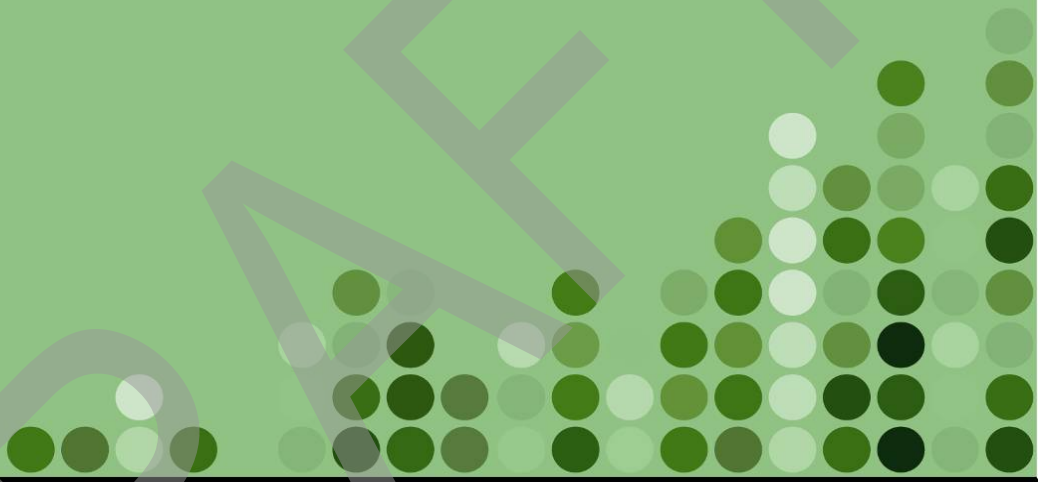
Department of **Natural Resources and Mi**



Offset Area Management Plan Template

December 2012

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Introduction

The purpose of this management plan is to identify the management objectives and outcomes, and the actions necessary to fulfil a statutory requirement for the provision of an offset under an approval (EPBC 2013/6868) granted under the *Environment Protection and Biodiversity Conservation Act 1999* (Clth)(EPBC Act) to BM Coal Alliance Operations Pty Ltd (BMA). This Plan has been developed to meet the EPBC Act requirements and also the requirements for a Voluntary Declaration under the *Vegetation Management Act 1999* (Qld).

This Plan forms part of a broader set of offset requirements and plans associated with the relocation of part of Dysart Road between Dysart and Moranbah, Qld.

The plan is composed of four components:

Part 1 – Summary Information

This section must be completed by all offset proposals and lists all of the following information:

1. Departmental reference details
2. Legislative triggers and impacts requiring an offset
3. Offset area details
4. Ecological Assessment
5. Description of the values impacted on the clearing area and the values located on the offset area

Part 2 – Management Plan

This section contains the management plan details that must be completed based on the offsets triggered and requires at minimum the following information:

1. The offset area management objectives and outcomes
2. Any restrictions imposed on the use of the offset area
3. The activities that will be undertaken to achieve the objectives and outcomes
4. Monitoring requirements
5. An analysis of the risks to achieve the management objectives and outcomes
6. A map that shows spatially the areas subject to the management plan
7. A reporting program
8. Consent between the landowner and the delegate

Part 3 - Attachments

1. Baseline data
    (a) Ecological assessment of offset area
    (b) Weed and pest species
    (c) Flora and fauna present on the offset area or adjacent to offset area
    (d) Monitoring data:
        - GPS points
        - Photo monitoring
2. Weed Fact Sheets
3. Land Managers Monitoring Guide

Part 4 - Appendices

Appendices are:

1. Mapping
2. Pest Animals Control Measures

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1. Summary Information

1.1. Departmental Reference Details

Details for application that triggers offset	
Departmental Reference Number and Case Name:	EPBC 2013/6868
Offset reference number (if applicable):	N/A
Tenure: Mining Lease	Primary Local Government Area: Isaac Regional Council

Offset Triggers and Values	
Offset Trigger	**Values requiring to be offset**
☐ Regional Vegetation Management Code ☐ Part P ☐ Part S ☐ Part Xa ☐ Part Xb ☐ Material Change of Use / Reconfiguration of a lot Policies (Table F1) ☒ EPBC Act	☐ Assessable vegetation adjacent to a wetland, significant wetland ☐ Assessable vegetation adjacent to a watercourse ☐ Connectivity ☐ Endangered regional ecosystem ☐ Of concern regional ecosystem ☐ Threshold regional ecosystem ☐ Critically limited regional ecosystem ☐ Essential habitat ☐ Essential habitat for koalas in SEQ ☐ Values within a highly vegetated bioregion ☒ Threatened Ecological Community

1.2. Offset Area Details

Landholder Details	
Register Owner/s on Title: [redacted]	
Lessee:	Trustee:
Business/Company name: [redacted]	
ABN/ACN: [redacted]	
Phone number: [redacted]	Mobile phone: [redacted]
Facsimile number:	Contact person (if required): [redacted]
Email: [redacted]	
Postal Address: [redacted]	

Property Details	
Property name: "Inderi"	
Real property description (lot on Plan/s): Lot 55 DSN318	
Tenure: Freehold	Primary Local Government Area: Central Highlands Regional Council
Planning Scheme Zone: Rural	Property area (ha): 3033.524 Offset area – the area required to satisfy the EPBC Approval Conditions is: 67.7ha. Added to this is a connectivity area of 69.5ha. Declared area – the total offset area plus any additional area that is mapped (see ***Section 2***): 137.2 hectares

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Landzone / geology	Land zone 8 – extensive rocky basalt rises and slopes.
Soils	Basalt soils
Pre-clear regional ecosystem (V.)	
Existing vegetation within Declared Area	Regional ecosystems 11.4.2, 11.8.5, 11.8.11a and 11.8.11
Estimated age of vegetation	In excess of 50 years
Is there a PMAV currently over all or part of the property, Please detail	No

Legally Binding Mechanism	
☒ Voluntary Declaration (*Vegetation Management Act 1999*)	☐ Covenant (*Land Act 1994/ Land Title Act 1994*)
Reference Number:	Reference Number:
☐ Nature Refuge (*Nature Conservation Act 1992*)	☐ Other
Reference Number:	Reference Number:

1.3. Description of clearing and offset values

The following table (***Table 1***) identifies the values that the offset provides on the offset area.

