7 FLORA AND FAUNA SURVEY LIMITATIONS AND CONSTRAINTS

Flora and fauna limitations of the current survey are summarised in Table 7.1 and Table 7.2.

Table 7.1: Summary of flora survey limitations

Constraint	Impact	Comment
Availability of contextual information at a regional and local scale	Nil	Broad scale vegetation, soil, and geology mapping data were available for the study area, in addition to flora database records, and conservation significant vegetation community records. This information is considered to be adequate to provide appropriate contextual information for the current survey.
Competency/experience of the team carrying out the survey, including experience in the bioregion surveyed	Nil	The botanists undertaking the field component of the survey have conducted numerous botanical surveys in Western Australia, including surveys in the Geraldton Sandplains Bioregion. The botanist responsible for plant identifications has completed identifications for many surveys from across WA, including the Geraldton Sandplains.
Proportion of flora recorded and/or collected, any identification issues	Minor	Representative specimens of all taxa identified were collected during the field survey. A number of these could not be confidently identified to species level due to a lack of flowering or fruiting material.
Was the appropriate area fully surveyed (effort and extent)	Minor	Thirty-six relevés were surveyed across the entire study area, and much of the study area was able to be observed during traverses. All seismic lines within the study area were surveyed for conservation significant species. Due to time constrains, receiver lines were not able to be fully surveyed.
Access restrictions within the survey area	Nil	All parts of the study area were accessible by walking from existing vehicle tracks.
Survey timing, rainfall, season of survey	Moderate	Due to suboptimal seasonality it is likely that some annual or ephemeral taxa will have been undetectable, and some conservation significant taxa, including perennial taxa, may not have been detectable.
Disturbance that may have affected the results of survey such as fire, flood or clearing	Nil	There were no natural or human interventions that constrained the survey of the study area.

Table 7.2: Summary of fauna survey limitations

Factor	Constraint	Comments
Competency and experience of consultants	Nil	Field personal had appropriate qualifications and several years' experience undertaking fauna surveys of this nature within this region (Table 4-3).
Scope	Nil	The scope was well defined. Fauna and their habitats were surveyed using standardised and well-established techniques. Relevant databases and previous studies surrounding the study area were reviewed.
Proportion of fauna identified recorded and/or collected	Nil	A detailed fauna survey was not a vital component for this level of assessment (Level 1 Survey). A comprehensive desktop study adequately gathered background information on the study area. A reconnaissance survey verified the desktop results and characterised habitats and terrestrial fauna likely to be present to enable an identification of potential impacts.
Sources of information sources (e.g. historic or recent)	Nil	Comprehensive database records, including conservation significant species, were available and considered adequate to provide appropriate contextual information for the survey. The study area is located in a relatively well-surveyed region in which *ecologia* has previous experience.
Proportion of task achieved, and further work which might be needed	Nil	Planned survey works were conducted and completed according to an agreed scope.
Timing / weather / season / cycle	Minor	A single phase Level 1 survey was conducted. Generally average rainfall was recorded in the vicinity of the study area in the four months prior to the December survey, however, this is unlikely to impact overall results.
Disturbances which May affect results of survey	Nil	There were no natural or human interventions that constrained the survey of the study area.
Intensity	No	The survey intensity was considered adequate and was appropriate for a Level 1 fauna assessment.
Completeness	No	The Level 1 survey was considered complete. Database searches were comprehensive and a large proportion of the Study Area was sampled on foot to verify desktop results and characterised habitats.
Resources	No	Resources were adequate to carry out the survey and survey participants were competent in the identification of species and likelihood of occurrence. Database searches were used to prepare for the survey.
Remoteness / access problems	No	The study area was easily accessible by vehicle and on foot.
Availability of contextual information on the region	No	The data available for the Geraldton Sandplains bioregion was adequate for the level of survey work undertaken during this assessment.

8 REFERENCES

Astron. 2015. 2D Seismic Survey, On-ground Ecological Survey (Nov-Dec 2015). Report prepared by Astron Environmental Services for UIL Energy. December 2015.

Bamford. 2013. Wedgetail Circle, Parkerville Fauna Assessment. Prepared for Coterra Environment. . Bamford Consulting Ecologists

Beard, J. S. 1976. Vegetation survey of Western Australia - Murchison 1:1 000 000 vegetation series. University of Western Australia Press, Perth.

Benshemesh, J. 2007. National Recovery Plan for Malleefowl.

Bush, B., Maryan, B., Browne-Cooper, R., and Robinson, D. 2007. Reptiles and Frogs in the Bush: Southwestern Australia. University of Western Australia Press, Crawley, Western Australia.

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

CALM. 1999. Environmental Weed Strategy for Western Australia. Department of Conservation and Land Management, Government of Western Australia, Western Australia.

