

CARMICHAEL COAL MINE PROJECT
MORAY DOWNS WEST OFFSET AREA MANAGEMENT PLAN
Offset Delivery Stage 1
2021 ANNUAL REPORT



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Abbreviations and Acronyms

Abbreviations and Acronyms	
Bravus	Bravus Mining and Resources Pty Ltd
AU	Area Units
BTF	Black-throated Finch
BTFMP	Black-throated Finch Management Plan
CCMP	Carmichael Coal Mine Project
EA	Environmental Authority
EIS	Environmental Impact Statement
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Comm)
MDW	Moray Downs West Pastoral Lease
MDW OAMP	Moray Downs West Offset Area Management Plan (OD Stage 1) 23 August 2019
ML	Mining Lease
MNES	Matters of National Environmental Significance
MSES	Matters of State Environmental Significance
OAMP	Offset Area Management Plan
RE	Regional Ecosystem
SDPWO Act	<i>State Development and Public Works Organisation Act 1971</i> (Qld)
Woongal	Woongal Environmental Services Pty Ltd

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1 Introduction

1.1 Project background

The Bravus Mining and Resources (Bravus) Carmichael Coal Mine Project (CCMP) is located approximately 160 km northwest of Clermont in the Galilee Basin. The CCMP has approval to include both open cut and underground mining within the mining lease areas (MLs) 70441, 70505 and 70506 (refer Figure 1-1).

On the 7 May 2014, following a comprehensive environmental impact assessment process under the *State Development and Public Works Organisation Act 1971* (Qld) (SDPWO Act), the Queensland Coordinator-General issued an evaluation report that approved the project with conditions. The evaluation report was provided to the Commonwealth Minister for the Environment for consideration in relation to a decision under the *Environment Protection and Biodiversity Conservation Act 1999* (Comm) (EPBC Act). On the 14 October 2015, approval EPBC 2010/5736 was issued with conditions. On the 2 February 2016, the Queensland Government, under the *Environmental Protection Act 1994* (Qld) (EP Act) issued EA (EPML01470513) with conditions.

As part of the conditions set out in approvals EPBC 2010/5736 and EA (EPML01470513), Bravus must provide and manage offset areas for the long-term protection of species included as Matters of National Environmental Significance (MNES) and Matters of State Environmental Significance (MSES). On 5th October 2019, Bravus submitted a request for a voluntary declaration to request Moray Downs West Offset areas as an area of high nature conservation value. The QLD Department of Natural Resources and Mines Chief Executive declared the area as an area of high nature conservation value in accordance with s19F of the *Vegetation Management Act 1999* on 21st April 2020.

The Moray Downs West Offset Area (MDW OA) is located in the western portion of Moray Downs (Lot 662 SP316209). The offset area for the active part of the CCMP is 33,665.57 ha. The offset area is outside of the MLs and is being managed specifically to protect and conserve MNES and MSES species.

This annual report includes management activities undertaken for the CCMP within MDW OA. Figure 1-1 shows the location of the mining leases and offset areas.

The annual report for the Moray Downs West Offset Area Management Plan (OD Stage 1) (MDW OAMP), whilst a standalone report, has been written to be consistent with the requirements of the Black-throated Finch Management Plan (BTFMP) and the Ground Water Dependent Ecosystem Management Plan (GDEMP).

Specific details about the Black-throated Finch Research Program (Research Program), the Black-throated Finch Management Plan (BTFMP), and the Groundwater Dependent Ecosystems Management Plan (GDEMP), and how they relate to the OAMP are described below.

Black-throated Finch Research Program

The Research Program has been developed by Bravus to increase knowledge of the species ecology within and adjacent to the Project site, inform and improve management of local populations, and to improve the understanding of the species ecology and biology across its range. The Research Program is relevant to the black-throated finch (southern) (*Poephila cincta cincta*) populations that occur within MDW and includes the following aims:

- estimating the home range and movements of black-throated finch in the mining lease, MDW offset areas and immediately adjacent properties (subject to landholder consent)
- determining the foraging and breeding habitat requirements and the relationship with vegetation structure and composition and water
- determining the dietary requirements for black-throated finch in the mining lease, MDW offset areas and immediately adjacent properties (subject to landholder consent)
- identifying management strategies for black-throated finch habitat regarding fire, grazing and water, in the mining lease, MDW offset areas and immediately adjacent properties (subject to landholder consent).

To improve habitat within MDW, and enhance management of the species, management within MDW will be informed by the outcomes of the Research Program. The results of the Research Program will be reviewed and adopted as part of the OAMP, as they become available. The Research Program will be implemented over five years.

Black-throated Finch Management Plan

The BTFMP is specific to the Project area and has been developed to protect black-throated finch and its habitat from avoidable Project related impacts.

Whilst the management actions in the BTFMP are designed to minimise the impact of the Project on black-throated finch, there are some instances where there is a need for coordination of management under the BTFMP and OAMP. For example, timing for the installation of additional watering points in MDW will be aligned with the timing of Project impacts and will be coordinated with the installation of any additional watering points within the Project area. The timing for the activities in MDW will be aligned with the timing for Project impacts to encourage the movement of populations from the impacted Project areas to the MDW offset areas.

In addition, the black-throated finch monitoring methods presented in this OAMP align with monitoring methods outlined in the BTFMP. Timing for implementation of monitoring activities will be coordinated between the OAMP and BTFMP.

Groundwater Dependent Ecosystems Management Plan

The GDEMP has been prepared to reduce the impacts of the Project on groundwater dependent ecosystems including *Livistona lanuginosa* (waxy cabbage palm) communities. The monitoring methods for waxy cabbage palm included as part of the OAMP align with methods outlined in the Groundwater Dependent Ecosystems Management Plan.

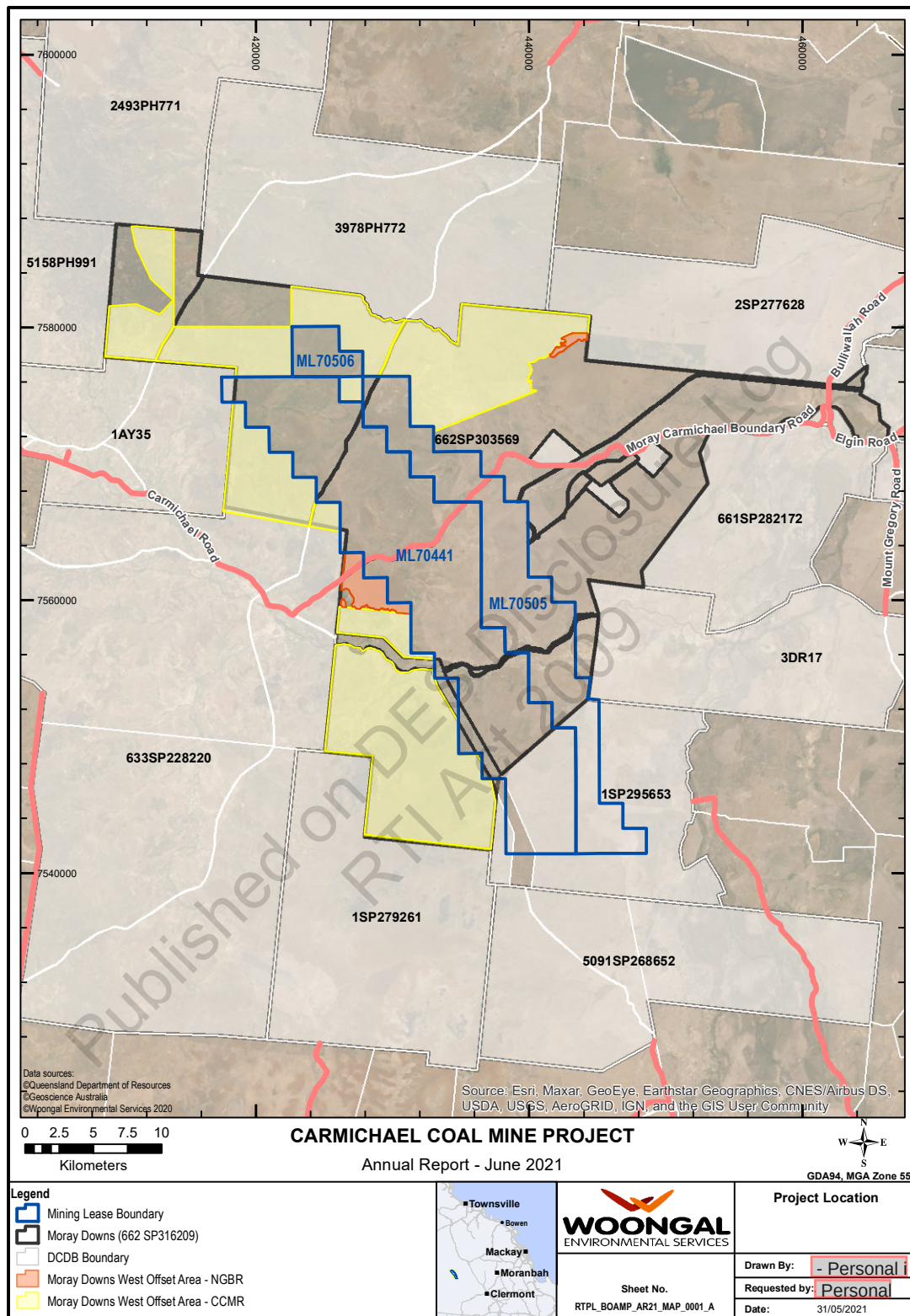


Figure 1-1: CCMP Mining Leases and Offset Areas

1.2 Woongal Environmental Services

Woongal Environmental Services Pty Ltd (Woongal) has been engaged by Bravus Mining and Resources Pty Ltd to undertake the implementation of the MDW OAMP.

Woongal provides environmental monitoring and land management services. Woongal provides these services by teaming expert environmental scientists with First Nations people in a way that recognises the value of First Nations people's knowledge and the science-based skills and knowledge of expert environmental scientists.

Woongal is a Supply Nations registered indigenous company, formed from the desires of the elders of the Wangan and Jagalingou mob to build better and lifelong opportunities for their people out of the development of mineral resources in central Queensland.

In the language of the Wangan and Jagalingou mob, Woongal means 'brigalow boomerang', a symbol of people returning to care for their traditional country. Caring for country is an important obligation for First Nations people across Australia, and participation in environmental monitoring and management is a way of honouring that obligation.

Through Woongal's involvement in delivering the MDW OAMP and the BTFMP, First Nations people are engaged in managing country and building careers as environmental managers and scientists.

1.3 Appropriately Qualified Persons

Responsibility and authorship of this annual report is taken by [s49 - Sch4 - Personal information] on behalf of Woongal Environmental Services Pty Ltd. [sch4 - Personal information] has over 20 years' experience in environmental monitoring and management. By reason of his formal qualifications, experience and standing he is an appropriately qualified person for this role.

Preparation of the annual report has been contributed to by [s49 - Sch4 - Personal information] Woongal Environmental Services Pty Ltd.

Implementation of the Biodiversity and Offset Area Management Project (BOAMP) is being directed by a team of suitably qualified and experienced sub-contractors to Woongal who are establishing the monitoring sites, training field staff, validating the data collected, reviewing the results and drawing conclusions from the results. The team of sub-consultants includes the following suitably qualified persons (Table 1-1):

Table 1-1: OAMP Management Team of Sub-consultants

Company	Person	Position	Qualifications	Role
BAAM Ecological Consultants	Sch4 - Personal information	Project Director	BSc Environmental Studies, Grad Cert Environmental Management. Certified Environmental Practitioner (Ecology Specialist)	Project Management and Review
		Principal Wildlife Specialist	Diploma of Management, Certified Environmental Practitioner (Ecology Specialist)	BTF population estimates, BTF - Biannual Surveys, Monitoring Offset Areas, Monitoring Waxy Cabbage Palm, Monitoring BTF, and Reporting
		Principal Ecologist	PhD Ornithology, BSC Hons Zoology and Botany, Certified Environmental Practitioner (Ecology Specialist)	BTF population estimates, BTF - Biannual Surveys, Monitoring Offset Areas, Monitoring Waxy Cabbage Palm, Monitoring BTF, and Reporting
Wild Environmental Consultants	Sch4 - Personal information	Project Director	B.Sc, Certified Environmental Practitioner (General Practice)	Biomass Surveys, and Reporting
		Senior Ecologist	B.Sc (Botany)	Biomass and Bio-Condition Surveys, and Reporting
		Ecologist	B.Sc (Hons) (Ecology)	Biomass and Bio-Condition Surveys
Vegetation Management Science	Sch4 - Personal information	Senior Ecologist	PhD (Vegetation Ecology), James Cook University	Fire Mosaic, Fire Plan, Fire Monitoring and Reporting
		Ecologist	BSc (Hons)	Fire Mosaic, Fire Plan, Fire Monitoring and Reporting
Sticks & Stones Environmental Consultants	Sch4 - Personal information	Principal Environmental Consultant	BSc, Masters in Natural Resource Management, Certified Environmental Practitioner (General Practice).	Weed and Pest Surveys, Management Plans, Monitoring and Reporting

Day to day operations to implement the MDW OAMP are directed by the Woongal BOAMP Project Manager through the Woongal ecologists and the Supervising Rangers with a team of First Nations Rangers. The supervisory staff bring a range of training, skills, and professional qualifications appropriate to the implementation of the MDW OAMP. The sub-consultants provide expertise and further training for the BOAMP project team.

1.4 Scope and Objectives

Bravus has a compliance requirement to provide an annual report on the CCMP OAMP by the 1st of July each year.

This report covers activities undertaken between the 1 June 2020 and – 31 May 2021 with respect to the CCMP OAMP and includes an evaluation of the effectiveness of mitigation measures based on the results of monitoring activities, variations in or changes to activities set out in the management plan, changes to risks or vulnerabilities to either the species or the management plan and recommendations for revision.

The annual reporting period 1 June 2020– 31 May 2021 constitutes ‘year 2’ of implementation of the CCMP OAMP. This annual report is to be provided to the relevant administering authority by 30 June 2021.

2 General description of climatic conditions for the year of management

The rainfall for the 2021 reporting period was not consistent with the long-term average for the area, meanwhile temperature remained fairly consistent with the long-term records.

Total mean annual rainfall within the vicinity of MDW was 531mm recorded at Ulcanbah, Queensland recording station (station #36050). The MDW wet season was pronounced during the 2021 reporting period with the majority of rainfall falling between December (252mm) and January (106mm), with some follow up rain in March and April.

Mean maximum and minimum monthly temperatures for the reporting period were consistent with the historical mean.

Figure 2-1 presents the summary of climate data for the year:

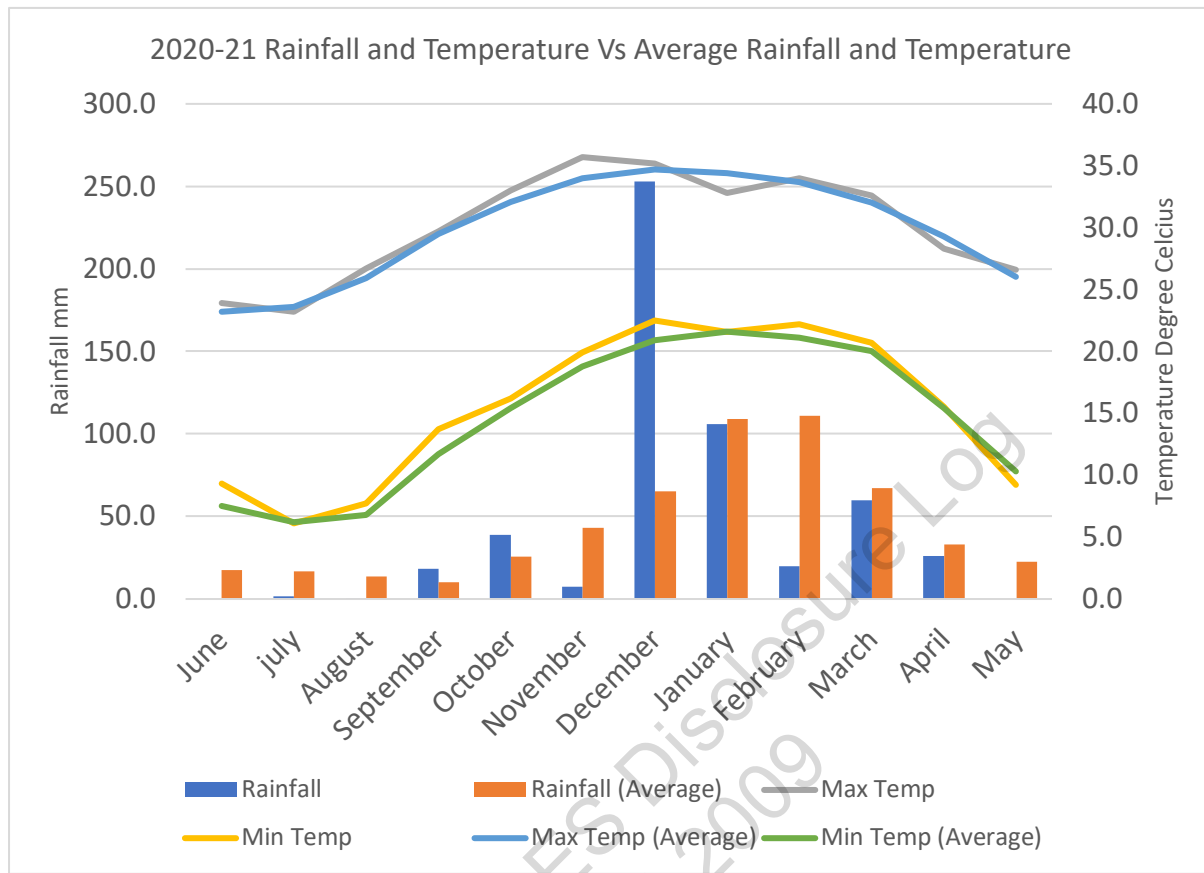


Figure 2-1: Monthly Rainfall (station #36050) and Temperature Data (station #35124) for the CCMP area vs the average for the same location

3 Monitoring results for the previous year

The MDW OAMP was approved on the 23 August 2019, with activities commencing late 2019. The first of the annual report required under the OAMP was prepared in 2020 and was referred to as Year 1. This report outlines activities undertaken in Year 2.

Year 1 activities focused on the identification, and installation of long-term monitoring points for several monitoring activities including: vegetation assessments utilising BioCondition and Biomass surveys and Waxy Cabbage Palm monitoring.

Table 3-1 lists the monitoring surveys that were undertaken in Year 1.

Table 3-1 Year 1 Monitoring Activities

Survey	Timing of Survey	Requirement under the OAMP
Waxy Cabbage Palm Population Survey and Pre-impact Monitoring	5-14 September 2019	Assessment in Year 1, with follow up surveys every 5 years.
Initial Weed survey to develop priority areas for control and help to tailor monitoring programmes for each conservation value.	May 2020	Year 1 weed survey to map the distribution and abundance of weed infestations.

4 Summary of Reporting Year Program

4.1 Adaptive Management Approach to Environmental Management

Adaptive Management is an important process in the implementation of management programs within the natural resource sector. By creating a framework for managing complex socio-economical systems and through planning and careful consideration of consequences it allows the management to adapt as a greater field-scale understanding of the area, the project and the requirements are understood.

The adaptive management process for this OAMP includes the following key components:

Identified threats to offset values – known and potential threats to the offset values have been identified as part of the risk assessment process.

Relevant offset values – MNES and MSES for which the identified threat is relevant have been indicated.

Management objectives – management objectives have been developed to address each identified threat to the offset values, and to ensure that the interim performance targets and completion criteria are attained.

Performance criteria – assessable performance criteria have been defined to measure adherence to the management objectives.

Management action – specific management actions have been identified to ensure that the performance criteria and management objectives are satisfied, and which will ultimately result in attainment of the interim performance targets and completion criteria.

Monitoring - a combination of qualitative and quantitative methodologies have been included in the OAMP to assess whether or not management actions are meeting the performance criteria and management objectives, and ultimately, whether or not the OAMP is able to attain the interim performance targets and completion criteria.

Adaptive management trigger – measurable events or parameters have been identified which, when triggered, indicate that a performance criteria has not been met, instigating the implementation of contingency plans and corrective actions.

Contingency response and corrective action – a two-step process has been established to identify the likely cause of the non-compliance with the performance criteria and allow for identification of suitable corrective actions.

Figure 4-1 illustrates how the key components of the adaptive management process are implemented through an ongoing cycle of implementation, learning and review, with the ultimate aim to achieve the interim performance targets and completion criteria.

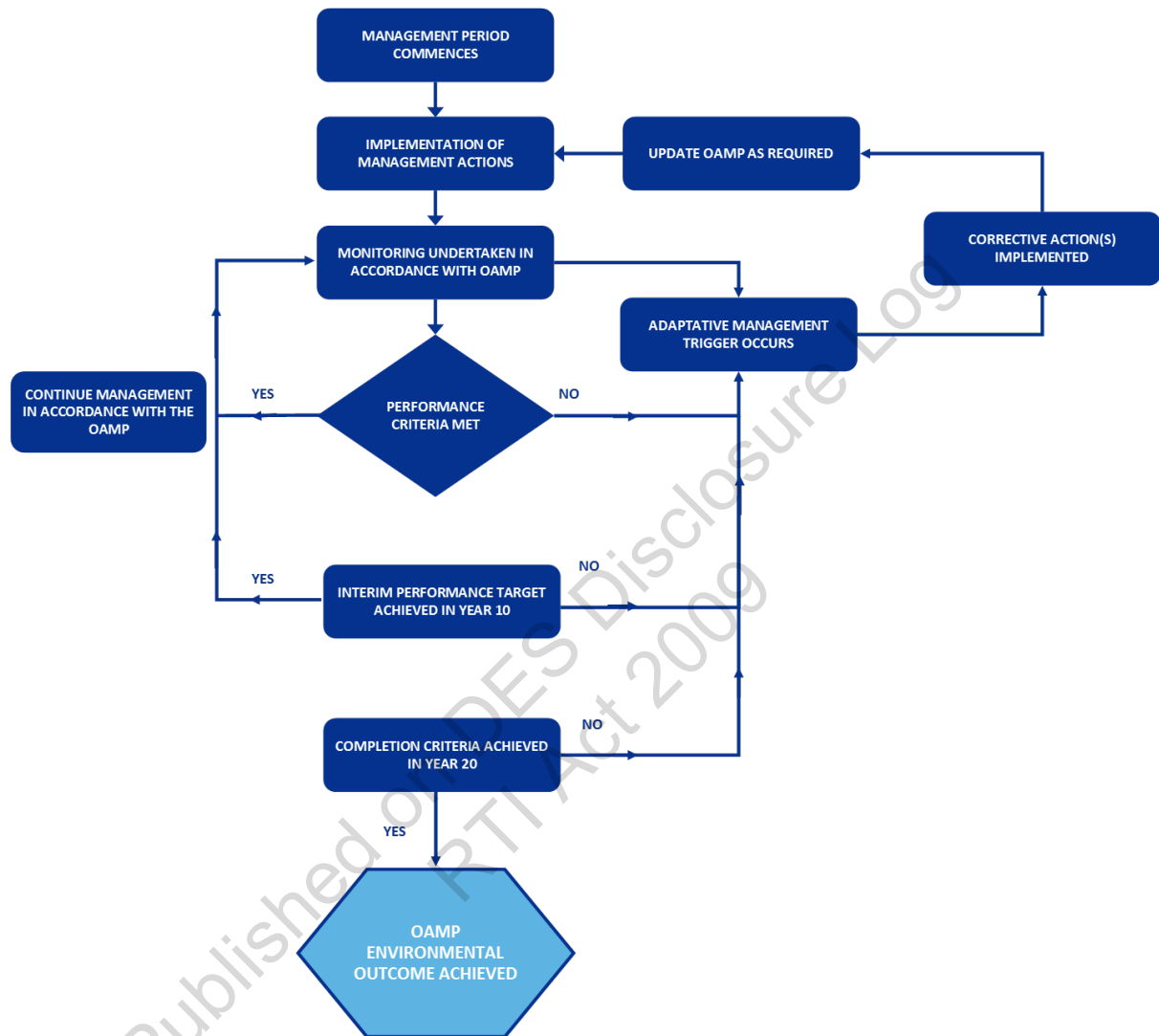


Figure 4-1. Illustration of the Adaptive Management Process

During the reporting period there were several adaptive management processes that resulted in variations from the methodologies laid out in the OAMP. All variations are detailed in Section 4.4 Monitoring and Surveys.

