palola siciliensis</i>			
299.	<i>Pandion cristatus</i>			
300.	25543 <i>Pandion haliaetus (Osprey)</i>			
301.	<i>Paphia (Paphia) semirugata</i>			
302.	<i>Paphia sp.</i>			
303.	<i>Paradrillia sp.</i>			
304.	<i>Paraplotosus albilabris</i>			
305.	<i>Parascorpaena picta</i>			
306.	<i>Parastrophia (Parastrophia) queenslandica</i>			Y
307.	24648 <i>Pelecanus conspicillatus (Australian Pelican)</i>			
308.	<i>Peneoenanthe pulverulenta subsp. cinereiceps</i>			
309.	<i>Periophthalmus minutus</i>			
310.	<i>Peristernia reincarnata</i>			
311.	25697 <i>Phalacrocorax carbo (Great Cormorant)</i>			
312.	24667 <i>Phalacrocorax sulcirostris (Little Black Cormorant)</i>			
313.	25699 <i>Phalacrocorax varius (Pied Cormorant)</i>			
314.	<i>Phos (Phos) senticosus</i>			
315.	<i>Pitar (Pitarina) citrinus</i>			
316.	<i>Placamen berryi</i>			
317.	<i>Placamen gravescens</i>			
318.	<i>Placamen tiara</i>			
319.	<i>Planaxis sp.</i>			
320.	<i>Planaxis sulcatus</i>			
321.	24842 <i>Platalea regia (Royal Spoonbill)</i>			
322.	<i>Platydorís scabra</i>			

