Government of Western Australia
Department of Mines and Petroleum

Clearing Permit Decision Report

1. Application details

1.1. Permit application details

Permit application No.: 7541/1
Permit type: Purpose Permit

1.2. Proponent details

Proponent's name: **Sandfire Resources NL**

1.3. Property details

Property: Mining Lease 52/1071
Miscellaneous Licence 52/170
Local Government Area: Shire of Meekatharra
Colloquial name: Monty Project

1.4. Application

Clearing Area (ha)	No. Trees	Method of Clearing	For the purpose of:
157.6		Mechanical Removal	Mineral Production

1.5. Decision on application

Decision on Permit Application: Grant
Decision Date: 18 May 2017

2. Site Information

2.1. Existing environment and information

2.1.1. Description of the native vegetation under application

Vegetation Description

Beard vegetation associations have been mapped for the whole of Western Australia and are useful to look at vegetation in a regional context. The following two Beard vegetation associations are located within the application area (GIS Database):

Beard Vegetation Association 18:;Low woodland; mulga (*Acacia aneura*); and

Beard Vegetation Association 29: Sparse low woodland; mulga & *Acacia victoriae* in scattered groups.

There has been at least three flora surveys conducted over parts of the application area (Sandfire Resources, 2017). A Level 2 flora and vegetation survey was conducted over the wider project area and included the majority of the application area. This survey was undertaken in 2015 by Mattiske Consulting Pty Ltd identified and the following 13 vegetation communities (Mattiske 2016; Sandfire Resources, 2017):

Drainage Channels

- Open scrub of *Acacia aneura* var. *aneura, Acacia aneura* var. *conifer, Acacia kempeana* and *Acacia tetragonophylla* over *Psydrax latifolia, Senna artemisioides* subsp. *helmsii, Eremophila galeata, Ptilotus obovatus* and *Solanum lasiophyllum* over mixed herbs over mixed grasses on flowlines on dolerite and ironstone pebbles on red/brown clay loam **(Vegetation code C1);**
- Low open woodland of *Acacia aneura, Acacia pteraneura, Acacia craspedocarpa, Acacia tetragonophylla* over *Eremophila galeata* over *Alternanthera nodiflora* and *Cyperus ?centralis* over mixed grasses with occasional emergent *Eucalyptus victrix* on flow-lines with dolerite and ironstone pebbles on red/brown sandy loam gravel **(Vegetation code C2)**;
- Scrub to thicket of *Acacia pteraneura, Acacia tetragonophylla, Acacia pruinocarpa* and *Psydrax latifolia* over *Eremophila forrestii* subsp. *forrestii, Solanum lasiophyllum, Ptilotus obovatus, Aristida contorta, Monachather paradoxus* and **Bidens bipinnata* on redbrown clay soils drainage lines and seasonally wet low lying areas (**Vegetation code C8**);
- Scrub of *Acacia paraneura* and *Acacia tetragonophylla* with emergent *Corymbia candida* over *Digitaria brownii* and *Eriachne mucronata* on red-brown sandy clays soils in major drainage channels (**Vegetation code C9**);

Woodlands

- Low woodland of *Acacia aneura, Acacia incurvaneura, Acacia pruinocarpa* and *Grevillea berryana* over *Eremophila foliosissima, Eremophila forrestii* subsp. *forrestii* and *Eremophila galeata* over *Ptilotus* species and mixed grasses on red/brown sandy loam flats with ironstone pebbles (**Vegetation code LW1**);