Table 1: Offset Area values

	Inderi Property	
	Survey Location G7	**Survey Location G8**
Patch Size (ha)		67.7
No. Indicator Species	3	6
Aristida latifolia		
Aristida leptopoda		1
Astrebla elymoides		
Astrebla lappacea		
Astrebla squarrosa		
Bothriochloa erianthoides		1
Dichanthium queenslandicum		
Dichanthium sericeum	1	1
Eriochloa crebra		1
Panicum decompositum	1	1
Panicum queenslandicum	1	1
Paspalidium globoideum		
Thellungia advena		
Tussock Cover	>200	>200
Woody Shrub Cover (%)	0	0
Canopy Cover (%)	5	0
Eucalyptus orgadophila	1	
Introduced Perennial non-woody Cover (%)	0	0
Quadrat 1	0	0
Quadrat 2	0	0
Quadrat 3	0	0
Quadrat 4	0	0

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	Inderi Property	
	Survey Location G7	**Survey Location G8**
Quadrat 5	0	0
Threatened Ecological Community (TEC) Condition Class	**Good**	**Best**
Analogous RE	11.8.11	11.8.11
Natural Grassland Origin	Confirmed in 1960 aerials	Confirmed in 1960 aerials
Dominant Species	*Panicum decompositum* and *Panicum queenslandicum*	*Dichanthium sericeum*
Landform	Shallow / rocky insitu soils on basalt crest on Waterford system	Deep cracking vertisol on basalt slopes on Oxford system
Groundcover structure	77.4% and 0.2 - 1.5m height	70.8% and 0.1 - 0.5m height
Additional Quality Comments	Minor grazing disturbances	Moderate grazing disturbances and gully erosion
	Comparable groundcover structure to DEHP RE technical description (11.8.11)	Below parameters for groundcover structure listed in the DEHP RE technical description (11.8.11)
Additional Values	Potential occurrence of *Dichanthium queenslandicum* and mosaic of RE11.8.5 and RE11.4.2 (Of Concern)	
Existing Threats	None	Grazing
Potential Threats	Increased grazing pressures	*Leucaena* cultivation and increased grazing pressures
Site Context	Offset area adjoins neighbouring woodland and grassland vegetation communities recognised as listed Threatened Ecological Community under EPBC and also as regionally significant under BPA. A large remnant area recognised as State Significant under BPA occurs east of the offset area. Direct linkage between the offset area is reduced to narrow vegetated linkages; however proximity to the area is high (200m). This remnant area forms part of a larger landscape network that connects to Albinia Downs National Park via Meteor Creek Bioregional Corridor.	
Management Requirements	Fencing, weed management and controlled grazing	
Total Offset Area (ha)	137.2	
Overall calculator rating (% of Impact Offset)	173% based on the EPBC Act Environmental Offsets Policy and associated Offset Assessment Guide (OAG)	

1.4. Ecological Equivalence Assessment

Ecological Equivalence Assessment	
Clearing area	**Offset area**
Date of Assessment: May 2013	Date of Assessment: 2 – 7 September 2013
Ecological Condition: good condition (as per listing advice [TSSC 2008a])	Ecological Condition: The Natural Grassland Threatened Ecological Community (TEC) areas range from good to best quality as per the listing advice; however generally the grassland areas are in very good condition with only minor to moderate grazing and erosion disturbances observed.

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Undertaken using Ecological Equivalence Methodology: Yes ☐ No ☒ Assessment was in accordance with EPBC Act requirements and guidelines.	Undertaken using Ecological Equivalence Methodology: Yes ☐ No ☒ Assessment was in accordance with EPBC Act requirements and guidelines.
Score sheets/assessment attached Yes: ☐ No ☒	Score sheets/assessment attached Yes: ☐ No ☒

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2. Management Plan

2.1 Management area objectives and outcomes

It is intended that the Offset area will remain under active management for at least the next 20 years (i.e. until 2034). It is anticipated that the management area objectives and outcomes identified below will be achieved by 2018. Monitoring and adaptive management will continue for 15 years beyond this date to ensure long-term protection and maintenance of the TEC. It is recognised that the timeframes are subject to natural conditions and unexpected events, and the risks identified in section 4, Risk Analysis.

The management area objectives and outcomes for the offset area are:

Ecological Community: The offset area is managed, restored and protected to protect and maintain the EPBC Act listed TEC until it attains the Ecological condition status as defined below.

(a) **Ecological condition**: The offset area is managed to improve the ecological condition of the regional ecosystem through appropriate restoration and management actions. Ecological condition indicators, identified below, align with the key diagnostic characteristics of the listed TEC. The TEC must achieve scores consistent with the relevant regional ecosystem benchmark score (RE 11.8.11) for that value.

- Recruitment of woody perennial species, benchmark requirement score: 0
- Native plant species richness, benchmark requirement: > 50% for each life-form
- Native perennial grass cover and organic litter, benchmark requirement score: 5
- Tree canopy height, benchmark requirement score: 0
- Tree canopy cover, benchmark requirement score: 0
- Shrub canopy cover, benchmark requirement score: 0
- Non-native plant cover, benchmark requirement score: 10

(b) **Weed and pest animal impacts:**

- As is noted in the Threat Abatement Plans relevant to Ornamental Snakes (i.e. Feral Pigs, Feral Cats and Foxes), eradication (that is the permanent removal of every last pig, fox, and cat) with currently available technology is not possible except on islands and in some local areas. Consequently, management actions in the offset areas are aimed at sustainable control of the damage caused by these pest species. Accordingly, the offset areas will be managed to minimise the physical presence of pigs, cats and foxes (this will be monitored by way of any evidence of sightings, prey carcasses, scats, tracks or furrowing activity).

- Weeds will be managed to ensure delivery of the benchmark scores in (a) above.

1. Detailed Offset Area Mapping

Detailed offset area map/s identifying values, vegetation types (Regional Ecosystems)) and monitoring points are included at **Appendix 1**.

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2. Restrictions imposed on the use of the offset area

The restrictions below (***Table 2***) will be implemented within the offset area management plan.

Table 2: Declared Area/Offset Area restrictions

Restriction	Details
Vegetation clearing	1. Vegetation clearing on the offset area is restricted to: a) that necessary for the removal of non-native weeds or declared pests; b) establishing and maintaining fencing around the boundary of the declared area; c) establishing and maintaining fire breaks; and d) ensure public safety Where vegetation clearing is sought for any other purpose, the landowner or other person proposing to undertake the clearing must contact the relevant department administering the *Vegetation Management Act 1999* and BMA. 2. Native forest practice, cultivation, ploughing, contour banking, construction of irrigation, earthworks and stockpiling is not allowed within the offset area. Note: Any vegetation clearing must be undertaken in accordance with: • best practice management methods; and • any applicable legislative requirements. For example, the clearing of endangered, vulnerable or near-threatened plant species under *Nature Conservation Act 1992.*
Grazing	1. Grazing of domestic livestock will occur on the offset area under the following arrangements: a) for fuel reduction purposes only; and b) noting that there are no set stocking rates or times throughout the year where stock are to be permitted to graze. The Landowner, at their discretion, is to graze stock at rates and times necessary to reduce the fuel load in the Offset Area without lowering the total ground cover to below 50% at the end of the dry season. The ground cover is to be determined as per ***Attachment 3: Land Manager's Monitoring Guide***. c) the grazing regime must allow native grasses to flower and set seed at least every two years (6-8 week period during the wet/summer season).
Fencing	1. Stock proof fencing is to be established to assist in the management of grazing within the offset areas.
Fire	1. Fire is to be, where possible, excluded from the offset area by: a) maintaining firebreaks relative to the offset area; b) co-locating firebreaks with existing roads and fence lines on the property where possible; and c) not using fire as a tool for regrowth management in the offset area.
Pest Animal Management	Minimise the introduction of pest animals and control of existing populations of pest animals within the Offset Area in accordance with *the Land Protection (Pest and Stock Route Management) Act 2002*. This includes feral cats and foxes if present, but is primarily focussed on feral pigs that are identified as posing a specific treat to grassland ecosystems.
Weeds *Note: existing weed control efforts on this property are very effective (i.e. the current levels of weed infestation are low). Any weed control required will be undertaken as early as practicable within the natural regeneration process throughout the Offset Area and then periodically as required.*	1. Keep the introduction, establishment and spread of non-native weeds including Declared Pest Plants listed under the L*and Protection (Pest and Stock Route Management) Act 2002* to no more than 5% weed cover over the Offset Area. 2. Control any existing infestations of non-native weeds including Declared Pest Plants under the *Land Protection (Pest and Stock Route Management) Act 2002* to ensure that the non-native weeds do not cover more than 5% of the Offset Area. 3. Potential weeds of specific concern include: Parthenium (*Parthenium hysterophorus*), Parkinsonia (*Parkinsonia aculeata*), Prickly Acacia (*Acacia nilotica subsp. indica*) Leucaena (*Leucaena leucocephala*) and Buffel Grass (*Cenchrus ciliaris*). 4. Minimise the spread of any non-native pasture species within the Offset Area in accordance with ***Table 4: Management Actions***.