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323.	<i>Plectropomus maculatus</i>			
324.	24382 <i>Pluvialis fulva</i> (Pacific Golden Plover)		IA	
325.	<i>Polinices (Conuber) conicus</i>			
326.	<i>Pomacanthus sexstriatus</i>			
327.	<i>Pomadasys</i> sp.			
328.	<i>Pomatostegus stellatus</i>			
329.	<i>Prionobutis microps</i>			
330.	<i>Psammoperca waigiensis</i>			
331.	24234 <i>Pseudomys delicatulus</i> (Delicate Mouse)			
332.	24237 <i>Pseudomys hermannsburgensis</i> (Sandy Inland Mouse)			
333.	24238 <i>Pseudomys laborifex</i> (Kimberley Mouse)			
334.	<i>Pseudovertagus (Pseudovertagus) aluco</i>			
335.	<i>Pterochelus triformis</i>			
336.	<i>Purpuradusta gracilis</i>			
337.	<i>Pyramidella dolabrata</i>			
338.	<i>Pyramidella sulcatus</i>			
339.	<i>Pyrene bidentata</i>			
340.	24245 <i>Rattus rattus</i> (Black Rat)	Y		
341.	24776 <i>Recurvirostra novaehollandiae</i> (Red-necked Avocet)			
342.	<i>Remora remora</i>			
343.	<i>Rhagada radleyi</i>			
344.	<i>Rhinoclavis (Rhinoclavis) bituberculata</i>			
345.	<i>Rhipidura (Rhipidura) phasiana</i>			
346.	25614 <i>Rhipidura leucophrys</i> (Willie Wagtail)			
347.	24457 <i>Rhipidura phasiana</i> (Mangrove Grey Fantail)			
348.	<i>Rissoina (Rissoina) vincentiana</i>			
349.	<i>Ruditapes bruguieri</i>			
350.	<i>Sardinella albella</i>			
351.	<i>Sardinella gibbosa</i>			
352.	<i>Sargocentron prasinum</i>			
353.	<i>Saurida tumbil</i>			
354.	<i>Selenotoca multifasciata</i>			
355.	<i>Siphonaria</i> sp.			
356.	<i>Siphonaria tasmanica</i>			
357.	<i>Sorsogona tuberculata</i>			
358.	<i>Sphyræna obtusata</i>			
359.	24522 <i>Sterna bergii</i> (Crested Tern)			
360.	24523 <i>Sterna caspia</i> (Caspian Tern)		IA	
361.	<i>Strepsicrates semicanella</i>			
362.	<i>Strombus (Canarium) urceus</i> subsp. <i>orrae</i>			
363.	<i>Strombus</i> sp.			
364.	25517 <i>Strophurus ciliaris</i>			
365.	24924 <i>Strophurus ciliaris</i> subsp. <i>aberrans</i>			
366.	24949 <i>Strophurus wellingtonae</i>			
367.	<i>Synalpheus streptodactylus</i>			
368.	<i>Synanceia horrida</i>			
369.	24207 <i>Tachyglossus aculeatus</i> (Short-beaked Echidna)			
370.	30870 <i>Taeniopygia guttata</i> (Zebra Finch)			
371.	<i>Taeniura lymma</i>			
372.	<i>Tapes (Tapes) literatus</i>			
373.	<i>Tapes</i> sp.			
374.	24175 <i>Taphozous georgianus</i> (Common Sheath-tail-bat)			
375.	<i>Tectus (Tectus) pyramis</i>			
376.	<i>Tellinella staurella</i>			
377.	<i>Tellinella virgata</i>			
378.	<i>Terapon theraps</i>			
379.	<i>Teredo furcifera</i>			
380.	<i>Thalasseus bengalensis</i>			
381.	<i>Thalasseus bergii</i>			
382.	24844 <i>Threskiornis molucca</i> (Australian White Ibis)			
383.	24845 <i>Threskiornis spinicollis</i> (Straw-necked Ibis)			
384.	<i>Todiramphus (Todiramphus) chloris</i> subsp. <i>sordidus</i>			
385.	25548 <i>Todiramphus chloris</i> (Collared Kingfisher)			
386.	24306 <i>Todiramphus chloris</i> subsp. <i>pilbara</i> (Collared Kingfisher)			
387.	42351 <i>Todiramphus pyrrhopygius</i> (Red-backed Kingfisher)			
388.	25549 <i>Todiramphus sanctus</i> (Sacred Kingfisher)			
389.	24309 <i>Todiramphus sanctus</i> subsp. <i>sanctus</i> (Sacred Kingfisher)			
390.	<i>Tragulichthys jaculiferus</i>			
391.	24808 <i>Tringa nebularia</i> (Common Greenshank)		IA	
392.	<i>Triplectides australicus</i>			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
393.	<i>Trivia (Ellatrivia) merces</i>			
394.	<i>Trochus hanleyanus</i>			
395.	<i>Turbo (Lunella) cinereus</i>			
396.	<i>Turbo (Marmarostoma) squamosus</i>			
397.	25212 <i>Varanus eremius</i> (Pygmy Desert Monitor)			
398.	<i>Vasticardium flavum</i> subsp. <i>dupuchense</i>			
399.	<i>Vasticardium vertebratum</i>			
400.	24205 <i>Vespadelus finlaysoni</i> (Finlayson's Cave Bat)			
401.	<i>Vexillum</i> sp.			
402.	<i>Yongeichthys criniger</i>			
403.	<i>Zoila decipiens</i>			
404.	<i>Zosterops lateralis</i> subsp. <i>chloronotus</i>			
405.	24857 <i>Zosterops luteus</i> (Yellow White-eye)			
406.	24248 <i>Zyzomys argurus</i> (Common Rock-rat)			
Fungi				
407.	27771 <i>Heppia lutosa</i>			
Plantae				
408.	4895 <i>Abutilon lepidum</i>			
409.	3209 <i>Acacia ampliceps</i>			
410.	44580 <i>Acacia ampliceps</i> x <i>bivenosa</i>			
411.	3241 <i>Acacia bivenosa</i>			
412.	13500 <i>Acacia coriacea</i> subsp. <i>coriacea</i>			
413.	3356 <i>Acacia gregorii</i> (Gregory's Wattle)			
414.	44583 <i>Acacia hilliana</i> x <i>stellaticeps</i>			
415.	3394 <i>Acacia jensenii</i>			
416.	19305 <i>Acacia melleodora</i>			
417.	3506 <i>Acacia pyrifolia</i> (Ranji Bush, Kandji)			
418.	15203 <i>Acacia sabulosa</i>			
419.	<i>Acacia</i> sp.			
420.	<i>Acacia</i> sp. <i>Barklys</i> (J.L.Egan 124)			
421.	19456 <i>Acacia stellaticeps</i>			
422.	3573 <i>Acacia tenuissima</i>			
423.	3579 <i>Acacia trachycarpa</i> (Minni Ritchi, Balgali)			
424.	17422 <i>Adriana tomentosa</i> var. <i>tomentosa</i>			
425.	6486 <i>Aegialitis annulata</i> (Club Mangrove)			
426.	6478 <i>Aegiceras corniculatum</i> (River Mangrove)			
427.	2646 <i>Aerva javanica</i> (Kapok Bush)	Y		
428.	20018 <i>Amaranthus undulatus</i>			
429.	4740 <i>Atalaya hemiglauc</i> a (Whitewood)			
430.	<i>Avicennia</i> sp.			
431.	2770 <i>Boerhavia coccinea</i> (Tar Vine, Wituka)			
432.	<i>Bonamia</i> sp.			
433.	12716 <i>Brachychiton acuminatus</i>			
434.	3749 <i>Canavalia rosea</i> (Wild Jack Bean)			
435.	11670 <i>Capparis spinosa</i> var. <i>nummularia</i> (Coastal Caper)			
436.	258 <i>Cenchrus ciliaris</i> (Buffel Grass)	Y		
437.	39680 <i>Cerlops australis</i>			
438.	2988 <i>Cleome viscosa</i> (Tickweed, Tjinduwadhu)			
439.	13692 <i>Clerodendrum floribundum</i> var. <i>angustifolium</i>			
440.	2776 <i>Commicarpus australis</i> (Perennial Tar Vine)			
441.	4862 <i>Corchorus parviflorus</i>			
442.	18414 <i>Corchorus sidoides</i> subsp. <i>vermicularis</i>			
443.	4867 <i>Corchorus walcottii</i> (Woolly Corchorus)			
444.	3774 <i>Crotalaria cunninghamii</i> (Green Birdflower, Bilbun)			
445.	20176 <i>Crotalaria cunninghamii</i> subsp. <i>cunninghamii</i>			
446.	19378 <i>Crotalaria dissitiflora</i> subsp. <i>benthamiana</i>			