Cogger, H. G. 2000. Reptiles and Amphibians of Australia. Reed New Holland, Sydney.

Crowley, R. D., Heislers, A., and Ealey, E. H. M. 1969. Effects of fire on wildlife. Proceedings Fire Ecology Symposium, Monash University.

DAFWA. 2007. Biosecurity and Agriculture Management Act 2007. As at 01 May 2013. Department of Agriculture and Food Western Australia. Government of Western Australia, South Perth.

DAFWA. 2016. Western Australian Organism List (WAOL) - Declared pest list. Available at https://www.agric.wa.gov.au/bam/western-australian-organism-list-waol. Department of Agriculture and Food Western Australia. Government of Western Australia., South Perth.

DEC. 2011. Plants Used by Carnaby's Black Cockatoo. List prepared by Christine Groom. Western Australian Department of Parks and Wildlife.

Desmond, A. J. and Chant, A. 2003. Geraldton Sandplains 3 (GS3 - Lesueur Sandplain subregion). pp. 293-313 *in* May, J. E., and McKenzie, N. L., eds. A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002. Department of Environment and Conservation, Perth.

DoEE. 2017a. EPBC Act Protected Matters Search Tool. Available at: http://www.environment.gov.au/. Department of the Environment and Energy. Canberra , Australia.

DoEE. 2017b. Species Profile and Threats Database: Calyptorhynchus latirostris — Carnaby's Cockatoo, Carnaby's Black-Cockatoo, Short-billed Black-Cockatoo. . Department of Environment and Energy. http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=59523

DPaW. 2013. Carnaby's Cockatoo (Calyptorhynchus latirostris) Recovery Plan. . Western Australian Department of Parks and Wildlife.

DPaW. 2015a. List of Threatened Ecological Communities endorsed by the Western Australian Minister for Environment (25 June 2015). Species and Communities Branch, Department of Parks and Wildlife.

DPaW. 2015b. Priority Ecological Communities for Western Australia version 23 (3 December 2015). Species and Community Branch, Department of Parks and Wildlife, Western Australia.

DSEWPaC. 2010. Survey Guidelines for Australia's Threatened Birds. Department of Sustainability, Environment, Water, Population and Communities.

DSEWPaC. 2011a. Survey Guidelines for Australia's Threatened Bats. Department of Sustainability, Environment, Water, Population and Communities.

DSEWPaC. 2011b. Survey guidelines for Australia's Threatened Mammals. Department of Sustainability, Environment, Water, Population and Communities.

DSEWPaC. 2011c. Survey Guidelines for Australia's Threatened Reptiles. Department of Sustainability, Environment, Water, Population and Communities.

DSEWPaC. 2012a. EPBC Act referral guidelines for three threatened black cockatoo species: Carnaby's cockatoo (endangered) *Calyptorhynchus latirostris*, Baudin's cockatoo (vulnerable) *Calyptorhynchus baudinii*, Forest red-tailed black cockatoo (vulnerable) *Calyptohynchus banksii naso*. Department of Sustainability, Environment, Water, Population and Communities, Canberra.

DSEWPaC. 2012b. Interim Biogeographic Regionalisation for Australia (IBRA), Version 7. Australian Government Department of Sustainability, Environment, Water, Population and Communities.

DSEWPaC. 2012c. Weeds of National Significance (WONS). Department of Sustainability, Environment, Water, Population and Communities. Commonwealth of Australia. Available at: http://www.environment.gov.au/biodiversity/invasive/weeds/weeds/lists/wons.html.

ecologia. 2013. Green Rock Energy, Desktop Biological Assessment, L12-7 Perth Basin Exploration. Report by ecologia Environmental to Green Rock Energy, July 2013.

EPA. 2002a. Position Statement No. 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection. . Environmental Protection Authority, Western Australia.

EPA. 2002b. Terrestrial Biological Surveys as an Element of Biodiversity Protection *in* Environmental Protection Authority, ed, Perth.

EPA. 2004a. Guidance for the Assessment of Environmental Factors. Guidance Statement 51: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia. Environmental Protection Authority, Western Australia.

EPA. 2004b. Guidance for the Assessment of Environmental Factors No. 51: Terrestrial flora and vegetation surveys for environmental impact assessment in Western Australia. Environmental Protection Authority, Perth.

EPA. 2004c. Guidance Statement No. 56: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia *in* Authority, E. P., ed.

EPA 2016. Technical Guidance - Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment (Environmental Protection Authority December 2016). Perth, Western Australia.

EPA & DPaW. 2015. Technical Guide - Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment (eds. K Freeman, G Stack, S Thomas and N Woolfrey). Perth, Western Australia.

EPA and DEC. 2010. Technical Guide - Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment. Environmental Protection Authority and Department of Environment and Conservation *in* Hyder, B. M., Dell, J., Cowan, M. A., ed. Environmental Protection Authority and Department of Environment and Conservation.