The OAMP will be reviewed and amended every three years to incorporate changes identified through management activities, regular site visits and monitoring activities. The amended OAMP will be submitted to the relevant administering authority by 30 July every three years.

4.2 Methods and Activities of Habitat Management and Monitoring

Timing of contract approvals and COVID-19 lockdown requirements, prior to, and during the key monitoring periods (March/April) specified in the MDW OAMP, saw the focus of activities shift from monitoring of all areas to establishing the required permanent monitoring plots and transects. Work commenced on the establishment of fire management regimes, control of weeds and feral animals and management of erosion and sedimentation, as a basis for maintaining or enhancing habitat values within MDW.

BTF monitoring surveys were conducted in May/June 2020 (late wet season), October / November 2020 (Dry) and March / April 2021 (wet season).

Biomass monitoring and habitat assessment occurred in May 2020, and April/May 2021.

Other methodologies such as incidental observation and water watch surveys were conducted throughout the reporting year. Preliminary Pest Plant and Pest Animal Monitoring occurred between August and December 2020; while the Targeted Weed Surveys and Pest Animal Surveys occurred between September 2020 and June 2021. The pastoral infrastructure inspections occurred between September and December 2020.

4.3 Management Regimes for Habitat Enhancement

4.3.1 Grazing Management

In accordance with the OAMP, livestock will be excluded from MDW with the exception of strategic grazing which will only be used as a management tool to:

- decrease the abundance and presence of weeds, including *Cenchrus ciliaris* (Buffel grass) and other exotic pasture grasses, and
- maintain or decrease fuel loads so as to reduce the risk of an uncontrolled fire within MDW

Best practice strategic grazing management principles are outlined in Section 6.7.2 of the OAMP. Table 4-1 lists the grazing management principles stipulated in the OAMP and how these have been addressed during the reporting year.

During the reporting year approximately 5.2km of fencing was installed in northeast MDW (Figure 4-2). The purpose of the fencing is to control the movement of cattle into the OA.

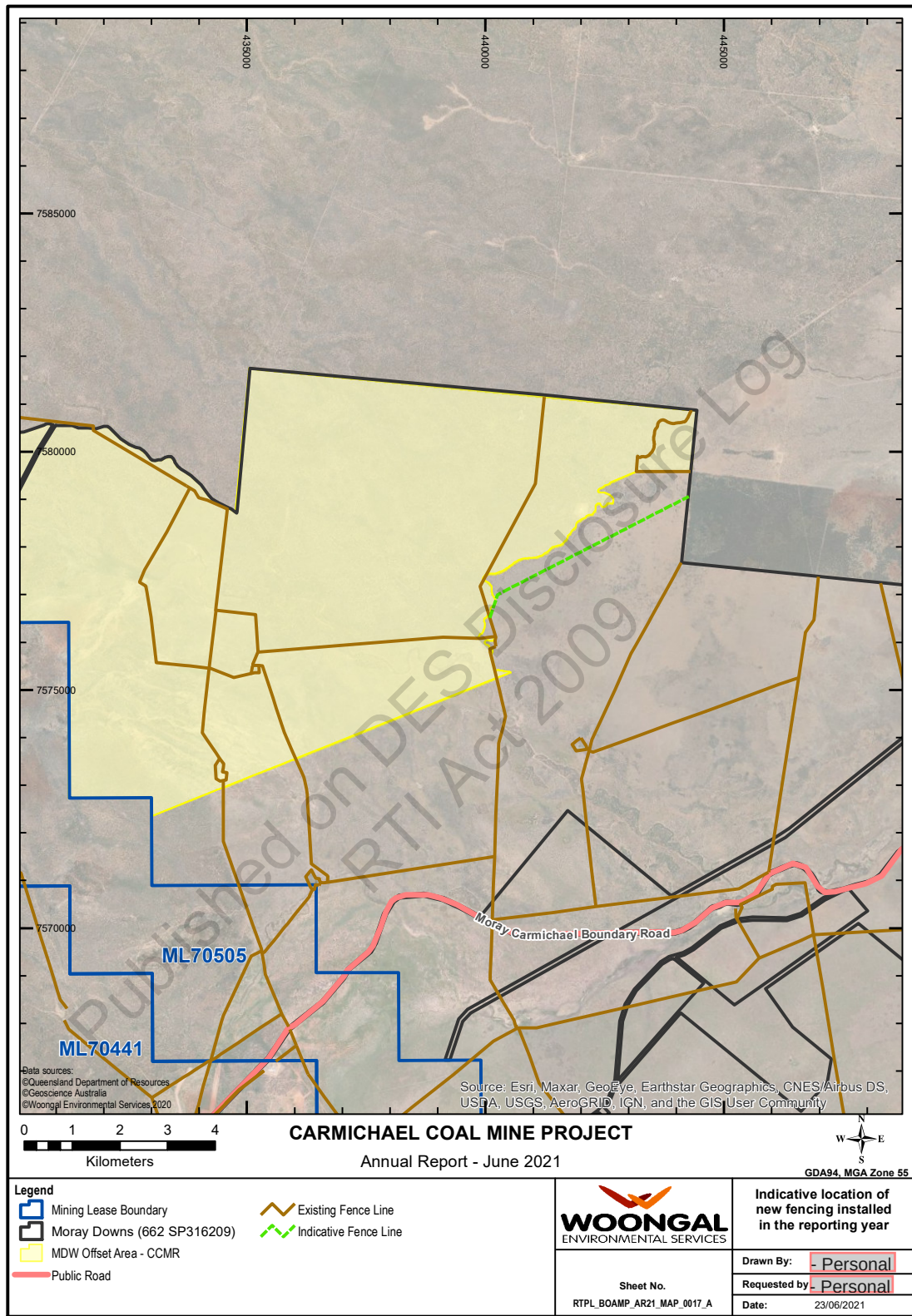


Figure 4-2. Location of new fencing in MDW OA

Table 4-1. Grazing Management Principles

Grazing Principle	Status
Livestock will only be permitted in the offset area to: <ul style="list-style-type: none"> – reduce fuel loads based on the results of biomass monitoring, and – to avoid weed seed set and reduce weed cover based on the results of weed monitoring 	Light stocking rates have been maintained throughout the reporting period, in addition to wet season spelling. Biomass monitoring results have indicated areas of high fuel loads and associated high fire risk within MDW. Grazing has been used to reduce fuel loads in some areas where appropriate in response to biomass results.
Livestock will be excluded from the offset area during the wet season (approximately December to March) to maximise native grass seed production and facilitate recovery of native perennial grasses and the herbaceous layer, unless grazing is required under exceptional circumstances (e.g. the grazing event may be required to be extended as a result of additional rainfall and resultant grass growth/extended flowering and seeding period). In the event strategic grazing is required to be undertaken during the wet season the minimum amount of grazing to reduce the identified risk will be implemented.	Livestock were excluded from MDW from late December 2020, prior to the onset of summer rains. Stock were gradually reintroduced from April 2021.
Livestock will be excluded from recently burnt areas (< 2 years) to allow native grasses to recover, including set seed, before being grazed.	No recently burnt areas.
Livestock will be excluded in offset management areas for wetlands associated with RE 11.3.3 (BVG 16c) and ornamental snake habitat by construction of livestock exclusion fencing.	Design works and ecological preclearance surveys have been completed and fencing materials have been procured. Vegetation clearing for the fences will commence once cultural heritage surveys have been finalised.
In the event that a confirmed yakka skink burrow is encountered within the yakka skink offset management area (Figure 8), livestock exclusion fencing will be installed around the burrow and associated microhabitat features (e.g. coarse woody debris) of an area no smaller than 100 m ² (10 m x 10 m).	No yakka skink burrows have been found.
For strategic grazing implemented during the dry season, a minimum of 1,500 kg/ha of dry matter will be retained at the end of the dry season.	Biomass survey conducted in June 2020 at 6 sites. Only one site was recorded with a yield lower than the target of 1,500 kg/ha of remaining biomass, while the remaining sites had biomass ranging from 4000-8000 kg/ha.

Grazing Principle	Status
Strategic grazing will involve light stocking rates (maximum 1 beast per 25 hectares), unless a higher rate is required to reduce biomass based on the results of biomass monitoring.	Light stocking rates have been maintained throughout the reporting period, in addition to wet season spelling. Biomass monitoring results have indicated areas of high fuel loads and associated high fire risk within MDW. Grazing has been used to reduce fuel loads in some areas where appropriate in response to biomass results.
If required, additional watering points that can be turned on and off for cattle will be installed in order to control grazing in sensitive areas or to encourage grazing in areas where there is a high infestation of <i>Cenchrus ciliaris</i> .	Additional water points are being installed to the north and south west of Ten Mile bore. These water points will be used to reduce grazing pressure within the 3 km radius of Ten Mile bore. The northern water point is within MDW.

Grazing trials are proposed to be developed through the Black-throated Finch Research Program (delivered by E2M).

Cattle grazing trials will consist of managing various stocking rates as well as trialling pulse grazing.

The following grazing regimes have been proposed under the BTF Research Program:

- Low grazing intensity (1 AE per 20 ha) – this is consistent with maximum stocking rates permitted for BTF habitat in the ML north of the Moray Carmichael Boundary Road
- High grazing intensity (1 AE per 10 ha) - this is consistent with maximum stocking rates permitted for BTF habitat in the ML south of the Moray Carmichael Boundary Road
- No grazing – these areas will have no grazing to provide a control against which grazing trials can be compared against
- Pulse grazing – this will consist of high intensity, short duration (approx. 3 months) grazing followed by long rests to allow pasture recovery. Short duration grazing has been proposed as a grazing regime to increase abundance of high-value forage species and potentially reduce buffel grass (Lawrence et al. 2019; ELA 2020).

Low and high intensity grazing would be based on a continuous grazing regime where a consistent stocking rate would be applied across the entire year. Pulse grazing, also known as cell grazing, intensive rotational grazing and short duration grazing, typically involves an intense grazing period during active forage growth (i.e. late wet season) of approximately 1 week followed by 4 or more weeks of spelling (Holechek et al 2000; Barnes et al 2008; McCosker 2000).

4.3.2 Fire Management

Fire is to be selectively used throughout the MDWOA as a land management practice to encourage the restoration of BTF habitat. Long-term fire management strategies will incorporate traditional First Nations burning techniques and outcomes from the BTF Research Project.

A Fire Strategy document covering MDW was prepared in January 2021. The objective of the fire strategy is to promote fire management that reduces the risk of fires threatening life and property, while providing an ecologically and culturally beneficial fire program.

The fire strategy involves regular burning in eucalypt woodlands at the end of each wet season. By implementing burning regimes using spot ignitions under mild weather conditions, while the soils remains moist and the grass fuel has not cured extensively; it will help to ensure fires are mostly of low to moderate intensity and create a patchwork of burnt and unburnt areas. The burning program includes a trial for refining fire management of Black-throated finch habitat, and burning to protect fire sensitive vegetation, including Brigalow (*Acacia harpophylla*) and riparian vegetation.

Monitoring sites established under the BioCondition and biomass monitoring aspects of the project will be used to gauge the effectiveness of the plan over a range of vegetation types. Surveys will be undertaken post fire to record the regeneration after burning.

The Woongal Ranger team underwent bushfire fire training during May 2021. Further training is planned for July 2021. Once this training has been completed the Ranger team will commence controlled burns as described in the Fire Strategy.

Some small-scale burns were undertaken for training purposes during this reporting period. These burns were intended to include experimental trials for the BTF Research Program, however, due to unfavourable weather conditions this was not achieved. These trials were undertaken in consultation with the BTF Research Program team and were not located within MDW.

The BTF Research Program have proposed three fire treatments: early-wet season burn (March to April), late-wet season burn (May to June) and unburnt. Fire trials will utilise existing tracks as firebreaks and be supervised by trained Woongal staff and where required sub-contractors to assist with fire management. Fire management trials are proposed to take place between 2022 – 2024.

Following the implementation of controlled burning regimes, the BTF Research team will capture high-resolution satellite imagery and fire-scars will be mapped. Vegetation transect surveys (wet and dry season) will be undertaken in these areas and incorporated into the BTFRP survey program. Surveys will aim to measure the response of vegetation (especially native grasses and canopy species recruitment) to fire, the condition of BTF habitat as well as the response to birds over time. This will be assessed with consideration to the timing of the fire, time since burn and fire frequency.

4.3.3 Weed Management

Woongal have developed an invasive species management program that covers the MDW and the BTFMP management areas.

The purpose of the Invasive Species Management Program is to provide operational guidance for invasive species management activities at the CCMR Project and MDW offset areas so that invasive species control requirements and management objectives directed by the MDW OAMP are met.

During Year 2 Woongal acquired the licenses and equipment necessary to undertake weed control within the OAMP and BTF management areas. The ranger team have also undergone specific training in weed control techniques.

An initial weed control campaign was undertaken during June 2021 and ongoing weed control will continue over subsequent reporting years. Information gathered during invasive species monitoring was used to identify areas for weed control.

Weed monitoring undertaken during the reporting period identified the presence of low levels of parthenium (*Parthenium hysterophorus*) along access tracks and stock watering points throughout MDW.

Prickly pear (*Opuntia spp.*) was found to be widespread, but in low numbers, throughout MDW. Harissia cactus (*Harrisia martinii*) was observed primarily in the northeast of MDW with some medium density infestations recorded. Rubber vine (*Cryptostegia grandiflora*) was recorded in multiple locations along the Carmichael River and tributaries, with some high-density areas identified. Additional weed species recorded within MDW (e.g *Vachellia spp.*) will be controlled during future weed control activities.

Table 4-2 describes the weed control activities undertaken during the reporting period.

Table 4-2. Weed Control Activities Undertaken in Year 2

Management Goal		Target Species	Location	Offset value present	Management activity
1	Manage invasive weed species to reduce degradation of MNES and MSES habitat	Harissia cactus	<ul style="list-style-type: none"> Langlands Paddock 	<ul style="list-style-type: none"> BTF Squatter pigeon Ornamental snake Yakka skink Brigalow TEC 	Chemical control (foliar spray)
2		Parthenium	<ul style="list-style-type: none"> Project Area 	<ul style="list-style-type: none"> BTF Squatter pigeon Watercourse vegetation Brigalow TEC 	
3		Prickly pears	<ul style="list-style-type: none"> Project Area 	<ul style="list-style-type: none"> BTF Squatter pigeon Ornamental snake Yakka skink Brigalow TEC 	Chemical control (drill and fill)
4		Rubber Vine	<ul style="list-style-type: none"> Carmichael River (Waxy Cabbage Palm habitat) 	<ul style="list-style-type: none"> RE 11.3.3 (BVG 16c) Significant wetlands Watercourse vegetation Waxy cabbage palm Wetland protection areas 	Chemical control (basal bark/cut stump)

A review of weed management activities will be undertaken every three years, to ensure the most effective, approved measures are in place for each weed species across the OAMP area. This review will include results of ongoing monitoring, control strategies, and results of the BTF research program.

4.3.4 Feral Animal Management

As described in Section 4.3.3 above, Woongal have developed an invasive species management program that covers the management of pest animals within MDW and the BTFMP management areas.

During Year 2 Woongal have acquired the equipment necessary to undertake feral animal control within the OAMP and BTF management areas. The ranger team have also undergone specific training in feral animal control techniques.

An initial feral animal control campaign was undertaken during June 2021 and ongoing control is planned for the remainder of the 'year 3' reporting year. Information gathered during invasive species monitoring was used to identify areas and target species for feral animal control. The initial campaign was utilised to trial and refine pest control techniques in terms of equipment used, location of traps, baits used and timing of deployment. Remote cameras were deployed at the trapping or baiting locations to assess the effectiveness of the techniques and provide information on feral animal abundance and behaviour.

Table 4-3 describes the feral animal control activities undertaken during the reporting period.

Table 4-3. Feral animal control activities undertaken during the reporting period

Management Goal		Target Species	Location	Offset value present	Management activity
1	Minimise the predation risk presented by feral cats to threatened fauna species at the Project area	Feral cat	<ul style="list-style-type: none"> Project area BTF habitat areas 	<ul style="list-style-type: none"> BTF Squatter pigeon Ornamental snake Yakka skink 	Baited cage trapping
2	Minimise the risk of accidental poisoning by cane toads to ornamental snakes at the Project area	Cane toad	<ul style="list-style-type: none"> 10-mile bore turkey nest 10-mile dam #1 dam 	<ul style="list-style-type: none"> Ornamental snake Yakka skink 	Acoustic trapping trial using Toadinator ¹

¹ The TOADINATOR is a cage trap designed specifically for the effective capture of cane toads. The trap uses UV light to attract insects, which in turn attracts toads. The lure also has a sound component which comes pre-loaded with cane toad calls. These calls are specific to cane toads and are demonstrated to be attractive to females.

Management Goal		Target Species	Location	Offset value present	Management activity
3	Minimise the degradation of MNES and MSES habitat by feral pigs at the Project area	Feral Pig	<ul style="list-style-type: none"> Project area 	<ul style="list-style-type: none"> RE 11.3.3 (BVG 16c) Significant wetlands Watercourse vegetation Waxy cabbage palm Wetland protection areas 	Targeted hog-hopper ² bait station trial (using 1080)

A review of pest management activities will be undertaken every three years, to ensure the most effective, approved measures are in place for each pest species across the OAMP area. This review will include results of ongoing monitoring, control strategies, and liaison with surrounding land holders to understand local pest animal populations and movement and to allow for a collaborative, coordinated approach where possible

4.4 Monitoring and Surveys

Table 4-4 provides a summary of monitoring surveys, inspections and reports prepared during the reporting year.

Table 4-4. Year 2 Monitoring Surveys, Inspections and Reports

Survey/Report	Timing	Status
BTF Monitoring Survey	Survey conducted June 2020	Survey complete, combined report issued. Results summarised in this report.
BTF Monitoring Survey	Survey conducted Oct-Nov 2020	
BTF Monitoring Survey	Survey conducted March 2021	Survey complete, draft report issued. Results summarised in this report.
Habitat Quality Assessment and surveys	April/May 2021	Survey completed
Biomass Survey	Survey conducted October 2020 end dry	Survey completed. Results summarised in this report.
Biomass Survey	Survey conducted May 2021	Survey completed

² The Hog Hopper is a bait delivery system designed to prevent non-target animal access. As the door of the HOGHOPPER™ can be locked in an 'open' (free-feed) position, pigs easily access non-toxic baits and become familiar with feeding from the HOGHOPPER™. After the door is closed, pigs learn to lift the door to access the baits. Pigs are the only animals in Australia which have the capacity to open the door.

Survey/Report	Timing	Status
	End of wet	
Waxy Cabbage Palm Monitoring Survey	17-19 June 2020 (early dry season); and 1-8 October 2020 (late dry season); and May 2021 (end of wet season).	Draft Report issued. Results summarised in this report.
Preliminary Pest Plant and Pest Animal Monitoring Report for the Moray Downs West Biodiversity Offsets Area	Pest Plant surveys were conducted between 24th July 2020 and 31st July 2020, and between 16th September 2020 and 27th September 2020. Pest animal surveys were conducted between August 2020 and December 2020, inclusive.	Survey and report complete. Results summarised in this report.
Targeted Weed Surveys	Sept 2020- March 2021	Survey Completed
Pest Animal Surveys	Feb-June 2021	Survey completed.
Pastoral Infrastructure Inspections	Sept-December 2020	Survey completed.
Incidental Observations (weeds and pests)	Throughout the reporting year.	Ongoing
Fire Strategy	January 2021	Report issued.

4.4.1 Offset Area Inspections

4.4.1.1 Fences and Infrastructure

Fence and in-field infrastructure inspections were undertaken between September and December 2020.

Prior to the commencement of the MDW fence and in-field infrastructure survey, the Woongal Ranger team completed a desktop assessment that reviewed and identified:

- road and in-field infrastructure expected to be encountered during the MDW fence and in-field infrastructure survey;
- expected maintenance requirements of MDW fence and in-field infrastructure that would be required post survey; and
- the type of information required to be collected to inform the development of an annual maintenance program for MDW fence and in-field infrastructure.

Information identified through the desktop assessment was utilised to develop an electronic field data capture system that enabled Woongal Rangers to electronically capture MDW fence and in-field infrastructure attributes encountered during the survey, using a systematic, consistent and repeatable method.

Following development of the electronic field data collection system, Woongal Rangers tested the system at MDW to confirm:

- a) The systems suitability to be used within a remote field environment;
- b) The systems suitability for collecting fence and in-field infrastructure assets at MDW; and
- c) The ability to upload, store, update and share collected information across various networks and operating platforms.

Refinements identified during the in-field-testing stage were immediately rectified within the electronic field data collection system to enable the MDW fence and in-field infrastructure survey to be completed accurately.

In total, 1,962 fence and in-field infrastructure items were captured during the MDW fence and in-field infrastructure survey, including:

- 261.35 kilometres of fencing;
- 141 gates;
- 865 wood and steel strainer posts; and
- 87 wood and steel strainer complexes.

Figure 4-3 shows the location of items inspected and denotes whether maintenance work is required.

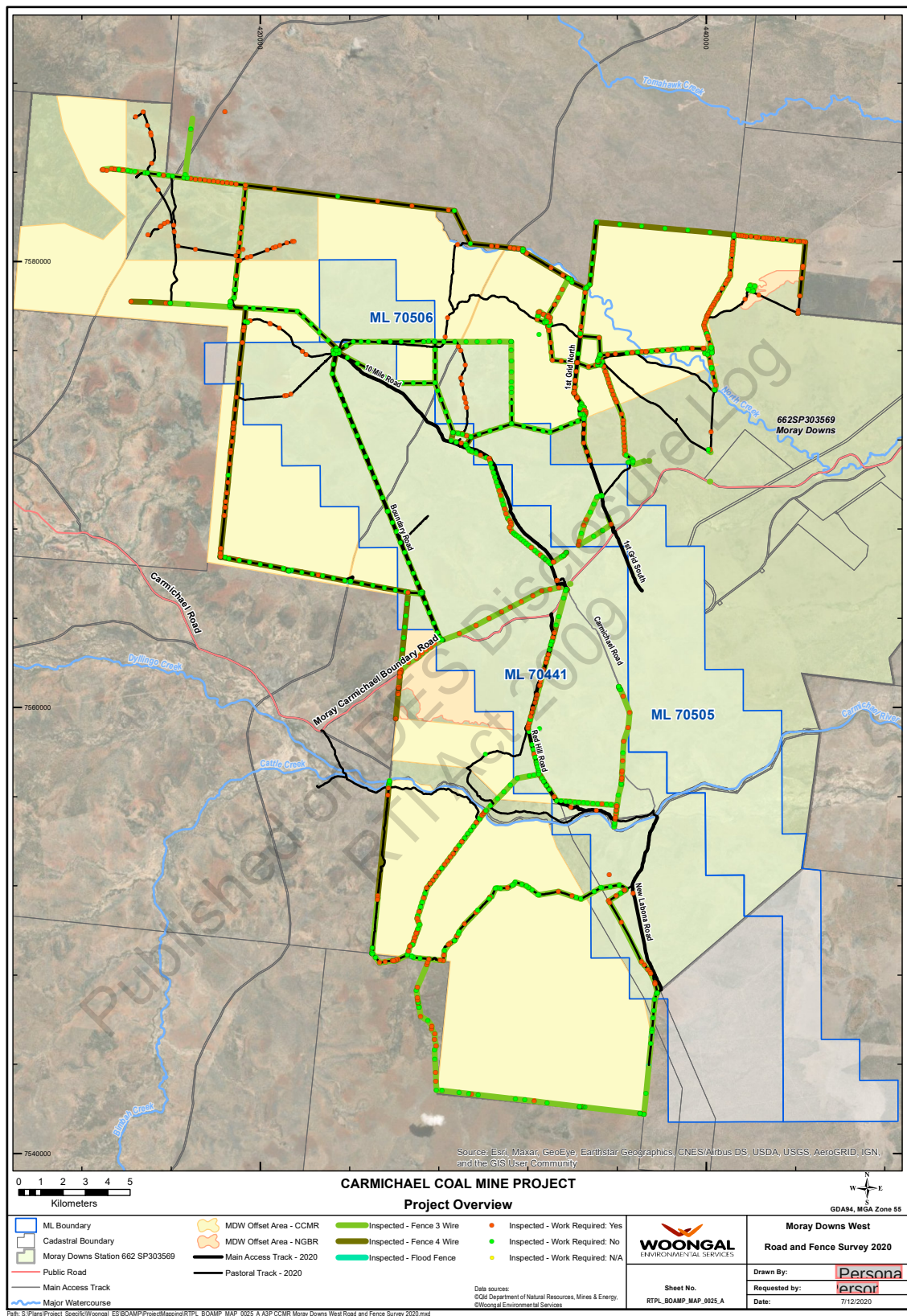


Figure 4-3. Fence and infrastructure inspection summary

MDW fence and in-field infrastructure varied in condition, with the much of the infrastructure being in an operational but poor condition.