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3. Analysis of Risks to Achieving Management Objectives and Outcomes

The following risk assessment (***Table 3***) has considered:

- any real or potential risks associated with achieving the management objectives and outcomes;
- the actions taken to minimise those risks and;
- any remedial action that will be undertaken if any of the risks occur

Table 3: Risk Analysis

Number	Risk	Level of Risk (Extreme, High, Moderate or Low)	Proposed Actions to Minimise Risk	Proposed Remedial Actions if Risk Occurs
1	Grazing	Low	Fence the Declared Area and graze the Declared Area in accordance with this management plan.	Reduce grazing.
2	Erosion	Low	Fence the Declared Area and graze the Declared Area in accordance with this management plan.	Reduce grazing. Rehabilitation and revegetation if necessary.
3	*Leucaena* incursion	Low	Ensure the exotic fodder plant *Leucaena* does not invade the Offset Area.	Treat the exotic fodder with a herbicide.
4	Pest Animals and Weeds	Moderate	Limit the introduction and presence of weeds and pest animals.	Instigate and increase control measures.
5	Drought	Moderate	Maintain biocondition of the offset area. Monitor climatic conditions and manage grazing levels accordingly.	Reduce gazing. Allow offset area to recover post drought, particularly through the control of weeds. Maintain a minimum of 50% groundcover at the end of the Dry season
6	Fire	Moderate	Maintaining firebreaks. Manage fuel loads through controlled grazing.	Allow offset area to recover post fire, particularly through the control of weeds. Rehabilitation and revegetation if necessary.

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4. Management Actions

The following table (***Table 4***) identifies the actions which will be undertaken for the offset area, by whom, when and more specific information relating to the action. The effectiveness of these actions and the frequency of application will be informed by the monitoring undertaken (see Section 6 below).

Table 4: Schedule of Management Actions

Management action	How the action will be carried out	Where the action will be carried out	When the action will be carried out	Who will be carrying out the action	Progress	Comments
Vegetation clearing*	Vegetation clearing on the offset area is restricted to: a) that necessary for the removal of non-native weeds or declared pests; b) establishing and maintaining fencing around the boundary of the declared area; c) establishing and maintaining fire breaks; and d) ensure public safety Where vegetation clearing is sought for any other purpose, the landowner or other person proposing to undertake the clearing must contact the relevant department administering the *Vegetation Management Act 1999* and BMA.	Where required	As required	Landowner or suitable qualified professional		
Fire*	Fire is to be, where possible, excluded from the offset area by: a) Maintaining firebreaks relative to the offset area; and b) Firebreaks are to be co-located with existing roads and fence lines on the property where possible. Fire is not to be used as a tool for regrowth management on the property.*	Throughout the Offset Area	As required	Landowner or suitable qualified professional appointed by the Landowner		
Grazing*	Stock will be grazed in the Offset Area for fuel reduction purposes only.* There is no set stocking rates or	Throughout the Offset Area	As required	Landowner.		

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	times throughout the year where stock are to be permitted to graze. Install and maintain stock proof fencing around the boundary of the declared area. The Landowner, at their discretion, is to graze stock at rates and times necessary to reduce the fuel load in the Offset Area without lowering the total ground cover to below 50% at the end of the dry season.					
Pest Animal Management *	Minimise the introduction of pest animals and control of existing populations of pest animals within the Offset Area, particularly focussed on feral pigs.* Monitor for the presence of feral cats and foxes and, if reported, instigate a control program.*	Throughout the Offset Area.	As required.	Landowner or suitable qualified professional appointed by the Landowner.		
Weeds	Keep the introduction, establishment and spread of non-native weeds including Declared Pest Plants listed under the *Land Protection (Pest and Stock Route Management) Act 2002* to no more than 5% weed cover over the Offset Area.* Control existing infestations of non-native weeds including Declared Pest Plants under the *Land Protection (Pest and Stock Route Management) Act 2002* to ensure that the non-native weeds do not cover more than 5% of the Offset Area. Potential weeds of specific concern include: Parthenium (*Parthenium hysterophorus*), Parkinsonia (*Parkinsonia aculeata*), Prickly Acacia (*Acacia nilotica subsp. indica*) Leucaena (*Leucaena leucocephala*) and Buffel Grass (*Cenchrus ciliaris*).*	Throughout the Offset Area.	Any weed control required will be undertaken as early as practicable within the natural regeneration process throughout the Offset Area and then periodically as required to treat the weeds at the optimum time in their life cycles to control and minimise the spread of the existing weed species.	Landowner or suitable qualified professional appointed by the Landowner.		

Note: Actions marked with an asterix (*) directly relate to priority actions identified in relevant Threat Abatement Plans and/or Conservation Advice.

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5. Monitoring requirements

Monitoring of the offset area will occur in accordance with ***Table 5***.

There are three parts to the monitoring process of the Offset Area, namely:

- photo point monitoring at the commencement of the Plan and then every two years for the first five years (to be undertaken by BMA, its agents, contractors or assigns);
- BioCondition site assessments at the commencement and then every five years (to be undertaken by BMA, its agents, contractors or assigns); and
- Landowner records.

Table 5: Offset Area monitoring

Monitoring	Attributes monitored	Frequency	Method	Location/s
Baseline monitoring		At commencement of Plan (year 1) and then every two years up to year 5.	Photo monitoring	Biocondition sites listed at ***Table 6***
Ecological condition	Recruitment of woody perennial species	At commencement (year 1) and then every 5 years to year 20.	Biocondition	Biocondition sites listed at ***Table 6***
	Native plant species richness	At commencement (year 1) and then every 5 years to year 20.		Biocondition sites listed at ***Table 6***
	Native perennial grass cover (required for grasslands only)	At commencement (year 1) and then every 5 years to year 20.		Biocondition sites listed at ***Table 6***
	Weed cover	At commencement (year 1) and then every 5 years to year 20.		Biocondition sites listed at ***Table 6***
Grazing	1. Stocking rates 2. Any evidence of vegetation or landform damage/degradation or erosion caused by stock	Quarterly	Landowner records. Photos. NB. Any unmanaged stock incursions or fencing failures should be recorded.	Within Offset Area
Fire	Incidence and extent	As required		
Weeds	Occurrence	Quarterly		
Pest animals	Occurrence or other physical evidence	Quarterly		

All monitoring (including landowner observations) are to be recorded in documented or electronic form suitable for external audit.