447.	11231 <i>Crotalaria novae-hollandiae</i> subsp. <i>novae-hollandiae</i>			
448.	19398 <i>Crotalaria ramosissima</i>			
449.	17117 <i>Cullen cinereum</i>			
450.	15714 <i>Cullen stipulaceum</i>			
451.	13733 <i>Cuscuta victoriana</i>			
452.	4745 <i>Diplopeltis eriocarpa</i> (Hairy Pepperflower)			
453.	7115 <i>Dolichandrone heterophylla</i> (Lemonwood)			
454.	357 <i>Enneapogon caerulescens</i> (Limestone Grass)			
455.	378 <i>Eragrostis dielsii</i> (Mallee Lovegrass)			
456.	380 <i>Eragrostis eriopoda</i> (Woollybutt Grass, Wangurnu)			
457.	381 <i>Eragrostis falcata</i> (Sickle Lovegrass)			
458.	17427 <i>Eragrostis lanicaulis</i>		P3	
459.	408 <i>Eriachne flaccida</i> (Claypan Grass)			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
460.	409 <i>Eriachne gardneri</i>			
461.	413 <i>Eriachne mucronata</i> (Mountain Wanderie Grass)			
462.	414 <i>Eriachne obtusa</i> (Northern Wandarie Grass)			
463.	415 <i>Eriachne ovata</i>			
464.	11011 <i>Eulalia aurea</i>			
465.	42876 <i>Euphorbia vaccaria</i> var. <i>vaccaria</i>			
466.	11200 <i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>			
467.	19648 <i>Ficus brachypoda</i>			
468.	<i>Ficus eosvilla</i>			
469.	35558 <i>Flaveria trinervia</i> (Speedy Weed)	Y		
470.	5188 <i>Frankenia ambita</i>			
471.	2835 <i>Glinus lotooides</i> (Hairy Carpet Weed)			
472.	3938 <i>Glycine canescens</i> (Silky Glycine)			
473.	2676 <i>Gomphrena canescens</i> (Batchelors Buttons)			
474.	18363 <i>Gomphrena canescens</i> subsp. <i>canescens</i>			
475.	7526 <i>Goodenia microptera</i>			
476.	7545 <i>Goodenia scaevolina</i> (Ngurubi)			
477.	4918 <i>Gossypium robinsonii</i> (Wild Cotton)			
478.	8030 <i>Helichrysum oligochaetum</i>		P1	
479.	6707 <i>Heliotropium curassavicum</i> (Smooth Heliotrope)			
480.	6713 <i>Heliotropium ovalifolium</i>			
481.	6714 <i>Heliotropium paniculatum</i>			
482.	29317 <i>Hibiscus austrinus</i> var. <i>austrinus</i>			
483.	4942 <i>Hibiscus sturtii</i> (Sturt's Hibiscus)			
484.	5215 <i>Hybanthus aurantiacus</i>			
485.	3980 <i>Indigofera linifolia</i>			
486.	3982 <i>Indigofera monophylla</i>			
487.	3987 <i>Indigofera trita</i>			
488.	11312 <i>Ipomoea pes-caprae</i> subsp. <i>brasiliensis</i>			
489.	3989 <i>Isotropis atropurpurea</i> (Poison Sage)			
490.	3035 <i>Lepidium pedicellosum</i>			
491.	6490 <i>Muellerolimon salicorniaceum</i>			
492.	17158 <i>Myoporum montanum</i> (Native Myrtle)			
493.	8121 <i>Myriocephalus rudallii</i>			
494.	2573 <i>Neobassia astrocarpa</i>			
495.	6971 <i>Nicotiana benthamiana</i> (Tjuntiwari)			
496.	11856 <i>Nicotiana occidentalis</i> subsp. <i>occidentalis</i>			
497.	<i>Notoleptopus decaisnei</i> var. <i>orbicularis</i> (A.B.Craig 428)			Y
498.	525 <i>Paspalidium tabulatum</i>			
499.	42006 <i>Pentalepis trichodesmoides</i> subsp. <i>hispida</i>		P2	
500.	3675 <i>Petalostylis labicheoides</i> (Slender Petalostylis)			
501.	1042 <i>Phoenix dactylifera</i> (Date Palm)	Y		
502.	6653 <i>Polymeria ambigua</i> (Morning Glory)			
503.	<i>Polymeria mollis</i>			
504.	2690 <i>Ptilotus aevoides</i>			
505.	2699 <i>Ptilotus axillaris</i> (Mat Mulla Mulla)			
506.	2704 <i>Ptilotus calostachyus</i> (Weeping Mulla Mulla)			
507.	2728 <i>Ptilotus gomphrenoides</i>			
508.	2746 <i>Ptilotus nobilis</i> (Tall Mulla Mulla)			
509.	41001 <i>Ptilotus nobilis</i> subsp. <i>nobilis</i> (Yellow Tails)			
510.	2766 <i>Ptilotus villosiflorus</i>			
511.	11240 <i>Rhagodia preissii</i> subsp. <i>obovata</i>			
512.	5295 <i>Rhizophora stylosa</i> (Spotted-leaved Red Mangrove)			
513.	4191 <i>Rhynchosia minima</i> (Rhynchosia)			
514.	2357 <i>Santalum lanceolatum</i> (Northern Sandalwood, Yarguli)			
515.	13178 <i>Scaevola amblyanthera</i> var. <i>centralis</i>			
516.	7606 <i>Scaevola crassifolia</i> (Thick-leaved Fan-flower)			
517.	7643 <i>Scaevola sericophylla</i>			
518.	7644 <i>Scaevola spinescens</i> (Currant Bush, Maroon)			
519.	41646 <i>Schenkia clementii</i>			
520.	12280 <i>Senna artemisioides</i> subsp. <i>oligophylla</i>			
521.	12309 <i>Senna glutinosa</i> subsp. <i>pruinosa</i>			
522.	12319 <i>Senna venusta</i>			
523.	18149 <i>Sida rohlenae</i> subsp. <i>rohlenae</i>			
524.	7002 <i>Solanum diversiflorum</i>			
525.	624 <i>Spinifex hirsutus</i> (Hairy Spinifex)			
526.	625 <i>Spinifex longifolius</i> (Beach Spinifex)			
527.	635 <i>Sporobolus virginicus</i> (Marine Couch)			
528.	8238 <i>Streptoglossa liatroides</i>			
529.	3182 <i>Stylobasium spathulatum</i> (Pebble Bush)			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
530.	4242 <i>Swainsona pterostylis</i>			
531.	33319 <i>Tecticornia indica</i> subsp. <i>bidens</i>			
532.	33318 <i>Tecticornia indica</i> subsp. <i>leiostachya</i> (Samphire)			
533.	4280 <i>Tephrosia rosea</i> (Flinders River Poison, Bungoo'dah)			
534.	41920 <i>Tephrosia rosea</i> var. <i>Port Hedland</i> (A.S. George 1114)		P1	
535.	19531 <i>Tephrosia rosea</i> var. <i>clementii</i>			
536.	<i>Tephrosia</i> sp.			
537.	41811 <i>Tephrosia</i> sp. <i>Fortescue</i> (A.A. Mitchell 606)			
538.	17819 <i>Themeda</i> sp. <i>Mt Barricade</i> (M.E. Trudgen 2471)			
539.	2644 <i>Threlkeldia diffusa</i> (Coast Bonefruit)			
540.	6279 <i>Trachymene ornata</i> (Spongefruit)			
541.	44240 <i>Trianthema cusackianum</i>			
542.	2830 <i>Trianthema portulacastrum</i> (Giant Pigweed)	Y		
543.	44360 <i>Trianthema turgidifolium</i>			
544.	4375 <i>Tribulus cistoides</i>			
545.	4377 <i>Tribulus hirsutus</i>			
546.	4380 <i>Tribulus occidentalis</i> (Perennial Caltrop)			
547.	4381 <i>Tribulus platypterus</i> (Cork Hopbush)			
548.	13559 <i>Trichodesma zeylanicum</i> var. <i>grandiflorum</i>			
549.	11750 <i>Trichodesma zeylanicum</i> var. <i>zeylanicum</i>			
550.	679 <i>Triodia angusta</i>			
551.	13131 <i>Triodia epactia</i>			
552.	14694 <i>Triumfetta clementii</i>			
553.	<i>Triumfetta</i> sp.			
554.	11359 <i>Vitex trifolia</i> var. <i>subtrisecta</i>	Y		
555.	728 <i>Whiteochloa cymbiformis</i>			
556.	29095 <i>Zaleya galericulata</i> subsp. <i>galericulata</i>			