Of those fence and in-field infrastructure recorded, 108 items were identified as requiring maintenance. A list of items requiring maintenance is shown below:

- 2 cocky gates;
- 1 x double steel gate;
- 1 x single steel gate;
- 2 x gate and strainer complexes – wood;
- 9 x roads;
- 45 x steel and wood strainers;
- 4 x strainer – wood complexes;
- 5 x water troughs; and
- 26 fences (8.11km)

A forward program will be developed and implementation to commence in the forward reporting year.

4.4.1.2 Inspections of artificial watering points

As per Section 6.9.1 of the OAMP, existing artificial watering points within the BTF management area have been inspected throughout the reporting period to ensure a constant supply of water for BTF. Any maintenance issues were reported immediately to Bravus, and the issues rectified.

A GIS system has been developed to capture fortnightly water point inspections. An example is shown in Figure 4-4.

Water Point ID: CWAT111

Date Lodged: 31/05/2021 8:52:41 AM	Collection Officer: 4 - Personal in	Maintenance Required: No	Maintenance Description: nil
BTF Sighted: No	Mature Number:	Juvenile Number:	Confidence: High
Comments: BTF water point (b)			
Water: Yes	Capacity: 80 %	pH: 4.98	DO (%): 8
		uS / cm 4885	ppm TDS 2443



Figure 4-4 Water infrastructure inspection report

As part of the BTF Research Program new artificial water sources are to be installed. The results of the research program will be used to inform the specific requirements and locations of the new water points. All new permanent watering points must be installed and operational within the sooner of one year after the completion of the five year BTF Research Program, or five years after the commencement of mining operations. Weekly inspections of the new BTF water points will commence once the water points have been installed and commissioned.

Figure 4-5 shows the locations of the BTF water inspections within MDWOA and the BTF management area.

Published on DES Disclosure Log
RTI Act 2009

Figure 4-5. BTF Water Inspections

4.4.1.3 Erosion and Sediment Control

Erosion and sediment control surveys were conducted in April and May 2021 and incidental observations of erosion are also captured and added to a GIS database. Surveys identified the location of existing and historical sites of erosion by type (gully, wash out, bank erosion) and severity.

The key observations from this baseline survey included:

- Gully erosion was noted in the survey, particularly where access tracks had been eroded.
- There is a small amount of sheet erosion which may be a result of grazing practices.
- 24 priority erosion sites were inspected and recorded across the study area.

An erosion and sediment control management plan has been prepared and a program of works is to be established to systematically remediate known gully and bank erosion locations within MDW.

Recommendations for remediation works and priorities include the installation of check dams, diversions and minor structural works. A forward program will be developed and implementation to commence in the forward reporting year.

Figure 4-6 details the inspections undertaken to then guide maintenance and other activities by Woongal, the Agistee or Bravus.

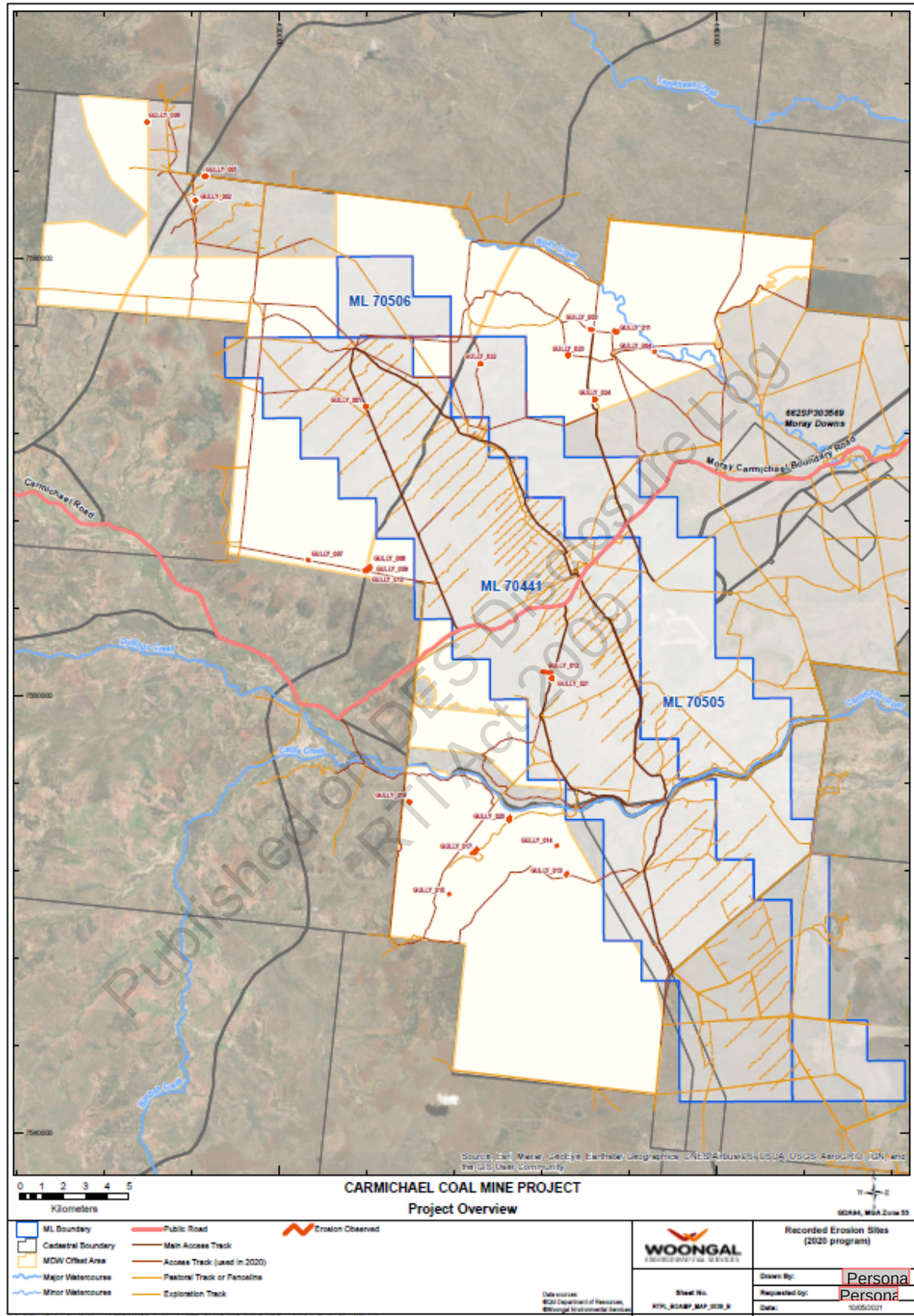


Figure 4-6. Erosion and Sediment Control Survey

4.4.2 Weed and Pest Animal Monitoring

Weed and pest animal surveys were undertaken in this reporting period to provide a preliminary assessment of the extent and severity of pest plant infestations, and the distribution and abundance of pest animal populations, in the MDWOA.

The surveys included a randomised assessment of weed cover across the site, and random surveys specific to wild dogs (*Canis familiaris dingo* / *C. familiaris*), feral pig (*Sus scrofa*), rabbit (*Oryctolagus cuniculus*), cane toad (*Rhinella marina*), goats (*Capra hircus*), European foxes (*Vulpes vulpes*) and feral cats (*Felis catus*). Figure 4-7 shows the location of weed and pest monitoring sites.

The survey found that generally there is a low incidence of weeds across the MDWOA. However, the distribution of positive data suggests that there are some locations with higher incidence of weeds or pest animals than others. Generally, higher incidence of pest animal and weed observations was recorded in the north east of the MDWOA, and close to the Carmichael River. This distribution broadly aligns with higher fertility soils with greater moisture holding capacity, and with greater availability of water in grazing installations or natural water sources. It was considered that this distribution pattern is a response to local edaphic conditions and was stimulated by seasonally changing environmental and resource conditions.

An Invasive Species Monitoring Program has also been developed, and dry season pest animal monitoring was conducted between August and December 2020.

Monitoring included:

- I. Pigs: A 500m transect located in randomly stratified, 500 m x 500 m plots (12 plots in total)
- II. Rabbits: Twenty-five, two hectare randomly stratified plots measured to assess the abundance of Rabbit signs, Rabbit damage and regenerating seedlings
- III. Camera monitoring: 14 baited and 10 unbaited monitoring stations.
- IV. Sand Plot: Sand plot trial to supplement camera data for foxes, dogs and cats.
- V. Vehicle Transect: Vehicle transect survey for feral goats.

A summary of the results from the post wet season survey is shown in Table 7 below.

Table 4-5. Summary of Post Wet Season Invasive Species Monitoring Observations

Agent	Monitoring Method	Observations
Pest plant	Plot based plant transects 100m x 100m	11 sites surveyed; parthenium, prickly pear, harissa cactus and buffel grass identified
Feral Pig	500m transects	32 sites surveyed; evidence of pig damage observed at 26 of the sites
Rabbits	Two hectare randomly stratified plots measured to assess the abundance of Rabbit signs, Rabbit damage and regenerating seedlings	30 targeted rabbit surveys completed; evidence of rabbit activity observed at 13 of the sites
Cane Toads	200m transects	65 x 200m transects completed; cane toads observed at 2 sites
Foxes, wild dogs and cats	Baited and unbaited trail camera monitoring. Sand plots	46 sites; 12 observations of dogs, six observations of rabbits, and 15 observations of cats.

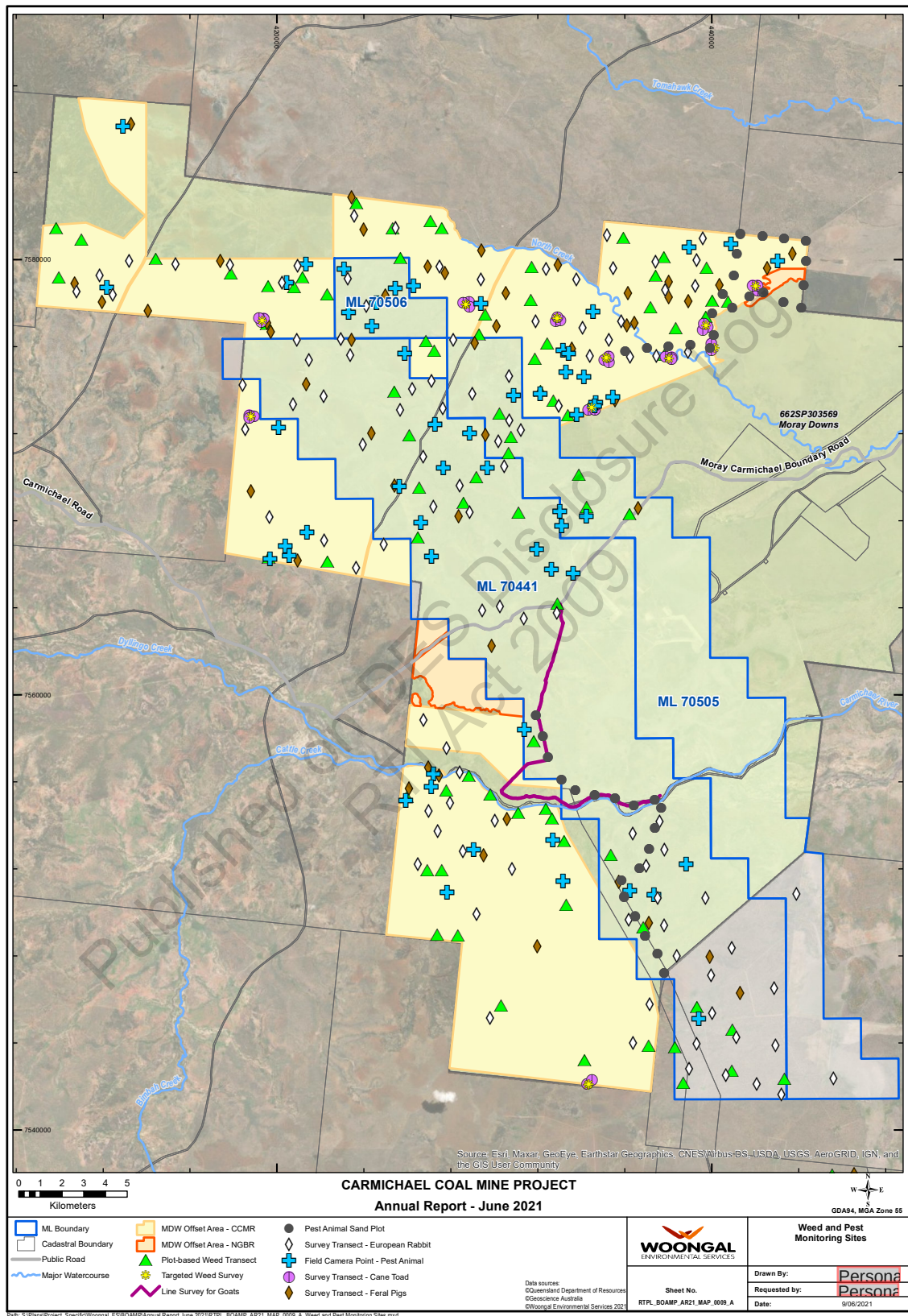


Figure 4-7. Weed and pest monitoring sites

4.4.3 Biomass Monitoring

Biomass monitoring is to be undertaken biannually at permanently established habitat monitoring sites at the locations shown in Figure 4-8 below, at the end of the wet season (March/April) when biomass is at its peak, and towards the end of the dry season (approximately October) when fire risk is greatest.

Results of these assessments will be used to set stocking rates for dry season strategic grazing to reduce fuel loads or for weed control. Strategic grazing implemented within MDW will aim to retain biomass of at least 1,500 kg/ha at the end of the dry season.

The biomass monitoring events assess pasture composition, pasture biomass and pasture ground cover using the Department of Natural Resources Queensland GRASS Check – Grazier Rangeland Assessment for Self-Sustainability DNRQ97002 Second Edition-revised methodology. Details of the methodology are provided below.

4.4.3.1 Site Setup

As the biomass sites align with the habitat assessment sites the star pickets of the established transects were used to guide the set-up of the biomass sites. As these sites were already established, the cardinal directions indicated in Figure 4-8 were not adhered to, though this will not affect the results of the assessments. In order to minimise the associated risks to cattle and farm workers, no additional star pickets were used to establish the site. Points and corners were established using temporary measures and removed upon completion.

- The 0 m mark was used as the photo site post and a temporary 1 m rule post placed 10 m along in the direction of the transect.
- Corners 2 and 3 were initially determined by running a 100 m tape perpendicular to the 100 m point and marking with flagging tape and recording as a GPS waypoint. To make this process more efficient, corners 2 and 3 were later determined using GIS software to map and export the points to GPS, creating a bearing toward which the assessment could be carried out. While there is less accuracy in this method due to the accuracy of the GPS device and availability of satellites, this should not affect the overall results due to the amount and nature of the data being collected.

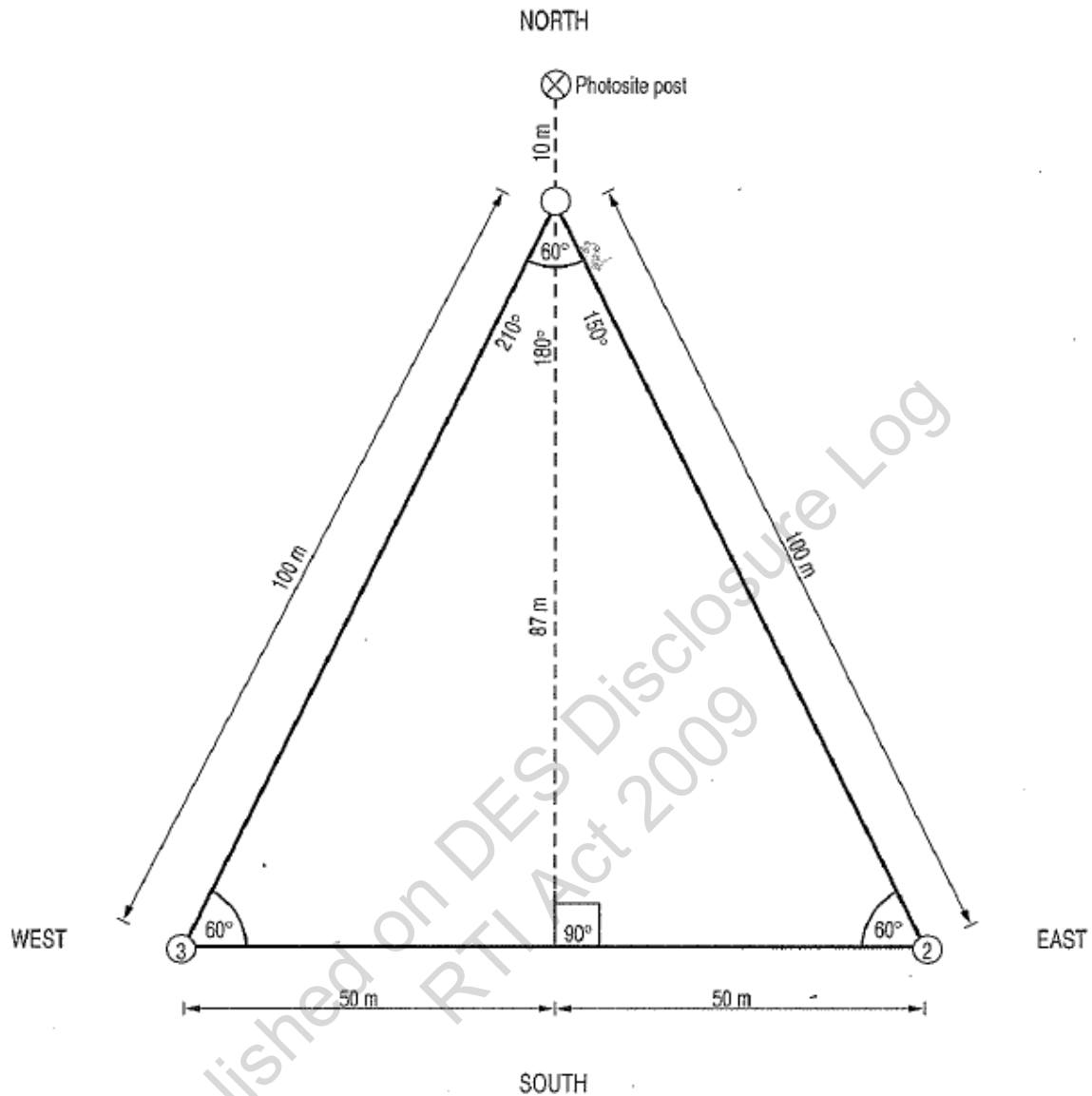


Figure 4-8. Set up of a biomass site taken from GRASS Check methodology. Note: Habitat site set up did not follow the cardinal directions in the diagram

4.4.3.2 Photo Monitoring

Ongoing photographic monitoring of sites is achieved by taking landscape photos from the photosite post toward the meter rule post at each monitoring event. The GRASS check methodology suggests both landscape and trayback photos be taken however, as trayback photo methodology was neither practical nor aligned with work, health and safety protocols, these were not included in the methodology. Photos were taken using a Panasonic Lumix camera at zero and 2 x zoom. The sighter post used for the 2020 Late-wet season monitoring was a 1m tall length of conduit alternating black and white in 10 cm increments. Figure 4-9 shows an example photo monitoring point for visual yield estimate comparisons with pasture photo standards.



Figure 4-9. Example photo monitoring point for visual yield estimate comparisons with pasture photo standards

4.4.3.3 *Yield Estimates*

Pasture photo standards obtained from the Future Beef website³ were used to visually estimate dry matter yield in kg/ ha based on the land type and/ or pasture composition. Each of the two (2) assessing ecologists made an individual estimate without discussion and recorded as a yield range as per the GRASS check methodology.

4.4.3.4 *Ground cover and species composition*

The ground cover and pasture composition were assessed using the methodology described in Section C2 of the GRASS Check methodology. An open ended 50 x 50 m quadrat was used to determine cover attributes.

³ <https://futurebeef.com.au/knowledge-centre/pasture-photo-standards/> Accessed May 2020

For ground cover and pasture composition:

- Starting at post 1, walk along the sides of the triangle, placing the quadrat in front of your feet 100 times (about every three paces).
- Estimate the percentage of ground covered by grass, herbage, low shrubs, litter and manure (not tree canopy). Categories are: <5%, 5-15%, 15-30%, 30-50%, 50-90% and >90%.
- Tick the appropriate row in each sample site column on Recording sheet 1.
 - o Unknown species can be recorded as intermediate. (Category of grasses recorded was determined as desirable, intermediate or less desirable using guides available through the Future Beef website⁴ and ecologists determination of grass growth habit and form.
 - o Only plants rooted inside the quadrat are recorded.
- Upon completion of the 100 quadrats, totals are carried across to the site summary sheet and used to determine a percentage for each ground cover category and species.
- Contribution to yield is estimated to determine total contribution to weight of the pasture and to provide a representation of the importance of each species; for example, forbs may have a frequency (count) of 90% but an estimated contribution to yield of only 5%, while buffel grass may have a frequency of 15%, but contribute 75% of the yield.
- Any events contributing to yield that have occurred since last sampling are recorded where identified (e.g. fire, drought, late rain).

4.4.3.5 Basal area

- At each corner of the triangular transect a pencil or pen is held vertically at arm's length. Each live tree in the line of vision with a trunk appearing wider than the pencil at 30 cm above the ground is counted as 1. If the trunk appears the same width as the pencil it is counted as a half.
- Totals for each corner are recorded and an average tree count obtained for the site.
- Basal area is calculated in square metres per hectare by dividing the average by four

4.4.3.6 Canopy cover

- Starting at post 1 the triangle is traversed and recordings taken at each step or approximate 1 m to a total of 100 recordings per side (i.e. 300 total recordings).
- Where the point of the boot is vertically beneath any tree or shrub canopy presence is recorded against the species.

⁴<https://futurebeef.com.au/knowledge-centre/land-types-in-grazing-land-management/> Accessed May 2020

- Overall canopy cover percentage is calculated by dividing the totals for each side by three.

4.4.3.7 *Stem density*

- Stems within 1 m either side of the triangular transect area recorded
- The total stem count is divided by three and multiplied by 50 to obtain a stems per ha figure.

Stem density was not recorded in the first round of monitoring due to the methodologies reference to woody weed control and no woody weeds were present on the sites. Stem count data should however, be collected where shrubs and saplings are present and particularly in thickened vegetation where the relationship between canopy cover and ground cover is more evident.

4.4.3.8 *Monitoring*

During this reporting year groundcover, species composition and biomass assessments were undertaken in June 2020 (end of dry season) and May 2021 (end of wet season). Figure 4-10 shows the location of biomass and species composition monitoring sites.

4.4.3.9 *Results*

During the June 2020 survey, only one site was recorded with a yield lower than the target of 1,500 kg/ha of remaining biomass, while the remaining sites had biomass ranging from 4000-8000 kg/ha.

Results for the May 2021 were not available at the time of preparing this report and will be presented once they have been made available.