Table 6: Biocondition Site

Transect	Easting	Northing
T1	651047.85077596	7308501.66797819
T2	651349.73456739	7309056.64447037
T3	650952.25326803	7308875.35847329
T4	650659.12867979	7309053.93260772
T5	651521.65523696	7308730.99612423

Site locations will be confirmed during January 2014 surveys.

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6. Reporting

BMA will prepare Offset area monitoring reports and submit the reports to the administering authority every 5 years for the life of this plan (i.e. till 2034).

Ongoing monitoring is required to ensure the Management Plan achieves the outcomes identified.

Monitoring activities must link back to the outcomes defined in ***Section 2***, and be a measurement of how the area is progressing in achieving these outcomes, and managing the potential threats and risks to achieving these outcomes.

The frequency of monitoring has been determined based on the established good condition of the area and the likely rate of change (improvement or decline). As an established good condition grassland community the expected rate of change is likely to be slow, with minimal opportunities for improvement and, with good management, a low risk of decline. Accordingly, monitoring frequency has been established on an initial 2-year photo point monitoring cycle followed by a 5-year BioCondition monitoring cycle.

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3. Consent

Administering authority

SIGNED by the <insert name, position> to indicate approval of the offset area management plan.

Name:…… Signature:……..

Witness name:…… Signature:……..

Date…….....

Landholder

The landowner agrees:

1. Any non-compliance with the requirements of this offset area management plan shall constitute a breach of the terms and conditions of the legally binding mechanism entered into.
2. To notify the State in writing of an Event, or the likelihood of the occurrence of an Event.
   Event means any agreement or understanding entered into or accepted by and or circumstance permitted or suffered by the landholder which effects a change of ownership, control or use of the offset area, the exercise of power of sale under any Mortgage, the granting of a Mortgage, the appointment of a receiver, the death of a landholder or any other circumstance which may allow or permit a person, other than the Landholder to own, control or use the offset area.
   In notifying the State of an Event, the landholder will notify the State of the nature of the change, or potential change of ownership, control or use result from the Event, and the name and address of any person who may own, control or use the offset area as a result of the Event.
3. That if, at the time of execution of this offset area management plan, there exists a Property Map of Assessable Vegetation (PMAV) over the offset area or a part of it, the landholder hereby agrees, where the management plan area is identified as Category X on the PMAV, to the replacement of the PMAV by the State to reflect the offset area as Category A.
4. To take all necessary steps as may be required to accomplish the obligations contained in this offset area management plan.

The landowner acknowledges:

5. That before the State will agree to the release this offset area management plan the State must be satisfied that the objectives and activities contained in the offset area management plan have been achieved.

The landowner notes:

6. All reports, notices or requests for amendment in relation to this offset area management plan must be in writing and delivered to the administering authority at the following address:
   <Insert departmental name>
   <Insert postal address and telephone number>

SIGNED by [redacted] being the current owner of the abovementioned property to indicate that the terms of this offset area management plan including responsibilities under the offset area management plan, have been read, understood and accepted.

Name:…… Signature:……..

Witness name:…… Signature:……..

Date…….....

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Attachment 1: Wildlife Online Extract

Queensland Government

Wildlife Online Extract

Search Criteria:	Species List for a Specified Point
	Species: All
	Type: Native
	Status: Rare and threatened species
	Records: Confirmed
	Date: All
	Latitude: 24.3258
	Longitude: 148.4481
	Distance: 5
	Email: natalie.zelow@earthtrade.com.au
	Date submitted: Friday 15 Nov 2013 12:26:40
	Date extracted: Friday 15 Nov 2013 12:30:03

There were no records retrieved for your selection

Disclaimer

As the DSITIA is still in a process of collating and vetting data, it is possible the information given is not complete. The information provided sho for the project for which it was requested and it should be appropriately acknowledged as being derived from Wildlife Online when it is used.

The State of Queensland does not invite reliance upon, nor accept responsibility for this information. Persons should satisfy themselves through means as to the accuracy and completeness of this information.

No statements, representations or warranties are made about the accuracy or completeness of this information. The State of Queensland discla responsibility for this information and all liability (including without limitation, liability in negligence) for all expenses, losses, damages and costs you may incur as a result of the information being inaccurate or incomplete in any way for any reason.

Attachment 2: Weed Fact Sheets

Parthenium hysterophorus

Fact sheet

DECLARED CLASS 2 PEST PLANT

Parthenium weed

Parthenium hysterophorus

Parthenium costs the beef industry a total of $16.5 million per year and cropping industries several million dollars per year.

Declaration details

In Queensland, Parthenium is a Class 2 declared plant.

Under the *Land Protection (Pest and Stock Route Management) Act 2002*, Class 2 declaration requires landholders to control pests on the land and waters under their control. A local government may serve a notice upon a landholder requiring control of declared pests.

WEED BUSTERS

Queensland Government

PP2 June 2011

Description and general information

Size

Parthenium weed is an annual herb with a deep tap root and an erect stem that becomes woody with age. As it matures, the plant develops many branches in its top half and may eventually reach a height of two metres.

Leaves

Its leaves are pale green, deeply lobed and covered with fine soft hairs.

Flowers

Small creamy white flowers occur on the tips of the numerous stems. Each flower contains four to five black seeds that are wedge-shaped, two millimetres long with two thin, white scales.

Lifecycle

Parthenium weed normally germinates in spring and early summer, produces flowers and seed throughout its life and dies around late autumn. However, with suitable conditions (rain, available moisture, mild temperatures), parthenium weed can grow and produce flowers at any time of the year. In summer, plants can flower and set seed within four weeks of germination, particularly if stressed.

Potential damage

Parthenium weed is a vigorous species that colonises weak pastures with sparse ground cover. It will readily colonise disturbed, bare areas along roadsides and heavily stocked areas around yards and watering points. Parthenium weed can also colonise brigalow, gidgee and softwood scrub soils. Its presence reduces the reliability of improved pasture establishment and reduces pasture production potential.

Parthenium weed is also a health problem as contact with the plant or the pollen can cause serious allergic reactions such as dermatitis and hay fever.

Habitat and distribution

Parthenium weed is capable of growing in most soil types but becomes most dominant in alkaline, clay loam soils.

The plant is well established in Central Queensland and present in isolated infestations west to Longreach and in northern and southern Queensland.

Infestations have also been found in northern and central parts of New South Wales and it is capable of growing in most states of Australia.

Control

Prevention and weed seed spread

As with most weeds, prevention is much cheaper and easier than cure. Pastures maintained in good condition, with high levels of grass crown cover, will limit parthenium weed colonisation. Drought, and the subsequent reduced pasture cover, creates the ideal window of opportunity for parthenium weed colonisation when good conditions return.

Parthenium seeds can spread via water, vehicles, machinery, stock, feral and native animals and in feed and seed. Drought conditions aid the spread of seed with increased movements of stock fodder and transports.

