BHP Billiton Iron Ore Pty Ltd

Report for Mesa Gap

Biological Survey

May 2008

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Executive Summary

Existing Environment

GHD was commissioned to provide a flora and fauna assessment for the Mesa Gap exploration area, east of Newman. This flora and fauna report details the existing environment at the Mesa gap study area and discusses potential environmental impacts on flora and fauna from proposed exploration activities.

The flora and fauna assessment includes a desktop assessment and the results of a field survey that was conducted in October 2007. The findings are summarised below:

- No reserves or conservation areas occur within the vicinity of the survey area;
- No Environmentally Sensitive Areas occur within the vicinity of the survey area;
- No defined wetlands or waterways occur within the survey area;
- Works will temporarily increase runoff and sedimentation. With appropriate management actions in place, hydrology and drainage is not considered likely to be adversely impacted by this project;
- There are eight vegetation types within the survey area, ranging from vegetation associated with low hills and breakaways (typically - Snappy gum over spinifex) to vegetation on creeklines, and broad drainage areas (Mixed *Corymbia hamersleyana* and *Acacia aneura* low open woodland)
- Based on the current extent of vegetation types in the survey area, they are classified as *Least Concern* in terms of extent of vegetation remaining compared to pre-European extents.
- No Threatened Ecological Communities were recorded within the survey area. No Priority Ecological Communities were recorded within the survey area;
- Vegetation within the survey areas is considered moderately diverse. A total of 133 taxa from 32 families were recorded from the survey area;
- No Declared Rare or Priority Flora species were recorded within the survey area. One potentially new species (*Aenictophyton* sp. nov. (G. Davis 183) / aff. *reconditum*) was collected from previously known locations within the survey area. The proposed works will not impact these areas;
- No weed species were recorded from the survey area;
- A total of 29 bird species, 6 mammal species, and four reptile species were recorded during the reconnaissance survey within the Mesa Gap survey area;
- The reconnaissance vertebrate fauna survey yielded the presence of one threatened fauna species within the project area: the Western Pebble-mound Mouse (*Pseudomys chapmani*). One mound (considered potentially active) was located within the vicinity of an historical exploration drill pad;
- No habitat of significance was recorded from the survey area;

- The exploration program proposed for Mesa Gap is considered to have minimal impact on fauna species present within the survey area;
- The presence of the Priority 4 fauna species Pebble Mound Mouse within the survey area is assessed in Principle (b2). The amount of clearing of native vegetation required for exploration purposes (cleared lines, drill pads) is minimal, and this species will not be directly impacted so long as the pebble mounds located by this survey are avoided. As a result this project has been assessed to be unlikely to be at variance with Principle (b2).
- This project is not considered to be at variance against any other Clearing Principle.
- This project is considered not to be required to be referred to the EPA.

Management of Flora and Fauna Impacts

The following recommendations are made from the preliminary results of the biological assessment of the Mesa Gap project area:

- The Pebble-mound Mouse mound identified in the survey area can be checked to see if it is still occupied.
- In addition, a follow-up targeted fauna survey (trapping program) may be required to identify the small mammal/marsupial species which was recorded within the survey area to determine their conservation status. It is considered unlikely that the exploration program will impact on this unknown mammal/marsupial species, as the species was located in sandy soils away from the areas targeted for exploration.
- If the orebody is proven follow-up flora and fauna surveys can be undertaken to target significant flora species (including *Aenictophyton* sp. nov. (G. Davis 183) / aff. *reconditum*) and associated habitat prior to the commencement of mining operations.

1. Introduction

1.1 Background

BHP Billiton Iron Ore Pty Ltd (BHPBIO) proposes to undertake mineral exploration activities in the Mesa Gap area, and consequently, a Native Vegetation Clearing Permit must be submitted to the Department of Industry and Resources (DOIR). A requirement of this application is to address the 10 Clearing Principles, which includes the requirement for a flora and fauna assessment of the survey area.

BHPBIO has commissioned GHD to undertake a baseline flora and fauna assessment of proposed exploration sites in the Mesa Gap area.

1.2 Study Area

The study area lies between Wheelarra Hill and Orebody 18 Mine sites approximately 40 km south east from Newman township. The Mesa Gap study area is approximately 2,773.73 ha.

1.3 Scope of Works

This flora and fauna assessment included both desktop and field assessments. The desktop assessment included:

» A review of the Department of Environment and Conservation's (DEC) Rare and Priority Flora databases;

» A review of the DEC's Threatened Ecological Community database;

» A review of the DEC's Threatened Fauna database;

» A review of local and regional significance of plant communities;

» A review of the Western Australian Museum database for threatened and endangered fauna;

» A review of the DEC's Environmentally Sensitive Areas; and

» A review of the Department of Environment, Water Heritage and the Arts (DEWHA) database for areas listed under the *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*.

The field survey verified the desktop study and provided a detailed assessment of the existing environment in the survey area and its relationship to adjoining areas. The field survey included the following actions and details.

» An inventory of the vascular plant species in the survey area, undertaken through the use of 50 m x 50 m quadrats and walking transect survey methods;

» A review of, and search for, significant flora species;

» An inventory of dominant exotic plants, including any declared noxious plants and environmental weed species;

- Advice on whether weeds are likely to spread to and result in environmental harm to adjacent areas of native vegetation that are in good or better condition;
- A description and location, including mapping, of plant communities;
- A rating of condition of the vegetation communities or areas using a published rating scale, as used in the assessment of vegetation in Bush Forever Sites (Government of Western Australia, 2000);
- A review of the local and regional significance of the plant communities in terms of their intrinsic value, extent, rarity and condition;
- Assessment of potential clearing against the *Environmental Protection Act*'s 10 Clearing Principles (Schedule 5). Each principle has been assessed in accordance with the DEC's Guideline to Assessment – Clearing of Native Vegetation.
- An inventory of the vertebrate fauna species in the survey area through targeted searches and opportunistic recording of species;
- Review of the fauna species considered to be rare or in need of special protection;
- Review of the presence and abundance of pest, declared or feral animals; and
- Identification of any habitats of significance.

2. Desktop Assessment

2.1 Previous Studies

A number of previous studies have examined the flora and fauna of the area surrounding Mesa Gap. These include:

- *ecologia* (2004). Orebodies 18, 23 & 25: Flora and Fauna Review. Report prepared for BHP Billiton Iron Ore Pty Ltd, August 2004.
- *ecologia* (2004). Eastern Ophthalmia Range Expansion: Biological Survey. Report prepared for BHP Billiton Iron Ore Pty Ltd, May 2004.
- *ecologia* (2004). Jimblebar – Wheelarra Hill Expansion: Biological Survey. Report prepared for BHP Billiton Iron Ore Pty Ltd, April 2004.
- ENV. Australia Pty Ltd (2007). Orebody 18 Fauna Assessment – Phase II. Report prepared for BHP Billiton Iron Ore Pty Ltd, June 2007. Job No: 06.052, Report No. RP002.
- ENV. Australia Pty Ltd (2007). Orebody 18 Flora and Vegetation Assessment – Phase II. Report prepared for BHP Billiton Iron Ore Pty Ltd, June 2007. Job No: 06.052, Report No. RP001.

A summary of background information from these investigations applicable to this project is included below.

2.1.1 Existing Environment

Climate

This region experiences an arid-tropical climate with two distinct seasons; a hot summer from October to April and a mild winter from May to September (Gentilli, 1972). Annual evaporation exceeds rainfall by as much as 2,500 mm per year. Seasonally low but unreliable rainfall, together with high temperatures and high diurnal temperature variations are also characteristic climatic features of the region. This region has in the past experienced no rainfall in any month of the year, which is typical of a desert climate (Beard, 1975).

The majority of the Pilbara has a bimodal rainfall distribution, resulting in two rainfall maxima per year. From January to March, rain results from storms penetrating from the north, producing sporadic and intense thunderstorms. Tropical cyclones and depressions moving southwards from northern Australian waters also cause heavy rainfall events. From May to June cold fronts move easterly across Western Australia and may occasionally reach the Pilbara Region. These fronts produce light winter rains that are generally ineffective for extensive plant growth. Surface water can be found in some pools and springs in the Pilbara Region all year round, although watercourses only flow briefly due to the short wet season.

Within the Pilbara Region the temperature range is large. Summer temperatures may reach extremes beyond 46°C (at Newman), and frosts may occasionally occur during July and August.

The closest official Bureau of Meteorology weather recording station is at Newman, where climate data is available for records between 1965 and 2003 (BoM, 2008) (Table 1). Mean maximum temperatures range from 22.3ºC (July) to 39ºC (January), and mean minimum temperatures range from 8.1ºC (July) to 25.3ºC (January). Annual rainfall is 310.2 mm over 45 rain days, with the highest daily recorded 151 mm

Table 1 Climate Data for Newman (source: BoM, 2008).

Statistic Element	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Mean maximum temperature (ºC)	39	37.2	35.8	31.6	26	22.4	22.3	24.8	29.2	33.6	36.6	38.3	31.4
Mean minimum temperature (ºC)	25.3	24.4	22.4	18.4	13	9.6	8.1	10.1	13.7	17.9	21.4	23.9	17.3
Mean Monthly rainfall (mm)	51.4	80.1	38.6	25.3	23.2	25	12.6	10.5	4.1	3.9	9.8	27	310.2
Highest daily rainfall (mm)	141.7	151	107.5	71.6	46.5	100.6	29.4	36	31.5	17.4	57.4	62.7	151
Mean number of days of rain	6.7	7	4.9	4.2	3.8	3.9	2.5	1.9	0.9	1.4	2.9	5.1	45.2
Mean number of days of rain ≥ 1 mm	4.5	5	3.3	2.6	2.6	2.3	1.7	1.4	0.6	0.8	1.5	3.2	29.5

The Mesa Gap survey area is considered to exhibit a similar climate to that recorded at Newman.

Geology

The Pilbara region comprises a portion of the ancient continental Western Shield that dominates the geology of Western Australia. The Western Shield is comprised of pre-Cambrian Proterozoic and Archaean rocks.

The geology of the region around the Eastern Ophthalmia Range has been mapped and described in detail by Tyler and Williams (1990). The Eastern Ophthalmia Range lies within the Ophthalmia Fold Belt which unconformably overlies Archaean basement rocks and abuts the Sylvania Inlier, an exposed portion of the cratonic basement. A summary of the main geological elements, which are important to both the development of the landscape and the vegetation, is outlined below in chronological sequence (after *ecologia,* 2004):

1. The main body of the Eastern Ophthalmia Range is dominated by the Brockman Iron Formation. This is economically the most important iron formation in the Hamersley Group and forms prominent strike ridges rising 200-400 m above the surrounding countryside, notably at the northern boundary of the Jimblebar lease. This formation is composed of chert, ferruginous chert and minor shale bands (Tyler and Williams, 1990).

2. North of the Eastern Ophthalmia Range, the Weeli Wolli Formation occurs, consisting of interbedded banded iron formation, chert, and shale. Closely associated with this formation are rocks of the Woongarra Volcanics, consisting of partially metamorphosed igneous rhyolite and rhyodacite as sills or flows.
3. South of the area dominated by the Brockman Iron Formation, Cainozoic deposits are found, taking the form of partly consolidated and cemented colluvium in valley-fill deposits. These deposits are derived from dissection of the Proterozoic rocks.
4. Quaternary deposits include colluvium and minor alluvium of the scree slopes and talus slopes adjacent to and derived from the bedrock, and alluvial deposits of silt, sand and gravel in drainage channels and associated floodplains that lie at the base of the range.

Landforms

The Hamersley Plateau is marked on the western, eastern and northern boundaries by an abrupt escarpment, while the southern edge of the outcrop near the project area is blurred due to the past trend of strong folding of rock. The Hamersley Plateau is comprised mainly of the Hamersley and Ophthalmia Ranges, which are characterised by long strike ridges rising 300 metres or more above the valley floors. Flats of Cainozoic sediments may be found on the valley floors, which were deposited on the less resistant units of the lower Hamersley Group (Tyler *et al.,* 1991). The entire region is one of rounded ranges and hills, and does not exhibit the 'mesa-form' hills seen in the country to the north-east.

In the biological survey of the Hamersley Range National Park (Karijini National Park) Dawe and Dunlop (1983) developed a landform-vegetation classification system of nine main landforms which were further categorised into sub-units. The Eastern Ophthalmia Range covers three of these main landforms:

1. Ridges and Hills: Low ridges and hills rising above the surrounding plains, represented in the project area by the eastern extension of the Ophthalmia Range. The surface is largely covered with skeletal soils, with areas of exposed rock.
2. Scree slopes: gravelly loams with pockets of skeletal soil on slopes 12º - 15º, elevation to 40 m; undulating, incorporating Cainozoic and later deposits on hill slopes south of the minesite.
3. Minor Drainage Lines: Minor drainage lines are generally shallow eroded channels with a sandy or gravelly washline with associated outwash areas.

Soils

The Eastern Ophthalmia Range lies within a large region of soils that have been classified by Bettenay *et al*. (1967) as 'loamy soils with weak pedologic development'. At higher resolution, the area lies upon a region of 'shallow, coherent and porous loamy soils', with shallow profiles. This soil type is associated with the Hamersley and

Ophthalmia Ranges. The soils are mainly stony, shallow loams, however there are wide areas with no or limited soil cover.

As a consequence of the sparse vegetation cover and the erosive force of heavy summer cyclonic rains, much of the soil on the hillslopes tends to be transported down to the valleys and plains. Plant species and associations of vegetation on the hills and slopes tend to be correlated to geology rather than soil type (Beard, 1975). Along drainage lines superficial deposits influence the distribution of vegetation, however, the presence of surface and groundwater is also a determining factor.

Phytogeography

The survey area lies in the Pilbara biogeographic region of the Interim Biogeographic Regionalisation for Australia (IBRA) (Thackway and Cresswell, 1995). This is a system of some eighty biogeographic regions covering the whole of Australia (including Tasmania) and is the result of collaboration between all State conservation agencies with co-ordination by the Australian Nature Conservation Agency (ANCA). Bioregions are defined on the basis of climate, geology, landforms, vegetation and fauna. The Pilbara biogeographic region is similar to that commonly recognised as the Pilbara Region, and includes four major components; Hamersley, Fortescue Plains, Chichester and Roebourne. Hamersley, the component relevant to this assessment, is summarised as “Mountainous areas of Proterozoic sedimentary ranges and plateaux with Mulga low woodland over bunch grasses on fine textured soils and Snappy Gum over Triodia on skeletal sandy soils of the ranges.”

Dominant environmental constraints for the Pilbara bioregion include extinction of critical weight range mammals, wildfire, feral animals (in particular cat and fox), weeds, and grazing or pastoral activities.

2.2 Relevant Legislation

Relevant legislation for the protection of flora and fauna within Western Australia includes the *Environmental Protection Act 1986*, the *Conservation and Land Management Act 1984*, and, in particular, the *Wildlife Conservation Act 1950*. Matters of national environmental significance are also protected under the Commonwealth *EPBC Act.* Projects that have the potential to impact on matters of national environmental significance, including projects that may impact significantly on flora and fauna species listed under the *EPBC Act,* need to be referred to the Commonwealth Minister for the Environment. The Commonwealth DEWHA and State DEC have signed a Bilateral Agreement that gives the DEC the power to assess some projects that would otherwise be assessed by the DEWHA. Projects that trigger the *EPBC Act* must still be referred under that Act but there will not be a duplication of assessment at a State and Federal level.

2.3 Reserves and Conservation Areas

No reserves or conservation areas occur within the vicinity of the Mesa Gap survey area.

2.4 Environmentally Sensitive Areas (ESA)

A search of the Department of Environment and Conservation's Native Vegetation Viewer indicated that no Environmentally Sensitive Areas (ESAs) occur within the vicinity of the project area.

2.5 Vegetation

2.5.1 Vegetation Description

In 2001-2 the (then) Department of Conservation and Land Management undertook an extensive audit of the State's terrestrial biodiversity. Detailed information for the State's biogeographic subregions was collated at this time, including information on the vegetation within each survey area. The survey area occurs within the Pilbara 2 – Fortescue Plains Sub region. The environment of this subregion is described in the Biodiversity Audit of Western Australia's 53 Biogeographical Subregions (Kendrick, 2001) and the vegetation types described for the survey area are included below:

» Extensive salt marsh, mulga-bunch grass, and short grass communities on alluvial plains in the east. Deeply incised gorge systems in the western (lower) part of the drainage. River gum woodlands fringe the drainage lines. Northern limit of Mulga (*Acacia aneura*).

» An extensive calcrete aquifer (originating within a palaeodrainage valley) feeds numerous permanent springs in the central Fortescue, supporting large permanent wetlands with extensive stands of river gum and cadjeput *Melaleuca* woodlands.

2.5.2 Vegetation Extent and Status

A vegetation type is considered underrepresented if there is less than 30 percent of its original distribution remaining. From a purely biodiversity perspective, and not taking into account any other land degradation issues, there are several key criteria now being applied to vegetation in States where clearing is still occurring (EPA, 2000).

» The "threshold level" below which species loss appears to accelerate exponentially at an ecosystem level is regarded as being at 30% of the pre-European / pre-1750 extent for the vegetation type;

» A level of 10% of the original extent is regarded as being a level representing *Endangered*; and

» Clearing which would put the threat level into the class below should be avoided.

Such status can be delineated into five (5) classes, where:

» *Presumed Extinct*: Probably no longer present in the bioregion

» *Endangered**: <10% of pre-European extent remains

- *Vulnerable**: 10-30% of pre-European extent exists
- *Depleted**: >30% and up to 50% of pre-European extent exists
- *Least Concern*: >50% pre-European extent exists and subject to little or no degradation over a majority of this area.

* or a combination of depletion, loss of quality, current threats and rarity gives a comparable status

Native vegetation types represented in the survey areas; their regional extent and reservation status are drawn from Shepherd, *et al*. (2002), and Shepherd pers. comm. These are shown in Table 2.

Table 2 Vegetation extent and status in the Pilbara IBRA region

Vegetation Association Number	Association Description	Pre-European Extent (ha) in Pilbara IBRA region	Current Extent (ha) in Pilbara IBRA region	% Remaining	% Pre-European Extent in IUCN Class I-IV Reserves	Occurrence on Site
29	Sparse low woodland; mulga, discontinuous in scattered groups	1,133,227	1,133,227	100	1.9	Within a small section in the south west of the study area
82	Hummock grasslands, shrub steppe; Grevillea refracta & hakea over soft spinifex	2,563,609	2,563,609	100	10.2	Occurs across approximately half of the study area
216	Shrublands; bowgada & Acacia victoriae scrub	26,669	26,669	100	0	Occurs across approximately half of the study area

The extent of the vegetation in the survey areas is considered of *Least Concern*, i.e. intact, with 100% of the pre-European extents of each vegetation type considered to be remaining.

2.5.3 Threatened Ecological Communities

Ecological communities are defined as 'naturally occurring biological assemblages that occur in a particular type of habitat' (English and Blythe, 1997). Threatened Ecological Communities (TECs) are ecological communities that have been assessed and assigned to one of four categories related to the status of the threat to the community, i.e. Presumed Totally Destroyed, Critically Endangered, Endangered, and Vulnerable.

Some TECs are protected under the *EPBC Act*. Although TECs are not formally protected under the State *Wildlife Conservation Act 1950,* the loss of, or disturbance to, some TECs triggers the *EPBC Act*. The Environmental Protection Authority's (EPA's) position on TECs states that proposals that result in the direct loss of TECs are likely to require formal assessment.

Possible TECs that do not meet survey criteria are added to the Department of Environment and Conservation's (DEC) Priority Ecological Community (PEC) Lists under Priorities 1, 2 and 3. These are ecological communities that are adequately known; are rare but not threatened, or meet criteria for Near Threatened. PECs that have been recently removed from the threatened list are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.

The Department of Environment and Conservation's (DEC's) Threatened Ecological Community (TEC) database was queried for known occurrences of TECs near the study area. There are no known occurrences of threatened or priority ecological communities recorded within 10 km of the study area.

2.6 Flora

2.6.1 Significant Flora

Commonwealth

Species of significant flora are protected under both State and Commonwealth Acts. Any activities that are deemed to have a significant impact on species that are recognised by the *EPBC Act*, and the *Wildlife Conservation Act 1950* can trigger referral to the DEWHA and/or the EPA.

A description of Conservation Categories delineated under the *EPBC Act* is detailed in Table 8 Appendix C. These are applicable to threatened flora and fauna species.

A search of the *EPBC Act* Protected Matters Search Tool did not identify any Commonwealth protected flora species within 5 km of the survey area.

State

In addition to the *EPBC Act,* significant flora in Western Australia is protected by the *Wildlife Conservation Act 1950*. This *Act*, which is administered by the DEC, protects Declared Rare Flora (DRF) species. The DEC also maintains a list of Priority Listed Flora (PLF) species. Conservation codes for flora species are assigned by the DEC to

define the level of conservation significance. PLF are not currently protected under the *Wildlife Conservation Act 1950*. PLF may be rare or threatened, but cannot be considered for declaration as rare flora until adequate surveys have been undertaken of known sites and the degree of threat to these populations clarified. Special consideration is often given to sites that contain PLF, despite them not having formal legislatory protection. A description of the DEC's Conservation Codes that relate to flora species is provided in

Table 9, Appendix C.

A search of the DEC's Rare Flora Databases and the Western Australian Herbarium (WAHERB) records was undertaken. There were no records of declared rare or priority flora within the search area on the DEC's Rare Flora Database. Species recorded by the WAHERB are outlined in Table 3.

Table 3 Significant flora present within the vicinity of the Mesa Gap survey area from records of the DEC and WAHERB.

Species	Conservation Code	Description
Gonocarpus ephemerus	P2	Procumbent annual or perennial, herb, 0.07–0.5 m high. Flowers are yellow and red, occurring in August. The preferred habitat is sand, primarily along drainage lines.
Eremophila pilosa	P1	Shrub, approximately 0.8 m high. This species flowers are purple and usually occur during September

Eremophila pilosa is the nearest significant flora species recorded within the vicinity of Mesa Gap located approximately 7 km to the south east of the project area.

2.6.2 Previous Surveys: Significant Flora

Previous surveys have identified the following significant flora species recorded within a close proximity to the project area (ENV. Australia 2007a, *ecologia* 2007, *ecologia* 2004):

- *Isotropis winneckei* (Priority 1);
- *Eremophila sp.* Ophthalmia Range (Priority 1);
- *Goodenia hartiana* ms (Priority 2);
- *Sida* sp. Wittenoom (Priority 3); and
- *Aenictophyton* sp. nov. (G. Davis 183) [*A.* aff. *reconditum*].

2.7 Fauna

A number of previous studies have surveyed the fauna in the vicinity of the project area (*ecologia,* 2004; *ecologia,* 2007; ENV Australia, 2007b).

This desktop assessment includes database searches in addition to drawing upon the results of previous surveys.

2.7.1 Significant Fauna Species

The conservation of fauna species and their significance status is currently assessed under both State and Commonwealth Acts. The acts include the *Western Australian Wildlife Conservation Act* 1950; *Wildlife Conservation (Specially Protected Fauna) Notice 2003,* and the *EPBC Act*.

The significance levels for fauna used in the *EPBC Act* are those recommended by the International Union for the Conservation of Nature and Natural Resources (IUCN). A description of Conservation Categories delineated under the *EPBC Act* is detailed in

Table 9, Appendix C and the circumstances under which a project will trigger referral to the DEWHA are described in Appendix D. The *WA Wildlife Conservation Act 1950* uses a set of Schedules but also classifies species using some of the IUCN categories. These Schedules are described in Table 11, Appendix D. The *EPBC Act* also protects migratory species that are listed under the following International Agreements:

» Appendices to the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals) for which Australia is a Range State under the Convention;

» The Agreement between the Government of Australia and the Government of the Peoples Republic of China for the Protection of Migratory Birds and their Environment (CAMBA); and

» The Agreement between the Government of Japan and the Government of Australia for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment (JAMBA).

Listed migratory species also include species identified in other international agreements approved by the Commonwealth Environment Minister.

The Act also protects marine species on Commonwealth lands and waters.

In Western Australia, the DEC also produces a supplementary list of Priority Fauna, these being species that are not considered Threatened under the Western Australian *Wildlife Conservation Act 1950* but for which the Department feels there is a cause for concern. These species have no special legislatory protection, but their presence would normally be considered. Such taxa need further survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna. Levels of Priority are described in Table 12, Appendix D.

The DEWHA maintains a database of matters of national environmental significance that are protected under the *EPBC Act.* An *EPBC Act* Protected Matters Report was

generated (from the website of the DEWHA), for the matters of significance that may occur in, or may relate to, the survey area.

A search of the DEC's Threatened Fauna database for any rare and priority species that may occur in the survey area was undertaken.

From the DEC and DEWHA databases and the records of the Western Australian Museum (WAM), a number of protected fauna species were identified as potentially occurring within the survey area Table 4.

It should be noted that some species that appear in the *EPBC Act* Protected Matters Search Tool are often not likely to occur within the specified area, as the search provides an approximate guidance to matters of national significance that require further investigation. The records from the DEC searches of threatened fauna provide more accurate information for the general area, however some records of sightings or trappings can be dated and often misrepresent the current range of threatened species.

Table 4 Listing of Potentially Occurring Significant, Rare and Priority Fauna Species within the Survey Area, with Information Source

Genus	Species	Common Name	Listing under Wildlife Conservation Act 1950 or DEC Priority List	Listing under EPBC Act	DEC Database	EPBC Protected Matters Search Tool
Birds						
Falco	*hypoleucos*	Grey Falcon	Priority 4		+	
Ardeotis	*australis*	Australian Bustard	Priority 4		+	
Merops	*ornatus*	Rainbow Bee-eater		Migratory, Marine		+
Ardea	*alba*	Great Egret, White Egret		Migratory, Marine		+
Ardea	*ibis*	Cattle Egret		Migratory, Marine		+
Charadrius	*veredus*	Oriental Plover, Oriental Dotterel		Migratory, Marine		+
Apus	*pacificus*	Fork-tailed Swift		Migratory, Marine		+
Mammals						
Petrogale	*lateralis lateralis*	Black-flanked Rock-wallaby (Warru)	Schedule 1		+	
Macrotis	*lagotis*	Greater Bilby	Schedule 1	Vulnerable		+
Rhinonicteris	*aurantius*	Pilbara Leaf-nosed Bat		Vulnerable		+
Pseudomys	*chapmani*	Western Pebble-mound Mouse (Ngadji)	Priority 4		+	
Reptile						
Liasis	*olivaceus barroni*	Pilbara Olive Python	Schedule 1		+	

2.7.2 Previous Surveys: Significant Fauna

In addition to the species listed above, the following significant fauna species have been previously recorded within the survey area:

(after *ecologia,* 2004):

- *Planigale* species — ?New Species.
- Striated Grasswren *(Amytornis striatus whitei)* — Priority 4
- Brown Quail *(Coturnix ypsilophora)* — Range Extension

(after ENV, 2007)

- Blind Snake (*Ramphotyphlops ganei*) — Priority 1

3. Field Assessment

3.1 Field Survey Methods

3.1.1 Vegetation and Flora

The flora assessment included desktop investigations and field surveys, conducted with regard to the EPA's Guidance Statement No. 51, where possible. GHD's qualified ecologists conducted the field flora survey between September and October 2007.

The flora and vegetation survey was conducted by undertaking walking transects across the study area and establishing 50m x 50m quadrats. Quadrats were located along indicative plans of drill lines, tracks and pads provided by BHP Billiton. Quadrat data provided information on substrate, condition, coverage, species present and the dominant species in each vegetation type. Quadrat data is presented in Appendix B. The walking transects included recording of flora species and mapping of vegetation types and conditions (including weed status). In addition areas that were potentially suitable to host significant flora taxa were surveyed thoroughly.