Shrublands

- Open scrub of *Grevillea berryana, Acacia aneura* and *Acacia kempeana* over *Eremophila incida, Eremophila margarethae, Eremophila forrestii* subsp. *forrestii, Ptilotus obovatus* and *Ptilotus schwartzii* over *Astrida contorta* and *Monachather paradoxus* on red/brown sandy loam flats with dolerite, ironstone and quartz (rarely) pebbles (**Vegetation code S1**);
- Open scrub of *Acacia incurvaneura, Acacia pruinocarpa, Acacia mulganeura* and *Acacia cuthbertsonii* subsp. *cuthbertsonii* over *Eremophila forrestii* subsp. *forrestii, Ptilotus obovatus, Sida picklesiana* (P3) and *Solanum lasiophyllum* on orange to red-brown clay loam soils on flats (**Vegetation code S11**);
- Open scrub of *Acacia macraneura* and *Acacia incurvaneura* over *Ptilotus schwartzii, Ptilotus obovatus, Solanum lasiophyllum, Eremophila galeata* and *Sida picklesiana* (P3) on red-brown clay loam soils with quartz pebbles on flats (**Vegetation code S12);**
- Scrub of *Acacia incurvaneura* over *Ptilotus obovatus* and *Senna glutinosa* subsp. *pruinosa* over *Aristida contorta, Sclerolaena eurotioides* and *Maireana convexa* on redbrown clay soils with ironstone and quartz rocks on flats (**Vegetation code S15**);
- Scrub to thicket of *Acacia incurvaneura, Acacia pruinocarpa, Acacia mulganeura* and *Acacia cuthbertsonii* subsp. *cuthbertsonii* over *Eremophila forrestii* subsp. *forrestii*, *Ptilotus obovatus, Sida picklesiana* (P3) and *Solanum lasiophyllum* on orange to red-brown clay loam soils on flats (**Vegetation code S16**);
- Open low shrubland of *Dodonaea pachyneura,Thryptomene decussata* and mixed shrubs on red-brown clay loam soils on flats and upper slopes (**Vegetation code S21**);
- Open low shrubland of *Solanum lasiophyllum, Ptilotus obovatus, Hemigenia virescens* (P3) and *Eremophila spectabilis* with emergent *Grevillea berryana* and mixed *Acacia* species over *Monachather paradoxus, Eragrostis ?kennedyae* and *Aristida contorta* on red-brown clay loam flats (**Vegetation code S22**);
- Scrub of *Acacia sect. Juliflorae (A. mulganeura, A. incurvaneura), Acacia pruinocarpa* and *Grevillea berryana* over *Aluta maisonneuvei* subsp. *auriculata* and *Ptilotus schwartzii* on red-brown rocky clay soils on slopes and ridges of hills (**Vegetation code S28**).

Note: Based on the preliminary mine site layout, the majority of the proposed clearing is expected to occur within vegetation community S11.

Clearing Description

Monty Project.
Sandfire Resources NL proposes to clear up to 157.6 hectares of native vegetation within a total boundary of approximately 1,761 hectares, for the purpose of mineral production. The project is located approximately 150 kilometres north of Meekatharra in the Shire of Meekatharra.

Vegetation Condition

Pristine: No obvious signs of disturbance (Keighery, 1994):

To:

Degraded: Structure severely disturbed; regeneration to good condition requires intensive management (Keighery, 1994).

Comment

The vegetation condition was derived from a flora and vegetation survey conducted by Mattiske Consulting Pty Ltd (2016).

3. Assessment of application against clearing principles

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

Comments

Proposal is not likely to be at variance to this Principle

The proposed clearing of up to 157.6 hectares of native vegetation will allow for the development of the Monty Project. Proposed mining activities include the construction and operation of an underground mine, Run of Mine (ROM) pad, haul roads, waste rock landforms, laydown yards, workshop and water storage infrastructure. The application area lies within the Augustus (GAS3) sub-region of the Gascoyne Interim Biogeographic Regionalisation of Australia (IBRA) bioregion (GIS Database). This sub-region is characterised by rugged low Proterozoic sedimentary and granite ranges divided by broad flat valleys (CALM, 2002).

A number of flora surveys have been conducted over the wider project area, which included the application area (Sandfire Resources, 2017). The most recent of which was a Level 2 flora and vegetation survey conducted in 2015 by Mattiske Consulting Pty Ltd which surveyed the application area and surrounding project areas.

Flora and vegetation surveys identified the occurrence of 13 vegetation communities within the application area, all of which are well represented regionally and not considered locally significant (Sandfire Resources, 2017; Mattikse, 2016). When rated using the Keighery condition scale (Keighery, 1994), the condition of these vegetation communities ranged from Degraded to Pristine (Mattiske, 2016). The majority of the vegetation is considered to be in “Excellent” condition and the areas defined as degraded were restricted to small areas that had previously been exposed to historic mining and pastoral activities (Mattiske, 2016).