Table 4-6. Summary of grass species composition for each site and average presence and contribution to yield across all sites monitored in June 2020

			Site	C03			C05			C22			C28			C38			C51			All sites Statistics	
			Yield	5000-6000			5000-6000			6000-7000			4000-5000			7000-8000			1100			Av. Presence %	Av. Yield contribution kg/ha
				Presence	Contribution	Yield kg/ha	Presence	Contribution	Yield kg/ha	Presence	Contribution	Yield kg/ha	Presence	Contribution	Yield kg/ha	Presence	Contribution	Yield kg/ha	Presence	Contribution	Yield kg/ha		
GRASSES	DESIRABLE	PERENNIAL	<i>Chrysopogon fallax</i>	61	45	2250	47	25	1250	37	15	900	0	0	0	7	2	160	49	35	2800	33.50	1226.67
			<i>Themeda triandra</i>	2	1	50	13	4	280	32	15	900	0	0	0	1	1	80	4	1	80	8.67	231.67
			<i>Panicum effusum</i>	0	0	0	2	2	140	4	1	60	2	1	40	1	1	80	0	0	0	1.50	53.33
			<i>Heteropogon contortus</i>	2	2	100	12	5	350	0	0	0	2	0	0	0	0	0	0	0	0	2.67	75.00
			<i>Bothriochloa ewartiana</i>	6	2	100	31	7	490	23	8	480	2	0	0	0	0	0	2	1	80	10.67	191.67
			<i>Eulalia aurea</i>	16	4	200	0	0	0	30	1800	2	0	0	0	0	0	0	7	2	160	4.17	360.00
			<i>Cenchrus ciliaris</i> *	20	20	1000	14	12	840	40	1	60	2	0	0	0	0	0	9	2	160	14.17	343.33
			<i>Triodia pungens</i>	4	1	50	25	18	1260	1	1	60	61	65	2600	96	81	6480	63	40	3200	41.67	2275.00
			Other	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	0	0	0.67	0.00
			*Present ☒	84			86			82			62			96			93			83.83	0.00
	INTERMEDIATE		<i>Digitaria brownii</i>	6	2	100	12	3	210	4	1	60	2	0	0	0	0	0	1	1	80	4.17	75.00
			<i>Enneapogon robustissimus</i>	3	1	50	13	2	140	0	0	0	2	0	0	0	0	0	3	1	80	3.50	45.00
			<i>Enneapogon lindleyanus</i>	0	0	0	4	0.5	35	1	0.5	30	0	0	0	0	0	0	1	0	0	1.00	10.83
			<i>Chloris divaricata</i>	0	0	0	0	0	0	2	1	60	0	0	0	0	0	0	3	1	80	0.83	23.33
			<i>Triodia sp.</i>	0	0	0	0	0	0	0	0	0	14	5	200	0	0	0	1	0	0	2.50	33.33
			<i>Cymbopogon bombycinus</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	80	0.33	13.33
			Other grasses	1	0.5	25	0	1	70	0	0	0	0	0	0	0	0	0	0	0	0	0.17	15.83
			*Present ☒	5			25			5			0			0			11			7.67	4973.33
	LD	PERENNIAL	<i>Aristida calycina</i>	2	1	50	17	5	350	8	2	120	7	6	240	0	0	0	7	2	160	6.83	153.33
			<i>Aristida sp.</i>	2	0.5	25	0	0	0	0	0	0	6	3	120	0	0	0	0	0	0	1.33	24.17

Site			C03			C05			C22			C28			C38			C51			All sites Statistics	
Yield			5000-6000			5000-6000			6000-7000			4000-5000			7000-8000			1100			Av. Presence %	Av. Yield contribution kg/ha
			Presence	Contribution	Yield kg/ha	Presence	Contribution	Yield kg/ha	Presence	Contribution	Yield kg/ha	Presence	Contribution	Yield kg/ha	Presence	Contribution	Yield kg/ha	Presence	Contribution	Yield kg/ha		
ANNUAL		<i>Eriachne mucronata</i>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0.00
		*Present ☒	4			12			8			13			0			7			7.33	177.50
		<i>Dactyloctenium radulans</i>	0	0	0	1	0.5	35	0	0	0	0	0	0	0	0	0	0	0	0	0.17	5.83
		<i>Tripogon loliiformis</i>	0	0	0	12	0.5	35	0	0	0	12	1	40	7	0	0	8	0.5	40	6.50	19.17
		<i>Paspalidium rarum</i>	41	3	150	1	0.5	35	24	4	240	1	1	40	0	0.5	40	3	0	0	11.67	84.17
		<i>Eragrostis sp. Annual</i>	46	3	150	1	0.5	35	5	1	60	0	0	0	0	0	0	0	0	0	8.67	40.83
		<i>Tragus australianus</i>	0	0	0	3	0.5	35	0	0	0	0	0	0	1	0	0	0	0	0	0.67	5.83
		<i>Panicum sp.</i>	0	0	0	2	0.5	35	0	3	180	1	0.5	20	1	0.5	40	1	0.5	40	0.83	52.50
		<i>Digitaria sp.</i>	5	1	50	0	0	0	22	2	120	0	0	0	0	0	0	0	0	0	4.50	28.33
		<i>Schizachirium fragile</i>	4	1	50	0	0	0	7	1	60	41	8	320	25	3	240	0	0	0	12.83	111.67
		<i>Sporobolus australis</i>	0	0	0	4	0.5	35	2	1	60	0	0	0	0	0	0	0	0	0	1.00	15.83
		<i>Setaria surgens</i>	7	1	50	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	1.67	8.33
		<i>Aristida holathera</i>	5	1	50	0	0	0	0	0	0	11	1	40	75	5	400	0	0		15.17	81.67
		Other	0	0	0	15	2	140	2	1	60	50	0	0	4	0	0	0	0	0	11.83	33.33
		*Present ☒	72			27			47			50			60			9			44.17	487.50
OTHER	FORBS	Native	73	5	250	84	5	350	73	5	300	22	8	320	1	5	400	32	5	400	47.50	336.67
		Stylo	88	5	250	33	5	350	53	5	300	0	0	0	0	0.5	40	27	3	240	33.50	196.67
		Exotic	0	0	0	0	0	0	5	1	60	0	0	0	0	0	0	0	0.5	40	0.83	16.67
		Other forbs	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0.50	0.00
		*Present ☒	94			88			50			7			61			37			56.17	550.00
	SEDGES		37	1	50	17	1	70	4	0.5	30	0	0.5	20	1	1	80	11	0.5	40	11.67	48.33
	WOODY PLANTS		13	0	0	6	0	0	1	0	0	21	0	0	10	0	0	27	0	0	13.00	0.00

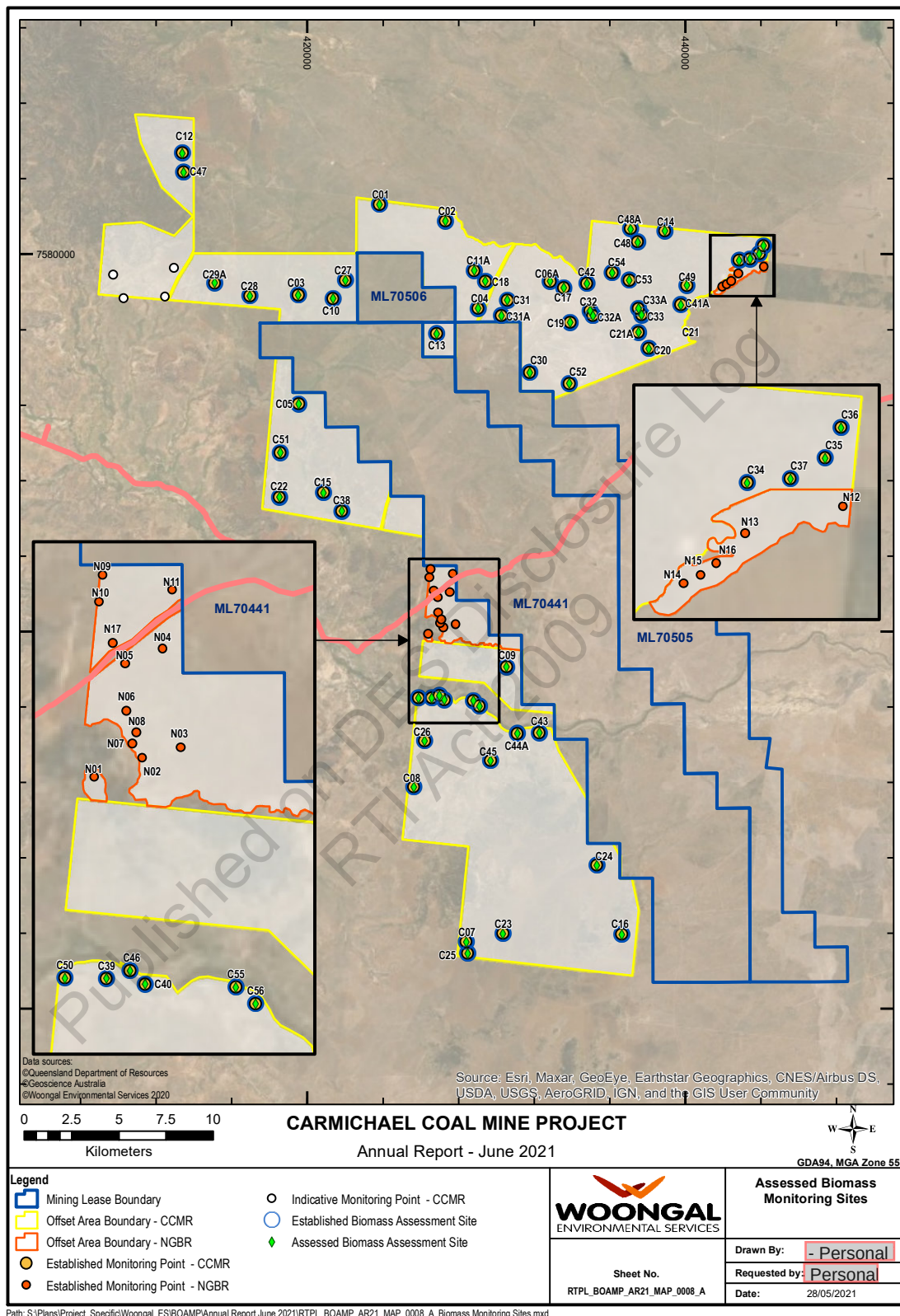


Figure 4-10: Biomass monitoring locations

4.4.4 Habitat Quality Monitoring (BioCondition)

4.4.4.1 *Context and objectives*

The OAMP includes specific requirements for the monitoring of offset management areas for each MNES and MSES identified in the OAMP to assess progress towards achieving interim performance targets and completion criteria for the offset. The MNES and MSES identified in the OAMP are outlined in Table 4-7.

Table 4-7. List of MNES and MSES included in the OAMP.

Environmental value	MNES/MSES
Ornamental Snake (<i>Denisonia maculata</i>)	MNES/MSES
Squatter Pigeon (<i>Geophaps scripta scripta</i>)	MNES/MSES
Black-throated Finch (<i>Poephila cincta cincta</i>)	MNES/MSES
Yakka Skink (<i>Egernia rugosa</i>)	MNES/MSES
Waxy Cabbage Palm (<i>Livistona lanuginosa</i>)	MNES/MSES
Wetland protection area	MSES
Significant wetland	MSES
RE 11.3.3 (BVG 16c)	MSES
Watercourse vegetation	MSES
Connectivity	MSES

Monitoring activities include offset area inspections, habitat quality assessments, photo monitoring, targeted fauna surveys, weed monitoring, pest animal monitoring, biomass monitoring and specific monitoring requirements for Waxy Cabbage Palm and Black-throated Finch (CO2 Australia 2019). The monitoring program that is required to ensure the OAMP meets the performance criteria and management objectives, and ultimately attains the interim performance targets and completion criteria for the MDW offset area includes (CO2 Australia 2019):

- offset area inspections (Section 7.1 of the OAMP)
- weed monitoring including a survey in year 1 (Section 7.2 of the OAMP)
- pest animal monitoring including a survey in year 1 (Section 7.3 of the OAMP)
- biomass monitoring for grazing and fire management (Section 7.4 of the OAMP)
- habitat quality assessments for each MNES and MSES (Section 7.5 of the OAMP)
- photo monitoring (Section 7.5.3 of the OAMP)
- specific monitoring activities for waxy cabbage palm (Section 7.6 of the OAMP) and black-throated finch (Section 7.7 of the OAMP).

Habitat quality assessments conducted during the reporting year address the monitoring requirements in year 1 for the following two components of the monitoring program:

- habitat quality assessments for each MNES and MSES; and
- photo monitoring.

The key interim performance targets and completion criteria to be achieved are increases in habitat quality, which is represented by habitat quality scores. Habitat quality scores are to be calculated by

assessing a range of indicators and ecological attributes that measure the overall viability of the offset and its capacity to support MNES and MSES. The detailed method for calculating habitat quality scores was outlined in Section 7.5 and Appendix D of the OAMP (CO2 Australia 2019). An outline of this method is provided in Section 4.4.4.10.

4.4.4.2 *Site Locations*

The OAMP specifies that permanent monitoring sites are to be established within the MNES and MSES offset management areas as part of the habitat quality assessments to be undertaken in the first year of implementation of the OAMP. The OAMP identified indicative locations for a total of 56 sites for the CCMR offset component. The number of monitoring sites was based on the minimum number of monitoring sites required to be established in accordance with the Guide to Determining Terrestrial Habitat Quality (State of Queensland 2017) for each MNES and MSES. As part of the habitat quality assessments undertaken in the first year of implementation of the OAMP, the habitat monitoring sites are to be demarcated with a capped stake and a GPS location recorded in GDA94, Zone 55 projection. Each monitoring site is to include a 100 m transect, with the start and central points marked with a galvanised steel picket with plastic safety cap (CO2 Australia 2019).

4.4.4.3 *Habitat quality assessments*

The OAMP specifies that to satisfy specific requirements of the EPBC Act Environmental Offsets Policy and offsets assessment guide, the habitat quality scores for MNES are to be determined based on the methods outlined in Appendix D of the OAMP. These methods were based on the Guide to Determining Terrestrial Habitat Quality (State of Queensland 2017) but incorporated additional assessment methods to ensure that the habitat quality score for each MNES aligns with the EPBC Act Environmental Offsets Policy and offsets assessment guide (CO2 Australia 2019).

The OAMP specifies that habitat quality assessments are to be undertaken in year 1 and year 2, followed by assessments every 2 years (CO2 Australia 2019). Habitat quality assessments are to be undertaken at the permanent habitat monitoring sites described above in Section 4.4.4.2.

Data from habitat quality assessments are to be recorded in survey sheets and these are to be attached to the monitoring reports. Reports prepared for year 2 and subsequent years are to include summary data from all previous years. These are to be presented so as to allow trend analysis of each of the measured attributes and to be used to assess progress towards achieving the completion criteria (CO2 Australia 2019).

The species habitat index assessment component of the habitat quality assessment is to include targeted fauna surveys for threatened species within their respective offset management areas. Targeted fauna surveys are to be undertaken in accordance with the Terrestrial Vertebrate Fauna Survey Guidelines for Queensland (Eyre et al. 2018), Survey Guidelines for Australia's Threatened Birds (Commonwealth of Australia 2010), Survey guidelines for Australia's threatened reptiles (Commonwealth of Australia 2011) and other species-specific survey guidelines endorsed by Queensland and/or Commonwealth Government. In the absence of specific seasonally-enhanced detectability of Squatter Pigeon, surveying is to be undertaken over a minimum of 3 days during the breeding season (between Spring and Summer). In accordance with the Survey Guidelines for Australia's Threatened Birds and based on effective previous experience in the Brigalow Belt, Squatter Pigeon is to be passively surveyed by flushing them while traversing the offset by vehicle and by foot;

recording the number (and abundance) of Squatter Pigeon encounters during any survey event. Targeted fauna surveys for Black-throated Finch are to be undertaken in accordance with Section 7.7 of the OAMP (CO2 Australia 2019).

4.4.4.4 Photo monitoring

The OAMP specifies that photo monitoring is to be undertaken at the same time as habitat quality assessments and at each of the permanent habitat quality monitoring sites. Permanent photo monitoring sites are to be established at each end of the 100m transects at all permanent habitat quality monitoring sites. Five photos are to be taken at each location (from 1.5 m height above ground level) in the direction of magnetic north, south, east, west and ground. The ground shot should be chosen to give a representative indication of cover and species composition for the general area if possible. A record of the photographs is to be maintained, including GPS co-ordinates, date and time of each photograph, the direction in which the photo was taken, and the height above ground at which the photo was taken.

4.4.4.5 Study approach

A field survey to establish and quantify habitat quality at the monitoring sites was undertaken by two teams over the period 8-19 April 2021. The teams were led by [Sch4 - Personal info] (Principal Ecologist) and [Sch4 - Personal info] (Principal Botanist), assisted by [Sch4 - Personal info] (Ecologist), [Sch4 - Personal info] (Ecologist) and [Sch4 - Personal info] (Ranger).

4.4.4.6 Monitoring site locations

The final selection of habitat quality monitoring site locations in the field was informed by a combination of the following:

- The spatial co-ordinates (as provided by Woongal Environmental Services) for the locations specified in the OAMP as the indicative locations for 56 monitoring sites;
- A GIS summary (as provided by Woongal Environmental Services) of the specific vegetation communities and MNES and MSES offset management areas that each monitoring site is intended to sample in accordance with the OAMP;
- An intersect of the spatial co-ordinates of the indicative monitoring site locations with the ground-truthed vegetation community map for the MDW offset area (provided by Bravus), to confirm that the indicative location of each monitoring site is located within the vegetation community that the site is intended to sample;
- Access constraints that prevented safe access (in accordance with the CCMR Health, Safety, Environmental and Security Management Plan) to some of the indicative monitoring site locations, in which case alternative monitoring site locations were identified as a preferred alternative to the construction of new access tracks to permit improved access to the original monitoring site locations;
- Field ground-truthing of the vegetation community at the indicative location of each monitoring site, to ensure that the vegetation community matched that specified for the monitoring site; when ground-truthing and/or the GIS intersect confirmed a mis-match, an alternative location for the monitoring site was selected; and

- The final alignment of each 100 m monitoring plot was selected to incorporate a representative sample of the vegetation community characteristics in that area.

The initial GIS intersect of the spatial co-ordinates of the indicative monitoring site locations with the ground-truthed vegetation community map for the MDW offset area identified that the indicative locations for 14 of the 56 CCMR monitoring sites did not match the intended vegetation community as identified in the ground-truthed vegetation community map presented in the OAMP. Further inconsistencies identified in the OAMP were as follows:

- Three monitoring sites (sites 31 to 33) are intended to sample vegetation community assessment unit (AU) AU4 as well as habitat for Black-throated Finch and Yakka Skink, yet AU4 is not identified as habitat for these species in the OAMP; to address this issue, three additional sites were established;
- One monitoring site (site 46) is intended to sample AU12 as well as function as one of only two sites sampling significant wetland habitat that corresponds to RE 10.3.13a, yet RE 10.3.13a corresponds to AU9, not AU12; this site was established in AU9 at the original indicative location.

During field ground-truthing of the vegetation community at each of the indicative monitoring site locations, the following inconsistencies with the ground-truthed vegetation community mapping were identified:

- A sizable portion of a polygon mapped as AU1 in the north-west corner of the offset area (at the indicative location of monitoring site 12) was ground-truthed as AU3, consistent with the Queensland Herbarium Regional Ecosystem mapping. Since the extent of AU3 is easily discernable from aerial imagery (it corresponds to a reddish sands photo pattern), the mapping of the AU1 polygon was revised to include a polygon of AU3.
- A polygon mapped as AU9 (corresponding to RE 10.3.13a or RE 10.3.14d *Eucalyptus camaldulensis* on land zone (LZ) 3) between monitoring sites 12 and 47 was found to be neither *Eucalyptus camaldulensis* nor on LZ3. Instead, it was ground-truthed as RE 10.5.4 (*Eucalyptus drepanophylla* woodland on sand plains), which corresponds to AU12. The mapping of AU9 in this area is inconsistent with Queensland Herbarium Regional Ecosystem mapping, which identifies LZ5 not LZ3 in this area. The same is likely to apply to another polygon further north mapped as AU9 by the OAMP, since the Queensland Herbarium RE mapping also identifies this as LZ5 not LZ3; however, no ground-truthing took place at this more northerly polygon.
- A polygon mapped as AU9 (corresponding to RE 10.3.13a or RE 10.3.14d *Eucalyptus camaldulensis* on LZ3) at monitoring site 38 was ground-truthed as RE 10.3.6a, which corresponds to AU1. An additional alternative site for sampling AU9 was established at the original indicative location of site 48, where the mapping of AU9 was extended based on ground-truthing.
- A further polygon mapped as AU9 (corresponding to RE 10.3.13a or RE 10.3.14d *Eucalyptus camaldulensis* on LZ3) to the west of monitoring site 38 was ground-truthed as a mix of RE 10.3.6, RE 10.3.28 and/or RE 10.5.5, corresponding to AU1. The presence of *Eucalyptus camaldulensis* along the minor drainage line through this polygon is restricted to a single line of trees along the bed of the drainage line, which is too fine-scale to map as a distinct vegetation community.
- A polygon in the north-west corner of the offset area mapped as AU12 (corresponding to REs 10.3.12a, 10.5.2b or 10.5.10, all BVG18a) was ground-truthed as RE 10.5.4; since the latter also corresponds to AU12 (BVG18b) no alteration to the vegetation community mapping was required.

The vegetation community mapping of the MDW offset area was revised on the basis of the ground-truthing reported above, restricted only to these identified inconsistencies.

The locations of the 60 finalised habitat quality monitoring sites within the CCMR component are shown in Figure 4-11.

Each monitoring site included a 100 m transect, measured using a straight, 100 m tape extended to its full length, with the start and central points marked with a galvanised steel picket driven into the ground to chest height with plastic safety cap attached on top; at a handful of sites, the steel pickets were placed at the start and end points if the middle point was assessed as being located in a risky position for motorbike mustering. The GPS locations of the start, middle and end points of each monitoring site transect were recorded in GDA94, Zone 55 projection to sub-zero precision with a Trimble GPS.

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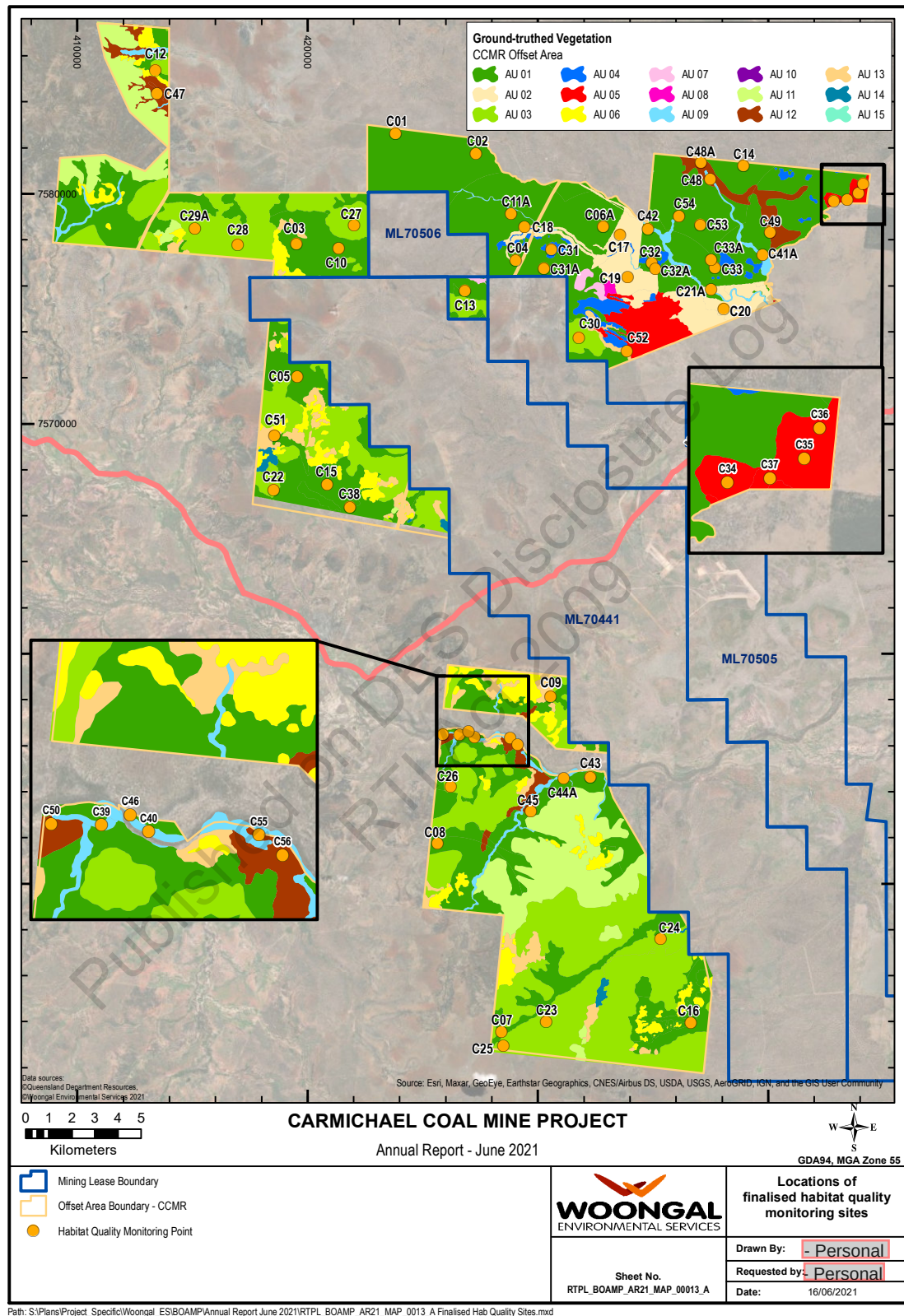


Figure 4-11. Habitat quality monitoring sites

4.4.4.7 Habitat quality assessment method

The habitat quality for each MNES is required to consider three attributes (CO2 Australia):

- site condition
- site context
- species habitat index.