EPA and DPaW. 2015. Technical Guide - Flora and Vegetation Surveys for Environmental Impact Assessment.

Finn, H. 2012. Assessment of habitat values for black-cockatoos within selected sites at Newmont Boddington Gold Mine. Report prepared for Newmont Boddington Gold Pty Ltd.

Garnett, S. T. and Crowley, G. M. 2000. The Action Plan for Australian Birds. Environment Australia, Canberra.

Groom, C. 2015. Roost site fidelity and resource use by Carnaby's Cockatoo, Calyptorhynchus latriostris, on the Swan coastal plain, Western Australia. School of Animal Biology. University of Western Australia. January 2015. University of Western Australia. .

Johnstone, R.E., Johnstone, C. and Kirkby, T. 2007. Assessment of Significant Habitat for Carnaby's Cockatoo *Calyptorhynchus latirostris* in the Eneabba region. Unpublished Report for Iluka Resources. December 2007. 2007

Johnstone, R. E., Johnstone, C., and Kirkby, T. 2008. Further Assessment of Significant Habitat for Carnaby's Cockatoo *Calyptorhynchus Latirostris* in the Eneabba Region. Unpublished Report Prepared for Iluka Resources Ltd. August 2008.

Johnstone, R. E., Johnstone, C., and Kirkby, T. 2009. Carnaby's Cockatoo Calyptorhynchus Latirostris in the Eneabba Region. Unpublished Report Prepared for Iluka Resources Ltd. February 2009.

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

Lee, J., Finn, H., and Calver, M. 2013. Feeding activity of threatened black cockatoos in mine-site rehabilitation in the jarrah forest of south-western Australia. Australian Journal of Zoology. 61:119-131. Australian Journal of Zoology.

Northcote, K. H., Beckmann, G. G., Bettenay, E., Churchward, H. M., Van Dijk, D. C., Dimmock, G. M., Hubble, G. D., Isbell, R. F., McArthur, W. M., Murtha, G. G., Nicolls, K. D., Paton, T. R., Thompson, C. H., Webb, A. A., and Wright, M. J. 1960-1968. Atlas of Australian Soils, Sheets 1 to 10. With explanatory data. CSIRO Australia and Melbourne University Press, Melbourne.

Pizzey, G. and Knight, F. 2003. A Field Guide to the Birds of Australia. Harper Collins Publishers, Sydney.

Shepherd, D. P., Beeston, G. R., and Hopkins, A. J. M. 2001. Native vegetation in Western Australia: Extent, type and status. Technical Report 249. Department of Agriculture, South Perth, Western Australia.

Strategen. 2016. Upper Swan Development. Biological Survey Report. Prepared for Satterley Property Group by Strategen. August 2016. . Strategen Environmental.

Tille, P. 2006. Soil Landscapes of Western Australia's Rangelands and Arid Interior. Resource Management Technical Report 313. Department of Agriculture and Food, Western Australia.

Valentine, L. E. and Stock, W. E. 2008. Food Resources of Carnaby's Black-cockatoo (*Calyptorhynchus latirostris*) in the Gnangara Sustainability Strategy Study Area. Report prepared for Gnangara Sustainability Strategy.

Wells, R. W. 2007. Some taxonomic and nomenclatural considerations on the class Reptilia in Australia. The genus *Cyclodomorphus* Fitzinger, 1843 with a new interpretation of *Cyclodomorphus branchialis* species-group. Australian Biodiversity Record. 2007:1-23.

Western Australian Herbarium. 1998-2016. FloraBase - The Western Australian Flora. Government of Western Australia Department of Parks and Wildlife. Available at: http://florabase.dpaw.wa.gov.au.

Whitford, K. R. 2002. Hollows in jarrah (*Eucalyptus marginata*) and marri (*Corymbia calophylla*) trees: I. Hollow sizes, tree attributes and ages. Forest Ecology and Management. 160:201-214.

Whitford, K. R. and Williams, M. R. 2002. Hollows in jarrah (*Eucalyptus marginata*) and marri (*Corymbia calophylla*) trees: II. Selecting trees to retain for hollow dependent fauna. Forest Ecology and Management. 160:215-232.

Wilson, S. and Swan, G. 2013. *A Complete Guide to Reptiles of Australia*. New Holland Publishers, Sydney.

Woinarski, J., Burbidge, A., and Harrison, P. 2012. The Action Plan for Australian Mammals. CSIRO Publishing.