Conservation Codes

T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

¹ For NatureMap's purposes, species flagged as endemic are those whose records are wholly contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

Appendix C

Johns Creek Mangrove Habitat Mapping Report

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1. Introduction

1.1 Background

Johns Creek Boat Harbour is a small facility comprising a boat harbour basin (hereafter; the Boat Harbour) and Entrance Channel, located south of the Point Samson town site and ~40 km north-east of Karratha, in the Pilbara region, Western Australia (WA; Figure 1.1). The Boat Harbour is located within a mangrove tidal creek and has historically experienced siltation issues (JFA & Oceanica 2005). Recent complaints from users regarding navigability have highlighted areas of sediment accretion and the Department of Transport (DoT) is proposing to complete maintenance dredging of the Boat Harbour in 2018.

Mangrove communities are an important benthic primary producer habitat (BPPH, EPA 2016). As a result, mangrove loss is assessed in the context of *Technical Guidance: Protection of Benthic Communities and Habitats* (EPA 2016). The mangrove communities of the Pilbara region are of high ecological significance, as they form the largest single unit of tropical arid zone mangroves in the world (EPA 2001). Six species are known to occur in the region, *Avicennia marina*, *Aegialitis annulata*, *Aegiceras corniculatum*, *Bruguiera exaristata*, *Ceriops australis* and *Rhizophora stylosa* (Wells & Walker 2003).

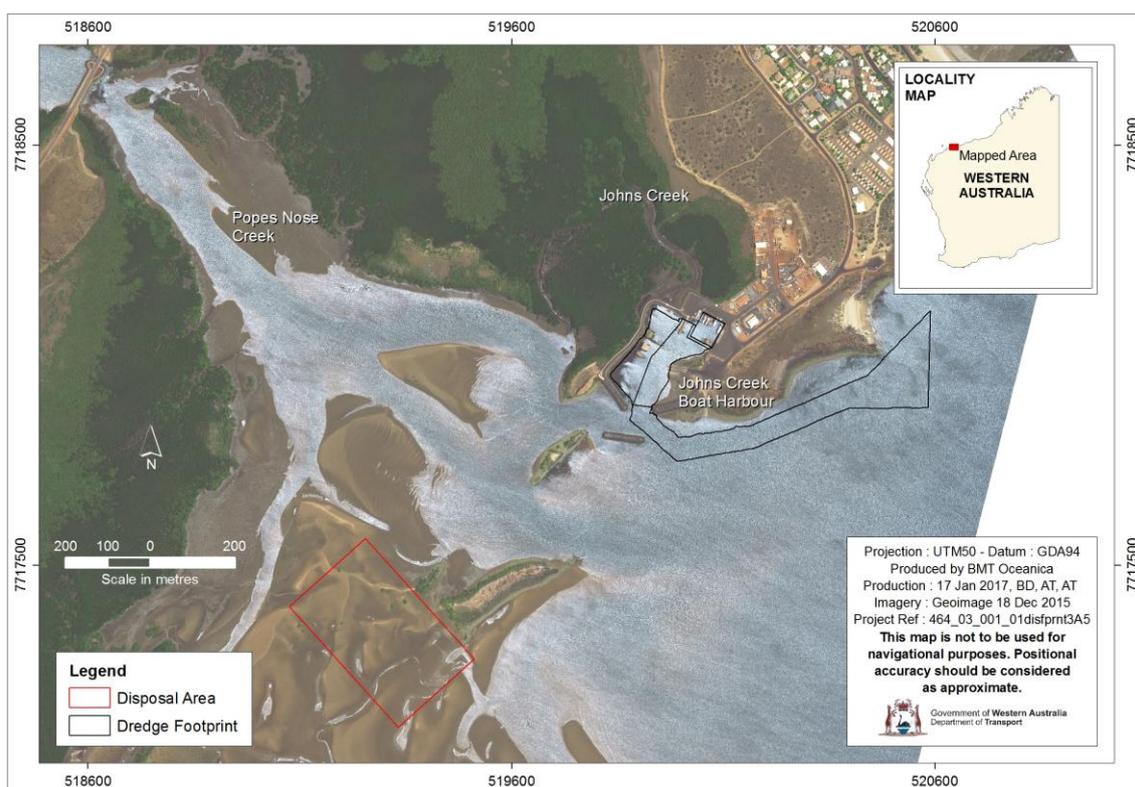


Figure 1.1 Location of Johns Creek Boat Harbour

1.2 This report

As part of the maintenance dredging Project scoping, a disposal area was selected in-line with the proposed future developmental plans for the Boat Harbour which was located within mangrove communities. Although the area selected was mostly cleared of mangroves in a previously disturbed area, it was anticipated there may be some mangroves loss during disposal of dredged material. As a result, an assessment of the anticipated mangrove loss (this report) was completed. Subsequently, due to the potential impacts to mangal habitat and Aboriginal Heritage, it was decided to assess other locations for disposal of dredged material within the Boat

Harbour vicinity. This report presents the results of BPPH mapping for both areas identified for disposal of dredged material.

1.3 Dredging and disposal

1.3.1 Dredging

The proposed maintenance dredging in autumn 2018 will restore the original design depths in most areas of the Boat Harbour and Entrance Channel down to -2.1 m LAT and 0.0 m LAT, respectively. To achieve this, up to 47 000 m³ of material will be removed from the Boat Harbour and the Entrance Channel using a small cutter-suction dredge. The duration of the maintenance dredging campaign will depend on the final dredge design selected, however; the works are expected to extend for ~2–3 months.

1.3.2 Disposal

In the initial Project scoping phase, it was originally proposed material from the Boat Harbour would be pumped via pipeline into a bunded disposal area on the banks of Johns Creek, north of the Boat Harbour (hereafter; Johns Creek Disposal area). However, following further evaluation of the potential environmental and social impacts from this disposal area, an alternative location was proposed to a sandbar south-west of the Boat Harbour (hereafter; the Western Disposal area, refer Figure 1.1). Dredged material is proposed to be pumped via pipeline to the intertidal sand bar and return water will discharge to the marine environment.