Vehicles and implements passing through parthenium weed infested areas should be washed down with water. Wash down facilities are located in Alpha, Biloela, Charters Towers, Emerald, Gracemere, Injune, Monto, Moura, Rolleston, Springsure and Taroom. Particular care should be taken with earthmoving machinery and harvesting equipment. The wash down procedure should be confined to one area, so that plants that establish from dislodged seed can be destroyed before they set seed.

Extreme caution should be taken when moving cattle from infested to clean areas. Avoid movement during wet periods as cattle readily transport seed in muddy soil. On arrival, cattle should be held in yards or small paddocks until seed has dropped from their coats and tails prior to their release into large paddocks. Infestations around yards can be easily spotted and controlled whereas infestations can develop unnoticed in large paddocks.

Particular care should be taken when purchasing seed, hay and other fodder materials. Always keep a close watch on areas where hay has been fed out for the emergence of parthenium or other weeds.

Property hygiene is important. Owners of clean properties should ensure that visitors from infested areas do not drive through their properties. If your property has parthenium weed on it, ensure that it is not spread beyond the boundary or further within the property.

Pasture management

Grazing management is the most useful method of controlling large-scale parthenium weed infestations. Maintain pastures in good condition with high levels of ground and grass crown cover. This may require rehabilitation of poor pastures, followed by a sound grazing maintenance program.

Sown pasture establishment—Poor establishment of sown pastures can allow parthenium weed colonisation. pasture agronomist Aerial seeding prior to scrub pulling is normally beneficial.

Overgrazing—High grazing pressure caused by drought or high stock numbers decreases the vigour and competitiveness of pastures and allows the entry and spread of parthenium weed. Maintenance of correct stock numbers is most important in controlling parthenium weed. pasture agronomist

Pastures spelling—In situations of serious infestation, pasture spelling is essential for rehabilitation. Total spelling is much more effective than simply reducing the

stocking rate. However, overgrazing of the remainder of the property must be avoided.

The most appropriate time for pasture spelling is the spring–summer growing period, with the first 6–8 weeks being particularly important. If the condition of perennial grasses (native or sown) is low, spelling for the entire growing season may be required or introduced grasses may need to be re-sown. Herbicide treatment can hasten the rehabilitation process by removing a generation of parthenium seedlings and allowing grass seedlings to establish without competition. In the presence of parthenium weed, grass establishment is poor.

Grazing during winter should not increase the parthenium weed risk. Most tropical grasses are dormant and can tolerate moderate grazing during this period. However, parthenium weed may germinate and grow at this time.

Fencing—One of the main problems in controlling parthenium weed is the large paddock size and the variability of country within paddocks. The resulting uneven grazing pressures encourage parthenium weed to colonise the heavily grazed country. Ideally, similar land types should be fenced as single units. Fencing can be used to great effect to break up large paddocks, allowing more flexible management such as pasture spelling or herbicide application, options not available previously.

Burning—Burning is not promoted as a control strategy for parthenium weed. However, research suggests that burning for pasture management (e.g. woody weed control) should not result in an increased infestation if the pasture is allowed to recover prior to the resumption of grazing. Stocking of recently burnt areas known or suspected to contain parthenium decreases pasture competition and favours parthenium, ultimately creating a more serious infestation.

Herbicide control

Non-crop areas—Parthenium weed should be sprayed early before it can set seed. A close watch should be kept on treated areas for at least two years.

Small and/or isolated infestations should be treated immediately. Herbicide control will involve a knockdown herbicide to kill plants that are present and a residual herbicide to control future germinations. Repeated spraying may be required even within the one growing season to prevent further seed production.

Extensive infestations will require herbicide treatment in conjunction with pasture management. Timing of spraying is critical so that parthenium weed is removed when plants are small and before seeding has occurred. Grasses should be actively growing and seeding so that they can recolonise the infested area.

Table 1 shows the herbicides registered for parthenium weed control and application rates. Before using any herbicide always read the label carefully. All herbicides must be applied strictly in accordance with the directions on the label.

Cropping areas—Controlling parthenium weed in cropland requires selective herbicide use and/or crop rotations. For further information on parthenium weed control in crops consult your local biosecurity officer.

Biological control

The combined effects of biological control agents reduced the density and vigour of parthenium weed and increased grass production.

There are currently a number of insect species and two rust pathogens that have been introduced to control parthenium weed—a selection of these are outlined below.

Epiblema strenuana is a moth introduced from Mexico established in all parthenium weed areas. The moth's larvae feed inside the stem, forming galls that stunt the plant's growth, reduce competitiveness and seed production.

Listronotus setosipennis is a stem-boring weevil from Argentina but is of limited success in reducing parthenium weed infestations.

Zygogramma bicolorata is a defoliating beetle from Mexico which is highly effective where present. It emerges in late spring and is active until autumn.

Smicronyx lutulentus (Mexico) lays eggs in the flower buds where the larvae feed on the seed heads.

Conotrachelus albocinereus (stem-galling weevil from Argentina) produces small galls and is still becoming established in Queensland.

Bucculatrix parthenica (leaf mining moth from Mexico) larvae feed on leaves, leaving clear windows in the leaf.

Carmentia ithacae is a stem boring moth from Mexico which is becoming established at favourable sites in the northern Central Highlands.

Puccinia abrupta is a winter rust from Mexico that infects and damages leaves and stems. It is currently established over a wide area from Clermont south. It requires a night temperature of less than 16 degrees and 5–6 hours of leaf wetness (dew). Sporadic outbreaks occur where weather conditions are suitable.

Puccinia melampodii is a summer rust from Mexico that weakens the plant by damaging the leaves over the summer growing season. It is currently established and spreading at a number of sites from north of Charters Towers to Injune in the south.

Manual control

Hand pulling of small areas is not recommended. There is a health hazard from allergic reactions and a danger that mature seeds will drop off and increase the area of infestation.

Further information

Further information is available from your local government office, or by contacting Biosecurity Queensland (call 13 25 23 or visit our website at www.biosecurity.qld.gov.au).

Table 1 Herbicides registered for parthenium weed.

Herbicide	Rate	Situation	Comments
2,4-D amine 500 g/L	0.4 L/100 L	Land—industrial, pastures; rights-of-way	Spot spray
atrazine 500 g/L	3.6–6 L/ha	Fields and fallow	Boom spray
max 3 kg/ha/yr	6 L/ha	Land—industrial, commercial, non-agricultural, roadside, right-of-way	Boom spray
atrazine 900 g/kg	2–3.3 kg/ha	Fields and fallow	Boom spray
max 3 kg/ha/yr	3.3 kg/ha	Land—non-agricultural, commercial, industrial	Boom spray
2,4-D + picloram (Tordon 75-D)	125 ml/100 L	Land—commercial, industrial, pastures, right-of-way	Spot spray
	3 L/ha	Land—commercial, industrial, pastures, right-of-way	Boom spray
2,4-D ester[1]	.025 L/10 L	Land—non-agricultural, pastures	Rosette stage
glyphosate (450 g/L)	0.8–1.2 L/ha	Fields and fallow	Spot spray
metsulfuron methyl	5–7 g/ha	Fields and fallow	Seedlings only
	5 g/100 L	Land—commercial, industrial, pastures, rights-of-way	Spot spray
hexazinone	3.5 L/ha or 7 L/10 L/20 m^2	Land—commercial, industrial, pastures, rights-of-way	Boom spray or spot spray
dicamba (200 g/L)	0.7–2.8 L/ha or 0.1–0.19 L/100L	Grass pastures	Boom spray or spot spray
(500 g/L)	0.28–1.1 L/ha or 0.40–0.76 L/100L	Grass pastures	Boom spray or spot spray
(700 g/kg)	200–800 g/ha or 30–60 g/100 L	Grass pastures	Boom spray or spot spray

[1]Use restricted in some areas of Central Queensland

Notes The registered rates are for non-crop uses. Consult label for in-crop recommendations.
For power hand spray or knapsack use, spray plants to the point of runoff.