A list of flora species collated from the quadrats and walking transects was generated for the study area. Where identification of flora species was uncertain, confirmation was made at the Western Australian State Herbarium. The presence of Declared Rare or Priority Flora was assessed. Vegetation was also assessed to determine the presence of TECs within the study area. Aerial photography was used to assist in the delineation of vegetation types present in the study area.

Nomenclature

Nomenclature used in this report follows that used by the DEC's *FloraBase* program as it is deemed to contain the most up-to-date species information for Western Australia.

Limitations

Complete flora and vegetation surveys can require multiple surveys, at different times of year, and over a period of a number of years, to enable observation of all species present.

Some flora species, such as annuals, are only available for collection at certain times of the year, and others are only identifiable at certain times (such as when they are flowering). Additionally, climatic and stochastic events (such as fire) may affect the presence of plant species. Species that have a very low abundance in the area are more difficult to locate, due to above factors. Therefore, while this flora survey was relatively exhaustive, and was conducted at a time of year when the majority of the flora species would be able to be identified, there is the possibility that some species with low abundance in the area have been overlooked.

The Mesa Gap project area covers approximately 2775 ha. The large scale of this project meant that sampling was conducted using quadrats and transects and intensive searching of areas likely to contain unusual flora species. The majority of species would have been identified using these techniques, however, there is the possibility

that species with a low abundance, or with a very restricted range in the survey area may have been overlooked.

The flora surveys were also restricted to predominantly flowering plants, with consideration of some other vascular plants such as cycads. Non-vascular plants were not systematically searched for, as the information available on these plants is generally limited.

3.1.2 Fauna

GHD's qualified ecologists conducted the fauna investigation in conjunction with the flora investigation. The fauna survey included desktop investigations and field surveys, conducted with regard to the EPA's Guidance Statement No. 56, where possible.

The fauna survey was an oppurtunistic survey and did not involve any fauna trapping. The survey involved visual and aural surveys for any fauna species utilising the study area. The study area was also searched for any fauna signs, such as tracks, scats, bones, diggings and feeding signs.

Surveys also included systematic searching across all habitat types, which is an effective method of surveying for many reptile species. This involved searching through microhabitats where reptiles are known to frequent, including turning over logs or rocks, turning over leaf litter and examining hollow logs. Reptiles were also sighted as they basked during the day.

Species – specific search strategies were used to identify any protected species in the area or evidence that they utilise the study area.

Nomenclature

Nomenclature used in this report follows that used by the Western Australian Museum *FaunaBase* program as it is deemed to contain the most up-to-date species information for Western Australia.

Limitations

The fauna survey undertaken was a reconnaissance survey only and thus only sampled those species that can be easily seen, heard or have distinctive signs, such as tracks, scats, diggings etc. Many cryptic and nocturnal species would not have been identified during a reconnaissance survey. Extensive detailed fauna surveys, involving trapping surveys, are required to obtain a more comprehensive list of fauna species that may utilise the site.

This survey was aimed at identifying the terrestrial vertebrate fauna of the study area; no sampling for invertebrates or aquatic species occurred. The information available on the identification, distribution and conservation status of invertebrates is generally less extensive than that of vertebrate species.

This survey was carried out during only one season, and in one year. Complete faunal surveys often require multiple surveys, at different times of year, and over a period of a number of years, to enable full survey of all species present.

3.2 Results of Field Survey – Vegetation and Flora

3.2.1 Vegetation Description

The vegetation of the Mesa Gap survey area was classified into 5 vegetation associations and 8 vegetation types. There is considerable overlap between vegetation types due to the similarity of underlying geology and landform. These vegetation types have been mapped (Appendix A) and are summarised below:

Table 5 Mesa Gap Vegetation Types and Description

Number[1]	Vegetation Association	Vegetation Type	Habitat Description
1	Broad Valley Plains	Localised areas of mulga woodland	*Acacia aneura* low open woodland over *Senna* spp., *Eremophila forrestii*, low shrubland over *Triodia basedowii* open hummock grassland with *Aristida* spp.
2	Drainage Lines	Broad drainage lines in low hills	*Eucalyptus trivalva* scattered low trees over *Acacia bivenosa, Acacia dictyophleba, Acacia tenuissima* shrubland, over *Triodia pungens* grassland. Density varies with soil moisture content.
3	Foot Slopes	Very open tree steppe, over scattered shrubs with mixed bunch and hummock grasslands	*Corymbia hamersleyana* low open woodland with scattered *Hakea lorea, Grevillea wickhamii*, shrubland over *Ptilotus calostachyus, Goodenia* sp. Sandy Creek, *Dodonaea coriacea, Acacia hilliana, Acacia adoxa* low shrubland over *Paraneurachne muelleri*, *Aristida* spp. grassland.
4	Broad Valley Plains	Very open tree steppe, over scattered shrubs with mixed bunch and hummock grasslands	*Corymbia hamersleyana* low open woodland with scattered *Acacia pruinocarpa, Acacia aneura* and *Grevillea striata*, over *Hakea lorea, H. chordophylla*, with scattered *Grevillea stenobotrya* tall shrubland over *Acacia ancistrocarpa, Acacia sclerosperma, Sida* species, *Senna* species, *Dampiera candicans*, over mixed hummock and bunch grasslands dominated by *Triodia basedowii, Triodia schinzii*, *Aristida* species, *Eragrostis* species, with mixed herbs, including *Goodenia* sp. Sandy Creek.
5	Hill Crests and Slopes	Low hills and rises, typically with breakaways	*Eucalyptus leucophloia* scattered low trees with *Eremophila latrobei, Senna* spp open shrubland over *Acacia hilliana, Acacia adoxa, Halgania solanacea, Dodonaea coriacea* low shrubland over *Triodia basedowii* open hummock grassland with *Iseilema membranaceum*. Clusters of taller trees occur in sheltered locations below breakaways.
6	Foot Slopes	Sandy soils raised above the surrounding plain	*Eucalyptus gamophylla, Corymbia hamersleyana* low open woodland over *Hakea lorea, Hakea chordophylla* scattered tall shrubs over *Grevillea stenobotrya, Acacia ancistrocarpa, Acacia pachyacra* shrubland over mixed low shrubland of *Gompholobium polyzygum, Scaevola parvifolia* low open shrubland over mixed hummock and bunch grasslands dominated by *Triodia* and *Aristida* spp.
7	Broad Valley	Lowest point of	Mixed *Corymbia hamersleyana* and *Acacia aneura* low

Number[1]	Vegetation Association	Vegetation Type	Habitat Description
	Plain	floodplain	open woodland, over *Acacia ancistrocarpa, Acacia dictyophleba*, *Grevillea wickhamii, Gossypium robinsonii* open shrubland over *Ptilotus obovatus*, *Solanum centrale*, low open shrubland, over *Paraneurachne muelleri, Aristida* spp., *Eriachne* spp., *Themeda triandra* closed grassland.
8	Degraded / Cleared Vegetation	Degraded / Cleared Vegetation	Areas of vegetation that have been cleared for mining activities, and includes rail and road infrastructure, such as materials extraction pits, etc.

[1] Numbers relate to mapped vegetation types.

Vegetation information collected from quadrat data is collated in Appendix B.

3.2.2 Vegetation Condition

Developed for Bush Forever, the vegetation Condition Rating is a scale that recognises the intactness of vegetation, which is defined by the following (Government of WA, 2000):

- Completeness of structural levels;
- Extent of weed invasion;
- Historical disturbance from tracks and other clearing or dumping; and
- The potential for natural or assisted regeneration.

The scale therefore consists of six (6) rating levels as outlined below in Table 6.

Table 6 Bush Forever (Government of WA, 2000) vegetation condition rating scale.

Vegetation Condition Rating	Vegetation Condition	Description
1	*Pristine or Nearly So.*	No obvious signs of disturbance.
2	*Excellent*	Vegetation structure intact, disturbance affecting individual species, and weeds are non-aggressive species.
3	*Very Good*	Vegetation structure altered, obvious signs of disturbance.
4	*Good*	Vegetation structure significantly altered by very obvious signs of multiple disturbances retains basic vegetation structure or ability to regenerate it.
5	*Degraded*	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not in a state approaching good condition without intensive management.
6	*Completely Degraded*	The structure of the vegetation is no longer intact and the area is completely or almost without native species.

In general, vegetation condition in the Pilbara is considered to range between Pristine and Very Good, with minor areas of disturbance relating to mining operations, road construction activities and livestock grazing.

Within the Mesa Gap survey area, the vegetation on the rocky slopes of the low hills was considered to be in better condition (*Excellent – Very Good*) than the broad plains and drainage lines (*Very Good*), primarily due to lower grazing pressure from livestock. Much of the eastern portion of the survey area had been recently burnt (<3 years), reducing the capability for accurate assessment. Areas where clearing had taken place for mining activities was considered to be *Degraded – Completely Degraded*.

Vegetation condition has not been mapped due to the fact that the variability is considered to be relatively low and the degree of overlap between categories is high.

3.2.3 Threatened Ecological Communities

No Threatened Ecological Communities were recorded during the field survey.

No Priority Ecological Communities were recorded during the field survey.

3.2.4 Flora Species

Vegetation within the survey areas is considered moderately diverse. A total of 133 taxa from 32 families were recorded from the survey area. This list includes subspecies (subsp.), variations (var.), affinities (aff.) and hybrids (x). Three collections could not be identified beyond genus level due to lack of flowering parts or fruiting bodies.

Dominant families recorded were:

- Mimosaceae (wattles): 21 taxa
- Poaceae (grasses): 20 taxa
- Myrtaceae (gums): 8 taxa
- Caesalpiniaceae (cassias): 8 taxa
- Myoporaceae (poverty / emu bushes): 7 taxa
- Amaranthaceae (mulla-mullas): 6 taxa
- Papilionaceae (peas): 6 taxa

Dominant genera recorded from the survey area were:

- *Acacia* 21 taxa
- *Senna* 7 taxa
- *Eremophila* 7 taxa
- *Ptilotus* 5 taxa

» *Triodia* 5 taxa

A full list of flora species present in the survey area is provided in Table 10, Appendix C.

The dry conditions of the soil and vegetation during the survey period is considered to have limited the species richness and abundance of plants recorded during this survey, particularly grass and herb species, and limited the abundance of flowering material.

This baseline survey provides a brief snapshot of the flora present in the site at the time of survey, and therefore the species inventory is influenced by factors such as climate (season) and the subsequent presence/absence of ephemeral species and the variety of habitats surveyed. Less common species may not have been collected due to spatial variability and impossibility of surveying the whole suite of microhabitats present in a survey area of this size.

3.2.5 Significant Flora Species

No Declared Rare or Priority Flora species were recorded from the Mesa Gap survey area during this survey.

A potentially locally significant taxon *Aenictophyton* sp. (aff. *reconditum*) was collected from a known location previously collected by ENV (2007) Orebody 18 Flora and Vegetation Assessment: Phase II at Quadrat 48. This taxon is undescribed, poorly collected and moderately geographically restricted.

Prior to the survey by *ecologia* (2004), *Aenictophyton* was believed to be a monotypic genus. However, recent collections (by *ecologia*, ENV and GHD) and a review of collections lodged at the WA Herbarium, indicate that it is potentially a new species: *Aenictophyton* sp. nov. (G. Davis 183). It is considered likely that this taxon may be added to the Rare and Priority listing, and management actions will need to be in place to ensure that any potential impacts from the development are minimised.

This taxon was collected only at previously known locations during the Mesa Gap survey, and is considered unlikely to occur at the southern portion of Mesa Gap survey area where exploration activities are planned to occur.

In addition to the survey of the Mesa Gap Project area, GHD also conducted a significant flora species search of the eastern Opthalmia Range. *Aenictophyton* sp. nov. (G. Davis 183) was recorded from a number of locations and appears to be restricted to the range and associated foothills.

3.2.6 Weeds

No weed species were recorded from the survey area.

3.3 Results of Field Survey - Fauna

3.3.1 Fauna Species

A total of 29 bird species, 6 mammal species, and four reptile species were recorded during the reconnaissance survey within the Mesa Gap survey area (Table 13, Appendix D).

This survey only provides a brief snapshot of those species present at the time of sampling (daytime), in one season, in one year. Not all potentially occurring species would be recorded during a single survey due to spatial and temporal variations in fauna population numbers.

A number of small mammal/marsupial tracks and diggings were located in sandy spinifex habitat between the rocky lowlands and mulga woodlands. Without an intensive fauna-trapping program, the identification of such fauna will remain uncertain.

3.3.2 Significant Fauna Species

The reconnaissance vertebrate fauna survey yielded the presence of one threatened fauna species within the project area: the Western Pebble-mound Mouse (*Pseudomys chapmani*). One mound (considered potentially active) was located at GDA 94 Zone 51 203596E, 7416382N, within the vicinity of an historical exploration drill pad.

Conservation significant species including the Wedge-tailed Eagle, Whistling Kite, Brown Falcon, Whistling Kite, Rainbow Bee-eater, Black-faced Cuckoo-shrike were recorded during the survey. These species are recognised under international treaties such as CAMBA and JAMBA, as well as the Bonn Convention for migratory species and EPBC Act 1999 list of marine species. Many of these fauna species have extended home ranges, and impacts on these species are considered to be negligible.

3.3.3 Introduced Species

Two introduced species were recorded from the survey area, including domestic livestock. These included:

» Feral Cat (*Felis catus*); and

» Domestic Longhorn Cattle (*Bos taurus*)

3.3.4 Fauna Habitat

Habitat Types

The field fauna assessment covered a number of different fauna habitats, including:

» Rocky outcrops and breakaways (includes small rock crevices and shallow caves);

» Spinifex rocky hills and slopes;

» Minor rocky drainage lines with denser vegetation;

- Open mixed sandy and rocky plains with hummock and bunch grasses; and
- (Recently burnt) mulga woodlands.

No habitats were recorded that are considered to be specific to the survey area.

No permanent or semipermanent water points were located within the survey area. Flight patterns of Zebra Finches observed during the time of survey indicates that available water is associated with runoff from Ophthalmia Range (particularly Shovelanna Hill) and current Orebody 18 mining operations.

Habitat Value

Grazing from livestock has reduced the habitat value within the survey area, particularly on the broad valley plains. Impact includes the preferential browsing of particular plant species (particularly grasses), and the disturbance of the soil surface.

Fauna habitat away from the plains is considered to be relatively unimpacted, primarily where non-palatable vegetation occurs.

Habitat Linkages

Fauna corridors and habitat linkage are important to allow animals to move between areas of resource availability. Such corridors are important for ground and aerial fauna, providing cover, resources, and linking areas suitable for rest and reproduction.

The project area is not considered to contain any significant breaks to habitat linkages, being completely surrounded by relatively unaltered vegetation. Creekline and riparian vegetation is considered to be vital for providing corridors for fauna species utilising temporary and dry waterways and pools.

4. Assessment against Clearing Principles

Any clearing of native vegetation will require a permit under Part V Division 2 of the *Environmental Protection Act 1986* (EP Act), except where an exemption applies under Schedule 6 of the Act or is prescribed by regulation in the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*, and it is not in an Environmentally Sensitive Area (ESA).

Table 7 provides an assessment of the proposed project against the "10 Clearing Principles" as outlined in Schedule 5 of the *Environmental Protection Amendment Act 2003* to determine whether it is at variance to the Principles. These Principles aim to ensure that all potential impacts resulting from removal of native vegetation can be assessed in an integrated way.

The presence of the Priority 4 fauna species Pebble Mound Mouse within the survey area is assessed in Principle (b2).

The amount of clearing of native vegetation required for exploration purposes (cleared lines, drill pads) is minimal, and this species will not be directly impacted as long as the pebble mounds located by this survey are avoided.

As a result this project has been assessed to be unlikely to be at variance with Principle (b2).

This project is not considered to be at variance against any other Clearing Principle.

This project is considered not required to be referred to the Environmental Protection Authority.

Table 7 Assessment against the Ten Clearing Principles

Principle	Criteria	Assessment	Outcome
a) Native vegetation should not be cleared if it comprises a high level of biological diversity.	a1) Native vegetation should not be cleared if it is representative of an area of outstanding biodiversity in the Bioregion.	The native vegetation is not considered to be representative of outstanding biodiversity.	Not at variance with clearing principle.
	a2) Native vegetation should not be cleared if it has higher diversity of indigenous aquatic or terrestrial plant or fauna species than native vegetation of that ecological community in good or better condition in the Bioregion.	The native vegetation within the project area to be is not considered to contain vegetation in good or better condition than similar vegetation within the vicinity of the project area	Not at variance with clearing principle.
	a3) Native vegetation should not be cleared if it has higher diversity of indigenous aquatic or terrestrial plant or fauna species than the remaining vegetation of that ecological community in the local area.	Remnant native vegetation was not considered to contain a higher diversity of indigenous aquatic or terrestrial plant or fauna species than the remaining vegetation of that ecological community in the local area.	Not at variance with clearing principle.
	a4) Native vegetation should not be cleared if it has higher ecosystem diversity than other native vegetation of that local area.	Native vegetation within the project area was not considered to have a higher ecosystem diversity than other native vegetation of that local area. Greater ecosystem diversity is considered to occur on the Ophthalmia Range, north of the project area.	Not at variance with clearing principle.
	a5) Native vegetation should not be cleared if it has higher genetic diversity than the remaining native vegetation of that ecological community.	Native vegetation is not considered to have a higher genetic diversity than the remaining native vegetation of that ecological community. The project area vegetation is contiguous with adjacent native vegetation.	Not at variance with clearing principle.

Principle	Criteria	Assessment	Outcome
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.	b1) Native vegetation should not be cleared if it is or is likely to be habitat for fauna that is declared Specially Protected under the *Wildlife Conservation Act*.	In the majority, the project area contained vegetation and habitat that has not been significantly altered. No specific habitat was noted within the survey area that was not present in the local area. Without intensive fauna searches, it is not certain if declared fauna is present within the survey area. The very small area required to be cleared for proposed exploration purposes is not likely to impact on significant fauna or required habitat.	Not at variance with clearing principle.
	b2) Native vegetation should not be cleared if it is or is likely to be habitat for Priority Listed Fauna.	Where native vegetation remained, it is generally considered to contain habitat for a number of fauna species, including threatened fauna. Priority fauna species were considered likely to utilise habitat in the project area, particularly the low, rocky hills of the southern portion of the Mesa Gap Project area. A potentially active mound of the Priority 4 Western Pebble-mound Mouse was recorded within the project area. The proposed works are likely to occur within the vicinity of this location. The very small area required to be cleared for proposed exploration purposes is not likely to impact on significant fauna or required habitat. No clearing will occur within 50m of the potentially active mound.	**Considered unlikely to be atvariance with clearing principle.**

Principle	Criteria	Assessment	Outcome
	b3) Native vegetation should not be cleared if it is or is likely to be habitat for fauna that is otherwise significant.	Conservation significant fauna were recorded during the survey. These species are recognised under international treaties such as CAMBA and JAMBA, as well as the Bonn Convention for migratory species and EPBC Act 1999 list of marine species. Many of these fauna species have extended home ranges, and impacts on these species are considered to be negligible. The very small area required to be cleared for proposed exploration purposes is not likely to impact on significant fauna or required habitat.	Unlikely to be at variance with clearing principle.
	b4) Native vegetation should not be cleared if it provides significant habitat for fauna species in the local area.	The vegetation and associated fauna habitat potentially cleared is considered to be minimal in a regional perspective. Fauna species present in the survey area are likely to find similar habitat adjacent to the project area. The very small area required to be cleared for proposed exploration purposes is not likely to impact on significant fauna or required habitat.	Not at variance with clearing principle.
	b5) Native vegetation should not be cleared if it maintains ecological functions and processes that protect significant habitat for fauna.	The clearing of native vegetation is not considered to alter ecological functions and processes that protect significant habitat for fauna. The very small area required to be cleared for proposed exploration purposes is not likely to impact on significant fauna or required habitat.	Not at variance with clearing principle.

Principle	Criteria	Assessment	Outcome
	b6) Native vegetation should not be cleared if it forms, or is part of, an ecological linkage that is necessary for the maintenance of fauna.	The project area is closely linked to the surrounding area. A number of ecological linkages run through the project area, particularly related to vegetation along drainage lines or ridgelines. The very small area required to be cleared for proposed exploration purposes is not likely to impact on ecological linkages.	Not at variance with clearing principle.
	b7) Native vegetation should not be cleared if it provides significant habitat for fauna communities (assemblages) and meta-populations.	The project area is not considered to contain significant habitat for faunal assemblages that are not also present adjacent to the project area. The project area is not considered to contain a set of geographically isolated fauna populations. The very small area required to be cleared for proposed exploration purposes is not likely to impact on significant fauna or required habitat.	Not at variance with clearing principle.
c) Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.	c1) Native vegetation should not be cleared if it is necessary for the continued *in situ* existence of populations of Declared Rare Flora under the *Wildlife Conservation Act 1950*.	No Declared Rare Flora has been previously recorded in the project area. No Declared Rare Flora was recorded during the survey. The very small area required to be cleared for proposed exploration purposes is not likely to impact on significant flora species. A follow-up targeted significant flora survey may be required if mining operations proceed.	Not at variance with clearing principle.

Principle	Criteria	Assessment	Outcome
	c2) Native vegetation should not be cleared if it is necessary for the continued *in situ* existence of other significant flora.	A species of native pea (*Aenictophyton* aff. *reconditum*) was recorded from the north of project area at a previously known location. This taxon may be recognised as a new significant species following formal analysis. If clearing is restricted to the southern portion of the Mesa Gap survey area, this taxon will not be impacted. The very small area required to be cleared for proposed exploration purposes is not likely to impact on significant flora species. A follow-up targeted significant flora survey may be required if mining operations proceed.	Not at variance with clearing principle.
	c3) Native vegetation should not be cleared if it is necessary for the continued *in situ* existence of significant habitat for priority flora species published by the Department of Environment and Conservation.	Priority Flora species have not been recorded in the project area. No significant habitat for the continued existence of priority flora species will be impacted by the proposed works. The very small area required to be cleared for proposed exploration purposes is not likely to impact on significant flora species. A follow-up targeted significant flora survey may be required if mining operations proceed.	Not at variance with clearing principle.
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.	d1) Native vegetation should not be cleared if threatened ecological communities listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* are present.	No EPBC Act TECs will be impacted by the proposed works.	Not at variance with clearing principle.
	d2) Native vegetation should not be cleared if it is necessary for the maintenance of Threatened Ecological Communities listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.	No EPBC Act TECs or associated native vegetation will be impacted by the proposed works.	Not at variance with clearing principle.

Principle	Criteria	Assessment	Outcome
	d3) Native vegetation should not be cleared if other significant ecological communities are present.	No other significant ecological communities are known from the survey area.	Not at variance with clearing principle.
	d4) Native vegetation should not be cleared if it is necessary for the maintenance of other significant ecological communities.	No DEC listed TECs or associated native vegetation will be will be impacted by the proposed works.	Not at variance with clearing principle.
	d5) Native vegetation should not be cleared if it is necessary for the continued *in situ* existence of significant examples of priority threatened ecological communities published by the Department of Environment and Conservation.	No PECs are known from within the vicinity of the survey area.	Not at variance with clearing principle.
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.	e1) Native vegetation should not be cleared if the remaining native vegetation represents less than 30%, or the clearing would reduce the representation of remaining native vegetation to less than 30% in the Bioregion (or subregion where applicable).	Clearing Native vegetation within the project area will not significantly reduce the known extent from pre-European extents. Pre-European extents are 99%	Not at variance with clearing principle.
	e2) Native vegetation should not be cleared if an ecological community represents less than 30% of its original extent or clearing would reduce the representation of any ecological community to less than 30% of its original extent in the Bioregion (or subregion where applicable).	Clearing Native vegetation within the project area will not significantly reduce the known extent from pre-European extents. Pre-European extents are 99%	Not at variance with clearing principle.
	e3) Native vegetation should not be cleared if clearing would reduce an ecological community to less than 1% of the Bioregion (or subregion where applicable)	Clearing Native vegetation within the project area will not significantly reduce the known extent from pre-European extents.	Not at variance with clearing principle.

Principle	Criteria	Assessment	Outcome
	e4) Native vegetation should not be cleared if the remaining native vegetation represents less than 30% or the clearing would reduce the representation of remaining native vegetation to less than 30% in the Local Area.	Clearing Native vegetation within the project area will not significantly reduce the known extent from pre-European extents.	Not at variance with clearing principle.
	e5) Native vegetation should not be cleared if an ecological community represents less than 30% of its original extent or clearing will reduce the representation of any ecological community to less than 30% of its original extent in the Local Area.	Clearing Native vegetation within the project area will not significantly reduce the known extent from pre-European extents. The recorded communities are locally well represented.	Not at variance with clearing principle.
	e6) Native vegetation should not be cleared if clearing would reduce any ecological community to less than 1% of the Local Area.	Clearing Native vegetation within the project area will not significantly reduce the known extent from pre-European extents.	Not at variance with clearing principle.
f) Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.	f1) Native vegetation should not be cleared if it is growing in a watercourse or wetland that has been identified as having significant environmental values.	No native vegetation occurs within the survey area that grows in a watercourse or wetland that has been identified as having significant environmental values.	Not at variance with clearing principle.
	f2) Native vegetation should not be cleared if it provides a buffer area for watercourses and wetlands identified in criteria (f1) and (f2).	No native vegetation occurs within the survey area that provides a buffer to watercourses and wetlands. No wetlands are present in the project area as holding significant environmental values.	Not at variance with clearing principle.
	f3) Native vegetation should not be cleared if water tables are likely to change and adversely affect ecological communities that are wetland or groundwater dependent.	This project is not considered likely to adversely alter water tables, and as such will not impact on any ecological communities that are wetland or groundwater dependent.	Not at variance with clearing principle.
	f4) Native vegetation should not be cleared if it is growing in other watercourses or wetlands.	No vegetation will be cleared from drainage lines..	Not considered to be at variance with clearing principle.

Principle	Criteria	Assessment	Outcome
g) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.	g1) Native vegetation should not be cleared if wind or water erosion of soil is likely to be increased (on or off site).	Short-term soil erosion may be associated with clearing due to exploration operations. Soil erosion can be mitigated by use of appropriate water management and rehabilitation regimes.	Not considered to be at variance with clearing principle.
	g2) Native vegetation on land with soils with high or low pH should not be cleared.	The project area is not considered to contain soils a risk of having Acid Sulphate Soils present. No vegetation on soils with significantly low (or high) pH will be impacted by the proposed works.	Not at variance with clearing principle.
	g3) Native vegetation should not be cleared if water logging is likely to be increased (on or off site).	It expected that waterlogging would not be increased by the clearing of native vegetation within the project area	Not at variance with clearing principle.
	g4) Native vegetation should not be cleared if land salinisation is likely to be increased (on or off site).	Soil salinity is not considered to be increased in the project area (on or off site) by the clearing of native vegetation.	Not at variance with clearing principle.
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.	h1) Native vegetation should not be cleared if it contributes significantly to the environmental values of a conservation area.	There are no conservation areas within the vicinity of the project area.	Not at variance with clearing principle.
	h2) Native vegetation should not be cleared if that vegetation provides a buffer to a conservation area.	There are no conservation areas within the vicinity of the project area.	Not at variance with clearing principle.
	h3) Native vegetation should not be cleared if the land contributes to an ecological linkage to a conservation area.	Minor impact to ecological linkages will occur, however, these will not be permanent. In addition, there are no conservation areas within the vicinity of the project area.	Not at variance with clearing principle.
	h4) Native vegetation should not be cleared if it provides habitats not well represented on conservation land.	There are no habitats within the project area that are not well represented on conservation land	Not at variance with clearing principle.