2. Benthic Habitat Mapping

2.1 Data collection and treatment

Historical aerial imagery from 1959 and multispectral satellite imagery from 2015 was used to map mangrove BPPH. The imagery in 1959 was acquired through DoT aerial flight archives and captured Johns Creek and surrounding mangrove BPPH covering an area of ~385 ha. Additional historical aerial imagery was acquired from 1974, 1986, 1995 and 2003 to aid in visual comparison of vegetation change over time.

Satellite imagery from 2015 was acquired from the DigitalGlobe WorldView-3 sensor and supplied as orthorectified 30 cm resolution panchromatic (grey-scale) and 1.2 m resolution multispectral (8 spectral bands) imagery. The satellite imagery captured a wider area encompassing mangrove BPPH along the entire creek system covering an area of ~2529 ha.

Prior to commencing the mangrove BPPH mapping, the aerial imagery was georeferenced to the orthorectified satellite imagery using ArcGIS 10.2.1 to allow for accurate vegetation change analysis between the images. The image was re-sampled to 2 m spatial resolution to remove noise and artefacts in the image resulting from the historical nature of the capture, and the image cropped to the 1959 classification study boundary (~214 ha). Atmospheric correction (top-of-atmosphere) was applied to the satellite imagery using ERDAS ER Mapper 2015 and the image cropped to the 2015 classification study area boundary (~445 ha).

2.2 Groundtruthing

Thirty-two sites (Figure 2.1) were chosen for groundtruthing for mangal habitat mapping. Sites were chosen based on accessibility and analysis of spectral signatures from the satellite imagery in relation to surrounding vegetation. Of the 32 sites, 30 were visited and photographed by personnel from BMT Oceanica on 14–16 May 2016. A GPS waypoint was taken at each site to verify the position of groundtruthing photographs.

Mangrove species were identified by a mangrove expert (Dr. Julia Philips) to family classification and, where possible from the data collected, to species classification. Four species of mangrove, *A. marina*, *R. stylosa*, *A. corniculatum* and *Ceriops australis* were identified. Classifications are discussed in Section 2.3 below.



Figure 2.1 Groundtruthing sites in the study area used to classify mangrove BPPH and proposed dredge and disposal areas

2.3 Benthic habitat classifications

Three categories were used to classify mangal habitats in Popes Nose and Johns Creeks (Table 2.1). These categories were chosen because they allowed for a comparison between

1959 and 2016 aerial imagery with the highest degree of accuracy. The fourth mangrove species, *A. corniculatum*, was located in an isolated patch and did not represent a large enough area for a meaningful classification using satellite imagery.

Table 2.1 Johns Creek mangrove benthic primary producer habitat categories

Habitat category	Description	Example photograph
<i>Avicennia marina</i> dominated	Mangrove community dominated by <i>A. marina</i> with sparse plants of other species intermingled	 A photograph showing a dense thicket of mangrove vegetation, primarily Avicennia marina, along a waterway. The plants are green and bushy, with a body of water visible to the right under a clear blue sky.
<i>Rhizophora stylosa</i> dominated	Mangrove community dominated by <i>R. stylosa</i> with sparse plants of other species intermingled	 A photograph of a mangrove community dominated by Rhizophora stylosa. The image shows the characteristic prop roots of the trees extending into the water, with dense green foliage above.
<i>Ceriops australis</i> dominated	Mangrove community dominated by <i>C. australis</i> with sparse plants of other species intermingled	 A photograph showing a dense mangrove community dominated by Ceriops australis. The vegetation is a mix of green and brownish-grey, with a thick canopy of leaves and branches.

2.3.1 Classification of 2015 mangrove benthic primary producer habitat

The atmospherically corrected satellite imagery was classified using a two step approach to create the 2015 mangrove BPPH map:

A vegetation index was applied to the atmospherically corrected multispectral satellite imagery to extract vegetation cover by generating an image displaying greenness (relative biomass). Preliminary testing of several indices was performed, including the NDVI (Normalised Difference Vegetation Index), GEMI (Global Environmental Monitoring Index) SAVI (Soil-Adjusted Vegetation Index) and Modified Soil Adjusted Vegetation Index (MSAVI2) using ArcGIS 10.2.1 (EASRI 2016). On visual assessment, the SAVI achieved best separation of vegetation and surrounding bare ground, while adjusting for the soil reflectance and not over-saturating other areas comprising denser vegetation. The SAVI attempts to decrease soil brightness influences using a soil-brightness correction factor, proving beneficial over more sparsely vegetated areas.

$$\text{SAVI} = ((\text{NIR} - \text{R}) / (\text{NIR} + \text{R} + \text{L})) \times (1 + \text{L})$$

Where:

L = 0.5, NIR and R refer to the near-infrared and red spectral bands of the satellite imagery.

The L value depends on the amount of green vegetation cover, with a value of L = 0.5 generally used in areas of moderate green vegetation cover. The index generates values between -1.0 and 1.0 and a threshold value of 0.34 was used to clip the multispectral imagery to the vegetation extent using ArcGIS 10.2.1.

The second step involved performing a supervised classification approach on the SAVI-extracted multispectral imagery to map mangrove species *A. marina* dominated, *R. stylosa* dominated and *C. australis* dominated. A random split was applied to the groundtruthing points to split them into classification (70%) and validation (30%) data. Several classifiers including Maximum Likelihood, Mahalanobis Distance, Minimum Distance and Spectral Angle Mapper classifiers were trialled using ERDAS Imagine 2015 (Hexagon Geospatial 2016a, b). All eight spectral bands and the 70% withheld classification groundtruthing data were used to generate spectral signatures for the classification. The minimum distance classifier achieved best results in distinguishing mangrove species.

Post-processing was applied to the classification to improve areas of noise in the data or misclassification resulting from spectral similarities among the species, especially in more sparsely vegetated areas, and smooth the boundary among classified mangrove species. A minimum mapping unit (MMU; Knight & Lunetta 2013) of 4 pixels was selected to remove small classified areas, i.e. classified areas of 4 pixels or less (below 5.75 m²) were removed and merged with neighbouring polygons.