Fact sheets are available from Department of Employment, Economic Development and Innovation (DEEDI) service centres and our Customer Service Centre (telephone 13 25 23). Check our website at www.biosecurity.qld.gov.au to ensure you have the latest version of this fact sheet. The control methods referred to in this fact sheet should be used in accordance with the restrictions (federal and state legislation, and local government laws) directly or indirectly related to each control method. These restrictions may prevent the use of one or more of the methods referred to, depending on individual circumstances. While every care is taken to ensure the accuracy of this information, DEEDI does not invite reliance upon it, nor accept responsibility for any loss or damage caused by actions based on it.

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CS0564

Seteria incrassate

pastures australia

A collaboration between AVM, GRDC, MLA, RIRDC and Dairy Australia

Purple pigeon grass

Scientific name(s)

Setaria incrassata

Strengths

- Large seed.
- Easy to harvest, handle and sow.
- Can be drilled into moist soil.
- Good emergence from depth, to 50mm.
- Relatively easy to establish on heavy, black cracking-clay soils.
- Vigorous seedlings.
- High growth rate.
- Tolerant of temporary waterlogging.
- Drought tolerant.

Limitations

- Freshly harvested seed is dormant for 7-18 months.
- Less palatable than some other improved grasses, such as green panic and Bambatsi.
- Needs moderate to high fertility soil.
- Intolerant of continuous heavy grazing.
- Contains relatively high concentration of oxalate, therefore not suited to horses continuously grazing pure stands.

Plant description

Plant: A tufted perennial grass.

Stems: Stems are 30-200 cm high with hairy nodes.

Leaves: Leaves are flat or rolled, 10-60 cm long, 3-15 mm wide, tapering to a long fine point. Ligule is a fringe of hairs.

Seedhead: Seedhead is a dense, continuous false spike, 3-30 cm long, 8 mm wide (excluding the bristles).

Seeds: 560,000-960,000 seeds/kg.

Pasture type and use

A medium-term pasture and long-term if sufficient nitrogen fertiliser is applied. It is suitable for short-term pastures.

Where it grows

Rainfall

It is grown in areas with 500 -1200 mm/yr.

Soils

It is adapted to heavy clays to fertile loams.

Temperature

It grows during the warm season and tops are killed by heavy frost.

Establishment

Companion species

Grasses: rhodes grass, Bambatsi.Legumes: lucerne, annual medics, butterfly pea, desmanthus, burgundy bean (all with low grass sowing rate).

Sowing/planting rates as single species

3-5 kg/ha.

Sowing/planting rates in mixtures

1-3 kg/ha.

Sowing time

It is sown from spring to late summer.

Inoculation

Not applicable

Fertiliser

Fertiliser is not required for establishment on fallowed fertile soil.

Management

Maintenance fertliser

A minimum of 50 kg N/ha/yr is needed to maintain stands.

Grazing/cutting

Periodic summer resting will help prolong life of stand. Pasture production in the first two years is superior to that of most other suitable grasses. Palatable hay can be produced.

Seed production

300 kg/ha from each of two harvests per year may be produced from well fertilised stands with good soil moisture. Good seed production after the first year is dependent on applying a minimum of 100 kg N/ha.

Ability to spread

It only spreads by seed in fertile bare soils.

Weed potential

It exhibits minimal weed potential.

Major pests

There are no known major pests.

Major diseases

There are no known major diseases.

Herbicide susceptibility

It is killed by glyphosate and atrazine.

Animal production

Feeding value

The growth of cattle grazing tropical pasture grasses, including purple pigeon grass, is limited by low dry matter digestibility, especially in winter. Supplementary nitrogen will increase feed intake in deficient situations.

Palatability

It is not as palatable as some suitable companion grasses.

Production potential

Live weight gain in pure stands is equal to or better than from other improved grasses.

Livestock disorders/toxicity

It can cause bighead in horses continuously grazing pure stands due to high oxalate concentration.

Cultivars

Cultivar	Seed source/Information
Inverell	Australian Herbage Plant Cultivars

℗ Denotes that this variety is protected by Plant Breeder's Rights Australia

Further information

Web links:Tropical Forages database (SoFT) - Purple pigeon grassGrassBaseTropical Grasslands SocietyPurple pigeon grass (QDPI&F)Purple pigeon grass - Agnote DPI-292 (NSWDPI)Purple pigeon grass - Agfact P2.5.21 (NSWDPI)