Principle	Criteria	Assessment	Outcome
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.	i1) Native vegetation should not be cleared if clearing the vegetation will reduce the quality of surface or underground water in proclaimed, gazetted or declared areas or catchments.	The clearing of native vegetation is not considered likely to alter the quality of surface or ground waters within the project area.	Not at variance with clearing principle.
	i2) Native vegetation should not be cleared if sedimentation, erosion, turbidity or eutrophication of water bodies on or off site is likely to be caused or increased.	Historical exploration within the survey area has caused some channeling of surface water flow, resulting in minor erosion and gullying. Localised erosion is likely to increase during exploration operations following vegetation clearing. However, this can be mitigated using appropriate management and rehabilitation techniques. Localised erosion will not impact any waterbodies.	Not at variance with clearing principle.
	i3) Native vegetation should not be cleared if water tables are likely to change significantly altering salinity or pH.	The clearing of native vegetation is not considered likely to alter the quality of surface or ground waters within the project area.	Not at variance with clearing principle.
	i4) Native vegetation should not be cleared if the clearing is likely to alter the water regimes of groundwater-dependent ecosystems (GDEs) on or off site, causing degradation to the biological communities associated with these systems.	The clearing of native vegetation is not considered likely to alter the regimes of surface or groundwater dependent vegetation within the project area. No surface water dependent mulga communities will be affected.	Not at variance with clearing principle.
j) Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding.	j1) Native vegetation should not be cleared if it is likely to lead to an incremental increase in peak flood height.	The clearing of native vegetation is not considered likely to cause any alteration to flood duration or flood height.	Not at variance with clearing principle.
	j2) Native vegetation should not be cleared if it is likely to lead to an incremental increase in duration of flood peak.	The clearing of native vegetation is not considered likely to cause any impact on local or regional flooding.	Not at variance with clearing principle.

5. Flora and Fauna Impacts

5.1 Vegetation and Flora

The main impacts on flora and vegetation are:

» Vegetation clearing;

» Potential impact on locally significant taxon *Aenictophyton* sp. nov. (G. Davis 183) / aff. *reconditum*. This is considered unlikely as no plants were recorded within the area to be impacted by the proposed exploration activities;

» Potential introduction and/or spread of weed species; and

» Soil degradation and erosion.

5.2 Fauna Impacts

The main faunal impacts of clearing within the Mesa Gap survey area are:

» Minor clearing of vegetation, used by fauna species for shelter and foraging. Removal of vegetation may improve their susceptibility to predation;

» Minor habitat loss and damage;

» Clearing of native vegetation, which is used by fauna of conservation significance for habitat/shelter and/or food sources (e.g. Pebble Mound Mouse);

» Soil disturbance – and potential refuge destruction for ground dwelling, or cryptic fauna species;

» Death of individual animals within the area may be caused during vegetation clearing;

» Changes to understorey and floristic composition may alter the habitat used by particular fauna species. For example, weed introduction/establishment may occur along disturbed tracks and drill pads, even with weed management measures in place. Weed species may provide a resource to fauna species not previously occurring within the area; and

» A potential increase in weedy species within the adjacent bushland, which could lead to a change in fire regime, may occur, potentially impacting on resident terrestrial fauna species and habitat.

5.3 Management of Flora Impacts

The following recommendations are made from the biological assessment of the Mesa Gap project area:

» The Pebble-mound Mouse mound identified in the survey area can be checked to see if it is still occupied.

» In addition, a follow-up targeted fauna survey (trapping program) may be required to identify the small mammal/marsupial species recorded within the survey area to

determine their conservation status. It is considered unlikely that the exploration program will impact on this unknown mammal/marsupial species, as these species were located in sandy soils away from the areas targeted for exploration.

» Follow-up flora and fauna surveys can be undertaken to target significant species (including *Aenictophyton* sp. nov. (G. Davis 183) / aff. *reconditum*) and associated habitat if the orebody is proven prior to the commencement of mining operations.

6. Conclusions

6.1 Existing Environment

This flora and fauna assessment report details the existing environment at the Mesa gap study area and discusses potential environmental impacts on flora and fauna from exploration activities.

The flora and fauna assessment includes a desktop assessment and the results of a field survey that was conducted in October 2007. The findings of the assessment are summarised below:

- No reserves or conservation areas occur within the vicinity of the survey area;
- No Environmentally Sensitive Areas occur within the vicinity of the survey area;
- No defined wetlands or waterways occur within the survey area;
- Works will temporarily increase runoff and sedimentation. With appropriate management actions in place, alteration to hydrology and drainage is not considered likely to be adversely impacted by this project;
- There are eight vegetation types within the survey area, ranging from vegetation associated with low hills and breakaways (typically - Snappy gum over spinifex) to vegetation on creeklines, and broad drainage areas (Mixed *Corymbia hamersleyana* and *Acacia aneura* low open woodland)
- Based on the current extent of vegetation types in the survey area, they are classified as *Least Concern* in terms of extent of vegetation remaining compared to pre-European extents.
- No Threatened Ecological Communities were recorded within the survey area. No Priority Ecological Communities were recorded within the survey area;
- Vegetation within the survey areas is considered moderately diverse. A total of 133 taxa from 32 families were recorded from the survey area;
- No Declared Rare or Priority Flora species were recorded within the survey area. One potentially new species (*Aenictophyton* sp. nov. (G. Davis 183) / aff. *reconditum*) was collected from previously known locations within the survey area. The proposed works will not impact these areas;
- No weed species were recorded from the survey area;
- A total of 29 bird species, 6 mammal species, and four reptile species were recorded during the reconnaissance survey within the Mesa Gap survey area;
- The reconnaissance vertebrate fauna survey yielded the presence of one threatened fauna species within the project area: the Western Pebble-mound Mouse (*Pseudomys chapmani*). One mound (considered potentially active) was located within the vicinity of an historical exploration drill pad;
- No habitat of significance was recorded from the survey area;

- The exploration program proposed for Mesa Gap is considered to have minimal impact on fauna species present within the survey area;
- The presence of the Priority 4 fauna species Pebble Mound Mouse within the survey area is assessed in Principle (b2). The amount of clearing of native vegetation required for exploration purposes (cleared lines, drill pads) is minimal, and this species will not be directly impacted so long as the pebble mounds located by this survey are avoided. As a result this project has been assessed to be unlikely to be at variance with Principle (b2).
- This project is not considered to be at variance against any other Clearing Principle.
- This project is considered not to be required to be referred to the EPA.

6.2 Management of Flora and Fauna Impacts

The following recommendations are made from the preliminary results of the biological assessment of the Mesa Gap project area:

- The Pebble-mound Mouse mound identified in the survey area can be checked to see if it is still occupied.
- In addition, a follow-up targeted fauna survey (trapping program) may be required to identify the small mammal/marsupial species recorded within the survey area to determine their conservation status. It is considered unlikely that the exploration program will impact on this unknown mammal/marsupial species, as these species were located in sandy soils away from the areas targeted for exploration.
- If the orebody is proven a follow-up flora and fauna surveys can be undertaken to target significant species (including *Aenictophyton* sp. nov. (G. Davis 183) / aff. *reconditum*) and associated habitat prior to the commencement of mining operations.

7. Report Limitations

This report presents the results of a Flora and Fauna Assessment prepared for the purpose of this commission. The data and advice provided herein relate only to the project and structures described herein and must be reviewed by a competent scientist/botanist before being used for any other purpose. GHD accepts no responsibility for other use of the data.

Where previous reports, flora surveys and similar work have been preformed and recorded by others the data is included and used in the form provided by others. The responsibility for the accuracy of such data remains with the issuing authority, not with GHD.

An understanding of site conditions depends on the integration of many pieces of information, some regional, some site specific, some structure specific and some experience based. Hence, this report should not be altered, amended or abbreviated, issued in part or incomplete in any way without prior checking and approval by GHD. GHD accepts no responsibility for any circumstances that arise from the issue of the report that has been modified in any way as outlined above.

8. References

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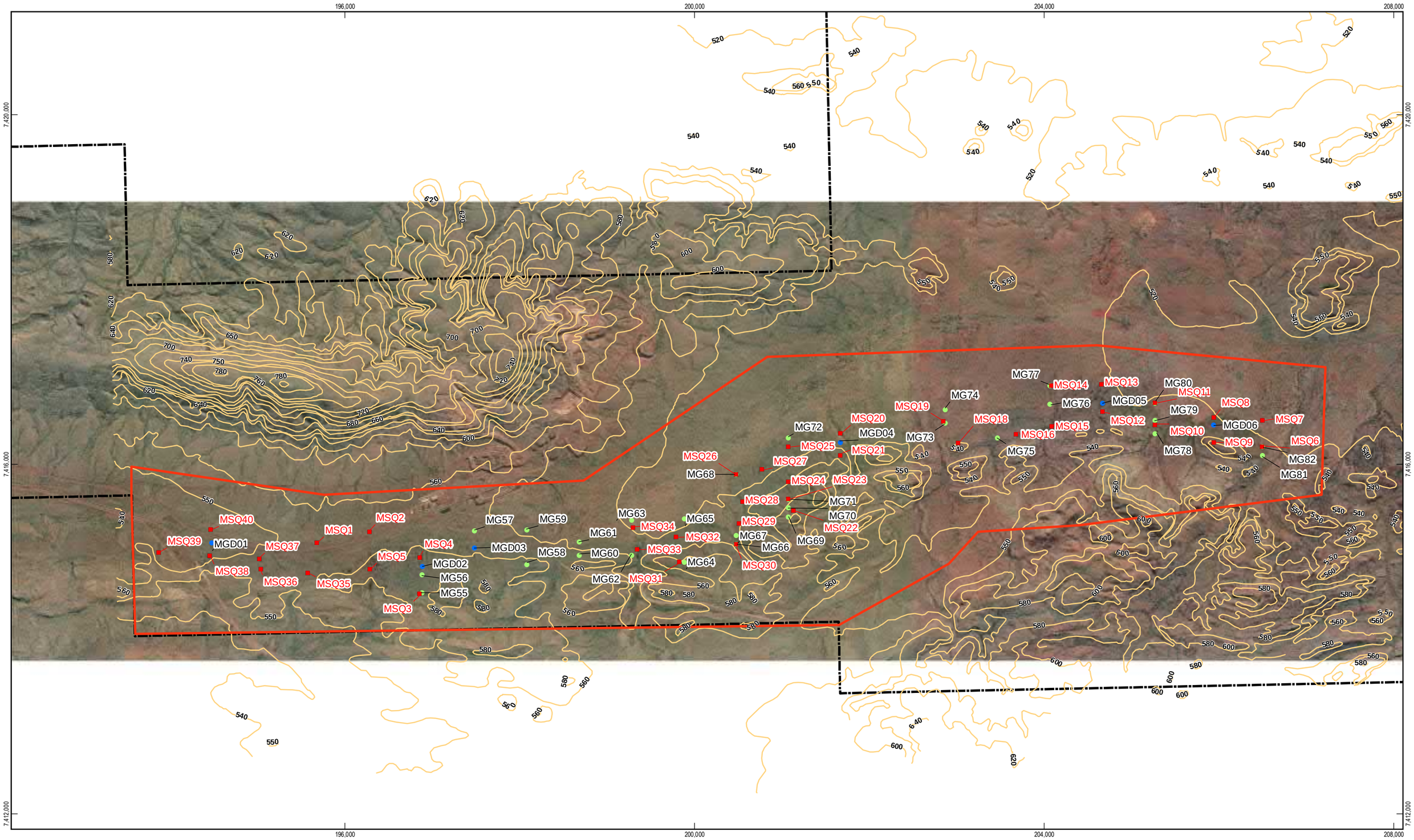
Appendix A

Figures



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Grid: Map Grid of Australia, Zone 50

N

LEGEND

- Quadrat Points - GHD - 20080220
- Native Vegetation Clearing Line - BHP - 200707
- Contours - BHP - 20071024
- Mesa Gap Tenement - DOIR - 20071004

Planned Drillholes - BHP - 200710

- Diamond
- RC Priority 2

BHB Billiton Iron Ore
Mesa Gap Ecological Survey

Aerial Overview

Job Number	6121381
Revision	0
Date	20 May 2008

Figure 1

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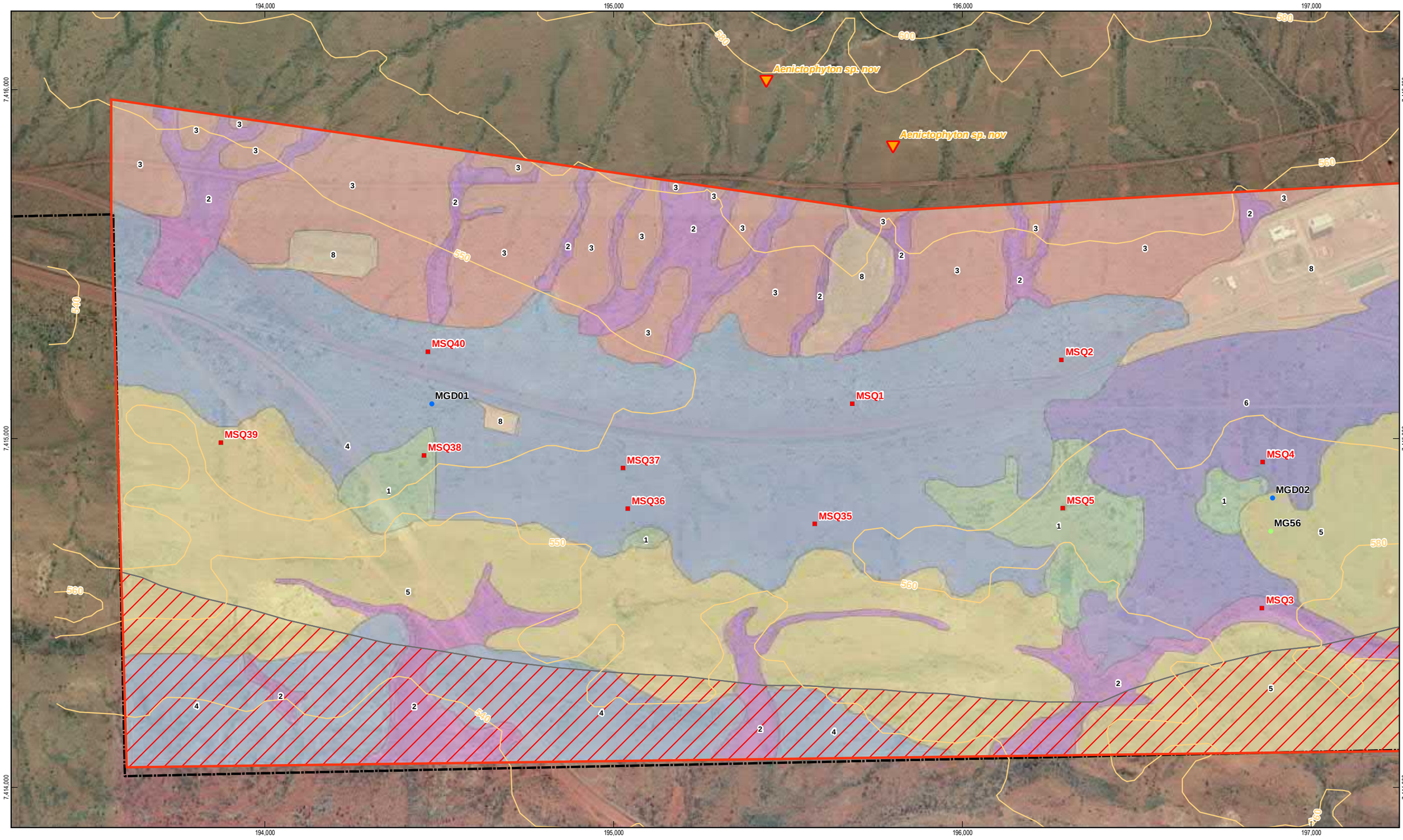

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Grid: Map Grid of Australia, Zone 51

N

LEGEND

- Native Vegetation Clearing Line - BHP - 200707
- Contours - BHP - 20071024
- Mesa Gap Tenement - DOIR - 20071004

Planned Drillholes - BHP - 200710

- Diamond
- RC Priority 2

- Inferred Vegetation - GHD - 20080131
- *Pseudomys chapmani* - GHD - 20080201
- *Aenictophyton sp. nov* - GHD - 20080201
- *Aenictophyton sp. nov* - ENV - 2007

Vegetation Type - GHD - 20080131

1 Localised areas of Mulga Woodland	2 Broad drainage lines in low hills
3 Very open tree steppe, over scattered shrubs with mixed bunch and hummock grasslands on foot slopes	4 Very open tree steppe, over scattered shrubs with mixed bunch and hummock grasslands on broad valley plains
5 Low hills and rises, typically with breakaways	6 Sandy soils raised above the surrounding plain
7 Lowest point of floodplain	8 Degraded/Cleared vegetation

BHB Billiton Iron Ore
Mesa Gap Ecological Survey

Vegetation Type Sheet 1

Job Number	6121381
Revision	0
Date	31 January 2008

Figure 2

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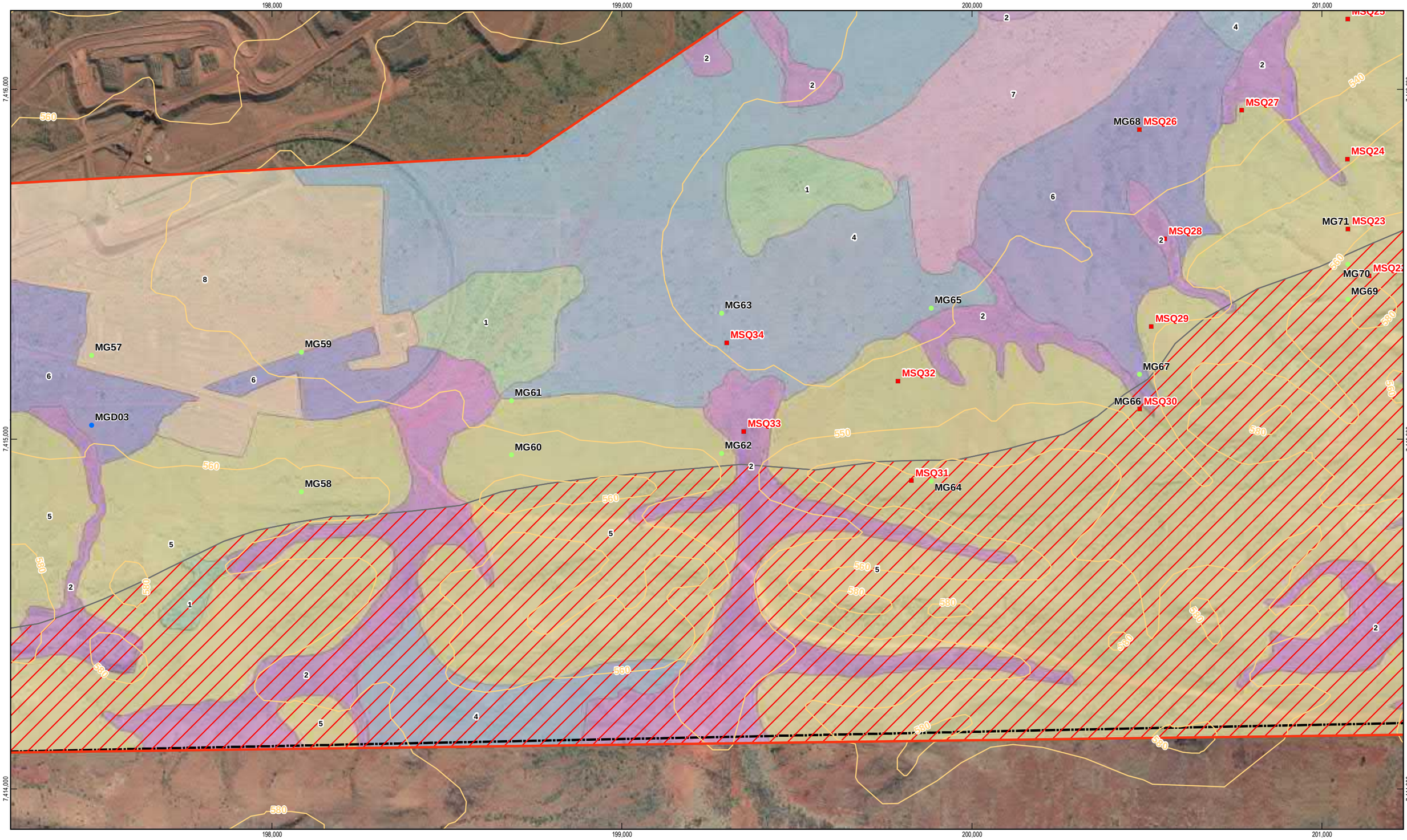

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Horizontal Datum: Geocentric Datum of Australia 1994
Grid: Map Grid of Australia, Zone 51

N

LEGEND

- Native Vegetation Clearing Line - BHP - 200707
- Contours - BHP - 20071024
- Mesa Gap Tenement - DOIR - 20071004

Planned Drillholes - BHP - 200710

- Diamond
- RC Priorty 2

- Inferred Vegetation - GHD - 20080131
- *Pseudomys chapmani* - GHD - 20080201
- *Aenictophyton sp. nov* - GHD - 20080201
- *Aenictophyton sp. nov* - ENV - 2007

Vegetation Type - GHD - 20080131

1 Localised areas of Mulga Woodland	2 Broad drainage lines in low hills
3 Very open tree steppe, over scattered shrubs with mixed bunch and hummock grasslands on foot slopes	4 Very open tree steppe, over scattered shrubs with mixed bunch and hummock grasslands on broad valley plains
5 Low hills and rises, typically with breakaways	6 Sandy soils raised above the surrounding plain
7 Lowest point of floodplain	8 Degraded/Cleared vegetation

BHB Billiton Iron Ore
Mesa Gap Ecological Survey

Vegetation Type Sheet 2

Job Number	6121381
Revision	0
Date	31 January 2008

Figure 2

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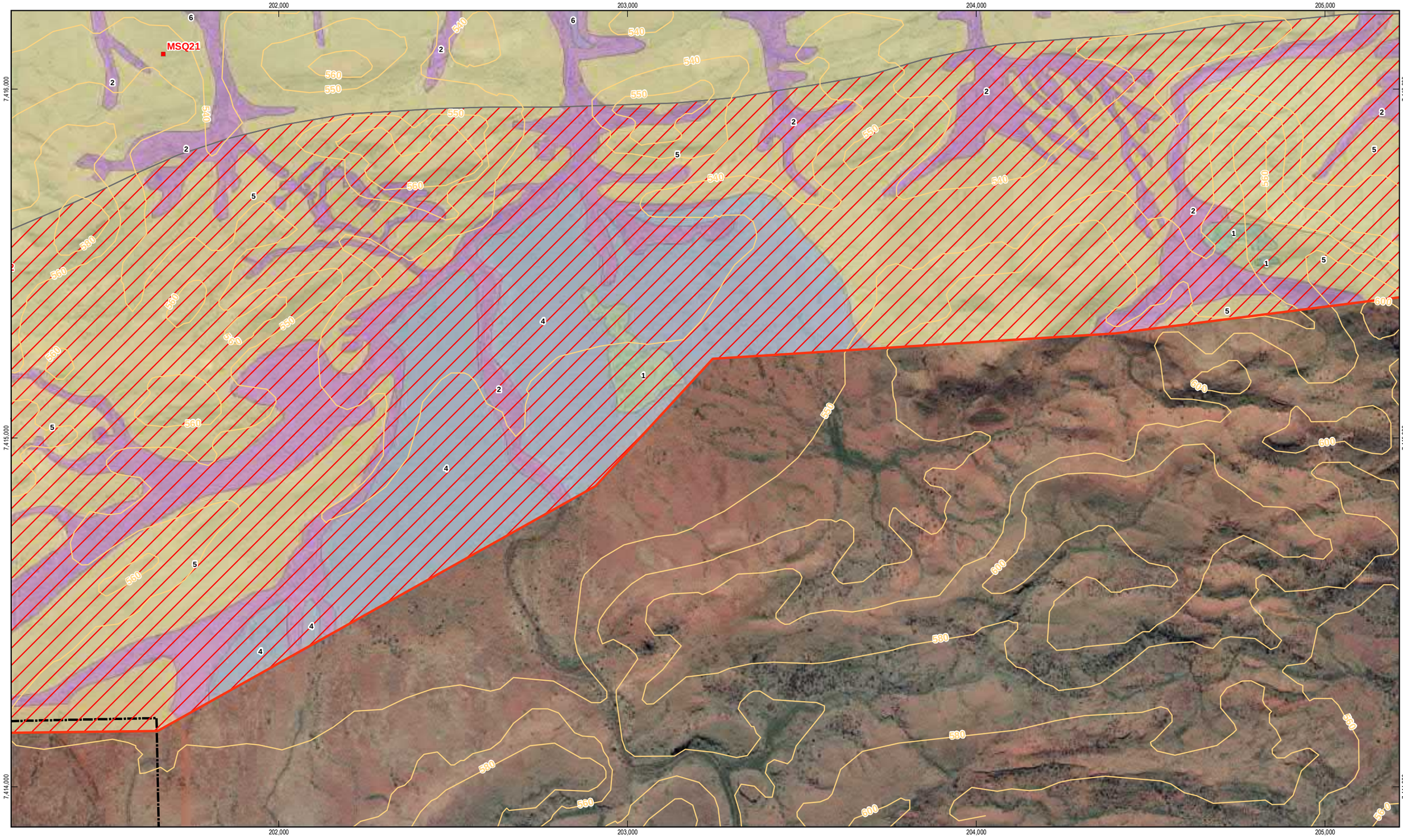

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Grid: Map Grid of Australia, Zone 51

N

LEGEND

- Native Vegetation Clearing Line - BHP - 200707
- Contours - BHP - 20071024
- Mesa Gap Tenement - DOIR - 20071004

Planned Drillholes - BHP - 200710

- Diamond
- RC Priority 2

- Inferred Vegetation - GHD - 20080131
- *Pseudomys chapmani* - GHD - 20080201
- *Aenictophyton sp. nov* - GHD - 20080201
- *Aenictophyton sp. nov* - ENV - 2007

Vegetation Type - GHD - 20080131

1. Localised areas of Mulga Woodland
2. Broad drainage lines in low hills
3. Very open tree steppe, over scattered shrubs with mixed bunch and hummock grasslands on foot slopes
4. Very open tree steppe, over scattered shrubs with mixed bunch and hummock grasslands on broad valley plains
5. Low hills and rises, typically with breakaways
6. Sandy soils raised above the surrounding plain
7. Lowest point of floodplain
8. Degraded/Cleared vegetation