An accuracy assessment was performed on the 2015 classification using the 30% withheld validation groundtruthing data, achieving an overall accuracy of 100% and Kappa statistic of 1.0 (Table 2.2). The Kappa value measures agreement between the classification of categorical data, and recognises the agreement that could occur by chance. Kappa values over 0.40 have been considered as representing moderate to strong agreement (Congalton 1991, 2001).

Table 2.2 Accuracy assessment for 2015 Johns Creek mangrove benthic primary producer habitat classification

Habitat type		Reference Data				User's Accuracy ¹
		<i>Avicennia sp</i> dominated	<i>Rhizophora sp</i> dominated	<i>Ceriops sp</i> dominated	Total	
Classified Data	<i>Avicennia sp</i> dominated	8	0	0	8	100 %
	<i>Rhizophora sp</i> dominated	0	1	0	1	100 %
	<i>Ceriops sp</i> dominated	0	0	1	1	100 %
	Total	8	1	1	10	-
	Producer's Accuracy²	100%	100%	100%	-	100%

Notes:

1. User's accuracy, or reliability, indicates the probability that a pixel classified in the image actually represents that class on the ground (error of commission). It is calculated by dividing the total number of correct pixels in a class by the total number of pixels that were classified in that class (Congalton 1991).
2. Producer's accuracy indicates the probability of a reference pixel being correctly classified (error of omission). It is calculated by dividing the total number of correct pixels in a class by the total number of pixels of that class as derived from the reference data.

2.3.2 Historical 1959 mangrove BPPH classification

The georeferenced historical 1959 imagery was classified using an unsupervised classification approach in ERDAS Imagine 2015 (Hexagon Geospatial 2016a). The approach involves creating clusters of pixels based on the spectral information of the image. No supervised classification could be performed due to historical groundtruthing unavailable to classify the 1959 aerial image. The K-means unsupervised classifier was selected, whereby pixels are iteratively classified into a predetermined number of output clusters. The clusters were then visually analysed and merged to generate the final categories for mangrove species *A. marina* dominated, *R. stylosa* dominated and *C. australis* dominated. Post-processing was applied to the classification to improve areas of noise in the data or misclassification resulting from spectral similarities between the species and smooth the boundary between classified mangrove species. The aerial imagery's limited spectral information inherent in its one spectral band and brightness differences across the imagery resulted in a similar spectral response and consequently misclassifications between the species categories. As a result, a large amount of manual processing was required to improve the classification. A MMU of 4 pixels was selected to remove small classified areas, i.e. classified areas of 4 pixels or less (below 16 m²) were removed and merged with adjacent polygons.

No accuracy assessment could be performed as no historical groundtruthing was available to validate the 1959 aerial image. However, a visual assessment and comparison with the 2015 classification showed good agreement between the species categories.

2.4 Final habitat maps

Habitat classification showed that *A. marina* dominated areas were situated on the inland side of mangrove habitat, with *R. stylosa* dominated habitats occurring predominantly along the creek banks (Figure 2.2, Figure 2.3). There were two small stands of *C. australis* east of the causeway. Isolated patches of *A. marina* occurred within the Western Disposal area (Figure 2.3). *C. australis* was not identified within the proposed dredging and disposal areas (Figure 2.3).