APPENDIX A DEFINITIONS

Threatened (WC Act) and Priority flora Categories

Code	Definition
T	**Threatened flora – (Declared Rare Flora – Extant)** Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection and have been gazetted as such (Schedule 1 under the *Wildlife Conservation Act 1950*).
X	**Presumed Extinct Flora (Declared Rare Flora - Extinct)** Taxa which have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such Schedule 2 under the *Wildlife Conservation Act 1950*).
P1	**Priority One – Poorly Known Species** Species that are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.
P2	**Priority Two – Poorly Known Species** Species that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. Species may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes.
P3	**Priority Three – Poorly Known Species** Species that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.
P4	**Priority Four – Rare, Near Threatened and other species in need of monitoring** (a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened. Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.
P5	**Priority Five - Conservation Dependent species** Species that are not threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.

Threatened flora (EPBC Act) Categories

Code	Definition
Ex	**Extinct** Taxa which at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.
ExW	**Extinct in the Wild** Taxa which is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
CE	**Critically Endangered** Taxa which at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
E	**Endangered** Taxa which is not critically endangered and it is facing a very high risk of extinction in the wild in the immediate or near future, as determined in accordance with the prescribed criteria.
V	**Vulnerable** Taxa which is not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
CD	**Conservation Dependent** Taxa which at a particular time if, at that time, the species is the focus of a specific conservation programme, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years.

Definition of codes for Threatened Ecological Communities

Code	Definition
PD: Presumed Totally Destroyed	An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future. An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant
CR: Critically Endangered	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated. An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future.
EN: Endangered	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future. An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future.
VU: Vulnerable	An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range. An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future.

Definition of codes for Priority Ecological Communities

Code	Definition
P1: Priority One	Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or Pastoral lands, urban areas, active mineral leases) and for which current threats exist. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
P2: Priority Two	Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, State forest, unallocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.
P3: Priority Three	(i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: (ii) Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; (iii) Communities made up of large, and/or widespread occurrences that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes. Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.
P4: Priority Four	Ecological communities that are adequately known, Rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring. (a) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands. (b) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. (c) Ecological communities that have been removed from the list of threatened communities during the past five years.
P5: Priority Five	Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Control categories for Declared Pests (Weeds)

Declared plant category	Description
C1 - Exclusion	Pests assigned to this category are not established in WA and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.
C2 - Eradication	Pests assigned to this category are present in WA in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.
C3 - Management	Pests assigned to this category are established in WA but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.

Definition of codes for vegetation condition

Vegetation condition (EPA & DPaW 2015)	Criteria
1	Pristine or nearly so, no obvious sign of disturbance or damage caused by human activities.
2	Vegetation structure intact; disturbance affecting individual species; weeds are non-aggressive species. Damage to trees caused by fire, the presence of non-aggressive weeds and occasional vehicle tracks.
3	Vegetation structure altered; obvious signs of disturbance. Disturbance to vegetation structure caused by repeated fires; the presence of some more aggressive weeds; dieback; logging and grazing.
4	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. Disturbance to vegetation structure caused by very frequent fires; the presence of some very aggressive weeds; partial clearing; dieback and grazing.
6	Basic vegetation structure severely impacted by disturbance. Scope for regeneration by not to a state approaching good condition without intensive management. Disturbance to vegetation structure caused by very frequent fires; the presence of some very aggressive weeds at high density; partial clearing; dieback and grazing.
7	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as “parkland cleared” with the flora comprising weed or crop species with isolated native trees or shrubs.

Categorisation of environmental weeds

Criteria	Description
Invasiveness	Ability to invade bushland in good to excellent condition or ability to invade waterways.
Distribution	Wide current or potential distribution including consideration of known history of widespread distribution elsewhere in the world.
Environmental impacts	Ability to change the structure, composition and function of ecosystems. In particular an ability to form single-species stands.
Category	**Scoring System**
High	A species which scores yes to all three of the above criteria. A rating of high indicates a species that should be prioritised for control and/or research.
Moderate	A species which scores yes for two of the above criteria. A rating of moderate indicates a species which should be monitored. Control or research should be directed to it if funds are available.
Mild	A species which scores yes to one of the criteria. A mild rating indicates monitoring or control if appropriate.
Low	A species which does not score yes for any of the criteria. A low rating indicates a low requirement for monitoring.