No Threatened Priority Ecological Communities (TECs), Priority Ecological Communities (PECs) or Threatened flora are known to occur or have been recorded within the application area (DPaW, 2017; Mattiske, 2016; GIS Database).

A number of Priority flora species are known from the local area including three Priority 1 species, twelve Priority 3 and two Priority 4 species. *Sida picklesiana* (P3) was the only species identified within the application area which is to be impacted by the proposed clearing. A total of 19 individuals were recorded, however the

current site layout indicates that only one individual will be removed (Sandfire Resources, 2017). The proposed removal of one individual is not likely to result in significant impacts at a species or population level, as *Sida picklesiana* has been shown to be common within the project area and across the wider region (Mattiske, 2016).

Seven broad fauna habitats were identified within the application area during a Level 1 reconnaissance fauna survey, all of which are widespread and common in the local area and region (Bamford, 2016; Sandfire Resources, 2017). In addition to this, no fauna species of conservation significance were recorded during the survey, although areas of habitat associated with a drainage line in the western sections of M 52/1071 support a rich and abundant bird assemblage (Bamford, 2016; Sandfire Resources, 2017). In order to minimise impacts to this area, the proponent has excised the main part of the drainage line from the clearing permit boundary and realigned the haul road to avoid this habitat where possible (Sandfire Resources, 2017).

Bidens bipinnata was the only introduced flora species (weed) recorded during surveys of the application area and surrounds (Mattiske, 2016). The introduction of new weeds species or the spread of existing weeds have the potential to significantly change the dynamics of a natural ecosystem and lower the biodiversity of an area. Potential impacts to the biodiversity as a result of the proposed clearing may be minimised by the implementation of a weed management condition.

Based on the above, the proposed clearing is not likely to be at variance to this Principle.

Methodology

Bamford (2016)
CALM (2002)
DPaW (2017)
Mattiske (2016)
Sandfire Resources (2017)

GIS Database:
- IBRA WA (Regions - Sub Regions)
- Pre-European vegetation
- Threatened Ecological Sites Buffered

(b) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.

Comments

Proposal is not likely to be at variance to this Principle

A Level 1 fauna survey was conducted over the application area and adjacent area in October 2015 by Bamford Consulting Ecologists, during which seven broad fauna habitats were identified (Bamford, 2016):

1. Breakaways and lateritic slopes supporting Acacia shrublands (dominated by Mulga) with scattered *Corymbia ferriticola*
2. Lateritic, gravelly hills supporting Mulga shrublands with an Eremophila shrub layer. Upper, stony slopes support areas of *Thryptomene decussata* and low myrtaceous heath.
3. Quartzite Hills supporting Acacia shrublands, with some areas of exposed outcropping. A large quartzite plateau occurs in the west of the project area supporting Acacia shrublands areas of *Thryptomene* and low myrtaceous heath;
4. Dolerite Hills supporting Acacia shrublands, with rounded, stony slopes;
5. Stony footslopes and undulating stony plains supporting sparse / open Acacia and Eremophila shrublands;
6. Hardpan plains supporting groves of Mulga shrublands and *Acacia pruinocarpa*; and
7. Drainage tracts supporting dense Acacia shrublands with patches of fringing eucalypt woodland (*E. camaldulensis* or *Corymbia candida*). A major drainage line in the centre of the survey area is deeply incised and supports temporary waterbodies (pools) after flooding.

The majority of the application area is comprised of habitat type No.5, although the greatest percentage of impacts to any one habitat type is to habitat type No. 2 (13.1% of mapped extent recorded during surveys to be impacted) (Bamford, 2016; Sandfire Resources, 2017).