BHB Billiton Iron Ore
Mesa Gap Ecological Survey

Vegetation Type Sheet 3

Job Number	6121381
Revision	0
Date	31 January 2008

Figure 2

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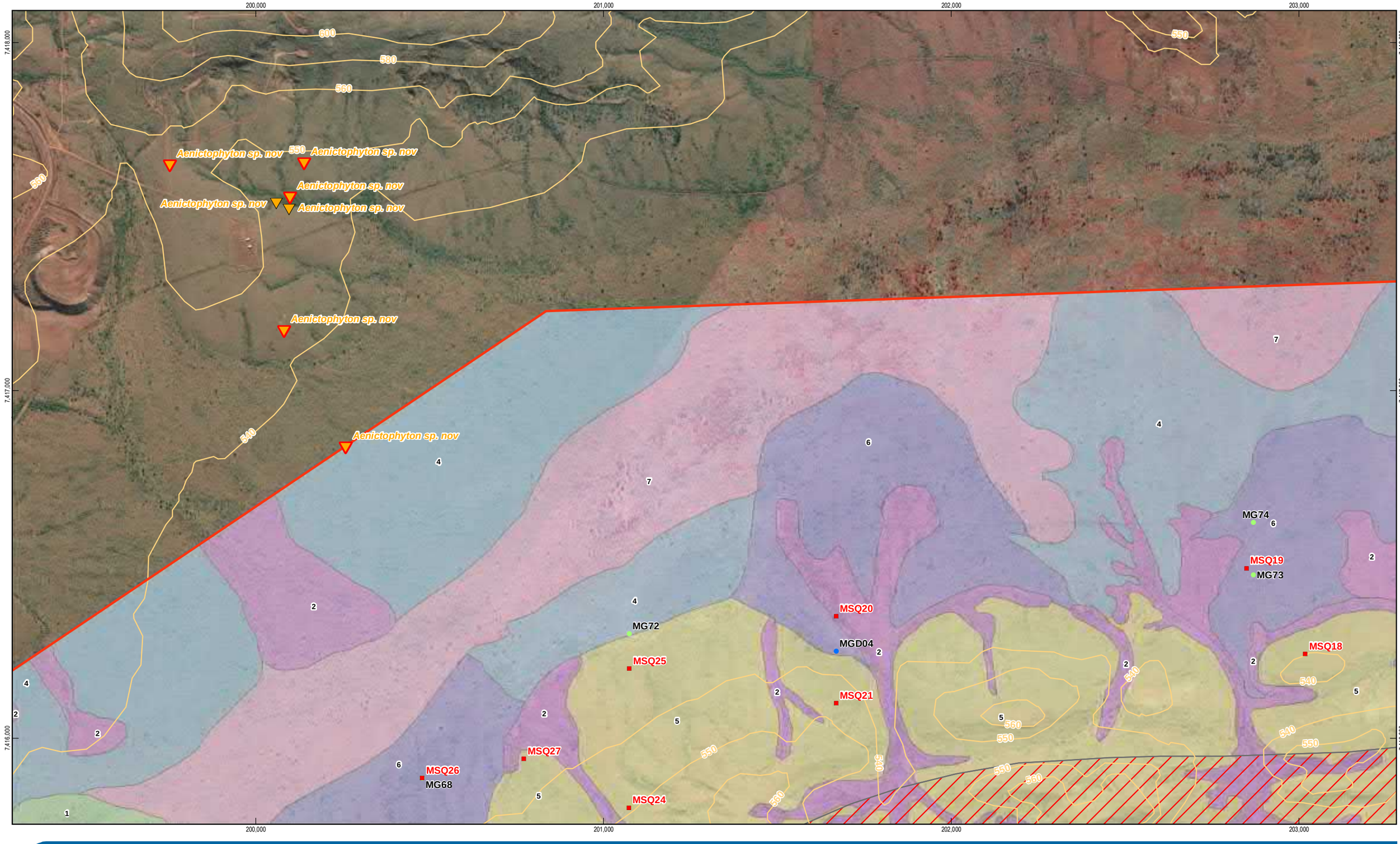

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Grid: Map Grid of Australia, Zone 51

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LEGEND

- Native Vegetation Clearing Line - BHP - 200707
- Contours - BHP - 20071024
- Mesa Gap Tenement - DOIR - 20071004

Planned Drillholes - BHP - 200710

- Diamond
- RC Priorty 2

- Inferred Vegetation - GHD - 20080131
- *Pseudomys chapmani* - GHD - 20080201
- *Aenictophyton sp. nov* - GHD - 20080201
- *Aenictophyton sp. nov* - ENV - 2007

Vegetation Type - GHD - 20080131

1	Localised areas of Mulga Woodland	2	Broad drainage lines in low hills
3	Very open tree steppe, over scattered shrubs with mixed bunch and hummock grasslands on foot slopes	4	Very open tree steppe, over scattered shrubs with mixed bunch and hummock grasslands on broad valley plains
5	Low hills and rises, typically with breakaways	6	Sandy soils raised above the surrounding plain
7	Lowest point of floodplain	8	Degraded/Cleared vegetation

BHB Billiton Iron Ore
Mesa Gap Ecological Survey

Vegetation Type Sheet 4

Job Number	6121381
Revision	0
Date	31 January 2008

Figure 2

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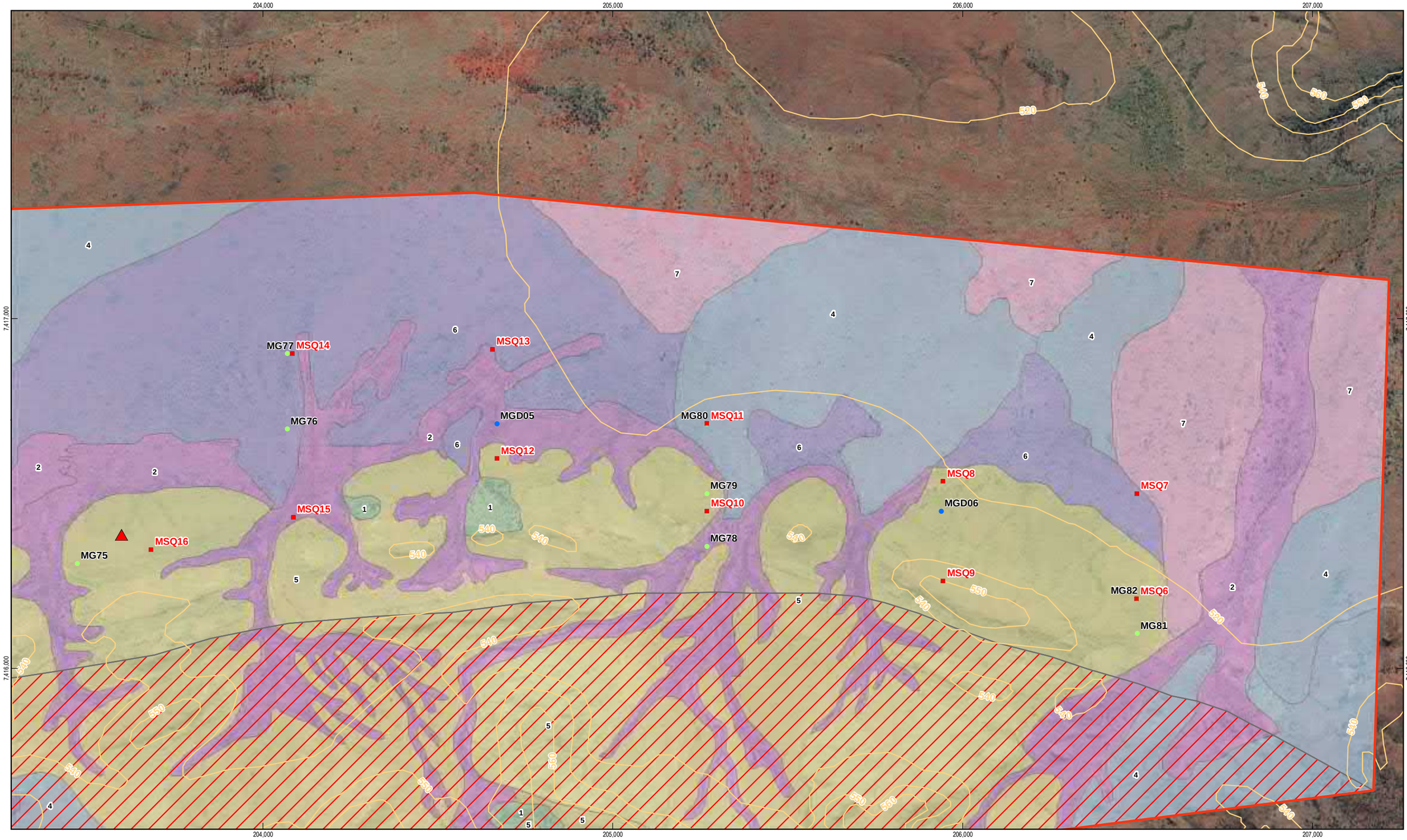

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N

LEGEND

- Native Vegetation Clearing Line - BHP - 200707
- Contours - BHP - 20071024
- Mesa Gap Tenement - DOIR - 20071004

Planned Drillholes - BHP - 200710

- Diamond
- RC Priorty 2

- Inferred Vegetation - GHD - 20080131
- *Pseudomys chapmani* - GHD - 20080201
- *Aenictophyton sp. nov* - GHD - 20080201
- *Aenictophyton sp. nov* - ENV - 2007

Vegetation Type - GHD - 20080131

1. Localised areas of Mulga Woodland
2. Broad drainage lines in low hills
3. Very open tree steppe, over scattered shrubs with mixed bunch and hummock grasslands on foot slopes
4. Very open tree steppe, over scattered shrubs with mixed bunch and hummock grasslands on broad valley plains
5. Low hills and rises, typically with breakaways
6. Sandy soils raised above the surrounding plain
7. Lowest point of floodplain
8. Degraded/Cleared vegetation

BHB Billiton Iron Ore
Mesa Gap Ecological Survey

Vegetation Type Sheet 5

Job Number	6121381
Revision	0
Date	31 January 2008

Figure 2

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Appendix B

Vegetation Description

Results of Quadrat Surveys

Quadrat ID	**MSQ1**
BHP Drillpad ID	MG10
Co-ordinates (GDA94, Zone 51):	195685 E 7415100 N

Plate 1 Quadrat MSQ1 taken from SW corner

Quadrat Description

Sandy Plain: Vegetation Description

Low open woodland of *Eucalyptus xerothermica, Grevillea striata* over open shrubland of *Acacia ancistrocarpa, Senna artemisioides* subsp. *helmsii*, *Sida* ?*arenicola*, over open grassland of *Aristida inaequiglumis, Triodia basedowii* and *Cymbopogon ambiguus*.

Substrate:	Red orange loamy sand
Slope:	Flat

Quadrat Cover

Bare open ground:	50%
Rocks:	No rocks except on old track
Logs/branches:	<2%
Bark:	2%

Fire History:	Recent fire 1-2 yrs. Mid shrubs burnt but grasses returning
Vegetation Condition:	2/3
Disturbance:	Evidence of fire, very old exploration and livestock grazing
Comments:	Old track that has been rehabilitated in centre of site

Vegetation Description

Low open woodland of *Eucalyptus xerothermica, Grevillea striata* over open shrubland of *Acacia ancistrocarpa, Senna artemisioides* subsp. *helmsii*, *Sida ?arenicola*, over open grassland of *Aristida inaequiglumis, Triodia basedowii* and *Cymbopogon ambiguus*.

Table 1 Species list – Quadrat MSQ1

Family	*Genus*	*Species*	Common Name	Status	Height (m)	Coverage
Caesalpiniaceae	*Senna*	*artemisioides* subsp *helmsii*			1.3	2-10
Poaceae	*Aristida*	*inaequiglumis*	Feathertop Threeawn		0.5	10-30
Malvaceae	*Sida*	*?arenicola* (not flowering)			0.6	2-10
Poaceae	*Triodia*	*basedowii*	Lobed Spinifex		0.5	2-10
Poaceae	*Aristida*	*latifolia*	Feathertop Threeawn		0.6	<2
Myrtaceae	*Eucalyptus*	*xerothermica*			5	<2
Mimosaceae	*Acacia*	*bivenosa*			0.8	<2
Caesalpiniaceae	*Senna*	*artemisioides* subsp. *oligophylla*			0.9	<2
Proteaceae	*Grevillea*	*striata*	Beefwood		5	<2
Poaceae	*Cymbopogon*	*ambiguus*	Scentgrass		0.8	2-10
Malvaceae	*Sida*	sp.			1.1	<2
Poaceae	*Enneapogon*	*caerulescens*	Limestone Grass		0.3	<2
Poaceae	*Triodia*	*schinzii*			1.6	<2
Mimosaceae	*Acacia*	*melleodora*			1.8	2-10
Mimosaceae	*Acacia*	*dictyophleba*			4	<2
Myrtaceae	*Corymbia*	*opaca*	Desert Bloodwood		1.6	<2
Mimosaceae	*Acacia*	*sclerosperma* subsp.			1	<2

Family	*Genus*	*Species*	Common Name	Status	Height (m)	Coverage
		sclerosperma				
Mimosaceae	*Acacia*	*ancistrocarpa*	Fitzroy Wattle		1.7	2-10
Poaceae	*Eriachne*	*aristidea*			0.2	<2
Poaceae	*Eragrostis*	*falcata*	Sickle Lovegrass		0.3	<2
Lamiaceae	*Discrastylis*	*cordifolia*			0.3	<2
Goodeniaceae	*Dampiera*	*candicans*			0.2	<2
Amaranthaceae	*Gomphrena*	*canescens*			0.2	<2
Poaceae	*Eulalia*	*aurea*	Silky Browntop		0.6	<2
Poaceae	*Aristida*	*contorta*	Bunched Kerosene Grass		0.3	<2
Mimosaceae	*Acacia*	*pachyacra*			2	<2
Poaceae	*Paraneurachne*	*muelleri*	Northern Mulga Grass		0.6	<2
Asteraceae	*Pterocaulon*	*sphaeranthoides*			0.2	<2
Asteraceae	*Chrysocephalum*	*eremaeum*			0.5	<2
Asteraceae	*Pluchea*	*dunlopii*			0.2	<2
Proteaceae	*Grevillea*	*wickhamii*	Wickham's Grevillea		2	<2
Papilionaceae	*Leptosema*	*chambersii*			0.6	<2

Quadrat ID: **MSQ2**

BHP Drillpad ID: MG53

Co-ordinates (GDA94, Zone 51): 196285 7415225

Plate 2 Quadrat MSQ2 taken from SW corner

Quadrat Description

Sandy Plain: Vegetation Description

Open Shrubland of *Acacia sclerosperma* subsp. *sclerosperma* and *A. pachyacra*, low open shrubland of *Sida ?arenicola* over grassland dominated by *Triodia basedowii* and *Aristida inaequiglumis.*

Substrate: Red orange loamy sand

Slope None

Quadrat Cover

Bare open ground 50%

Rocks: <2%

Logs/branches: <2%

Bark: <2%

Fire: Evidence of fire in patches, some patches 2-5 yrs since fire

Condition: Under powerlines is condition 4/5 most of site condition 2/3

Disturbance: Powerline construction and maintenance and cattle grazing

Comments: SW corner is underneath powerlines. Lots of dead burnt branches in centre of quadrat.

Table 2 Species list – Quadrat MSQ2

Family	*Genus*	*Species*	Common Name	Status	Height	Coverage
Poaceae	*Eulalia*	*aurea*	Silky Browntop		1	<2
Poaceae	*Cymbopogon*	*ambiguus*	Scentgrass		1	<2
Mimosaceae	*Acacia*	*melleodora*			1.6	<2
Poaceae	*Triodia*	*basedowii*	Lobed Spinifex		0.9	30-50
Caesalpiniaceae	*Senna*	*artemisioides* subsp. *helmsii*			0.6	<2
Poaceae	*Aristida*	*contorta*	Bunched Kerosene Grass		0.3	<2
Poaceae	*Aristida*	*inaequiglumis*	Feathertop Threeawn		0.6	2-10
Caesalpiniaceae	*Senna*	*artemisioides* subsp. *oligophylla*			0.5	<2
Goodeniaceae	*Dampiera*	*candicans*			0.4	<2
Mimosaceae	*Acacia*	*sclerosperma* subsp. *sclerosperma*			2	2-10
Mimosaceae	*Acacia*	*pachyacra*			1.5	2-10
Lamiaceae	*Discrastylis*	*cordifolia*			0.5	<2
Lauraceae	*Cassytha*	sp. (not flowering)			0.05	<2
Poaceae	*Eragrostis*	*falcata*	Sickle Lovegrass		0.4	<2
Tiliaceae	*Triumfetta*	sp.			0.9	<2
Proteaceae	*Hakea*	*chordophylla*			0.5	<2
Poaceae	*Paraneurachne*	*muelleri*	Northern Mulga Grass		0.3	<2
Rubiaceae	*Psydrax*	*latifolia*			1.6	<2
Sapindaceae	*Dodonaea*	*coriaceae*			0.6	<2
Malvaceae	*Sida*	*?arenicola (*not flowering)			0.7	2-10
Myrtaceae	*Corymbia*	*opaca*	Desert Bloodwood		5	<2
Convolvulaceae	*Bonamia*	*rosea*			0.3	<2
Mimosaceae	*Acacia*	*bivenosa*			0.9	<2

Family	*Genus*	*Species*	Common Name	Status	Height	Coverage
Mimosaceae	*Acacia*	*inaequilatera*	Baderi		1.5	<2

Quadrat ID: **MSQ3**

BHP Drillpad ID: MG55

Co-ordinates: 196860 7414514

Plate 3 Quadrat MSQ3 taken from SW corner

Quadrat Description

Base end of gully: Vegetation Description

Low Open Woodland of *Eucalyptus leucophloia* over *Hakea chordophylla, Senna artemisioides* subsp. *helmsii, Acacia pachyacra*, over Grassland dominated by *Triodia* angustata and *T. pungens*.

Substrate:	Rocks
Slope	Top slope of gully to top of ridge
Bare open ground	20%
Rocks:	No rocks except on old track
Logs/branches:	<2%
Bark:	<2%

Fire History: Long time, 5+ years (Spinifex large tussocks)

Condition: 1/2

Disturbance: No visible signs of disturbance

Table 3 Species list – Quadrat MSQ3

Family	Genus	Species	Common Name	Status	Height	Coverage
Myrtaceae	*Eucalyptus*	*leucophloia*	Snappy Gum		4	2-10
Poaceae	*Cymbopogon*	*ambiguus*	Scentgrass		1	<2
Poaceae	*Triodia*	*angusta*			1	30-50
Poaceae	*Triodia*	*pungens*	Soft Spinifex		1.2	10-30
Loranthaceae	*Amyema*	*miquelii*	Stalked Mistletoe		5	<2
Loranthaceae	*Lysiana*	*casuarinae*			4	<2
Mimosaceae	*Acacia*	*bivenosa*			3	<2
Poaceae	*Triodia*	*epactia*			0.3	<2
Caesalpiniaceae	*Senna*	*artemisioides* subsp. *helmsii*			0.8	2-10
Mimosaceae	*Acacia*	*tetragonophylla*			3	<2
Caesalpiniaceae	*Senna*	*glutinosa* subsp. *?*			1.1	<2
Chenopodiaceae	*Maireana*	*cordifolia*	Satiny Bluebush		0.4	<2
Mimosaceae	*Acacia*	*pachyacra*			1.1	2-10
Mimosaceae	*Acacia*	*hilliana*			0.5	<2
Proteaceae	*Hakea*	*chordophylla*			1	2-10
Asteraceae	*Pterocaulon*	*sphaeranthoides*			0.5	<2
Papilionaceae	*Gompholobium*	*polyzygum*			0.5	<2
Goodeniaceae	*Goodenia*	sp. (senescent)			0.2	<2
Convolvulaceae	*Duperreya*	*commixta*			climbing	<2
Poaceae	*Eragrostis*	*falcata*	Sickle Lovegrass		0.4	<2
Myrtaceae	*Calytrix*	*carinata*			1	<2
Myoporaceae	*Eremophila*	*latrobei* subsp. *latrobei*	Warted Fuschia Bush		2	<2
Proteaceae	*Grevillea*	*stenobotrya*			1.2	<2
Amaranthaceae	*Ptilotus*	*rotundifolius*	Royal Mulla Mulla		0.5	<2

Quadrat ID:	**MSQ4**	
BHP Drillpad ID:	MG16	
Co-ordinates:	196862	7414932

Quadrat Description

Slope of rocky edge: Vegetation Description

Shrubland of *Acacia ancistrocarpa, Acacia bivenosa, Grevillea wickhamii* over low open shrubland of *Acacia adoxa* over grassland dominated by *Triodia basedowii*.

Substrate:	Rocks
Bare open ground:	20%
Slope:	Flat
Rocks:	100%
Logs/branches:	<2%
Bark:	<2%
Fire History:	Unburnt 5+ years
Condition:	1/2
Disturbance:	Possibly old disturbances, including clearing, from exploration
Comments:	Old track running through quadrat

Table 4 Species list – Quadrat MSQ4

Family	Genus	Species	Common Name	Status	Height	Coverage
Proteaceae	*Hakea*	*lorea*	Tree Hakea		2.5	<2
Mimosaceae	*Acacia*	*bivenosa*			2	2-10
Mimosaceae	*Acacia*	*ancistrocarpa*	Fitzroy Wattle		1.8	10-30
Poaceae	*Cymbopogon*	*ambiguus*	Scentgrass		0.7	<2
Poaceae	*Triodia*	*basedowii*	Lobed Spinifex		0.5	50-70
Poaceae	*Triodia*	*pungens*	Soft Spinifex		0.8	<2
Proteaceae	*Grevillea*	*wickhamii*			1.5	2-10
Mimosaceae	*Acacia*	*ancistrocarpa*	Fitzroy Wattle		1.8	<2
Sterculiaceae	*Keraudrenia*	*velutina* subsp. *elliptica*			0.7	<2
Solanaceae	*Solanum*	*lasiophyllum*	Flannel Bush		0.6	<2
Mimosaceae	*Acacia*	*adoxa*			0.7	2-10
Sterculiaceae	*Waltheria*	*virgata*			0.6	<2
Mimosaceae	*Acacia*	*inaequilatera*	Baderi		1.5	<2
Myrtaceae	*Calytrix*	*carinata*			0.5	<2
Mimosaceae	*Acacia*	*rhodophloia*			1.6	<2
Zygophyllaceae	*Tribulus*	*suberosus*	Corky Bark		1.1	<2
Molluginaceae	*Mollugo*	*molluginea*			0.05	<2

Quadrat ID: **MSQ5**

BHP Drillpad ID: MG11

Co-ordinates: 196289 7414800

Plate 4 Quadrat MSQ5 taken from SW corner

Quadrat Description

Sandy Plain:Vegetation Description

Low Open woodland of *Acacia arida* over open shrubland of *Eremophila fraseri, E. forrestii*, over open grassland of *Triodia basedowii* and *Eragrostis falcata*.

Substrate: red orange loamy sand

Slope: Flat

Bare open ground: 70%

Rocks: Occasional scattered rocks

Logs/branches <2%

Bark <2%

Fire History: 5+ years

Condition 3

Disturbance: Old track and cow disturbance

Comments: Old track through quadrat, but good regrowth

Table 5 Species list – Quadrat MSQ5

Family	Genus	Species	Common Name	Status	Height	Coverage
Poaceae	*Eragrostis*	*falcata*	Sickle Lovegrass		0.3	2-10
Poaceae	*Triodia*	*basedowii*	Lobed Spinifex		0.7	10-30
Mimosaceae	*Acacia*	*ancistrocarpa*	Fitzroy Wattle		4	<2
Myoporaceae	*Eremophila*	*fraseri*	Turpentine Bush		1.8	2-10
Mimosaceae	*Acacia*	*arida*			4	2-10
Myoporaceae	*Eremophila*	*forrestii*	Wilcox Bush		0.9	2-10
Santalaceae	*Anthobolus*	*leptomerioides*			0.7	<2
Zygophyllaceae	*Tribulus*	*suberosus*	Corky Bark		0.6	<2
Amaranthaceae	*Ptilotus*	*calostachyus*	Weeping Mulla Mulla		0.3	<2
Poaceae	*Cymbopogon*	*ambiguus*	Scentgrass		0.4	<2
Goodeniaceae	*Goodenia*	sp. Sandy Creek			0.6	<2
Mimosaceae	*Acacia*	*melleodora*			0.9	<2

Quadrat ID:	**MSQ6**
BHP Drillpad ID:	MG82
Co-ordinates:	206498 7416199

Plate 5 Quadrat MSQ6 taken from SW corner

Quadrat Description

Laterite hill: Vegetation Description

Open shrubland of *Senna artemisioides* subsp. *helmsii*, *Acacia bivenosa*, over mixed grassland of *Triodia basedowii, T. pungens, Aristida latifolia*

Substrate:	rocks
Slope:	slight slope to east
Bare open ground:	0%
Rocks:	100%
Logs/branches:	<2%
Bark:	<2%
Fire History:	5+ years
Condition:	1/2

Disturbance: Cattle, *Acacia victoriae* in creekline

Table 6 Species list – Quadrat MSQ6

Family	*Genus*	*Species*	Common Name	Status	Height	Coverage
Poaceae	*Triodia*	*basedowii*	Lobed Spinifex		0.8	10-30
Caryophyllaceae	*Polycarpaea*	*corymbosa*			0.05	<2
Caesalpiniaceae	*Senna*	*artemisioides* subsp. *oligophylla*			1	<2
Caryophyllaceae	*Polycarpaea*	*longiflora*			0.1	<2
Caryophyllaceae	*Polycarpaea*	*holtzei*			0.05	<2
Poaceae	*Iseilema*	*membranaceum*	Small Flinders Grass		0.1	<2
Caesalpiniaceae	*Senna*	*artemisioides* subsp. *helmsii*			1.2	2-10
Poaceae	*Enneapogon*	*caerulescens*	Limestone Grass		0.2	<2
Myrtaceae	*Corymbia*	*deserticola*	Twin-leaf Mallee		0.3	<2
Poaceae	*Eragrostis*	*falcata*	Sickle Lovegrass		0.3	<2
Mimosaceae	*Acacia*	*bivenosa*			0.8	2-10
Poaceae	*Aristida*	*latifolia*	Feathertop Threeawn		0.7	2-10
Poaceae	*Aristida*	*contorta*	Bunched Kerosene Grass		0.3	<2
Proteaceae	*Grevillea*	*wickhamii*			1.8	<2
Poaceae	*Eriachne*	*aristidea*			0.3	<2
Amaranthaceae	*Ptilotus*	*?exaltatus* (post-flowering)	Tall Mulla Mulla		0.5	<2
Solanaceae	*Solanum*	*lasiophyllum*	Flannel Bush		0.4	<2
Amaranthaceae	*Gomphrena*	*canescens*	Batchelor's Buttons		0.4	<2
Mimosaceae	*Acacia*	*tetragonophylla*			2	<2
Amaranthaceae	*Ptilotus*	*incanus*			0.3	<2
Mimosaceae	*Acacia*	*sclerosperma* subsp. *sclerosperma*			0.4	<2
Myoporaceae	*Eremophila*	*cuneifolia*			0.7	<2
Mimosaceae	*Acacia*	*maitlandii*			.6	<2
Chenopodiaceae	*Maireana*	*georgei*			.4	<2
Solanaceae	*Solanum*	*sturtianum*			.8	<2

Family	*Genus*	*Species*	Common Name	Status	Height	Coverage
Proteaceae	*Hakea*	*chordophylla*			.4	<2
Poaceae	*Cymbopogon*	*ambiguus*	Scentgrass		.9	<2
Zygophyllaceae	*Tribulus*	*suberosus*	Corky bark		.6	<2
Poaceae	*Triodia*	*pungens*	Soft Spinifex		1.3	2-10
Amaranthaceae	*Ptilotus*	*obovatus*			.9	<2
Amaranthaceae	*Ptilotus*	*calostachyus*	Weeping Mulla Mulla		.7	<2
Solanaceae	*Solanum*	*orbiculatum*			.4	<2
Myoporaceae	*Eremophila*	*latrobei* subsp. *latrobei*			1.2	<2
Myrtaceae	*Calytrix*	*carinata*			.6	<2
Caesalpiniaceae	*Senna*	*glutinosa* subsp *?*			.6	<2
Mimosaceae	*Acacia*	*hilliana*			.8	<2
Poaceae	*Paraneurachne*	*muelleri*	Northern Mulga Grass		.3	<2
Myrtaceae	*Eucalyptus*	*leucophloia*	Snappy Gum		5m	<2

Quadrat ID:	**MSQ7**
BHP Drillpad ID:	MG47
Co-ordinates:	206499 7416500

Plate 6 Quadrat MSQ7 taken from SW corner

Quadrat Description

Flat plain: Vegetation Description:

Open shrubland of *Acacia marramamba, A. tenuissima*, over low open shrubland of *Dampiera candicans, Bonamia rosea*, over *Triodia pungens* grassland

Substrate	Orange-red sandy loam, occasional laterite rock heaps
Slope	Flat
Bare open ground	40%
Rocks	20% (gibber/ laterite rocks)
Logs/branches	<2%
Bark	<2%
Fire History:	5+ years
Condition:	1/2

Disturbance: Small amount of livestock

Table 7 Species list – Quadrat MSQ7

Family	*Genus*	*Species*	Common Name	Status	Height	Coverage
Poaceae	*Triodia*	*pungens*	Soft Spinifex		1.2	30-50
Poaceae	*Eragrostis*	*falcata*	Sickle Lovegrass		0.4	<2
Poaceae	*Aristida*	*inaequiglumis*	Feathertop Threeawn		0.7	<2
Poaceae	*Cymbopogon*	*ambiguus*	Scentgrass		0.9	<2
Poaceae	*Paraneurachne*	*muelleri*	Northern Mulga Grass		0.6	<2
Boraginaceae	*Heliotropium*	*sp. (dead)*			0.2	<2
Poaceae	*Eriachne*	*aristidea*			0.4	<2
Convolvulaceae	*Bonamia*	*rosea*			0.6	2-10
Lamiaceae	*Discrastylis*	*cordifolia*			0.2	<2
Caesalpiniaceae	*Senna*	*artemisioides* subsp. *helmsii*			1	<2
Proteaceae	*Hakea*	*lorea*			2	<2
Solanaceae	*Solanum*	*sturtianum*			0.5	<2
Malvaceae	*Sida*	*fibulifera*	Silver Sida		0.6	<2
Goodeniaceae	*Dampiera*	*candicans*			0.5	2-10
Mimosaceae	*Acacia*	*bivenosa*			2.5	<2
Mimosaceae	*Acacia*	*kempeana*	Witchetty Bush		2	<2
Mimosaceae	*Acacia*	*tenuissima*			2.5	2-10
Mimosaceae	*Acacia*	*arida*			2	<2
Mimosaceae	*Acacia*	*pruinocarpa*	Gidgee		2	<2
Myoporaceae	*Eremophila*	*forrestii*	Wilcox Bush		1.1	<2
Caesalpiniaceae	*Senna*	*artemisioides* subsp. *oligophylla*			0.7	<2
Zygophyllaceae	*Tribulus*	*suberosus*	Corkybark		0.6	<2
Mimosaceae	*Acacia*	*melleodora*			0.6	<2
Mimosaceae	*Acacia*	*marramamba*			1.9	2-10
Caesalpiniaceae	*Senna*	*glutinosa*			0.8	<2
Poaceae	*Triodia*	*epactia*			0.4	<2
Papilionaceae	*Indigofera*	*fractiflexa*			0.05	<2
Goodeniaceae	*Goodenia*	*sp. (dead)*			0.3	<2

Quadrat ID: **MSQ8**

BHP Drillpad ID: MG44

Co-ordinates: 205945 7416535

Plate 7 Quadrat MSQ8 taken from SW corner

Quadrat Description

Sand/loam plain: Vegetation Description

Very open shrub mallee of *Eucalyptus gamophylla* over shrubland of *Acacia marramamba, A. bivenosa*, over low open shrubland of *Dampiera candicans*, over grassland of *Themeda triandra, Triodia basedowii*.