Acknowledgements

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Author and date

Dr. Walter Scattini

December 2008

Attachment 3: Land Managers Monitoring Guide

Refer to separately supplied document

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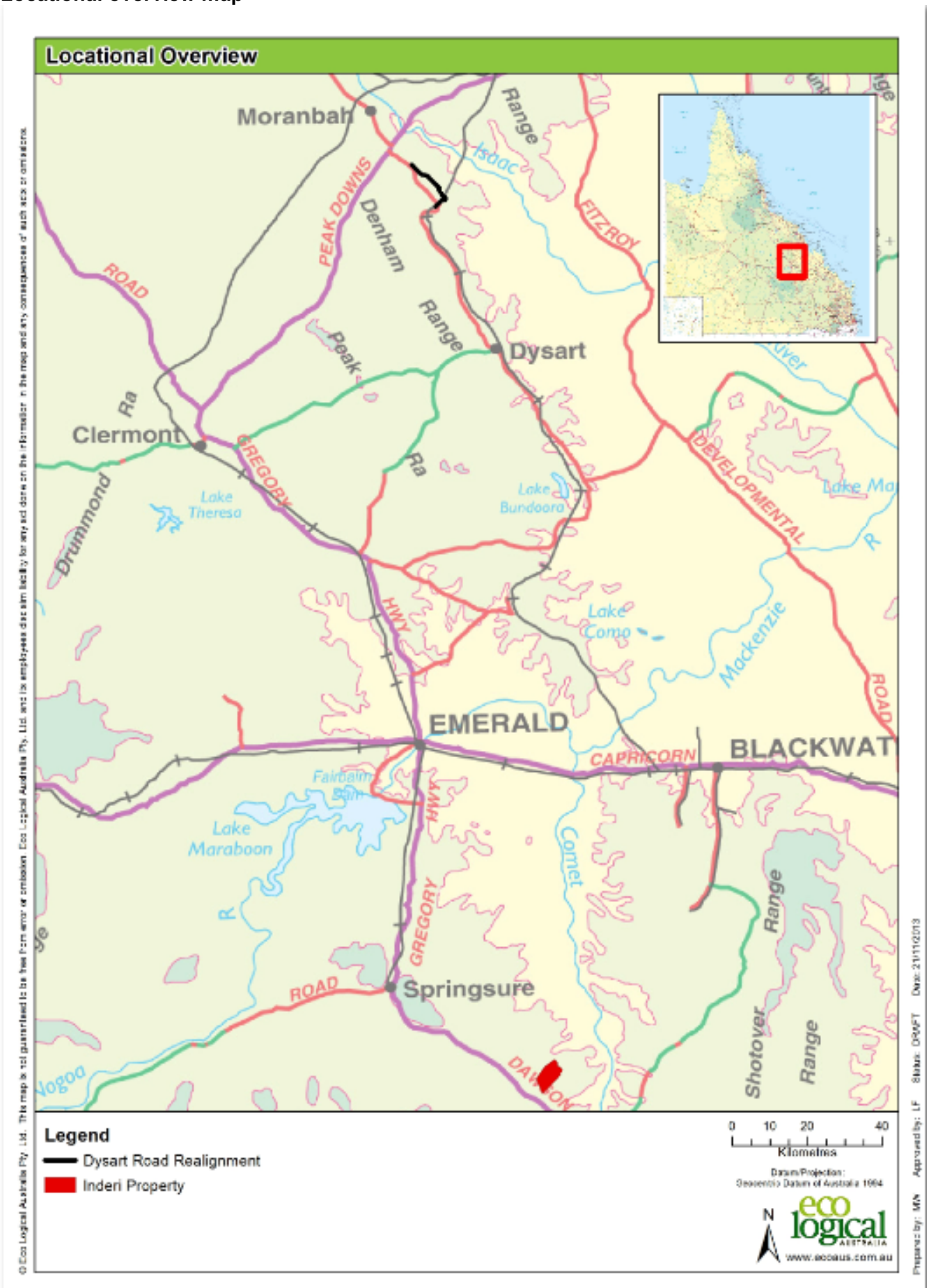
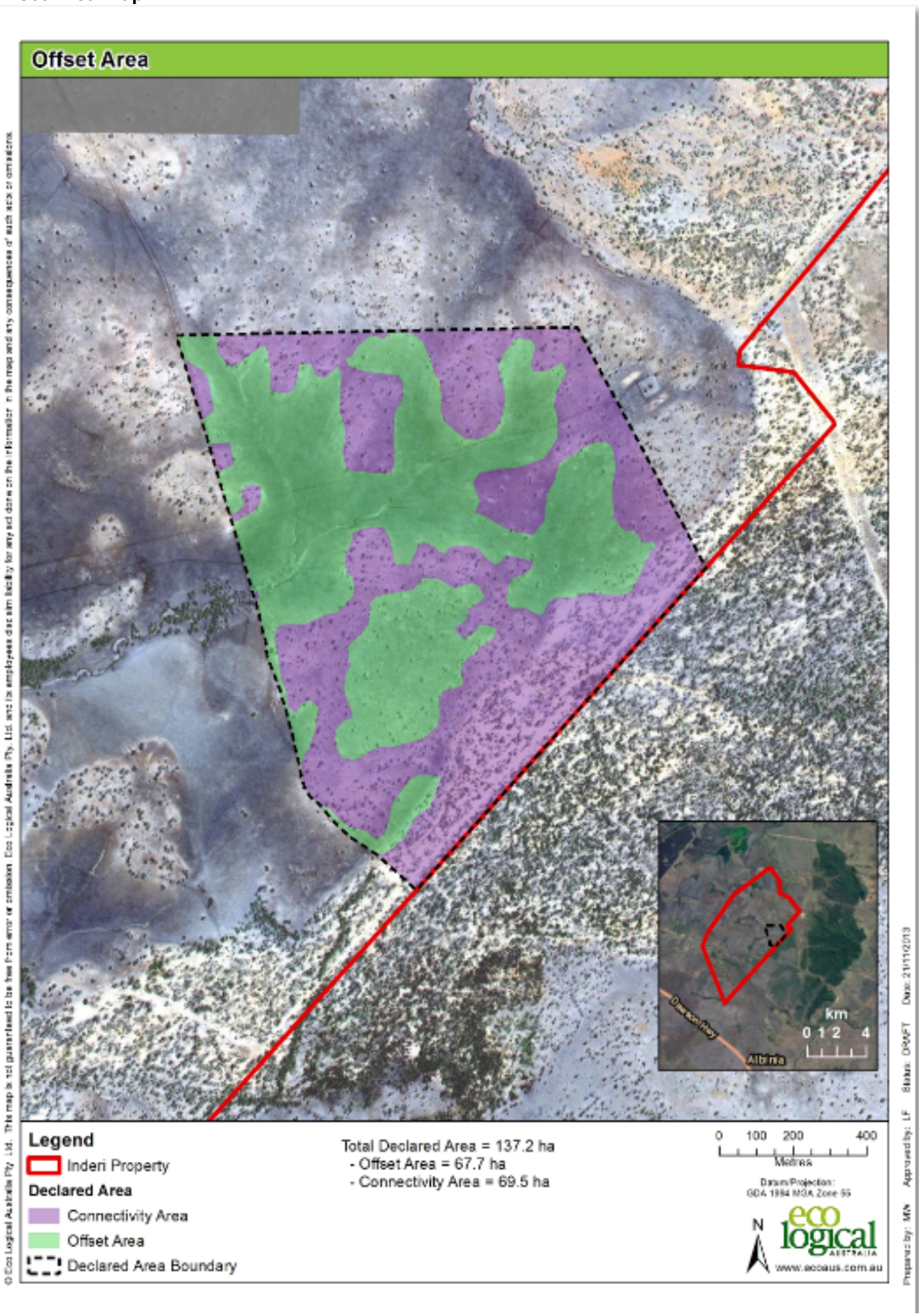
Appendix 1: Mapping