The following sections provide an overview of the methodology used to calculate habitat quality. All three components were assessed for threatened fauna and flora species; however, for other MSES only site condition and site context components contributed to the habitat quality score.

To account for variance in vegetation community types, vegetation structure and quality of habitat within the offset site, the offset area was delineated into ‘assessment units’. In accordance with the approved OAMP, assessment units were based on a combination of condition state (remnant versus non-remnant regrowth) and broad vegetation groups (BVGs). While regional ecosystems characterize vegetation communities in Queensland based on a combination of bioregion, land zone (geology, landform and soil) and vegetation type (Neldner *et al.* 2019a), broad vegetation groups are a higher-level classification of regional ecosystems based on floristic, structural, functional, biogeographic and landscape attributes (Neldner *et al.* 2019b). Habitat quality was then measured separately for each assessment unit at the set of habitat quality monitoring sites within each assessment unit. The number of sampling sites for each assessment unit was specified in the OAMP based on the total area of the assessment unit within the offset area.

Site condition

The assessment of site condition was undertaken using the approach outlined in the Guide to Determining Terrestrial Habitat Quality (State of Queensland 2020), which is based on the BioCondition Assessment Manual, a field methodology developed by the Queensland Herbarium (Eyre *et al.* 2015) for measuring terrestrial habitat quality in accordance with the Queensland Government’s Environmental Offsets Policy. This approach aligns with the Commonwealth Government’s EPBC Act Environmental Offsets Policy measure of ‘habitat quality’ and is intended to provide a consistent framework for measuring habitat quality in Queensland.

The BioCondition Assessment Manual specifies that the best time for assessment of site condition is at the end of the summer rainfall growing season, when plant species richness is greatest. As a general rule of thumb, site assessment north of the Tropic of Capricorn should generally be conducted after the wet season, ideally between March and May, to ensure adequate sampling of ground cover species (Eyre *et al.* 2015). The assessment of site condition was undertaken by two teams over the period 8-19 April 2021. While some vegetation communities showed considerable drying of vegetation after the summer rainfall growing season, ground cover species richness and cover could still be adequately assessed, and nearly all grass species could be identified on the basis of flowering inflorescences. Thus, the site condition assessment was appropriately timed in accordance with the BioCondition Assessment Manual survey timing guidelines.

Site condition was assessed in the field using a suite of 13 attributes to describe the structure and function of the vegetation community. Each of these attributes was measured within a 100 m x 50 m plot as prescribed by the BioCondition Assessment Manual. A summary of the 13 site condition attributes and their maximum scores is provided in Table 4-15. The vegetation community at each site was ground-truthed as a regional ecosystem during the assessment. Each of the 13 site condition

attributes was then scored by comparing it to a benchmark that represents the expected range for that regional ecosystem in a relatively undisturbed state. The majority of the MDW offset area falls within the Desert Uplands bioregion, but a small portion in the north-east of the offset area falls within the Brigalow Belt North bioregion. There are currently no published regional ecosystem benchmarks for the Desert Uplands bioregion. Consequently, draft benchmarks were obtained from the Queensland Herbarium for those regional ecosystems for which draft benchmarks are available. For regional ecosystems that lack a draft benchmark, the approved OAMP specifies that a benchmark for a different regional ecosystem in the same BVG is to be used. The sum of the scores for each of the 13 attributes determined the final site condition score for each monitoring site out of a maximum score of 80, as summarised in Table 4-15.

Due to the uncertainty of benchmark values at the time of the field assessment, the diameter-at-breast-height (dbh) of all eucalypts >30 cm dbh (or >20cm dbh in some communities) and all non-eucalypts >20 cm dbh within the 100 m x 50 m plot at each monitoring site were measured and recorded.

GIS analysis of ecological indicators

The methods for deriving scores for site context and species habitat index include metrics that rely on GIS analysis of various spatial layers. The spatial layers used to assess the GIS-based ecological indicators were:

- Ground-truthed Regional Ecosystem map for the MDW offset area (OAMP GTRE with updates to 03/06/2021)
- Ground-truthed Regional Ecosystem map for the mine lease area (E2M GTRE 2020-10-20)
- Queensland Government biodiversity status of 2019 remnant regional ecosystems, Version 11, for areas outside the MDW offset area and mine lease areas
- Active Mining Area map
- Permanent and seasonal water source maps.

Site context

The method prescribed in the OAMP to calculate site context for each monitoring site is based on an adapted version of the site context assessment method used as part of the Guide to Determining Terrestrial Habitat Quality to ensure the requirements for site context under the offsets assessment guide are adequately assessed (CO2 Australia 2019).

The following components were assessed through a GIS desktop analysis at each relevant monitoring site for each MNES:

- patch size
- connectedness
- context; and
- ecological corridors.

Patch size

Patch size is the size of the patch/assessment unit being assessed and any directly connecting suitable/known habitat and remnant vegetation. To calculate the patch size score:

1. The area of vegetation in which the assessment unit is contained was added on to all other directly connecting areas of suitable or known habitat for the threatened species or community and remnant vegetation.
2. The score for patch size was then determined based on the category class ranges outlined in Table 4-8.

Suitable or known habitat was based on mapped vegetation comprising regional ecosystems known or likely to support the MNES value as defined in the offset strategy for the Project (Eco Logical Australia 2014).

Where the connecting patch comprised a RE that is known or suitable habitat, then 100% of the area of that RE was attributed to the total patch size area. Where the connecting RE is not considered known or suitable habitat but is a remnant RE, only 10% of the area of that RE was attributed to the total patch size area sum. The reduced weighting for non-compliant REs acknowledges the importance of these REs in contributing to the overall patch size through its contribution to supporting a source meta-population.

Connectedness

The proportion of the assessment unit's boundary that was connected to suitable/known habitat and remnant vegetation was measured. To calculate the connectedness score:

1. The percentage of suitable/known habitat and remnant vegetation along the boundary of the assessment unit was measured.
2. The score for connectedness was then determined based on the category class ranges outlined in Table 4-8.

Context

The percentage of suitable/known habitat and remnant vegetation within a 15 km buffer around the midpoint (50 m mark) of the monitoring site was measured. To calculate the context score:

1. A 15 km buffer around the midpoint of the monitoring site was created.
2. The percentage of suitable/known habitat and remnant vegetation within the buffer zone was measured.
3. The score for site context was then determined based on the category class ranges outlined in Table 4-8.

Ecological corridors

To calculate the ecological corridor score:

1. The location of the assessment unit containing the monitoring site was assessed in relation to the closest boundary of a state, bioregional, regional or sub-regional corridors (terrestrial or riparian) and categorised as: not within; sharing a common boundary; or within (whole or part) a state, bioregional, regional or sub-regional corridor.
2. The score for ecological corridors was then determined based on the category class ranges outlined in Table 4-8.

Table 4-8. Site context scoring categories

Patch size	Score	0	2	5	7	10
	Description	<5 ha	5-25 ha	26-100 ha	101-200 ha	>200 ha
Connectedness	Score	0	2	4	5	
	Description	0-10%	>10%-<50%	50-75%	>75% or >500 ha	
Context	Score	0	2	4	5	
	Description	<10%	>10-30%	>30-75%	>75%	
Ecological corridors	Score	0	4	6		
	Description	Not within	Sharing a common boundary	Within, whole or part		

The total site context score for each MNES at each relevant monitoring site was calculated out of a maximum possible score of 26.

4.4.4.8 Habitat suitability

The suitability of habitats for each MNES were derived from the habitat definitions provided in the MDW Ecological Equivalence Assessment Report (Eco Logical Australia 2014) that was provided as part of the approved Biodiversity Offset Strategy for the Project. These habitat definitions are summarised in Table 4-9 below.

Table 4-9. MNES habitat suitability within the MDW offset area

MNES	Assessment units	Regional Ecosystems
Black-throated Finch – high value habitat	1, 2, 9, 12	10.3.6a, 10.3.6ax1, 10.5.5a, 10.3.13a, 10.3.14d, 10.3.12a, 10.5.2b, 10.5.10
Black-throated Finch – medium value habitat	3, 10, 13, 15	10.5.1a, 10.5.1c, 10.5.1d, 10.3.14a, 10.7.4, 10.3.15g, 10.3.15k, 11.3.3
Ornamental Snake	4, 5, 7, 8	10.4.3a, 10.4.5a
Squatter Pigeon	1, 2, 3, 9, 10, 12, 13, 15	10.3.6a, 10.3.6ax1, 10.5.5a, 10.5.1a, 10.5.1c, 10.5.1d, 10.3.14a, 10.3.13a, 10.3.14d, 10.3.12a, 10.5.2b, 10.5.10, 10.7.4, 10.3.15g, 10.3.15k, 11.3.3
Yakka Skink	1, 2, 6, 11, 12, 13, 14	10.3.6a, 10.3.6ax1, 10.5.5a, 10.7.3a, 10.10.1a, 10.7.3c, 10.10.3, 10.10.4, 10.3.12a, 10.5.2b, 10.5.10, 10.7.4, 10.7.7
Waxy Cabbage Palm		10.3.12a, 10.3.13a, 10.3.14a, 11.3.3, 11.3.25

For the purposes of site context scoring calculations: (a) only remnant vegetation was characterised as suitable habitat for Black-throated Finch, Squatter Pigeon and Yakka Skink if it corresponded to the assessment units or REs listed in Table 4-9; and (b) both remnant and non-remnant vegetation was

characterised as suitable habitat for Ornamental Snake if it corresponded to the assessment units or REs listed in Table 4-9 within the offset area, or if it corresponded to REs 10.3.3, 10.3.4, 10.4.3a, 10.4.5, 11.3.1, 11.3.3, 11.4.5, 11.4.6, 11.4.8 or 11.4.9 outside the offset area.

4.4.4.9 Species habitat index

A quantitative method has been used to determine the species habitat index scores for Black-throated Finch, Ornamental Snake, Squatter Pigeon and Yakka Skink (Table 4-10). The method is based on the species habitat index method described in the Guide to Determining Habitat Quality as well as the requirements for species stocking rate under the EPBC Act Offsets Assessment Guide for species stocking rate, as described in Appendix D of the MDW OAMP.

Table 4-10. Method to assess species habitat index

Component	Sub-components	Score
Threats to species	<u>High threat level</u> (i.e. likely to result in death, irreversible damage): Site subject to a high level of threat, whether being part of a highly fragmented system, without core area, with extensive edge effect and limited previous, present and future management (pest animal management) realising an ongoing threat.	1
	<u>Moderate threat level</u> : Site subject to a moderate, realised level of threat, being part of a fragmented system with edge effects resulting in high edge/core area ratio and/or with previous, present and future management (e.g. pest animal management) resulting in a moderate level of threat.	7
	<u>Low threat level</u> (i.e. likely to survive): Limited actual or realised threat occur on or near the site. Not part of a fragmented system, with limited edge effects, and no intermediate threat from present or future management.	15
Quality and availability of food and foraging habitat	<u>Poor</u> : Very limited species-specific habitat (e.g. presence of gilgai and cracking clays for Ornamental Snake), conditions or resources available.	1
	<u>Moderate</u> : Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited.	5
	<u>High</u> : Species-specific habitat, conditions or resources for all relevant stages of the life cycle present.	10
Quality and availability of shelter	<u>Poor</u> : Very limited species-specific habitat (e.g. coarse woody debris for Ornamental Snake), conditions or resources available.	1
	<u>Moderate</u> : Species-specific habitat, conditions or resources for most relevant stages of the life cycle are present, yet limited.	5
	<u>High</u> : Species-specific habitat, conditions or resources for all relevant stages of the life cycle present.	10
Species mobility capacity This attribute should be measured in consideration of the present and severity of factors that would	<u>Severely restricted</u> (76-100% reduction): Natural barriers may include steep mountain ranges (cliffs), unsuitable habitats, major rivers/waterbodies or treeless areas more than 2 km wide. Artificial barriers may include infrastructure (such as roads, rail, mines), or developments that create treeless areas more than 2 km wide.	1
	<u>Highly restricted</u> (51-75% reduction)	4
	<u>Moderately restricted</u> (26-50% reduction)	7

Component	Sub-components	Score
contribute to a reduction in the mobility of the species.	<u>Minor restriction</u> (0-25% reduction)	10
Role of site location to species overall populations	<u>Not or unlikely to be critical to species' survival</u> : Site is unlikely to support a population of the species and site is within geographical range and site contains low quality food, foraging and shelter habitat.	1
	<u>Likely to support habitat critical to species' survival</u> : Site likely to support a population of the species and site is within geographical range and site contains moderate quality of food, foraging and shelter habitat.	3
	<u>Known to support habitat critical to species' survival</u> : Evidence of one or more species records within the last 10 years within 5 km of the site and contains greater than moderate food, foraging and shelter habitat.	4
	<u>Site is critical to species survival</u> : Evidence of multiple records within the last 10 years and site contains high quality food, foraging and shelter habitat.	5

Specific habitat index/stocking rate measures were developed for the four target fauna species to align with the methods. In addition to the site condition and site context field measures, a range of species-specific values were recorded in the field to inform the habitat index assessment. It should be noted that the offset areas are within an intact landscape, and therefore threats to species were focused on current and planned land management impacts.

The measures applied to derive habitat index scores for each of the target species are set out in Table 4-11 to Table 4-14.

Table 4-11. Black-throated Finch Habitat Index

Component	Sub-components	Score
Threats to species	<u>High threat level</u> : Vegetation clearing or thinning is planned; pasture improvement actions are planned (e.g. seeding with non-native grass species); cattle grazing has significant noticeable effects on habitat quality (grasses are heavily grazed, trampling and soil compaction); cattle use has significant noticeable effects on nearby water sources (degradation of riparian habitat and other water points that are ≤ 1 km distant) that decrease suitability for use by BTF; rabbits and feral cats are present and are not managed.	1
	<u>Moderate threat level</u> : No vegetation clearing or thinning is planned; pasture slashing is planned in the early wet season; no pasture improvement actions are planned; prescribed burning occurs when native grasses are seeding; cattle grazing is not controlled (e.g. wet season spelling) as has moderate noticeable effect on habitat quality; cattle use has moderate impact on suitability of nearby (≤ 1 km distant) water sources; rabbits and feral cats are present and not managed.	7
	<u>Low threat level</u> : No vegetation clearing or thinning is planned; no pasture slashing is planned; no pasture improvement actions are planned; prescribed burning is planned to favour native grass species (particularly early-flowering perennials); cattle grazing is absent or	15

Component	Sub-components	Score
	does not occur when food source plants are seeding (e.g. wet season spelling is in place); nearby (≤ 500 m) suitable permanent water sources are protected from cattle damage; rabbits and feral cats are managed.	
Quality and availability of food and foraging habitat	<u>Poor</u> : Native grass species richness scores 0-1; invasive non-native grass or other groundcover species that are not a food source for BTF are dominant; water sources within 3 km are limited to temporary sources following rainfall.	1
	<u>Moderate</u> : Native grass species richness scores 2-3; invasive non-native grass and other groundcover species that are not a food source for BTF are present but not dominant; the site is not within 3 km of a permanent water source accessible to and suitable for BTF and drinking water is limited to temporary sources following rainfall.	5
	<u>High</u> : At least two key grass species (those species previously recorded as food for BTF) are present at the site; invasive non-native grass and other groundcover species that are not a food source for BTF are absent or occur in low numbers/densities; the site is within 3 km of a permanent water source accessible to and suitable for BTF.	10
Quality and availability of shelter	<u>Poor</u> : Habitat is not grassy woodland or open forest dominated by eucalypts, paperbarks or acacias.	1
	<u>Moderate</u> : Habitat is a non-remnant, grassy woodland or open forest dominated by eucalypts, paperbarks or acacias.	5
	<u>High</u> : Habitat is a remnant, grassy woodland or open forest dominated by eucalypts, paperbarks or acacias.	10
Species mobility capacity This attribute should be measured in consideration of the present and severity of factors that would contribute to a reduction in the mobility of the species.	<u>Severely restricted</u> : Percentage of suitable/known habitat and remnant vegetation within a 15 km buffer around the site/Assessment Unit is 0-10% (see results of the BioCondition 'Connectedness measure).	1
	<u>Highly restricted</u> : Percentage of suitable/known habitat and remnant vegetation within a 15 km buffer around the site/Assessment Unit is $>10\%$ and $<50\%$ (see results of the BioCondition 'Connectedness measure).	4
	<u>Moderately restricted</u> : Percentage of suitable/known habitat and remnant vegetation within a 15 km buffer around the site/Assessment Unit is 50-75% (see results of the BioCondition 'Connectedness measure).	7
	<u>Minor restriction</u> : Percentage of suitable/known habitat and remnant vegetation within a 15 km buffer around the site/Assessment Unit is $>75\%$ or >500 ha (see results of the BioCondition 'Connectedness measure).	10
Role of site location to species overall populations	<u>Not or unlikely to be critical to species' survival</u> : All sites are within range. The site scored 1 for 'Quality and availability of food and foraging habitat' and 1 for 'Quality and availability of shelter'.	1
	<u>Likely to support habitat critical to species' survival</u> : All sites are within range. The site scored at least 5 and up to 10 for both 'Quality and availability of food and foraging habitat' and 'Quality and availability of shelter'.	3
	<u>Known to support habitat critical to species' survival</u> : Evidence of one or more BTF records within the last 10 years within 5 km of the site;	4

Component	Sub-components	Score
	the site scored at least 5 and up to 10 for both 'Quality and availability of food and foraging habitat' and 'Quality and availability of shelter'.	
	<u>Site is critical to species survival:</u> Multiple BTF records within the last 10 years within 5 km of the site; the site scored 10 for 'Quality and availability of food and foraging habitat' and 10 for 'Quality and availability of shelter'.	5

Table 4-12. Ornamental Snake Habitat Index

Component	Sub-components	Score
Threats to species	<u>High threat level:</u> Vegetation clearing or thinning is planned within or adjacent to habitat; ripping of clay soils is planned; alteration to surface hydrology is planned; evidence of European Foxes and/or Feral Cats; evidence of high numbers of Cane Toads present; Cattle grazing and/or Feral Pigs have noticeable effects on habitat quality (particularly soil compaction); no feral animal management; non-native plant cover scores between 0 and 3.	1
	<u>Moderate threat level:</u> No vegetation clearing or thinning is planned within or adjacent to habitat; no ripping of clay soils is planned; no alteration to surface hydrology is planned; low numbers of Cane Toads present; Cattle grazing and/or Feral Pigs have no noticeable effect on habitat quality (particularly soil compaction); no feral animal management; non-native plant cover scores 5.	7
	<u>Low threat level:</u> No vegetation clearing or thinning is planned within or adjacent to habitat; no ripping of clay soils is planned; no alteration to surface hydrology is planned; low numbers of Cane Toads present; Cattle grazing and/or Feral Pigs have no noticeable effect on habitat quality (particularly soil compaction); feral animal management is in place; non-native plant cover scores 10.	15
Quality and availability of food and foraging habitat	<u>Poor:</u> Surface water is absent despite recent rainfall or site is considered unlikely to retain water following rainfall; no or few frogs are apparent despite suitable temperatures/season.	1
	<u>Moderate:</u> Surface water is not well-retained following rainfall, or site is considered unlikely to retain water for more than a week following rainfall; few frogs are apparent despite suitable temperatures/season.	5
	<u>High:</u> Surface water is present or likely to be retained for longer than a week following rainfall.	10
Quality and availability of shelter	<u>Poor:</u> Vegetation may be cleared or intact; no gilgai depressions or soil cracks are present; very little fallen timber is present (coarse woody debris scores ≤ 1).	1
	<u>Moderate:</u> Vegetation may be cleared or intact; gilgai depressions or soil cracks are infrequent or are shallow; there is some fallen timber (coarse woody debris scores 2-3).	5
	<u>High:</u> Vegetation may be cleared or intact; diverse gilgai depressions are present and/or soil cracks are frequent and deep; there is plentiful fallen timber (coarse woody debris scores 4-5).	10
Species mobility capacity	<u>Severely restricted:</u> Percentage of remnant vegetation within a 1 km radius is 0-25%.	1

Component	Sub-components	Score
This attribute should be measured in consideration of the present and severity of factors that would contribute to a reduction in the mobility of the species.	<u>Highly restricted</u> : Percentage of remnant vegetation within a 1 km radius is 26-50%.	4
	<u>Moderately restricted</u> : Percentage of remnant vegetation within a 1 km radius is 51-75%.	7
	<u>Minor restriction</u> : Percentage of remnant vegetation within a 1 km radius is 76-100%.	10
Role of site location to species overall populations	<u>Not or unlikely to be critical to species' survival</u> : All sites are within range. The site scored 1 for 'Quality and availability of food and foraging habitat' and 1 for 'Quality and availability of shelter'.	1
	<u>Likely to support habitat critical to species' survival</u> : All sites are within range. The site scored at least 5 and up to 10 for both 'Quality and availability of food and foraging habitat' and 'Quality and availability of shelter'.	3
	<u>Known to support habitat critical to species' survival</u> : Evidence of one or more Ornamental Snake record within the last 10 years within 5 km of the site; the site scored at least 5 and up to 10 for both 'Quality and availability of food and foraging habitat' and 'Quality and availability of shelter'.	4
	<u>Site is critical to species survival</u> : Multiple Ornamental Snake records within the last 10 years within 5 km of the site; the site scored 10 for 'Quality and availability of food and foraging habitat' and 10 for 'Quality and availability of shelter'.	5

Table 4-13. Squatter Pigeon Habitat Index

Component	Sub-components	Score
Threats to species	<u>High threat level</u> : Vegetation clearing or thinning is planned; Cattle grazing has noticeable effects on habitat quality; no feral animal management.	1
	<u>Moderate threat level</u> : No vegetation clearing or thinning is planned; Cattle grazing has little or moderate effect on habitat quality; no feral animal management.	7
	<u>Low threat level</u> : No vegetation clearing or thinning is planned; Cattle grazing is absent or has little noticeable effect on habitat quality; feral animals are managed, particularly Feral Cats.	15
Quality and availability of food and foraging habitat	<u>Poor</u> : Surface water is absent despite recent rainfall or site is considered unlikely to retain water following rainfall; no or few frogs are apparent despite suitable temperatures/season.	1
	<u>Moderate</u> : Surface water is not well-retained following rainfall, or site is considered unlikely to retain water for more than a week following rainfall; few frogs are apparent despite suitable temperatures/season.	5
	<u>High</u> : Surface water is present or likely to be retained for longer than a week following rainfall.	10
Quality and availability of shelter	<u>Poor</u> : Few or no legumes present (e.g. Stylo); native grass richness scores 0-1.	1

Component	Sub-components	Score
	<u>Moderate</u> : Legumes and/or native grass present; native grass richness scores >1 and ≤3.	5
	<u>High</u> : Legumes and/or native grass present; native grass richness scores >3 and ≤5.	10
Species mobility capacity This attribute should be measured in consideration of the present and severity of factors that would contribute to a reduction in the mobility of the species.	<u>Severely restricted</u> : Percentage of remnant vegetation within a 1 km radius is 0-25%.	1
	<u>Highly restricted</u> : Percentage of remnant vegetation within a 1 km radius is 26-50%.	4
	<u>Moderately restricted</u> : Percentage of remnant vegetation within a 1 km radius is 51-75%.	7
	<u>Minor restriction</u> : Percentage of remnant vegetation within a 1 km radius is 76-100%.	10
Role of site location to species overall populations	<u>Not or unlikely to be critical to species' survival</u> : All sites are within range. The site scored 1 for 'Quality and availability of food and foraging habitat' and 1 for 'Quality and availability of shelter'.	1
	<u>Likely to support habitat critical to species' survival</u> : All sites are within range. The site scored at least 5 and up to 10 for both 'Quality and availability of food and foraging habitat' and 'Quality and availability of shelter'.	3
	<u>Known to support habitat critical to species' survival</u> : Evidence of one or more Squatter Pigeon record within the last 10 years within 5 km of the site; the site scored at least 5 and up to 10 for both 'Quality and availability of food and foraging habitat' and 'Quality and availability of shelter'.	4
	<u>Site is critical to species survival</u> : Multiple Squatter Pigeon records within the last 10 years within 5 km of the site; the site scored 10 for 'Quality and availability of food and foraging habitat' and 10 for 'Quality and availability of shelter'.	5