Most of the identified fauna habitats are broad in extent; however the drainage tracts (Habitat No. 7) are significant in providing connectivity across the landscape. Of particular significance is the dense Acacia shrublands and Eucalypt Woodlands associated with drainage lines (found within habitat type No. 7), which are important in providing connectivity across the landscape, supports a rich and abundant bird assemblage and is sensitive to hydrological change (Bamford, 2016). The large eucalypt trees contain shelter sites (tree hollows) for several specialised fauna species including a number of bats, owls and parrots. Rocky areas including the crests of quartzite hills, dolerite hills and breakaways also support a restricted fauna assemblage such as the Woolley's Pseudantechinus (*Pseudantechinus woolleyae)*, recorded from the quartzite hill and the Long-tailed Dunnart (*Sminthopsis longicaudata* – P4*),* which is a likely resident.

The major drainage line associated with habitat type No.7 has been excised from the application area and no breakaway habitat is to be disturbed, although areas of this habitat remain within the clearing permit boundary. In addition to excising areas of significant habitat associated with drainage lines, the proponent has committed

to retaining trees with hollows and reptile habitat where possible. Potential impacts to the fauna species associated with Breakaway habitat as a result of the proposed clearing may be minimised by the implementation of a restricted clearing condition.

A relatively small section of the Quartzite Hill habitat (habitat No. 3) will be impacted by the proposal. Clearing associated with the haul road will result in 2.9% of this habitat (mapped during fauna surveys) being impacted, which is not anticipated to result in significant impacts to dependent species.

The Level 1 fauna survey conducted over the application area included a search for Short Range Endemic (SRE) fauna species. The survey found that overall; the project area lacks the distinctive and isolated geological features known to promote short-range endemism in invertebrates (Bamford, 2016). No known invertebrate species of high conservation significance were recorded during the fauna survey. Gaius villosus was the only trapdoor spider species recorded. This species is widespread and not of conservation concern (Bamford, 2016).

Based on the above, the proposed clearing is not likely to be at variance to this Principle.

Methodology Bamford (2016)
Sandfire Resources (2017)

GIS Database
- Imagery

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

Comments **Proposal is not likely to be at variance to this Principle**

According to available databases, no Threatened flora species are known from the local area (20 kilometre radius) (DPaW, 2017; GIS Database) and none were identified during a Level 2 flora and vegetation survey of the application area and surrounding areas (Mattiske, 2016).

Based on the above, the proposed clearing is not likely to be at variance to this Principle.

Methodology DPaW (2017)
Mattiske (2016)

GIS Database
- Threatened and Priority Flora List

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

Comments **Proposal is not likely to be at variance to this Principle**

According to available databases, there are no known Threatened Ecological Communities (TECs) within 100 kilometres of the application area (GIS Database) and no communities analogous to any known TECs were recorded during a flora survey conducted over the area (Mattiske, 2016; Sandfire Resources, 2017).

Based on the above, the proposed clearing is not likely to be at variance to this Principle.

Methodology Mattiske (2016)
Sandfire Resources (2017)

GIS Database:
- Threatened and Priority Ecological Communities Buffers
- Threatened and Priority Ecological Communities Boundaries

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

Comments **Proposal is not at variance to this Principle**

The application area occurs within the Gascoyne Interim Biogeographic Regionalisation of Australia (IBRA) bioregion, in which approximately 99.9% of the pre-European vegetation remains (see table below) (Government of Western Australia, 2016; GIS Database).

The vegetation within the application area has been mapped as Beard vegetation associations 18 and 29 (GIS Database). As the below table illustrates, both Beard vegetation associations are well represented, retaining at least 99% of pre-European vegetation within the State and the bioregion (Government of Western Australia, 2016). Given the amount of vegetation remaining in the local area and bioregion, the vegetation proposed to be cleared is not considered to represent a remnant within an extensively cleared area.

	Pre-European area (ha)*	Current extent (ha)*	Remaining %*	Conservation Status**	Pre-European % in DPaW Managed Lands
IBRA Bioregion - Gascoyne	18,075,219.48	18,067,441	99.9	Least Concern	~ 10.3
Beard veg assoc. - State					
18	19,892,305	19,843,727	~ 99.8	Least Concern	~ 6.6
29	7,903,991	7,900,200	~ 99.9	Least Concern	~ 6.3
Beard veg assoc. - Bioregion					
18	3,273,580	3,271,339	~ 99.9	Least Concern	~ 9.6
29	3,802,460	3,799,636	~99.9	Least Concern	~ 7.8

* Government of Western Australia (2016)

** Department of Natural Resources and Environment (2002)

Based on the above, the proposed clearing is not at variance to this principle.