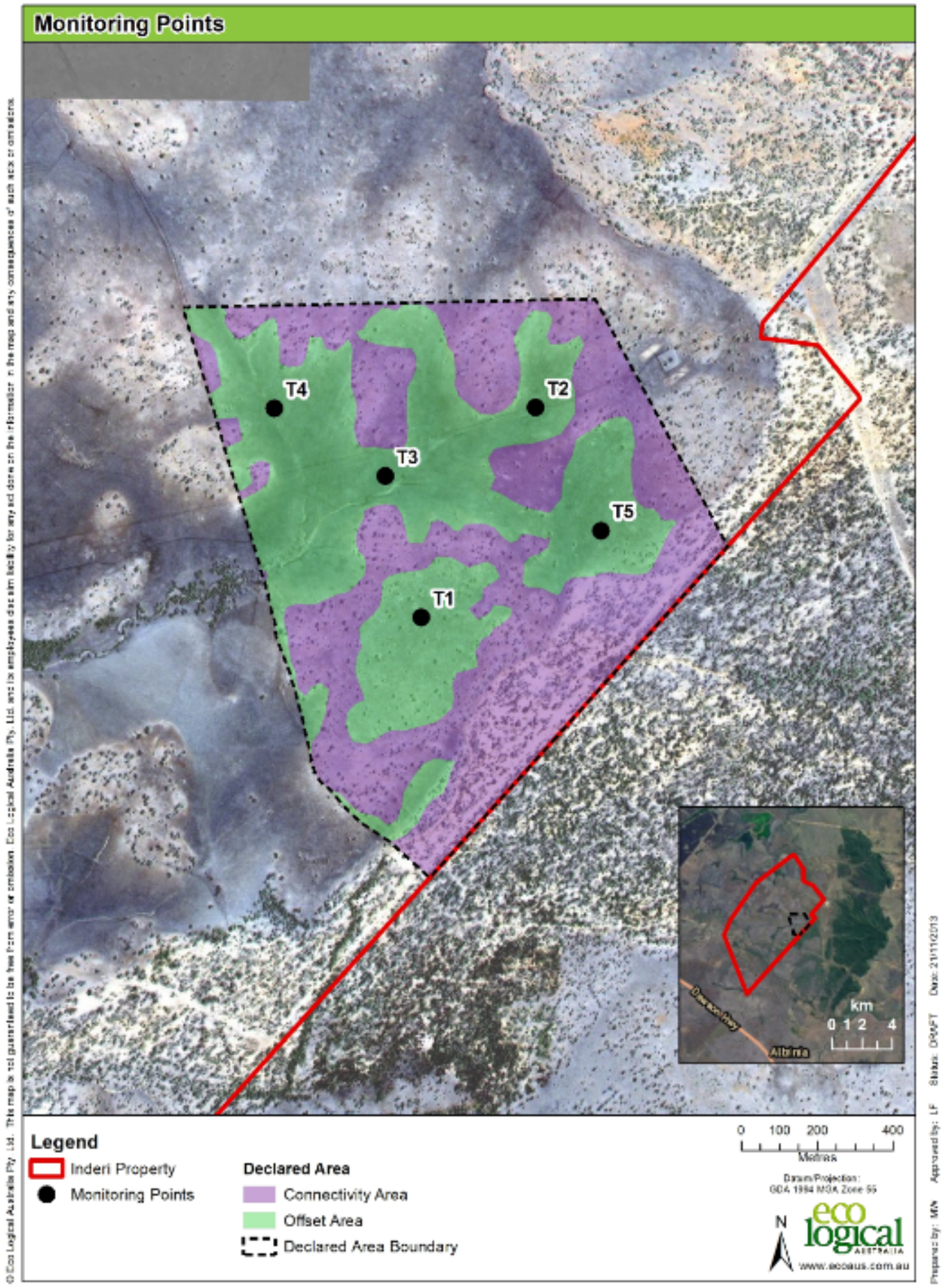
Locational overview map



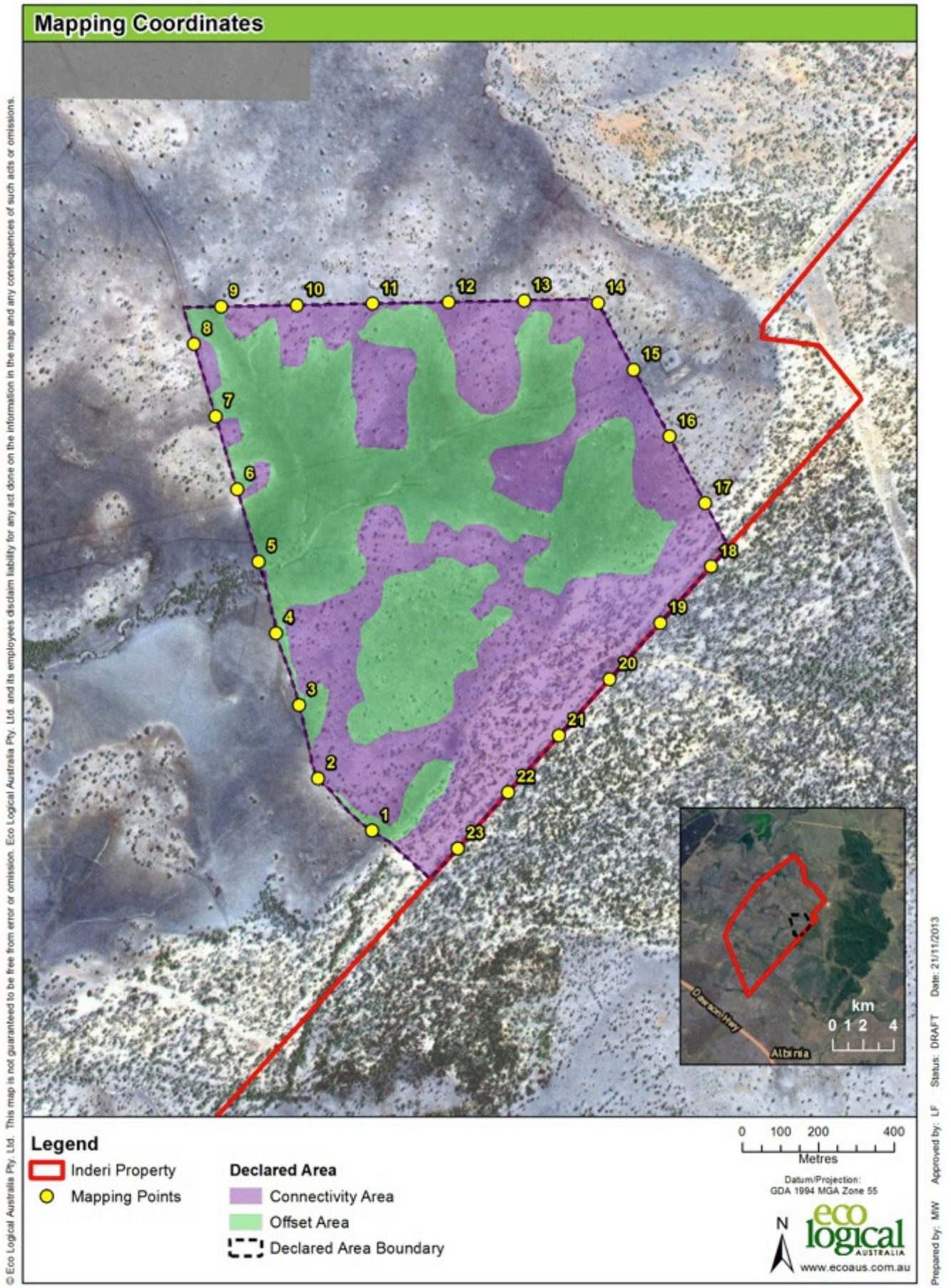
Offset Area map



Monitoring Points map



Mapping Coordinates



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6	650560.48473900000	7308841.96287000000
7	650503.49220900000	7309033.67059000000
8	650446.49968000000	7309225.37832000000
9	650517.91514400000	7309323.29892000000
10	650717.87445100000	7309327.33317000000
11	650917.83375900000	7309331.36743000000
12	651117.79306700000	7309335.40168000000
13	651317.75237500000	7309339.43594000000
14	651511.90917100000	7309333.55665000000
15	651606.30342800000	7309157.23387000000
16	651700.69768400000	7308980.91108000000
17	651795.09194100000	7308804.58830000000
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19	651676.68734100000	7308489.03496000000
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