Table 4-14. Yakka Skink Habitat Index

Component	Sub-components	Score
Threats to species	<u>High threat level</u> : Vegetation clearing or thinning is planned; ripping of rabbit warrants is planned; feral cats are not actively managed; Cattle grazing and/or Feral Pigs have noticeable effects on habitat quality; non-native plant cover scores between 0 and 3.	1
	<u>Moderate threat level</u> : No vegetation clearing or thinning is planned; Cattle grazing has little or moderate effect on habitat quality; no feral animal management; non-native plant cover scores ≤5.	7
	<u>Low threat level</u> : No vegetation clearing or thinning is planned; Cattle grazing is absent or has little effect on habitat quality; Feral Cats are actively managed; non-native plant cover scores ≤10.	15
Quality and availability of food and foraging habitat	<u>Poor</u> : Few invertebrates (e.g. beetles, grasshoppers, spiders) apparent; few soft plants and fruits available in number (sparse) and in richness (native forb and shrub richness score ≤1).	1

Component	Sub-components	Score
	<u>Moderate</u> : Noticeable invertebrates present; soft plants (forbs) and/or fruits present are available in number (occasional) and in richness (native forb and/or shrub richness score 2-3).	5
	<u>High</u> : Plentiful invertebrates present; soft plants (forbs) and/or fruits present are available in number (frequent) and in richness (native forb and/or shrub richness score 4-5).	10
Quality and availability of shelter	<u>Poor</u> : Very little fallen timber (coarse woody debris scores ≤ 1); very little leaf litter and fallen bark (organic litter scores ≤ 1); no burrows or hollow-bearing logs suitable for Yakka Skink within the 50 x 100m plot or adjacent to it.	1
	<u>Moderate</u> : Some fallen timber (coarse woody debris scores 2-3); some leaf litter and fallen bark (organic litter scores 2-3); infrequent buried rocks; no rabbit warrens present.	5
	<u>High</u> : Plentiful fallen timber (coarse woody debris scores 4-5); plentiful leaf litter and fallen bark (organic litter scores 4-5); frequent buried rocks; two or more burrows or hollow-bearing logs suitable for Yakka Skink within the 50 x 100m plot.	10
Species mobility capacity This attribute should be measured in consideration of the present and severity of factors that would contribute to a reduction in the mobility of the species.	<u>Severely restricted</u> : Percentage of remnant vegetation within a 1 km radius is 0-25%.	1
	<u>Highly restricted</u> : Percentage of remnant vegetation within a 1 km radius is 26-50%.	4
	<u>Moderately restricted</u> : Percentage of remnant vegetation within a 1 km radius is 51-75%.	7
	<u>Minor restriction</u> : Percentage of remnant vegetation within a 1 km radius is 76-100%.	10
Role of site location to species overall populations	<u>Not or unlikely to be critical to species' survival</u> : All sites are within range. The site scored 1 for 'Quality and availability of food and foraging habitat' and 1 for 'Quality and availability of shelter'.	1
	<u>Likely to support habitat critical to species' survival</u> : All sites are within range. The site scored at least 5 and up to 10 for both 'Quality and availability of food and foraging habitat' and 'Quality and availability of shelter'.	3
	<u>Known to support habitat critical to species' survival</u> : Evidence of one or more Yakka Skink record within the last 10 years within 5 km of the site; the site scored at least 5 and up to 10 for both 'Quality and availability of food and foraging habitat' and 'Quality and availability of shelter'.	4
	<u>Site is critical to species survival</u> : Multiple Yakka Skink records within the last 10 years within 5 km of the site; the site scored 10 for 'Quality and availability of food and foraging habitat' and 10 for 'Quality and availability of shelter'.	5

4.4.4.10 Final habitat quality score

The final habitat quality score for each MNES was calculated in accordance with Section 8 of the Guide to Determining Terrestrial Habitat Quality. Table 4-15 provides a summary of the components used to

score habitat quality at each habitat quality monitoring site for each MNES and the maximum score and relevant weighting for each component as specified in the OAMP (CO2 Australia 2019).

Table 4-15. Maximum habitat quality site score for each component and attribute

Site condition		Site context		Species habitat index	
Recruitment of woody perennial species	5	Size of patch	10	Threats to species	15
Native plant species richness - trees	5	Connectivity	5	Quality and availability of food and foraging habitat	10
Native plant species richness - shrubs	5	Context	5	Quality and availability of shelter	10
Native plant species richness - grasses	5	Ecological corridors	6	Species mobility capacity	10
Native plant species richness - forbs	5			Role of site location to species overall population in the state	5
Tree canopy height	5				
Tree canopy cover	5				
Shrub canopy cover	5				
Native perennial grass cover	5				
Organic litter	5				
Large trees	15				
Coarse woody debris	5				
Non-native plant cover	10				
Total	/80	Total	/26	Total	/50
Weighting	51%	Weighting	17%	Weighting	32%

The habitat quality score for each assessment unit and each MNES or MSES was calculated as the average area-weighted score across all monitoring sites for each assessment unit, MNES or MSES, using the example outlined below.

The average habitat quality score for an assessment unit (AU) was calculated as:

$$AU(average) = \frac{S1 + S2 + \dots Sx}{N}$$

where:

AU(average) = the average habitat quality score for the assessment unit;

Sx = the habitat quality score for monitoring site x in the assessment unit; and

N = the number of monitoring sites sampled within the assessment unit.

The size weighting for each assessment unit (AU) was calculated as:

$$AU(size\ weighting) = \frac{Assessment\ unit\ area\ (ha)}{Total\ offset\ management\ area\ (ha)}$$

The area-weighted habitat quality score for an assessment unit (AU) was calculated as:

$$Z = AU(average) \times AU(size\ weighting)$$

where:

Z = the area-weighted habitat quality score for an assessment unit;

AU(average) = the average habitat quality score for the assessment unit;

AU(size weighting) = size weighting for the assessment unit.

The final habitat quality score for the relevant MNES or MSES was then calculated as the sum of the area-weighted habitat quality scores across all assessment units relevant to the MNES or MSES.

4.4.4.11 *Additional measures for Black-throated Finch*

The total number of preferred native foraging grass species for Black-throated Finch at each habitat quality assessment site is prescribed by the OAMP as one of the metrics to assess progress against interim performance targets. Therefore, all the native and non-native grass species detected within the 50m x 10m species richness plot were identified to species to record a grass species list for each habitat quality monitoring site within the Black-throated Finch offset management area.

A list of preferred native foraging grass species for Black-throated Finch was derived by combining the list of preferred native foraging grass species for Black-throated Finch prescribed in Table ES 1 of the Black-throated Finch Management Plan (Eco Logical Australia 2019) with any additional native species identified as providing a good food source for Black-throated Finch in the published literature or as part of the research program. The latter list was developed through consultation with research program scientists 4 - Personal in and 4 - Personal info. It should be noted that the research of preferred native foraging grass species for Black-throated Finch across Moray Downs Station is still a work in progress; therefore, the list of preferred native foraging grass species for Black-throated Finch is expected to be finalised only once the relevant components of the research program have been completed.

4.4.4.12 *Photo monitoring*

Photo monitoring was undertaken at the same time as habitat quality assessments and at each of the permanent habitat quality monitoring sites. In accordance with the OAMP specifications, five photos, including four landscape photos and one ground photo were taken at each of the start (0 m) and end (100 m) points at each monitoring site transect. In accordance with the BioCondition Assessment Manual (Eyre *et al.* 2015), a further four landscape photos were taken at the middle (50 m) point of each transect. All photos were taken from approximately 1.5 m height above ground level in the direction of magnetic north, south, east, west and ground. The landscape photos were taken in four directions, recorded as the closest direction to magnetic north, south, east, west, but two photos were taken in opposite directions in alignment with the transect midline and two photos were taken in opposite directions at right angles to the transect midline. The ground shot was taken at the start and end points, looking down the transect midline with the camera angled such that the top of the photo coincided with a point 4 m from the start or end point. This provided a representative indication of cover and species composition for the ground cover. All photos were taken using an iPad blue-toothed to a Trimble GPS, with GPS co-ordinates, date and time of each photograph, and the direction in which the photo was taken recorded using a Fulcrum app.

4.4.4.13 *Targeted fauna surveys*

Targeted surveys for Ornamental Snake, Squatter Pigeon and Yakka Skink have been undertaken to inform the 'role of site location to species overall population' component of the species habitat index assessments which take account of records of the species within a 5 km radius of the habitat assessment sites. Records of Black-throated Finch were pooled between the location data held by the Black-throated Finch Research Team (including historical data), BTF surveys undertaken to meet the requirements of the Black-throated Finch Management Plan (BAAM 2020, 2021) and incidental records by ecological survey teams and land managers.

4.4.4.14 Results

The total areas of habitat, split by assessment unit, within the offset management areas for each MNES and MSES are summarised in Table 4-16.

The average habitat quality scores (out of a maximum score of 10) for each assessment unit within the offset management areas for each MNES and MSES are summarised in Table 4-17.

The final, area-weighted habitat quality scores (out of a maximum score of 10) for each MNES and MSES are summarised in Table 4-18.

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Table 4-16. Summary of the total areas of habitat for each MNES/MSES within their respective offset management area in the MDW offset area.

MNES/MSES	Assessment unit area (ha) within the relevant offset management area														
	AU1	AU2	AU3	AU4	AU5	AU6	AU7	AU9	AU10	AU11	AU12	AU13	AU14	AU15	Total
Black-throated Finch (critical)	8,261.36	1,346.22						415.13			479.50				10,502.21
Black-throated Finch (core)	6,060.93	4.73	36.07					169.47		0.12	385.34				6,656.66
Black-throated Finch (marginal)	0.01		2,753.95						8.58			175.52			2,938.06
Squatter Pigeon	1,281.15		765.12					157.03	8.58		231.98	64.10			2,507.96
Ornamental Snake					137.74										137.74
Yakka Skink	5,178.53	9.11						12.45			410.05				5,610.14
Waxy Cabbage Palm	25.38							34.74			22.05	0.66			82.82
Wetland protection area	12.69							6.27			4.65				23.61
Significant wetland								10.73							10.73
RE 11.3.3 (BVG 16)	2.71							1.02	8.58						12.30
Watercourse vegetation	465.16	51.97	78.29	19.10	17.73	32.82	6.41	572.13		69.80	53.59	13.40	2.89		1,383.29
Connectivity	1,161.22		1,594.70			189.11		133.08	8.58	1,642.01	185.60	51.75	8.08		4,974.13

Table 4-17. Summary of the average habitat quality scores (out of a maximum score of 10) for each assessment unit within the offset management areas for each MNES and MSES

	Average score (out of 10) for each assessment unit (AU)								
MNES/MSES	AU1	AU2	AU3	AU4	AU5	AU9	AU10	AU12	AU13
Black-throated Finch (critical)	7.8	6.9				7.7		8.1	
Black-throated Finch (core)	7.7					6.8		7.8	
Black-throated Finch (marginal)			7.4				8.2		8.8
Squatter Pigeon	8.2		8.1			7.5	7.2	8.5	
Ornamental Snake					6.4				
Yakka Skink	7.1							7.8	
Waxy Cabbage Palm						8.3		8.4	
Wetland protection area						8.5		7.8	
Significant wetland						8.3			
RE 11.3.3 (BVG 16)							8.6		
Watercourse vegetation	8.4	6.8	6.7	8.0		7.9		8.5	8.3
Connectivity			6.7			8.3		8.7	

Table 4-18. Summary of the final area-weighted habitat quality scores (out of a maximum score of 10) for each assessment unit within the offset management areas for each MNES and MSES.

MNES/MSES	Final score	Weighted assessment unit (AU) habitat quality score ¹								
		AU1	AU2	AU3	AU4	AU5	AU9	AU10	AU12	AU13
Black-throated Finch (critical)	7.7	6.2	0.9				0.3		0.4	
Black-throated Finch (core)	7.7	7.0					0.2		0.5	
Black-throated Finch (marginal)	7.5			6.9						0.5
Squatter Pigeon	8.2	4.3		2.5			0.5		0.8	
Ornamental Snake	6.4					6.4				
Yakka Skink	7.1	6.6							0.6	
Waxy Cabbage Palm	8.4						5.1		3.2	
Wetland protection area	8.2						4.9		3.3	
Significant wetland	8.3						8.3			
RE 11.3.3 (BVG 16)	8.6							8.6		
Watercourse vegetation	8.0	3.1	0.3	0.4	0.1		3.6		0.4	0.1
Connectivity	7.0			5.5			0.6		0.8	

4.4.5 Targeted Fauna Surveys

4.4.5.1 *Ornamental Snake*

During the targeted Ornamental Snake surveys 1 individual Ornamental Snake was recorded during nocturnal spotlighting within the CCMP Ornamental Snake OMA within 400 m of a significant tract of mostly intact remnant vegetation representing preferred Ornamental Snake habitat (Brigalow woodland with gilgaied soils) that is outside of the property boundary.

Many gilgais were dry, which may be a function of the landscape/soil type not being able to hold water for long periods, particularly where vegetation cover has been removed and evaporation of surface water is high. Alternatively, the survey may have been too late in the wet season to record all potential activity. The timing of the surveys is difficult as wet conditions do not favour vehicle access. In future, Woongal site ecologists will be leading the surveys and as they have a permanent presence on site, the timing of surveys should be as close to a period of good rainfall as possible and as soon as tracks are trafficable.

The poor condition of the vegetation in both offset areas due to previous clearing would have a significant influence on the quality of habitat for Ornamental Snake, although the detection of one Ornamental Snake within the CCMP Ornamental Snake OMA influences the habitat quality scoring in the offset management area as the record is within 5 km of the habitat quality survey sites.

4.4.5.2 *Squatter Pigeon*

During the targeted Squatter Pigeon surveys 52 individual Squatter Pigeons were recorded within the CCMP Squatter Pigeon Offset Management Area. All of these were observed during slow drive transects, with none observed during the flushing surveys on foot.

A further 1,115 Squatter Pigeons have been recorded as incidental sightings during the course of other, recent ecological surveys and land management activities (2020/21) within 5 km of the boundary of the offset management area.

4.4.5.3 *Yakka Skink*

During the targeted Yakka Skink surveys no Yakka Skinks were observed. Two excavated soil mounds/burrows were recorded. One of these was inactive as evidenced by undisturbed vegetation and spider web across its entrance and a search found no further burrows/entrances and no latrines or basking sites in the vicinity. The other record was of several burrows and mounded earth and was considered to have potential for Yakka Skink, although no further burrows and no latrines or basking sites were found in the vicinity. While the lead ecologist was quite certain the burrows were not supporting Yakka Skinks, camera traps were set at this location for a period of 4 nights (8 camera trap nights) to confirm. The cameras did not capture Yakka Skink activity.

In northern Queensland the distribution of the species is poorly known with scattered records in several locations, including in the Einasleigh Uplands, Wet Tropics and Cape York Peninsula Biogeographic Regions (Ferguson and Mathieson, 2014). Yakka Skink distribution is known to be patchy throughout its range, and while the dominant remnant vegetation and soil types are suitable for the species and there are some areas that contain moderate quantities of coarse woody debris and leaf litter that are preferred habitat, it is possible that the species does not occur in this location.

The nearest record of Yakka Skink from the Atlas of Living Australia is 82 km south west of the OMA, on the south western edge of Lake Galilee.

4.4.6 Assessment of Year 1 results against interim performance targets and completion criteria

The interim performance targets and completion criteria for offset values (MNES and MSES) within the MDW offset area are summarised in Table 4-19. A comparison of the year 1 habitat quality assessment results with interim performance targets for year 5 is summarised in Table 4-20 to indicate progress towards meeting the year 5 interim performance targets. The offset year 1 habitat quality scores exceed the year 5 interim performance targets for habitat quality for all MNES and MSES.

It should be noted that the starting habitat quality scores outlined in the OAMP are not directly comparable to the year 1 habitat quality scores for the following reasons:

- The method used to calculate the site context score differs between the OAMP starting habitat quality scoring approach and the prescribed approach for monitoring habitat quality. Specifically, site context scoring for starting habitat quality used the method for an intact landscape, whereas the approach for monitoring habitat quality, outlined in Section 4.4.4 above, used the method for a fragmented landscape.
- The OAMP starting habitat quality scoring did not include scoring for species habitat index, whereas the approach for monitoring habitat quality prescribed in the OAMP, outlined in Section 4.4.4 above, does include a scoring component for species habitat index.
- The field assessment for site condition scoring of starting habitat quality was undertaken over the period 8-14 September 2014 in the late dry season, when the species richness of grass and forb life forms may be difficult to quantify for species that become undetectable after extended dry conditions, and no reference sites were established. By contrast, the Year 1 monitoring field assessment was undertaken over the period 8-19 April 2021, within the recommended March to May timing to ensure appropriate sampling of ground cover species (Eyre et al. 2015).

Table 4-19. Interim performance targets and completion criteria for offset values (MNES and MSES) within the MDW offset area

Offset value	Start habitat quality	Interim performance target – Year 5	Interim performance target – Year 10	Completion criteria – Year 20
Black-throated Finch	Critical: 8 Core: 7 Marginal: 6	Improve the quality of Black-throated Finch habitat to achieve the following habitat quality scores for Black-throated Finch: <ul style="list-style-type: none"> - Critical: >8 - Core: ≥8 - Marginal: >6 	Improve the quality of Black-throated Finch habitat to achieve the following habitat quality scores for Black-throated Finch: <ul style="list-style-type: none"> - Critical: >8 - Core: ≥8 - Marginal: >6 	Improve the quality of Black-throated Finch habitat to achieve the following habitat quality scores for Black-throated Finch: <ul style="list-style-type: none"> - Critical: 9 - Core: 9 - Marginal: 7
		Presence of one or more of the preferred native foraging grass species for Black-throated Finch (as listed in Appendix 5) at each habitat quality assessment site.	Presence of two or more of the preferred native foraging grass species for Black-throated Finch (as listed in Appendix 5) at each habitat quality assessment site.	Presence of four or more of the preferred native foraging grass species for Black-throated Finch (as listed in Appendix 5) at each habitat quality assessment site.
		Increase the average % cover of preferred native foraging grass species for Black-throated Finch at each habitat quality assessment site within the Black-throated Finch offset management area.	Increase the average % cover of preferred native foraging grass species for Black-throated Finch at each habitat quality assessment site within the Black-throated Finch offset management area.	Increase the average % cover of preferred native foraging grass species for Black-throated Finch at each habitat quality assessment site within the Black-throated Finch offset management area.
		Artificial watering points are installed and maintained in the Black-throated Finch offset management area.	Artificial watering points are maintained in the Black-throated Finch offset management area.	Artificial watering points are maintained in the Black-throated Finch offset management area.
		No increase in exotic perennial grass species richness and relative abundance such as Buffel Grass and Indian bluegrass at 80% of weed monitoring sites within the Black-throated Finch offset management area.	No increase in exotic perennial grass species richness and relative abundance such as Buffel Grass and Indian bluegrass at 80% of weed monitoring sites within the Black-throated Finch offset management area.	No increase in exotic perennial grass species richness and relative abundance such as Buffel Grass and Indian bluegrass at 80% of weed monitoring sites within the Black-throated Finch offset management area.
Waxy Cabbage Palm	7	Improve the quality of Waxy Cabbage Palm habitat to achieve a habitat quality score greater than 7.	Improve the quality of Waxy Cabbage Palm habitat to achieve a habitat quality score greater than 7.	Improve the quality of Waxy Cabbage Palm habitat to achieve a habitat quality score of at least 8.
		Increase the baseline population of WCP within the Waxy Cabbage Palm offset management area.	Increase the baseline population of WCP within the Waxy Cabbage Palm offset management area.	Increase the baseline population of WCP within the Waxy Cabbage Palm offset management area.
Ornamental Snake	5	Improve the quality of Ornamental Snake habitat to achieve a habitat quality score greater than 5.	Improve the quality of Ornamental Snake habitat to achieve a habitat quality score greater than 5.	Improve the quality of Ornamental Snake habitat to achieve a habitat quality score of at least 6.

Offset value	Start habitat quality	Interim performance target – Year 5	Interim performance target – Year 10	Completion criteria – Year 20
Squatter Pigeon	7	Improve the quality of Squatter Pigeon habitat to achieve a habitat quality score greater than 7.	Improve the quality of Squatter Pigeon habitat to achieve a habitat quality score greater than 7.	Improve the quality of Squatter Pigeon habitat to achieve a habitat quality score of at least 8.
Yakka Skink	6	Improve the quality of Yakka Skink habitat to achieve a habitat quality score greater than 6.	Improve the quality of Yakka Skink habitat to achieve a habitat quality score greater than 6.	Improve the quality of Yakka Skink habitat to achieve a habitat quality score of at least 7.
WPA and significant wetlands	5	Improve the quality of WPA and significant wetlands habitat to achieve a habitat quality score greater than 5.	Improve the quality of WPA and significant wetlands habitat to achieve a habitat quality score of at least 6.	Improve the quality of WPA and significant wetlands habitat to achieve a habitat quality score of at least 7.
Watercourse vegetation	6	Improve the quality of watercourse vegetation habitat to achieve a habitat quality score greater than 6.	Improve the quality of watercourse vegetation habitat to achieve a habitat quality score of at least 7.	Improve the quality of watercourse vegetation habitat to achieve a habitat quality score of at least 8.
RE 11.3.3 (BVG16)	5	Improve the quality of RE 11.3.3 (BVG16) habitat to achieve a habitat quality score greater than 5.	Improve the quality of RE 11.3.3 (BVG16) habitat to achieve a habitat quality score of at least 6.	Improve the quality of RE 11.3.3 (BVG16) habitat to achieve a habitat quality score of at least 7.
Connectivity	6	Improve the quality of connectivity habitat to achieve a habitat quality score greater than 6.	Improve the quality of connectivity habitat to achieve a habitat quality score of at least 7.	Improve the quality of connectivity habitat to achieve a habitat quality score of at least 8.

Table 4-20. Summary of Year 1 habitat quality assessment results against the Year 5 interim performance targets for offset values (MNES and MSES) within the MDW offset area

Offset value	Start habitat quality	Interim performance target – Year 5	Year 1 assessment results
Black-throated Finch	Critical: 8 Core: 7 Marginal: 6	Improve the quality of Black-throated Finch habitat to achieve the following habitat quality scores for Black-throated Finch: <ul style="list-style-type: none"> - Critical: >8 - Core: ≥8 - Marginal: >6 	Year 1 habitat quality scores for Black-throated Finch: <ul style="list-style-type: none"> - Critical: 7.7 - Core: 7.7 - Marginal: 7.5
		Presence of one or more of the preferred native foraging grass species for Black-throated Finch (as listed in Appendix 5) at each habitat quality assessment site.	The average number of preferred native foraging grass species for Black-throated Finch at each habitat quality assessment site was 9 (range 0 to 15).

Offset value	Start habitat quality	Interim performance target – Year 5	Year 1 assessment results
		Increase the average % cover of preferred native foraging grass species for Black-throated Finch at each habitat quality assessment site within the Black-throated Finch offset management area.	Average native perennial grass cover at Black-throated Finch habitat quality monitoring sites within the Black-throated Finch offset management area was 24%.
		Artificial watering points are installed and maintained in the Black-throated Finch offset management area.	No new artificial watering points have yet been established in the Black-throated Finch offset management area.
		No increase in exotic perennial grass species richness and relative abundance such as buffel grass and Indian bluegrass at 80% of weed monitoring sites within the Black-throated Finch offset management area.	This metric is addressed in the weed monitoring report that is independent to this habitat quality assessment report.
Waxy Cabbage Palm	7	Improve the quality of Waxy Cabbage Palm habitat to achieve a habitat quality score greater than 7.	Year 1 Waxy Cabbage Palm habitat quality score: 8.4 .
		Increase the baseline population of WCP within the Waxy Cabbage Palm offset management area.	The baseline population of WCP within the Waxy Cabbage Palm offset management area is reported in BAAM (2021).
Ornamental Snake	5	Improve the quality of Ornamental Snake habitat to achieve a habitat quality score greater than 5.	Year 1 Ornamental Snake habitat quality score: 6.4 .
Squatter Pigeon	7	Improve the quality of Squatter Pigeon habitat to achieve a habitat quality score greater than 7.	Year 1 Squatter Pigeon habitat quality score: 8.2 .
Yakka Skink	6	Improve the quality of Yakka Skink habitat to achieve a habitat quality score greater than 6.	Year 1 Yakka Skink habitat quality score: 7.1 .
WPA and significant wetlands	5	Improve the quality of WPA and significant wetlands habitat to achieve a habitat quality score greater than 5.	Year 1 WPA habitat quality score: 8.2 . Year 1 significant wetlands habitat quality score: 8.3 .
Watercourse vegetation	6	Improve the quality of watercourse vegetation habitat to achieve a habitat quality score greater than 6.	Year 1 watercourse vegetation habitat quality score: 8.0 .
RE 11.3.3 (BVG16)	5	Improve the quality of RE 11.3.3 (BVG16) habitat to achieve a habitat quality score greater than 5.	Year 1 RE 11.3.3 (BVG16) habitat quality score: 8.6 .
Connectivity	6	Improve the quality of connectivity habitat to achieve a habitat quality score greater than 6.	Year 1 connectivity habitat quality score: 7.0 .