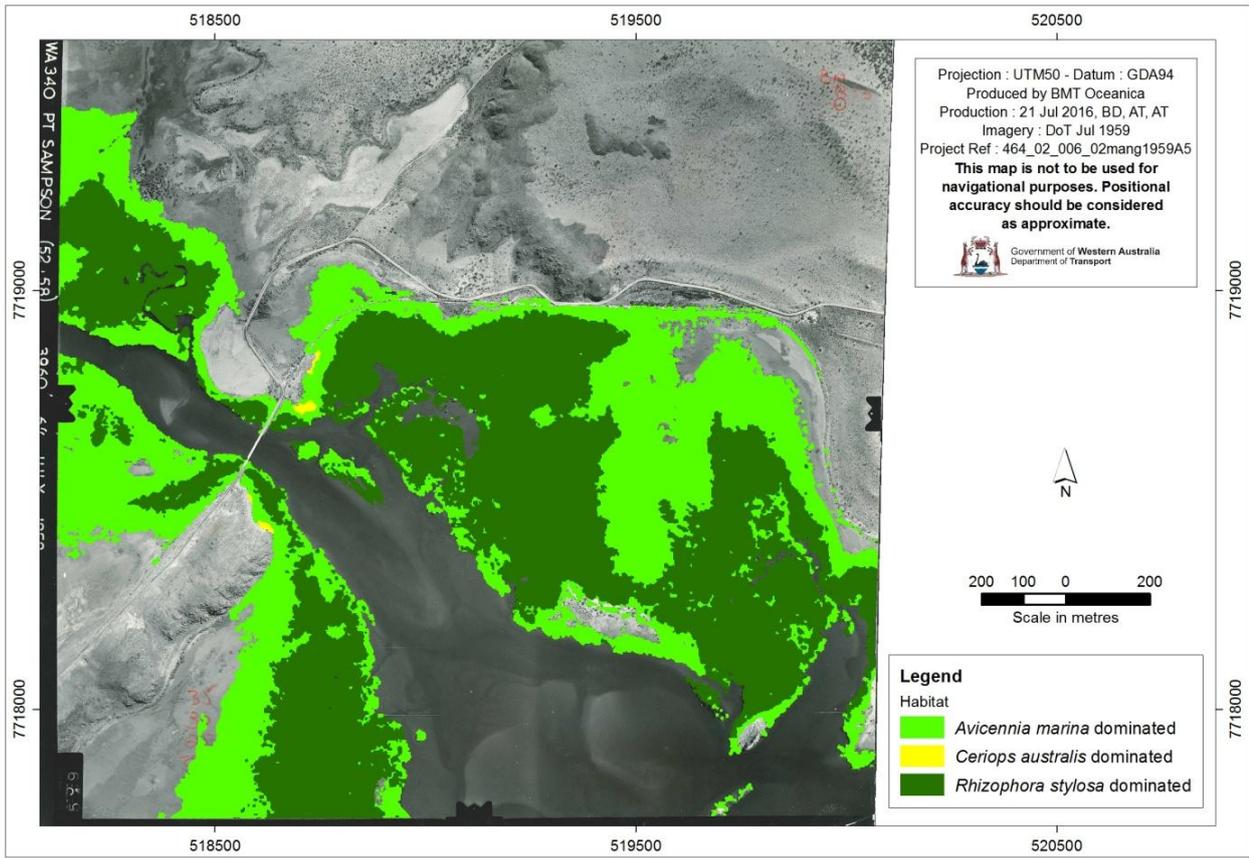


Figure 2.2 Mangal habitat map for Popes Nose and Johns Creeks in 1959

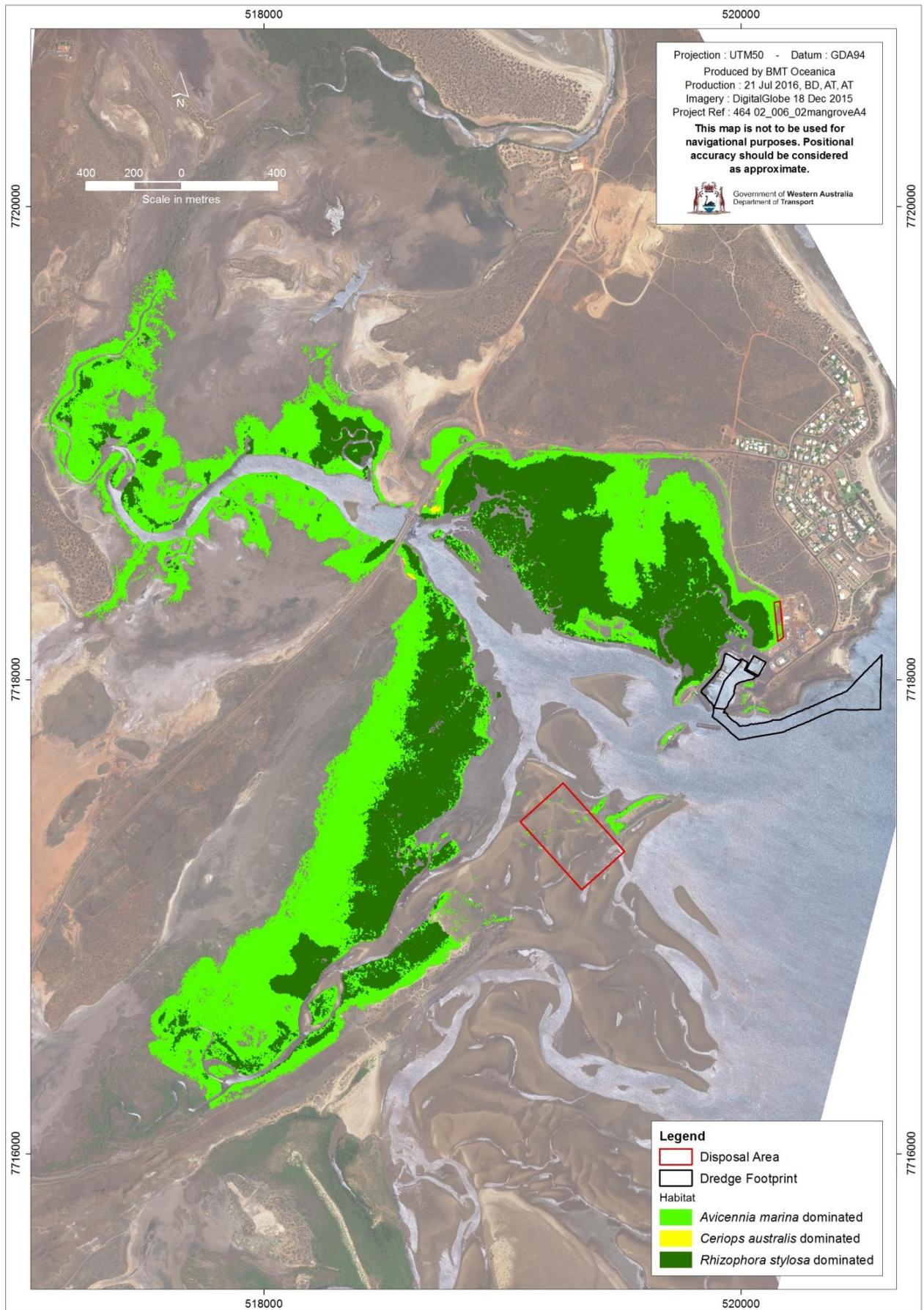


Figure 2.3 Mangrove habitat map for Popes Nose and Johns Creeks in 2015

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Appendix D

Aboriginal Heritage Inquiry System Search Tool Results



Search Criteria

3 Registered Aboriginal Sites in Custom search area (3); 518853.07mE, 7716722.96mN z50 (MGA94) : 521590.05mE, 7718795.83mN z50 (MGA94)

Disclaimer

The *Aboriginal Heritage Act 1972* preserves all Aboriginal sites in Western Australia whether or not they are registered. Aboriginal sites exist that are not recorded on the Register of Aboriginal Sites, and some registered sites may no longer exist.

The information provided is made available in good faith and is predominately based on the information provided to the Department of Aboriginal Affairs by third parties. The information is provided solely on the basis that readers will be responsible for making their own assessment as to the accuracy of the information. If you find any errors or omissions in our records, including our maps, it would be appreciated if you email the details to the Department at heritageenquiries@daa.wa.gov.au and we will make every effort to rectify it as soon as possible.



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Coordinate Accuracy

Accuracy is shown as a code in brackets following the coordinates. Map coordinates (Latitude/Longitude and Easting/Northing) are based on the GDA 94 Datum. The Easting/Northing map grid can be across one or more zones. The zone is indicated for each Easting on the map, i.e. '500000mE:Z50' means Easting=500000, Zone=50.

Terminology (NB that some terminology has varied over the life of the legislation)

Place ID/Site ID: This a unique ID assigned by the Department of Aboriginal Affairs to the place

Status:

- o **Registered Site:** The place has been assessed as meeting Section 5 of the *Aboriginal Heritage Act 1972*
- o **Other Heritage Place which includes:**
 - **Stored Data / Not a Site:** The place has been assessed as not meeting Section 5 of the *Aboriginal Heritage Act 1972*
 - **Lodged:** Information has been received in relation to the place, but an assessment has not been completed at this stage to determine if it meets Section 5 of the *Aboriginal Heritage Act 1972*

Status Reason: e.g. Exclusion - Relates to a portion of an Aboriginal site or heritage place as assessed by the Aboriginal Cultural Material Committee (ACMC). e.g. such as the land subject to a section 18 notice.