Threatened (WC Act) Fauna Categories

Category	Code	Definition	Schedule
Critically Endangered	CR	Threatened species considered to be facing an extremely high risk of extinction in the wild. Published as Specially Protected under the *Wildlife Conservation Act 1950,* in Schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.	**Schedule 1** Fauna that is rare or is likely to become extinct as critically endangered fauna
Endangered	EN	Threatened species considered to be facing a very high risk of extinction in the wild. Published as Specially Protected under the *Wildlife Conservation Act 1950,* in Schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.	**Schedule 2** Fauna that is rare or is likely to become extinct as endangered fauna
Vulnerable	VU	Threatened species considered to be facing a high risk of extinction in the wild. Published as Specially Protected under the *Wildlife Conservation Act 1950,* in Schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.	**Schedule 3** Fauna that is rare or is likely to become extinct as vulnerable fauna
Presumed Extinct	EX	Species which have been adequately searched for and there is no reasonable doubt that the last individual has died. Published as Specially Protected under the *Wildlife Conservation Act 1950,* in Schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice for Presumed Extinct Fauna and Wildlife Conservation (Rare Flora) Notice for Presumed Extinct Flora.	**Schedule 4** Fauna presumed to be extinct
Migratory	IA	Birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and the Bonn Convention, relating to the protection of migratory birds. Published as Specially Protected under the *Wildlife Conservation Act 1950,* in Schedule 5 of the Wildlife Conservation (Specially Protected Fauna) Notice.	**Schedule 5** Migratory birds protected under an international agreement
Conservation Dependent	CD	Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened. Published as Specially Protected under the *Wildlife Conservation Act 1950,* in Schedule 6 of the Wildlife Conservation (Specially Protected Fauna) Notice.	**Schedule 6** Fauna that is of special conservation need as conservation dependent fauna
Special Protection	OS	Fauna otherwise in need of special protection to ensure their conservation. Published as Specially Protected under the *Wildlife Conservation Act 1950,* in Schedule 7 of the Wildlife Conservation (Specially Protected Fauna) Notice.	**Schedule 7** Other specially protected fauna

Fauna (EPBC Act) Categories

Category	Code	Definition
Extinct	Ex	Fauna not definitely located in the wild during the past 50 years
Extinct in the Wild	EW	Fauna which is known only to survive in captivity
Critically Endangered	CR	Fauna that is considered to be facing an extremely high risk of extinction in the wild in the immediate future
Endangered	EN	Fauna that is considered to be facing a very high risk of extinction in the wild in the near future
Vulnerable	VU	Fauna that is considered to be facing a high risk of extinction in the wild in the medium-term future
Conservation Dependent	CD	Fauna whose survival depends upon ongoing conservation measures. Without these measures, a conservation dependent taxon would be classified as Vulnerable or more severely threatened.
Migratory	IA	Fauna that migrates to, over and within Australia and its external territories.

Definition of codes for Priority Fauna

Code	Definition
P1: Priority One	**Poorly-known species** Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
P2: Priority Two	**Poorly-known species** Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
P3: Priority Three	**Poorly-known species** Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
P4: Priority Four	**Rare, Near Threatened and other species in need of monitoring** (a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for Vulnerable, but are not listed as Conservation Dependent. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

APPENDIX B VASCULAR FLORA SPECIES RECORDED WITHIN 20 KM OF THE STUDY AREA

* Summary statistics of NatureMap records within 20 km of the study area

NatureMap
Mapping Western Australia's biodiversity

NatureMap Species Report

Created By Guest user on 13/03/2017

Kingdom	Plantae
Current Names Only	Yes
Core Datasets Only	Yes
Method	'By Circle'
Centre	115° 22' 04" E,29° 59' 02" S
Buffer	20km
Group By	Kingdom

Area (ha)		125622.02
Taxa:	Naturalised	41
	Native	1009
Endemics:		5
Families:		78
Genera:		274
Conservation Status:	-	904
	1	5
	3	55
	T	24
	4	28
	2	34
MS Status:	-	1002
	PN	44
	MS	4
Rank:	-	876
	forma	5
	subsp.	118
	var.	51

Top Ten Families

		Species	Records
1.	Myrtaceae	173	1143
2.	Proteaceae	156	1000
3.	Fabaceae	117	462
4.	Ericaceae	43	230
5.	Cyperaceae	37	161
6.	Stylidiaceae	36	144
7.	Haemodoraceae	35	215
8.	Asteraceae	33	59
9.	Goodeniaceae	31	127
10.	Asparagaceae	28	67

Top Ten Genera

		Species	Records
1.	*Banksia*	48	359
2.	*Acacia*	39	137
3.	*Eucalyptus*	37	335
4.	*Stylidium*	34	139
5.	*Verticordia*	29	223
6.	*Leucopogon*	27	126
7.	*Drosera*	25	81
8.	*Hakea*	25	148
9.	*Grevillea*	25	135
10.	*Daviesia*	22	118

[1]Endemic To Query Area

Name ID	Species	Conservation Status
6377	*Daviesia debilior*	
26364	*Grevillea metamorpha*	P1
15775	*Petrophile nivea*	T
16894	*Ptilotus falcatus*	P1
19690	*Tetratheca nephelioides*	T

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

APPENDIX C TERRESTRIAL FAUNA SPECIES RECORDED WITHIN 20 KM OF THE STUDY AREA

Appendix C1 NatureMap Search Results within 20 km of the study area

Appendix C2 BirdLife Search Results within 20 km of the study area

NatureMap Species Report

Created By Guest user on 27/02/2017

Current Names Only Yes
Core Datasets Only Yes
Species Group Mammals
Method 'By Circle'
Centre 115° 22' 04" E,29° 59' 32" S
Buffer 20km