Methodology Department of Natural Resources and Environment (2002)
Government of Western Australia (2016)

GIS Database:
- IBRA WA (regions - subregions)
- Pre-European Vegetation

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

Comments **Proposal is at variance to this Principle**

The application area is in a semi-arid environment with no permanent waterbodies, wetlands or groundwater dependent ecosystems. Rainfall is low and variable with many years not receiving significant rainfall (Sandfire Resources, 2017). Ephemeral drainage lines only flow during and after rainfall events, when direct runoff from rainfall and interflow through shallow surface water sediments drains westerly towards the Gascoyne River (Sandfire Resources, 2017).

A number of ephemeral drainage lines dissect the application area and five vegetation communities have been identified as being associated with these features (Mattiske, 2016; Sandfire Resources, 2017; GIS Database). Of particular significance are the dense Acacia shrublands and Eucalypt Woodlands associated with these drainage lines, which are important in providing connectivity across the landscape, support a rich and abundant bird assemblage and are sensitive to hydrological change (Bamford, 2016). Areas of significant habitat associated with drainage lines have been excised from the application area and the proponent has committed to a number of management and mitigation measures including minimising clearing along ephemeral watercourses, rehabilitating disturbed areas and locating infrastructure outside drainage lines and associated vegetation communities. Potential impacts to vegetation growing in association with watercourses may be further minimised through the implementation of a vegetation management condition.

Based on the above, the proposed clearing is at variance to this Principle.

Methodology Mattiske (2016)
Sandfire Resources (2017)

GIS Database:
- Hydrography, linear

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

Comments **Proposal is not likely to be at variance to this Principle**

The application area is mapped as occurring on the Beasley and Horseshoe land systems (GIS Database). The Beasley Land system is described as low ridges, hills and laterised residuals above stony footslopes and broad, stony lower plains supporting scattered mulga and snakewood-dominated shrubland (Curry et al., 1994). This land system is mostly resistant to erosion (Curry et al., 1994). The Horseshoe land system is described as undulating stony plains and low rounded hills based on Proterzoic metamorphic rocks, with somewhat saline drainage foci and alluvial tracts; supports scattered mulga and waita-while shrublands with halophytes (Curry et al., 1994).This land system is generally not susceptible to erosion (Curry et al., 1994).

The water table level of the area is sufficiently deep so that clearing of native vegetation will not cause a major rise or result in soil salinity (Sandfire Resources, 2017).

Given the low erodibility of the land systems and the relatively large amounts of intact native vegetation remaining in the local area, the proposed clearing of up to 157.6 hectares of native vegetation is not anticipated to result in an increase, or major change to, existing land degradation regimes. Minor localised erosion is possible following clearing when areas are exposed to wind and surface water flows. The proponent has committed to a number of management and mitigation measures to reduce potential erosion issues. Potential impacts associated with localised erosion may be further minimised through the implementation of a staged clearing condition.

Based on the above, the proposed clearing is not likely to be at variance to this Principle.

Methodology Curry et al (1994)
Sandfire Resources (2017)

GIS Database:
-Landsystem Rangelands

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

Comments **Proposal is not likely to be at variance to this Principle**

The application area falls within the proposed Doolgunna Conservation Reserve (Sandfire Resources, 2017; GIS Database). The area proposed for conservation was a former pastoral lease with an extent well over 85, 000 hectares. The proponent has committed to a number of management measures and is in consultation with the Department of Parks and Wildlife (DPaW), which may lead to further measures being implemented.

Given the extent of the proposed Doolgunna Conservation Reserve, and the likely implementation of management measures developed in consultation with DPaW, the proposed clearing of up to 157.6 hectares of native vegetation is unlikely to impact the environmental values of the proposed Doolgunna Conservation Reserve.