Substrate: Red orange loamy sand

Slope: flat

Bare open ground: 50-70%

Rocks: 30-50 gibber (laterite)

Logs/branches: <2%

Bark: <2%

Fire	Old (5+ years)
Condition	1/2
Disturbance:	Livestock
Comments:	Vague signs of waterway (ill-defined channel)

Table 8 Species list – Quadrat MSQ8

Family	Genus	Species	Common Name	Status	Height	Coverage
Myrtaceae	*Eucalyptus*	*gamophylla*	Twin-leaf Mallee		3	2-10
Convolvulaceae	*Duperreya*	*commixta*			0.5	<2
Tiliaceae	*Corchorus*	sp. (not fruiting)			0.7	<2
Papilionaceae	*Rhynchosia*	*minima*			0.05	<2
Malvaceae	*Gossypium*	*robinsonii*	Wild Cotton		1.8	<2
Mimosaceae	*Acacia*	*marramamba*			1.5	10-30
Poaceae	*Cymbopogon*	*ambiguus*	Scentgrass		0.8	<2
Poaceae	*Themeda*	*triandra*	Kangaroo Grass		1.2	2-10
Goodeniaceae	*Dampiera*	*candicans*			0.8	2-10
Mimosaceae	*Acacia*	*bivenosa*			3	2-10
Caesalpiniaceae	*Senna*	*artemisioides* subsp. *oligophylla*			0.9	<2
Proteaceae	*Hakea*	*lorea*			0.8	<2
Convolvulaceae	*Bonamia*	*rosea*			0.6	<2
Mimosaceae	*Acacia*	*monticola*	Gawar		0.7	<2
Mimosaceae	*Acacia*	*adoxa*			0.6	<2
Malvaceae	*Sida*	*fibulifera*	Silver Sida		0.4	<2
Mimosaceae	*Acacia*	*pruinocarpa*	Gidgee		2	<2
Poaceae	*Eragrostis*	*falcata*	Sickle Lovegrass		0.3	<2
Mimosaceae	*Acacia*	*hilliana*			0.4	<2
Poaceae	*Triodia*	*pungens*	Soft Spinifex		1.1	<2
Poaceae	*Triodia*	*basedowii*	Lobed Spinifex		0.7	2-10
Poaceae	*Eriachne*	*lanata*			0.6	<2
Amaranthaceae	*Ptilotus*	*incanus*			0.3	<2
Amaranthaceae	*Gomphrena*	*canescens*	Batchelor's Buttons		0.2	<2
Malvaceae	*Sida*	sp.			0.3	<2

Family	Genus	Species	Common Name	Status	Height	Coverage
Poaceae	*Aristida*	*inaequiglumis*	Feathertop Threeawn		0.7	<2
Amaranthaceae	*Ptilotus*	*obovatus*	Cotton Bush		0.8	<2
Mimosaceae	*Acacia*	*aneura* var. *conifera*			1.1	<2
Myoporaceae	*Eremophila*	*fraseri*	Turpentine Bush		0.8	<2
Lauraceae	*Cassytha*	sp. (not flowering)			0.7	<2

Quadrat ID:	**MSQ9**
BHP Drillpad ID:	MG42
Co-ordinates:	205945 7416250

Plate 8 Quadrat MSQ9 taken from SW corner

Quadrat Description

Top of low rocky hills and associated northern slopes: Vegetation Description

Triodia basedowii grassland with scattered emergent *Grevillea wickhamii* and *Acacia marramamba*.

Substrate	Red orange loamy sand
Bare open ground:	70-100%
Rocks	70-100, some outcropping rocks
Slope:	Medium (aspect - north)
Logs/branches:	<2%
Bark	<2%
Condition	1/2
Disturbance	Evidence of fire

Comments Very limited overstorey, predominantly spinifex with some *Acacia spp*

Table 9 Species list – Quadrat MSQ9

Family	Genus	Species	Common Name	Status	Height	Coverage
Poaceae	*Triodia*	*basedowii*	Lobed Spinifex		0.5	50-70
Amaranthaceae	*Ptilotus*	*calostachyus*	Weeping Mulla Mulla		0.7	<2
Proteaceae	*Grevillea*	*wickhamii*			2	2-10
Mimosaceae	*Acacia*	*hilliana*			0.6	<2
Mimosaceae	*Acacia*	*adoxa*			0.4	<2
Poaceae	*Cymbopogon*	*ambiguus*	Scentgrass		0.8	<2
Zygophyllaceae	*Tribulus*	*suberosus*	Corkybark		0.7	<2
Mimosaceae	*Acacia*	*marramamba*			2	2-10
Goodeniaceae	*Goodenia*	sp. Sandy Creek			0.4	<2
Mimosaceae	*Acacia*	*bivenosa*			2.5	<2
Myrtaceae	*Calytrix*	*carinata*			0.6	<2
Caesalpiniaceae	*Senna*	*artemisioides* subsp. *helmsii*			1.3	<2
Malvaceae	*Sida*	sp.			0.3	<2
Poaceae	*Eriachne*	*lanata*			0.8	<2
Mimosaceae	*Acacia*	*pruinocarpa*	Gidgee		0.9	<2
Poaceae	*Triodia*	*pungens*	Soft Spinifex		0.6	<2
Mimosaceae	*Acacia*	*?monticola*	Gawar		0.5	<2

Quadrat ID: **MSQ10**

BHP Drillpad ID: MG40

Co-ordinates: 205270 7416450

Plate 9 Quadrat MSQ10 taken from SW corner

Quadrat Description

Saddle/side of hill of rocky hill: Vegetation Description:

Triodia basedowii open grassland with scattered emergent *Acacia bivenosa*.

Substrate: Red/brown rock

Slope: Medium (aspect - south, north and east)

Bare open ground 70-100%

Rocks 70-100

Logs/branches <2%

Bark: <2%

Fire History: 5+ years

Condition: 1/2

Disturbance: Old drill pad in SW corner, windrows for erosion, some livestock grazing

Table 10 Species list – Quadrat MSQ10

Family	Genus	Species	Common Name	Status	Height	Coverage
Poaceae	*Triodia*	*pungens*	Soft Spinifex		0.9	<2
Mimosaceae	*Acacia*	*bivenosa*			3	2-10
Mimosaceae	*Acacia*	*pruinocarpa*	Gidgee		2	<2
Mimosaceae	*Acacia*	*tetragonophylla*			2.5	<2
Mimosaceae	*Acacia*	*victoriae*			1.3	<2
Proteaceae	*Grevillea*	*wickhamii*			2	<2
Amaranthaceae	*Ptilotus*	*obovatus*	Cotton Bush		0.9	<2
Myrtaceae	*Corymbia*	*opaca*	Desert Bloodwood		2	<2
Poaceae	*Enneapogon*	*caerulescens*	Limestone Grass		0.3	2-10
Poaceae	*Aristida*	*contorta*	Bunched Kerosene Grass		0.3	<2
Amaranthaceae	*Ptilotus*	*rotundifolius*	Royal Mulla Mulla		0.8	<2
Solanaceae	*Solanum*	*lasiophyllum*	Flannel Bush		0.4	<2
Poaceae	*Triodia*	*basedowii*	Lobed Spinifex		0.6	2-10
Poaceae	*Aristida*	*inaequiglumis*	Feathertop Threeawn		0.4	<2
Chenopodiaceae	*Salsola*	*tragus*	Roly Poly		0.2	<2
Amaranthaceae	*Ptilotus*	*calostachyus*	Weeping Mulla Mulla		0.4	<2
Goodeniaceae	*Goodenia*	sp. (dead)			0.3	<2
Caesalpiniaceae	*Senna*	*artemisioides* subsp. *oligophylla*			0.8	<2
Goodeniaceae	*Goodenia*	sp. Sandy Creek			0.5	<2
Boraginaceae	*Halgania*	*solanacea* var. Mt. Doreen			0.2	<2
Poaceae	*Cymbopogon*	*ambiguus*	Scentgrass		0.5	<2
Zygophyllaceae	*Tribulus*	*suberosus*	Corky Bark		0.6	<2
Poaceae	*Aristida*	*inaequiglumis*	Feathertop Threeawn		0.6	<2
Caryophyllaceae	*Polycarpaea*	*corymbosa*			0.1	<2
Asteraceae	*Pterocaulon*	*sphaeranthoides*			0.6	<2
Tiliaceae	*Corchorus*	*incanus* subsp. *lithophilus*			0.8	<2

Family	Genus	Species	Common Name	Status	Height	Coverage
Amaranthaceae	*Ptilotus*	*incanus*			0.5	<2
Mimosaceae	*Acacia*	*inaequilatera*	Baderi		1.5	<2

Quadrat ID: **MSQ11**

BHP Drillpad ID: MG80

Co-ordinates: 205270 7416700

Plate 10 Quadrat MSQ11 taken from SW corner

Quadrat Description

Sandy plain: Vegetation Description

Acacia bivenosa, Acacia inaequilatera, Acacia melleodora, *Solanum sturtianum* shrubland over *Triodia basedowii* grassland

Substrate: Red-orange loamy sand with slight scattering of rock

Slope: Flat

Bare open ground: 60%

Rocks: 10

Logs/branches: <2%

Bark: <2%

Fire History: 5+ years

Condition: 1/2

Disturbance: Cattle grazing

Table 11 Species list – Quadrat MSQ11

Family	Genus	Species	Common Name	Status	Height	Coverage
Poaceae	*Triodia*	*pungens*	Soft Spinifex		0.8	30-50
Myoporaceae	*Eremophila*	*fraseri*	Turpentine Bush		0.9	<2
Mimosaceae	*Acacia*	*bivenosa*			4	2-10
Solanaceae	*Solanum*	*sturtianum*			0.8	2-10
Solanaceae	*Solanum*	*lasiophyllum*	Flannel Bush		0.3	<2
Poaceae	*Aristida*	*inaequiglumis*	Feathertop Threeawn		0.6	<2
Poaceae	*Eragrostis*	*falcata*	Sickle Lovegrass		0.3	<2
Lauraceae	*Cassytha*	sp. (not flowering)			0.6	<2
Mimosaceae	*Acacia*	*inaequilatera*	Baderi		1.5	2-10
Proteaceae	*Hakea*	*lorea*			0.9	<2
Mimosaceae	*Acacia*	*melleodora*			1.8	2-10
Amaranthaceae	*Ptilotus*	*incanus*			0.7	<2
Lamiaceae	*Discrastylis*	*cordifolia*			0.3	<2
Poaceae	*Cymbopogon*	*ambiguus*	Scentgrass		0.9	<2
Poaceae	*Eriachne*	*aristidea*			0.6	<2
Goodeniaceae	*Dampiera*	*candicans*			0.4	<2
Malvaceae	*Gossypium*	*robinsonii*	Wild Cotton		1.2	<2
Caesalpiniaceae	*Senna*	*artemisioides* subsp. *oligophylla*			0.6	<2
Mimosaceae	*Acacia*	*pachyacra*			2	<2
Malvaceae	*Sida*	sp. (not flowering)			0.7	<2
Mimosaceae	*Acacia*	*tenuissima*			1.6	<2
Mimosaceae	*Acacia*	*marramamba*			1.8	<2
Asteraceae	*Chrysocephalum*	*eremaeum*			0.2	<2
Myrtaceae	*Eucalyptus*	sp. (juvenile)			0.3	<2

Quadrat ID:	**MSQ12**
BHP Drillpad ID:	MG38
Co-ordinates:	204670 7416600

Plate 11 Quadrat MSQ12 taken from SW corner

Quadrat Description

Rocky Hill Slope: Vegetation Description

Triodia pungens grassland with scattered *Acacia hilliana*, with scattered emergent *Acacia bivenosa* and *Grevillea wickhamii*.

Substrate:	Lateritic Rocks
Slope:	Gentle, to the north
Bare open ground:	50-70%
Rocks:	70-100%
Logs/branches:	<2%
Bark:	<2%

Fire History: 5+ years

Condition: 1/2

Disturbance: historical disturbance – old track at edge of quadrat. Good regrowth

Table 12 Species list – Quadrat MSQ12

Family	Genus	Species	Common Name	Status	Height	Coverage
Poaceae	*Triodia*	*pungens*	Soft Spinifex		0.7	50-70
Mimosaceae	*Acacia*	*bivenosa*			3.5	2-10
Mimosaceae	*Acacia*	*pruinocarpa*	Gidgee		0.8	<2
Proteaceae	*Grevillea*	*wickhamii*	Wickham's Grevillea		0.6	2-10
Mimosaceae	*Acacia*	*melleodora*			0.9	<2
Myrtaceae	*Calytrix*	*carinata*			0.6	<2
Boraginaceae	*Halgania*	*solanacea* var. Mt. Doreen			0.4	<2
Sterculiaceae	*Keraudrenia*	*velutina* subsp. *elliptica*			0.8	<2
Sapindaceae	*Dodonaea*	*coriaceae*			0.3	<2
Mimosaceae	*Acacia*	*sclerosperma* subsp. *sclerosperma*			0.6	<2
Mimosaceae	*Acacia*	*hilliana*			0.4	2-10
Amaranthaceae	*Ptilotus*	*calostachyus*	Weeping Mulla Mulla		0.5	<2
Caesalpiniaceae	*Senna*	*artemisioides x sturtii*			0.6	<2
Mimosaceae	*Acacia*	*adoxa*			0.3	<2
Proteaceae	*Hakea*	*lorea*			0.4	<2
Myrtaceae	*Corymbia*	*opaca*	Desert Bloodwood		0.1	<2

Quadrat ID: **MSQ13**

BHP Drillpad ID: MG39

Co-ordinates: 204657 7416912

Plate 12 Quadrat MSQ13 taken from SW corner

Quadrat Description

Flat Plain: Vegetation Description

Acacia marramamba shrubland with scattered *Rhynchosia minima* low shrubs over mixed grassland of *Triodia pungens* and *Aristida inaequiglumis*.

Substrate: loamy sand

Slope: flat

Bare open ground: 30-50%

Rocks: <2%

Logs/branches: <2%

Bark: <2%

Fire History: (old) >5+ years

Condition: 2

Disturbance: historical exploration disturbance – topsoil pushed up at edge of quadrat. Good regrowth

Table 13 Species list – Quadrat MSQ13

Family	Genus	Species	Common Name	Status	Height	Coverage
Myrtaceae	*Corymbia*	*deserticola*	Twin-leaf Mallee		3	<2
Caesalpiniaceae	*Senna*	*glutinosa* subsp *?*			0.8	<2
Poaceae	*Aristida*	*inaequiglumis*	Feathertop Threeawn		1.1	30-50
Poaceae	*Triodia*	*pungens*	Soft Spinifex		0.9	10-30
Mimosaceae	*Acacia*	*bivenosa*			2.5	<2
Mimosaceae	*Acacia*	*pruinocarpa*	Gidgee		2.5	<2
Proteaceae	*Grevillea*	*wickhamii*	Wickham's Grevillea		0.6	<2
Mimosaceae	*Acacia*	*marramamba*			1.7	10-30
Proteaceae	*Hakea*	*lorea*			0.9	<2
Caesalpiniaceae	*Senna*	*artemisioides x sturtii*			0.8	<2
Caesalpiniaceae	*Senna*	*artemisioides* subsp. *oligophylla*			0.8	<2
Santalaceae	*Santalum*	sp.			1.1	<2
Mimosaceae	*Acacia*	*sclerosperma* subsp. *sclerosperma*			0.7	<2
Poaceae	*Aristida*	*inaequiglumis*	Feathertop Threeawn		0.4	<2
Papilionaceae	*Rhynchosia*	*minima*			0.95	2-10
Poaceae	*Aristida*	*contorta*	Bunched Kerosene Grass		0.2	<2
Boraginaceae	*Halgania*	*solanacea* var. Mt. Doreen			0.1	<2
Amaranthaceae	*Ptilotus*	*obovatus*			0.6	<2
Chenopodiaceae	*Rhagodia*	*eremaea*			1	<2
Mimosaceae	*Acacia*	*pachyacra*			1.3	<2
Solanaceae	*Solanum*	*lasiophyllum*	Flannel Bush		0.5	<2
Poaceae	*Cymbopogon*	*ambiguus*	Scentgrass		0.7	<2
Convolvulaceae	*Bonamia*	*rosea*			0.6	<2
Mimosaceae	*Acacia*	*melleodora*			0.4	<2
Poaceae	*Eriachne*	*aristidea*			0.3	<2

Family	Genus	Species	Common Name	Status	Height	Coverage
Lamiaceae	*Discrastylis*	*cordifolia*		.	0.2	<2
Malvaceae	*Sida*	sp.			0.4	<2
Mimosaceae	*Acacia*	*inaequilatera*	Baderi		1.8	<2

Quadrat ID: **MSQ14**

BHP Drillpad ID: MG77

Co-ordinates: 204085 7416900

Plate 13 Quadrat MSQ14 taken from SW corner

Quadrat Description

Sandy Flat Plain with scattered rocks: Vegetation Description

Acacia marramamba, A. bivenosa, A. pachyacra shrubland over *Rhynchosia minima* low shrubs over *Triodia pungens*.

Substrate: red loamy sand

Slope: flat

Bare open ground: 30-50%

Rocks: <2%

Logs/branches: <2%

Bark: <2%

Fire History: (old) >5+ years

Condition: 1/2

Disturbance: historical disturbance – topsoil pushed up near edge of quadrat. Good regrowth. *Acacia marramamba* population may be result of historical disturbance.

Table 14 Species list – Quadrat MSQ14

Family	Genus	Species	Common Name	Status	Height	Coverage
Mimosaceae	*Acacia*	*bivenosa*			3	2-10
Mimosaceae	*Acacia*	*melleodora*			0.7	<2
Poaceae	*Triodia*	*pungens*	Soft Spinifex		0.8	<2
Lamiaceae	*Discrastylis*	*cordifolia*			0.3	<2
Amaranthaceae	*Ptilotus*	*calostachyus*	Weeping Mulla Mulla		0.5	<2
Convolvulaceae	*Bonamia*	*rosea*			0.3	<2
Malvaceae	*Sida*	sp.			0.3	<2
Poaceae	*Cymbopogon*	*ambiguus*	Scentgrass		0.7	<2
Poaceae	*Eriachne*	*aristidea*			0.3	<2
Papilionaceae	*Rhynchosia*	*minima*			0.5	2-10
Proteaceae	*Hakea*	*lorea*			3	<2
Lauraceae	*Cassytha*	sp. (not flowering)			0.7	<2
Mimosaceae	*Acacia*	*pachyacra*			1	2-10
Malvaceae	*Gossypium*	*robinsonii*	Wild Cotton		2.5	<2
Myrtaceae	*Eucalyptus*	*gamophylla*	Twin-leaf Mallee		3.5	<2
Boraginaceae	*Halgania*	*solanacea* var. Mt. Doreen			0.2	<2
Goodeniaceae	*Dampiera*	*candicans*			0.3	<2
Mimosaceae	*Acacia*	*tenuissima*			1.7	<2
Mimosaceae	*Acacia*	*marramamba*			2	10-30
Poaceae	*Aristida*	*contorta*	Bunched Kerosene Grass		0.4	<2
Mimosaceae	*Acacia*	*hilliana*			0.7	<2
Mimosaceae	*Acacia*	*adoxa*			0.6	<2
Amaranthaceae	*Ptilotus*	*incanus*			0.3	<2
Mimosaceae	*Acacia*	*pruinocarpa*	Gidgee		4	<2
Solanaceae	*Solanum*	*sturtianum*			0.6	<2
Poaceae	*Eragrostis*	*falcata*	Sickle Lovegrass		0.3	<2

Family	Genus	Species	Common Name	Status	Height	Coverage
Sapindaceae	*Dodonaea*	*coriaceae*			0.7	<2
Caesalpiniaceae	*Senna*	*artemisioides* subsp. *oligophylla*			0.7	<2

Quadrat ID:	**MSQ15**
BHP Drillpad ID:	MG36
Co-ordinates:	204088 7416432

Plate 14 Quadrat MSQ15 taken from SW corner

Quadrat Description

Broad sheetwash at base of low rocky hills: Vegetation Description

Tall open scrub of *Acacia marramamba* over Open grassland of *Triodia pungens* and *Paraneurachne muelleri*.

Substrate:	red-orange loamy sand with scattered rocks
Slope:	flat
Bare open ground:	30-50%
Rocks:	10-30%
Logs/branches:	2-10%
Bark:	<2%
Fire History:	(old) >5+ years

Condition: 1/2

Disturbance: mostly cattle grazing

Table 15 Species list – Quadrat MSQ15

Family	Genus	Species	Common Name	Status	Height	Coverage
Mimosaceae	*Acacia*	*marramamba*			2	50-70
Poaceae	*Paraneurachne*	*muelleri*	Northern Mulga Grass		0.3	2-10
Goodeniaceae	*Dampiera*	*candicans*			0.2	<2
Convolvulaceae	*Bonamia*	*rosea*			0.3	<2
Lamiaceae	*Discrastylis*	*cordifolia*			0.3	<2
Amaranthaceae	*Ptilotus*	*incanus*			0.2	<2
Poaceae	*Triodia*	*pungens*	Soft Spinifex		0.7	10-30
Boraginaceae	*Halgania*	*solanacea* var. Mt. Doreen			0.4	<2
Poaceae	*Eragrostis*	*falcata*	Sickle Lovegrass		0.3	<2
Caesalpiniaceae	*Senna*	*artemisioides x sturtii*			0.6	<2
Caesalpiniaceae	*Senna*	*artemisioides* subsp. *oligophylla*			0.6	<2
Myrtaceae	*Eucalyptus*	*gamophylla*	Twin-leaf Mallee		1.2	<2
Mimosaceae	*Acacia*	*hilliana*			0.2	<2
Poaceae	*Cymbopogon*	*ambiguus*	Scentgrass		0.6	<2
Sapindaceae	*Dodonaea*	*coriaceae*			0.5	<2
Mimosaceae	*Acacia*	*bivenosa*			2	<2
Poaceae	*Themeda*	*triandra*	Kangaroo Grass		0.8	<2
Solanaceae	*Solanum*	*sturtianum*			0.6	<2
Malvaceae	*Sida*	sp.			0.6	<2
Zygophyllaceae	*Tribulus*	*suberosus*	Corkybark		0.9	<2
Poaceae	*Iseilema*	*membranaceum*	Small Flinders Grass		0.2	<2
Proteaceae	*Grevillea*	*wickhamii*	Wickham's Grevillea		1.6	<2
Tiliaceae	*Corchorus*	sp. (not fruiting)			0.8	<2

Quadrat ID: **MSQ16**

BHP Drillpad ID: n/a not on drill line

Co-ordinates: 203681 7416340

Plate 15 Quadrat MSQ16 taken from SW corner

Quadrat Description

Low rocky hills: Vegetation Description

Triodia basedowii grassland with scattered *Acacia hilliana* shrubs, and isolated emergent *Acacia bivenosa*.

Substrate: lateritic rocks

Slope: gentle slope to the north

Bare open ground: 30-50%

Rocks: 50-70%

Logs/branches: <2%

Bark: <2%

Fire History: 2-5 years

Condition: 1/2

Disturbance: no visible disturbance

Table 16 Species list – Quadrat MSQ16

Family	Genus	Species	Common Name	Status	Height	Coverage
Poaceae	*Triodia*	*basedowii*	Lobed Spinifex		0.5	30-70
Mimosaceae	*Acacia*	*hilliana*			0.3	2-10
Mimosaceae	*Acacia*	*bivenosa*			2.5	<2
Boraginaceae	*Halgania*	*solanacea* var. Mt. Doreen			0.2	<2
Amaranthaceae	*Ptilotus*	*rotundifolius*	Royal Mulla Mulla		0.6	<2
Sterculiaceae	*Keraudrenia*	*velutina* subsp. *elliptica*			0.5	<2
Poaceae	*Cymbopogon*	*ambiguus*	Scentgrass		0.7	<2
Mimosaceae	*Acacia*	*victoriae*			2.5	<2
Mimosaceae	*Acacia*	*adoxa*			0.3	<2
Mimosaceae	*Acacia*	*melleodora*			1.1	<2
Mimosaceae	*Acacia*	*inaequilatera*	Baderi		2	<2
Mimosaceae	*Acacia*	*pachyacra*			1.2	<2

Quadrat ID: **MSQ17**

BHP Drillpad ID: n/a not on drill line

Co-ordinates: 203407 7416469

Plate 16 Quadrat MSQ17 taken from SW corner

Quadrat Description

Flat sandy/rocky plain: Vegetation Description

Acacia marramamba shrubland over grassland dominated by *Triodia pungens, T. basedowii*.