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
1.	24187	*Chalinolobus morio (Chocolate Wattled Bat)*			
2.	24132	*Macropus fuliginosus (Western Grey Kangaroo)*			
3.	24135	*Macropus robustus subsp. erubescens (Euro, Biggada)*			
4.	24223	*Mus musculus (House Mouse)*	Y		
5.	24194	*Nyctophilus geoffroyi (Lesser Long-eared Bat)*			
6.	24085	*Oryctolagus cuniculus (Rabbit)*	Y		
7.	24230	*Pseudomys albocinereus (Ash-grey Mouse)*			
8.	24173	*Pteropus scapulatus (Little Red Flying-fox)*			
9.	24243	*Rattus fuscipes (Western Bush Rat)*			
10.	24112	*Sminthopsis granulipes (White-tailed Dunnart)*			
11.	24207	*Tachyglossus aculeatus (Short-beaked Echidna)*			
12.	24167	*Tarsipes rostratus (Honey Possum, Noolbenger)*			
13.	24040	*Vulpes vulpes (Red Fox)*	Y		

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 wholely 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.

NatureMap
Mapping Western Australia's biodiversity

NatureMap Species Report

Created By Guest user on 27/02/2017

Current Names Only Yes
Core Datasets Only Yes
Species Group Birds
Method 'By Circle'
Centre 115° 22' 04" E,29° 59' 32" S
Buffer 20km