Based on the above, the proposed clearing is not likely to be at variance to this Principle.

Methodology Sandfire Resources (2017)

GIS Database:
- DPaW tenure

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

Comments **Proposal is not likely to be at variance to this Principle**

The application area is not located within a Public Drinking Water Source Area (GIS Database). The application area is located within the proclaimed East Murchison Groundwater Area under the *Rights in Water and Irrigation Act 1914* (GIS Database). Any groundwater extraction and/or taking or diversion of surface water for the purposes other than domestic and/or stock watering is subject to licence by the Department of Water.

The application area is located within a Semi-arid climate, with a low and variable rainfall that often receives no significant rainfall for many years (Sandfire Resources, 2017). Most rain falls during the first six months of the year from scattered thunderstorms and the occasional tropical cyclone and associated depressions. Data recorded on site shows that while rainfall is variable, large volumes are possible in short periods (Sandfire Resources, 2017).

Clearing of native vegetation may temporarily cause excess runoff and sedimentation to enter drainage lines (depending on rainfall occurrence). The proponent has committed to a number of management measures in order to reduce impacts to surface water quality, including progressive rehabilitation to limit exposure of open areas. Potential impacts to surface water quality may be minimised through the implementation of a staged clearing condition.

The application area has a groundwater salinity that is marginal (500 to 1,000 milligrams/Litre Total Dissolved solids) (GIS Database). With high annual evaporation rates and low annual rainfall (BoM, 2017), there is likely to be limited groundwater recharge throughout large portions of the year. The proposed clearing is unlikely to result in measurable impacts to the quality of groundwater (GIS Database).

Based on the above, the proposed clearing is not likely to be at variance to this Principle.

Methodology BoM (2017)
Sandfire Resources (2017)

GIS Database:

- Groundwater Salinity, Statewide
- Hydrography, linear
- Public Drinking Water Source Areas (PDWSAs)
- RIWI Act, Groundwater Areas

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

Comments

Proposal is not likely to be at variance to this Principle

The application area is located in a relatively flat to slightly undulating area which may on occasion be at risk of flooding as a result of 1:100 year average recurrence interval (ARI) rainfall events (Sandfire Resources, 2017), however extended periods of no or little rainfall are also common (BoM, 2017). The proponent has committed to implementing management strategies to prevent flooding related issues, including maintaining existing flow paths and creating diversion (where necessary) to direct surface water flows into local drainage lines at rates similar to natural flows (Sandfire Resources, 2017).

Given the large amount of vegetation remaining in the local area and region, and proposed management measures, the proposed clearing of up to 157.6 hectares of native vegetation is unlikely to alter existing flood regimes.

Based on the above, the proposed clearing is not likely to be at variance to this Principle.

Methodology BoM (2017)
Sandfire Resources (2017)

Planning instrument, Native Title, RIWI Act Licence, EP Act Licence, Works Approval, Previous EPA decision or other matter.

Comments

There is one native title claim over the application area (WC1999/046) (DAA, 2017). However, the mining tenure has been granted in accordance with the future act regime of the *Native Title Act 1993* and the nature of the act (i.e. the proposed clearing activity) has been provided for in that process, therefore, the granting of a clearing permit is not a future act under the *Native Title Act 1993*.

According to available databases, there are no registered Sites of Aboriginal Significance located in the area applied to clear (DAA, 2017). It is the proponent's responsibility to comply with the *Aboriginal Heritage Act 1972* and ensure that no Sites of Aboriginal Significance are damaged through the clearing process.

It is the proponent's responsibility to liaise with the Department of Environment Regulation, the Department of Parks and Wildlife and the Department of Water, to determine whether a Works Approval, Water Licence, Bed and Banks Permit, or any other licences or approvals are required for the proposed works.

The clearing permit application was advertised on 10 April 2017 by the Department of Mines and Petroleum inviting submissions from the public. No submissions were received.

Methodology DAA (2017)

4. References

Bamford (2016) Sandfire Resources NL Monty Project, Level 1 Fauna Assessment. Report prepared for MBS Environmental by Bamford Consulting Ecologists, March 2016.