4.4.7 Waxy Cabbage Palm Monitoring

4.4.7.1 *Methodology*

Population Survey

The first comprehensive population survey of Waxy Cabbage Palm including within the offset management area was conducted over ten days on 5-14 September 2019 (late dry season). The second population survey within the offset management area was conducted over two days on the 21st and 24th May 2021 (post-wet season). Survey team members traversed the offset management area on foot, spaced approximately 20-40 m apart to cover the entire survey area in a transect fashion actively searching for all Waxy Cabbage Palms. Wherever Waxy Cabbage Palms were detected, the following information was recorded using an iPad connected to a Trimble PG200 differential GPS unit (2-3 m precision); life stage and number of individuals within 5 m; condition measures and presence/absence of threats; and a photograph of any adult or sub-adult life stage individuals.

Condition Survey

The condition monitoring survey was conducted in October 2020. Six condition monitoring sites were established. At each site, two permanent transects of 100 x 20 m were established approximately parallel with the river. Transect A (inner) was as close as possible to the river within the offset management area, noting that the offset management area includes the banks of the main channel of Dyllingo Creek at only two of the six monitoring sites (sites C40 and C46). Transect B (outer) was at the extent of the population, furthest from the main river channel. The start and end points of each transect were recorded using differential GPS with sub-metre precision. The following information was recorded for each individual palm within each transect: spatial location (sub-metre precision); height (cm); life stage; condition (good, moderate, poor, dead); presence/absence of drought stress, fire damage, cattle or feral animal damage; severity of weeds; and a photograph of each individual.

4.4.7.2 *Results*

Population Survey

The total population size of Waxy Cabbage Palms within the offset management area in September 2019 was 888 palms, or 455 palms if seedlings are excluded (Table 4-21 and Figure 4-12). This corresponds to 9.5% of the total population surveyed along the Carmichael River/Dyllingo Creek, or 8.9% if seedlings are excluded. The second population survey in May 2021 recorded a total of 3137 Waxy Cabbage Palms within the offset management area, or 528 palms excluding seedlings. This second survey recorded an additional 78 non-seedling palms not detected during the first survey and provides a more accurate ratio of reproductive to non-reproductive adults. A substantially larger total of seedlings recorded in the May 2021 survey reflects good seedling establishment following river flooding events over the past three wet seasons. Of the palms recorded alive in the population survey of September 2019, only four palms had died by May 2021: a non-reproductive adult that had already been felled by erosion in September 2019; and two established palms and two rosettes that died due to flood damage. A further four fans detected after September 2019 at the condition monitoring sites died between October 2020 and May 2021, three buried under flood debris and one dug up by feral pigs.

Table 4-21. Waxy Cabbage Palm life stage structure for all living palms within the Waxy Cabbage Palm offset management area compared to that of the total population surveyed along the Carmichael River/Dyllingo Creek as a whole.

Life stage	Total population (September 2019)	Offset management area (September 2019)	% in offset management area (September 2019)	Offset management area (May 2021)
Adult (reproductive)	1363	153	11.2	150
Adult (non- reproductive)	131	10	7.6	27
Sub-adult	460	41	8.9	36
Established	955	83	8.7	94
Rosette	2046	164	8.0	206
Fan	152	4	2.6	15
Seedling	4234	433	10.2	2609
Total	9341	888	9.5	3137
Total (excl seedlings)	5107	455	8.9	528

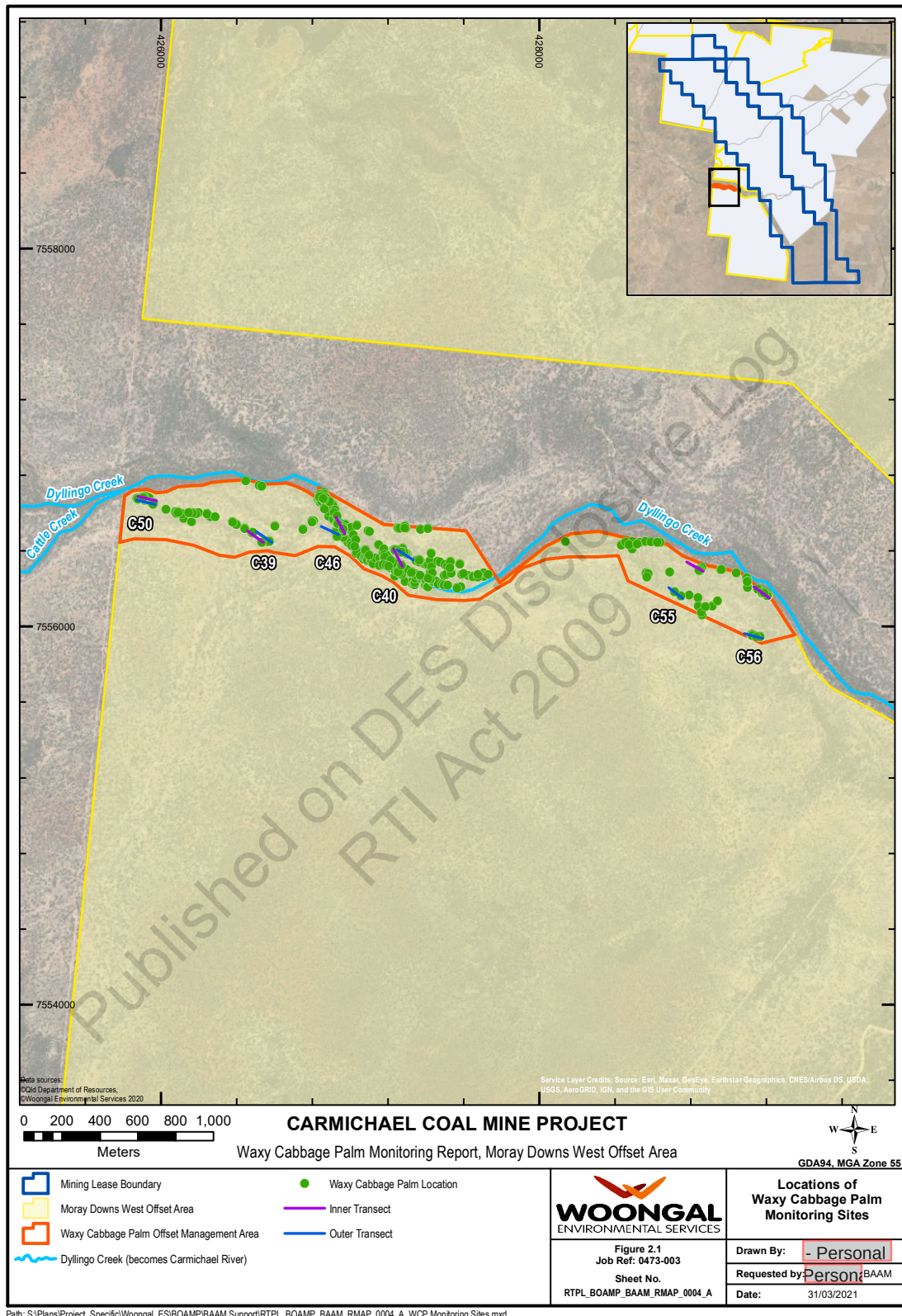


Figure 4-12. Location of Waxy Cabbage Palms and condition monitoring sites

Condition Monitoring

The total number of palms included in the six monitoring sites was 606 if seedlings are included, but 89 palms if seedlings are excluded (Table 4-22 and Figure 4-12). Excluding seedlings, the six monitoring sites incorporate 19.6% of the Waxy Cabbage Palms that occur within the offset management area. Seedlings were present in all monitoring plots containing reproductive adult palms, confirming successful reproduction in the monitored population. All living palms were in good condition, with no evidence of significant livestock browsing, feral animal damage, erosion or drought stress. Rubber Vine, a robust weed that may threaten the condition of Waxy Cabbage Palms was recorded at one site, where it was relatively abundant and had started climbing some palms.

Table 4-22. Waxy Cabbage Palm life stage structure for all living palms within each of the 100 x 20 m monitoring plots in October 2020

Monitoring site	Position	Adult (reproductive)	Adult (non-reproductive)	Sub-adult	Established	Rosette	Fan	Seedling	Total
C39	inner					2			2
C39	outer	1						10	11
C40	inner	5		1	1	3		202	212
C40	outer	9						83	92
C46	inner	2	1	2	5	4	2	75	91
C46	outer	1				2		45	48
C50	inner	2		1		2		10	15
C50	outer	10			2	3	3	44	62
C55	inner		1	2					3
C55	outer	2						28	30
C56	inner	5			2	4		14	25
C56	outer	4				5		6	15
Total		41	2	6	10	25	5	517	606

Overall, 71% of reproductive adult palms produced flowers during the 2020 flowering season, a percentage that was little different between adults in inner (closer to the main river channel, 71.4% flowering) versus outer (furthest from the main river channel, 70.4% flowering) monitoring positions. Among the palms that flowered, 48% had produced immature (small, pea-sized) fruit by October 2020; the inflorescences of the remaining 52% had dried out after flowering. The percentage of flowering adults that had produced immature fruit did not differ notably between inner (50% fruiting) versus outer (47% fruiting) monitoring positions.

4.4.7.3 Adaptive management for waxy cabbage palm

The MDW OAMP specifies that older life forms (sub-adult and older) will be permanently tagged. Due to the large number of older palms in the study area, as well as the potential for tags to damage palms, the location of individuals was recorded using sub-metre GPS essentially providing the same dataset.

The following management actions are recommended:

- control rubber vine along the entire section of the Carmichael River and associated floodplain within the WCP offset management area, focusing initially at and upstream of site C46 and then downstream of this site. This action commenced in June 2021.
- control feral pigs along the entire section of the Carmichael River within the WCP offset management area, focusing initially at and around sites C40 and C50. This action commenced in June 2021.
- prior to any controlled burning of Waxy Cabbage Palm habitat within the WCP offset management area, rake away dead palm-leaf material from around the bases of adult palms to minimise the risk of fire damage to the trunks of adult palms. No controlled burns have been undertaken in this area to date.

4.4.8 Black-throated Finch Monitoring

4.4.8.1 Methodology

The methodology for BTF monitoring is set out in the BTFMP. The monitoring program consists of:

- Water point watches: Within MDW offset 6 sites – CWAT02, CWAT03, CWAT101, CWAT104, CWAT105 CWAT116 were surveyed for 3 (three) continuous hours commencing at dawn.
- Active searches: Conducted for 3 hours from dawn within a 600m radius of all MDW offset water point sites.
- One kilometre transects: A slow walk along a predetermined 1 km transect searching for BTF birds and nests. These were conducted at all water point sites within the MDW OAMP Offset Area, and at an additional six sites that are not co-located with watering points.
- Water source inspections: During/after water point watches the details of watering point attributes were recorded.
- Incidental observations: Travelling to or from sites and continuously throughout the survey activities any BTF observations were recorded.

4.4.8.2 Monitoring Results

Table 4-23: BTF Monitoring Results for both the Mining Lease and Offset Area

#	Activity	BTFMP Requirement	Reporting Year Results – BTF Records
1	Water source watches	The following information will be recorded during water watches: a. Time of observation b. Number of individuals c. Other species present in mixed flocks d. Behaviour (e.g., foraging, drinking, perching, flying, etc).	June 2020 - 2 records October/November 2020 - 113 records March/April 2021 - 146 records
2	Active searches	Random meanders within one kilometre of each water point monitoring site will be undertaken for at least three hours with specific effort devoted to areas with grassy open-woodland habitat. One kilometre transects will also be undertaken during active searches.	June 2020 - 15 records October/November 2020 - 12 records March/April 2021 - 0 records

#	Activity	BTFMP Requirement	Reporting Year Results – BTF Records
3	Vegetation transects	BioCondition transects will be established to monitor the condition of BTF habitats	June 2020 - 1 record October/November 2020 - 0 records March/April 2021 - 2 records
4	Call playback	On advice from Bravus, call playback was implemented in March/April monitoring as a component of the 14 1 km DISTANCE method transects that are independent of the water source locations.	June 2020 - Not deployed October/November 2020 - Not deployed March/April 2021 - 0 records
5	Camera Traps	Cameras were deployed for a minimum of 4 days at each source, and for longer at sources where BTF were considered likely or have been recorded drinking previously. Cameras were fixed either to structures that were part of the cattle troughs, to trees where they were suitably positioned, or to purposely placed star pickets where no other structure was available.	June 2020 - Not deployed as start of project October/November 2020 - 0 records March/April 2021 - 7 records
6	Incidental observations	Opportunistic incidental sightings of BTF whilst travelling between survey sites	June 2020 - 51 records October/November 2020 - 10 records March/April 2021 - 10 records

Figure 4-13 to Figure 4-16 provide locations of survey and monitoring carried out through the reporting year.

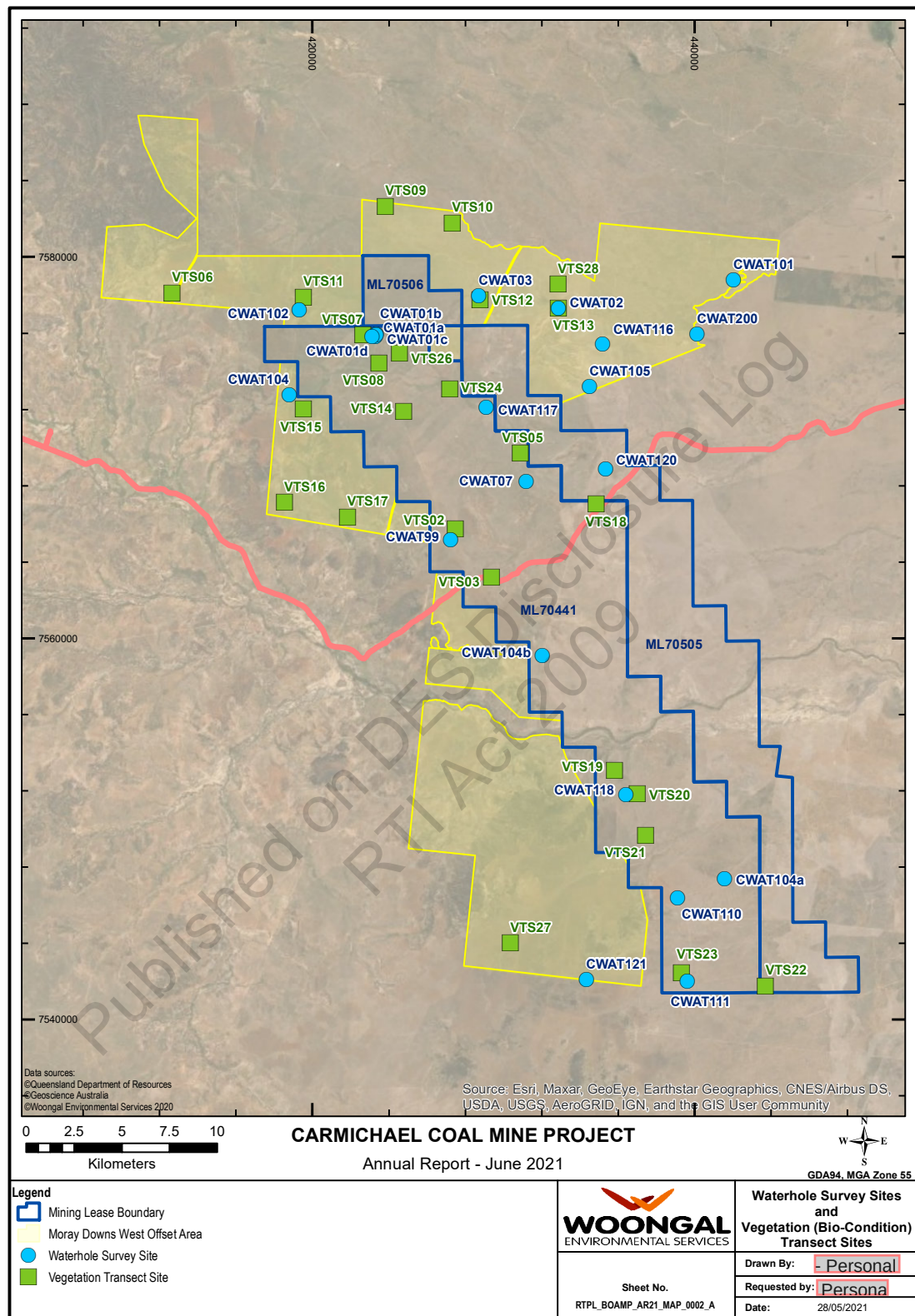


Figure 4-13. Location of BTF waterhole survey sites, and vegetation (BioCondition) transect sites