Substrate: part rocks, part sand

Slope: flat

Bare open ground: 10-30%

Rocks: 10-30%

Logs/branches: <2%

Bark: <2%

Fire History: 5+ years

Condition: 1/2

Disturbance: Very old track and drill cores nearby but little disturbance in quadrat - some cattle and fire

Table 17 Species list – Quadrat MSQ17

Family	Genus	Species	Common Name	Status	Height	Coverage
Poaceae	*Triodia*	*pungens*	Soft Spinifex		0.7	30-50
Mimosaceae	*Acacia*	*marramamba*			2	10-30
Mimosaceae	*Acacia*	*sclerosperma* subsp. *sclerosperma*			1.2	<2
Caesalpiniaceae	*Senna*	*artemisioides* subsp. *oligophylla*			0.5	<2
Convolvulaceae	*Bonamia*	*rosea*			0.3	<2
Poaceae	*Triodia*	*basedowii*	Lobed Spinifex		0.6	10-30
Papilionaceae	*Rhynchosia*	*minima*			0.4	<2
Mimosaceae	*Acacia*	*pachyacra*			2	<2
Solanaceae	*Solanum*	*sturtianum*			0.6	<2
Caesalpiniaceae	*Senna*	*glutinosa* subsp. *x luerssenii*			0.9	<2
Myoporaceae	*Eremophila*	*latrobei*			0.6	<2
Mimosaceae	*Acacia*	*inaequilatera*	Baderi		2	<2
Poaceae	*Eragrostis*	*falcata*	Sickle Lovegrass		0.4	<2
Poaceae	*Aristida*	*contorta*	Bunched Kerosene Grass		0.3	<2
Poaceae	*Paraneurachne*	*muelleri*	Northern Mulga Grass		0.4	<2
Myrtaceae	*Corymbia*	*opaca*	Desert Bloodwood		5	<2
Mimosaceae	*Acacia*	*tenuissima*			1	<2
Proteaceae	*Hakea*	*lorea*			3	<2

Quadrat ID:	**MSQ18**
BHP Drillpad ID:	MG33
Co-ordinates:	203019 7416242

Plate 17 Quadrat MSQ18 taken from SW corner

Quadrat Description

Low rocky hills: Vegetation Description

Triodia basedowii grassland with *Acacia hilliana* low shrubs

Substrate:	part rocks, part sand
Slope:	moderate, to the north
Bare open ground:	10-30%
Rocks:	70-100%
Logs/branches:	<2%
Bark:	<2%
Fire History:	5+ years

Condition: 1/2

Disturbance: no disturbance visible

Table 18 Species list – Quadrat MSQ18

Family	Genus	Species	Common Name	Status	Height	Coverage
Poaceae	*Triodia*	*basedowii*	Lobed Spinifex		0.6	50-70
Mimosaceae	*Acacia*	*hilliana*			0.3	30-50
Mimosaceae	*Acacia*	*adoxa*			0.4	<2
Amaranthaceae	*Ptilotus*	*rotundifolius*	Royal Mulla Mulla		0.4	<2
Proteaceae	*Grevillea*	*wickhamii*	Wickham's Grevillea		1.9	<2
Mimosaceae	*Acacia*	*inaequilatera*	Baderi		2	<2
Boraginaceae	*Halgania*	*solanacea* var. Mt. Doreen			0.4	<2
Proteaceae	*Hakea*	*chordophylla*			2	<2
Malvaceae	*Sida*	sp.			0.3	<2
Poaceae	*Cymbopogon*	*ambiguus*	Scentgrass		0.7	<2

Quadrat ID: **MSQ19**

BHP Drillpad ID: MG73

Co-ordinates: 202850 7416488

Plate 18 Quadrat MSQ19 taken from SW corner

Quadrat Description

Flat Plain: Vegetation Description

Acacia pachyacra, Acacia melleodora shrubland over *Dampiera candicans* low shrubland over very open grassland dominated by *Eragrostis falcata*.

Substrate: orange-red sand with dark iron-rich rocks as surface coating

Slope: flat

Bare open ground: 30-50%

Rocks: <2%

Logs/branches: <2%

Bark: <2%

Fire History: 5+ years

Condition: 1/2

Disturbance: cattle disturbance, and close by old mounds from exploration drilling

Table 19 Species list – Quadrat MSQ19

Family	Genus	Species	Common Name	Status	Height	Coverage
Mimosaceae	*Acacia*	*melleodora*			1.2	2-10
Convolvulaceae	*Bonamia*	*rosea*			0.2	<2
Poaceae	*Eriachne*	*lanata*			0.2	<2
Chenopodiaceae	*Dysphania*	*kalpari*	Rat's Tail		0.05	<2
Proteaceae	*Hakea*	*chordophylla*			4	<2
Poaceae	*Paraneurachne*	*muelleri*	Northern Mulga Grass		0.3	<2
Solanaceae	*Solanum*	*sturtianum*			0.5	<2
Poaceae	*Eragrostis*	*falcata*	Sickle Lovegrass		0.2	<2
Poaceae	*Aristida*	*inaequiglumis*	Feathertop Threeawn		0.4	<2
Malvaceae	*Hibiscus*	*sturtii*	Sturt's Hibiscus		0.2	<2
Poaceae	*Eulalia*	*aurea*	Silky Browntop		0.4	<2
Caesalpiniaceae	*Senna*	*artemisioides* subsp. *helmsii*			0.7	<2
Poaceae	*Cymbopogon*	*ambiguus*	Scentgrass		0.6	<2
Goodeniaceae	*Dampiera*	*candicans*			0.3	2-10
Mimosaceae	*Acacia*	*pachyacra*			2	2-10
Amaranthaceae	*Ptilotus*	*calostachyus*	Weeping Mulla Mulla		0.4	<2
Mimosaceae	*Acacia*	*maitlandii*			2	<2
Malvaceae	*Sida*	sp.			0.6	<2
Poaceae	*Eragrostis*	*falcata*	Sickle Lovegrass		0.4	2-10
Mimosaceae	*Acacia*	*inaequilatera*	Baderi		0.4	<2
Lamiaceae	*Discrastylis*	*cordifolia*			0.3	<2
Caesalpiniaceae	*Senna*	*artemisioides* subsp. *oligophylla*			0.8	<2
Mimosaceae	*Acacia*	*pruinocarpa*	Gidgee		1.3	<2
Amaranthaceae	*Gomphrena*	*canescens*	Batchelor's Buttons		0.2	<2
Lauraceae	*Cassytha*	sp. (not flowering)			0.5	<2

Quadrat ID: **MSQ20**

BHP Drillpad ID: MG32

Co-ordinates: 201670 7416350

Plate 19 Quadrat MSQ20 taken from SW corner

Quadrat Description

Flat Plain (ephemeral creekline): Vegetation Description

Acacia monticola, A. marramamba, A. bivenosa, Gossypium robinsonii tall shrubland over *Triodia basedowii* dominated grassland on ephemeral creeklines

Substrate: mix of sand and rocks

Slope: flat

Bare open ground: 2-10%

Rocks: 30-50%

Logs/branches: 2-10%

Bark: <2%

Fire History: 5+ years

Condition: 1/2

Disturbance: old exploration track adjacent

Table 20 Species list – Quadrat MSQ20

Family	Genus	Species	Common Name	Status	Height	Coverage
Mimosaceae	*Acacia*	*marramamba*			2	10-30
Poaceae	*Paraneurachne*	*muelleri*	Northern Mulga Grass		0.5	<2
Mimosaceae	*Acacia*	*pachyacra*			2.5	<2
Mimosaceae	*Acacia*	*monticola*	Gawar		4	10-30
Poaceae	*Cymbopogon*	*ambiguus*	Scentgrass		0.7	<2
Tiliaceae	*Corchorus*	sp. (not fruiting)			1.5	<2
Malvaceae	*Gossypium*	*robinsonii*	Wild Cotton		5	2-10
Convolvulaceae	*Duperreya*	*commixta*			2.5	<2
Poaceae	*Aristida*	*inaequiglumis*	Feathertop Threeawn		0.6	<2
Poaceae	*Themeda*	*triandra*	Kangaroo Grass		1.1	<2
Goodeniaceae	*Dampiera*	*candicans*			0.4	<2
Papilionaceae	*Tephrosia*	*rosea*			0.4	<2
Myrtaceae	*Corymbia*	*opaca*	Desert Bloodwood		4	<2
Convolvulaceae	*Bonamia*	*rosea*			0.4	<2
Poaceae	*Eragrostis*	*falcata*	Sickle Lovegrass		0.4	<2
Amaranthaceae	*Gomphrena*	*canescens*	Batchelor's Buttons		0.3	<2
Proteaceae	*Hakea*	*lorea*			2.5	<2
Sterculiaceae	*Keraudrenia*	*velutina* subsp. *elliptica*			0.8	<2
Amaranthaceae	*Ptilotus*	*calostachyus*	Weeping Mulla Mulla		0.4	<2
Caesalpiniaceae	*Senna*	*glutinosa* subsp. *x luerssenii*			0.5	<2
Goodeniaceae	*Goodenia*	sp. (dead)			0.3	<2
Boraginaceae	*Halgania*	*solanacea* var. Mt. Doreen			0.3	<2
Caesalpiniaceae	*Senna*	*artemisioides* subsp. *helmsii*			1	<2
Poaceae	*Triodia*	*basedowii*	Lobed Spinifex		0.8	10-30
Mimosaceae	*Acacia*	*melleodora*			1.2	<2
Mimosaceae	*Acacia*	*bivenosa*			4.5	2-10

Quadrat ID: **MSQ21**

BHP Drillpad ID: MG29

Co-ordinates: 201670 7416100

Plate 20 Quadrat MSQ21 taken from SW corner

Quadrat Description

Low Rocky hills: Vegetation Description

Triodia basedowii grassland with *Acacia hilliana* and *Ptilotus rotundifolius* low shrubs

Substrate: rocks

Slope: medium to the north-east

Bare open ground: 10-30%

Rocks: 50-70%

Logs/branches: <2%

Bark: <2%

Fire History: 5+ years

Condition: 1/2

Disturbance: no disturbance visible

Table 21 Species list – Quadrat MSQ21

Family	*Genus*	*Species*	Common Name	Status	Height	Coverage
Poaceae	*Triodia*	*basedowii*	Lobed Spinifex		0.7	50-70
Mimosaceae	*Acacia*	*hilliana*			0.7	10-30
Amaranthaceae	*Ptilotus*	*rotundifolius*	Royal Mulla Mulla		0.6	2-10
Proteaceae	*Grevillea*	*stenobotrya*			3.5	<2
Poaceae	*Cymbopogon*	*ambiguus*	Scentgrass		0.7	<2
Caesalpiniaceae	*Senna*	*glutinosa* subsp. *x luerssenii*			2	<2
Myrtaceae	*Calytrix*	*carinata*			0.4	<2
Convolvulaceae	*Duperreya*	*commixta*			0.9	<2
Zygophyllaceae	*Tribulus*	*suberosus*			0.5	<2
Poaceae	*Triodia*	*pungens*	Soft Spinifex		1.1	<2
Caesalpiniaceae	*Senna*	*artemisioides x sturtii*			1	<2
Papilionaceae	*Gompholobium*	*polyzygum*			0.4	<2
Solanaceae	*Solanum*	*lasiophyllum*	Flannel Bush		0.3	<2
Mimosaceae	*Acacia*	*adoxa*			0.4	<2
Boraginaceae	*Halgania*	*solanacea* var. Mt. Doreen			0.2	<2
Malvaceae	*Sida*	sp.			0.3	<2
Proteaceae	*Grevillea*	*wickhamii*	Wickham's Grevillea		2	<2
Myrtaceae	*Corymbia*	*opaca*	Desert Bloodwood (juvenile)		1.8	<2
Mimosaceae	*Acacia*	*sclerosperma* subsp. *sclerosperma*			0.8	<2
Goodeniaceae	*Goodenia*	sp. Sandy Creek			0.2	<2
Sterculiaceae	*Keraudrenia*	*velutina* subsp. *elliptica*			0.5	<2

Quadrat ID: MSQ22

BHP Drillpad ID: MG69

Co-ordinates: 201136 7415466

Plate 21 Quadrat MSQ22 taken from SW corner

Quadrat Description

Low Rocky hills: Vegetation Description

Triodia basedowii grassland with *Gompholobium polyzygum* low shrubs with emergent *Eucalyptus leucophloia*

Substrate:	rocks
Slope:	medium to the north-east
Bare open ground:	30-50%
Rocks:	50-70%
Logs/branches:	<2%
Bark:	<2%
Fire History:	5+ years
Condition:	1/2
Disturbance:	no disturbance visible

Table 22 Species list – Quadrat MSQ22

Family	Genus	Species	Common Name	Status	Height	Coverage
Myrtaceae	*Eucalyptus*	*leucophloia*	Snappy Gum		5	2-10
Poaceae	*Triodia*	*basedowii*	Lobed Spinifex		0.7	30-50
Poaceae	*Triodia*	*pungens*	Soft Spinifex		0.9	<2
Amaranthaceae	*Ptilotus*	*rotundifolius*	Royal Mulla Mulla		1.1	<2
Caesalpiniaceae	*Senna*	*artemisioides x sturtii*			1.1	<2
Papilionaceae	*Gompholobium*	*polyzygum*			0.6	2-10
Boraginaceae	*Halgania*	*solanacea* var. Mt. Doreen			0.3	<2
Poaceae	*Aristida*	*inaequiglumis*	Feathertop Threeawn		0.3	<2
Poaceae	*Aristida*	*contorta*	Bunched Kerosene Grass		0.3	<2
Poaceae	*Paraneurachne*	*muelleri*	Northern Mulga Grass		0.2	<2
Malvaceae	*Sida*	sp.			0.2	<2
Proteaceae	*Hakea*	*chordophylla*			2.5	<2
Sapindaceae	*Dodonaea*	*pachyneura*			1.5	<2
Poaceae	*Cymbopogon*	*ambiguus*	Scentgrass		0.8	<2
Sterculiaceae	*Keraudrenia*	*velutina* subsp. *elliptica*			0.7	<2
Asteraceae	*Pterocaulon*	*sphaeranthoides*			0.4	<2
Sapindaceae	*Dodonaea*	*coriaceae*			0.6	<2
Myrtaceae	*Calytrix*	*carinata*			0.7	<2
Mimosaceae	*Acacia*	*maitlandii*			0.4	<2
Mimosaceae	*Acacia*	*hilliana*			0.5	<2
Proteaceae	*Grevillea*	*wickhamii*	Wickham's Grevillea		0.8	<2
Proteaceae	*Grevillea*	*stenobotrya*			0.7	<2
Myrtaceae	*Lamarchea*	*sulcata*			0.5	<2

Quadrat ID: **MSQ23**

BHP Drillpad ID: MG71

Co-ordinates: 201076 7415600

Plate 22 Quadrat MSQ23 taken from SW corner

Quadrat Description

Low Rocky hills: Vegetation Description

Triodia basedowii grassland with *Gompholobium polyzygum* low shrubs with emergent *Eucalyptus leucophloia*

Substrate: rocks

Slope: medium to the north-east

Bare open ground: 30-50%

Rocks: 50-70%

Logs/branches: <2%

Bark: <2%

Fire History: 5+ years

Condition: 1/2

Disturbance: no disturbance visible

Table 23 Species list – Quadrat MSQ23

Family	Genus	Species	Common Name	Status	Height	Coverage
Proteaceae	*Grevillea*	*wickhamii*	Wickham's Grevillea		2	2-10
Poaceae	*Iseilema*	*membranaceum*	Small Flinders Grass		0.05	<2
Mimosaceae	*Acacia*	*melleodora*			0.9	2-10
Mimosaceae	*Acacia*	*sclerosperma* subsp. *sclerosperma*			2	2-10
Myrtaceae	*Eucalyptus*	*gamophylla*	Twin-leaf Mallee		1	<2
Poaceae	*Cymbopogon*	*ambiguus*	Scentgrass		0.7	<2
Amaranthaceae	*Ptilotus*	*calostachyus*	Weeping Mulla Mulla		0.3	<2
Rubiaceae	*Psydrax*	*latifolia*			0.6	<2
Mimosaceae	*Acacia*	*pruinocarpa*	Gidgee		1.9	<2
Caryophyllaceae	*Polycarpaea*	*corymbosa*			0.1	<2
Poaceae	*Enneapogon*	*caerulescens*	Limestone Grass		0.2	<2
Poaceae	*Eragrostis*	*falcata*	Sickle Lovegrass		0.3	<2
Goodeniaceae	*Goodenia*	sp. Sandy Creek			0.2	<2
Zygophyllaceae	*Tribulus*	*suberosus*			1.5	<2
Caesalpiniaceae	*Senna*	*glutinosa*			0.9	<2
Amaranthaceae	*Ptilotus*	*rotundifolius*	Royal Mulla Mulla		0.7	<2
Proteaceae	*Hakea*	*chordophylla*			2	<2
Mimosaceae	*Acacia*	*monticola*	Gawar		1.3	<2
Mimosaceae	*Acacia*	*hilliana*			0.6	<2
Papilionaceae	*Gompholobium*	*polyzygum*			0.4	<2
Poaceae	*Eriachne*	*lanata*			0.5	<2
Mimosaceae	*Acacia*	*adoxa*			0.4	<2
Sterculiaceae	*Keraudrenia*	*velutina* subsp.			0.8	<2

Family	Genus	Species	Common Name	Status	Height	Coverage
		elliptica				
Apiaceae	*Trachymene*	*oleracea*			0.3	<2
Mimosaceae	*Acacia*	*marramamba*			1.5	<2

Quadrat ID: **MSQ24**

BHP Drillpad ID: MG26

Co-ordinates: 201074 7415800

Plate 23 Quadrat MSQ24 taken from SW corner

Quadrat Description

Low Rocky foothills, adjacent to plain: Vegetation Description

Grevillea wickhamii tall shrubland over low open shrubland of *Acacia hilliana* with grassland of *Triodia basedowii*.

Substrate: rocks

Slope: medium to the north

Bare open ground: 10-30%

Rocks: 30-50%

Logs/branches: <2%

Bark: <2%

Fire History: 5+ years

Condition: 2

Disturbance: very old drill pad, with some old windrows - but otherwise little sign of disturbance

Table 24 Species list – Quadrat MSQ24

Family	Genus	Species	Common Name	Status	Height	Coverage
Proteaceae	*Grevillea*	*wickhamii*	Wickham's Grevillea		4	10-30
Myrtaceae	*Calytrix*	*carinata*			0.7	<2
Poaceae	*Triodia*	*basedowii*	Lobed Spinifex		0.8	50-70
Mimosaceae	*Acacia*	*pruinocarpa*	Gidgee		1.8	<2
Papilionaceae	*Gompholobium*	*polyzygum*			0.6	<2
Mimosaceae	*Acacia*	*hilliana*			0.5	2-10
Mimosaceae	*Acacia*	*adoxa*			0.5	<2
Poaceae	*Eriachne*	*lanata*			0.8	<2
Boraginaceae	*Halgania*	*solanacea* var. Mt. Doreen			0.6	<2
Sterculiaceae	*Keraudrenia*	*velutina* subsp. *elliptica*			0.5	<2
Myoporaceae	*Eremophila*	*latrobei*			0.5	<2
Amaranthaceae	*Ptilotus*	*calostachyus*	Weeping Mulla Mulla		0.4	<2
Malvaceae	*Gossypium*	*robinsonii*	Wild Cotton		0.6	<2
Amaranthaceae	*Ptilotus*	*rotundifolius*	Royal Mulla Mulla		0.5	<2
Poaceae	*Cymbopogon*	*ambiguus*	Scentgrass		0.9	<2
Caesalpiniaceae	*Senna*	*artemisioides* subsp. *oligophylla*			0.8	<2

Quadrat ID: **MSQ25**

BHP Drillpad ID: MG28

Co-ordinates: 201075 7416200

Plate 24 Quadrat MSQ25 taken from SW corner

Quadrat Description

Rocky Plain: Vegetation Description

Tall open shrubland of *Gossypium robinsonii*, *Senna artemisioides* subsp. *oligophylla* over open shrubland of *Acacia melleodora* over grassland of *Triodia basedowii*.

Substrate: rocks

Slope: gentle to the north

Bare open ground: 10-30%

Rocks: 30-50%

Logs/branches: <2%

Bark: <2%

Fire History: 5+ years

Condition: 1/2

Disturbance: Grazing by cattle

Table 25 Species list – Quadrat MSQ25

Family	Genus	Species	Common Name	Status	Height	Coverage
Poaceae	*Triodia*	*basedowii*	Lobed Spinifex		0.8	30-50
Malvaceae	*Gossypium*	*robinsonii*	Wild Cotton		4	2-10
Caesalpiniaceae	*Senna*	*artemisioides* subsp. *oligophylla*			4	2-10
Mimosaceae	*Acacia*	*melleodora*			1.7	2-10
Caesalpiniaceae	*Senna*	*glutinosa* subsp. *x luerssenii*			0.8	<2
Mimosaceae	*Acacia*	*pachyacra*			1.5	<2
Proteaceae	*Grevillea*	*wickhamii*	Wickham's Grevillea		1.5	<2
Poaceae	*Paraneurachne*	*muelleri*	Northern Mulga Grass		0.3	<2
Poaceae	*Cymbopogon*	*ambiguus*	Scentgrass		0.7	<2
Malvaceae	*Sida*	*fibulifera*	Silver Sida		0.2	<2
Solanaceae	*Solanum*	*lasiophyllum*	Flannel Bush		0.4	<2
Poaceae	*Eragrostis*	*falcata*	Sickle Lovegrass		0.3	<2
Solanaceae	*Solanum*	*sturtianum*			0.4	<2
Mimosaceae	*Acacia*	*adoxa*			0.3	<2
Lamiaceae	*Discrastylis*	*cordifolia*			0.2	<2
Mimosaceae	*Acacia*	*pruinocarpa*	Gidgee		2.5	<2
Papilionaceae	*Gompholobium*	*polyzygum*			0.6	<2
Goodeniaceae	*Goodenia*	sp. Sandy Creek			0.2	<2
Mimosaceae	*Acacia*	*sclerosperma* subsp. *sclerosperma*			2	<2
Sapindaceae	*Dodonaea*	*coriaceae*			0.5	<2
Poaceae	*Triodia*	*pungens*	Soft Spinifex		1.2	<2
Sterculiaceae	*Keraudrenia*	*velutina*			0.9	<2

Family	Genus	Species	Common Name	Status	Height	Coverage
		subsp. *elliptica*				
Mimosaceae	*Acacia*	*tenuissima*			1.5	<2

Quadrat ID:	**MSQ26**	
BHP Drillpad ID:	MG68	
Co-ordinates:	200480	7415885

Plate 25 Quadrat MSQ26 taken from SW corner

Quadrat Description

Rocky Plain: Vegetation Description

Tall shrubland of *Acacia marramamba* with *Acacia melleodora, A. sclerosperma subsp. sclerosperma, A. tenuissima* open shrubland over grassland dominated by *Triodia pungens* and *T. basedowii*.

Substrate:	shallow layer of rocks over sand
Slope:	flat
Bare open ground:	30-50%
Rocks:	30-50%
Logs/branches:	<2%
Bark:	<2%

Fire History: 5+ years

Condition: 1/2

Disturbance: Grazing by cattle, old quadrat to west, possibly causing alteration in natural drainage pattern

Table 26 Species list – Quadrat MSQ26

Family	Genus	Species	Common Name	Status	Height	Coverage
Poaceae	*Triodia*	*pungens*	Soft Spinifex		1.2	30-50
Poaceae	*Aristida*	*inaequiglumis*	Feathertop Threeawn		6	<2
Mimosaceae	*Acacia*	*monticola*	Gawar		2.5	2-10
Proteaceae	*Grevillea*	*wickhamii*	Wickham's Grevillea		3.5	<2
Mimosaceae	*Acacia*	*marramamba*			2	10-30
Mimosaceae	*Acacia*	*sclerosperma* subsp. *sclerosperma*			2	2-10
Mimosaceae	*Acacia*	*tenuissima*			2	2-10
Poaceae	*Iseilema*	*membranaceum*	Small Flinders Grass		0.2	<2
Mimosaceae	*Acacia*	*adoxa*			0.5	<2
Poaceae	*Cymbopogon*	*ambiguus*	Scentgrass		0.8	<2
Convolvulaceae	*Bonamia*	*rosea*			0.2	<2
Poaceae	*Triodia*	*basedowii*	Lobed Spinifex		0.8	2-10
Sterculiaceae	*Keraudrenia*	*velutina* subsp. *elliptica*			0.8	<2
Caesalpiniaceae	*Senna*	*artemisioides* subsp. *oligophylla*			1.1	<2
Mimosaceae	*Acacia*	*bivenosa*			2.5	<2
Poaceae	*Themeda*	*triandra*	Kangaroo Grass		0.7	<2
Poaceae	*Eragrostis*	*falcata*	Sickle Lovegrass		0.5	<2
Mimosaceae	*Acacia*	*hilliana*			0.5	<2
Malvaceae	*Sida*	sp.			0.9	<2
Amaranthaceae	*Ptilotus*	*calostachyus*	Weeping Mulla Mulla		0.6	<2
Malvaceae	*Gossypium*	*robinsonii*	Wild Cotton		5	<2
Mimosaceae	*Acacia*	*pachyacra*			1.2	<2
Proteaceae	*Hakea*	*chordophylla*			2	<2
Mimosaceae	*Acacia*	*melleodora*			1.2	2-10
Myoporaceae	*Eremophila*	*jucunda* subsp. *pulcherrima*			0.8	<2

Family	Genus	Species	Common Name	Status	Height	Coverage
Myoporaceae	*Eremophila*	*forrestii*	Wilcox Bush		0.4	<2

Quadrat ID:	**MSQ27**
BHP Drillpad ID:	MG24
Co-ordinates:	200772 7415940

Plate 26 Quadrat MSQ27 taken from SW corner

Quadrat Description

Rocky Plain, broad sheetflow: Vegetation Description

Tall open shrubland of *Acacia marramamba* and Grevillea wickhamii with *Acacia sclerosperma subsp. sclerosperma, A. inaequilatera* open shrubland A. hilliana low shrubland over grassland dominated by *Triodia basedowii*.