BoM (2017) Climate Statistics for Australian Locations. A Search for Climate Statistics for Meekatharra, Australian Government Bureau of Meteorology. www.bom.gov.au (Accessed May 2017).

CALM (2002) A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions. Department of Conservation and Land Management.

Curry, P.J., Payne, A.L., Leighton, K.A., Hennig, P. and Blood, D.A. (1994) An Inventory and Condition Survey of the Murchison River Catchment and Surrounds, Western Australia.

DAA (2017) Aboriginal Heritage Enquiry System. Department of Aboriginal Affairs. http://maps.dia.wa.gov.au/AHIS2/ (Accessed May 2017).

Department of Natural Resources and Environment (2002) Biodiversity Action Planning. Action planning for native biodiversity at multiple scales; catchment bioregional, landscape, local. Department of Natural Resources and Environment, Victoria.

DPaW (2017) NatureMap. Department of Parks and Wildlife, http://naturemap.dec.wa.gov.au (Accessed May 2017).

Government of Western Australia (2016) 2016 Statewide Vegetation Statistics incorporating the CAR Reserve Analysis (Full Report). Current as of October 2016. WA Department of Parks and Wildlife, Perth.

Keighery, B.J. (1994) Bushland Plant Survey: A Guide to Plant Community Survey for the Community. Wildflower Society of WA (Inc). Nedlands, Western Australia.

Mattiske (2016) Flora and Vegetation of the Monty Survey Area. Report prepared for Sandfire Resources NL Ltd by Mattiske Consulting Pty Ltd, January 2016.

Sandfire Resources (2017) Purpose Permit Application, Development of the Monty Project, Supporting Information for CPS 7541/1. Sandfire Resources NL, March 2017.

5. Glossary

Acronyms:

BoM	Bureau of Meteorology, Australian Government
DAA	Department of Aboriginal Affairs, Western Australia
DAFWA	Department of Agriculture and Food, Western Australia
DEC	Department of Environment and Conservation, Western Australia (now DPaW and DER)
DEE	Department of the Environment and Energy, Australian Government
DER	Department of Environment Regulation, Western Australia
DMP	Department of Mines and Petroleum, Western Australia
DRF	Declared Rare Flora
DoE	Department of the Environment, Australian Government (now DEE)
DoW	Department of Water, Western Australia
DPaW	Department of Parks and Wildlife, Western Australia
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities (now DEE)
EPA	Environmental Protection Authority, Western Australia
EP Act	*Environmental Protection Act 1986*, Western Australia
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Federal Act)
GIS	Geographical Information System
ha	Hectare (10,000 square metres)
IBRA	Interim Biogeographic Regionalisation for Australia
IUCN	International Union for the Conservation of Nature and Natural Resources – commonly known as the World Conservation Union
PEC	Priority Ecological Community, Western Australia
RIWI Act	*Rights in Water and Irrigation Act 1914*, Western Australia
TEC	Threatened Ecological Community

Definitions:

{DPaW (2015) Conservation Codes for Western Australian Flora and Fauna. Department of Parks and Wildlife, Western Australia}:-

T **Threatened species:**
Published as Specially Protected under the *Wildlife Conservation Act 1950,* listed under Schedules 1 to 4 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora (which may also be referred to as Declared Rare Flora).

Threatened fauna is that subset of 'Specially Protected Fauna' declared to be 'likely to become extinct' pursuant to section 14(4) of the Wildlife Conservation Act.

Threatened flora is flora that has been declared to be 'likely to become extinct or is rare, or otherwise in need of special protection', pursuant to section 23F(2) of the Wildlife Conservation Act.

The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.

CR **Critically endangered species**
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.

EN **Endangered species**
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.

VU **Vulnerable species**
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.

EX **Presumed extinct species**
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.

IA **Migratory birds protected under an international agreement**
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.

CD **Conservation dependent fauna**
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.

OS **Other specially protected fauna**
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.

P **Priority species**
Species which are poorly known; or
Species that are adequately known, are rare but not threatened, and require regular monitoring. Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.

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.