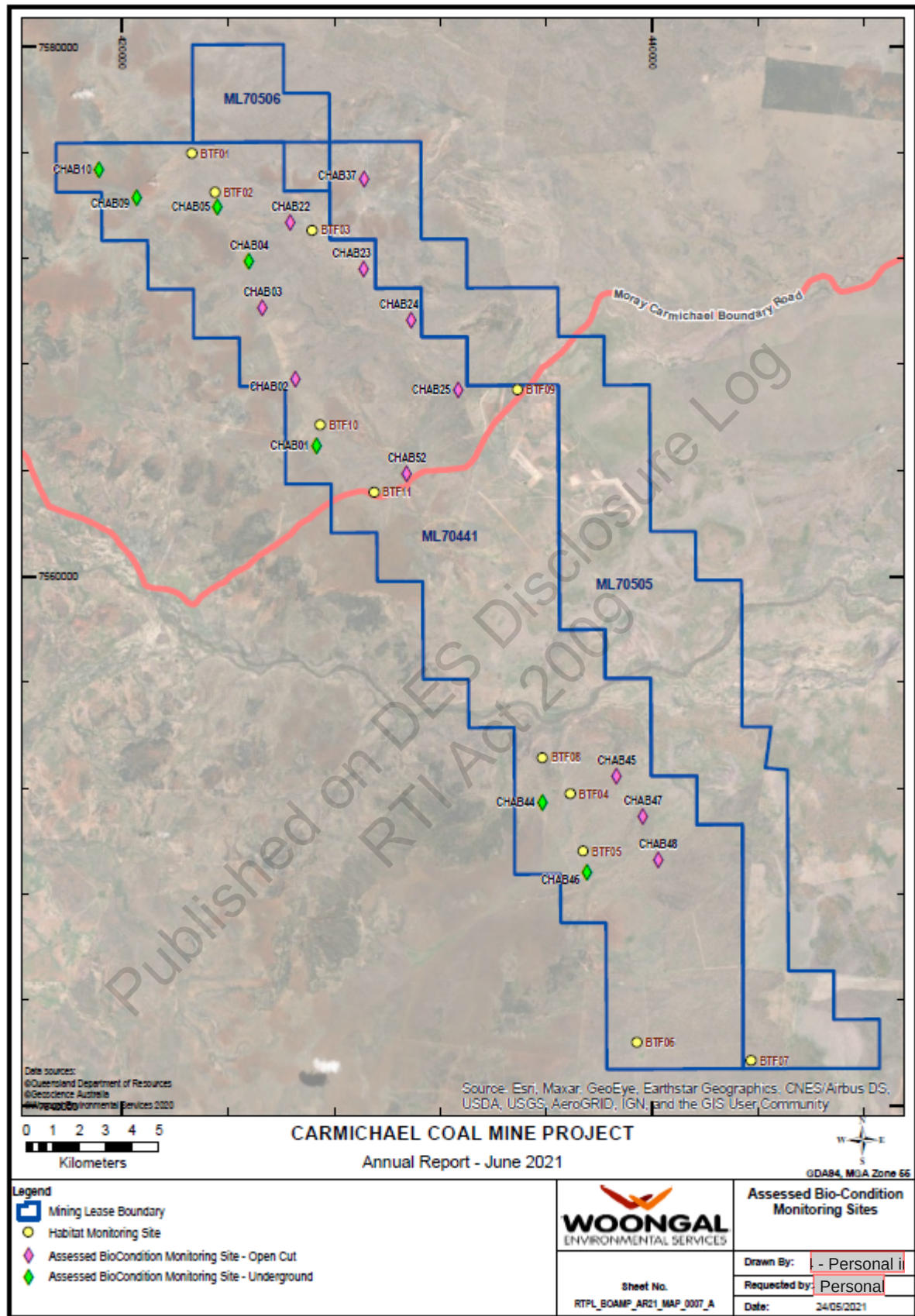


Figure 4-14. BTF survey records – June 2020 monitoring

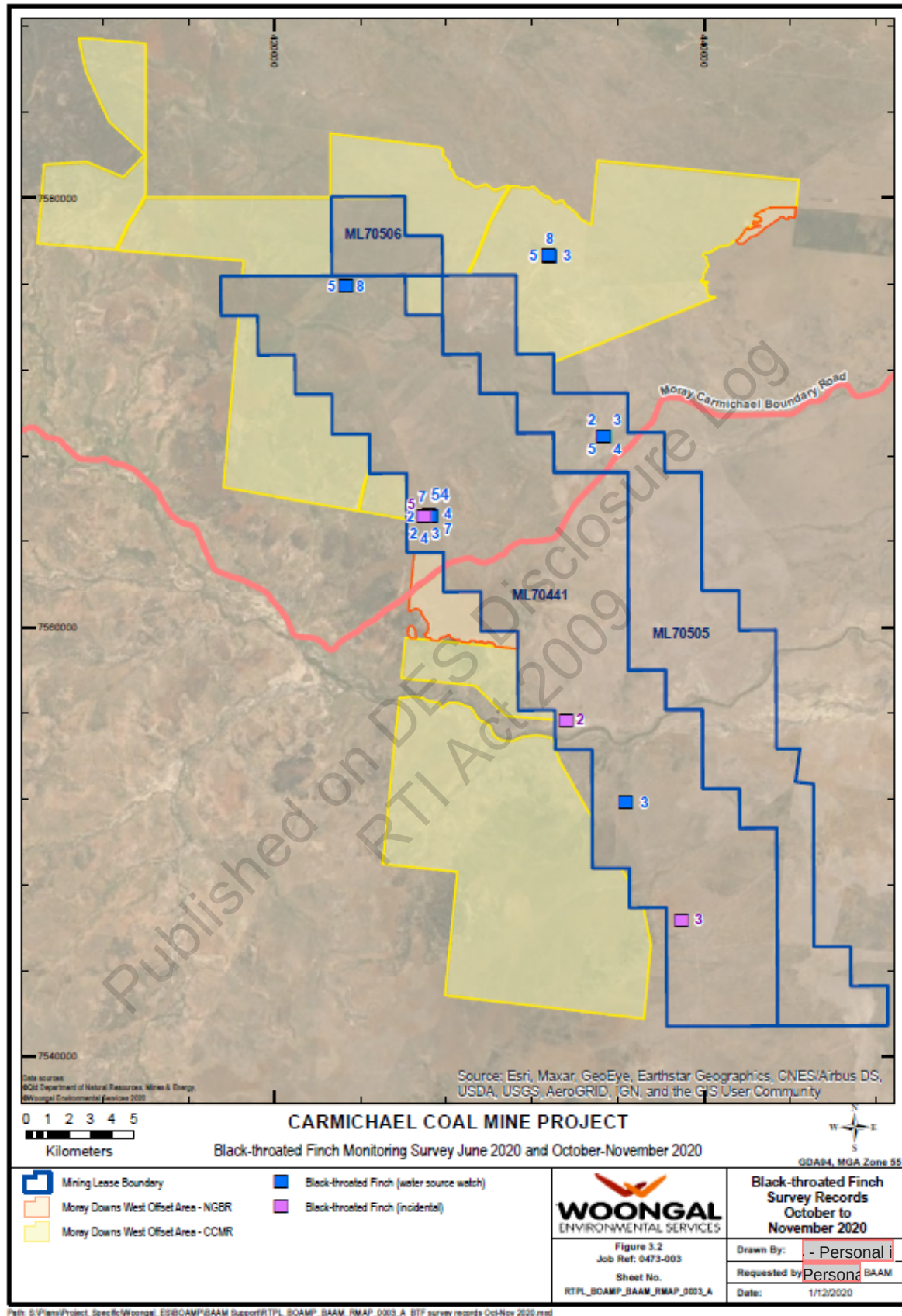


Figure 4-15. BTF survey records – October/November 2020 monitoring

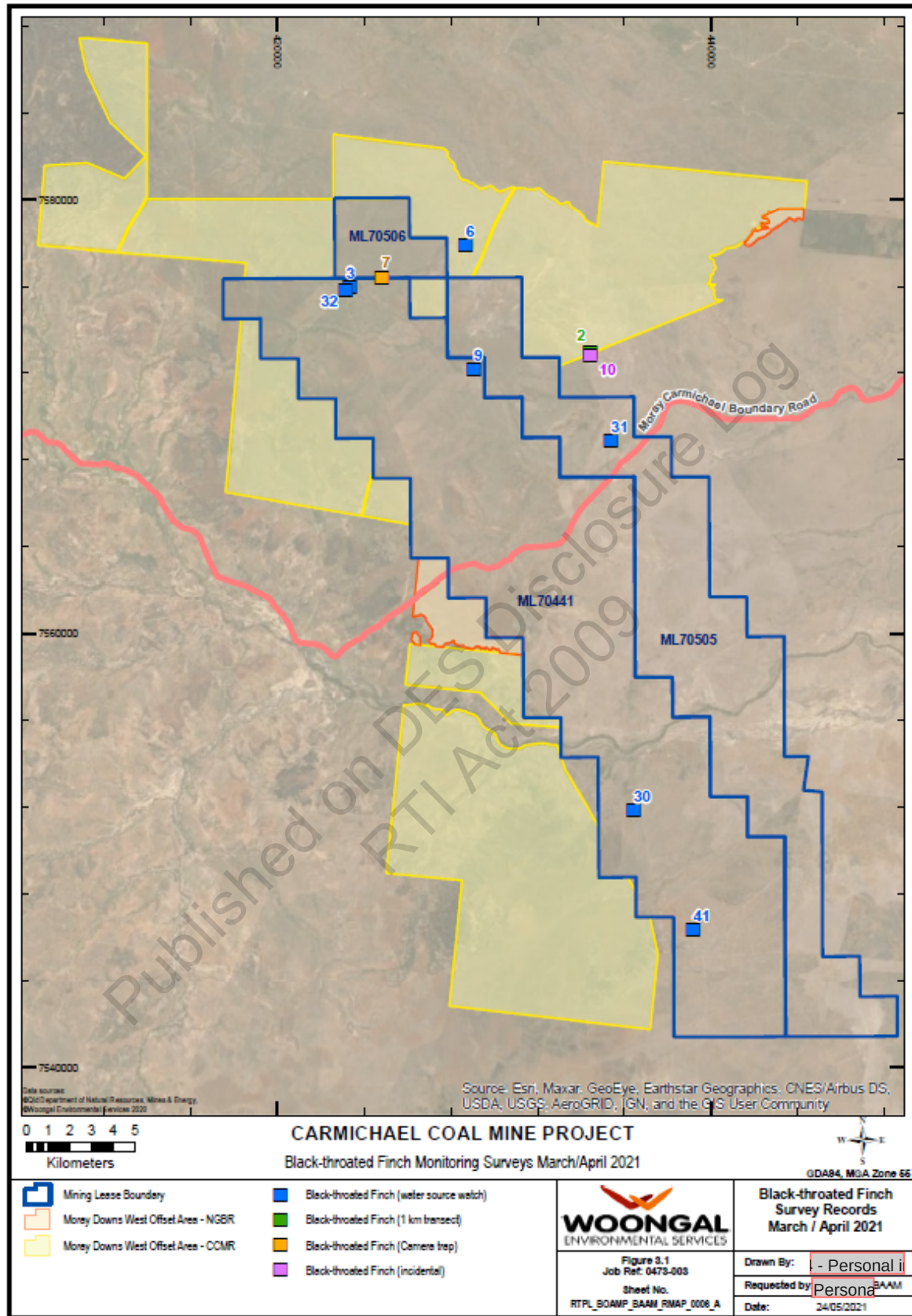


Figure 4-16. BTF survey records – April/May 2021 Monitoring

4.4.8.3 Discussion

The March/April 2021 surveys represent late wet season conditions. Previous BTF monitoring surveys under the BTFMP, including within the MDWOA were undertaken in June 2020 (early dry season) and October/ November 2020 (late dry season). A total of 171 BTF were recorded in March/April 2021 (adults and juveniles), 151 in October/November 2020 (all adults) and 76 in June 2020 (all adults). During all three survey periods there was standing water from rainfall events which provided water resources for BTF outside of the monitored permanent water sources and which would have affected the results of water source watches, as BTF activity is dispersed across multiple water points.

Cameras were established at remote water sources (within the ML and MDW) in both March/April 2021 and October/November 2020 to monitor some of those areas, although water was available widely in the landscape and there was only one record of BTF (7 individuals) made at one of the remotely monitored water source sites located on the ML during March/April 2021.

One inactive nest was recorded within MDW during the June 2020 survey. In March/April 2021 there was no active nesting recorded and juveniles were present in the company of adult birds at water sources, comprising approximately 4% of the observed individuals.

Comparison of BTF numbers between surveys is complicated by substantial variation in survey effort, survey methods and survey timing in relation to rainfall affecting local water source availability between survey periods. However, it is apparent that water source watches, incidental observations and area searches have provided the majority of records to date.

To ensure that water source watches are conducted at an optimal time and data collected in mining lease and offset areas are comparable for monitoring purposes, it is recommended that the water source watch methodology under the BTF MP, and MDW OAMP be revised and standardised to be conducted for three continuous hours commencing from 9 am, as also previously recommended by E2M Consulting.

4.4.8.4 Future Activities:

Biannual surveys will continue to be undertaken in accordance with the BTFMP. Survey timing will coincide with the end of the dry season (approximately late October 2021) and the latter part of the breeding season (March - May 2022).

5 Progress towards achieving the interim performance targets and completion criteria

Activities in the reporting year have seen the majority of methodologies (except BTF water point watches and active searches) harmonised across the BTFMP and MDW OAMP to allow results to be compared and provide a better understanding of habitats, land management practices, and vegetation communities, and inform conservation and remediation programs in subsequent years. With the establishment of the permanent monitoring sites, baseline datasets have now been collected and recorded.

The Woongal Ranger team are building capacity and have now have the necessary equipment, licenses and training to undertake controlled burns, weed control, pest animal control and maintenance of pastoral infrastructure (fences, gates, access tracks).

Weed and pest animal surveys have been completed and control measures have commenced. Trials of the Hog Hopper for feral pigs and Toadinator for cane toads have been undertaken. Ongoing weed and

pest animal control has the potential to significantly improve habitat quality and reduce predation pressure on threatened species.

A fire strategy has been prepared and Woongal will work closely with the BTF research team to undertake trial burns in BTF habitat, as well as targeted burns to help control buffel grass.

An erosion and sediment control management plan has been prepared and a program of works is to be established to systematically remediate known gully and bank erosion locations within MDW.

An overview of the MDW OAMP management objectives, monitoring requirement and progress since the commencement of the plan (2019-2021) has been provided in Table 5-1.

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Table 5-1: MDW OAMP management objectives, monitoring and 2019-2021 progress

Identified threats to offset values	Relevant offset values	Monitoring	2019-2020 progress	2020-2021 progress
Degradation of habitat	<ul style="list-style-type: none"> Ornamental Snake Squatter Pigeon Black-throated Finch Yakka Skink Waxy Cabbage Palm Wetland Protection Area Significant Wetlands RE 11.3.3 (BVG 16c) Watercourse Vegetation Connectivity 	<ul style="list-style-type: none"> Monitoring of MDW and MNES and MSES habitat quality scores will be undertaken in accordance with Section 4.4, including <ul style="list-style-type: none"> Offset area inspections Habitat Quality assessments to determine habitat quality scores Black-throated Finch Monitoring The results of monitoring events will be compared against the habitat quality scores in the interim performance targets and completion criteria to determine the progress of MDW and recorded as part of the annual report 	<ul style="list-style-type: none"> Monitoring activities have commenced for the management of MNES and MSES habitat Offset area inspections are yet to commence Habitat quality assessment sites have been established with monitoring set to commence August 2020 BTF monitoring was completed in June 2020, with one location surveyed in December 2019. The next monitoring period will be October/November 	<ul style="list-style-type: none"> Habitat quality assessments undertaken (Section 4.4.4) Offset area inspections have been undertaken Section 4.4.1. Infrastructure requiring maintenance has been identified and a forward works program is under development. Woongal have a full time team based at the Carmichael mine site undertaking regular ongoing inspections of the offset area. An erosion and sediment control management plan has been developed and a forward works program is under development (Section 4.4.1.3)

Identified threats to offset values	Relevant offset values	Monitoring	2019-2020 progress	2020-2021 progress
				<ul style="list-style-type: none"> Biomass, ground cover and species composition surveys have been undertaken in October 2020 and May 2021. Waxy Cabbage Palms Population Surveys and condition surveys were completed for the MDW OAMP areas (Section 4.4.7)
Habitat or vegetation loss through land clearing	<ul style="list-style-type: none"> Ornamental Snake Squatter Pigeon Black-throated Finch Yakka Skink Waxy Cabbage Palm Wetland Protection Area Significant Wetlands RE 11.3.3 (BVG 16c) 	<ul style="list-style-type: none"> Regular inspections of MDW OAMP areas Offset area inspections will be undertaken at least twice a year 	<ul style="list-style-type: none"> Offset Area inspections methodology and data capture system established. 	<ul style="list-style-type: none"> Offset area inspections completed (Section 4.4.1.) Woongal have a full time team based at the Carmichael mine site undertaking regular ongoing inspections of the offset area. Infrastructure requiring maintenance has been identified and a forward works program developed.

Identified threats to offset values	Relevant offset values	Monitoring	2019-2020 progress	2020-2021 progress
	<ul style="list-style-type: none"> Watercourse Vegetation Connectivity 	<ul style="list-style-type: none"> Compliance with restrictions for vegetation clearing associated with maintenance and establishment of access tracks, fencing and firebreaks will be assessed as part of offset area inspections. 	<ul style="list-style-type: none"> No new areas of clearing have been identified within the offset area 	<ul style="list-style-type: none"> No new areas of clearing have been identified within the offset area
Degradation of habitat by livestock overgrazing	<ul style="list-style-type: none"> Ornamental Snake Squatter Pigeon Black-throated Finch Yakka Skink Waxy Cabbage Palm Wetland Protection Area Significant Wetlands RE 11.3.3 (BVG 16c) Watercourse Vegetation Connectivity 	<ul style="list-style-type: none"> Offset area inspections to be undertaken at least twice a year will include monitoring to access the: <ul style="list-style-type: none"> Condition of fencing to identify any necessary maintenance requirements. Presence of livestock within the offset management area The presence of livestock in the offset management events, biomass monitoring and habitat quality assessments Habitat quality assessments will be undertaken in accordance with Section 7.5.2. These will include assessment of % cover of native perennial grasses (BTF) Native grass species will be recorded in each habitat quality site assessment outlines in accordance with Section 7.5.2 	<ul style="list-style-type: none"> Biomass monitoring sites were established Waxy cabbage palm population surveys were completed for the MDW OAMP areas in May/June 2020 Grazing restrictions introduced 	<ul style="list-style-type: none"> Offset area inspections have been completed (Section 4.4.1.) Biomass, ground cover and species composition surveys have been undertaken in October 2020 and May 2021. <p>Waxy Cabbage Palms:</p> <ul style="list-style-type: none"> Population Surveys and condition surveys were completed for the MDW OAMP areas (Section 4.4.7) Grazing restrictions maintained including wet season spelling (Section 4.3.1) Planning for additional fencing and stock water points undertaken

Identified threats to offset values	Relevant offset values	Monitoring	2019-2020 progress	2020-2021 progress
		<ul style="list-style-type: none"> • (Yakka) Offset area inspections will be undertaken at least twice a year (Sections 7.1) will include monitoring to assess the: <ul style="list-style-type: none"> ○ Condition of fencing to identify any necessary maintenance requirements ○ Presence of livestock within the fenced area ○ Confirmed Yakka Skink burrow areas • (Waxy Cabbage) Population surveys will be undertaken within the waxy cabbage palm offset area in accordance with Section 7.6.1 • (biomass) Biomass monitoring will be undertaken in accordance Section 7.4 • (Strategic Grazing) Offset area inspections will be undertaken at least twice a year (Section 7.1) will include monitoring to assess the: <ul style="list-style-type: none"> ○ Condition of fencing to identify any necessary maintenance requirements. ○ Presence of livestock within the offset management area 		

Identified threats to offset values	Relevant offset values	Monitoring	2019-2020 progress	2020-2021 progress
Predation by feral cats	<ul style="list-style-type: none"> Ornamental Snake Squatter Pigeon Black-throated Finch Yakka Skink 	<ul style="list-style-type: none"> Undertake monitoring for feral cats in accordance with Section 7.3 	<ul style="list-style-type: none"> Initial pest animal survey was conducted in May. Presence of feral cats identified within the ML. 	<ul style="list-style-type: none"> Targeted pest animal survey completed, and ongoing monitoring is underway. Cat trapping commenced in June 2021
Predation by foxes	<ul style="list-style-type: none"> Ornamental Snake Squatter Pigeon Black-throated Finch Yakka Skink 	<ul style="list-style-type: none"> Undertake monitoring for foxes in accordance with Section 7.3 	<ul style="list-style-type: none"> Initial pest animal survey was conducted in May. Currently no sightings of foxes are confirmed. 	<ul style="list-style-type: none"> Targeted pest animal survey completed, and ongoing monitoring is underway.
Poisoning of ornamental snake by cane toads	<ul style="list-style-type: none"> Ornamental Snake 	<ul style="list-style-type: none"> Undertake monitoring for cane toads in accordance with Section 7.3 	<ul style="list-style-type: none"> Initial pest animal survey was conducted in May. Currently no sightings of cane toads are confirmed. 	<ul style="list-style-type: none"> Targeted pest animal survey completed, and ongoing monitoring is underway. Cane toads were observed. Cane toad trapping commenced in June 2021
Degradation of habitat by rabbits	<ul style="list-style-type: none"> Ornamental Snake Squatter Pigeon Black-throated Finch Yakka Skink Waxy Cabbage Palm Wetland Protection Area Significant Wetlands 	<ul style="list-style-type: none"> Undertake monitoring for rabbits in accordance with Section 7.3 	<ul style="list-style-type: none"> Initial pest animal survey was conducted in May. Presence established; abundance likely to be low. 	<ul style="list-style-type: none"> Targeted pest animal survey completed, and ongoing monitoring is underway.

Identified threats to offset values	Relevant offset values	Monitoring	2019-2020 progress	2020-2021 progress
	<ul style="list-style-type: none"> RE 11.3.3 (BVG 16c) Watercourse Vegetation Connectivity 			
Degradation of habitat by feral pigs	<ul style="list-style-type: none"> Ornamental Snake Squatter Pigeon Black-throated Finch Yakka Skink Waxy Cabbage Palm Wetland Protection Area Significant Wetlands RE 11.3.3 (BVG 16c) Watercourse Vegetation Connectivity 	<ul style="list-style-type: none"> Undertake monitoring for pigs in accordance with Section 7.3 	<ul style="list-style-type: none"> Initial pest animal survey was conducted in May. Infestations of feral pigs noted across MDW. 	<ul style="list-style-type: none"> Targeted pest animal survey completed, and ongoing monitoring is underway. Pigs were observed at multiple locations. Pig baited control system (Hog Hopper) deployed in June 2021
Invasion of habitat by weed species, including exotic grasses	<ul style="list-style-type: none"> Ornamental Snake Squatter Pigeon Black-throated Finch Yakka Skink Waxy Cabbage Palm Wetland Protection Area 	<ul style="list-style-type: none"> Undertake weed monitoring in accordance with Section 7.2 	<ul style="list-style-type: none"> Monitoring sites established. 	<ul style="list-style-type: none"> Initial monitoring completed, ongoing monitoring underway. Fire training completed to allow targeted controlled burns. Weed control equipment purchased and training undertaken.

Identified threats to offset values	Relevant offset values	Monitoring	2019-2020 progress	2020-2021 progress
	<ul style="list-style-type: none"> Significant Wetlands RE 11.3.3 (BVG 16c) Watercourse Vegetation Connectivity 			<ul style="list-style-type: none"> Weed control commenced in June 2021.
In appropriate fire regimes (reduce the risk of adverse impacts to MNES and MSES habitat by appropriate fire regimes)	<ul style="list-style-type: none"> Ornamental Snake Squatter Pigeon Black-throated Finch Yakka Skink Waxy Cabbage Palm Wetland Protection Area Significant Wetlands RE 11.3.3 (BVG 16c) Watercourse Vegetation Connectivity 	<ul style="list-style-type: none"> Habitat quality assessments to determine habitat quality scores will be undertaken in accordance with section 7.5.2 	<ul style="list-style-type: none"> Initial planning undertaken. 	<ul style="list-style-type: none"> Habitat quality assessments undertaken (Section 4.4.4) Fire regime document prepared. Firefighting equipment procured. Fire training undertaken to allow controlled burns to be conducted in line with OAMP and BTFMP commitments. Effectiveness of the control will be noted through the vegetation assessments and through the information gathered by the BTRP
In appropriate fire regimes (Avoid uncontrolled)	<ul style="list-style-type: none"> Ornamental Snake Squatter Pigeon Black-throated Finch Yakka Skink 	<ul style="list-style-type: none"> Habitat quality assessments to determine habitat quality scores will be undertaken in accordance with section 7.5.2 	<ul style="list-style-type: none"> Initial planning undertaken 	<ul style="list-style-type: none"> Habitat quality assessments undertaken (Section 4.4.4) Fire regime document prepared.

Identified threats to offset values	Relevant offset values	Monitoring	2019-2020 progress	2020-2021 progress
bushfire in MDW)	<ul style="list-style-type: none"> • Waxy Cabbage Palm • Wetland Protection Area • Significant Wetlands • RE 11.3.3 (BVG 16c) • Watercourse Vegetation • Connectivity 			<ul style="list-style-type: none"> • Firefighting equipment procured. • Fire training undertaken to allow controlled burns to be conducted in line with OAMP and BTFMP commitments. • Effectiveness of the control will be noted through the vegetation assessments and through the information gathered by the BTFRP
In appropriate fire regimes (BTF)	<ul style="list-style-type: none"> • Black-throated Finch 	<ul style="list-style-type: none"> • Monitoring of BTF will be undertaken in accordance with Section 7.7 • Ground Cover species will be recorded in each foraging plot as outlined in Sections 7.7.5 	<ul style="list-style-type: none"> • Initial planning undertaken 	<ul style="list-style-type: none"> • Habitat quality assessments undertaken (Section 4.4.4) • Fire regime document prepared. • Firefighting equipment procured. • Fire training undertaken to allow controlled burns to be conducted in line with OAMP and BTFMP commitments. • Effectiveness of the control will be noted through the vegetation assessments and

Identified threats to offset values	Relevant offset values	Monitoring	2019-2020 progress	2020-2021 progress
				through the information gathered by the BTFRP
Unavailability of water sources	<ul style="list-style-type: none"> Black-throated Finch 	Weekly watering point inspections will be undertaken to ensure they are functioning effectively and are maintained to meet the requirements for BTF watering points based on the outcomes of the Research Program (see Section 7.7.7)	<ul style="list-style-type: none"> Inspection undertaken by Bravus environmental team. Responsibility to be handed over to Woongal. 	<ul style="list-style-type: none"> Fortnightly inspections of all existing artificial watering points have been undertaken throughout reporting period.
Offset fails to achieve the interim performance targets and completion criteria within the anticipated 5, 10 and 20 year timeframes respectively	<ul style="list-style-type: none"> Ornamental Snake Squatter Pigeon Black-throated Finch Yakka Skink Waxy Cabbage Palm Wetland Protection Area Significant Wetlands RE 11.3.3 (BVG 16c) Watercourse Vegetation Connectivity 	<ul style="list-style-type: none"> Monitoring of the MDW will be undertaken in accordance with Section 7, including: <ul style="list-style-type: none"> Offset area inspections (Section 7.1) Habitat quality assessments to determine habitat quality scores (Section 7.5.2) Waxy Cabbage Palm monitoring (Sections 7.6) Black-throated Finch monitoring (Section 7.7) The result of monitoring events will be completed against the interim performance targets and completion criteria (Table 7) to determine the progress of MDW and recorded as part of the annual report (Section 8) 	<ul style="list-style-type: none"> Establishment of monitoring locations commenced. 	<ul style="list-style-type: none"> All required monitoring has commenced Assessment of quality scoring underway

Identified threats to offset values	Relevant offset values	Monitoring	2019-2020 progress	2020-2021 progress
Once achieved the habitat quality is not sustained for the life of the approval	<ul style="list-style-type: none"> • Ornamental Snake • Squatter Pigeon • Black-throated Finch • Yakka Skink • Waxy Cabbage Palm • Wetland Protection Area • Significant Wetlands • RE 11.3.3 (BVG 16c) • Watercourse Vegetation • Connectivity 	<ul style="list-style-type: none"> • Monitoring will be undertaken in accordance with the plan for sustaining habitat quality in MDW 	<ul style="list-style-type: none"> • Establishment of monitoring locations commenced. 	<ul style="list-style-type: none"> • Woongal full time site team established and operational. • All required monitoring programs are in place.

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6 Recommended Changes to be incorporated into the OAMP

The following issues arose in the implementation of the MDW OAMP during the reporting period. Some of the issues have given rise to recommendations for changes to the MDW OAMP.

- 6.1. **BioCondition Monitoring** – The MDW OAMP has 56 indicative locations for the establishment of habitat quality monitoring sites. The establishment of these monitoring sites has shown the known limitations associated with regional ecosystem mapping that is useful at a regional scale but requires validation at a property and paddock scale to ensure that monitoring points are located in the desired ecosystems and vegetation communities.

Adjustments have been made to some of the installed monitoring points based on the observed extent and distribution of REs. Five of the indicative locations could not be reached due to access constraints. Alternative accessible sites located in the relevant area units (AU) were substituted. If the access constraints can be resolved in the next reporting period, the original sites will be re-instated.

The indicative location for one site (C04) was in highly disturbed habitat 70 m from a water trough servicing the paddock, where livestock spend a disproportionate amount of time. Since this location was not representative of the broader occurrence of the relevant AU, it was moved to a location away from the water trough.

It is recommended that field surveys of regional ecosystems and vegetation communities occur in the coming reporting period to refine the regional ecosystem mapping and validate the locations of the habitat monitoring sites.

- 6.2. **Waxy Cabbage Palm Monitoring** – The MDW OAMP specifies that older life forms (sub-adult and older) will be permanently tagged. Due to the large number of older palms in the study area, as well as the potential for tags to damage palms, the location of individuals was recorded using sub-metre GPS essentially providing the same dataset.

It is recommended that the method of identifying individual palms in the MDW OAMP be changed to the recording of their location using sub-metre GPS locations.

- 6.3. **Black-throated Finch Surveys** – It is recommended that monitoring methodologies are aligned with the BTFMP to ensure consistency across datasets and to allow comparison over sites and over time.

- 6.4. **Biomass monitoring** - The application of the Grass Check methodology is considerably intense in terms of the amount of data collected at each site. Good species knowledge is crucial to maintain efficient implementation and accurate results. Cover and yield categories rather than single or continuous cover are simpler to collect in the field however they offer less opportunity to explore relational statistics with respect to either of these attributes and tree and shrub cover. It may be possible to perform a regression analysis by numbering categories 1-5 however the category ranges are not evenly distributed and so not a reliable nor accurate analysis.

Cut dry weigh calibrations of yield estimates of selected representative sites would provide additional certainty with respect to visual yield estimates and assist assessors to calibrate their own estimates

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