Substrate:	rocks
Slope:	flat
Bare open ground:	10-30%
Rocks:	30-50%
Logs/branches:	<2%
Bark:	<2%

Fire History: 5+ years

Condition: 1/2

Disturbance: Grazing by cattle

Table 27 Species list – Quadrat MSQ27

Family	Genus	Species	Common Name	Status	Height	Coverage
Poaceae	*Triodia*	*basedowii*	Lobed Spinifex		0.8	50-70
Mimosaceae	*Acacia*	*adoxa*			0.4	<2
Mimosaceae	*Acacia*	*hilliana*			0.6	2-10
Mimosaceae	*Acacia*	*melleodora*			1.7	<2
Mimosaceae	*Acacia*	*marramamba*			2	2-10
Proteaceae	*Grevillea*	*wickhamii*	Wickham's Grevillea		3	2-10
Mimosaceae	*Acacia*	*inaequilatera*	Baderi		2	<2
Mimosaceae	*Acacia*	*sclerosperma* subsp. *sclerosperma*			2	2-10
Poaceae	*Triodia*	*pungens*	Soft Spinifex		0.9	<2
Sterculiaceae	*Keraudrenia*	*velutina* subsp. *elliptica*			0.7	<2
Mimosaceae	*Acacia*	*tenuissima*			2	<2
Proteaceae	*Hakea*	*chordophylla*			2	<2
Poaceae	*Paraneurachne*	*muelleri*	Northern Mulga Grass		0.7	<2
Poaceae	*Aristida*	*inaequiglumis*	Feathertop Threeawn		0.5	<2
Boraginaceae	*Halgania*	*solanacea* var. Mt. Doreen			0.3	<2
Poaceae	*Cymbopogon*	*ambiguus*	Scentgrass		0.7	<2
Poaceae	*Iseilema*	*membranaceum*	Small Flinders Grass		0.1	<2
Mimosaceae	*Acacia*	*bivenosa*			1.5	<2
Myrtaceae	*Corymbia*	*opaca*	Desert Bloodwood		5	<2
Sapindaceae	*Dodonaea*	*coriaceae*			1	<2
Mimosaceae	*Acacia*	*monticola*	Gawar		2	<2
Solanaceae	*Solanum*	sp.			0.2	<2

Quadrat ID: MSQ28

BHP Drillpad ID: MG22

Co-ordinates: 200552 7415572

Plate 27 Quadrat MSQ28 taken from SW corner

Quadrat Description

Rocky Plain, broad sheetflow: Vegetation Description

Tall shrubland of *Acacia monticola* and *Acacia sclerosperma subsp. sclerosperma* over grassland dominated by *Triodia basedowii* and *T. pungens.*

Substrate:	rocks and sand
Slope:	flat
Bare open ground:	10-30%
Rocks:	30-50%
Logs/branches:	<2%
Bark:	<2%
Fire History:	5+ years
Condition:	1/2
Disturbance:	Grazing by cattle

Table 28 Species list – Quadrat MSQ28

Family	Genus	Species	Common Name	Status	Height	Coverage
Poaceae	*Eriachne*	*mucronata*	Mountain Wanderrie Grass		0.3	<2
Myrtaceae	*Corymbia*	*opaca*	Desert Bloodwood		5	<2
Mimosaceae	*Acacia*	*monticola*	Gawar		4	10-30
Poaceae	*Enneapogon*	*caerulescens*	Limestone Grass		0.9	<2
Poaceae	*Triodia*	*basedowii*	Lobed Spinifex		0.9	30-50
Poaceae	*Triodia*	*pungens*	Soft Spinifex		1.2	10-30
Mimosaceae	*Acacia*	*bivenosa*			5	<2
Mimosaceae	*Acacia*	*sclerosperma* subsp. *sclerosperma*			2.5	10-30
Mimosaceae	*Acacia*	*adoxa*			0.5	<2
Proteaceae	*Grevillea*	*wickhamii*	Wickham's Grevillea		2.5	<2
Caesalpiniaceae	*Senna*	*glutinosa*			0.5	<2
Caesalpiniaceae	*Senna*	*artemisioides x sturtii*			0.5	<2
Poaceae	*Iseilema*	*membranaceum*	Small Flinders Grass		0.1	<2
Proteaceae	*Hakea*	*chordophylla*			0.6	<2
Malvaceae	*Gossypium*	*robinsonii*	Wild Cotton		3	<2
Poaceae	*Eragrostis*	*falcata*	Sickle Lovegrass		0.4	<2
Tiliaceae	*Corchorus*	sp. (not fruiting)			0.6	<2
Convolvulaceae	*Bonamia*	*rosea*			0.4	<2
Boraginaceae	*Halgania*	*solanacea* var. Mt. Doreen			0.4	<2
Poaceae	*Themeda*	*triandra*	Kangaroo Grass		0.7	<2
Poaceae	*Paraneurachne*	*muelleri*	Northern Mulga Grass		0.5	<2
Poaceae	*Eulalia*	*aurea*	Silky Browntop		0.4	<2
Mimosaceae	*Acacia*	*rhodophloia*			0.7	<2

Quadrat ID: **MSQ29**

BHP Drillpad ID: MG21

Co-ordinates: 200514 7415322

Plate 28 Quadrat MSQ29 taken from SW corner

Quadrat Description

Low rocky foothills: Vegetation Description

Low shrubland of *Acacia hilliana* with *A. adoxa, Halgania solanacea* var. Mt Doreen, over grassland of *Triodia basedowii*.

Substrate: rocks

Slope: medium to the north-west

Bare open ground: 10-30%

Rocks: 70-100%

Logs/branches: <2%

Bark: <2%

Fire History: 5+ years

Condition: 1/2

Disturbance: no apparent disturbance

Table 29 Species list – Quadrat MSQ29

Family	Genus	Species	Common Name	Status	Height	Coverage
Myrtaceae	*Eucalyptus*	*leucophloia*	Snappy Gum		4	<2
Poaceae	*Triodia*	*basedowii*	Lobed Spinifex		0.6	50-70
Mimosaceae	*Acacia*	*hilliana*			0.5	30-50
Papilionaceae	*Gompholobium*	*polyzygum*			0.6	<2
Mimosaceae	*Acacia*	*bivenosa*			2	<2
Amaranthaceae	*Ptilotus*	*rotundifolius*	Royal Mulla Mulla		0.9	<2
Boraginaceae	*Halgania*	*solanacea* var. Mt. Doreen			0.3	2-10
Mimosaceae	*Acacia*	*adoxa*			0.6	2-10
Myrtaceae	*Calytrix*	*carinata*			0.5	<2
Zygophyllaceae	*Tribulus*	*suberosus*			0.6	<2
Mimosaceae	*Acacia*	*tenuissima*			1.2	<2
Sterculiaceae	*Keraudrenia*	*velutina* subsp. *elliptica*			0.6	<2
Goodeniaceae	*Goodenia*	sp. Sandy Creek			3	<2
Proteaceae	*Grevillea*	*wickhamii*	Wickham's Grevillea		2	<2
Amaranthaceae	*Ptilotus*	*calostachyus*	Weeping Mulla Mulla		0.5	<2
Poaceae	*Eragrostis*	*falcata*	Sickle Lovegrass		0.2	<2
Myoporaceae	*Eremophila*	*latrobei*			0.4	<2
Malvaceae	*Sida*	*?arenicola* (not flowering)			0.3	<2
Poaceae	*Paraneurachne*	*muelleri*	Northern Mulga Grass		0.4	<2
Mimosaceae	*Acacia*	*aneura* var. *conifera*			0.8	<2

Quadrat ID: **MSQ30**

BHP Drillpad ID: MG66

Co-ordinates: 200481 7415085

Plate 29 Quadrat MSQ30 taken from SW corner

Quadrat Description

Low rocky foothills: Vegetation Description

Shrubland of *Acacia monticola* with *Senna glutinosa* over mixed bunch and hummock grassland of *Triodia pungens, Triodia basedowii*, with *Aristida contorta*

Substrate: rocks

Slope: medium to the north-west

Bare open ground: 10-30%

Rocks: 70-100%

Logs/branches: <2%

Bark: <2%

Fire History: 5+ years

Condition: 1/2

Disturbance: no apparent disturbance

Table 30 Species list – Quadrat MSQ30

Family	Genus	Species	Common Name	Status	Height	Coverage
Caesalpiniaceae	*Petalostylis*	*labicheoides*	Slender Petalostylis		3	<2
Mimosaceae	*Acacia*	*monticola*	Gawar		2	30-50
Caesalpiniaceae	*Senna*	*glutinosa* subsp. *x luerssenii*			1	2-10
Caesalpiniaceae	*Senna*	*glutinosa*			1.2	2-10
Zygophyllaceae	*Tribulus*	*suberosus*			0.4	<2
Poaceae	*Paraneurachne*	*muelleri*	Northern Mulga Grass		0.3	<2
Poaceae	*Aristida*	*contorta*	Bunched Kerosene Grass		0.3	2-10
Poaceae	*Enneapogon*	*caerulescens*	Limestone Grass		2	<2
Poaceae	*Iseilema*	*membranaceum*	Small Flinders Grass		0.1	<2
Amaranthaceae	*Ptilotus*	*?exaltatus* (post-flowering)	Tall Mulla Mulla		0.2	<2
Amaranthaceae	*Ptilotus*	*obovatus*	Cotton Bush		0.5	<2
Myoporaceae	*Eremophila*	*cuneifolia*			0.4	<2
Poaceae	*Triodia*	*basedowii*	Lobed Spinifex		0.6	10-30
Solanaceae	*Solanum*	*lasiophyllum*	Flannel Bush		0.3	<2
Asteraceae	*Steptoglossa*	*decurrens*			0.4	<2
Mimosaceae	*Acacia*	*bivenosa*			2.5	<2
Caesalpiniaceae	*Senna*	*artemisioides x sturtii*			0.8	<2
Malvaceae	*Sida*	*?arenicola* (not flowering)			0.5	<2
Amaranthaceae	*Gomphrena*	*canescens*	Batchelor's Buttons		0.3	<2
Poaceae	*Cymbopogon*	*ambiguus*	Scentgrass		0.7	<2
Mimosaceae	*Acacia*	*pachyacra*			0.6	<2
Caryophyllaceae	*Polycarpaea*	*corymbosa*			0.05	<2
Myoporaceae	*Eremophila*	*latrobei*			0.4	<2
Poaceae	*Eragrostis*	*falcata*	Sickle Lovegrass		0.4	<2
Caesalpiniaceae	*Senna*	*artemisioides x sturtii*			0.6	<2
Caryophyllaceae	*Polycarpaea*	*holtzei*			0.05	<2
Tiliaceae	*Triumfetta*	sp.			1.5	<2

Family	Genus	Species	Common Name	Status	Height	Coverage
Rubiaceae	*Psydrax*	*latifolia*			2	<2
Proteaceae	*Grevillea*	*wickhamii*	Wickham's Grevillea		2	<2
Poaceae	*Triodia*	*pungens*	Soft Spinifex		1.2	10-30
Poaceae	*Eriachne*	*mucronata*	Mountain Wanderrie Grass		0.4	<2

Quadrat ID:	**MSQ31**
BHP Drillpad ID:	MG64
Co-ordinates:	199828 7414881

Plate 30 Quadrat MSQ31 taken from SW corner

Quadrat Description

Low rocky hills with associated gullies: Vegetation Description

Tall open shrubland of *Grevillea wickhamii* over open shrubland of *Ptilotus rotundifolius* over low open shrubland of *Acacia hilliana, A. adoxa* over mixed grassland of *Triodia basedowii* with *Eriachne mucronata*.

Substrate:	rocks
Slope:	high to the north-west, gullying
Bare open ground:	30-50%
Rocks:	70-100%
Logs/branches:	<2%
Bark:	<2%

Fire History: 5+ years

Condition: 1/2

Disturbance: no apparent disturbance

Table 31 Species list – Quadrat MSQ31

Family	Genus	Species	Common Name	Status	Height	Coverage
Poaceae	*Triodia*	*basedowii*	Lobed Spinifex		0.7	50-70
Mimosaceae	*Acacia*	*hilliana*			0.5	2-10
Proteaceae	*Grevillea*	*wickhamii*	Wickham's Grevillea		4	2-10
Amaranthaceae	*Ptilotus*	*rotundifolius*	Royal Mulla Mulla		1.1	2-10
Mimosaceae	*Acacia*	*pruinocarpa*	Gidgee		2	<2
Poaceae	*Aristida*	*inaequiglumis*	Feathertop Threeawn		0.7	<2
Poaceae	*Cymbopogon*	*ambiguus*	Scentgrass		0.8	<2
Mimosaceae	*Acacia*	*adoxa*			0.4	2-10
Caesalpiniaceae	*Senna*	*glutinosa*			0.8	<2
Poaceae	*Eriachne*	*mucronata*	Mountain Wanderrie Grass		0.4	2-10
Mimosaceae	*Acacia*	*bivenosa*			3.5	<2
Myoporaceae	*Eremophila*	*latrobei*			0.6	<2
Poaceae	*Iseilema*	*membranaceum*	Small Flinders Grass		0.1	<2
Boraginaceae	*Halgania*	*solanacea* var. Mt. Doreen			0.3	<2
Solanaceae	*Solanum*	*centrale*			0.3	<2
Solanaceae	*Solanum*	*lasiophyllum*	Flannel Bush		0.2	<2
Poaceae	*Paraneurachne*	*muelleri*	Northern Mulga Grass		0.2	<2
Papilionaceae	*Gompholobium*	*polyzygum*			0.5	<2
Zygophyllaceae	*Tribulus*	*suberosus*			0.4	<2
Convolvulaceae	*Duperreya*	*commixta*			4	<2
Poaceae	*Triodia*	*pungens*	Soft Spinifex		1.3	<2
Caesalpiniaceae	*Senna*	*artemisioides x sturtii*			0.8	<2
Malvaceae	*Sida*	*excedentifolia* ms			0.2	<2

Quadrat ID: **MSQ32**

BHP Drillpad ID: MG20

Co-ordinates: 199720 7415166

Plate 31 Quadrat MSQ32 taken from SW corner

Quadrat Description

Rocky plain at base of hills: Vegetation Description

Open Shrubland of *Acacia marramamba* over low shrubland of *Acacia melleodora, Acacia hilliana, A. adoxa* over *Triodia basedowii* dominated grassland

Substrate: rocks

Slope: predominantly flat

Bare open ground: 10-30%

Rocks: 50-70%

Logs/branches: <2%

Bark: <2%

Fire History: 5+ years

Condition: 1/2

Disturbance: no apparent disturbance

Table 32 Species list – Quadrat MSQ32

Family	Genus	Species	Common Name	Status	Height	Coverage
Proteaceae	*Grevillea*	*wickhamii*	Wickham's Grevillea		2.5	<2
Mimosaceae	*Acacia*	*hilliana*			0.8	30-50
Poaceae	*Triodia*	*basedowii*	Lobed Spinifex		0.6	30-50
Mimosaceae	*Acacia*	*inaequilatera*	Baderi		0.8	<2
Myoporaceae	*Eremophila*	*latrobei*			0.8	<2
Proteaceae	*Hakea*	*chordophylla*			2.5	<2
Mimosaceae	*Acacia*	*marramamba*			2	2-10
Mimosaceae	*Acacia*	*aneura* var. *conifera*			0.9	<2
Mimosaceae	*Acacia*	*melleodora*			1.1	2-10
Mimosaceae	*Acacia*	*bivenosa*			2.5	<2
Mimosaceae	*Acacia*	*adoxa*			0.6	2-10
Amaranthaceae	*Ptilotus*	*rotundifolius*	Royal Mulla Mulla		0.9	<2
Sterculiaceae	*Keraudrenia*	*velutina* subsp. *elliptica*			0.8	<2
Poaceae	*Cymbopogon*	*ambiguus*	Scentgrass		1.1	<2
Mimosaceae	*Acacia*	*tenuissima*			2	<2
Poaceae	*Iseilema*	*membranaceum*	Small Flinders Grass		0.01	<2
Mimosaceae	*Acacia*	*sclerosperma* subsp. *sclerosperma*			0.9	<2
Mimosaceae	*Acacia*	*pachyacra*			1.5	<2
Amaranthaceae	*Ptilotus*	*calostachyus*	Weeping Mulla Mulla		0.8	<2
Poaceae	*Eragrostis*	*falcata*	Sickle Lovegrass		0.2	<2
Lamiaceae	*Discrastylis*	*cordifolia*			0.2	<2
Myrtaceae	*Calytrix*	*carinata*			0.4	<2

Quadrat ID: MSQ33

BHP Drillpad ID: MG62

Co-ordinates: 199349 7415022

Plate 32 Quadrat MSQ33 taken from SW corner

Quadrat Description

Mulga woodland in gully between hills: Vegetation Description

Tall open scrub of *Acacia ancistrocarpa* with *Acacia arida* over *Themeda triandra* grassland with *Aristida inaequiglumis*.

Substrate:	sandy-loam
Slope:	flat
Bare open ground:	30-50%
Rocks:	<2%
Logs/branches:	<2%
Bark:	<2%
Fire History:	recent 2-5 years
Condition:	3/4
Disturbance:	heavy grazing and trampling by cattle

Table 33 Species list – Quadrat MSQ33

Family	Genus	Species	Common Name	Status	Height	Coverage
Mimosaceae	*Acacia*	*arida*			4	2-10
Mimosaceae	*Acacia*	*ancistrocarpa*	Fitzroy Wattle		5	50-70
Mimosaceae	*Acacia*	*melleodora*			0.6	<2
Poaceae	*Themeda*	*triandra*	Kangaroo Grass		1.1	30-50
Tiliaceae	*Triumfetta*	sp.			2.5	<2
Poaceae	*Cymbopogon*	*ambiguus*	Scentgrass		0.6	<2
Poaceae	*Eulalia*	*aurea*	Silky Browntop		0.8	<2
Poaceae	*Aristida*	*inaequiglumis*	Feathertop Threeawn		0.3	2-10
Myrtaceae	*Corymbia*	sp. (juv)			1.6	<2
Asteraceae	*Pterocaulon*	sp. (dead)			0.4	<2
Proteaceae	*Grevillea*	*wickhamii*	Wickham's Grevillea		0.8	<2
Poaceae	*Enneapogon*	*caerulescens*	Limestone Grass		0.2	<2
Caryophyllaceae	*Polycarpaea*	*corymbosa*			0.1	<2
Malvaceae	*Hibiscus*	*sturtii*	Sturt's Hibiscus		0.7	<2
Malvaceae	*Gossypium*	*robinsonii*	Wild Cotton		0.7	<2
Poaceae	*Paraneurachne*	*muelleri*	Northern Mulga Grass		0.3	<2
Poaceae	*Eragrostis*	*falcata*	Sickle Lovegrass		0.3	<2

Quadrat ID:	**MSQ34**
BHP Drillpad ID:	MG63
Co-ordinates:	199300 7415725

Plate 33 Quadrat MSQ34 taken from SW corner

Quadrat Description

Flat Plain: Vegetation Description

Low open woodland of *Corymbia opaca* over mixed grassland dominated by *Themeda triandra, Aristida inaequiglumis*, with *Eulalia aurea* and *Paraneurachne muelleri*.

Substrate:	orange-red sandy-loam
Slope:	flat
Bare open ground:	50-70%
Rocks:	<2%
Logs/branches:	<2%
Bark:	<2%

Fire History: recent 2-5 years

Condition: 3/4

Disturbance: heavy grazing and trampling by cattle

Table 34 Species list – Quadrat MSQ34

Family	Genus	Species	Common Name	Status	Height	Coverage
Myrtaceae	*Corymbia*	*opaca*	Desert Bloodwood		6	2-10
Poaceae	*Themeda*	*triandra*	Kangaroo Grass		1.1	30-50
Mimosaceae	*Acacia*	*melleodora*			1.5	<2
Poaceae	*Aristida*	*inaequiglumis*	Feathertop Threeawn		1.1	30-50
Tiliaceae	*Corchorus*	sp. (not fruiting)			1.5	<2
Poaceae	*Eulalia*	*aurea*	Silky Browntop		0.8	2-10
Malvaceae	*Sida*	*?arenicola* (not flowering)			0.4	<2
Poaceae	*Paraneurachne*	*muelleri*	Northern Mulga Grass		0.3	2-10
Poaceae	*Eragrostis*	*falcata*	Sickle Lovegrass		0.3	<2
Proteaceae	*Grevillea*	*wickhamii*	Wickham's Grevillea		0.5	<2
Poaceae	*Aristida*	*contorta*	Bunched Kerosene Grass		0.6	<2
Myoporaceae	*Eremophila*	*longifolia*	Berrigan		0.8	<2
Goodeniaceae	*Dampiera*	*candicans*			0.2	<2
Proteaceae	*Hakea*	*lorea*			0.8	<2

Quadrat ID:	**MSQ35**
BHP Drillpad ID:	MG8
Co-ordinates:	195578 7414755

Plate 34 Quadrat MSQ35 taken from SW corner

Quadrat Description

Gentle rise above Flat Plain: Vegetation Description

Shrubland of *Acacia tenuissima* with scattered *Hakea chordophylla* over open herbland of *Goodenia* sp. Sandy Creek with mixed grassland dominated by *Triodia basedowii* and *Aristida caricinus*.

Substrate:	rocks
Slope:	flat
Bare open ground:	50-70%
Rocks:	70-100%
Logs/branches:	<2%
Bark:	<2%

Fire History: recent 2-5 years

Condition: 2

Disturbance: previous exploration, fire

Table 35 Species list – Quadrat MSQ35

Family	*Genus*	*Species*	Common Name	Status	Height	Coverage
Poaceae	*Amphipogon*	*caricinus*	Long Greybeard Grass		0.5	2-10
Poaceae	*Triodia*	*basedowii*	Lobed Spinifex		0.6	10-30
Goodeniaceae	*Goodenia*	sp. Sandy Creek			0.2	2-10
Amaranthaceae	*Ptilotus*	*calostachyus*	Weeping Mulla Mulla		0.7	<2
Mimosaceae	*Acacia*	*tenuissima*			1.5	10-30
Proteaceae	*Hakea*	*chordophylla*			0.7	2-10
Caesalpiniaceae	*Senna*	*artemisioides x sturtii*			0.8	<2
Mimosaceae	*Acacia*	*sclerosperma* subsp. *sclerosperma*			0.8	<2
Gyrostemonaceae	*Codonocarpus*	*cotinifolius*	Native Poplar		2	<2
Malvaceae	*Sida*	*?arenicola* (not flowering)			0.4	<2
Proteaceae	*Grevillea*	*stenobotrya*			1	<2
Poaceae	*Eragrostis*	*falcata*	Sickle Lovegrass		0.3	<2
Myrtaceae	*Calytrix*	*carinata*			0.4	<2
Mimosaceae	*Acacia*	*melleodora*			2	<2
Sapindaceae	*Dodonaea*	*coriaceae*			0.4	<2
Mimosaceae	*Acacia*	*bivenosa*			2.5	<2
Solanaceae	*Solanum*	*lasiophyllum*	Flannel Bush		0.7	<2
Mimosaceae	*Acacia*	*arida*			3	<2
Mimosaceae	*Acacia*	*marramamba*			1.5	<2

Quadrat ID: **MSQ36**

BHP Drillpad ID: MG5

Co-ordinates: 195042 7414799

Plate 35 Quadrat MSQ36 taken from SW corner

Quadrat Description

Rocky Flat: Vegetation Description

Shrubland of *Acacia tenuissima*, *Acacia marramamba* over low open shrubland of *Keraudrenia velutina* subsp. *elliptica* over mixed grassland dominated by *Triodia basedowii* and *Eragrostis falcata*.

Substrate: rocks

Slope: flat

Bare open ground: 50-70%

Rocks: 70-100%

Logs/branches: <2%

Bark: <2%

Fire History: old >5 years

Condition: 1/2

Disturbance: no apparent disturbance

Table 36 Species list – Quadrat MSQ36

Family	Genus	Species	Common Name	Status	Height	Coverage
Proteaceae	*Grevillea*	*wickhamii*	Wickham's Grevillea		2.5	<2
Poaceae	*Triodia*	*basedowii*	Lobed Spinifex		0.8	50-70
Mimosaceae	*Acacia*	*bivenosa*			2.5	<2
Mimosaceae	*Acacia*	*melleodora*			1.8	<2
Poaceae	*Cymbopogon*	*ambiguus*	Scentgrass		1.1	<2
Myrtaceae	*Calytrix*	*carinata*			0.9	<2
Proteaceae	*Hakea*	*chordophylla*			4	<2
Mimosaceae	*Acacia*	*tenuissima*			1.5	2-10
Amaranthaceae	*Ptilotus*	*rotundifolius*	Royal Mulla Mulla		0.4	<2
Lamiaceae	*Discrastylis*	*cordifolia*			0.2	<2
Molluginaceae	*Mollugo*	*molluginea*			0.05	<2
Goodeniaceae	*Goodenia*	sp. Sandy Creek			0.3	<2
Amaranthaceae	*Ptilotus*	*calostachyus*	Weeping Mulla Mulla		0.5	<2
Mimosaceae	*Acacia*	*marramamba*			2	2-10
Sterculiaceae	*Keraudrenia*	*velutina* subsp. *elliptica*			0.5	2-10
Poaceae	*Eragrostis*	*falcata*	Sickle Lovegrass		0.5	2-10
Asteraceae	*Chrysocephalum*	*eremaeum*			0.4	<2
Asteraceae	*Pterocaulon*	sp. (dead)			0.3	<2
Sapindaceae	*Dodonaea*	*coriaceae*			0.4	<2
Mimosaceae	*Acacia*	*tetragonophylla*	Kurara		1.5	<2
Malvaceae	*Sida*	*?arenicola* (not flowering)			0.3	<2
Caryophyllaceae	*Polycarpaea*	*holtzei*			0.05	<2
Poaceae	*Aristida*	*inaequiglumis*	Feathertop Threeawn		0.3	<2
Convolvulaceae	*Bonamia*	*rosea*			0.2	<2

Quadrat ID: **MSQ37**

BHP Drillpad ID: MG5

Co-ordinates: 195028 7414915

Plate 36 Quadrat MSQ37 taken from SW corner

Quadrat Description

Rocky Plain: Vegetation Description

Acacia marramamba shrubland with *Grevillea wickhamii* and *Acacia tenuissima* over mixed grassland dominated by *Triodia basedowii* with *Eragrostis falcata*.

Substrate: rocks

Slope: flat

Bare open ground: 50-70%

Rocks: 70-100%

Logs/branches: <2%

Bark: <2%

Fire History: old >5 years

Condition: 1/2

Disturbance: no apparent disturbance

Table 37 Species list – Quadrat MSQ37

Family	Genus	Species	Common Name	Status	Height	Coverage
Mimosaceae	*Acacia*	*marramamba*			1.5	30-50
Mimosaceae	*Acacia*	*aneura* var. *conifera*			0.8	<2
Proteaceae	*Grevillea*	*wickhamii*	Wickham's Grevillea		2	2-10
Mimosaceae	*Acacia*	*melleodora*			0.8	<2
Mimosaceae	*Acacia*	*tenuissima*			1.1	2-10
Poaceae	*Triodia*	*basedowii*	Lobed Spinifex		0.8	10-30
Poaceae	*Eragrostis*	*falcata*	Sickle Lovegrass		0.6	2-10
Malvaceae	*Sida*	*?arenicola* (not flowering)			0.3	<2
Lamiaceae	*Discrastylis*	*cordifolia*			0.3	<2
Asteraceae	*Chrysocephalum*	*eremaeum*			0.4	<2
Myrtaceae	*Eucalyptus*	*gamophylla*	Twin-leaf Mallee		3	<2
Poaceae	*Cymbopogon*	*ambiguus*	Scentgrass		0.7	<2
Goodeniaceae	*Goodenia*	sp. Sandy Creek			0.3	<2
Sterculiaceae	*Keraudrenia*	*velutina* subsp. *elliptica*			0.4	<2
Sapindaceae	*Dodonaea*	*coriaceae*			0.3	<2
Asteraceae	*Pluchea*	*dentex*			0.4	<2
Poaceae	*Aristida*	*inaequiglumis*	Feathertop Threeawn		0.5	<2
Amaranthaceae	*Ptilotus*	*calostachyus*	Weeping Mulla Mulla		0.3	<2
Proteaceae	*Hakea*	*chordophylla*			0.4	<2
Papilionaceae	*Rhynchosia*	*minima*			0.7	<2
Asteraceae	*Streptoglossa*	*decurrens*			0.4	<2

Quadrat ID:	**MSQ38**
BHP Drillpad ID:	MG3
Co-ordinates:	194458 7414952

Plate 37 Quadrat MSQ38 taken from SW corner

Quadrat Description

Rocky Plain: Vegetation Description

Low open woodland of *Eucalyptus gamophylla* over Tall open shrubland of *Acacia marramamba*, *Acacia tenuissima, Hakea chordophylla* over grassland dominated by *Triodia basedowii*.