Origin Place ID: Used in conjunction with Status Reason to indicate which Registered Site this Place originates from.

Access and Restrictions:

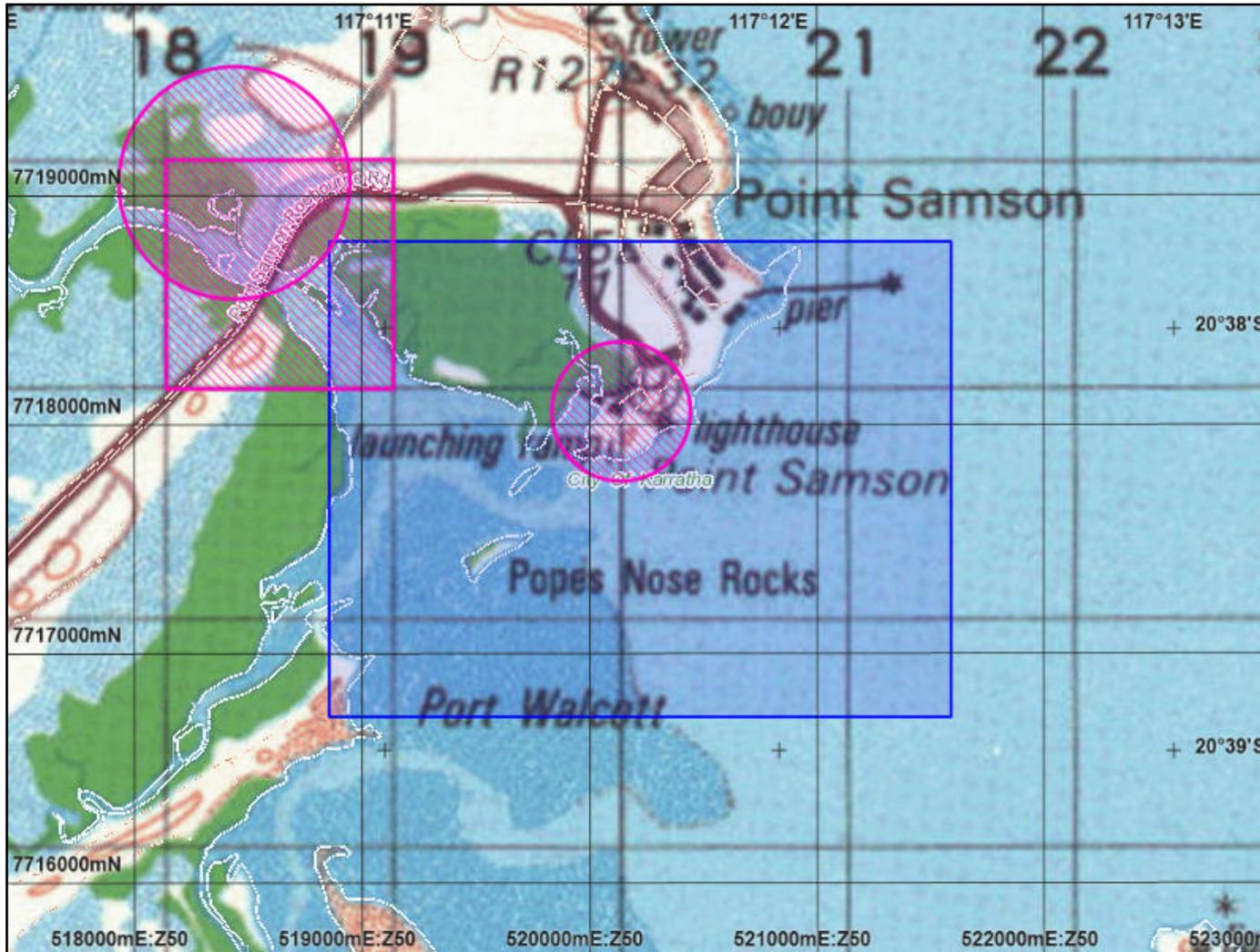
- o **File Restricted = No:** Availability of information (other than boundary) that the Department of Aboriginal Affairs holds in relation to the place is not restricted in any way.
- o **File Restricted = Yes:** Some of the information that the Department of Aboriginal Affairs holds in relation to the place is restricted if it is considered culturally sensitive. This information will only be made available if the Department of Aboriginal Affairs receives written approval from the informants who provided the information. Download the [Request to Access Restricted Information](#) letter and form.
- o **Boundary Restricted = No:** place location is shown as accurately as the information lodged with the Registrar allows.
- o **Boundary Restricted = Yes:** To preserve confidentiality the exact location and extent of the place is not displayed on the map. However, the shaded region (generally with an area of at least 4km²) provides a general indication of where the place is located. If you are a landowner and wish to find out more about the exact location of the place, please contact DAA.
- o **Restrictions:**
 - **No Restrictions:** Anyone can view the information.
 - **Male Access Only:** Only males can view restricted information.
 - **Female Access Only:** Only females can view restricted information

Legacy ID: This is the former unique number that the former Department of Aboriginal Sites assigned to the place. This has been replaced by the Place ID / Site ID.



List of Registered Aboriginal Sites with Map

Site ID	Site Name	File Restricted	Boundary Restricted	Restrictions	Status	Status Reason	Origin Place ID	Site Type	Knowledge Holders	Coordinates	Legacy ID
560	ROEBOURNE MIDDEN	No	No	No Gender Restrictions	Registered Site			Midden / Scatter		518639mE 7718656mN Zone 50 [Unreliable]	P07498
8797	POINT SAMSON 1	No	No	No Gender Restrictions	Registered Site			Artefacts / Scatter, Midden / Scatter, Shell		520139mE 7718055mN Zone 50 [Reliable]	P03722
8926	JINTUPI MIDDEN	No	No	No Gender Restrictions	Registered Site			Artefacts / Scatter, Midden / Scatter		518439mE 7719055mN Zone 50 [Unreliable]	P03569



Legend

Selected Heritage Sites

-  Registered Sites
-  Aboriginal Community Occupied
-  Aboriginal Community Unoccupied
-  Town
-  Search Area

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