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
1.	24559	*Acanthagenys rufogularis (Spiny-cheeked Honeyeater)*			
2.	24260	*Acanthiza apicalis (Broad-tailed Thornbill, Inland Thornbill)*			
3.	24261	*Acanthiza chrysorrhoa (Yellow-rumped Thornbill)*			
4.	24262	*Acanthiza inornata (Western Thornbill)*			
5.	24265	*Acanthiza uropygialis (Chestnut-rumped Thornbill)*			
6.	24560	*Acanthorhynchus superciliosus (Western Spinebill)*			
7.	25536	*Accipiter fasciatus (Brown Goshawk)*			
8.	25755	*Acrocephalus australis (Australian Reed Warbler)*			
9.	41323	*Actitis hypoleucos (Common Sandpiper)*		IA	
10.	24312	*Anas gracilis (Grey Teal)*			
11.	24316	*Anas superciliosa (Pacific Black Duck)*			
12.	24561	*Anthochaera carunculata (Red Wattlebird)*			
13.	24562	*Anthochaera lunulata (Western Little Wattlebird)*			
14.	25670	*Anthus australis (Australian Pipit)*			
15.	24285	*Aquila audax (Wedge-tailed Eagle)*			
16.	24341	*Ardea pacifica (White-necked Heron)*			
17.	24610	*Ardeotis australis (Australian Bustard)*			
18.	25566	*Artamus cinereus (Black-faced Woodswallow)*			
19.	24353	*Artamus cyanopterus (Dusky Woodswallow)*			
20.		*Barnardius zonarius*			
21.	24319	*Biziura lobata (Musk Duck)*			
22.	25714	*Cacatua pastinator (Western Long-billed Corella)*			
23.	25715	*Cacatua roseicapilla (Galah)*			
24.	25716	*Cacatua sanguinea (Little Corella)*			
25.	25598	*Cacomantis flabelliformis (Fan-tailed Cuckoo)*			
26.	42307	*Cacomantis pallidus (Pallid Cuckoo)*			
27.	24269	*Calamanthus campestris (Rufous Fieldwren)*			
28.	34000	*Calamanthus campestris subsp. montanellus (Rufous Fieldwren, Western Fieldwren (western wheatbelt))*			
29.	24734	*Calyptorhynchus latirostris (Carnaby's Cockatoo (short-billed black-cockatoo), Carnaby's Cockatoo)*		T	
30.	24377	*Charadrius ruficapillus (Red-capped Plover)*			
31.	24321	*Chenonetta jubata (Australian Wood Duck, Wood Duck)*			
32.		*Cheramoeca leucosterna*			
33.	24488	*Cheramoeca leucosternus (White-backed Swallow)*			
34.	24431	*Chrysococcyx basalis (Horsfield's Bronze Cuckoo)*			
35.	24833	*Cincloramphus cruralis (Brown Songlark)*			
36.	24834	*Cincloramphus mathewsi (Rufous Songlark)*			
37.	24289	*Circus assimilis (Spotted Harrier)*			
38.	25675	*Colluricincla harmonica (Grey Shrike-thrush)*			
39.	24399	*Columba livia (Domestic Pigeon)*	Y		
40.	25568	*Coracina novaehollandiae (Black-faced Cuckoo-shrike)*			
41.	24416	*Corvus bennetti (Little Crow)*			
42.	25592	*Corvus coronoides (Australian Raven)*			
43.	24417	*Corvus coronoides subsp. perplexus (Australian Raven)*			
44.	24671	*Coturnix pectoralis (Stubble Quail)*			
45.	24420	*Cracticus nigrogularis (Pied Butcherbird)*			
46.	25595	*Cracticus tibicen (Australian Magpie)*			
47.	25596	*Cracticus torquatus (Grey Butcherbird)*			
48.	24322	*Cygnus atratus (Black Swan)*			
49.	30901	*Dacelo novaeguineae (Laughing Kookaburra)*	Y		
50.	25607	*Dicaeum hirundinaceum (Mistletoebird)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
51.	24470	*Dromaius novaehollandiae (Emu)*			
52.		*Egretta novaehollandiae*			
53.		*Elanus axillaris*			
54.		*Elseyornis melanops*			
55.		*Eolophus roseicapillus*			
56.	24652	*Eopsaltria georgiana (White-breasted Robin)*			
57.	24567	*Epthianura albifrons (White-fronted Chat)*			
58.	24570	*Epthianura tricolor (Crimson Chat)*			
59.	24379	*Erythrogonys cinctus (Red-kneed Dotterel)*			
60.	25621	*Falco berigora (Brown Falcon)*			
61.	25622	*Falco cenchroides (Australian Kestrel)*			
62.	25623	*Falco longipennis (Australian Hobby)*			
63.	25530	*Gerygone fusca (Western Gerygone)*			
64.	24443	*Grallina cyanoleuca (Magpie-lark)*			
65.	25734	*Himantopus himantopus (Black-winged Stilt)*			
66.	24491	*Hirundo neoxena (Welcome Swallow)*			
67.	25629	*Hirundo nigricans (Tree Martin)*			
68.	24367	*Lalage tricolor (White-winged Triller)*			
69.	25661	*Lichmera indistincta (Brown Honeyeater)*			
70.	24326	*Malacorhynchus membranaceus (Pink-eared Duck)*			
71.	25651	*Malurus lamberti (Variegated Fairy-wren)*			
72.	24544	*Malurus lamberti subsp. assimilis (Variegated Fairy-wren)*			
73.	25652	*Malurus leucopterus (White-winged Fairy-wren)*			
74.	24551	*Malurus pulcherrimus (Blue-breasted Fairy-wren)*			
75.	25654	*Malurus splendens (Splendid Fairy-wren)*			
76.	24583	*Manorina flavigula (Yellow-throated Miner)*			
77.	25663	*Melithreptus brevirostris (Brown-headed Honeyeater)*			
78.	24736	*Melopsittacus undulatus (Budgerigar)*			
79.	24598	*Merops ornatus (Rainbow Bee-eater)*		IA	
80.		*Microcarbo melanoleucos*			
81.	25747	*Ninox connivens (Barking Owl)*			
82.	25748	*Ninox novaeseelandiae (Boobook Owl)*			
83.	24820	*Ninox novaeseelandiae subsp. boobook (Boobook Owl)*			
84.	24742	*Nymphicus hollandicus (Cockatiel)*			
85.	24407	*Ocyphaps lophotes (Crested Pigeon)*			
86.	24618	*Oreoica gutturalis (Crested Bellbird)*			
87.	25680	*Pachycephala rufiventris (Rufous Whistler)*			
88.	25682	*Pardalotus striatus (Striated Pardalote)*			
89.	24659	*Petroica goodenovii (Red-capped Robin)*			
90.	25699	*Phalacrocorax varius (Pied Cormorant)*			
91.	24409	*Phaps chalcoptera (Common Bronzewing)*			
92.	25587	*Phaps elegans (Brush Bronzewing)*			
93.	24594	*Phylidonyris melanops (Tawny-crowned Honeyeater)*			
94.	25669	*Phylidonyris nigra (White-cheeked Honeyeater)*			
95.	24596	*Phylidonyris novaehollandiae (New Holland Honeyeater)*			
96.	24681	*Poliocephalus poliocephalus (Hoary-headed Grebe)*			
97.	24683	*Pomatostomus superciliosus (White-browed Babbler)*			
98.	24278	*Pyrrholaemus brunneus (Redthroat)*			
99.	25614	*Rhipidura leucophrys (Willie Wagtail)*			
100.	25534	*Sericornis frontalis (White-browed Scrubwren)*			
101.	24279	*Sericornis frontalis subsp. maculatus (White-browed Scrubwren)*			
102.	30948	*Smicrornis brevirostris (Weebill)*			
103.	25655	*Stipiturus malachurus (Southern Emu-wren)*			
104.	25705	*Tachybaptus novaehollandiae (Australasian Grebe, Black-throated Grebe)*			
105.	24331	*Tadorna tadornoides (Australian Shelduck, Mountain Duck)*			
106.	30870	*Taeniopygia guttata (Zebra Finch)*			
107.	24845	*Threskiornis spinicollis (Straw-necked Ibis)*			
108.	42351	*Todiramphus pyrrhopygius (Red-backed Kingfisher)*			
109.	25549	*Todiramphus sanctus (Sacred Kingfisher)*			
110.		*Tribonyx ventralis*			
111.	24851	*Turnix velox (Little Button-quail)*			
112.	24386	*Vanellus tricolor (Banded Lapwing)*			
113.	25765	*Zosterops lateralis (Grey-breasted White-eye, Silvereye)*			