Substrate:	rocks
Slope:	flat
Bare open ground:	50-70%
Rocks:	70-100%
Logs/branches:	<2%
Bark:	<2%

Fire History: old >5 years

Condition: 1/2

Disturbance: old minor track through quadrat

Table 38 Species list – Quadrat MSQ38

Family	Genus	Species	Common Name	Status	Height	Coverage
Poaceae	*Triodia*	*basedowii*	Lobed Spinifex		0.8	50-70
Proteaceae	*Hakea*	*chordophylla*			3	2-10
Mimosaceae	*Acacia*	*pachyacra*			1	<2
Mimosaceae	*Acacia*	*bivenosa*			4	<2
Mimosaceae	*Acacia*	*marramamba*			2	2-10
Mimosaceae	*Acacia*	*tenuissima*			3	2-10
Proteaceae	*Hakea*	*lorea*			2	<2
Poaceae	*Cymbopogon*	*ambiguus*	Scentgrass		0.7	<2
Myoporaceae	*Eremophila*	*forrestii*	Wilcox Bush		0.5	<2
Boraginaceae	*Halgania*	*solanacea* var. Mt. Doreen			0.4	<2
Malvaceae	*Sida*	*?arenicola* (not flowering)			0.4	<2
Proteaceae	*Grevillea*	*wickhamii*	Wickham's Grevillea		2.5	<2
Poaceae	*Aristida*	*inaequiglumis*	Feathertop Threeawn		0.3	<2
Asteraceae	*Pterocaulon*	*sphaeranthoides*			0.3	<2
Goodeniaceae	*Dampiera*	*candicans*			0.3	<2
Caesalpiniaceae	*Senna*	*artemisioides* subsp. *helmsii*			0.4	<2
Asteraceae	*Streptoglossa*	*decurrens*			0.1	<2
Myoporaceae	*Eremophila*	*cuneifolia*			0.4	<2
Amaranthaceae	*Ptilotus*	*calostachyus*	Weeping Mulla Mulla		0.5	<2
Goodeniaceae	*Goodenia*	sp. (dead)			0.5	<2
Myoporaceae	*Eremophila*	*fraseri*			0.4	<2
Myrtaceae	*Eucalyptus*	*gamophylla*	Twin-leaf Mallee		3	2-10
Mimosaceae	*Acacia*	*tetragonophylla*	Kurara		3	<2
Convolvulaceae	*Bonamia*	*rosea*			0.3	<2
Mimosaceae	*Acacia*	*melleodora*			0.8	<2
Papilionaceae	*Rhynchosia*	*minima*			0.3	<2
Goodeniaceae	*Goodenia*	sp. Sandy Creek			0.2	<2
Sapindaceae	*Dodonaea*	*coriaceae*			0.5	<2

Family	Genus	Species	Common Name	Status	Height	Coverage
Lamiaceae	*Discrastylis*	*cordifolia*			0.4	<2
Poaceae	*Eriachne*	*mucronata*	Mountain Wanderrie Grass		0.3	<2

Quadrat ID: **MSQ39**

BHP Drillpad ID: MG01

Co-ordinates: 193875 7414988

Plate 38 Quadrat MSQ39 taken from SW corner

Quadrat Description

Rocky Plain: Vegetation Description

Tall open shrubland of *Acacia marramamba*, with *Acacia inaequilatera, A. tenuissima, A. bivenosa, Grevillea wickhamii* over low open shrubland of *Acacia hilliana, A. adoxa*, *Gompholobium polyzygum* over grassland dominated by *Triodia basedowii*.

Substrate: rocks

Slope: flat

Bare open ground: 30-50%

Rocks: 70-100%

Logs/branches: <2%

Bark: <2%

Fire History: old >5 years

Condition: 2/3

Disturbance: old minor track through quadrat

Table 39 Species list – Quadrat MSQ39

Family	Genus	Species	Common Name	Status	Height	Coverage
Proteaceae	*Grevillea*	*wickhamii*	Wickham's Grevillea		3	2-10
Myrtaceae	*Corymbia*	*opaca*	Desert Bloodwood		3	<2
Myrtaceae	*Eucalyptus*	*gamophylla*	Twin-leaf Mallee		2	<2
Mimosaceae	*Acacia*	*marramamba*			1.5	10-30
Mimosaceae	*Acacia*	*bivenosa*			3.5	2-10
Mimosaceae	*Acacia*	*hilliana*			0.6	2-10
Mimosaceae	*Acacia*	*adoxa*			0.5	2-10
Papilionaceae	*Gompholobium*	*polyzygum*			0.5	2-10
Mimosaceae	*Acacia*	*melleodora*			0.6	<2
Mimosaceae	*Acacia*	*sclerosperma* subsp. *sclerosperma*			0.9	<2
Mimosaceae	*Acacia*	*inaequilatera*	Baderi		2	2-10
Boraginaceae	*Halgania*	*solanacea* var. Mt. Doreen			0.4	<2
Poaceae	*Triodia*	*basedowii*	Lobed Spinifex		0.8	30-50
Poaceae	*Eulalia*	*aurea*	Silky Browntop		0.6	<2
Poaceae	*Eriachne*	*mucronata*	Mountain Wanderrie Grass		0.3	<2
Sapindaceae	*Dodonaea*	*coriaceae*			0.5	<2
Goodeniaceae	*Goodenia*	sp. Sandy Creek			0.3	<2
Mimosaceae	*Acacia*	*tenuissima*			0.4	2-10
Malvaceae	*Sida*	*?arenicola* (not flowering)			0.3	<2
Poaceae	*Aristida*	*inaequiglumis*	Feathertop Threeawn		0.5	<2
Poaceae	*Paraneurachne*	*muelleri*	Northern Mulga Grass		0.3	<2
Poaceae	*Eragrostis*	*falcata*	Sickle Lovegrass		0.3	<2
Convolvulaceae	*Bonamia*	*rosea*			0.2	<2
Poaceae	*Cymbopogon*	*ambiguus*	Scentgrass		0.4	<2
Amaranthaceae	*Gomphrena*	*canescens*	Bachelor's Buttons		0.3	<2
Mimosaceae	*Acacia*	*tetragonophylla*	Kurara		0.4	<2

Family	Genus	Species	Common Name	Status	Height	Coverage
Amaranthaceae	*Ptilotus*	*calostachyus*	Weeping Mulla Mulla		0.4	<2
Amaranthaceae	*Ptilotus*	*incanus*			0.3	<2
Solanaceae	*Solanum*	*lasiophyllum*	Flannel Bush		0.4	<2
Proteaceae	*Hakea*	*chordophylla*			0.3	<2

Quadrat ID:	**MSQ40**
BHP Drillpad ID:	MG04
Co-ordinates:	194469 7415249

Plate 39 Quadrat MSQ40 taken from SW corner

Quadrat Description

Sandy Plain: Vegetation Description

Low open woodland of *Grevillea striata* with juvenile *Corymbia* sp. over open shrubland of *Acacia pachyacra* over low open shrubland of *Rhynchosia minima, Dampiera candicans* over mixed grassland dominated by *Triodia schinzii* with *Cymbopogon ambiguus*.

Substrate:	sand
Slope:	gentle to the south
Bare open ground:	30-50%
Rocks:	<2%
Logs/branches:	<2%
Bark:	<2%

Fire History:	old >5 years
Condition:	2/3
Disturbance: grazing	old minor track through quadrat, minor erosion, cattle

Table 40 Species list – Quadrat MSQ40

Family	Genus	Species	Common Name	Status	Height	Coverage
Proteaceae	*Grevillea*	*striata*	Beefwood		5	2-10
Poaceae	*Triodia*	*schinzii*			1.2	10-30
Papilionaceae	*Rhynchosia*	*minima*			0.4	2-10
Caesalpiniaceae	*Senna*	*artemisioides* subsp. *oligophylla*			0.6	<2
Amaranthaceae	*Ptilotus*	*calostachyus*	Weeping Mulla Mulla		0.7	<2
Mimosaceae	*Acacia*	*pachyacra*			2	2-10
Poaceae	*Aristida*	*inaequiglumis*	Feathertop Threeawn		0.5	<2
Boraginaceae	*Halgania*	*solanacea* var. Mt. Doreen			0.3	<2
Convolvulaceae	*Bonamia*	*rosea*			0.4	<2
Mimosaceae	*Acacia*	*bivenosa*			3	<2
Poaceae	*Eragrostis*	*falcata*	Sickle Lovegrass		0.4	<2
Lamiaceae	*Discrastylis*	*cordifolia*			0.6	<2
Poaceae	*Cymbopogon*	*ambiguus*	Scentgrass		0.7	2-10
Mimosaceae	*Acacia*	*melleodora*			0.9	<2
Myrtaceae	*Corymbia*	sp. (juv)			2	2-10
Goodeniaceae	*Dampiera*	*candicans*			0.3	10-30

Appendix C

Flora

Conservation Categories and Definitions for *EPBC Act* Listed Flora and Fauna Species

Conservation Codes and Descriptions for the DEC Declared Rare and Priority Flora Species

Mesa Gap Flora List

Table 8 Conservation Categories and Definitions for *EPBC Act* Listed Flora and Fauna Species.

Conservation Category	Definition
Extinct	Taxa not definitely located in the wild during the past 50 years
Extinct in the Wild	Taxa known to survive only in captivity
Critically Endangered	Taxa facing an extremely high risk of extinction in the wild in the immediate future
Endangered	Taxa facing a very high risk of extinction in the wild in the near future
Vulnerable	Taxa facing a high risk of extinction in the wild in the medium-term
Near Threatened	Taxa that risk becoming Vulnerable in the wild
Conservation Dependent	Taxa whose survival depends upon ongoing conservation measures. Without these measures, a conservation dependent taxon would be classified as Vulnerable or more severely threatened.
Data Deficient (Insufficiently Known)	Taxa suspected of being Rare, Vulnerable or Endangered, but whose true status cannot be determined without more information.
Least Concern	Taxa that are not considered Threatened

Table 9 Conservation Codes and Descriptions for DEC Declared Rare and Priority Flora Species.

Conservation Code	Description
R: Declared Rare Flora – Extant Taxa	Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such.
P1: Priority One – Poorly Known Taxa	Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat, e.g. road verges, urban areas, farmland, active mineral leases, etc., or the plants are under threat, e.g. from disease, grazing by feral animals etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.
P2: Priority Two – Poorly Known Taxa	Taxa which are known from one or a few (generally<5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.
P3: Priority Three – Poorly Known Taxa	Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora' but are in need of further survey.
P4: Priority Four – Taxa in need of monitoring	Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5 – 10 years.

Table 10 Mesa Gap Survey Area Flora List

Family	Genus	Species	Common Name	Status
Amaranthaceae	*Gomphrena*	*canescens*		
Amaranthaceae	*Ptilotus*	*?exaltatus* (post-flowering)	Tall Mulla Mulla	
Amaranthaceae	*Ptilotus*	*calostachyus*	Weeping Mulla Mulla	
Amaranthaceae	*Ptilotus*	*incanus*		
Amaranthaceae	*Ptilotus*	*obovatus*	Cotton Bush	
Amaranthaceae	*Ptilotus*	*rotundifolius*	Royal Mulla Mulla	
Apiaceae	*Trachymene*	*oleracea*		
Asteraceae	*Chrysocephalum*	*eremaeum*		
Asteraceae	*Pluchea*	*dunlopii*		
Asteraceae	*Pluchea*	*dentex*		
Asteraceae	*Pterocaulon*	*sphaeranthoides*		
Asteraceae	*Streptoglossa*	*decurrens*		
Boraginaceae	*Halgania*	*solanacea* var. *Mt. Doreen*		
Boraginaceae	*Heliotropium*	sp. (dead)		
Brassicaceae	*Stenopetalum*	*decipiens*		
Caesalpiniaceae	*Petalostylis*	*labicheoides*	Slender Petalostylis	
Caesalpiniaceae	*Senna*	*?stricta*		
Caesalpiniaceae	*Senna*	*artemisioides* subsp. *oligophylla*		
Caesalpiniaceae	*Senna*	*artemisioides* subsp. *helmsii*		
Caesalpiniaceae	*Senna*	*artemisioides x sturtii*		
Caesalpiniaceae	*Senna*	*glutinosa* subsp. *?*		
Caesalpiniaceae	*Senna*	*glutinosa* subsp. *x luerssenii*		
Caesalpiniaceae	*Senna*	*notabilis*	Cockroach Bush	
Caryophyllaceae	*Polycarpaea*	*corymbosa*		
Caryophyllaceae	*Polycarpaea*	*holtzei*		
Caryophyllaceae	*Polycarpaea*	*longiflora*		
Chenopodiaceae	*Dysphania*	*kalpari*	Rat's Tail	
Chenopodiaceae	*Maireana*	*georgei*	Satiny Bluebush	
Chenopodiaceae	*Maireana*	*tomentosa*	Felty Bluebush	
Chenopodiaceae	*Rhagodia*	*eremaea*		

Family	Genus	Species	Common Name	Status
Chenopodiaceae	*Salsola*	*tragus*	Roly Poly	
Convolvulaceae	*Bonamia*	*rosea*		
Convolvulaceae	*Duperreya*	*commixta*		
Cyperaceae	*Fimbristylis*	*dichotoma*	Eight Day Grass	
Euphorbiaceae	*Euphorbia*	sp.		
Goodeniaceae	*Dampiera*	*candicans*		
Goodeniaceae	*Goodenia*	*microptera*		
Goodeniaceae	*Goodenia*	sp. Sandy Creek		
Goodeniaceae	*Goodenia*	*stobbsiana*		
Goodeniaceae	*Scaevola*	*browniana*		
Gyrostemonaceae	*Codonocarpus*	*cotinifolius*	Native Poplar	
Lamiaceae	*Clerodendrum*	*floribundum*	Lollybush	
Lamiaceae	*Discrastylis*	*cordifolia*		
Lauraceae	*Cassytha*	sp. (not flowering)		
Loranthaceae	*Amyema*	*miquelii*	Stalked Mistletoe	
Loranthaceae	*Lysiana*	*casuarinae*		
Malvaceae	*Gossypium*	*robinsonii*	Wild Cotton	
Malvaceae	*Hibiscus*	*sturtii*	Sturt's Hibiscus	
Malvaceae	*Sida*	*?arenicola* (not flowering)		
Malvaceae	*Sida*	*?excedentifolia* ms		
Malvaceae	*Sida*	*fibulifera*	Silver Sida	
Mimosaceae	*Acacia*	*adoxa*		
Mimosaceae	*Acacia*	*ancistrocarpa*	Fitzroy Wattle	
Mimosaceae	*Acacia*	*aneura* var. *conifera*		
Mimosaceae	*Acacia*	*arida*		
Mimosaceae	*Acacia*	*bivenosa*		
Mimosaceae	*Acacia*	*dictyophleba*		
Mimosaceae	*Acacia*	*hilliana*		
Mimosaceae	*Acacia*	*inaequilatera*	Baderi	
Mimosaceae	*Acacia*	*kempeana*	Witchetty Bush	
Mimosaceae	*Acacia*	*maitlandii*		
Mimosaceae	*Acacia*	*marramamba*		

Family	Genus	Species	Common Name	Status
Mimosaceae	*Acacia*	*melleodora*		
Mimosaceae	*Acacia*	*monticola*	Gawar	
Mimosaceae	*Acacia*	*pachyacra*		
Mimosaceae	*Acacia*	*pruinocarpa*	Gidgee	
Mimosaceae	*Acacia*	*pyrifolia*	Ranji Bush	
Mimosaceae	*Acacia*	*rhodophloia*		
Mimosaceae	*Acacia*	*sclerosperma* subsp. *sclerosperma*		
Mimosaceae	*Acacia*	*tenuissima*		
Mimosaceae	*Acacia*	*tetragonophylla*	Kurara	
Mimosaceae	*Acacia*	*victoriae*		
Molluginaceae	*Mollugo*	*molluginea*		
Myoporaceae	*Eremophila*	*cuneifolia*		
Myoporaceae	*Eremophila*	*forrestii*	Wilcox Bush	
Myoporaceae	*Eremophila*	*fraseri*	Turpentine Bush	
Myoporaceae	*Eremophila*	*jucunda* subsp. *pulcherrima*		
Myoporaceae	*Eremophila*	*latrobei* subsp. *filiformis*	Warty Fuschia Bush	
Myoporaceae	*Eremophila*	*latrobei* subsp. *latrobei*	Warty Fuschia Bush	
Myoporaceae	*Eremophila*	*longifolia*	Berrigan	
Myrtaceae	*Calytrix*	*carinata*		
Myrtaceae	*Corymbia*	*deserticola*	Twin-leaf Mallee	
Myrtaceae	*Corymbia*	*opaca*	Desert Bloodwood	
Myrtaceae	*Eucalyptus*	*gamophylla*	Twin-leaf Mallee	
Myrtaceae	*Eucalyptus*	*leucophloia*	Snappy Gum	
Myrtaceae	*Eucalyptus*	*trivalva*	Desert Mallee	
Myrtaceae	*Eucalyptus*	*xerothermica*		
Myrtaceae	*Lamarchea*	*sulcata*		
Papilionaceae	*Aenictophyton*	sp. nov (G. Davis 120)		sp. nov
Papilionaceae	*Gompholobium*	*polyzygum*		
Papilionaceae	*Indigofera*	*fractiflexa*		
Papilionaceae	*Leptosema*	*chambersii*		
Papilionaceae	*Rhynchosia*	*minima*		
Papilionaceae	*Tephrosia*	*rosea*		

Family	Genus	Species	Common Name	Status
Poaceae	*Amphipogon*	*caricinus*	Long Greybeard Grass	
Poaceae	*Aristida*	*contorta*	Bunched Kerosene Grass	
Poaceae	*Aristida*	*inaequiglumis*	Feathertop Threeawn	
Poaceae	*Aristida*	*latifolia*	Feathertop Threeawn	
Poaceae	*Cymbopogon*	*ambiguus*	Scentgrass	
Poaceae	*Enneapogon*	*caerulescens*	Limestone Grass	
Poaceae	*Eragrostis*	*eriopoda*	Woollybutt Grass	
Poaceae	*Eragrostis*	*falcata*	Sickle Lovegrass	
Poaceae	*Eriachne*	*aristidea*		
Poaceae	*Eriachne*	*lanata*		
Poaceae	*Eriachne*	*mucronata*	Mountain Wanderrie Grass	
Poaceae	*Eulalia*	*aurea*	Silky Browntop	
Poaceae	*Iseilema*	*membranaceum*	Small Flinders Grass	
Poaceae	*Paraneurachne*	*muelleri*	Northern Mulga Grass	
Poaceae	*Themeda*	*triandra*	Kangaroo Grass	
Poaceae	*Triodia*	*angusta*		
Poaceae	*Triodia*	*basedowii*	Lobed Spinifex	
Poaceae	*Triodia*	*epactia*		
Poaceae	*Triodia*	*pungens*	Soft Spinifex	
Poaceae	*Triodia*	*schinzii*		
Proteaceae	*Grevillea*	*stenobotrya*		
Proteaceae	*Grevillea*	*striata*	Beefwood	
Proteaceae	*Grevillea*	*wickhamii*	Wickham's Grevillea	
Proteaceae	*Hakea*	*chordophylla*		
Proteaceae	*Hakea*	*lorea*		
Rubiaceae	*Psydrax*	*latifolia*		
Santalaceae	*Anthobolus*	*leptomerioides*		
Sapindaceae	*Dodonaea*	*coriaceae*		
Sapindaceae	*Dodonaea*	*pachyneura*		
Solanaceae	*Solanum*	*centrale*		
Solanaceae	*Solanum*	*lasiophyllum*	Flannel Bush	
Solanaceae	*Solanum*	*sturtianum*		

Family	Genus	Species	Common Name	Status
Sterculiaceae	*Keraudrenia*	*velutina* subsp. *elliptica*		
Sterculiaceae	*Waltheria*	*virgata*		
Surianaceae	*Stylobasium*	*spathulatum*	Pebble Bush	
Tiliaceae	*Corchorus*	*incanus* subsp. *lithophilus*		
Tiliaceae	*Corchorus*	sp. (not fruiting)		
Tiliaceae	*Triumfetta*	*maconochieana*		
Zygophyllaceae	*Tribulopis*	*suberosus*		

Where sp. nov. = new species

Appendix D

Fauna

EPBC Act Fauna Conservation Categories

Western Australia Wildlife Conservation Act 1950 Conservation Codes

The DEC Priority Fauna Codes

Table 13 Fauna Species Recorded from the Mesa Gap survey area.

Family	Genus	Species	Common Name	Status
Birds				
Acanthizidae	*Acanthiza*	*?chrysorrhoa*	Yellow-rumped Thornbill	
Accipitridae	*Accipiter*	*fasciatus*	Brown Goshawk	Migratory, Marine
Accipitridae	*Aquila*	*audax*	Wedge-tailed Eagle	Migratory
Accipitridae	*Haliastur*	*sphenurus*	Whistling Kite	Migratory, Marine
Artamidae	*Artamus*	*cincerus*	Black-faced Woodswallow	
Artamidae	*Artamus*	*personatus*	Dusky Woodswallow	
Campephagidae	*Coracina*	*novaehollandiae*	Black-faced Cuckoo-shrike	Marine
Columbidae	*Geopelia*	*striata*	Peaceful Dove	
Columbidae	*Geophaps*	*plumifera*	Spinifex Pigeon	
Columbidae	*Ocyphaps*	*lophotes*	Crested Pigeon	
Cracticidae	*Cracticus*	*torquatus*	Grey Butcherbird	
Cuculidae	*Cacomantis*	*flabelliformis*	Fan-tailed Cuckoo	
Dicruridae	*Grallina*	*cyanoleuca*	Magpielark	Marine
Dicruridae	*Rhipidura*	*leucophrys*	Willie Wagtail	
Falconidae	*Falco*	*berigora*	Brown Falcon	Migratory
Falconidae	*Falco*	*cenchroides*	Australian Kestrel	Migratory, Marine
Maluridae	*Amytornis*	*striatus*	Striated Grasswren	
Maluridae	*Malurus*	*sp. (female)*	Fairy-wren species	
Meliphagidae	*Lichenostomus*	*virescens*	Singing Honeyeater	
Meliphagidae	*Lichmera*	*indistincta*	Brown Honeyeater	
Meliphagidae	*Manorina*	*flavigula*	Yellow-throated Miner	
Motacillidae	*Anthus*	*australis*	Australian Pipit	
Pachycephalidae	*Colluricincla*	*harmonica*	Grey Shrike-thrush	
Pachycephalidae	*Pachycephala*	*rufiventris*	Rufous Whistler	
Passeridae	*Emblema*	*pictum*	Painted Finch	
Passeridae	*Taeniopygia*	*guttata*	Zebra Finch	
Pomatostomidae	*Pomatostomus*	*temporalis*	Grey-crowned Babbler	
Psittacidae	*Cacatua*	*roseicapilla*	Galah	
Sylviidae	*Cincloramphus*	*matthewsii*	Brown Songlark	

EPBC Act Fauna Conservation Categories

Listed threatened species and ecological communities

An action will require approval from the Environment Minister if the action has, will have, or is likely to have a significant impact on a species listed in any of the following categories:

- extinct in the wild,
- critically endangered,
- endangered, or
- vulnerable.

(See **Table 8**)

Critically endangered and endangered species

An action has, will have, or is likely to have a significant impact on a critically endangered or endangered species if it does, will, or is likely to:

- lead to a long-term decrease in the size of a population, or
- reduce the area of occupancy of the species, or
- fragment an existing population into two or more populations, or
- adversely affect habitat critical to the survival of a species, or
- disrupt the breeding cycle of a population, or
- modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or
- result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat*, or
- interfere with the recovery of the species.

**Introducing an invasive species into the habitat may result in that species becoming established. An invasive species may harm a critically endangered or endangered species by direct competition, modification of habitat, or predation.*

Vulnerable species

An action has, will have, or is likely to have a significant impact on a vulnerable species if it does, will, or is likely to:

- lead to a long-term decrease in the size of an important population of a species, or
- reduce the area of occupancy of an important population, or
- fragment an existing important population into two or more populations, or
- adversely affect habitat critical to the survival of a species, or
- disrupt the breeding cycle of an important population, or

- modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or
- result in invasive species that are harmful a vulnerable species becoming established in the vulnerable species' habitat*, or
- interferes substantially with the recovery of the species.

An important population is one that is necessary for a species' long-term survival and recovery. This may include populations that are:

- key source populations either for breeding or dispersal,
- populations that are necessary for maintaining genetic diversity, and/or
- populations that are near the limit of the species range.

*Introducing an invasive species into the habitat may result in that species becoming established. An invasive species may harm a vulnerable species by direct competition, modification of habitat, or predation.

Listed migratory species

An action will require approval from the Environment Minister if the action has, will have, or is likely to have a significant impact on a listed migratory species. Note that some migratory species are also listed as threatened species. The criteria below are relevant to migratory species that are not threatened.

An action has, will have, or is likely to have a significant impact on a migratory species if it does, will, or is likely to:

- substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat of the migratory species, or
- result in invasive species that is harmful to the migratory species becoming established* in an area of important habitat of the migratory species, or
- seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of thespecies.

An area of important habitat is:

4. habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species, or
5. habitat utilised by a migratory species which is at the limit of the species range, or
6. habitat within an area where the species is declining.

Listed migratory species cover a broad range of species with different life cycles and population sizes. Therefore, what is an ecologically significant proportion of the population varies with the species (each circumstance will need to be evaluated).

*Introducing an invasive species into the habitat may result in that species becoming established. An invasive species may harm a migratory species by direct competition, modification of habitat, or predation.

The Commonwealth marine environment

An action will require approval from the Environment Minister if:

» the action is taken in a Commonwealth marine area and the action has, will have, or is likely to have a significant effect on the environment, or

» the action is taken outside a Commonwealth marine area and the action has, will have, or is likely to have a significant effect on the environment in a Commonwealth marine area.

An action has, will have or is likely to have a significant impact on the environment in a Commonwealth marine area if it does, will, or is likely to:

» result in a known or potential pest species becoming established in the Commonwealth marine area*, or

» modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity in a Commonwealth marine area results, or

» have a substantial adverse effect on a population of a marine species or cetacean including its life cycle (eg breeding, feeding, migration behaviour, and life expectancy) and spatial distribution, or

» result in a substantial change in air quality** or water quality (including temperature) which may adversely impact on biodiversity, ecological integrity, social amenity or human health, or

» result in persistent organic chemicals, heavy metals, or other potentially harmful chemicals accumulating in the marine environment such that biodiversity, ecological integrity, social amenity or human health may be adversely affected.

*Translocating or introducing a pest species may result in that species becoming established.

**The Commonwealth marine area includes any airspace over Commonwealth waters.

Table 11 *Western Australian Wildlife Conservation Act 1950* Conservation Codes

Conservation Code	Description
Schedule 1	"…fauna that is rare or likely to become extinct, are declared to be fauna that is in need of special protection."
Schedule 2	"…fauna that is presumed to be extinct, are declared to be fauna that is in need of special protection."
Schedule 3	"…birds that are subject to an agreement between the governments of Australia and Japan relating to the protection of migratory birds and birds in danger of extinction, are declared to be fauna that is in need of special protection."
Schedule 4	"…fauna that is in need of special protection, otherwise than for the reasons mentioned [in Schedule 1 – 3]"

Table 12 DEC Priority Fauna Codes.

(Species not listed under the *Wildlife Conservation Act 1950*, but for which there is some concern).

Conservation Code	Description
Priority 1	Taxa with few, poorly known populations on threatened lands.
Priority 2	Taxa with few, poorly known populations on conservation lands. Taxa which are known from few specimens or sight records from one or a few localities on lands not under immediate threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown Land, water reserves, etc.
Priority 3	Taxa which are known from few specimens or sight records, some of which are on lands not under immediate threat of habitat destruction or degradation.
Priority 4	Rare taxa. Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5 – 10 years.
Priority 5	Taxa in need of monitoring. Taxa which are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.

Family	Genus	Species	Common Name	Status
Mammals				
Bovidae	*Bos*	*taurus*	Longhorn	+
Canidae	*Canus*	*familiaris dingo*	Dingo	
?Dasyuridae/Muridae	*spp.*			
Felidae	*Felis*	*catus*	Feral Cat	*
Macropodidae	*Macropus*	sp.	Kangaroo	
Muridae	*Pseudomys*	*chapmani*	Pilbara Pebble-mound Mouse	Priority 4
Reptiles				
Agamidae	*Ctenophorus*	*caudicinctus caudicinctus*	Ring-tailed Dragon	
Agamidae	*Ctenophorus*	*isolepis*	Central Military Dragon	
Agamidae	*Ctenophorus*	sp.	Dragon	
Varanidae	*Varanus*	sp.	Goanna	

Where + = domestic livestock, * = feral / introduced fauna

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