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

APPENDIX D TERRESTRIAL FAUNA OF CONSERVATION SIGNIFICANCE RECORDED WITHIN THE VICINITY OF THE STUDY AREA

Appendix D1 DPaW Threatened and Priority Fauna Search Results within 50 km of the study area

Appendix D2 NatureMap Conservation Significant Fauna Results within 20 km of the study area

	Common Name	Status
Mammals		
Megaptera novaeangliae	Humpback Whale	CD
Macropus irma	Western Brush Wallaby	P4
Eubalaena australis	Southern Right Whale	VU
Macroderma gigas	Ghost Bat	VU
Neophoca cinerea	Australian Sea-lion	VU
Birds		
Pezoporus flaviventris	Western Ground Parrot	CR
Calyptorhynchus baudinii	Baudin's Cockatoo	EN
Calyptorhynchus latirostris	Carnaby's Cockatoo	EN
Apus pacificus	Fork-Tailed Swift	IA
Ardea modesta	Great Egret, White Egret	IA
Arenaria interpres	Ruddy Turnstone	IA
Calidris acuminata	Sharp-Tailed Sandpiper	IA
Calidris alba	Sanderling	IA
Calidris ruficollis	Red-Necked Stint	IA
Merops ornatus	Rainbow Bee-Eater	IA
Numenius phaeopus	Whimbrel	IA
Plegadis falcinellus	Glossy Ibis	IA
Pluvialis fulva	Pacific Golden Plover	IA
Pluvialis squatarola	Grey Plover	IA
Puffinus pacificus (Ardenna pacifica)	Wedge-Tailed Shearwater	IA
Sterna caspia (Hydroprogne caspia)	Caspian Tern	IA
Tringa glareola	Wood Sandpiper	IA
Tringa nebularia	Common Greenshank	IA
Charadrius leschenaultii	Greater Sand Plover	IA (& VU as subsp)
Limosa lapponica	Bar-Tailed Godwit	IA (& VU as subsp)
Falco peregrinus	Peregrine Falcon	OS
Charadrius rubricollis	Hooded Plover	P4
Oxyura australis	Blue-Billed Duck	P4
Leipoa ocellata	Malleefowl	VU
Sterna nereis nereis	Fairy Tern	VU
Calidris ferruginea	Curlew Sandpiper	VU & IA
Limosa lapponica menzbieri	Bar-Tailed Godwit	VU (& IA at sp. level)
Reptiles		
Aspidites ramsayi (southwest subpop.)	Woma (Southwest Sub pop.)	P1
Neelaps calonotos	Black-Striped Snake	P3
Cyclodomorphus branchialis	Common Slender Blue-tongue	VU
Dermochelys coriacea	Leatherback Turtle	VU
Egernia stokesii badia	Western Spiny-tailed Skink	VU
Invertebrates		
Austromerope poultoni	(A Scorpionfly)	P2
Phasmodes jeeba	(A Cricket)	P2
Hemisaga vepreculae	(A Cricket)	P3
Hylaeus globuliferus	Woolybush Bee	P3
Synemon gratiosa	Graceful Sunmoth	P4
Idiosoma nigrum	Shield-Backed Trapdoor Spider	VU

NatureMap Species Report

Created By Guest user on 27/02/2017

Kingdom	Animalia
Conservation Status	Conservation Taxon (T, X, IA, S, P1-P5)
Current Names Only	Yes
Core Datasets Only	Yes
Method	'By Circle'
Centre	115° 22' 04" E,29° 59' 32" S
Buffer	20km

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
1.	41323	*Actitis hypoleucos (Common Sandpiper)*		IA	
2.	24734	*Calyptorhynchus latirostris (Carnaby's Cockatoo (short-billed black-cockatoo), Carnaby's Cockatoo)*		T	
3.	24598	*Merops ornatus (Rainbow Bee-eater)*		IA	
4.	25249	*Neelaps calonotos (Black-striped Snake)*		P3	
5.	24905	*Pogona minor subsp. minima (Dwarf Bearded Dragon (Houtman Abrolhos Is.), Dwarf Bearded Dragon)*		T	

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 wholely 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.